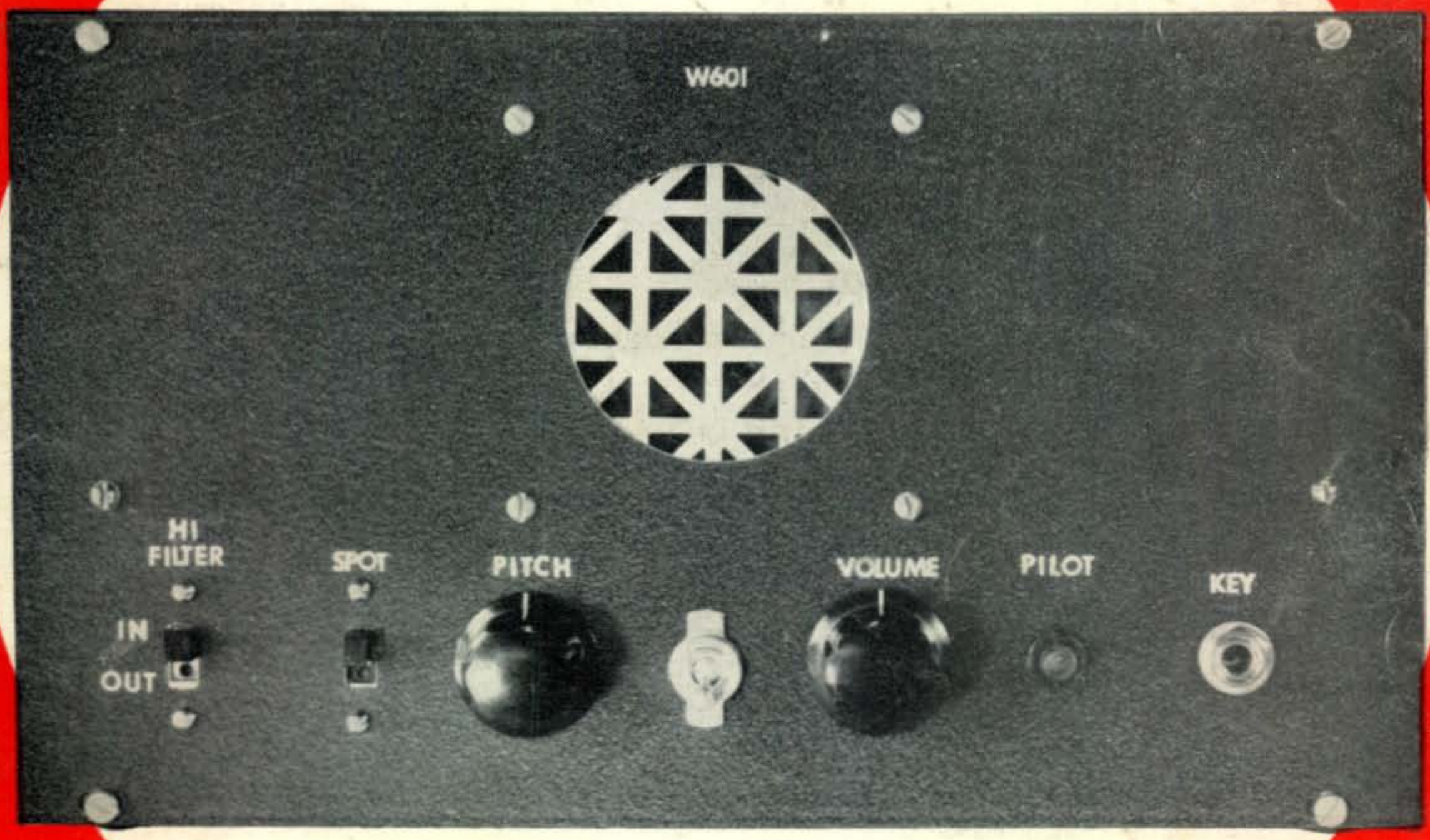
May 1964
50¢

CQ

ICD

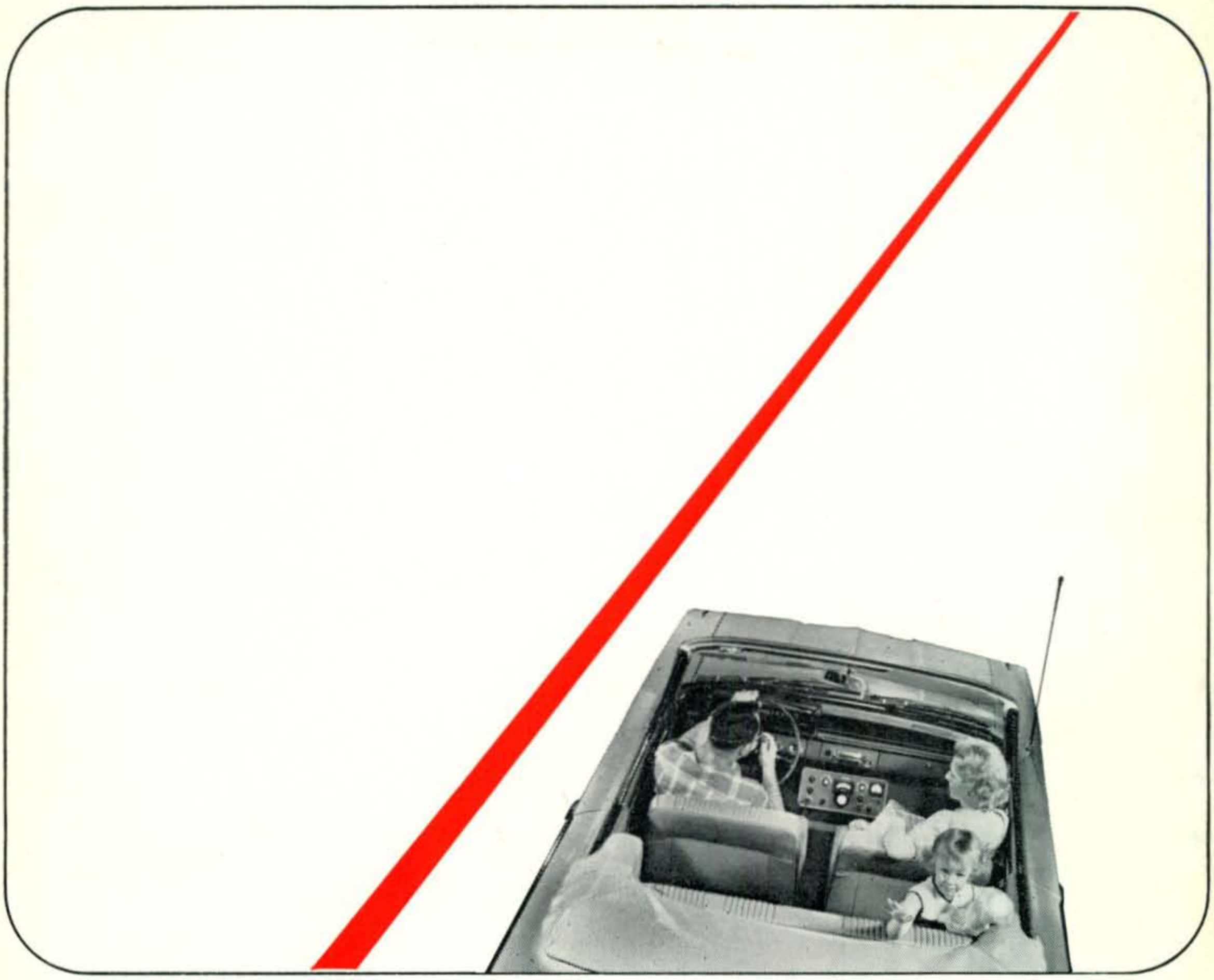
This Month:

"The C.W. Paine Killer"



Tuned Audio Amplifier Keys
Audio Oscillator for
Noise-Free C.W.

The Radio Amateur's Journal



One for the road

That KWM-2 for the road is the same one you use in your ham shack. When you want to take it with you, just mount it in your car and you're ready to go with the same performance your KWM-2 gives you in your ham shack, proven in 5 years as the top performing transceiver on the market. At home or on the highway, this lightweight unit covers the popular HF ham bands. Providing ample power on 80 through 10 meters with 175 watts PEP input on SSB, or 160 watts on CW, the KWM-2 connects automatically in your car's mobile mount. So, whether you're taking a long trip this summer or just going to visit Grandma, put the KWM-2 on your vacation list. Contact your distributor today and find out how little it costs to own the finest.

P.S. If you're going through Iowa this summer, stop during working hours in Cedar Rapids and visit the plant.

COLLINS

For further information, check number 3, on page 110

EVERY PR CRYSTAL is UNCONDITIONALLY GUARANTEED

Unconditional Guarantee is proof of the maker's absolute confidence in his product... and PR Crystals have been UNCONDITIONALLY GUARANTEED SINCE 1934. You're not taking the slightest chance when you put PRs in your rig, for you'll have the finest radio frequency control that money can buy! PR Crystals are made to PERFORM...under good conditions and bad. They have that extra measure of stability and dependability BUILT-IN, that guarantees years of outstanding performance. Get PRs today from your jobber.

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Fundamental, PR Type Z-2

Frequency Ranges in Kcs.: 1750 to 2000 (160M); 3,500 to 4,000 (80M); 7,000 to 7,425 (40M); 8,000 to 8,222 (2M); 8,334 to 9,000 (6M).
Rugged. Low drift, fundamental oscillators. High activity and power output. Stands up under maximum crystal currents. Stable, long-lasting; ± 500 cycles.....**$2.95** Net
(All Z-2 Crystals calibrated with a load of 32 mmfd.)

AMATEUR TYPES

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Hermetically sealed; calibrated 24,000 to 24,666 and 25,000 to 27,000 Kc., ± 3 Kc.; .050" pins. .**$3.95** Net

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Fifth overtone; for operating directly in 6-meter band; hermetically sealed; calibrated 50 to 54 Mc., ± 15 Kc.; .050" pins.
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Suitable for converters, experimental etc. Same holder dimensions as Type Z-2. 1600 to 12000 Kc., (Fund.) ± 5 Kc. **$3.45** Net
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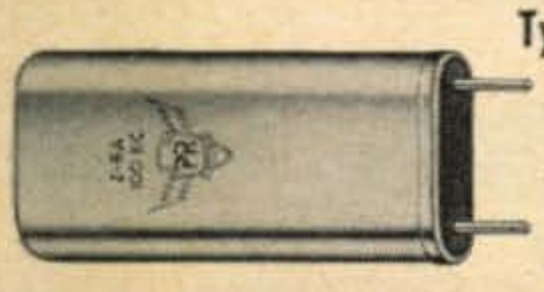
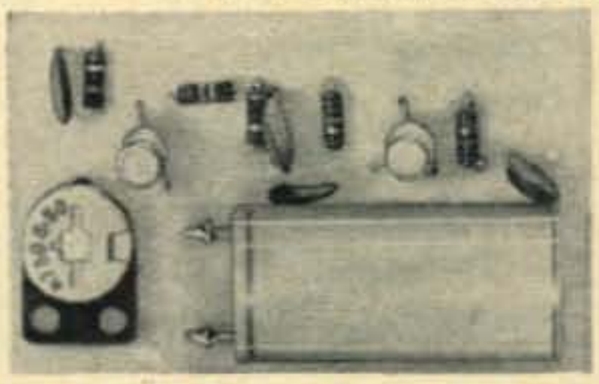


To determine band edge. To keep VFO and receiver properly calibrated. .050" pins. 100 Kc. ....**$6.95** Net

PR-100 Transistorized Oscillator



With PR-100 you can check harmonics at 100 Kc. intervals through 54 Mc. A precision oscillator, fully wired, ready to install. Includes a Z-6A Crystal. Power requirements: 12V DC @ 14 Ma. Oscillator output connects to receiver antenna, high side. Base is 1-7/8 x 2-13/16 inches. Negligible mounting space required. Weighs 2 ounces. .....**$12.95** Net

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COMMERCIAL CRYSTALS AVAILABLE FROM 100 KC. TO 70 MC. PRICES ON REQUEST.

For further information, check number 1, on page 110

think small*...

TALK BIG

No one but Hallicrafters could shoehorn such sheer, unadulterated **talk power** into so beautifully compact a package as the new SR-160 Tri-band Transceiver. Why Hallicrafters alone? **Eight productive, successful years of SSB and transceiver experience,** leading to such advanced, exclusive techniques as **AALC (Amplified Automatic Level Control)** providing up to 12 db. of effective compression . . . **RIT (Receiver Incremental Tuning)** with ± 3 kc, for superior net and CW operation . . . and a superbly designed **crystal lattice filter** which makes the most of the desirable SSB transmission characteristics. **A built-in changeover relay** permits direct operation with the HT-45 or other linear amplifier. Sensitivity is **less than 1 μv for 20 db.** (yes, 20) S + N/N ratio.

The receiver employs a separate AVC amplifier providing a figure of merit of 100 db. These and a dozen other outstanding features make the new SR-160 your best transceiver buy. Write for complete specifications or see your Hallicrafters distributor today.

* *Small size:* *13" x 6½" x 11"*
Small weight: *Only 13¼ lb.*
Small price: *$349.50 less power supplies and mobile mounting kit.*

NEW SR-160

Tri-band SSB/CW Transceiver

by hallicrafters

Fifth & Kostner Aves. Chicago, Ill. 60624

Export: Hallicrafters International Div. **Canada:** Gould Sales Co., Montreal, P.Q.

For further information, check number 2, on page 110

CQ

The Radio Amateur's Journal

Vol. 20, No. 5 May 1964

OFFICES

300 West 43rd Street
New York, N. Y. 10036
Telephone, 212 JUdson 2-4460

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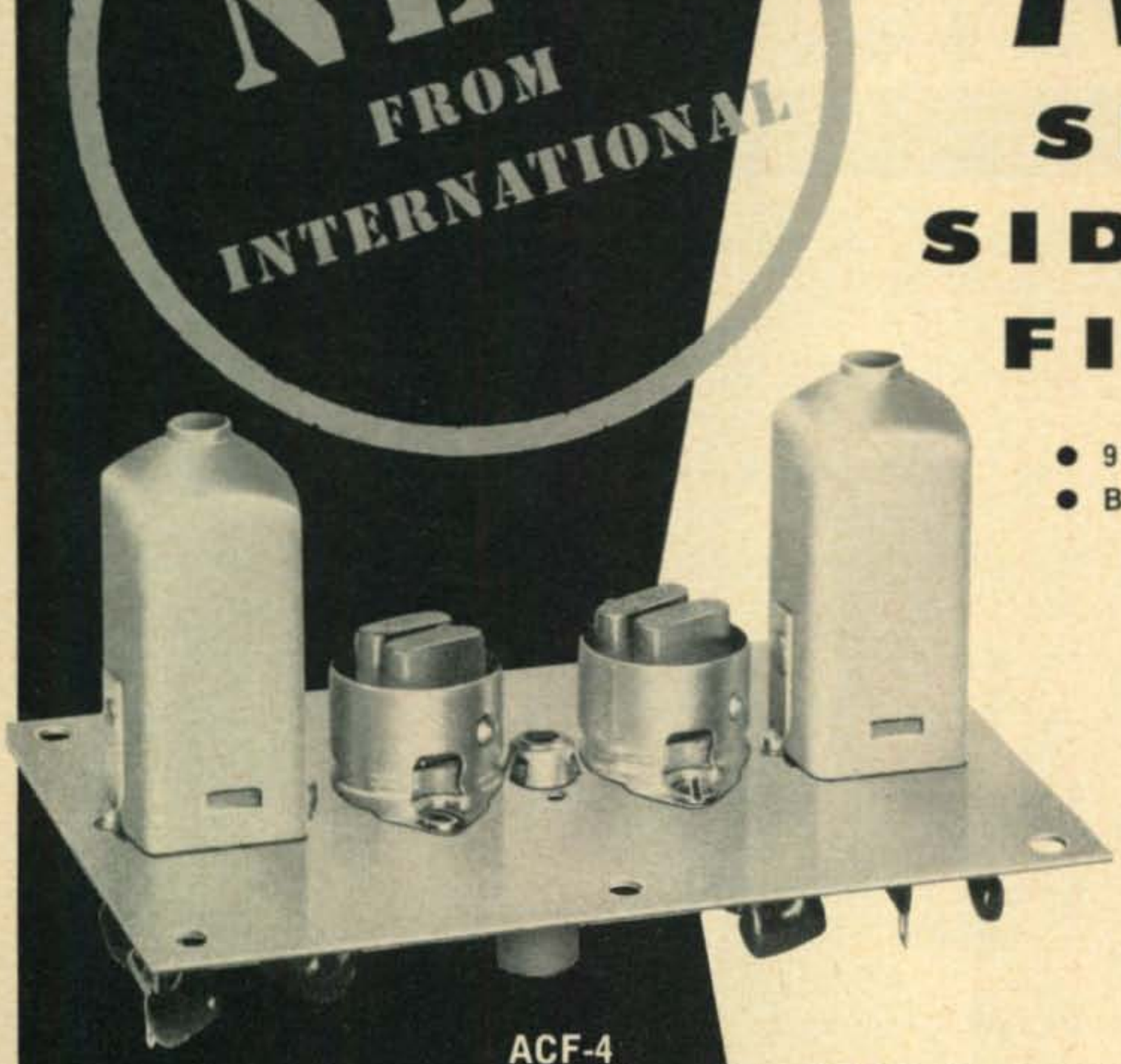
NEW FROM INTERNATIONAL

AOC*

SINGLE SIDEBAND FILTERS



ACF-4

- 9 mc center frequency
- Bandpass 6 db 3 kc (approximate)

ACF-2 Two-crystal filter circuit using low impedance link input and 2K resistive output load. Unwanted sideband rejection greater than 30 db. **$9.95**

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MATCHING OSCILLATOR CRYSTALS for the ACF filter series. Recommended for use in OS-4 oscillator.
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For further information, check number 4, on page 110

FIELD ENGINEERING WITH A FUTURE

Ed Dodge, W1CMU, has been an active ham for 35 years and a member of the Raytheon staff for more than 20. Ed spends a good deal of his leisure time with a key in his fist. He works the whole spectrum from 20 to 160 meters concentrating on CW except in the summer when he operates on 6 and 10 meter mobile from his cabin cruiser. Ed feels that ham radio has been a relaxing extension of his deep interest in electronics.

As Manager of Raytheon's Field Operations, Ed Dodge coordinates the activities of five project engineers and more than 300 field engineers. He has been involved with field engineering assignments on radar, fire control and many other key military electronic systems and installations. His duties have taken him through the United States, Europe, Central and South America. Ed Dodge's association with Raytheon has certainly been exciting and rewarding.

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For further information, check number 5, on page 110

IT'S HERE!!!

THE NEWEST - MOST POWERFUL - MOST COMPACT FULL COVERAGE 80-40-20 METER 300-WATT SSB/CW TRANSCEIVER ANYWHERE!

GALAXY III SSB/CW TRANSCEIVER

$349.95

THE GALAXY III IN ITS ACTUAL COMPACT SIZE, 6" x 10¼" x 11¼", IS SMALLER THAN THIS OPEN MAGAZINE. WEIGHS ONLY 14 LBS.

STARTLING FEATURES OF THE GALAXY III

1. MOST POWER OUTPUT OF ANY 3 BAND TRANSCEIVER TODAY!
2. SMALLEST 300-WATT SSB/CW TRANSCEIVER. 6" x 10¼" x 11¼" – 14 lbs. Makes it best Mobile – Fixed Station.
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5. BEST FILTER AVAILABLE. Suppression better than: 45db, unwanted SB 55db.
6. NEW! 6-SECTION CRYSTAL FILTER. Exceptional – 1.8 to 1 shape factor at 2.1 KC bandwidth.
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10 SOUTH 34TH STREET
COUNCIL BLUFFS, IOWA ZIP 51504

For further information, check number 6, on page 110

ZERO BIAS

UNLIKE our contemporary, high in the hills of New Hampshire, who tallies votes before the ballots are distributed, and whose March editorial containing the "Time To Be Counted" statistics was obviously written before the ink was dry on the February issue—we have had to skip one month to determine reader reaction to the ZERO BIAS proposal appearing in the March issue of *CQ*.

To our delight we find that the proposal has been, in general, warmly received. With the exception of increase in power, only a minor segment of letters disliked the proposal. Of these, the "mechanical" arrangements of band occupancy brought the greatest criticism, some indicating too much space was allocated for the Advanced amateur, while others thought not enough.

As this is being written not *one* letter has been received voicing favorable sentiments for an increase in power. On the contrary, we've been called, "the tool of industry" and other uncomplimentary adjectives for even thinking of the idea. We humbly bow to what appears to be majority opinion and withdraw any further comments on two kilowatts d.c. input.

With so many potent signals now on the air, it was our impression that a large segment of this group would approve of such a plan. It appears, however, that those running high power enjoy the privilege but disapprove of publicly adding their personal endorsement. Remember, gentlemen, you need not run one or two kw just because the regulations so permit.

We have not, nor do we intend to, formally place our proposal before the FCC. Already heavily burdened with dozens of amateur and citizen's band petitions, the Commission is well aware of *CQ*'s proposal. Should they feel a compromise situation is necessary with ARRL's RM-499, we're sure they are capable of modifying the proposal, using some or all of *CQ*'s ideas for the benefit of all.

A number of readers have asked how the proposed Advanced Class amateur would be distinguished from others when operating in the confines of their "special" portions of the band. It's a good question, but then how do we know when a Technician slips down to 20 meters or how do we know when a Novice drops the N and moves outside his assigned segment to chase a new one? The answer is, we don't, and for those of you who feel the "other guy" is ready to cheat, we can only emphasize that there are heavy penalties now being enforced for illegal operation. We certainly feel that distinctive call signs are not the answer.

It is extremely interesting to note that K1FYP/2W3519 must have rechecked the statistics of his recent poll taken by *73 Magazine;* for after boisterously condemning incentive licensing for over a year—deliberately misguiding his readers with fallacies instead of facts—and maliciously offering juicy bits of "confidential" letters from League Headquarter's employees, he too has joined the ranks of the "me too'ers." Carefully avoiding the words "incentive licensing," which to many has been the stumbling block in understanding its purpose, he has craftily petitioned the FCC (RM-577) with a proposal so similar to *CQ*'s as to be humorous. We can only assume he was not to be outdone, since his proposal was dated early March, following the release of *CQ*'s proposal.

Has the editor seen the light? Did he misplace a decimal point during his polling? Has he abandoned his status quo followers? No—we think not!

This man is *not* the pioneering "free press" journalist he would like others to believe he is. He is *not* out to right amateur radio's wrongs as he professes he has the power to do. He is a gambler—cleverly, egotistically playing one side against the other, hoping to win friends, fame and subscriptions. He knows on which side his bread is buttered. RM-499 gave him the wedge he's been looking for for years. Unfortunately, he underrated those in favor of a revamping of amateur regulations. It is now obvious that his maneuver of changing horses in midstream is resulting in a good case of wet feet.

The newest money making scheme designed to keep him in New Hampshire clover is his Institute of Amateur Radio. Originally designed to provide European air tours at cut rate, with a free seat thrown in for the organizer, he now claims that a $10.00 donation to the "Institute" will benefit U. S. amateurs where the League has faltered. (A subscription to *73 Magazine* is extra, by the way). We would like to know how much of the $10.00 membership fee this "friend of the amateur" (?) will pocket personally for his trouble.

Many organizations have a conniver. Amateur radio has Mr. Green. We couldn't care less what he does with his time or money, and we're sure most hams know of the shenanigans he's been carrying on for years; we only want to clear the air, get the facts straight and alert newcomers to just what this character's crusade is really all about.

LETTERS TO THE EDITOR

CQ's Incentive Proposal

Editor, *CQ:*

Congratulations on your step forward by proposing incentive licensing for c.w. radio amateurs. It appears that some other groups have forgotten the c.w. amateur in the uncompromising haste. . . .

I was previously opposed to all new licensing proposals because they gave no consideration to c.w. operators. I genuinely support the idea of incentive licensing if it will include incentives for all groups.

However, in the final stretch, how can there by any change in amateur licensing unless the FCC or a majority of the radio amateurs want it?

Gary H. Dudovitz, KØCNN
1661 Westwood Hills Drive
Minneapolis, Minnesota 55426

Editor, *CQ:*

In reference to your incentive proposal in the March, '64 issue of *CQ*, I agree with it on the most part, but will have to take exception where it comes to raising power . . . other than that I agree with it 100%.

Ron Toller, WA4FVD
P.O. Box 2466
Marathon Shores, Fla.

Editor, *CQ:*

Congratulations! Was so impressed with your incentive proposal I just had to write. Under these changes neither the c.w. nor phone man will be severely penalized because of his lack of technical know-how or lack of time to study for an advanced class license. In fact, in the article I find nothing which would not promote amateur radio so everyone can enjoy it to the fullest. Concerning the power: Aren't the battling kw's enough on the bands today. . . .

Dana Seaman, K1SMT
476 N. Washington St.
N. Attleboro, Mass.

Editor, *CQ:*

I thoroughly agree with your incentive plan described in the March issue of *CQ* . . .

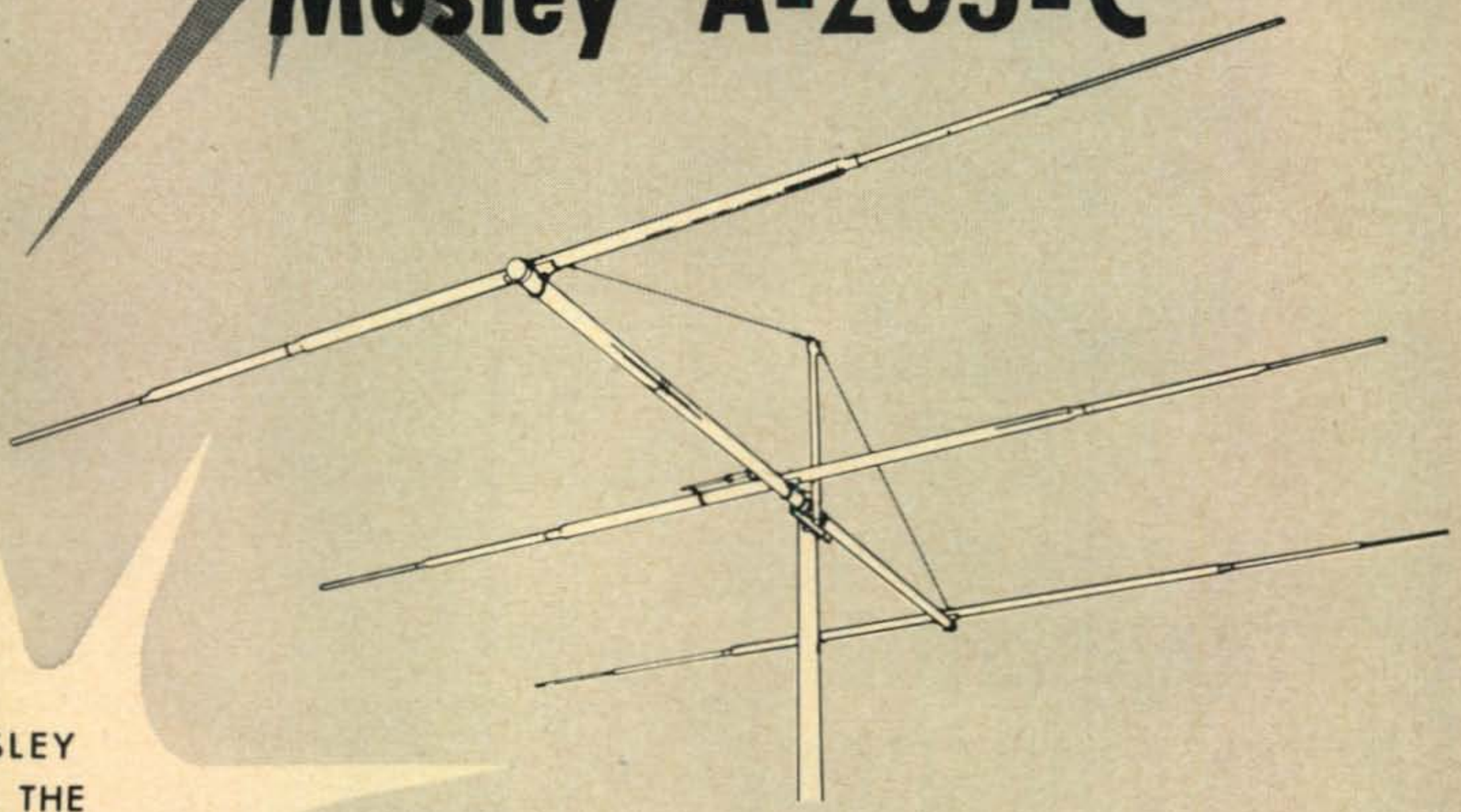
Your plan provides incentive, without totally denying phone rights to the majority of licensed amateurs. I think incentive is good and will produce the results desired without throwing hamdom into chaos.

The present allocation plan by the FCC was adopted to encourage occupancy. This it has done. If the *status quo* must be altered . . . let's have it your way.

F. C. Miller, WØRQS
5327 N. 52nd St.
Omaha 4, Nebr.

◀ For further information, check number 8, on page 110

NEW.....for 20 meter operation
Mosley A-203-C

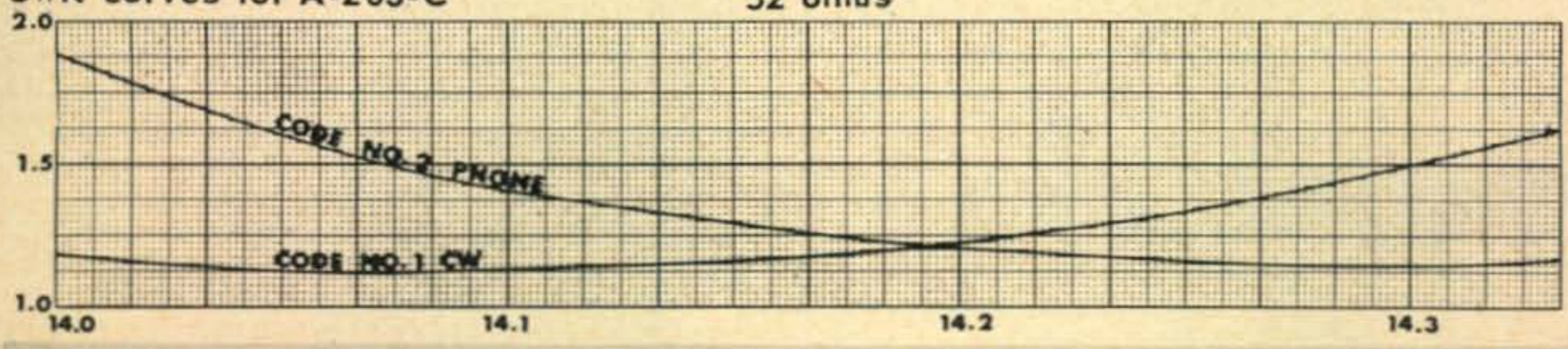


MOSLEY HAS THE OUTSTANDING THREE ELEMENT ARRAY FOR TWENTY METER DX OPERATION.

The new clean-line A-203-C will give you that DX punch that will over-ride QRM. The A-203-C is a three element twenty meter beam using swaged tubing elements to give this antenna rugged durability. The antenna has a special new type element design that virtually eliminates element flutter and boom vibration. A-203-C is a wide spaced, gamma matched, full size beam that every ham needs for the tough competition enforced by the present conditions on the DX bands. This antenna will equal the performance of many four to six element beams without the headaches of large size and heavy weight necessary for these big beams.

- *GAIN (8 db. or better) (F/B 24 db.)*
- *HANDLES MAXIMUM LEGAL POWER*
- *BOOM LENGTH 24 ft.*
- *MAXIMUM ELEMENT LENGTH 37 ft.*
- *TURNING RADIUS 22 ft.*
- *WIND LOAD (80 mph wind) – 140 lbs.*
- *ASSEMBLED WEIGHT 40 lbs.*
- *SHIPPING WEIGHT 49½ lbs.*

SWR curves for A-203-C 52 ohms



MOSLEY ELECTRONICS INC. 4610 N. LINDBERGH BLVD. – BRIDGETON MO. 63044

For further information, check number 9, on page 110

Editor, *CQ:*

Your incentive licensing proposal as outlined in the March issue of *CQ* contains points worthy of consideration. The ARRL proposal under present consideration may split amateur radio into halves, and such an outcome would greatly weaken amateur radio in its stand against external forces.

There is one section of your proposal against which I must react most strongly. I am opposed to any change which would increase the maximum legal input to the final of an amateur transmitter above 1000 watts. . . .

Kurt T. Meyers, W8IBX/8
Box 594
Capital University
Columbus, Ohio 43209

Editor, *CQ:*

Congratulations on a fine incentive proposal which is certainly more than a simple "me too." Ham radio needs improving and I surely hope that the FCC recognizes this quickly! As a student of 18 I must say that studying for the Extra has been more *fun* than work, and the proposals require even less than the Extra class. No one can complain.

There is one minor point that I strongly disagree with, though: the power limit. In my opinion a 2 kw limit would only do harm . . .

I think that our high power is one of the reasons we're *not* respected abroad, and with incentive licensing we hope to achieve the opposite effect.

John Herro, K9YRA
1017 Pfingsten Road
Glenview, Illinois

Editor, *CQ:*

The *CQ* incentive proposal as outlined in Zero Bias, March issue of *CQ* is truly a real plan of incentive licensing. If only it is not too late after that dastardly unfair and selfish proposal the ARRL has put on a petition to the FCC. Real incentive is to strive for something special, not to regain something lost. Congratulations and best wishes for continued success. I quit ARRL so your mag is the only ham news I now get and it is enough. It's great!

Ernest H. Oman, Major USAR-Ret.
318 N. Ninth Street
Santa Paula, California

Editor, *CQ:*

Congratulations on your erudite solution to the incentive licensing problem! Too long have we waited for a modern Moses to lead us out of the wilderness of unfair and confusing proposals.

Your plan, although admittedly more complex, is eminently fair and I hope that sufficient numbers of our hobby will see the justice of it and rally to its support.

This solution gives the advanced amateur the exclusiveness he seems to desire while at the same time does not deprive the average amateur the pleasures he worked so hard to enjoy.

Here's to success in your efforts to get the present proposal altered before it becomes law.

J. P. Long, W8MVO
30800 Summit Lane
Pepper Pike
Cleveland, Ohio

Editor, *CQ:*

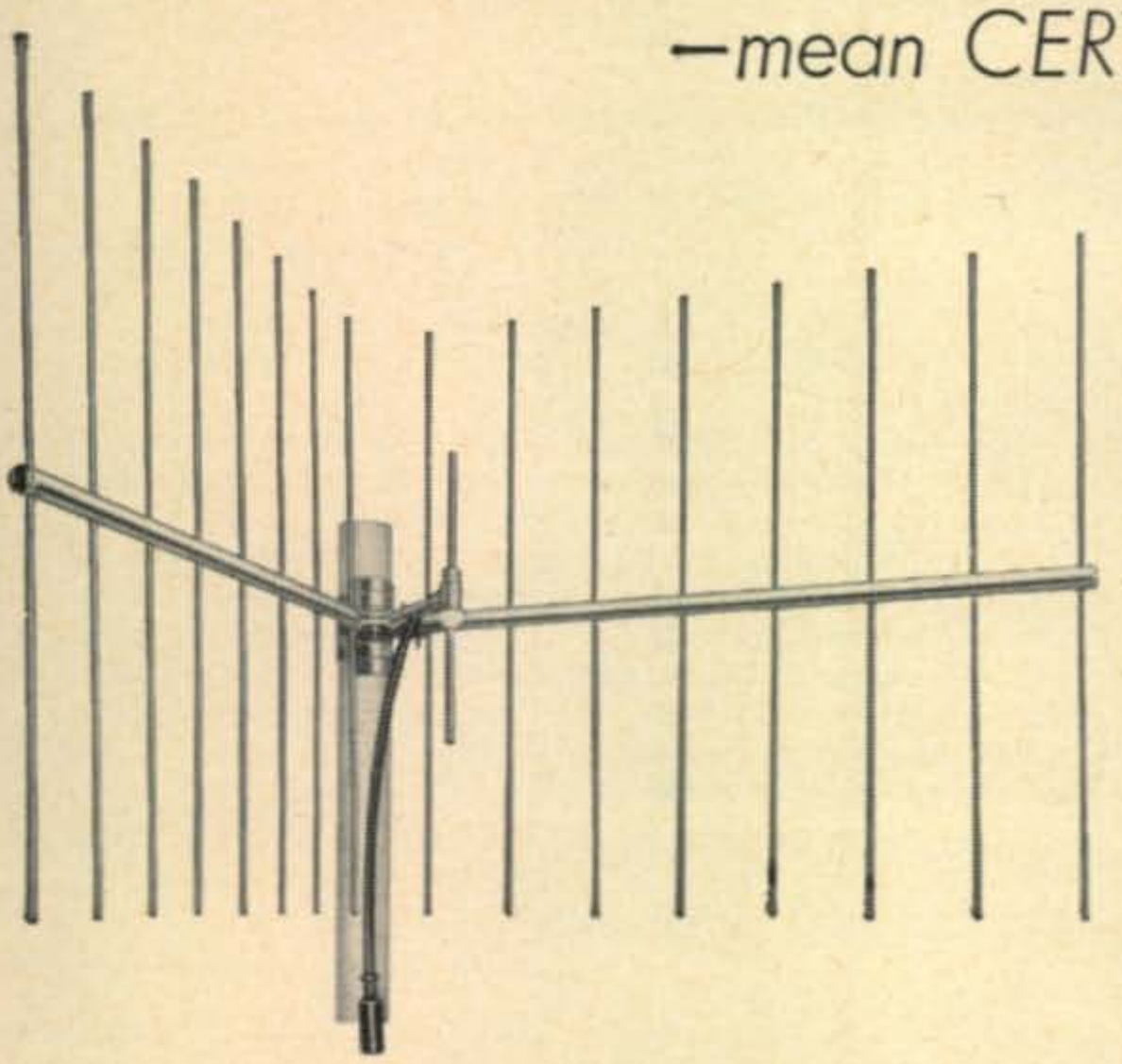
This is my first letter to an editor, but after reading your ZERO BIAS in the March issue, I simply have to say something.

Your plan is by far the best that has come to my attention, regardless of the source. As most of us on the air have heard in discussion, some plans go much too far, and some do not go nearly far enough. This plan of yours goes just far enough, taking nothing away from most hams, and yet giving something to those who want and can take the proposed incentive exams. It hurts considerably to hear some two letter ham say that he is just about to lose his phone privileges after so many years on the air, and that has been heard several times.

S. C. Agnew, W5LPW
Old Santa Fe Trail
Santa Fe, New Mexico

C-P COMMUNICATION ANTENNA SYSTEMS

—mean *CERTIFIED PERFORMANCE!*



Base Station Corner Reflector Advanced Design Antenna

(10X-Unidirectional Gain)

Cat. No. 161-509, Frequency Range 450-470 MC

Cat. No. 161-509 Corner Reflector Antenna is designed for use in the 450-470 Mc band. All reflector screen components are manufactured of high strength aluminum alloys, all mounting components are fabricated of hot-galvanized steel and all radiating components are fabricated of aluminum. The above combine maximum strength, optimum electrical performance and minimum weight for the first time in an antenna of this type.

This lightweight aluminum antenna is ideal for use in multiple corner arrays.

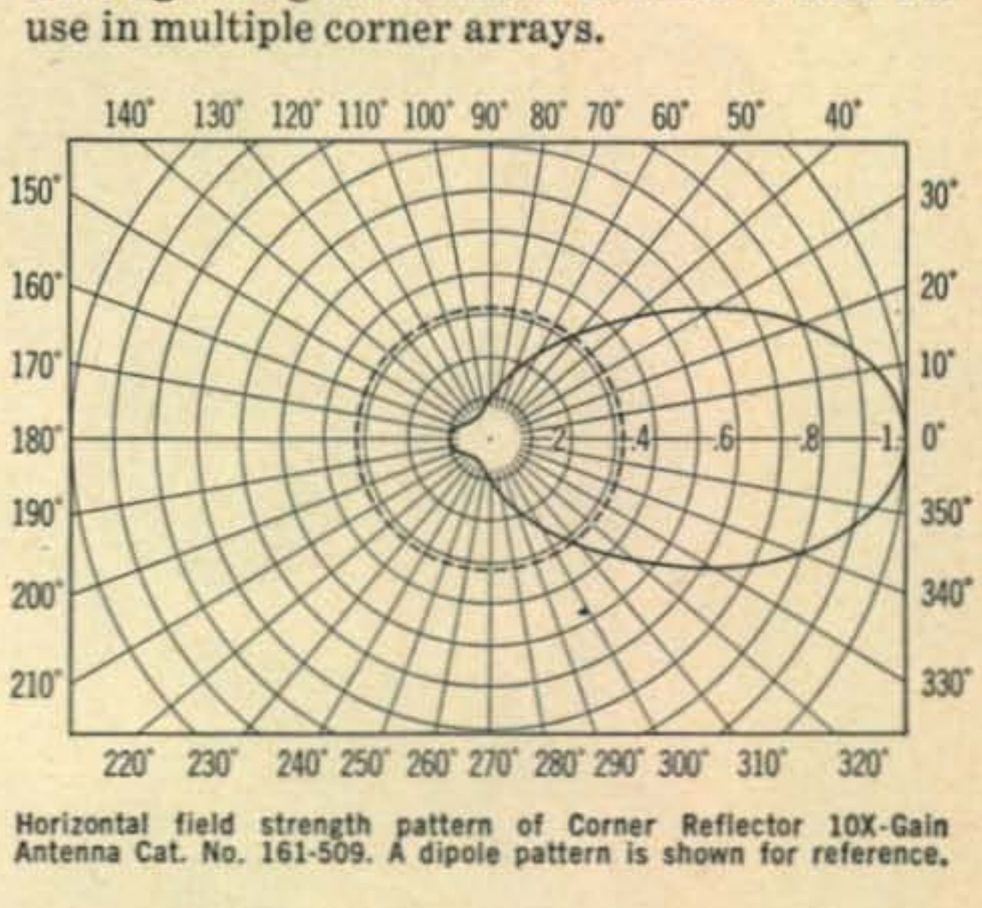
Electrical Specifications:

Nominal input impedance	50 ohms
Forward gain	10 db
Front-to-back ratio	20 db
Maximum power input	250 watts
Internal feedline	RG-8A/U
Flexible terminal extension	18" of RG-8A/U
Termination	Type N male with Neoprene housing
VSWR	1.5:1
Bandwidth	±3%
Lightning protection	Direct ground

Mechanical Specifications:

Reflector (size per side)	2' x 2'
Reflector material	High strength aluminum alloy
Radiating element material	High strength aluminum alloy
Radiating element diameter	⅜"
Rated wind velocity	100 MPH
Lateral thrust at rated wind	16 lbs.
Torsional moment on mounting pipe	16 ft. lbs.
Weight	8 lbs.

Stainless steel hardware supplied to mount antenna on 2" IPS pipe.



Horizontal field strength pattern of Corner Reflector 10X-Gain Antenna Cat. No. 161-509. A dipole pattern is shown for reference.

SINCE 1933

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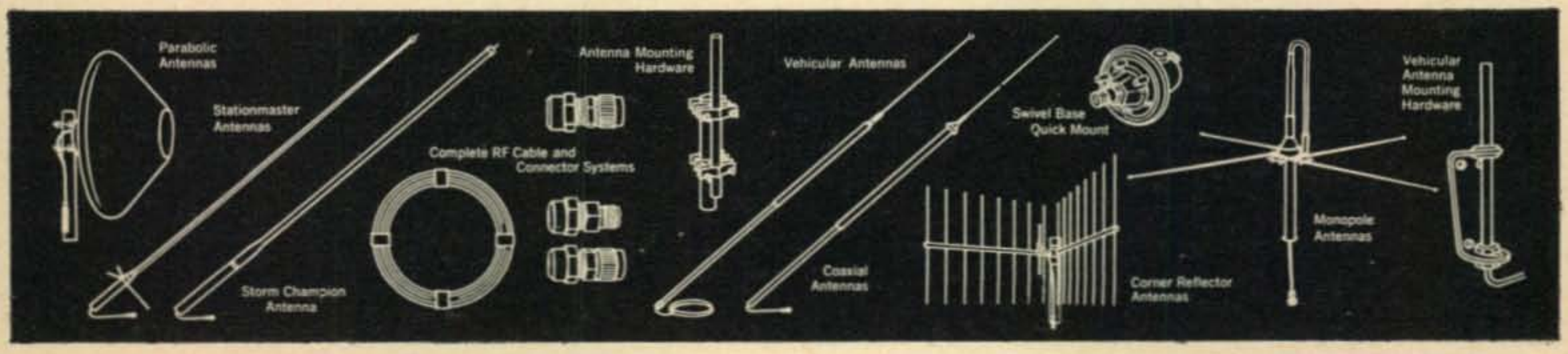


Editor, *CQ:*

I have just read the ZERO BIAS in your March issue of *CQ*. It is indeed a pleasure to finally find a common sense approach to the licensing problem. I congratulate you and your staff and encourage you to do everything possible to have this plan considered instead of the League's misguided proposal.

Howard L. Cordell, Jr., WA4AGC
1010 Academy Avenue
Dublin, Georgia

Editor, *CQ:*

I would just like to say that your proposal on incentive licensing is about the best I have heard to date.

You have my full support.

Marc A. Armstrong, WN2KOV
Quarters 267, USMA
West Point, N.Y.

Editor, *CQ:*

In your March issue the editorial in ZERO BIAS concerning "The Plan" was met by me with great enthusiasm until I read the last segment on "Power."

If the Advanced Class amateur is given his ticket he is supposed to know more than basic electronics. He can put this knowledge to work in obtaining better engineering techniques in his rig and radiators. Is it really necessary to allow him twice the current maximum output when his abilities can accomplish the same desired effect by increasing the efficiency?

Robert A. Applegate, WA9WR/VO1
Box 12, Navy 103
FPO, New York, N. Y.

Editor, *CQ:*

I have been reading most of the articles on the ARRL "Restricted Voice" plan and I am very much against it. However, I would suggest the compromise in the March ZERO BIAS.

I have been studying for my general and hope to take the test soon. I find that the 13 w.p.m. requirement is fairly rough and the theory's no snap. If this problem is not worked out we will loose many prospective Generals.

Mark C. Northup, WN2IDW
Philmont, N.Y.

Editor, *CQ:*

Re your editorial in March, 1964 *CQ*, you go a bit far, don't you? Incentive licensing fine—but keep in mind the target: to improve ham radio. How will 2 kw do that when 1 kw now only creates unneeded QRM.

Your other stuff I can buy, except stick the c.w. speed up to 20-25. Anybody can memorize an exam but most everybody would have to "sweat" the code. And who has respect for something he doesn't have to work for. Which is why the post-WW II hams are usually so lacking in savvy and consideration.

K. A. Fichthorn, W1BGJ
166 N. Main St.
Southington, Conn.

Editor, *CQ:*

Your proposal of exclusive bands for incentive licensing is ridiculous and shows complete lack of thought and consistency.

To grant exclusive c.w. bands for passing a phone theory test equals granting exclusive phone bands for passing a c.w. test. If there are to be exclusive c.w. bands let those who can earn them have the privilege of them and not give them to a group who may not even be interested in them. Let us split the extra class license into two: a 20 w.p.m. code test and c.w. theory for use on your exclusive c.w. bands and a phone theory test for use on your exclusive phone bands.

Also, all should be made to take the General test when they present themselves for either of these two tests to show they are qualified to operate either phone or c.w. in that portion of the band if they so desire.

Never, never give exclusive c.w. bands without a code test so it will truly be a Class A c.w. band.

Robert Mentzer, W8ELL
Box 101
Petersburg, Ohio

If you, like many of today's amateurs, find yourself with your interest fairly equally divided between working AM/CW and SSB, there's a real feeling of frustration with most available equipment. Why? Because most AM rigs require extensive modification to operate SSB—and no SSB rig offers high level AM and Class "C" CW—and the end result is compromise in one mode or the other!

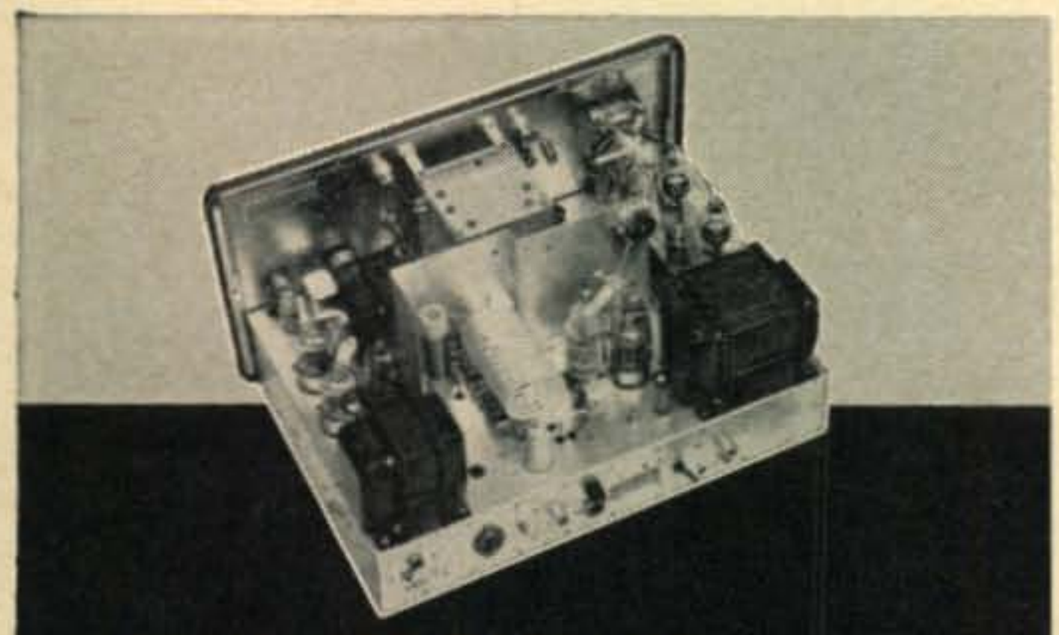
Not so with the Viking SSB Adapter/Valiant II combination, for here's the package that gives you 275 watts CW and SSB plus 200 watts high level AM phone! Now, keep your contacts and work old friends no matter what portion of the band they are operating in, and no matter what mode they are using—and do it with maximum punch!

VALIANT II SSB ADAPTER

SSB ADAPTER

Filter-type SSB generator—bandswitching 80 through 10 meters—more than 50 db sideband suppression—more than 45 db carrier suppression. Features built-in multiplier requiring VFO input only—design and front panel make operating practically foolproof!

Cat. No. 240-305-2 . . . Wired, tested . . . **Net $369.50**



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Outstanding flexibility and performance in a compact desk-top rig! Bandswitching 160 through 10 meters—275 watts input CW or SSB (with Viking SSB Adapter) and 200 watts AM!

Cat. No. 240-105-1 . . . . . Kit . . . . . **Net $375.00**
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COMPLETE CATALOG

Drop us a card and we will send you Amateur Catalog 962, which gives the full story on the "Viking SSB Adapter" and the "Valiant II", as well as detailed information on our complete line of amateur transmitters and station accessories.

E. F. JOHNSON COMPANY
WASECA, MINNESOTA, U.S.A.

For further information, check number 13, on page 110

Editor, *CQ:*

I have followed with keen interest the correspondence in the American Amateur Radio magazines on the A.R.R.L.'s proposals for incentive licensing. I would like to comment upon *CQ*'s plan as outlined in the March, 1964 editorial from the viewpoint of a non-American amateur.

In simple language I gather that the A.R.R.L. thinks there are too many amateurs in the U.S.A. using the DX bands and has proposed rules which would reserve portions of these bands for a select few. As this is purely an American domestic issue, I do not intend either to justify or condemn the idea but rather to criticize your plan's effect upon non-American amateurs.

160 Meters—The Europeans share this band on a non-interference basis with fixed coastal shipping stations. In Britain we have from 1800 through 2000 kc, but other European countries have no amateur allocation in this band at all. I doubt whether your plan for this band would be of any consequence to us.

80 Meters—The European allocation is 3500 through 3800 kc shared with many high power commercial stations. Your proposals for the 3800 through 4000 kc band do not affect us. However, most European c.w. operators use the 3500 through 3550 kc part of the band and your plan would probably lessen the number of U.S.A./European QSO's.

40 Meters—You are lucky to still have 300 kc to use, we have but 100 kc left—7000 through 7100 kc—and have to compete with hundreds of kilowatts of broadcast QRM. With the very strong pressure from the many bodies demanding more and more frequencies for broadcast use. . . .

20 Meters—Here on up we are more affected by your ideas. Whereas now c.w. U.S. QRM is pretty evenly spread over the first 100 kc, the implementation of your plan would cause a considerable increase in the occupancy of the 14025 through 14100 kc segment. Consequently, DX stations would tend to use the Advanced Class band for working each other thus lessening the chances of General Class licensees working such stations.

The same argument would apply to the 14275 through 14300 band which is not a wise choice anyway due to the increasing number of intruders into this section of 20 meters. At certain times, these intruders, together with the harmonics of 7 mc broadcast stations, make it difficult for Europeans to have a decent QSO with the U.S.A.

Another point that you have rather overlooked is that the top 100 kc of 20 meters has become the accepted portion for s.s.b. There would probably be many Advanced Class a.m. addicts. Would you suggest that they used this reservation and if not, what benefit would they derive from your plan?

15 Meters—I agree with your idea to curtail the Novice band and increase the phone allocation whilst we have 450 kc at our disposal. However, when this band is wide open, much the same drawbacks would appear on c.w. as outlined in the remarks on 20 meters. Your proposal to limit the top 50 kc to Advanced Class licensees is open to the same objections regarding a.m. as for 20 meters.

10 Meters—This band is wide enough to be split up any way you choose without affecting DX amateurs and your proposals for amateur bands above 30 mc do not concern us at all here in Europe.

Where I disagree violently with your plan is with respect to your idiotic proposal to increase still further the power input limit to two kilowatts. What a pointless, stupid and utterly inconsiderate proposal! You are absolutely wrong here and a far more sensible approach would be to *reduce* the maximum input for General Class licensees whilst reserving the present one kilowatt for the elite. Do this and you will earn the everlasting gratitude of the non-American amateur world.

Can't you people work any DX unless you run a kilowatt and five element beam at 80 feet? And to crown it all, you even want to sweep away the average ham with his 100 to 200 watts and triband beam at 40 feet just so that the select few who can afford it can have their DX easier still on their own little reservation. No, this doesn't make sense to me, however I look at it and you have completely ignored the effect this discourteous idea would have on the rest of the DX world. It is about time you re-read the International Regulations your country has signed wherein it says you are only supposed to use sufficient power for satisfactory communication.

I trust you will give serious thought to the substance of this letter, in particular to this power question, and remember that one third of the World's hams are outside of the U.S.A.

Norman A.S. Fitch, G3FPK/3A2BT
79, Murchison Road,
London, E 10, England

12 NEW AMATEUR BEAMS

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3 New combination 6 & 2 meter beams
5 New 6 meter beams
3 New 2 meter beams
1 New 1¼ meter beam

SEND FOR NEW TECHNICAL INFORMATION CATALOG #20-226

THE FINNEY COMPANY

34 West Interstate • Bedford, Ohio

For further information, check number 15, on page 110

Alabama

The Birmingham A.R.C. will once again sponsor the 11th consecutive "Birminghamfest" which will be held on May 2-3 at the State Fair Grounds in Birmingham. The club can be reached *via* Box 603 for more info.

Massachusetts

Swampscott is the place, and the annual New England ARRL convention is the event. This year it's May 9 & 10. Besides the many speakers and interesting exhibits there will be a Laser demonstration that should be a big hit. Dinner and dance Saturday night and delicious banquet Sunday evening. John McCormick, W1KCO, RFD 1, Bereley St., Taunton, Mass., is handling registration. See you there!

Indiana

The Clinton County VHF A.R.C. invites all amateurs in the Frankford area to attend their hamfest to be held on June 7th, 1964. It will be held at the Shady Acres Ranch on state road 38, about 1 mile east of Mulberry, Indiana. Bill Strong, K9FUE is sec'ty of the club and he'll be pleased to send you more information.

Kansas

The Neosho Valley Amateur Radio Club of Emporia, Kansas will hold its hamfest on Sunday, May 3 at the National Guard Armory located on K-99 in the north section of town. The event will be held rain or shine and the covered dish picnic starts at noon. Registration is 50 cents. WØZGB, 420 Neosho St., Emporia, Kansas will fill in on events, *etc.*

Michigan

A certificate will be issued by the Henry Ford Museum to any station that works the "Motor City Radio Club" station W8MRM during the 24 hour period (GMT) of May 30, 1964. Old Timers night banquet and program follow on May 31st. Look for the station on 1.815, 3.660, 3.877, 7.040, 7.142, 7.215, 14.060, 14.230, 29.610, 50.178, 146.94 and 147.3 mc. A QSL will get you the certificate.

New Jersey

Another certificate can be obtained by working W2HGR/2, the High Point Amateur Radio Association during their "Field Day" on May 2 and 3, 1964. Operations will take place from the highest point in New Jersey (Sussex County). Look for them on 3.850, 21.350 and "all over" 6 meters.

Delaware

Here's another one for you! The Wilmington Radio Club is also going to Sussex County, only this time it's Delaware. They'll be on during May 2 & 3 using K3QBD/3 and they promise to QSL all contacts.

Illinois

The Kishwaukee R.C. will hold their Swap-fest on Sunday, May 3, 1964 at the Hopkins Park Shelter House on Route 23, in DeKalb, Ill. A $1.00 donation is requested. Bring your tradable goods and have a ball. More information can be received by writing Al Brand, 415 E. Sycamore St., Sycamore, Ill.

Pennsylvania

The Lehigh University Radio Society, W3AEQ will conduct an auction of surplus gear and parts on May 9 in the Packard Laboratory Auditorium. Amateurs in the Bethlehem area are invited to attend.

Correction

The power supply circuit for the 700 watt linear shown on page 24 of the March issue of *CQ* shows four VR-150 voltage regulators in the screen supply. There should be two VR-150 and two VR-90 regulators.

[*Continued on page 80*]

SS-1R

ross Modulation and Overload Performance ....

ONE OF THE MOST IMPORTANT CHARACTERISTICS of a communications receiver– par-ılarly one used on the crowded HF bands — yet most equipment specifications quietly neglect this tor and many receivers (even some expensive ones) behave just miserably in the presence of strong al signals nearby on the band. Not so with the SS-1R — its superb freedom from cross modulation overload is an outstanding feature and a result of the completely new balanced mixer (7360) nt end *with no r. f. stage.* The SS-1R performance in this characteristic (see specification below) ans, from a practical point of view, that the key clicks and the splatter from the strong locals will appear in all but the most impossible situations — when that kilowatt neighbor blasts in on almost same frequency.

e SS-1R offers many other performance advantages over other receivers, such as direct *digital* fre-ncy readout (no more mental arithmetic); exceptional frequency stability and accuracy; *Auto-ibration* of amateur bands with WWV; crystal bandpass filters with unusually sharp skirt selectiv-and the excellent sensitivity of the unique low noise front end mixers. *Motor Tuning* control gets from one end of the band to the other without the tedium of knob cranking. There are *different* essories also: the SS-1S Noise Silencer for *elimination* of most impulse noise and the SS-1RS tching speaker. The SS-1T transceive transmitter and the S-1V Video Bandscanner will be an-nced soon to complete the SS station.

ECIFICATION PROFILE

requency Coverage: 80 through 10 M (eight 500 kc. segments). Fixed tuned WWV at 10.0 and 15.0 MC; 5.0-5.5 MC auxiliary (WWV 5.0 MC). Two general coverage 500 kc segments

electivity: 5 kc./2.5 kc./0.35 kc.

tability: Less than 500 cps warmup drift (typically in less than 5 min.); less than 100 cps thereafter including low to high line variation

ensitivity: ½ μv, or better, for 10 db S/N on 10 M with 5 kc. bandwidth

- **I.F. and Image Rejection:** Greater than 60 db
- **Cross Modulation:** Example: Receiving a **10** μv signal with 2.5 kc. selectivity, an unwanted **0.1 volt** signal 20 kc. away produces negligible cross modulation
- **Internal Spurious:** None at stated sensitivity
- **AGC:** Attack — 1 ms., **Slow** release — 1.0 sec., **Fast** release — 0.1 sec.
- **ANL:** I.F. type; operates on AM, SSB, and CW
- **Size:** 7¾" H x 16¼" W x 13" D, 25 lb.

The SS-1R, SS-1RS and SS-1S are available — ask your distributor for information or write

Squires-Sanders, Inc.

475 WATCHUNG AVENUE, WATCHUNG, N.J. • 755-0222

For further information, check number 17, on page 110

HERE IT IS! THE SPECTACULAR SSB TRANSCEIVER

Featuring the same unmatched performance, reliability and craftsmanship you have learned to expect from Swan Electronics. These units are now in production.

SWAN-406 MINIATURIZED CONTROL UNIT

Miniature design for mobile mounting in conjunction with the Swan-400. May also be used for fixed station operation if desired.

- Phone Band Coverage as follows: 3.8-4.0, 7.1-7.3, 14.15-14.35, 21.25-21.45, 28.5-28.7, and 28.7-28.9 MC. (These ranges can be easily adjusted to cover other segments, if desired.)
- Direct reading dial scale calibrated in 2 kc increments. Dual tuning knobs provide choice of fast 6:1 ratio or slow 36:1 vernier tuning.
- Transistorized VFO circuit with Zener regulated power supply.
- Temperature Stability: Warm-up drift is virtually eliminated due to separation of the VFO from the transceiver's relatively high temperature, and by the use of transistors. Oscillator circuit is fully compensated for wide excursions in ambient operating temperature.
- Voltage Stability: Zener voltage regulator completely isolates oscillator circuit from power supply variations. Input voltage can change plus or minus 50 per cent with no change in oscillator frequency.
- Mechanical Stability: Extremely rugged construction and precision tuning system establishes new standards in operating smoothness.
- Includes receiver R.F. Gain control; thus the 406 functions as a mobile control head, and makes it possible to install the Swan-400 transceiver in the trunk, if necessary.
- Compact size allows installation on the automobile dashboard within easy reach and visibility of the operator. Supplied with mounting brackets and hardware. Only 3 in. high, 4¾ in. wide, 5 in. deep, 3 lbs. weight.

$65

SWAN-400 5 BAND 400 WAT

- Operates with the Swan-406 or 420 Frequency Control Unit, and the Swan-117B, 117AC, or 512 DC Power Supply.
- Covers the 10, 15, 20, 40 and 80 meter amateur bands.
- Transmitter Power: 400 watts SSB, P.E.P. input, dist. prod. down 30db. 320 watts CW input, 125 watts AM input. P.A. efficiency: 60 per cent.
- Two 6HF5 P.A. tubes, 6GK6 Driver Stage, 7360 bal. mod. 17 tubes, total.
- Output Circuit: Wide range Pi Coupler, Coarse and Fine Adjustment.
- Panel Controls: Function Switch, Sideband Selector, Phone-CW Transmit Selector, Rec. A.F. Gain, Headphone Jack, Mic. Jack, Mic. Gain, Carrier Bal., P.A. Tune, P.A. Grid, P.A. Lo Fine-Coarse, Band Selector.
- Grid Block CW Keying. Key jack chassis rear.
- Trans. Metering: 0-800 ma. P Cath., and Grid Current positi for over-modulation indicator.
- Provision for Plug-In VOX Acc sory.
- High Frequency Crystal Lattice ter. Common to transmit and ceive circuits. 3 kc bandwid Unwanted sideband more than db down. Carrier down over 50
- Overall audio bandpass: esser ally flat from 300 to 3300 cycl transmitting and receiving.

JUST THREE YEARS AGO Swan Engineering introduced the now famous SW-120/14 175 single band SSB transceiver. Our company began as a one-man operation w Herb Johnson, then W7GRA, now W6QKI. In three short years we have grown include a talented management team of 13 licensed hams, and a top-qua production department. Our success would have been impossible without tremendously enthusiastic support of Swan owners. We will continue our policy providing the finest quality control and reliability, top dollar value, and custon service second to none. And now the latest development from the Swan laboratori We think you'll agree that the Swan-400 is the most versatile, feature-pack transceiver on the market, regardless of price.

WB6AWJ WA6EDJ K6HON WA6IVC WB6JBL W6K
W6OFT WA6OQY K6OUK W6QKI WA6YKZ WA6ZAC K6

NEW SWAN-400

5 BANDS - 400 WATTS

Separate frequency control heads for maximum stability and versatility, in fixed, portable or mobile operation. Read the following specifications, and we think you'll agree. — The new Swan-400 is for you.

SINGLE SIDEBAND TRANSCEIVER

Single Conversion Design. Spurious emission and image response down more than 80 db.

Receiver Sensitivity: better than .5 uv for 10 db signal-plus-noise to noise ratio.

Wide range AGC system. S-meter functions automatically when receiving.

- 100 KC Crystal Calibrator.
- Built-In Speaker. Also provision for external speaker.
- 5½ in. high, 13 in. wide, 11 in. deep. 15 lbs. weight.

$375

ACCESSORIES

AC Power Supply, Model 117B.....$75
500 Watt Mobile Power Supply, Model 512.....$145
Plug-In VOX Unit, Model VX-1 .....$25

SWAN-420 FULL COVERAGE FREQUENCY CONTROL UNIT

Designed for fixed station operation in conjunction with the Swan-400 SSB Transceiver. May be installed for mobile operation if full frequency coverage is desired.

- Full frequency coverage of 10, 15, 20, 40, and 80 meter amateur bands in **20 ranges** of **200 kc each,** including WWV range as follows: 3.4-3.6, 3.6-3.8, 3.8-4.0, 7.0-7.2, 7.2-7.4, 14.0-14.2, 14.2-14.4, 14.8-15.0, 21.0-21.2, 21.2-21.4, 21.4-21.6, 28.0-28.2, 28.2-28.4, 28.4-28.6, 28.6-28.8, 28.8-29.0, 29.0-29.2, 29.2-29.4, 29.4-29.6, 29.6-29.8.
- Direct reading dial scale calibrated in 2 kc increments. Dual tuning knobs provide choice of fast 6:1 ratio or slow 36:1 vernier tuning.
- Transistorized VFO circuit with Zener regulated power supply.
- Temperature Stability: Warm-up drift is virtually eliminated due to separation of the VFO from the transceiver's relatively high temperature, and by the use of transistors. Oscillator circuit is fully compensated for wide excursions in ambient operating temperature.
- Voltage Stability: Zener voltage regulator completely isolates oscillator circuit from power supply variations. Input voltage can change plus or minus 50 per cent with no change in oscillator frequency.
- Mechanical Stability: Extremely rugged construction and precision tuning system establishes new standards in operating smoothness.
- Matches the Swan-400 in height, depth, and styling. Plugs directly into the 400. 5½ in. high, 6½ in. wide, 11 in. deep, 9 lbs. weight.
- Supplied with mounting base which joins the 400 and 420 in a neat tilt-up arrangement for desk top operating. (As illustrated above.)

$120

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powerful, peak performance pair

SB-33/SB1-LA . . . diminutive duo . . . four-band (80-40-20-15) SSB transceiver/exciter and high power linear amplifier. Bright, state-of-the-art version of a full thumping kilowatt . . . entirely self contained, **including all power supplies** . . . in two tiny cabinets! The only "extras" needed are microphone . . . antenna . . . two lineal feet of mounting space . . . and a strong desire for a clean-cut big signal. And when you look at the photograph above, (the 664 dynamic **does** look big in comparison to the linear amplifier behind it) consider that the SB-33 transceiver on the right also includes **an outstanding receiver** capable of solid-copy reception of the DX that is bound to be stirred up by the KW signal from your powerful pair.

Aside from the use of advanced solid-state circuitry and techniques, there are at least 37 other good reasons why SB-33 can be so small and still deliver in such a convincing manner—18 transistors, 18 diodes and 1 zener diode! (The heavy-duty work is done by two rugged PL-500 beam tetrodes and a 12DQ7 driver). The SB1-LA linear uses 6—6JE6's for 1000 watts P.E.P. on 80-40-20 and 750 watts P.E.P. on 15, achieves its small size in part by careful design and by the use of an all-solid-state voltage-multiplying power supply.

See these best buys at your SBE distributor—**compare** them fully with anything else available, feature-wise, price-wise. (Remembering that SB-33 has **4-bands—panel selectable sidebands—Collins Mechanical Filter—built-in 117V AC power supply** and **loudspeaker,** is 5½"H, 11¾"W, 10¼"D, weighs 15 pounds.

SB-33 TRANSCEIVER

389.50

SB1-LA LINEAR AMPLIFIER

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Please send full information on SB1-LA Linear and SB-33 Transceiver.

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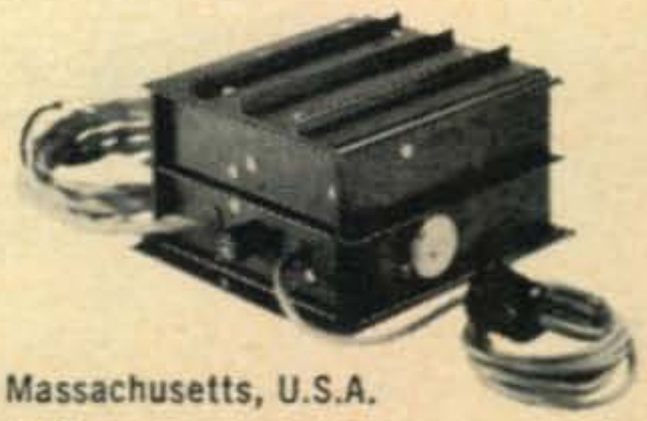
NEW | **Model SB2-DCP DC to AC INVERTER** for SB-33 (only) Quiet . . . entirely solid-state.



Export sales: Raytheon Company, International Sales & Services, Lexington 73, Massachusetts, U.S.A.

For further information, check number 21, on page 110

TRANSMITTER, RECEIVER AND POWER SUPPLY ALL IN ONE HANDY PACKAGE!

GONSET G-50 6 METER Fixed Station COMMUNICATOR

Here's another great GONSET concept in amateur radio communications: Model G-50 with 48 watt transmitter with VFO, ultra-sensitive dual conversion receiver and power supply in a "package" less than one cubic foot! Frequency coverage: 50-54 mcs. Simply connect antenna, microphone and 115 v. AC power and enjoy a new, exciting communications experience in 6-meter DX.

TRANSMITTER: Simple, uncomplicated in operation and adjustment • Husky 48 watt input transmitter uses Type 6146 tube, has pi network output • Modulated by a pair of GL 6 GC's • Multiplier stages ganged and tracked with highly stable, calibrated VFO or optional crystal • VFO spotting switch facilitates "zeroing in" on desired stations • Panel meter switchable to read amplifier grid or plate currents or modulator plate current • Built-in low pass filter attenuates transmitter harmonics, spurious emissions above 65 mcs by 80 db or more.

RECEIVER: Contains RF stage for low-signal-to-noise ratio and ultra-high sensitivity • Dual conversion provides excellent image rejection and 7 kcs selectivity • Adjustable squelch • Super-sensitive noise limiter, "S" meter, panel mounted loudspeaker • Calibrated "Full-Vision" dial with planetary vernier for smooth, easy tuning.

POWER SUPPLY: Heavy duty 115 v. AC power supply.

DIMENSIONS: 7½" h., 13" w., 12½" d.; wt. 29 lbs. Finished in attractive Light Gray.

PRICE: $367.30 Amateur Net; CD Model 3300: $389.95.

For complete information, visit your Gonset Distributor or write Dept. CQ-5

GONSET, INC.

A Subsidiary of Altec Lansing Corporation

1515 S. MANCHESTER AVENUE, ANAHEIM, CALIFORNIA

For further information, check number 22, on page 110

For further information, check number 23, on page 110

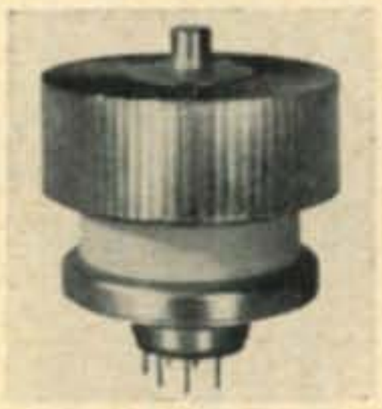
PATTERN FOR PERFORMANCE

Here is a straightforward approach to the problem of preventing electrons from returning to the screen region of a transmitting tube. When channeled into beams like those below, electrons reach the anode, where they do their useful work. Penta's exclusive, patented vane-type suppressor grid does the trick.

The characteristics of Penta tubes employing this electrode geometry approach those of the theoretically perfect beam tube. Plate current is practically independent of plate voltage. Kinks and wiggles are absent. Plate voltage can swing well below screen voltage without appreciable loss of current.

The result is outstanding linearity, efficiency, stability. For example, Penta's PL-8295A—the ceramic version of the famous PL-8295/172—delivers 1000 watts of Class AB_1 useful output at only 2000 plate volts . . . more than 1500 watts at maximum Class AB_1 ratings. Introduced in 1955, Penta tubes with vane-type suppressor grids are in important equipment the world over, and their use in high-quality linear amplifiers is growing daily.

You, too, can enjoy the advantages of this years-ahead design by specifying the PL-177A, PL-175A, PL-8295/172, or PL-8295A, for 100-watt to 1.5-kilowatt power output applications. Detailed, factual data sheets are available for the asking. Ask also for your copy of Penta's latest Summary Catalogue, which describes all Penta products, with prices.



PL-8295A 1000W beam ceramic pentode. High-output Class AB_1 linear amplifier.

PL-175A 400W beam pentode. Popular Class AB_1 linear amplifier.

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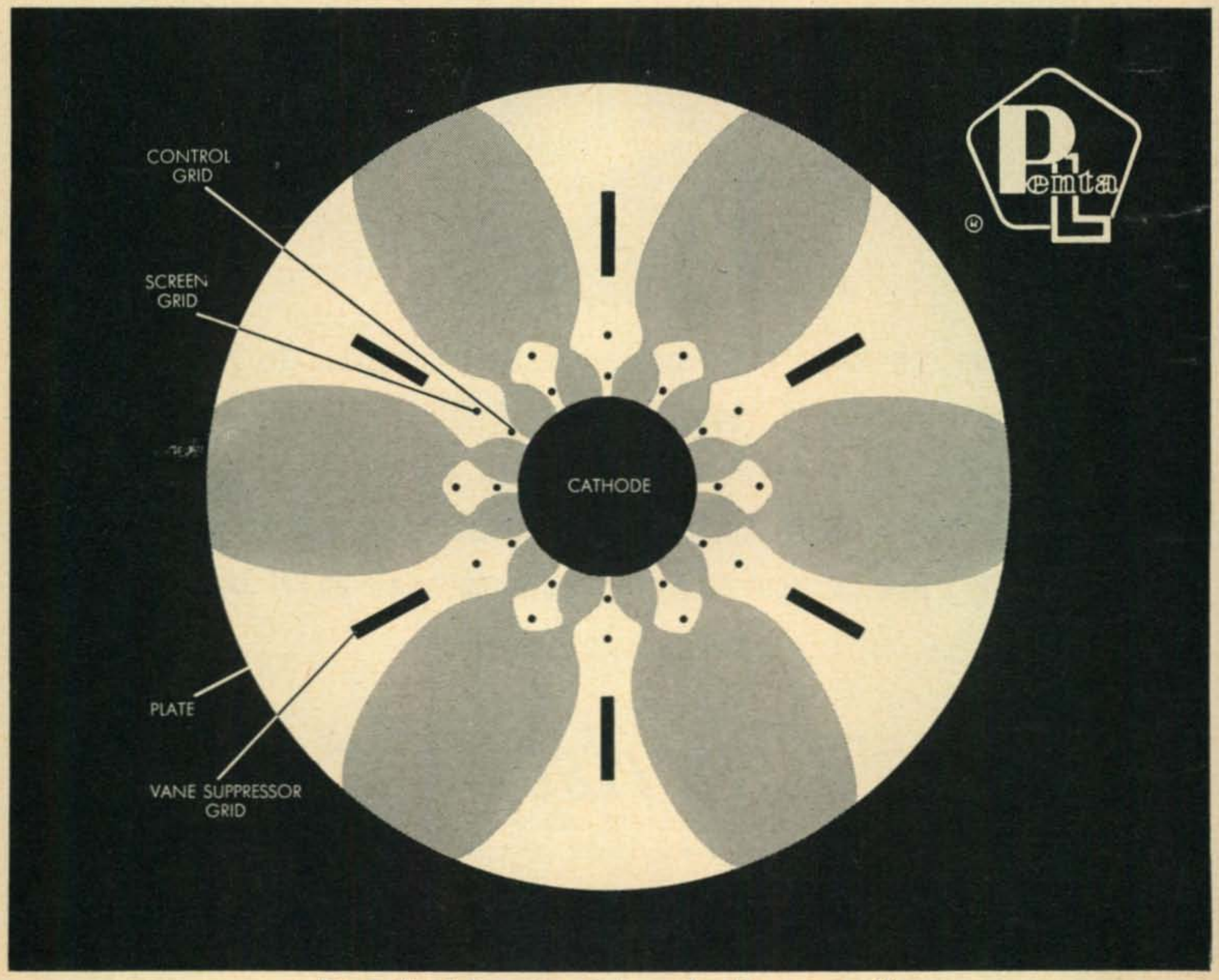
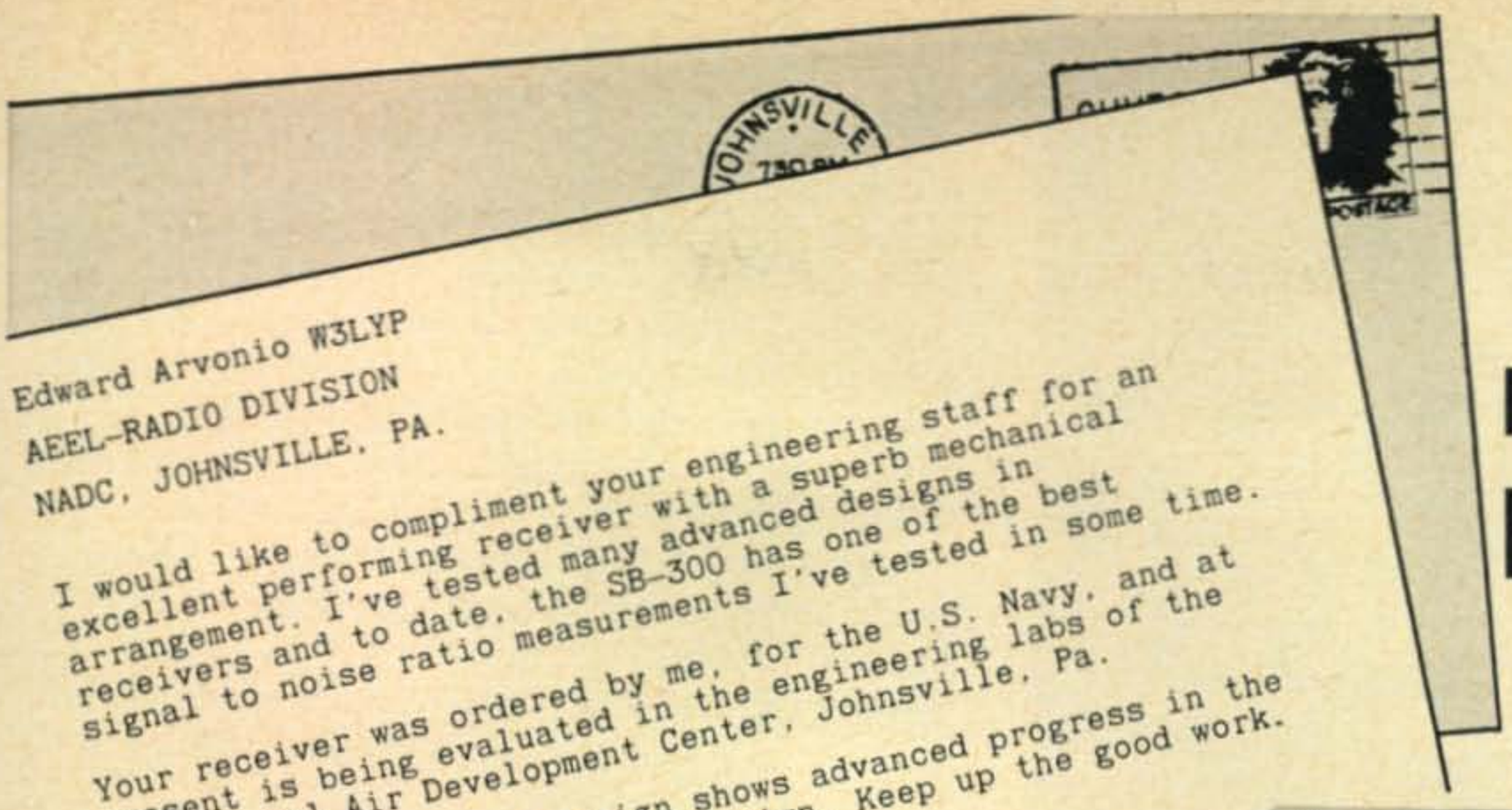


For further information, check number 24, on page 110



Edward Arvonio W3LYP
AEEL-RADIO DIVISION
NADC, JOHNSVILLE, PA.

I would like to compliment your engineering staff for an excellent performing receiver with a superb mechanical arrangement. I've tested many advanced designs in receivers and to date, the SB-300 has one of the best signal to noise ratio measurements I've tested in some time.

Your receiver was ordered by me, for the U.S. Navy, and at present is being evaluated in the engineering labs of the U. S. Naval Air Development Center, Johnsville, Pa.

This type of receiver design shows advanced progress in the state of the art of receiver design. Keep up the good work.

Best of 73's

Edward Arvonio W3LYP

Read this report on the New Heathkit® SB-300!

Heathkit® Deluxe SSB Receiver

SB-300
$265.00

CHECK THESE FEATURES!

• Professional styling & features at 60% savings! • Compiete coverage of 80 through 10 meter amateur bands with all crystals furnished, plus provision for VHF converters • Prebuilt, calibrated linear master oscillator (LMO) • 25 KC per tuning knob revolution offers bandspread equal to 10 feet per megacycle • Built-in crystal calibrator • 2.1 KC crystal bandpass filter • Stability of 100 CPS after initial warmup • Wiring harness & two heavy-duty circuit boards for easy assembly

The SB-300 SSB Receiver is the first in an exciting new series of Heathkit SSB amateur gear designed to bring you the finest in communications facilities at great savings. Its professional styling, quality and features offer performance never before found in kit equipment.

Features include a crystal-controlled front-end for same rate tuning on all bands; prebuilt, Linear Master Oscillator (LMO) for linear tuning with 1 kc dial calibrations; built-in crystal calibrator; hermetically-sealed 2.1 kc crystal bandpass filter; smooth, non-backlash vernier dial drive mechanism; optional AM & CW filters; high frequency I.F.; AGC control; provision for transceive operation with matching transmitter available soon.

Kit SB-300..17 lbs..$27 dn., $22 mo.....$265.00
SBA-300-1, AM Crystal Filter (3.75 kc)..1 lb.....$ 19.95
SBA-300-2, CW Crystal Filter (400 cps)..1 lb.....$ 19.95

CHECK THESE SPECIFICATIONS!

Frequency range (megacycles): 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5 21.0 to 21.5, 28.0 to28.5, 28.5 to 29.0, 29.0 to 29.5, 29.5 to 30. **Intermediate frequency:** 3.395 megacycles. **Frequency stability:** 100 cps after warmup. **Visual dial accuracy:** Within 200 cps on all bands. **Electrical dial accuracy:** Within 400 cps on all bands. **Backlash:** No more than 50 cps. **Sensitivity:** Less than 1 microvolt for 15 db signal plus noise-to-noise ratio for SSB operation. **Modes of operation:** Switch selected: LSB, USB, CW, AM. **Selectivity: SSB:** 2.1 kc at 6 db down, 5.0 kc at 60 db down (crystal filter supplied). **AM:** 3.75 kc at 6 db down, 10 kc at 60 db down (crystal filter available as accessory). **CW:** 400 cps at 6 db down, 2.5 kc at 60 db down (crystal filter available as accessory). **Spurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **Audio response: SSB:** 350 to 2450 cps nominal at 6 db. **AM:** 200 to 3500 cps nominal at 6 db. **CW:** 800 to 1200 cps nominal at 6 db. **Antenna input impedance:** 50 ohms nominal. **Muting:** Open external ground at Mute socket. **Crystal calibrator:** 100 kc crystal, ± .005%. **Front panel controls:** Main tuning dial; function switch; mode switch; AGC switch; band switch; AF gain control; RF gain control; pre-selector; phone jack. **Rear apron connections:** Accessory power plug; HF antenna; VHF #1 antenna; VHF #2 antenna; mute; spare; anti-trip; 500 ohm; 8 ohm speaker; line cord socket; heterodyne oscillator output; LMO output; BFO output; VHF converter switch. **Tube complement:** (1) 6BZ6 RF amplifier; (1) 6AU6 Heterodyne mixer; (1) 6AB4 Heterodyne oscillator; (1) 6AU6 LM osc.; (1) 6AU6 LMO mixer; (2) 6BA6 IF amplifier; (1) 6AU6 Crystal calibrator; (1) 6HF8 1st audio, audio output; (1) 6AS11 Product detector, BFO, BFO amplifier. **Power supply:** Transformer operated with silicon diode rectifiers. **Power requirements:** 120 volts AC, 50/60 cps, 50 watts. **Dimensions:** 14⅛"W x 6⅝"H x 13⅜"D.

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For further information, check number 25, on page 110

In weak TV signal areas, even with normally "clean" 50 mc transmitters, radiation of extremely minute amounts of harmonic and sub-harmonic energy can lead to TVI of varying degrees. This has led to the recommended use of low-pass filters, half-wave "Harmoniker" type filters, or better yet, cavity or coaxial type filters between the final amplifier and the antenna coupler or the antenna feed system. Coaxial filters are especially suitable, since the insertion loss is very low, and they provide attenuation of a high order to any frequencies either above or below the operating frequency. Search for design criteria for such a unit for 50 mc led to the development of the Coaxial Line amplifier herein described, which was built by WA4BYR.

A Coaxial Line Amplifier for 50 Mc

BY ANSEL E. GRIDLEY*, W4GJO

After all, if we are going to build a coaxial filter, why not make it an integral part of the final r.f. amplifier? In addition to achieving the desired purpose of attenuating undesired energy both above and below the operating frequency, we come up with some very worthwhile "dividends" in improved performance of the amplifier.

For one thing, such a unit exhibits a high Q, yet maintains high efficiency. This cannot readily be done with the conventional coil-capacitor configuration, as a lower Q is more efficient in this application. The high Q is especially good for linear operation, and the performance of this final in a.m. and s.s.b. linear modes is outstanding. Another important consideration is that the copper tubing plate line slips directly around the 4X150 anode and acts as a tremendously effective heat sink. This, in combination with the prescribed air flow and the high amplifier efficiency, means that the tube itself runs very cool.

A 4X150 in use in this amplifier has been run for protracted periods at close to 4X250 ratings, with no deleterious effects, and the tube has remained bright, shiny and in apparently new condition. Another plus is that the output coupling efficiency is very good because of the high Q of the tank circuit. While at first glance the unit may appear a bit bulky, it takes very little bench space, and in most ham shacks plenty of height is available, and well worth using.

*P.O. Box 1294, Sarasota, Florida.

View of complete unit, with 4X150A in foreground for size comparison.

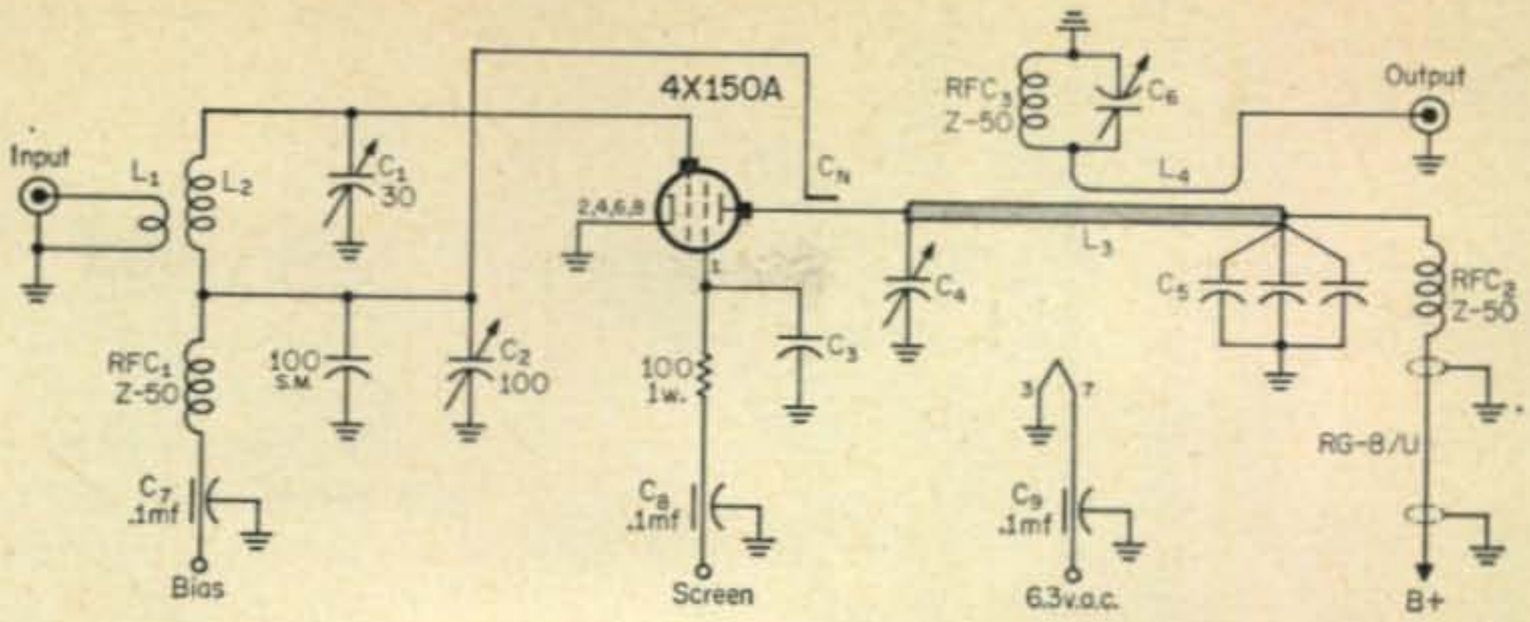


Fig. 1—Schematic diagram of the 50 mc coaxial line amplifier. All capacitors are in mmf unless otherwise indicated.

C_1—30 mmf variable. Hammarlund HF-30X.
C_2—100 mmf variable. Hammarlund HF-100.
C_3—Screen by-pass in Eimac SK-610 socket.
C_4—Plate tuning capacitor. See text & photos.
C_5—.005 mf 2.5 kv d.c. blocking capacitor. Three Aerovox series 1445.
C_6—50 mmf variable. Hammarlund HF-50.
C_7, C_8, C_9—.1 mf 400 v. Sprague 80P1 Hypass capacitors.
C_n—Neutralizing capacitor. See text.
L_1—2 t. #12, ¾" dia. ⅜" long.
L_2—5 t. #12, ¾" dia. 1¼" long.
L_3—Plate coax tank. See text and fig. 3.
L_4—Output link. #12 wire 8½" long. See fig. 3.

Tank Construction

The basic circuit is conventional, as shown in the schematic diagram, fig. 1. Although the construction is somewhat unorthodox, no difficult assembly procedures are encountered. The basic unit is constructed from 6" o.d. aluminum irrigation pipe, available from Sears or from many farm equipment or plumbing contracting firms. The overall height of the unit is 48". This is made in two sections. The top section is 39", and the bottom section, which houses the grid circuitry, tube and plate tuning capacitor and associated components, is 9". The two sections are joined in final assembly by a 1½" strip of the same tubing, which is split to fit tightly inside the two sections. The assembly is secured with self-tapping screws.

The chassis for mounting the tube socket is a round aluminum plate cut to make a tight fit inside the 6" tubing. It is important that this be a reasonably tight fit, as the lower compartment is pressurized to permit adequate air flow through the tube. This chassis plate is placed 3" from the bottom, and secured with small angle brackets and bolted in. Before mounting this plate, a 2-3/16" diameter socket hole is provided in the center for mounting the Eimac SK-610 air-system socket. Six 3/16" holes are drilled near the edge of this plate, so that a small amount of air flow is provided to help cool the outside of the plate line and to provide some air circulation in the upper compartment.

The use of a SK-606 chimney is recommended for maximum tube cooling. A note of caution regarding the installation of the socket itself: Be sure the clamps which secure the socket to the chassis, clamp only to the outer lip of the socket as shown in the photos. Otherwise, the mica in the socket may be damaged, with resultant arcing to the chassis. The plate tuning capacitor is made from two 4" diameter discs of aluminum. One of these is drilled and tapped to accept a ¼-20 threaded brass rod, and secured with a brass nut behind the plate. The threaded rod extends to the tuning knob through a bushing with an attached ¼-20 brass nut.

Securing the nut to the bushing may be expedited as follows: Run an aluminum screw through the bushing to hold the brass nut while soldering. Solder will not adhere to aluminum, so after soldering, the aluminum screw may be easily removed, leaving the threads in perfect alignment with the bushing. The other tuning plate is bolted to the inner plate line.

The entrance for the forced air from the blower in our case was made from a discarded Aerosol can with the top hacksawed off, attached to a copper plate and screen inside the unit, providing a 2" diameter fitting which connects perfectly to automotive defroster hose, available at any auto supply house. If preferred, of course, the blower may be attached directly to the unit.

Three 0.1 mf 400 volt coaxial capacitors provide a convenient method of feeding filament, bias and screen voltages, and provide effective by-passing. A metal protective cover should be installed to protect against accidental contact with these external terminals.

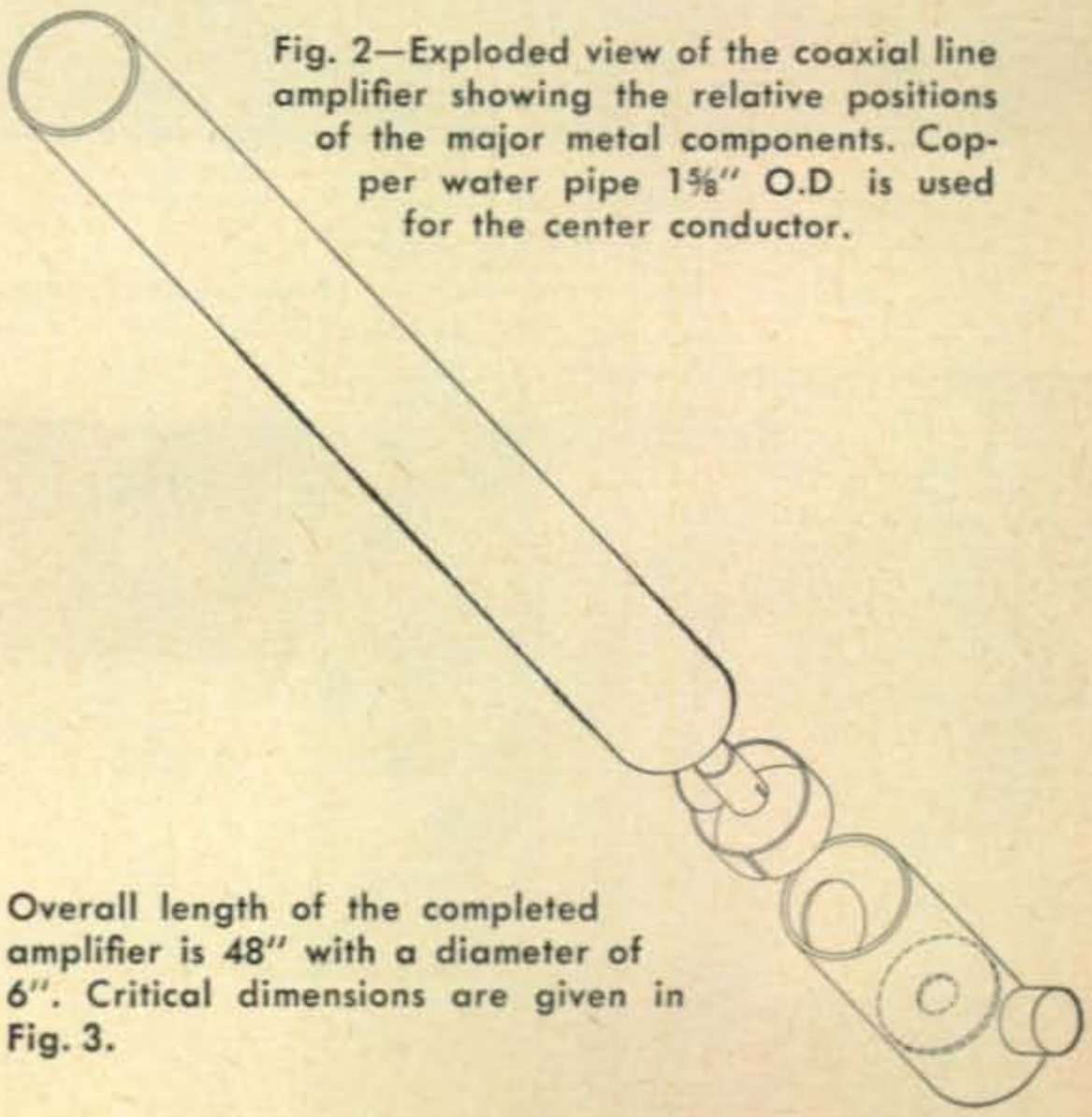
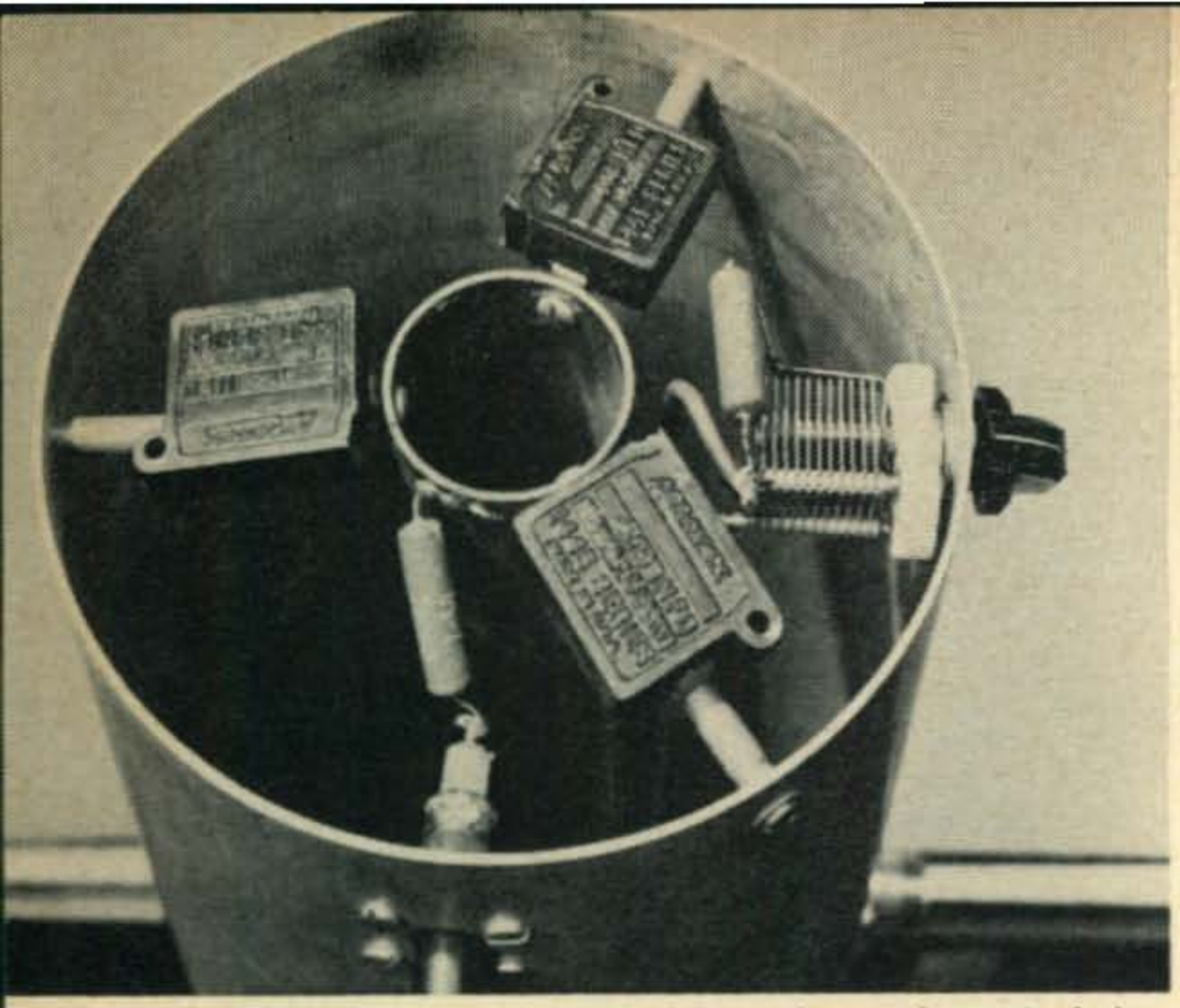


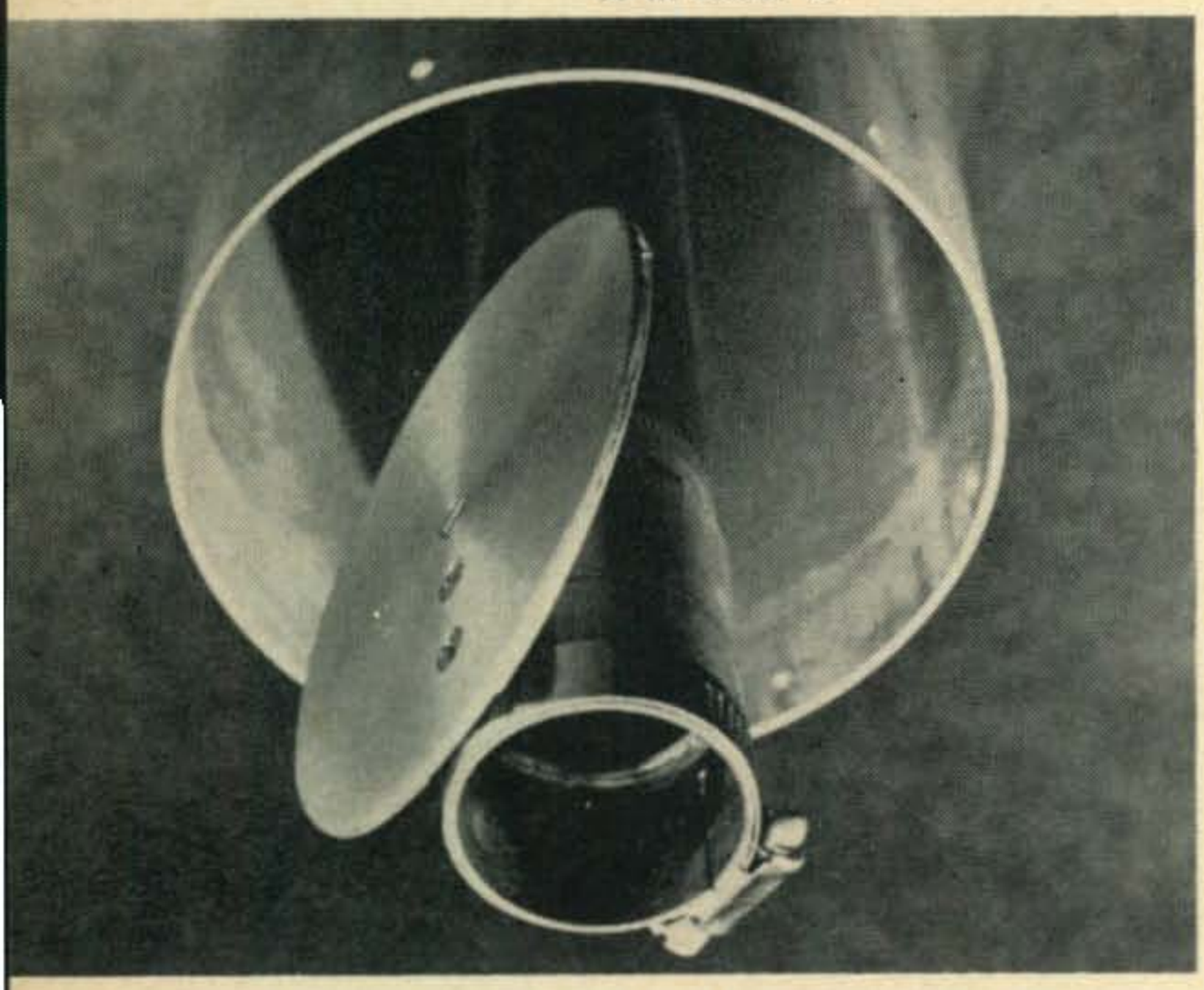
Fig. 2—Exploded view of the coaxial line amplifier showing the relative positions of the major metal components. Copper water pipe 1⅝" O.D is used for the center conductor.

Overall length of the completed amplifier is 48" with a diameter of 6". Critical dimensions are given in Fig. 3.

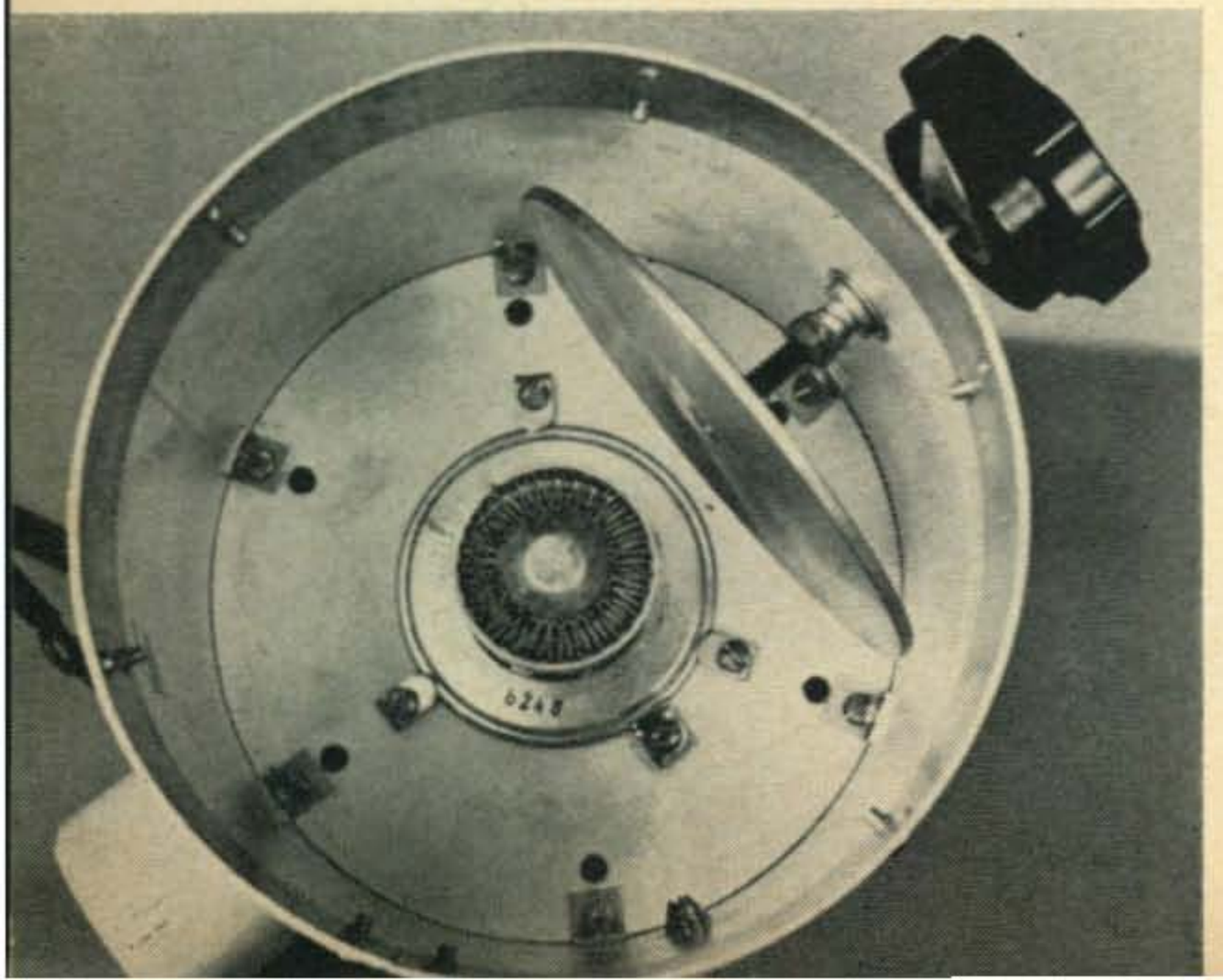


Top of coaxial line amplifier. Plate voltage is fed to the top of plate line through an ohmite Z-50 r.f.c. Antenna pickup link L_4 runs from the stator of output capacitor C_6 along the plate line to the antenna coax connector, which is 8¾" from the top of the tank.

Tube end of the plate line. A fixed 4" diameter tuning plate is bolted to the inner plate line so that it is parallel to the variable plate when the unit is assembled. The fixed plate is notched slightly to allow a hose clamp to fit under it.



Top view of the tube compartment. Feed-back neutralization is provided by the fixed tab of sheet copper 1⅛" long and ⅜" wide, mounted on fiber feed-through washer near the 4X150A socket.



The inner plate line consists of 42½" of 1⅝" o.d. copper tubing (1½" nominal copper water pipe available at any plumbing shop), with a standard solder-type pipe coupling, (1⅝" i.d. copper, 2" long) attached to the lower end. The overall length of the tubing with the coupling installed is 43⅞". The coupling presents a nice fit around the 4X150 anode. It is slotted lengthwise, and a hose clamp attached for later tightening to the tube.

Before mounting the plate by-pass capacitors at the top of the plate line, slip the inner tubing over the 4X150, making certain that the two tuning capacitor plates are parallel to each other. Bend the connecting tabs back on the transmitting mica by-pass capacitors, and bolt them to the plate line as seen in the top view of the unit. It will be necessary to remove carefully with a hacksaw the inner mounting "ear" on each of these capacitors, so that they will clear the inner tubing when mounted.

Use short lengths of ¼" copper tubing between the outside capacitor connections and the outer tubing, and bolt them in firmly. When these are tightly installed, the entire assembly will then be quite rugged and mechanically stable. While three .005 mf plate by-pass capacitors were used in this unit, three .001 mf units would undoubtedly do the job just as effectively. Using three such capacitors in place of the usual one, does help distribute the current, and everything runs cool and stable. But by all means do use this *type* of capacitor. TV type "doorknob" capacitors were first tried, and they just *won't* do.

Plate voltage is fed through a length of RG-8/U cable and an Amphenol 83-1H hood-type connector. This makes a safe high voltage entrance method, and with the braid folded back and soldered directly to the hood fitting, provides excellent shield contact. The high voltage inner lead of the RG-8/U protrudes just far enough to make easy connection to the Ohmite Z-50 r.f. choke. The additional Z-50 choke, RFC_3, across the reactance capacitor is simply "life insurance," in that it will provide a d.c. path to ground in case the antenna pickup link should accidentally come into contact with the plate line.

Placement of other parts is not critical, and wiring is straightforward. If the general layout as seen in the photographs and the detailed mechanical drawing, fig. 2, is followed, no difficulty should be encountered.

When all assembly and wiring are completed, place an air-tight aluminum cover over the bottom of the complete unit, and a perforated shield cover over the top to complete the shielding and as a safety protection, and yet allow free flow of air through the top.

Initial Adjustment

Be sure the blower is in operation. Provide a dummy load for testing, and never operate the amplifier without an adequate load. First adjustment should be made with reduced plate

and screen potentials and with adequate grid bias applied.

After applying drive and initial tuning up, proceed with neutralization as follows: Insert a diode r.f. probe at the output coax receptacle. Disconnect the screen and plate leads from the unit entirely or rectification will make proper neutralization impossible. Apply sufficient drive so that measurable grid current is drawn, and carefully resonate the grid circuit. Then adjust the 100 mmf variable capacitor, C_2, for minimum r.f. output as indicated on the r.f. indicator. Re-resonate the grid circuit, and again adjust C_2 for minimum r.f. in the probe, and continue this procedure until no further improvement is possible. Apply reduced plate and screen voltages again, and if all is well, full operating voltages may be applied.

S.S.B. Operation

For linear s.s.b. or a.m. operation, for n.b.f.m. or c.w. operation, 350 volts of regulated screen voltage may be used. With 350 volts on the screen and 2000 volts on the plate, about —55 volts of grid bias will allow 75 ma of resting plate current to flow under no-drive conditions. Adjust the bias until you obtain no more than 75 ma static plate current. This is right at the maximum plate dissipation rating of the 4X150, but in this amplifier configuration, the tube remains cool and unperturbed. The relatively high idling plate current means less plate current swing when drive is applied, with resultant somewhat better s.s.b. linearity, and less stringent demands on the plate power supply. Of course, the power supply itself, especially for s.s.b. use, should have good overall regulation, and as much output capacitance as feasible, for good dynamic as well as static regulation under varying load requirements.

On s.s.b., voice peaks will show a meter indication of 125 to 150 ma. Screen current under no-drive conditions will be zero, and in our case, with full s.s.b. drive will swing negative 3 to 4 ma. D.c. screen current will vary from tube to tube, but in tetrode and pentode amplifiers with a relatively small average plate swing, the screen current readings will usually be very low, and may be either positive or negative. Such negative screen current is not in any way detrimental to proper linear operation.

If a zero-center meter for reading screen current positive or negative is not available, a resistor to ground may be installed on the screen side of the meter to draw, say 5 ma. Positive screen current will then read upward from 5 ma, and negative screen current will cause the meter to deflect downward from the 5 ma reading. With 350 volts, a 70K resistor to ground will accomplish this.

A.M. and C.W. Operation

For a.m. linear operation, carrier may be inserted until final plate current is from 135 to 150 ma. Screen current in our case will be negative about 3 ma. If the final is loaded properly,

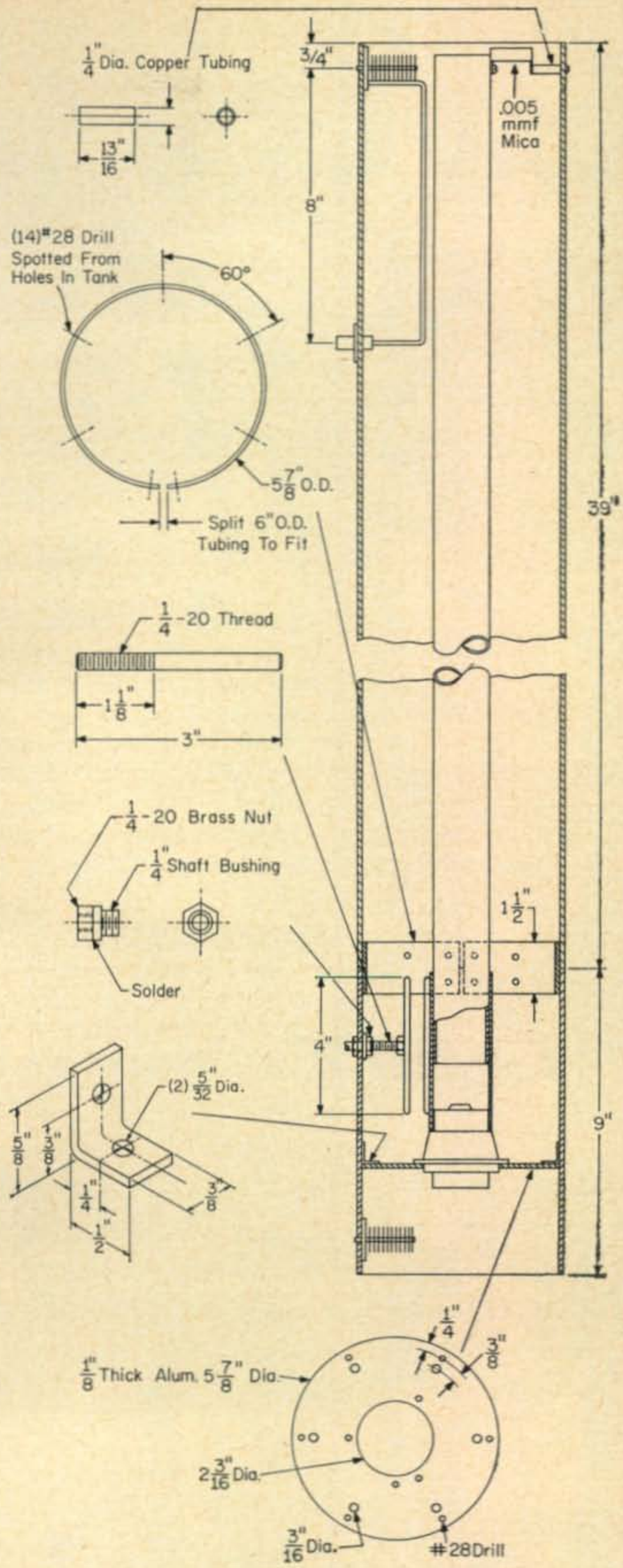
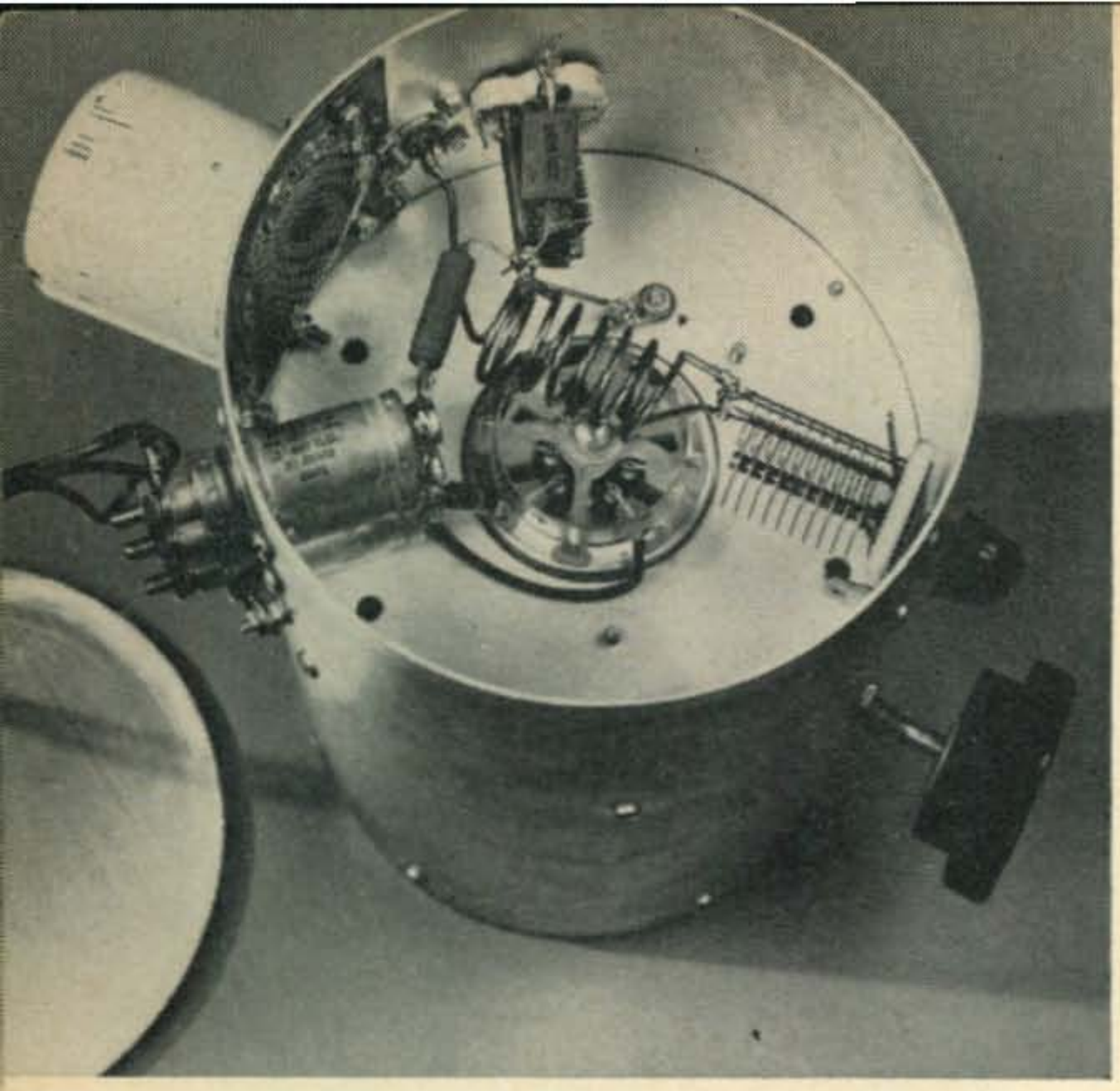


Fig. 3—Detailed sectional view of the amplifier. The chassis plate is spaced 3" from the bottom end.

operation will be linear. The screen current will go positive rapidly if loading is too light, and operation will not be linear.

For n.b.f.m. or c.w. operation, plate current may be increased to 250 ma. Bias of —90 volts is employed, consisting of —75 volts of fixed bias in series with a 1000 ohm 1 watt resistor. Grid current is 15 ma.



Grid compartment showing grid tank circuit details. The 100 mmf variable capacitor, C_2, is used for neutralization adjustment. Filament, bias and screen voltages are fed through coaxial capacitors. Also seen is the entrance for forced air from the blower.

D.c. bias of —105 volts will be satisfactory if high-level plate modulation is employed, but plate voltage should be reduced to 1000 to 1500 volts, and screen voltage should be 250. Of course, for high-level modulation, the usual choke will have to be inserted in the screen lead, or the modulation may be supplied through a separate screen winding on the modulation transformer.

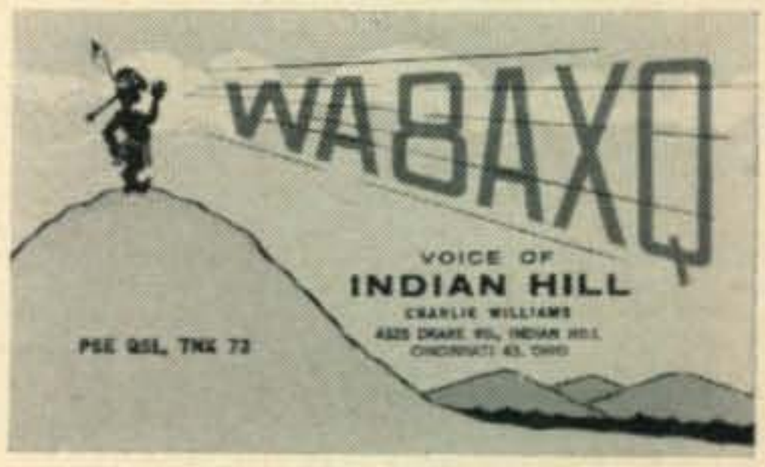
When using the screen choke, if a low-frequency parasitic resonance develops, as it did with us, the choke may be shunted with a resistor. The resistor should be the highest value which will stop the resonant condition. Plate current for this operation may be from 150 to 200 ma.

Operation of this amplifier is a real pleasure. It tunes as easily and remains as stable as a well-designed 75 meter final. Plate tuning is not critical; a 200 kc change in frequency requires a full 180 degrees rotation of the tuning capacitor. The plate current dip, the grid current maximum, and maximum r.f. output all coincide perfectly . . . quite unusual for a v.h.f. amplifier.

No matter what mode, amplifier efficiency is outstanding. And in Englewood, Florida, where TV channel 11 is a real fringe-area signal, all last vestiges of fourth harmonic TVI are gone at last. And all the other TV channels are clean, too. Try this with many a *low* power 50 mc transmitter! All this, and the "dividends," too! ■

QSL contest

Runners Up



It's been a few months since we've had space available for a QSL Contest, but there sure has been no shortage of entries!

This month, among from the many attractive cards received, we judged DJ8EG to be about the most handsome; runners-up are WA8AXQ, YV4CP and 9A1AIJ. All the cards are multicolor and on "chrome-cote" stock.

CQ Reviews:

The Eico Model 722 V.F.O.

THE Eico Model 722 variable-frequency oscillator is an excellent unit of fine quality for the amateur who would like to get away from being "rock-bound." It provides full frequency-coverage for the five amateur bands from 80 to 10 meters, in six ranges, two of which are used for the 10-meter band. The unit may be used in place of a crystal with all of the currently popular crystal-controlled transmitters.

For those who enjoy the fun of putting their own gear together, the Model 722 is available in kit form; but if one is not so inclined, completely wired and tested units also may be obtained.

Unusually rugged construction is used throughout, resulting in a high order of mechanical stability, while electrical stability is ensured through the use of carefully selected components and thermal compensation. Other salient features are: an easy-to-read 6" slide-rule type dial separately calibrated for each range, with a velvet-smooth and reliable tuning mechanism, a buffer-multiplier providing plenty of r.f. output (10-20 volts), a mode switch with a frequency-spotting position, provision for separate *or* simultaneous keying of v.f.o. and transmitter, regulated plate potential and a self-contained a.c. operated power supply using silicon diode rectifiers which eliminate heat build-up that might otherwise be experienced.

Circuitry

The oscillator, which operates on 80 meters, employs a 6AU6 in the well-known electron-coupled series-tuned Clapp circuit. A slug-tuned tank coil is used, while the band-set capacitors, of which there are three, are the miniature air-trimmer type. Separate temperature-compensating capacitors are used for each range. The main-tuning capacitor is a double-bearing type with double-spaced plates. The frequency-determining components are contained within a shielded enclosure, while the oscillator tubes are mounted outside of it and at the rear of the chassis, so that the radiated heat from the tubes is kept away from the temperature-sensitive components. This arrangement contributes to the fine overall stability of the v.f.o., which by the way, is achieved without the use of a ceramic coil form for the oscillator inductor.

The output stage utilizes a 6CB6 which functions as a straight-through buffer-amplifier when 80-meter operation is conducted and as a frequency multiplier with 40-meter output when the other bands are used.

Dial

The slide-rule dial is calibrated in 10 kc increments for the 80 and 40 meter bands, in 50 kc increments on 15, and with 100 kc points on the two 10-meter scales. The ranges are: 3.5-4.0 mc (80 m.), 7.0-7.3 mc (40 m.), 14.0-14.35 mc (20 m.), 21.0-21.45 mc (15 m), 28.0-29.2 mc (10 m.) and 29.0-29.7 mc (10 m.). A large disc-pulley on the tuning capacitor is rotated by means of a friction-type drive having a tuning ratio of approximately 10 to 1, requiring about five revolutions of the tuning knob to fully cover most of the ranges. The pointer for the slide-rule dial is moved along the scale by a string-drive arrangement from the pulley on the capacitor.

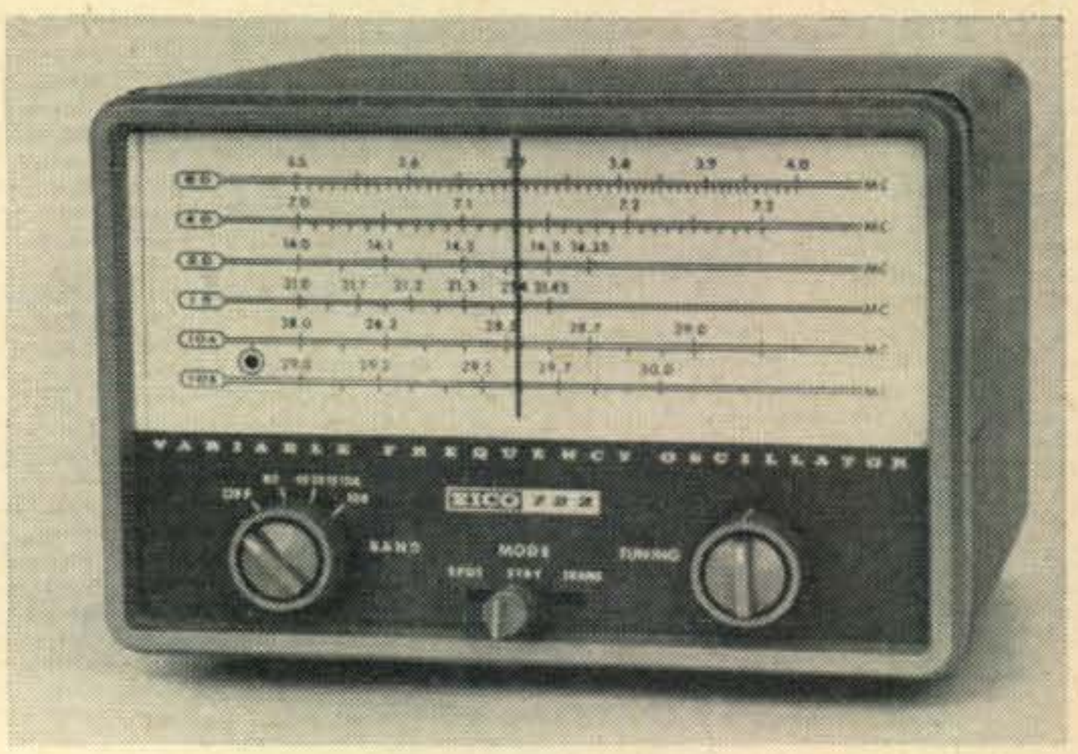
The front panel with the drive and dial mechanism is firmly braced by side brackets secured to the heavy-gauge metal chassis. The panel itself is a metal casting. The overall result is an assembly which resists warping and twisting.

Controls

Besides the tuning knob, the other panel controls are the BAND switch and the MODE switch. The former includes a POWER-OFF position. The MODE switch is a lever-type which may easily be flipped with one finger to select any of the three modes which are SPOT, STANDBY and TRANSMIT. The SPOT position enables the v.f.o. signal to be set to frequency, while it is heard on a receiver, without putting a signal on the air.

Lighting of the dial is not provided, nor is it needed, as the scales and pointer may readily be seen with normal room lighting. Dial glare is thereby eliminated. A small neon pilot lamp may be seen through a small hole at the left end of the dial scale.

The rear apron of the unit contains a phono-type output jack, a standard type key jack, a screw-in fuse holder and a two-terminal strip for keying connections to a transmitter.



The Eico Model 722 v.f.o. is a smartly styled unit. The full-view slide-rule dial has separately calibrated scales for each amateur band. The lever-type MODE switch, at the bottom center, may be easily flipped to any position. The pilot light is at the left end of the 10m scales.

Assembly

Assembly time for the Eico Model 722K v.f.o. kit, following the step-by-step instructions set forth in the construction manual, involved a little over 7 hours, exclusive of calibration. No special problems were encountered, except during the assembly of the dial, drive mechanism and panel, in which case it was found necessary to slightly elongate some of the mounting holes in the side brackets in order that the drive arrangement fit properly without undue stress on the tuning capacitor.

In order to clarify wiring instructions, the routing of many of the power leads is shown quite spread out in the assembly diagram. Actually, these leads may be run alongside one another to make a neat and uncluttered appearance, as shown in the bottom view photo.

Performance

The following performance was obtained from the Model 722 tested for evaluation: During the first 20 minutes of operation, from a cold start at normal room-ambient temperature, the frequency drifted 500 cycles. Following this "warm-up" period, the stability held to better than 50 c.p.s. per hour. Line potential changes of ±10% caused less than a 25-cycle frequency shift. These observations were made at 7.1 mc. Since the v.f.o. frequency is multiplied for operation on the 20, 15 and 10 meter bands, the given figures will be increased by a factor of 2, 3 or 4 for the respective bands.

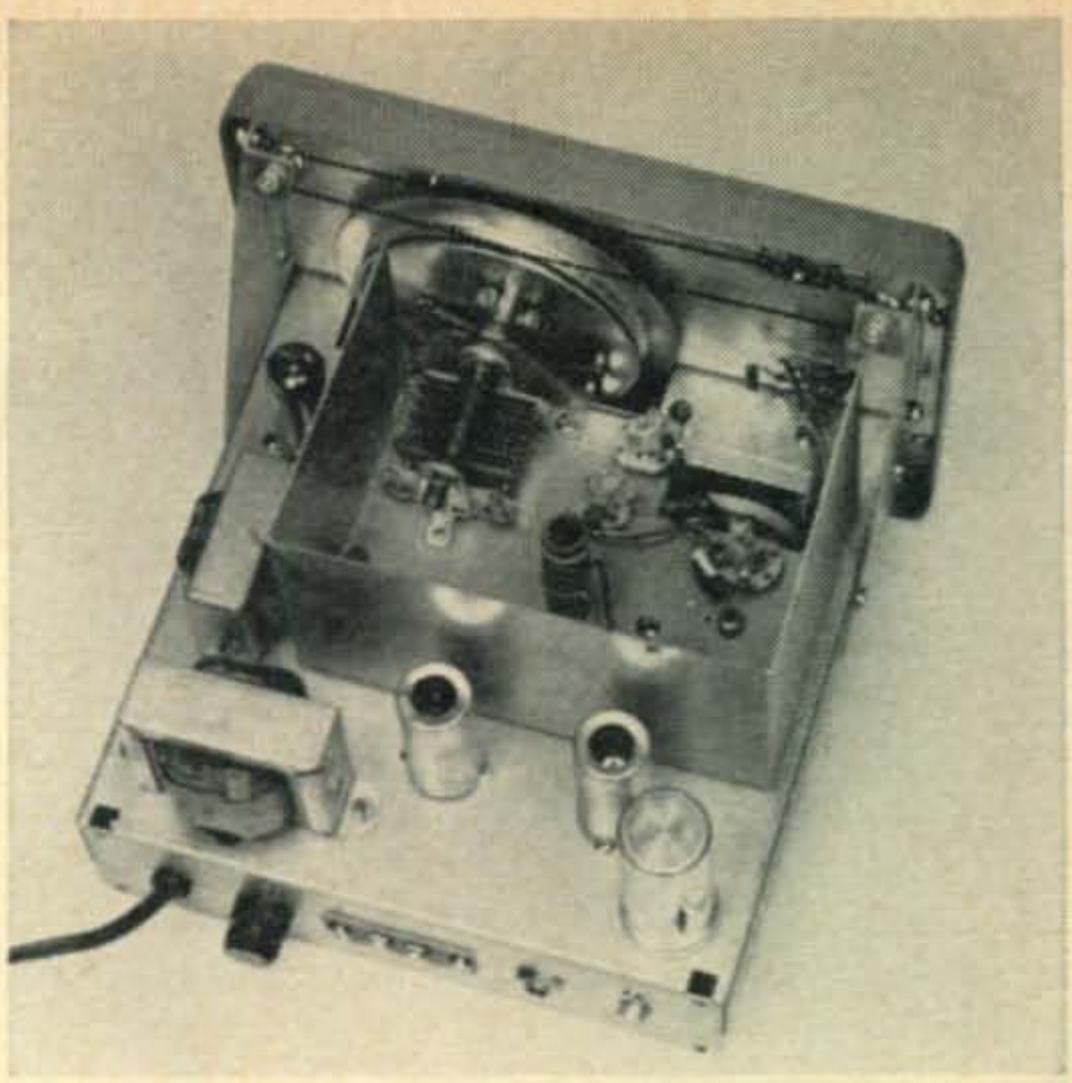
The mechanical stability of the unit was found to be exceptionally good, especially for a unit of this type using the Clapp configuration, where frequency quivver and microphonics often are experienced when the equipment is vibrated. No such adverse effects occurred when the Model 722 was subjected to banging and jarring, nor did attempts at twisting the cabinet by hand indicate any frequency shift.

Keying

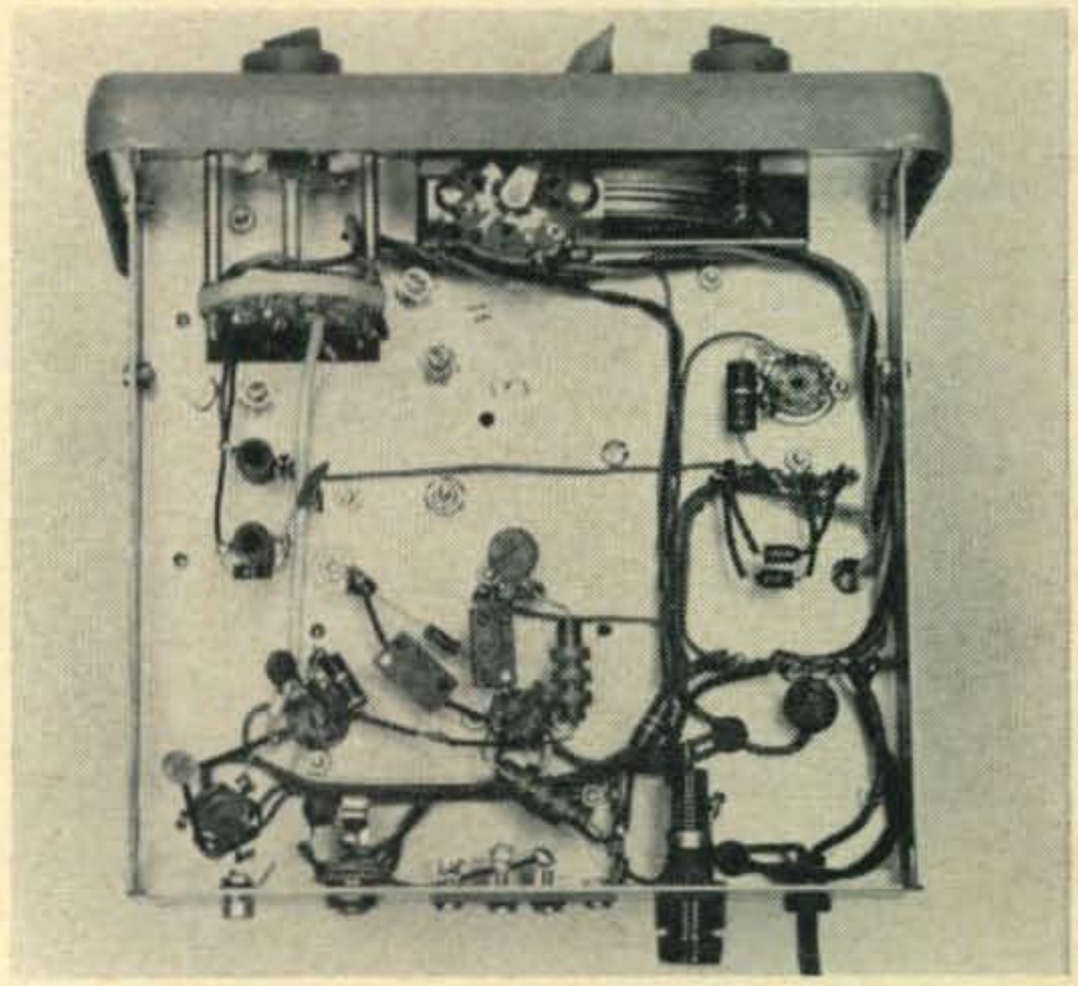
Keying of the v.f.o. itself is exceptionally clean and crisp without chirps on the 40 through 10 meter bands (on ten there was a slight lilt if one listened critically). The fine keying qualities were also experienced on the 80-meter band as long as the output stage was tuned to the high-frequency side of resonance. This situation is a result of operating the output stage on the same frequency as that of the v.f.o. With the output tuned so that it is on the high-frequency side of resonance for *any* frequency in the 80-meter band, plenty of output with chirpless keying is still available; in fact, 20 volts of r.f. can be obtained across a load of 3900 ohms. The 40-meter output also is at least 20 volts.

Calibration

It was not possible to make all the calibrations on both the 40 and 80 meter bands fall precisely in line at the same time, so inasmuch as the calibrations for the higher bands are dependent on the 40-meter settings, the tracking was adjusted for best 40-meter accuracy, which, incidentally, resulted in the calibration's falling exactly in line as closely as one could read. The 80-meter band also fell in line up to 3850 kc above which the frequency read progressively lower until at 4 mc it was 10 kc off. The tuning mechanism is a real pleasure to operate with the very smooth and positive drive without backlash.



Top view of the Model 722. The frequency-determining components are located within the shielded enclosure from which the top has been removed. The oscillator inductor and the air-trimmers are near the center of the enclosure. The pulley-disc on the main tuning capacitor is directly driven by a friction drive. Only the scale pointer is operated from the string arrangement.



Bottom view of the Eico v.f.o. It is simply and neatly constructed with all components readily accessible.

The Model 722 is housed in a wrap-around type of cabinet and it is most attractively styled in two shades of tan. Its solid construction makes a fine impression in keeping with its excellent performance. The size of the unit is 6" h. × 8½" w. × 9" d. and its weight is 8 lbs.

The Eico v.f.o. in kit form (Model 722K) is priced at $44.95. The wired units (Model 722) are $59.95. The manufacturer is Eico, Electronic Instrument Co., Inc., 33-00 Northern Blvd., L.I.C. 1, N.Y.—*W2AEF*

The C.W. "Paine" Killer

BY JIM PAINE*, W6OI

The use of the device described below permits the c.w. signal being received to key an audio oscillator. The result is a clear, crisp signal without that "through the barrel" sound and completely devoid of background noise.

EVER since the days of "wireless," operators have had to contend with many types of interference. In recent years, the various crystal, magnetostriction, *L-C* and other types of filters have been designed. These have helped to attenuate the various types of interference. But they all have one thing in common. They all have a "ringing" or hash-like hollow sound when set for maximum selectivity. This makes copying very annoying. It seemed to me that if a circuit could be designed that would attenuate *all* but a very narrow band of audio frequencies, this situation would be greatly improved. It is true that the above mentioned filter systems do a very good job of attenuation but—we still have the hash, growl, etc. The equipment to be described in this article eliminates the hash and growl completely.

Essentially this unit is a tuned audio amplifier (900 cycles) connected to the output of the receiver. When the c.w. signal is at 900 cycles it is amplified, rectified and then filtered. The rectified and filtered voltage controls a relay. The relay contacts control an audio oscillator and amplifier. Each time a character is received it is amplified and processed so that the relay follows it. The audio oscillator and amplifier reproduce the character perfectly. Between characters you hear no noise or hash and, of course, there is a complete absence of hollowness or ringing.

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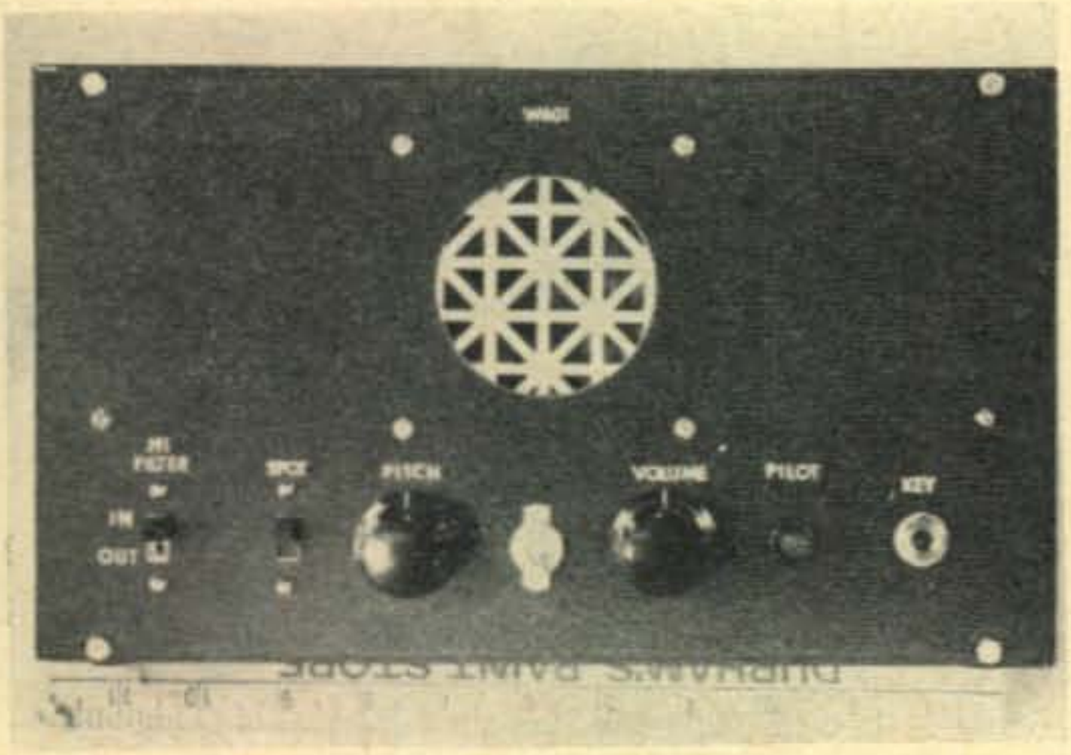


Front view of the C.W. "Paine" Killer shows the simple control arrangement. They are, from left to right, FILTER IN-OUT, SPOTTING, PITCH CONTROL ON-OFF, VOLUME, INDICATOR and KEY JACK. It is housed in a cabinet that measures 6" × 7" × 12".

How It Works

This device is connected to the *audio output* of the receiver having an output impedance of 500 to 5000 ohms. If your receiver has only speaker output terminals which are low impedance, an output transformer can be connected with the voice coil leads to these terminals and the other winding, which is high impedance, to the input terminals of the filter.

In circuit shown in fig. 1, J_1 is the input jack and must be insulated from the cabinet. Capacitor C_1 isolates the frame of J_1 from the chassis ground. Capacitor C_2 is the coupling capacitor from J_1 to L_1, L_2 and L_3. These chokes, with C_3 and C_4 attenuate the higher frequencies. Switch S_1 provides means of bypassing this section of the filter when not troubled with higher frequencies heterodynes. Capacitor C_5 couples filtered input signal to pin 2 of V_1 and C_7 couples the signal to the second triode section. These two capacitors provide the necessary attenuation of the low frequencies. Be sure that these are 50 mmf. Pin 6 of V_1 connects to the primary of T_1; the secondary of T_1 is center tapped and provides the 900 cycle voltage for the 1N538 diode rectifiers (CR_3, CR_4). Capacitor C_8 across K_1 prevents relay chatter due to filtering action. This completes the super filter circuit.

Tubes V_2 and V_3 are the audio oscillator and amplifier and with the associated circuitry provide the tone we copy. This tone is variable by means of R_2. The volume is controlled by R_3 and R_1 is the regeneration control. Once this is set it may be left alone. This starts the oscillator which runs continuously. It will be noted from the diagram that the voice coil circuit is keyed by either the relay or by a key plugged into J_2.

The power supply is a conventional voltage doubler circuit that provides 250 volts for V_1 and V_2. The input to the 50L6 is reduced by a 25K resistor.

Switch S_3 is used to disconnect the speaker from the receiver. It is not desirable to have the receiver speaker operating when using the filter but it may be used for spotting the station you wish to copy. In fact it is nearly impossible to locate a desired station without first hearing it in the receiver speaker.

Tuning The Filter

An audio oscillator and a v.t.v.m. are desirable but are not absolutely necessary. The actual

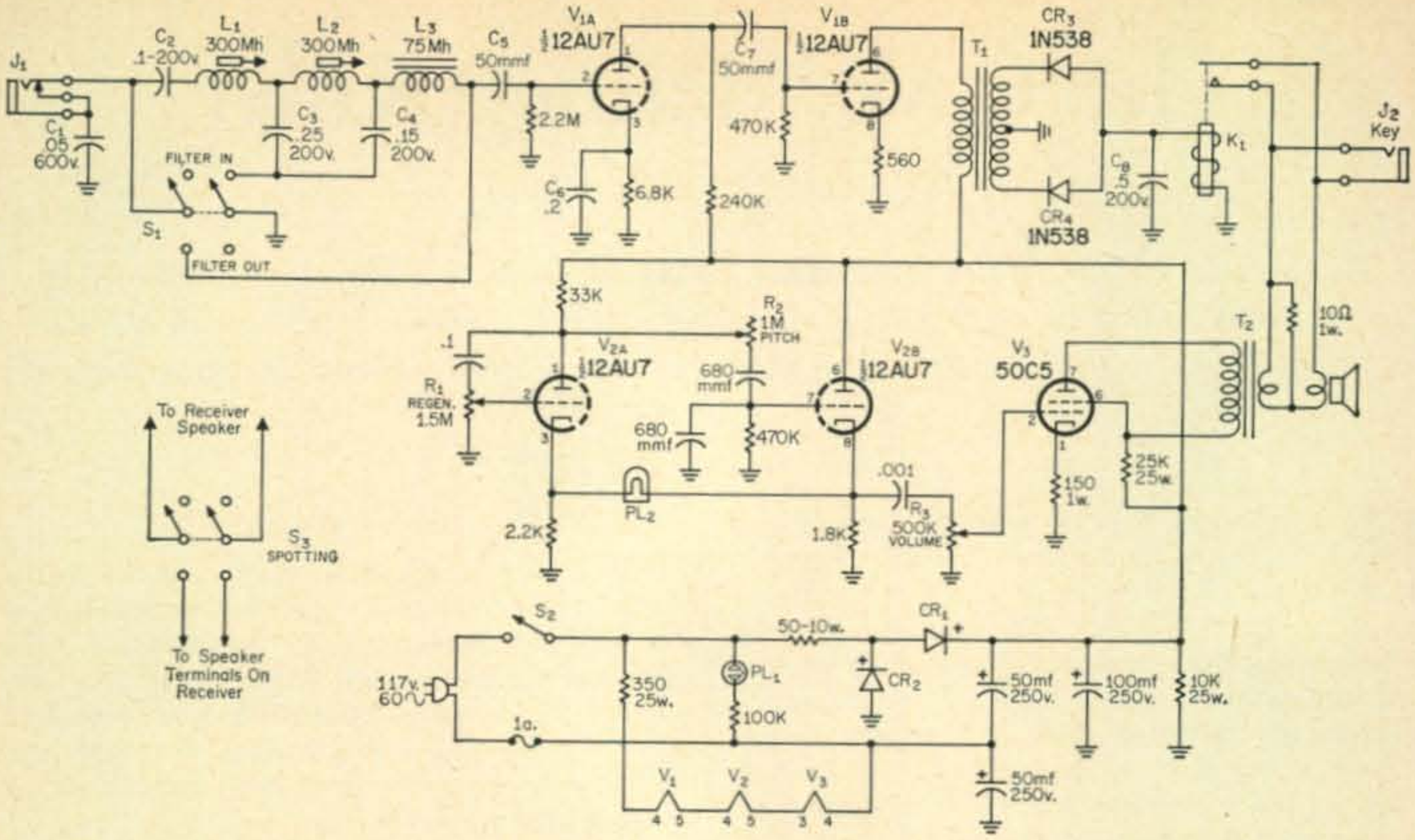
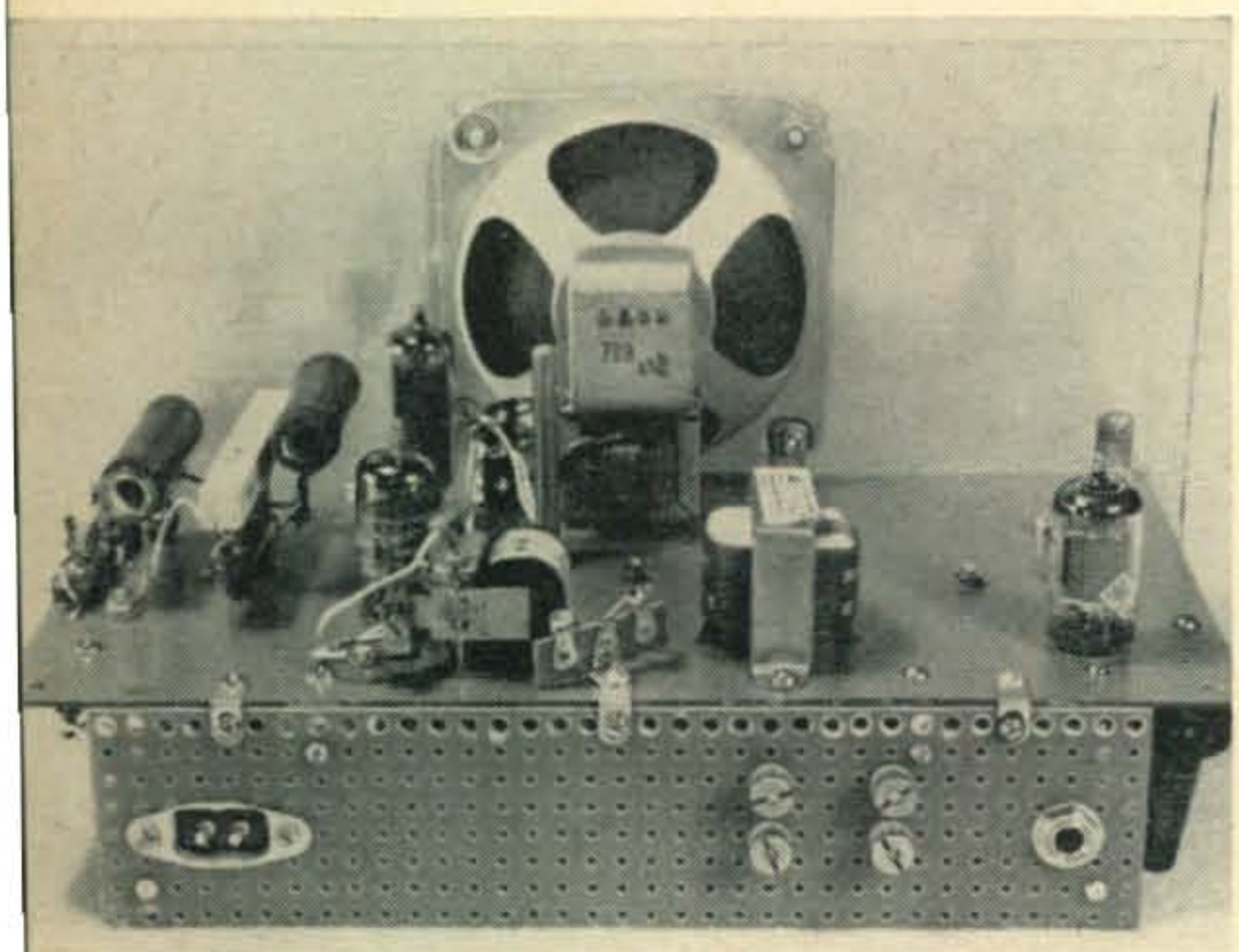


Fig. 1—Circuit of the c.w. "Paine" Killer that produces clear, crisp noiseless copy. All capacitors are in mf and all resistors are ½ watt unless otherwise noted.

CR_1, CR_2—200 ma, 400 p.i.v. diodes
CR_3, CR_4—1N538
K_1—S.p.s.t., 8000 ohm coil.
L_1, L_2—300 mh, Miller #9008.
L_3—75 mh, Miller #959.
PL_1—NE2 and holder.
PL_2—3 w. 115 v. incandescent bulb.
T_1—Audio interstage, 1:3. Stancor A53C or equiv.
T_2—Output transformer, 2,500 ohms to voice coil.

tuning is done with the slugs in L_1 and L_2. Feed the output of the audio oscillator into J_1 and connect a v.t.v.m. across J_1. Set the audio oscillator to 900 cycles and adjust the input voltage to 1.8 volts. Set S_1 to IN and screw L_1 slug all the way in. Screw the slug of L_2 about ¾ the way in. The relay should now trigger the copying oscillator. If it does not, adjust the slug of L_2 slowly. If it still does not trigger, increase the input from the audio oscillator slightly. It may be necessary to reduce the tension on the relay armature. A bit of playing around with the slug and the relay armature should do the trick. When all is correct the relay will trigger with 1.8 volts input from the audio oscillator.



Rear view of the C.W. Filter shows the location of major components. The 12AU7, V_1, is on the right of the chassis and the filter components are just visible between it and the panel. Transformer T_1 is to the left of V_1. The oscillator, V_2, is to the left of the relay. The rear board contains the a.c. input on the left, J_1 on the right and terminals for the SPOT switch.

The filter can be adjusted to have maximum sensitivity at other than 900 cycles by juggling the cores of L_1 and L_2. It is a good plan to have the maximum sensitivity close to 900 cycles in order to have the best attenuation at both the high and low frequencies.

If an audio oscillator is not available, the filter can be tuned closely to the desired 900 cycles by tuning in WWV on your receiver and listening to the lower tone which is 440 cycles. Switch on the b.f.o. of the receiver and adjust the pitch one octave higher. This will be 880 cycles. Continue just a little bit beyond this and you will have 900 cycles. Adjust the pitch from the audio oscillator of the Filter-Oscillator to this same pitch. This will give you a reference frequency to which you can retune the receiver when WWV transmits other than the 440 cycles. Tune in a steady carrier from any station on your calibrator and beat the b.f.o. with it for 900 cycles using the Filter audio oscillator as mentioned above. It will of course be necessary to short the key jack, J_2. It is obviously easier to arrive at the 900 cycles with an audio oscillator as mentioned previously, but this second method will work.

[*Continued on page 105*]

Let's Talk About Decibels

BY JOSEPH TARTAS*, W2YKT

Despite the manner in which many amateurs talk about decibels, few really understand them. Here is a clear explanation of decibels with many examples, illustrations and short cuts. It's a good review for the old-timer, as well as an excellent introduction for the beginner.

THE phone rang and I picked it up. It was my friend Earl. "Say, Joe, as you know I've been taking a correspondence course in electronics and I'm stuck. Do you think you can explain the db to me?" Having used the db in electronic work for so many years that it was almost second nature, I replied, "Sure, come over and we'll talk about db."

By the time Earl arrived and we had settled down over a cup of coffee, I had realized that to explain what the decibel is, and how it is used, is not as simple as one might think. In spite of the way in which every audiophile or hi-fi salesman bandies it about, its real meaning remains a mystery to most of them.

"Well Earl," I said, "the equation for decibels may be found in any textbook as:

$$db = 10 \log \frac{P_2}{P_1}$$

It goes a little further to explain that the ratio P_2/P_1 is simply a ratio of two power levels. Whether they be the input and output of an amplifier, *change* in power level due to an adjustment of a control, or a power level that is related to some fixed reference value, the result is still *only a ratio*.

"The simplest approach to any understanding of the decibel is to first develop the basic concept of logarithms, since the number of decibels is simply the logarithm of the ratio I just mentioned, multiplied by ten for power and twenty for voltage or current. In order to do this we must review some basic algebraic rules regarding engineering notation (also called powers of ten) and their relation to logarithms.

A Review

"In engineering notation any number can be expressed as a number *between* one and ten, multiplied by a *power of ten* (multiplying by ten a given number of times).

"For example, suppose we wish to express 43,000,000 in engineering notation. The first step will be to place a decimal point to the right of the first digit. This will give us 4.3,000,000. This gives us the number 4.3 (between one and ten) which is our starting point. Next, to determine the power of ten by which this 4.3 is to be multiplied we simply count the number of decimal places to the right of the decimal point. This number of decimal places is seven. Thus we may now say that the number 43,000,000 may be represented in engineering notation as 4.3×10^7. This simply means that 4.3 multiplied by ten seven times is equal to 43,000,000. Working in the other direction, if we start out with 4.3×10^7 (engineering notation), the number in ordinary notation is obtained by dropping the power of 10 and moving the decimal point seven places to the right.

"If the number is less than one, or 0.000,000,43, it could be expressed in engineering notation as 4.3×10^{-7} to show the number of places the decimal point is moved to the right. It is negative because it is divided by 10 seven times. From this it can be seen that division or multiplication is indicated by the algebraic sign, plus (understood) or minus (indicated). For example, a light year is approximately 6,000,000,000,000 miles (the distance light will travel in a year at the speed of light, 186,000 miles a second). Expressed in engineering notation, a light year is simply 6×10^{12}, and the speed of light is 1.86×10^5.

"Yeah," said Earl, "I know all this, but what's this got to do with the db?"

"Well, let's go one step further and develop a logarithm table by making a graph relating the powers of 10 to their actual numerical values. Let's go over a few basic math rules first, though. I'm sure everything will then fall into place," I said, confidently, seeing Earl was still with me.

Exponential Curves

"Any number raised to the zero power is equal to one. It follows, therefore, that 10^0 must equal one. Also, $10^1 = 10$; $10^2 = 10 \times 10 = 100$; $10^3 = 10 \times 10 \times 10 = 1000$; etc. Furthermore,

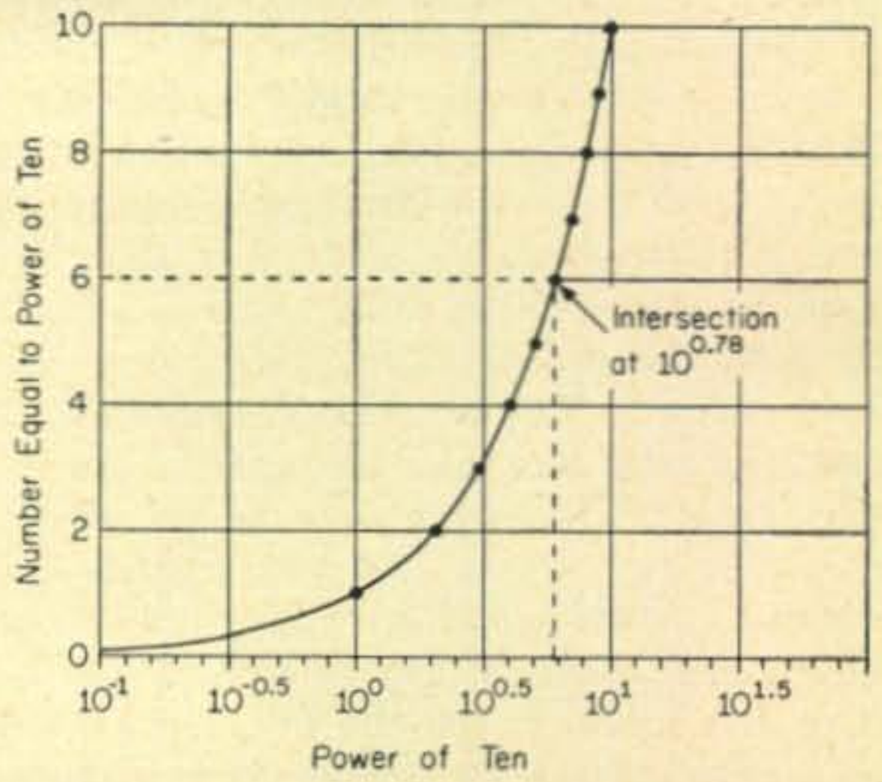


Fig. 1—The curve shown above is called a logarithmic or exponential curve.

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$10^{-1} = 1/10^1 = 0.1$; $10^{-2} = 1/10^2 = 0.01$; $10^{-3} = 1/10^3 = 0.001$; etc.

"Certain intermediate powers of ten are easy to calculate. For example, $10^{1/2} = \sqrt{10} = 3.16$; $10^{-1/2} = \sqrt{1/10} = 0.32$. Since the square root of the square root is the one-fourth power, we can also find $10^{1/4}$. This is equal to 1.78. Another convenient value to calculate is $10^{3/4}$. This would simply be the value of $10^{1/4}$ multiplied by itself 3 times or $1.78 \times 1.78 \times 1.78$. This is equal to 5.62. This gives enough points to make a graph for all values from 10^{-1} to 10^1. Take a look at the one I've prepared and labelled fig. 1. The shape of the curve resulting in fig. 1 is known as a logarithmic, or exponential curve.

Log Scales

"The information shown in fig. 1 can be presented in a more convenient form as shown in fig. 2. In this figure the scale on the horizontal

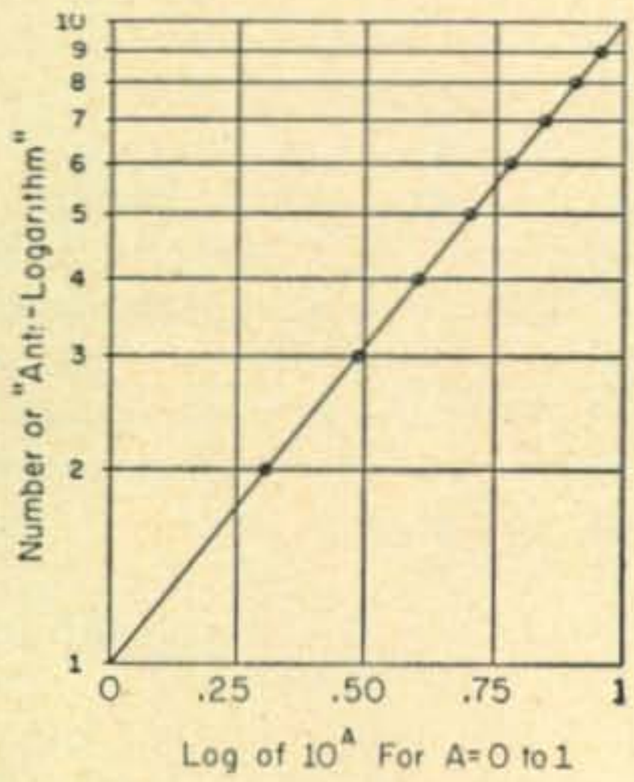


Fig. 2—The curve above shows how the vertical axis may be developed into a logarithmic scale.

axis shows only the exponents. In addition, the negative exponents are eliminated since they will be of little use to us. Only the positive exponents from zero to one are shown. A straight line (AB) is now drawn from the origin at any convenient angle. Since we know that an exponent of one corresponds to the number ten we are able to mark off the number ten in its correct position on the vertical axis. Similarly, since the exponent zero corresponds to the number one, the one can be appropriately marked on the vertical axis.

The problem now is to place the numbers intermediate between one and ten in their proper position on the vertical scale. This can be done by locating the points along the curve of fig. 1 corresponding to the vertical scale of powers of ten, starting with one. For example, to locate the number two on the vertical axis we go across from two in fig. 1 until we intersect the curve. We then go down vertically to the power of ten and then find that the log of two is 0.30. This gives us the location for the anti-log scale of 2 in fig. 2. The rest of the numbers are located in the same manner. A line drawn through each point will then give the graph of fig. 2.

"It is interesting and important to note that this gives rise to a non-linear scale on the vertical axis. The spacing shown is called a logarithmic scale.

"You will notice that this graph is limited by the fact that it can only give us the logarithms of numbers between one and ten. An additional rule of algebra will allow us to use this graph for any number, no matter how large or small, by means of the 'engineering notation.'

Multiplication

"If we wish to multiply large numbers, even in simple arithmetic, we utilize the fact that we can round off a number and then combine the number of zeros. In effect, we are *adding exponents* when powers of 10 are concerned. You can easily prove to yourself that powers of ten (let us denote them as A and B) add when the numbers are multiplied, or $10^A \times 10^B = 10^{A+B}$, by sticking in any numbers you desire for A and B, then multiplying.

"For example, suppose $A = 2$ and $B = 3$. We would then have $10^2 \times 10^3 = 10^5 = 100{,}000$ or $100 \times 1000 = 100{,}000$, which checks.

"Thus by giving the number B any desired value, we will have any desired power of 10 as a multiplier so that any size number can then be covered in a simple manner.

Logs

"The reason you need to know this fact is simple. If we keep the number represented by A between zero and one, as we've done in fig. 2, then any number B will give you any desired power of ten as a multiplier, and the log of *any* size number then can be found in a simple manner. For example, the light year we discussed before is 6×10^{12} miles. From the graph we can see that 6 on the vertical scale corresponds to 0.78 on the horizontal scale. This is 10^A (or $A = 0.78$) as I just explained. The multiplier, 10^B is now 10^{12}, and we now have $10^{0.78+12}$ or $10^{12.78}$. The logarithm is simply the exponent, or 12.78." I took a sip of coffee and looked at a frowning Earl.

"Let's try one more example," I said, "to make things a little clearer. As we mentioned at the outset, the formula for determining the number of db corresponding to a given power gain is:

$$db = 10 \log \frac{P_2}{P_1}$$

"Now suppose that P_2 divided by P_1 is equal to thirty. It is obvious that before we calculate the number of db we must find the value of the log of thirty. Using the method described above, the first step is to change thirty into two factors, the first of which will be a number between one and ten and the second will be some power of ten, thus $30 = 3 \times 10^1$.

"Next we determine the logarithm of the first factor, 3, by using the graph of fig. 2. This turns out to be 0.60 and we can now say that: $30 = 3 \times 10^1 = 10^{0.60} \times 10^1 = 10^{1.6}$.

"Therefore, the log of 30, equals 1.6. To get the number of db we multiply by 10 or 16 db.

Log Tables

"Gee," he said, "What makes this such a handy method if I have to go through this every time I want to find a logarithm?"

"You don't," I hastened to assure him, "any good math text book or reference book has a table of logarithms for instant use, but it's no good to you unless you know how to use it. The table covers all powers of ten from 10^0 to 10^1, or numbers from 1 to 10 as we did, and you just add the *B* number mentally when the number is 10 or more. In logarithms, the *A* number is known as the *mantissa*, and the *B* number is called the *significant figure*. Aside from their application to db's, logarithms, or logs for short, are very handy for multiplying, dividing, squaring, and getting roots of very large numbers with a few simple steps."

"That sounds like a very useful tool," Earl remarked, "but when I went through the lesson on logarithms I didn't put too much effort into it because I didn't think they were important. I'm going to go over it again, now that I see their value."

"It sure is," I hastened to assure him, "it has probably been the most important mathematical tool I have ever learned. And I'm now going to show you how logarithms apply to the decibel. As you already know from your previous reading, the basic unit is not the decibel, but the *bel*. It was agreed upon at a national convention many years ago that a Bel = log of a power ratio. It was named after Alexander Graham Bell, but why they dropped one l, I'll never know. You've also read that the human ear responds logarithmically to sound, but this probably didn't mean a thing to you at the time. Let's try to relate the logarithms we've talked about to the ear's response.

"You might wonder at this point why all this bother with db. For instance the problem we just used as an example would tend to indicate to the uninformed that since the power ratio was thirty that the output should therefore be thirty times as loud as the input. This is far from the truth. It has been determined that the human ear does not interpret a sound with twice the power as one which is twice as loud. Rather it hears a doubling in volume for every 3 db increase in power or a 2 to 1 change as shown in fig. 3. This might be summarized by saying that the response of the human ear is not linear with power but logarithmic with power. In this case where we have a 16 db rise it is a little more than five times as loud.

"So, as we saw in our example, we can use the curve, or a table of common logarithms (base 10) which it represents, and finds the number of db for any power ratio."

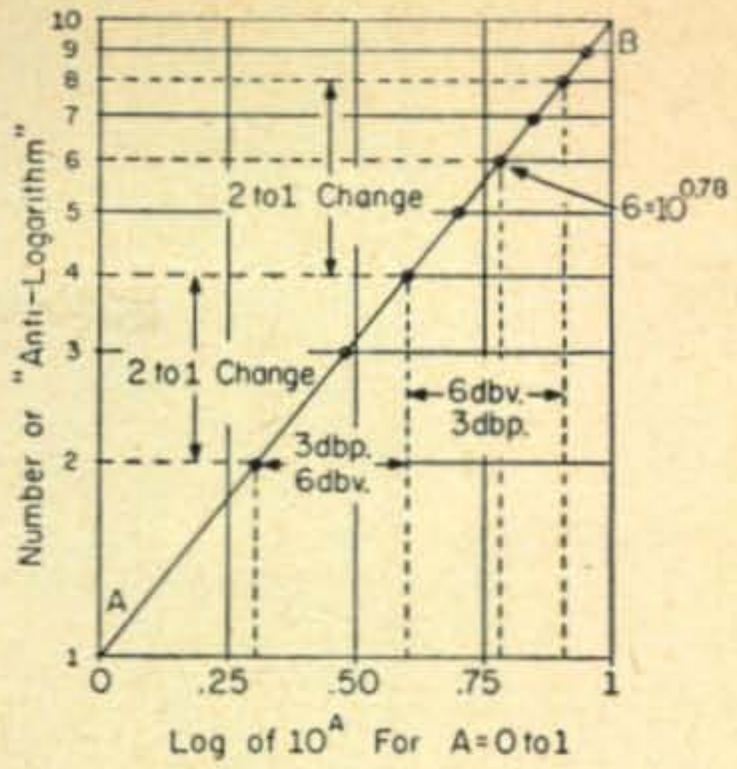


Fig. 3—For a given amount of change, say 2 to 1, anywhere on the number scale, you move the same amount on the log scale as shown above.

Voltage Ratios

"But I thought the db was used for voltage ratios," Earl questioned, thinking he had me in a corner. "Of course," I replied, "the db was used for power ratios at first, but it can be related to a voltage or current ratio as well, but with a slight change in the formula. To explain this, let's review Ohm's law for power. You know that the power *P* equals both E^2/R and I^2R, but the db is related to changes or ratios, so we must take a ratio of powers, the same as before:

$$\frac{P_1}{P_2} = \frac{E_1^2/R_1}{E_2^2/R_2} \quad \text{or} \quad \frac{I_1^2\,R_1}{I_2^2 R_2}$$

If the same circuit or equal resistances applies in each case, the R's divide out, and we then have:

$$\frac{P_1}{P_2} = \frac{E_1^2}{E_2^2} = \frac{I_1^2}{I_2^2} \quad \text{or} \quad \left(\frac{E_1}{E_2}\right)^2 = \left(\frac{I_1^2}{I_2}\right)$$

In each P_1 is larger, and so are E_1 and I_1. I can also show that the logarithm of some number raised to a power (written as log N^m) is also equal to the logarithm of the number *multiplied by the power*, or for the example, let the number *N* be 5, and the power be 2, or 5^2, then the logarithm may be written as $2 \times \log 5$. I've already shown you that the db is 10 times the log of the power ratio, so if the power ratio is equal to the voltage or current ratio squared, then in voltage or current, the db is:

$$2 \times 10 \times \log \frac{E_2}{E_1} \quad \text{or} \quad 20 \log \frac{E_2}{E_1} \quad \text{or} \quad \frac{I_2}{I_1}$$

"Figure 4 shows a graph that can be used to convert power, current or voltage ratios into db with great convenience.

"There's only one thing more you must know in order to complete your db education. The above facts only apply if the input and output resistances are equal. If they are different, you must plug the values of resistance into the formula $P = E^2/R$ and get:

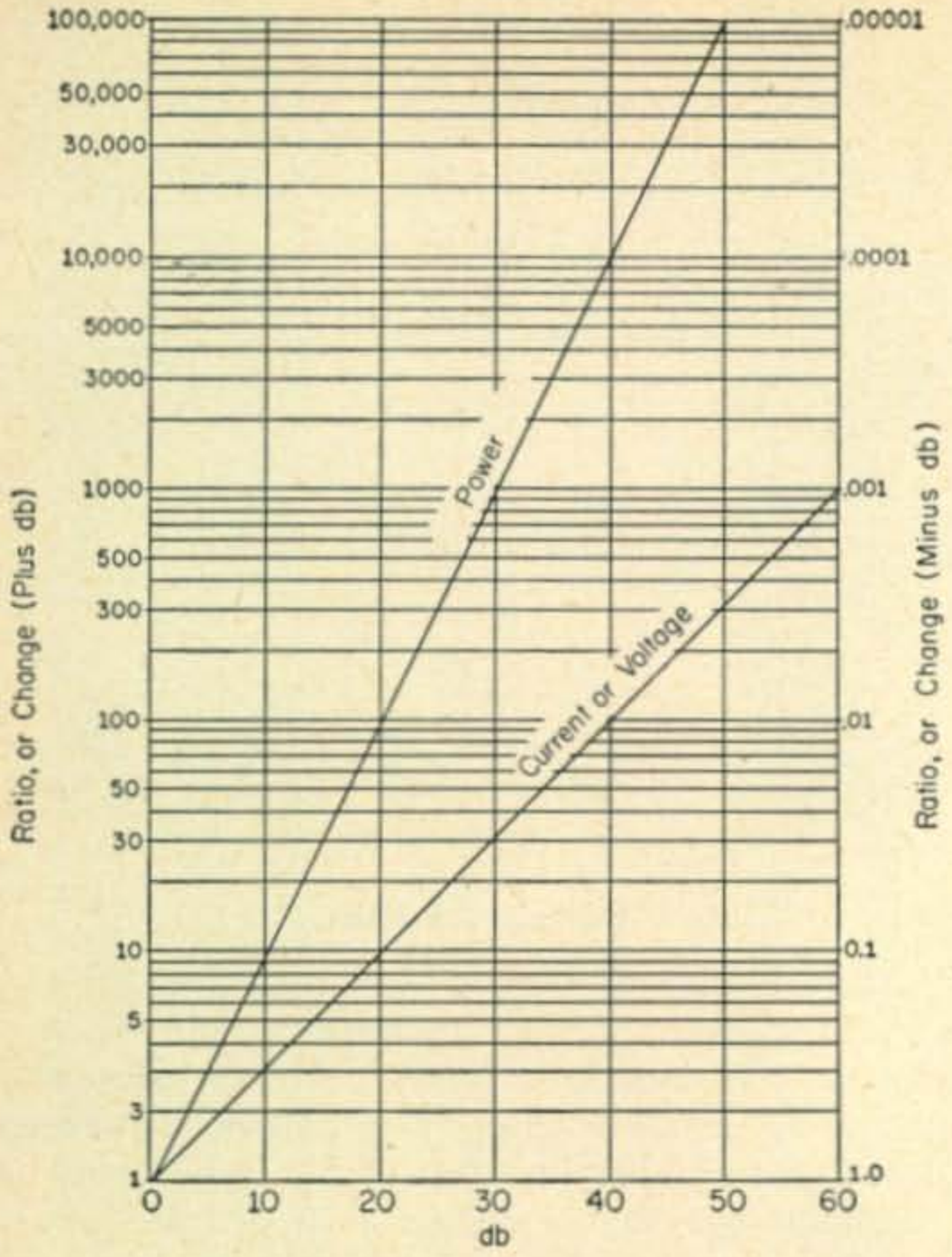


Fig. 4—The above graph permits convenient conversion of power, current or voltage ratios to db.

$$\frac{P_2}{P_1} = \frac{\frac{E_2^2}{R_2}}{\frac{E_1^2}{R_1}} \text{ which equals } \frac{E_2^2 \times R_1}{E_1^2 \times R_2}$$

and you can see that if the ratio of R_2 to R_1 is greater than one, the power ratio must be smaller. Here again, you can always satisfy yourself by putting in some values, but you know that a high voltage drop will occur with a large resistor but less power is dissipated compared to a small resistor. For this reason, the power ratio, which would be obtained for equal load resistors (P'_{out}/P'_{in}), must be multiplied by the inverse ratio of the resistors, or:
You can see, from this, that if the resistances are equal we have the same formula we started with."

$$P\ db = 10 \times \log \left(\frac{P'_{out}}{P'_{in}} \times \frac{R_{in}}{R_{out}} \right)$$

"I think I'm beginning to get it now," said Earl, "but so far you've only shown how to get an increase in db. What happens when you turn down the amplifier volume and the output is less? You said that the db is only a change. How do you handle a ratio that is less than one?"

"That's easy," I said, seeing the light beginning to dawn on Earl's face, "you just invert the power ratio and keep the biggest number on top so that the ratio is always greater than one (assuming there is a change, of course) and calling it *minus db*. Because, as I've repeated so many times, and you did too a second ago, to show I've gotten the point across, positive decibels is an increase, negative (or minus) decibels is a decrease. Any reference level may be used, zero, two, or ten db; so many db change is just added or subtracted from that number."

"Oh!" exclaimed Earl, "now I see why amplifier literature talks about 3 db response, or output referred to 1 milliwatt. The output they measure is so many db greater than that!"

"That's right," I replied confidently for a change, "Once you start thinking in db as I do, you can save yourself a lot of trouble. Instead of multiplying the voltage gain of each stage in an amplifier to get the overall gain, just convert the gain of each stage to db and add the db up. In this way you would get, for example, 100 db gain instead of a voltage gain of 100,000. If you are talking about transmitters, a power output of 30 dbw is the same as one kilowatt. The reference level in this case is db above a watt (dbw).

"You might liken the whole thing to the difference between the use of Arabic numerals and Roman numerals when handling large numbers. It's easier to add 18 and 23 than XVIII and XXIII."

"I've noticed that you seem to pull numbers out of the air without using a log table," Earl remarked, "how do you do it? Don't tell me you've memorized the whole table of logarithms."

"That's easy," I answered, "just make yourself a basic chart such as all engineers start out with, and you'll know them by heart in short order. Take this table and memorize it:

Db	*Power Ratio*	*Current or voltage ratio*
1	1.25	1.1
3	2.0	1.4
6	4 (2 × 2)	2
10	10	3.16
20	100 (10 × 10)	10
30	1000 (10 × 10 × 10)	31.6

You should be able to see the pattern by now. To add db, multiply the ratios. Note that the power ratio is always the current or voltage ratios squared. For example, 10 db is the sum of 1, 3, and 6 db. The power ratio of 10 is 1.25 × 2 × 4. You can also work backwards. For example, 14 db is 6 db less than 20 db. Since minus 6 db is ½, then 14 db is, in voltage, ½ of 10 (which is 20 db), or 5. In power, 20 db is equal to 100, and —6 db is ¼, so 14 db is then ¼ of 100, or 25."

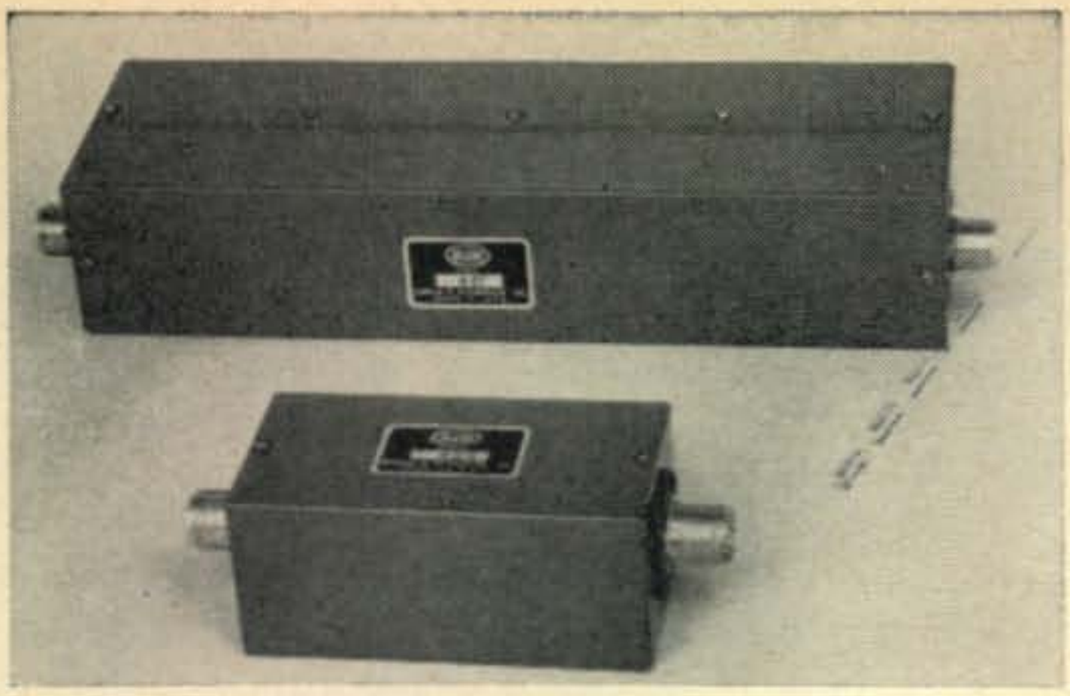
"I'm not sure I understand all this, yet" said Earl as he got up to go, "but I'm going back over the lessons on the db and logarithms and this time they'll make more sense. I didn't place enough importance on the logs when I went through them. Too bad I can't take home your explanation word for word to go over again a few times."

"That's why I've had my tape recorder going all this time," I replied, "I'll type up a copy and give it to you."

As Earl left, closing the door behind him, I reached over and shut off the tape recorder. ■

CQ Reviews:

The B&W Model 423 and 427 Low Pass Filters



The B & W low-pass r.f. filters for use with 30-54 mc transmitters. The model 423 is in the foreground, the Model 427 is at the rear. They are enclosed in copper cases which are finished in gray.

THE B & W Model 423 and 427 low-pass r.f. filters are designed to reduce spurious and harmonic radiation through the transmission line of amateur and commercial transmitters operating in the 30 to 54 mc range. Very high attenuation is provided throughout the TV and f.m. channels above 62 mc. The filters are especially suited for use with six-meter transmitters.

The Model 423 is built to handle a maximum transmitter power of 100 watts. It is a three-section filter consisting of a constant-K mid section and two M-derived end sections. Attenuation above 62 mc is rated at 50 db minimum, equivalent to a power reduction of 100,000 to 1.

The Model 427 will handle 1000 watts (4 kw peak). It is a five-section unit using three constant-K mid-sections and two M-derived end sections. The rated attenuation above 62 mc is at least 60 db, offering a power reduction of 1,000,000 to 1.

The filters are symmetrical, making them reversible and permitting either end to be used for input or output. Impedance is 52 ohms, so they should be used with 52-ohm coaxial lines, but 72-ohm lines also may be used with negligible difference in performance as long as the s.w.r. is low; in fact, a low s.w.r. will ensure optimum filter performance in any case.

The Model 423 will also be found beneficial when installed between an exciter and a power amplifier to suppress the introduction of harmonics above 62 mc into the input of the amplifier. Suggested filter installations are shown in fig. 1.

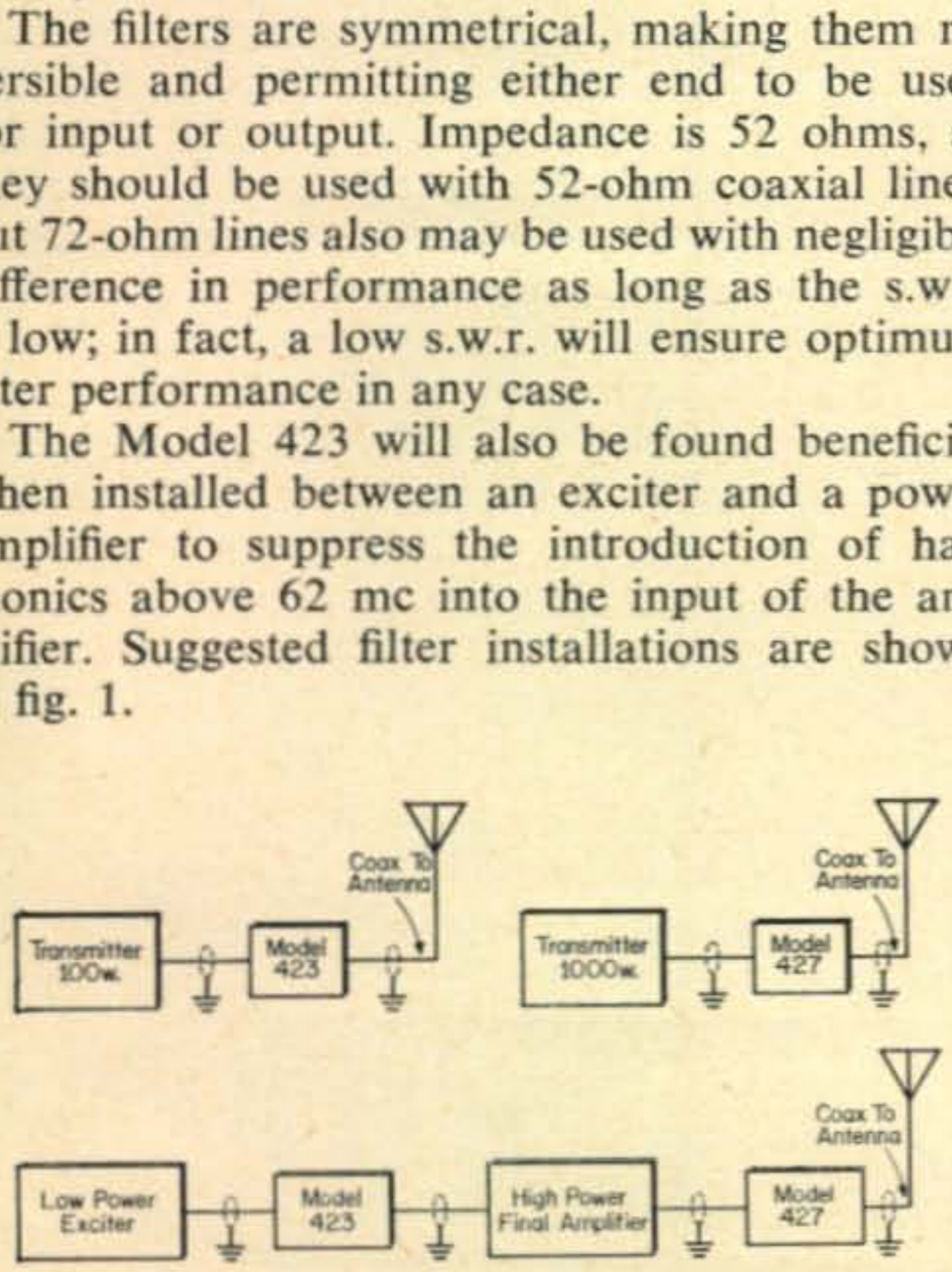


Fig. 1—Suggested installations for the B & W Models 423 and 427 low pass filters.

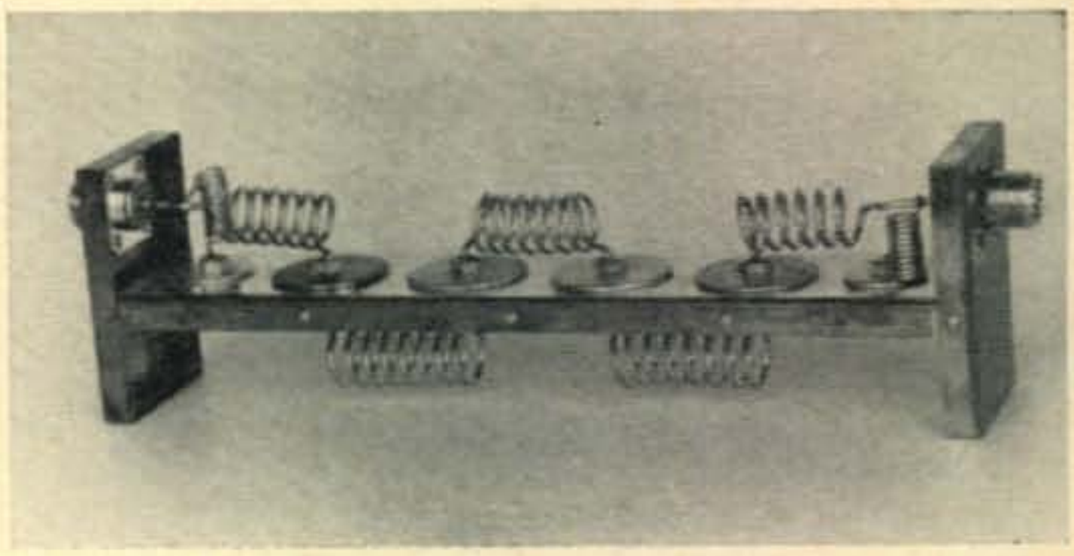
Construction

The construction of the Model 427 B & W filter is shown in the photos. The entire framework is made of copper to provide excellent r.f. shielding and conductivity. The inductors are air-wound with tinned copper wire used, providing high power capabilities and high *Q*. The capacitors are made of brass discs placed against the ground plate (the center partition) with a dielectric made of pure Teflon sheet inserted between the disc and the ground surface. This type of fabrication enhances the *Q* and reduces the self-inductance of the capacitors to an insignificant value for avoiding undesired resonances.

Adjacent filter sections (the constant-K ones) are mounted on opposite sides of the center ground partition with a feedthrough connection between their respective capacitor discs, further cutting down undesired lead inductance. Inductive coupling is also minimized, eliminating the need for additional shielding between inductors.

The filter sections are accurately aligned at the factory for optimum performance by squeezing or stretching the inductors after the capacitors have been set to a specified tolerance by adjusting the pressure exerted at the feedthrough connectors; that is, applied to the capacitor discs, which are slightly cupped.

Type SO-239 coax connectors are installed at each end of the unit. A copper shield cover which



Internal construction of the B & W Model 427 Filter. The end pieces and the center partition are made of copper. The discs on the center section are the special low-inductance and hi-Q capacitors, the construction of which is described in the text. The filter sections are precisely adjusted by stretching or squeezing the inductors as is evident by the center inductor.

is placed around the entire assembly is secured with a large number of screws to make good contact all around and break up eddy currents in the shield. This assures excellent shielding and minimizes stray r.f. leakage.

The size of the Model 423 is 5" × 2" × 1¾". Weight is 7 oz. The Model 427 is 11" × 3" × 2" and it weighs 1 lb. 10 oz.

Performance

Both models of the B & W filters were checked out using a signal generator. The results confirmed the specified attenuation characteristics, with the Model 427 having an extremely sharp cutoff starting at 58 mc. Cutoff for the Model 423 was 57 mc and dropped more gradually, as might be expected, because of its slightly lower cutoff frequency, fewer sections and lower attenuation characteristics.

The actual *power* level of a harmonic in the region above 62 mc is approximately the same for both filters when 100 watts is applied to the Model 423 and 1000 watts is applied to the Model 427, provided the percentage of harmonic content from the source is the same in each case.

The effectiveness of the filters also was proved by first applying r.f. from a signal generator (set to the various TV channel frequencies from 62 mc up) to a TV set at the same time TV programs were being received. The signal generator output level was adjusted to the point where the TV pictures were completely obliterated. While the signal generator output was left set at this level, the different filters were then connected between the generator and the TV set, making interference-free reception possible.

On-the-air tests, with six-meter band operation, proved the filters to be highly effective for the elimination of t.v.i., except where front-end overloading of the TV set was encountered. This usually involves Channel 2 to the greatest extent. In this respect, it should be kept in mind that no filter connected to a 50 mc transmitter will prevent overloading of a TV set tuned to Channel 2, unless such a filter also attenuates the transmitter fundamental signal at the same time. This does not preclude the possibility of a Channel 2 filter or trap, being effective where spurious or parasitic radiation or modulation splatter in the 54-60 mc region may be produced by the transmitter.

It should be noted that these B & W filters are intended for use with transmitters operating between 30 and 54 mc. Actually, they may be used at frequencies below 30 mc also; however, harmonic protection against t.v.i. on Channel 2 will not be realized. Under such circumstances it will be better to use Model 424 in place of Model 423, and Models 425 or 426 instead of Model 427. These units have a cutoff frequency of 42 mc and provide a minimum of 85 db attenuation above 54 mc.

The B & W Low-Pass Filters are priced as follows: Model 423, $9.66; Model 427, $19.86. They are produced by Barker & Williamson, Inc., Bristol, Pa.—*W2AEF*

The Kolin NL-1 Noise Limiter

The Kolin Model NL-1 Noise Limiter is a solid-state device designed to suppress impulse-type noise picked up by an a.m. receiver. It is a very small encapsulated unit (1-5/16" × 1-5/16" × ⅝") which may easily be installed within the equipment involved.

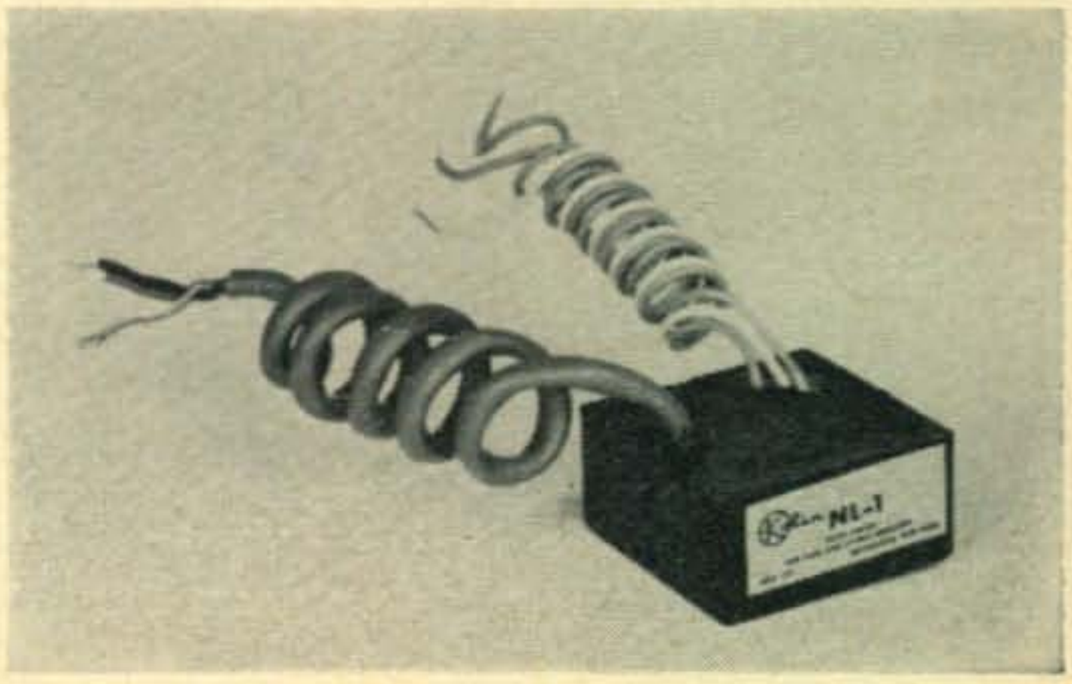
The NL-1 is a self-adjusting series-type limiter which employs low-leakage silicon diodes, resulting in extremely effective performance. The solid-state circuitry permits use with vacuum tube receivers or with hybrid receivers which utilize a vacuum tube a.f. amplifier after the detector. Operation is not dependent on receiver supply voltages. The Model NL-1 is not suitable for operation in transistorized receivers; however, the Model NLT is available for this application.

Three color-coded wires from the unit must be connected to the receiver at the last i.f. transformer, the detector and volume control. Complete installation instructions, in this respect, are furnished with the unit. There also is a twin-conductor shielded lead which may be connected to a separate toggle switch, also supplied, for disabling the noise limiter when it is not needed.

No holes are required to be drilled for mounting the Kolin limiter, as a strip of double-sided precision pressure tape, having a high bonding strength, is furnished to hold it firmly in place.

For cases where a good a.m. noise limiter is required, or where an inferior one is in use, the installation of the Kolin NL-1 should provide effective results. It may be connected with a minimum of effort.

The unit is priced at $7.95 and may be obtained from Kolin Engineering Company, Box 357, Bronxville, N.Y. or your local supplier. —*W2AEF*



The Kolin model NL-1 noise limiter.

Combining The Ranger and SB-10

BY RODNEY R. HOGG*, KØEQH

The Johnson Ranger or Ranger II and Heathkit SB-10, both time proven units, are combined for inexpensive s.s.b. operation on 80 through 10 meters. The Ranger, though modified, is still capable of a.m. operation on all bands.

THE Johnson Ranger Transmitters, compact and efficient a.m.-c.w. rigs, are readily available these days along with the Heath SB-10 sideband exciter. Their availability and excellence brought about this combination to provide a simple and relatively inexpensive s.s.b. transmitter. The combination requires work in the Ranger only and consists of breaking the r.f. signal path from the driver to the output tube and making provisions for changing the 6146 to Class AB operation.

Conversion

It is necessary to place the r.f. input and output jacks (J_1-J_2) and the new mode switch (A.M.-C.W./S.S.B.) in the rear of the transmitter. The location of these components are shown in the photograph. After these components are mounted the wiring may begin. The changes are shown in fig. 1. All parts that are numbered are original (part of the Ranger); those with values indicated are added and those that are marked with an X are to be removed or disconnected.

Capacitor C_{35} is removed to allow for the added capacitance of the coax used to connect the SB-10 to the transmitter. The Ranger thus retains approximately the same tuning characteristics.

Capacitor C_{32} is disconnected from the grid circuit of the 6146 and connected to one arm (A) of the 6 p.d.t. mode switch via some small coax such as RG-162 or Columbia Wire #1369. The 6146 grid circuit is then connected to another arm (B) of the switch, as shown, through which the output of the SB-10 is returned through a 100 mmf capacitor.

A bias supply is added to those Ranger units that do not have one. (Those with TSK will already have this bias supply). When the bias supply is wired in, a section of the mode switch (C) is included so that when in the S.S.B. position the negative voltage output is applied to the control grid of the 6146 and the return of the 0B2 string regulating the 6146 screen is grounded. More about this later. Section (D) of the 6 p.d.t. is used to disconnect the a.c. input to the bias supply when in the A.M.-C.W. position. Section (E) of the switch shorts out a portion of the grid return resistance (R_{37}) in the S.S.B. position.

*715 North Sheridan, Minneapolis, Kansas 67467.

The bias pot, a 50K ½ watt unit, is mounted on the driver circuit shield, just behind the crystal socket. This enables the bias to be adjusted, with a long screwdriver, through the opening behind the false knob. The pot used in this conversion was a miniature AB type picked up on the surplus market but a conventional ½ watt unit can be used.

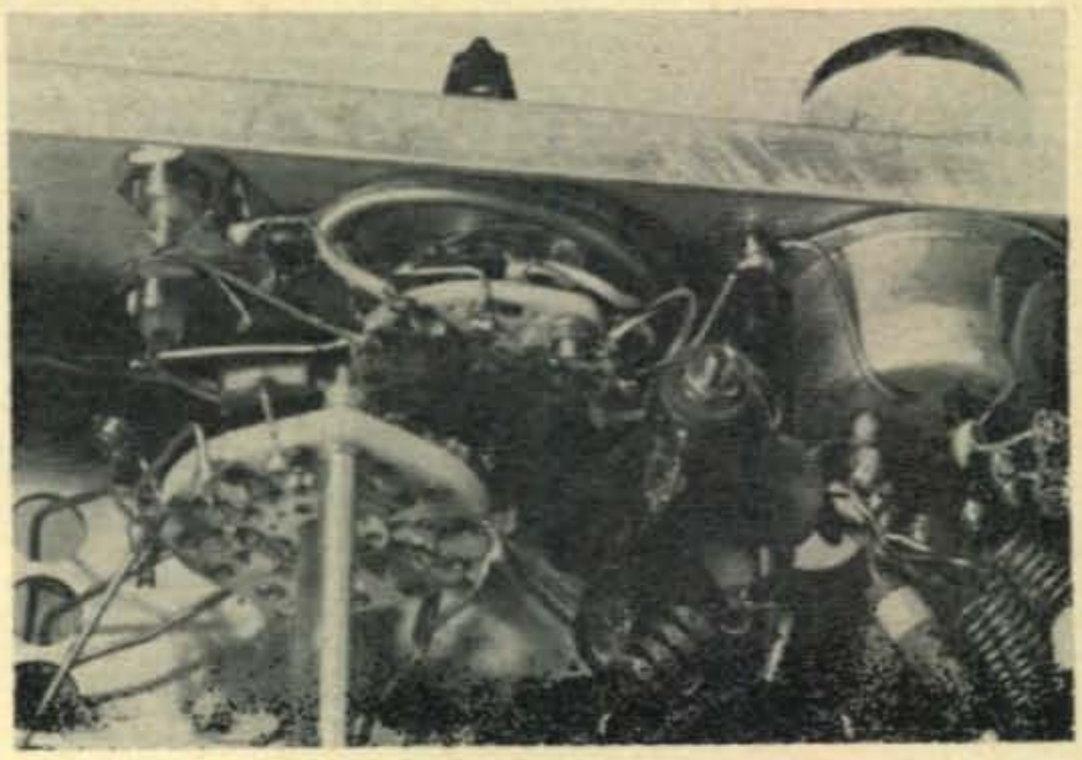
The bias is fed to the 6146 through the cold end of the meter shunt, SH_3, which is lifted from ground at the meter switch, so that the grid circuit is still metered in the S.S.B. function.

The screen voltage for the 6146 is regulated by the two 0B2 v.r. tubes which are located on the main topside shield in a horizontal position. The tubes are mounted on a small angle chassis positioned to clear the 5R4 rectifier. The voltage to and from the 0B2's was routed by an insulated shielded wire which was bypassed on both ends. The tap added on R_{35} is set at about 250 volts to provide an adequate firing voltage. This locates it at about 12K above ground. Note, also, the addition of an r.f. choke in the screen circuit.

Parts placement is not critical other than the two coax leads in the 6146 grid circuit and J_1 and J_2. Trouble may be encounted on 10 meters in the A.M.-C.W. position of the mode switch. In the A.M.-C.W. position of the new mode switch the 6146 may tend to take-off. This can be corrected by lead dress; experiment with the location of the new wiring until stability is achieved on 10.

Checking The Ranger

After the conversion is completed the Ranger



Bottom view of the Johnson Ranger shows the rear panel where the two r.f. jacks and new MODS switch are located alongside the auxiliary power plug.

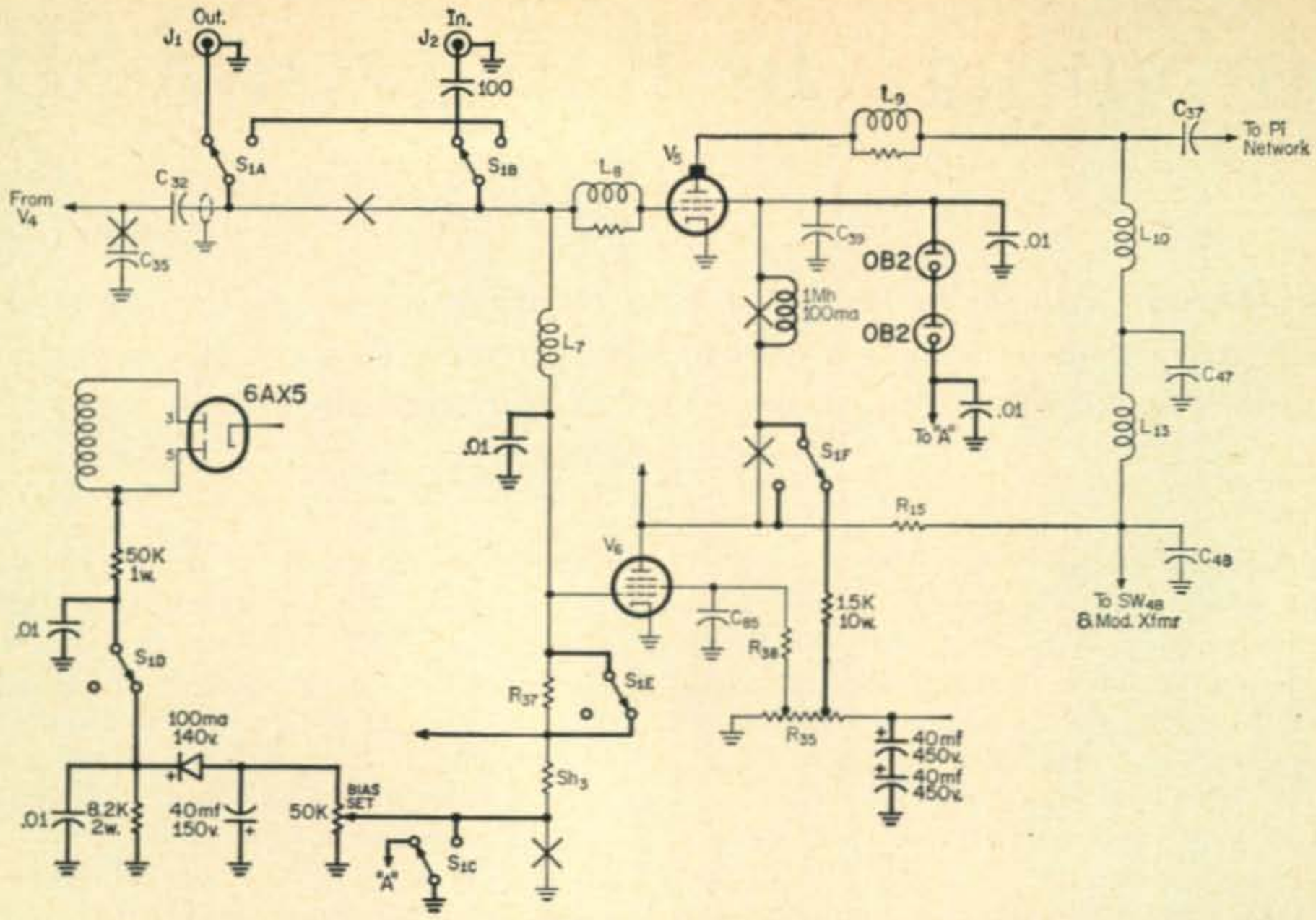


Fig. 1—Circuit of the modified final stage in the Ranger. All heavy lines represent added circuitry. Components with part numbers are original and those with part values are added.

should be checked out. Set the new mode switch in the A.M.-C.W. position; the rig should work as well as it did before the conversion. After checking this, switch to STANDBY and set the new mode switch to the S.S.B. position. It would be well to note here that to protect the new mode switch it is advisable that the Ranger always be placed in STANDBY before switching modes.

Now switch to the C.W. position. With the DRIVE control fully ccw, meter the final plate current. If it is over 50 ma quickly adjust the new bias pot so that the plate current drops to 50 ma. This requires a bias setting of about 50 volts.

The SB-10

After assuring that the Ranger is operating properly, connect the SB-10 to it. First, r.f. cables should be attached to the new jacks, J_1 and J_2. The lead length is not too critical and about 18 inches seemed to work well.

Connect the Ranger key jack to two normally open contacts on the SB-10 vox relay (terminals 4 and 2). This allows vox operation through the SB-10 circuits.

Place the SB-10 in the MANUAL position and the Ranger front panel switch to TUNE. Advance one of the SB-10 CARRIER NULL controls out of position to inject carrier. Also advance the Ranger DRIVE control until an output is indicated on the SB-10 meter. Now, adjust the Ranger GRID TUNING for maximum reading on the SB-10 meter.

Set the Ranger front panel FUNCTION switch in the C.W. position and tune the SB-10 BALANCED MOD. and OUTPUT CONTROL for maximum plate current on the Ranger. Now dip the Ranger final. This, of course, is done with a dummy load attached to the Ranger output. This completes the initial tuneup.

The Ranger DRIVE control must be set very carefully to prevent overdrive and thus poor carrier suppression. Adjust the DRIVE control for maximum output on the SB-10 meter and then back off until a reading of ¾ of maximum is obtained. This will normally be near the minimum drive setting. Now check the 6146 grid to see if any current is flowing. There should be

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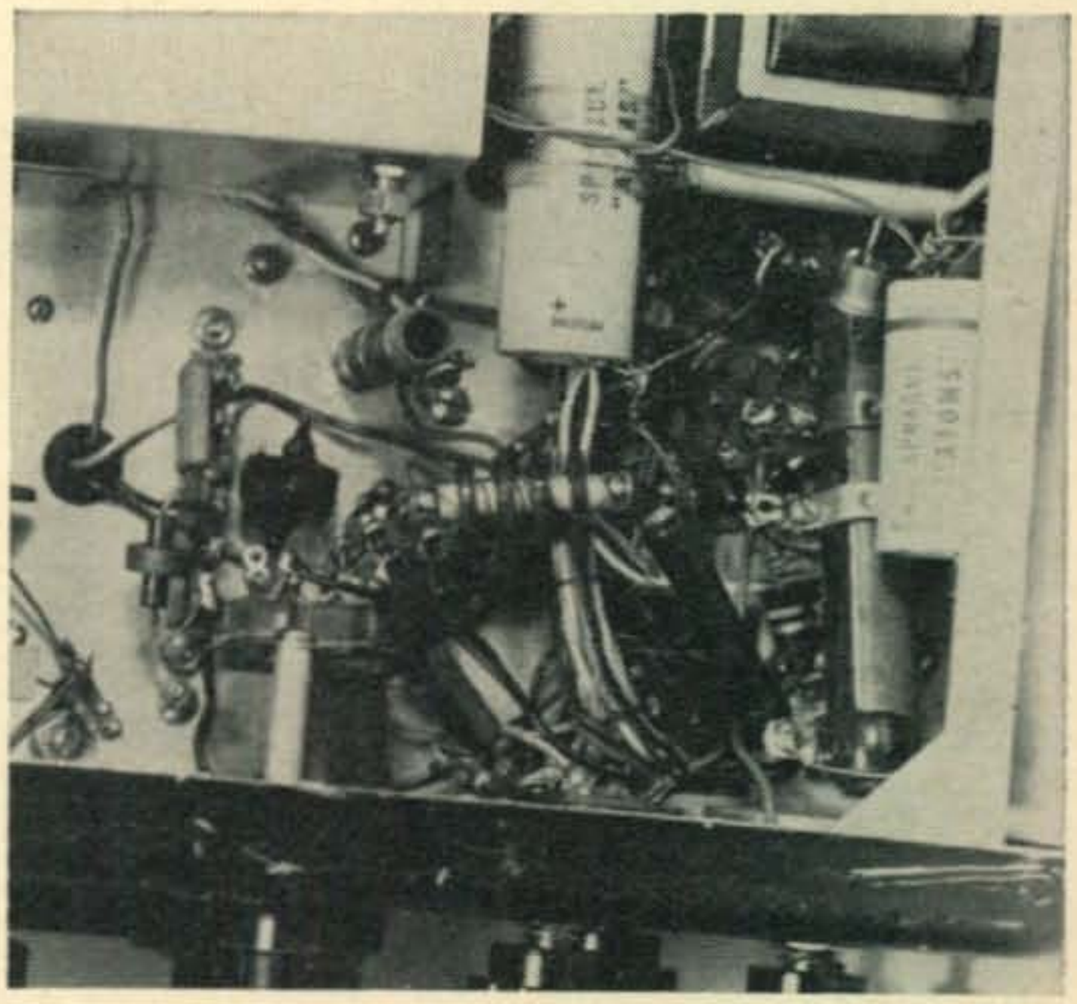
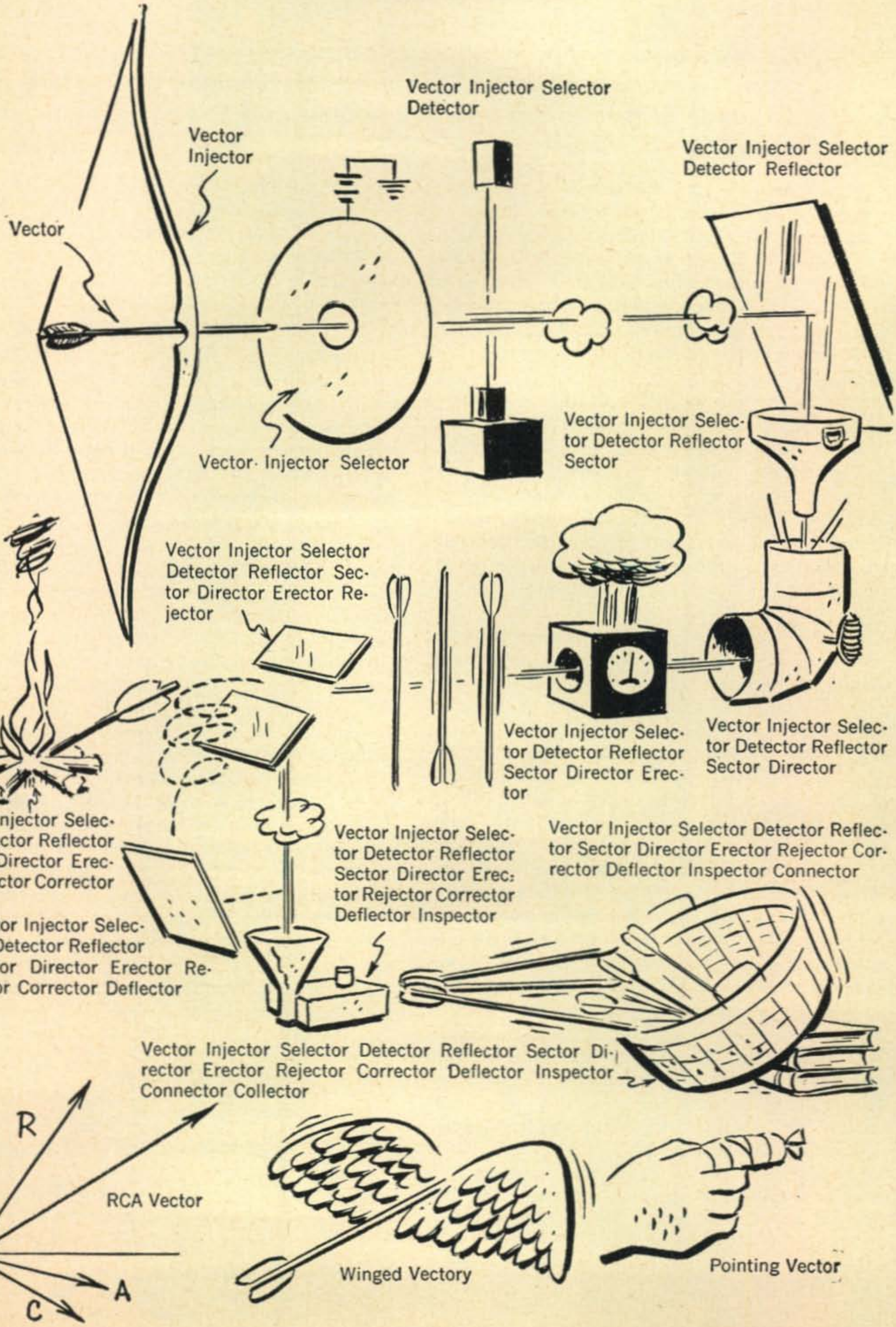


Bottom view of the Johnson Ranger shows several of the modifications. The BIAS ADJUST pot can be seen mounted on the shield behind the false knob covering the crystal socket. The adjustable resistor for the screen voltage is located on the right edge of the chassis and the new series wired electrolytics may be seen mounted on standoffs to clear the filter choke.

Vector Conjecture

Vector Conjecture first appeared in CQ for April 1957 under the authorship of Robert Katzine, K2UFS, but we thought some of the newcomers would enjoy seeing it, 1964 style.



Diversity Reception Made Easy

BY CAPTAIN PAUL H. LEE*, W3JHR

Little has been published in ham journals about diversity reception and for this reason, diversity has rarely been used for amateur work. Here is an explanation of the various diversity systems and how to apply them.

THE phrase "diversity receiving" may conjure up in the reader's mind visions of large receiver stations with acres of multiple rhombic or curtain antennas, such as are used for point-to-point communications. This is a bit frightening, and little has appeared in print about diversity receiving in amateur radio journals. Most amateurs simply do not have the backyard space for large antennas spaced several wavelengths apart. The principle of diversity which makes use of such spaced antennas is called "space diversity", and is based upon the fact that ionospherically reflected signals seldom fade down simultaneously on antennas spaced several wavelengths apart. Thus, if each antenna is connected to a receiver, and the receivers' outputs are combined in the proper manner, the resulting output signal will be quite steady in amplitude.

There are other means of obtaining diversity action, however. One is by reception of two signals containing identical intelligence on two separate frequencies, on the same or separate antennas, through separate receivers, to a combiner. This is called "frequency diversity." Because it is obviously wasteful of valuable h.f. spectrum space, its use has been mostly confined to u.h.f. and microwaves, especially to tropo scatter circuits.

Another type of diversity action may be obtained by use of two antennas of different polarizations for receiving, feeding two separate receivers whose output are combined. This is called "polarization diversity."[1] To date it has been used a lot at u.h.f. and microwaves, especially in tropo scatter. It is just beginning to be used at h.f., as more and more research studies (mostly for the military) are beginning to show that it is of considerable value at h.f. It does not require large antenna areas as does space diversity, nor does it require use of two frequencies as does frequency diversity.

Obviously, if one wants a very sophisticated (and expensive) setup, one can use combinations of space, frequency, and polarization diversity, with multiple receivers and combiners. This is done on microwave and tropo scatter circuits where the utmost in reliability (99.99%) is required. For the average h.f. user, however, dual diversity of one of the above types is quite satisfactory.

Diversity Reception for Amateurs

You may well ask how the average amateur can take advantage of the benefits to be obtained by diversity operation. There are several means, to be described here, each with advantages and disadvantages. Each is based upon the use of polarization diversity with two antennas, one horizontal and one vertical. This can be done in very little space, and is quite effective.

The simplest way, which has been used by some amateurs, is to take the two antenna leadins or coaxial lines, and parallel them at the receiver input. Or, one can build and use an orthogonally (cross) polarized antenna. The disadvantage of this technique is that there is no way of separately controlling the amplitudes of the signals from the horizontal and vertical components of the received wave. One is usually stronger than the other, depending on many factors over which the amateur may have no control. Although their fading characteristics may be optimum for diversity combining, their ratios may be far from optimum, with the result that much fading does occur, and the signal-to-noise ratio is not as good as it could be. This might be called "the poor man's diversity", because it does not require the use of a second receiver.

The next technique is the use of two cross-polarized antennas as before, but feeding two

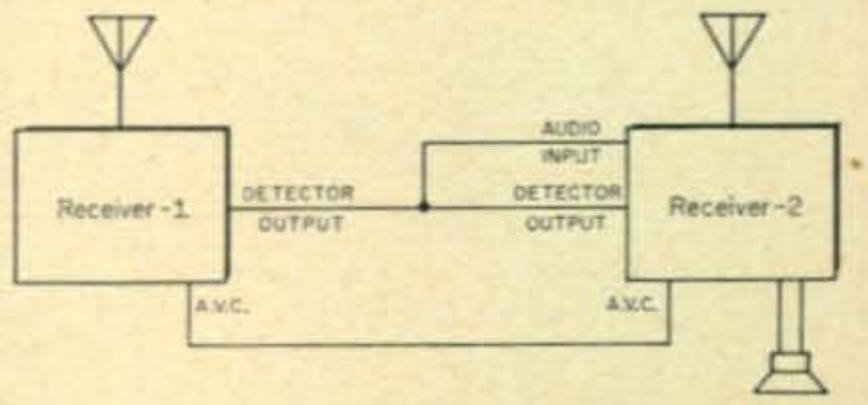


Fig. 1—Block diagram showing the interconnections for two receivers in diversity operation. This arrangement is called "base band combining."

*5209 Bangor Drive, Kensington, Maryland

[1]Lee, P. H., "Optimum Antenna Design for DX," *CQ*, Nov. 1962, p. 49.

separate receivers whose outputs are combined very simply. I use my vertical transmitting antenna and a horizontal 50 foot wire for this. One requirement is that the receivers must be identical and have identical a.v.c. characteristics. In this type of setup, the a.v.c. bus from each receiver is brought out to a terminal on the rear of the set, and the audio system in each receiver is broken after the audio gain control but ahead of the following audio stage, and the two leads thus created are brought out to a pair of terminals at the rear of the receiver. For diversity operation the a.v.c. terminals are tied together so that the set with the stronger signal biases down the weaker one. The audio output leads from the audio gain controls are tied together, and the combined audio output thus created is fed through the output stage of one set. The block diagram of fig. 1 shows this clearly. This is called "baseband combining", and it is usually used for radiotelephone work. The baseband is the audio band being received.

With this type of setup, it is desirable to be able to control the i.f. or r.f. gain of each set independently of the other, and independently of the a.v.c., to enable the signal levels to be equalized before the sets are connected in diversity. This can be done by connection of a potentiometer in the cathode lead of an i.f. stage which is not subject to a.v.c., or in the r.f. stage if it is not subject to a.v.c. It could also be done by adjustment of the antenna trimmer. It must be done before the sets are connected together, because the S-meters will read the same at all instants after they are connected together if the S-meters are in any way dependent upon a.v.c. voltage.

To facilitate the diversity connection, a switching arrangement is desirable. That shown in fig. 2 is used with my two Collins 51J-2 receivers. Throwing the switch to the left puts the audio through one set, and throwing it to the right puts it through the other. Leaving the switch in neutral connects each set as a separate identity with its own audio output. There is a separate audio gain control on each set, so that in the diversity mode the audio outputs may be matched in level. This scheme works quite well. It gives characteristic curves of audio output versus signal input

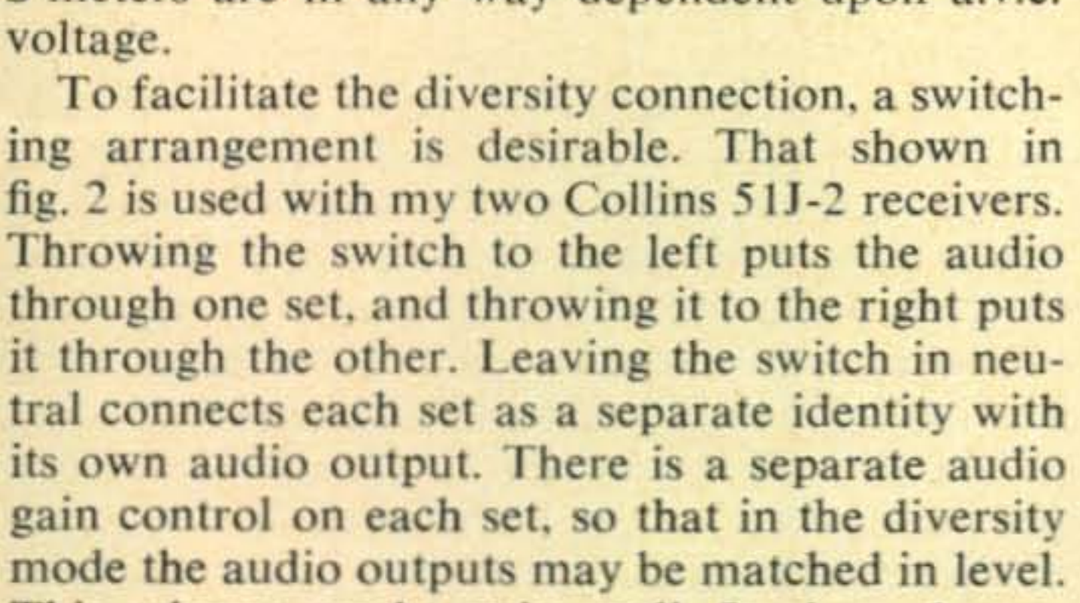


Fig. 2—Switching arrangement enables the audio output to be obtained from receiver 1 in switch position one. Switch position two is neutral and each set uses its own audio output stage. Position three feeds both audio signals through the output of receiver 2.

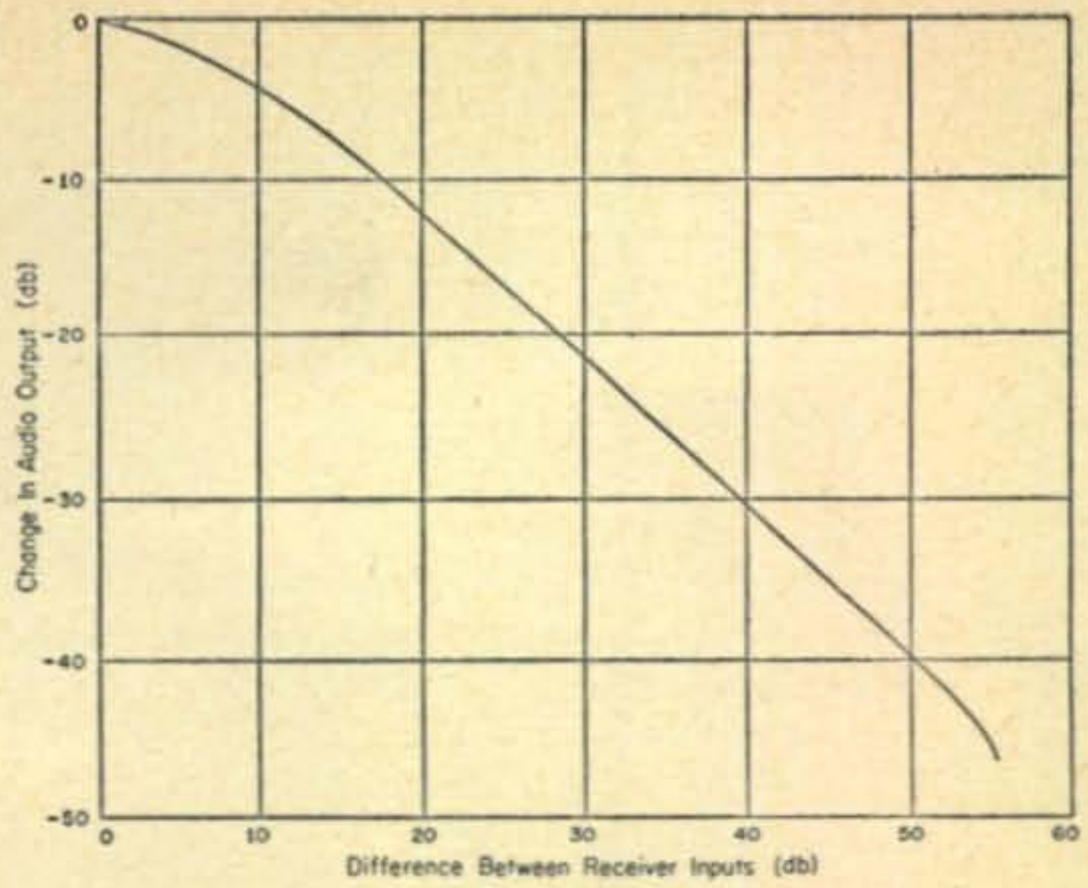


Fig. 3—Characteristic curve for audio output *versus* signal input with the set-up shown in figs. 1 and 2.

level shown in fig. 3. It may be seen that a 10 db difference in input signal gives a difference of 5 db in audio outputs, and a 20 db difference in input signal gives a differential of 13 db in audio output. That is to say that if the signal on one receiver takes a 20 db fade with respect to that on the other, the audio output of the first set to the common audio system drops 13 db below the other. If the signals to each receiver are equal, their audio outputs to the common audio system are equal. This system works well for many applications, such as reception of voice or program material, but it still does not do as well as can be done as far as signal-to-noise ratio (when one set has faded) is concerned.

Combiners

The ultimate which is required is a switching system or differential action which will give an absolute and instantaneous switch between the stronger and weaker signal. Design of such a combiner has been the aim of communications equipment engineers for many years. However, it is almost impossible to obtain instantaneous switching action without introduction of objectionable switching transients or thumps, in the radiotelephone case. For simple RTTY operation the transients introduced by a flip-flop circuit in the RTTY converter can be tolerated, but for radiotelephone we must have a more gradual switching or differential action. Thus the design of a differential circuit becomes a compromise between the speed of absolute and instantaneous switching and the difference in input signal levels which triggers it.

A more sophisticated type of combining circuit, with improved differential action, is shown in fig. 4. The receiver a.v.c. buses are tied together as before. However, the audio outputs are brought out separately to a differential rectifier circuit consisting of V_1 and V_2. Each rectifier is connected independently to bias a push-pull audio stage consisting of V_3 and V_4. The outputs of the two push-pull amplifiers are then combined in parallel to feed the speaker or program line. This type of circuit gives double differential ac-

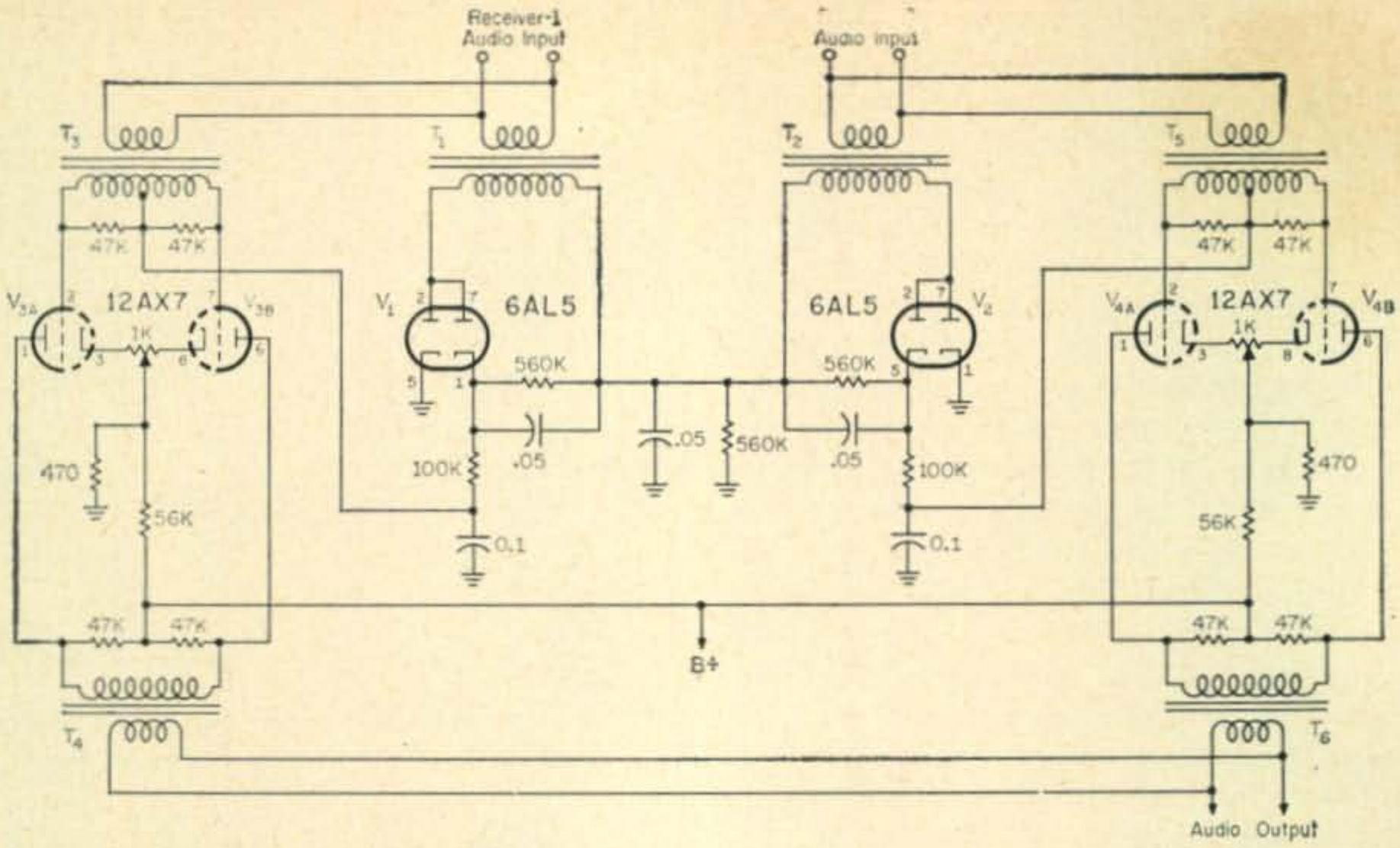


Fig. 4—A base-band diversity combiner giving improved action over the systems of figs. 1 and 2. Transformers T_1, T_2, T_4 and T_6 are Triad HSM-31's, while T_3 and T_5 are Triad HSM-29's.

tion. First, there is the depression of the audio output of the set with the weaker signal, caused by the common a.v.c. connection. Any depression or difference of one audio signal with reference to the other will cause the rectifiers V_1 and V_2 to apply a large difference in bias to the push-pull audio stages. The result is the differential action shown in fig. 5. The improvement over the action represented in fig. 3 is quite obvious. There is a faster and more complete switching action. This simple combiner may easily be built on a small chassis with its own power supply. A power audio stage could be added before the common output goes to the speaker or line. It could also be transistorized, but that is beyond the scope of this article.

The above circuitry is directed at radiotelephone. For frequency shift RTTY a much simpler approach can be used with an RTTY converter with dual i.f. inputs. A flip-flop circuit triggering the switching action between them can be controlled by the receiver a.v.c. voltages.

The curves of figures 3 and 5 obviously apply only to the 51J-2 receivers. Other receivers with different a.v.c. characteristics will give somewhat different curves.

DX Applications

At this point the reader may ask what interest is diversity to the amateur operator. Obviously it is a primary requirement on point-to-point communications circuits where the utmost in reliability is needed. But what does it buy the amateur? How can it be used to improve DX contacts?

Obviously it will find its greatest applications on radiotelephone, where the impact of fading on intelligibility and readability is greatest. For simple a.m. operations the arrangements for fig. 2 and fig. 4 can be used with great success, especially in DX work, to greatly reduce the number and magnitude of deep fades and the resulting distortion, loss of signal, and increased noise level. For s.s.b. operation there is an added requirement; this is the short and long term frequency stability of the receivers. The first element in this matter is the stability of the h.f. oscillator, or in the case of the Collins sets, the p.t.o unit. The second element is the stability of the product detector b.f.o. Each of these items must be stable if the s.s.b. audio signal from one receiver is to stay in synchronism with that from the other receiver. If the audio signals are out of synchronism, an annoying audio beat or flutter will be heard, especially with the simpler circuit of fig. 2, where differential action permits some weak-receiver signal to feed through. The commercial answer to the stability problem is to use a common h.f. oscillator and a common b.f.o. for the two receivers. One set is actually "slaved" to the other. However, for the amateur this complicates tuning and is undesirable. In the case of my Collins 51J-2's, the p.t.o.'s and crystal controlled product detectors[2] are sufficiently stable

[*Continued on page 102*]

[2]Lee, P. H., "The Single Tube Product Detector," *CQ*, April 1961, p. 50.

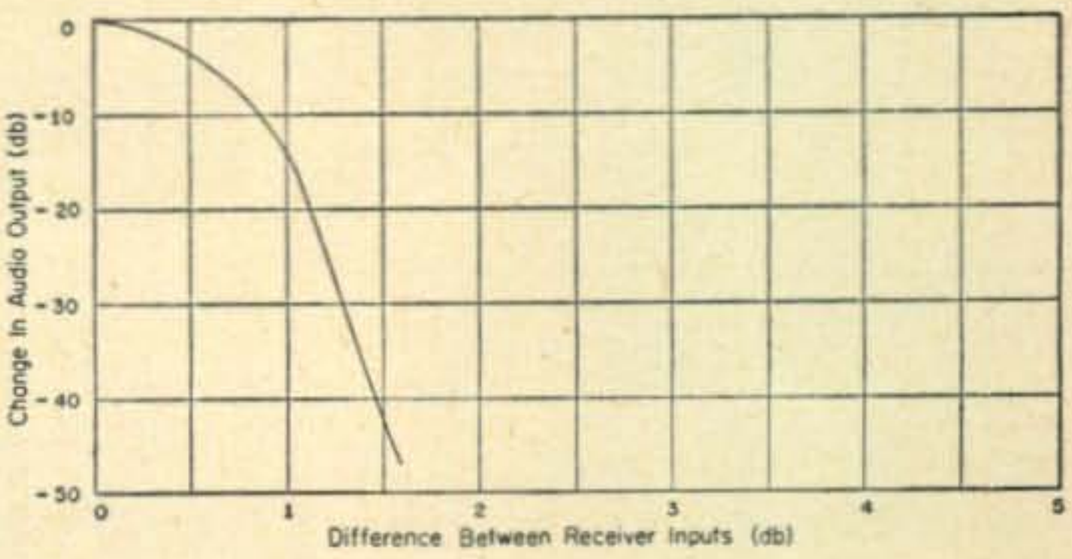


Fig. 5—Characteristic curve for audio output versus signal input when the combiner, shown in fig. 4, is used. Note the improvement over the curve of fig. 3.

TOOTS, A Timed Sequence Station Control

BY COL. CHARLES FELSTEAD*, KH6CU

This station control unit protects both the receiver and transmitter by the use of sequentially timed relays. It is effective for both c.w. and phone.

NOTHING adds more pleasure to operating an amateur station than a device that removes most of the mechanical task of switching back and forth from receiving to transmitting. Many such circuits exist, from simple antenna change-over and power-control switches to the most sophisticated electronic timed sequence systems; but after trying and discarding a number of them, TOOTS finally came into being. It is sort of an embryonic electronic brain, you might say, that on command switches on the transmitting equipment in a prescribed order, and then decides when a c.w. operator has finished sending and automatically switches back to receiving.

Transmitter On-Off Timed Sequence, TOOTS, after long use in actual communication has proved eminently satisfactory. It is based on TATOO, a time-delay circuit developed by E. Laird Campbell,[1] W1CUT; but that circuit has been greatly expanded and modified to make it more comprehensive in function. By the addition of a timed sequence feature, both the transmitter and receiver are given the protection of sequential relay control operation, yet with quite simple circuitry.

Sequence

TOOTS operates in this fashion: When the key is closed, even for only the duration of a dot, these actions take place in sequence: the receiver is muted, the antenna is transferred from receiving to transmitting, and finally the transmitter is keyed. Thus the transmitter cannot be operated until the receiver is muted and the antenna disconnected from it, providing complete protection to the receiver; and the transmitter is protected since it cannot be keyed until the antenna is firmly connected to it, which prevents burned antenna relay contacts and the flash-over that can occur when a transmitter is operated without an antenna load.

As long as the key is operated at a speed determined by the setting of the time-delay potentiometer R_3 or faster, the relays will remain locked in the transmit position; but at the end of transmission, or if the initial pulse that caused the relays to close is not followed up within the adjusted time interval by additional closing of the key, the keying circuit of the transmitter is opened, the antenna is reconnected to the receiver, and the receiver muting circuit is opened.

Circuit Operation

TOOTS accomplishes these functions in this manner: With the switch S_1 in the C.W. position, a momentary closing of the key causes current to flow in the diode-connected half of the 12AU7, marked V_{1B} in fig. 1. The current flow through the cathode resistor R_3 charges C_1 and places a positive charge on the grid of V_{1A}, causing that tube to conduct. The current flow through V_{1A} energizes relay K_1, closing its contacts. The relay will remain closed for the length of time dictated by the time-delay circuit made up of C_1 and R_3, which is, with the key open and no current flowing through V_{1B} and R_3, the length of time required for C_1 to discharge through R_3. Actually, before C_1 is completely discharged, its voltage will fall to a value too low to maintain a sufficient positive voltage on the grid of V_{1A} to keep it conducting. The current through V_{1A} will then drop to zero, and the contacts of relay K_1 will open.

The time interval is expressed mathematically as $T = CR$, where T (time in seconds) $= C_1$ (in microfarads) $\times$ R_3 (in megohms).

The tap on the key that causes K_1 to operate also closes relay K_2 momentarily. Since K_2 is the keying relay, it would turn on the transmitter if the keying circuit were not held open by the auxiliary contacts of relay K_3, the antenna relay,

Rear view of the timed sequence station control unit, TOOTS, shows the power supply on the left and the 12AU7s and relays on the right. A simpler power supply, shown in fig. 1, was built for subsequent models.

[1]Campbell, E. L., "'Tattoo' — Automatic C.W. Transmitter Control," *QST*, August 1956, p. 18.

*Colonal, AUS-Ret., 430 Kaiolu St., Honolulu 15, Hawaii.

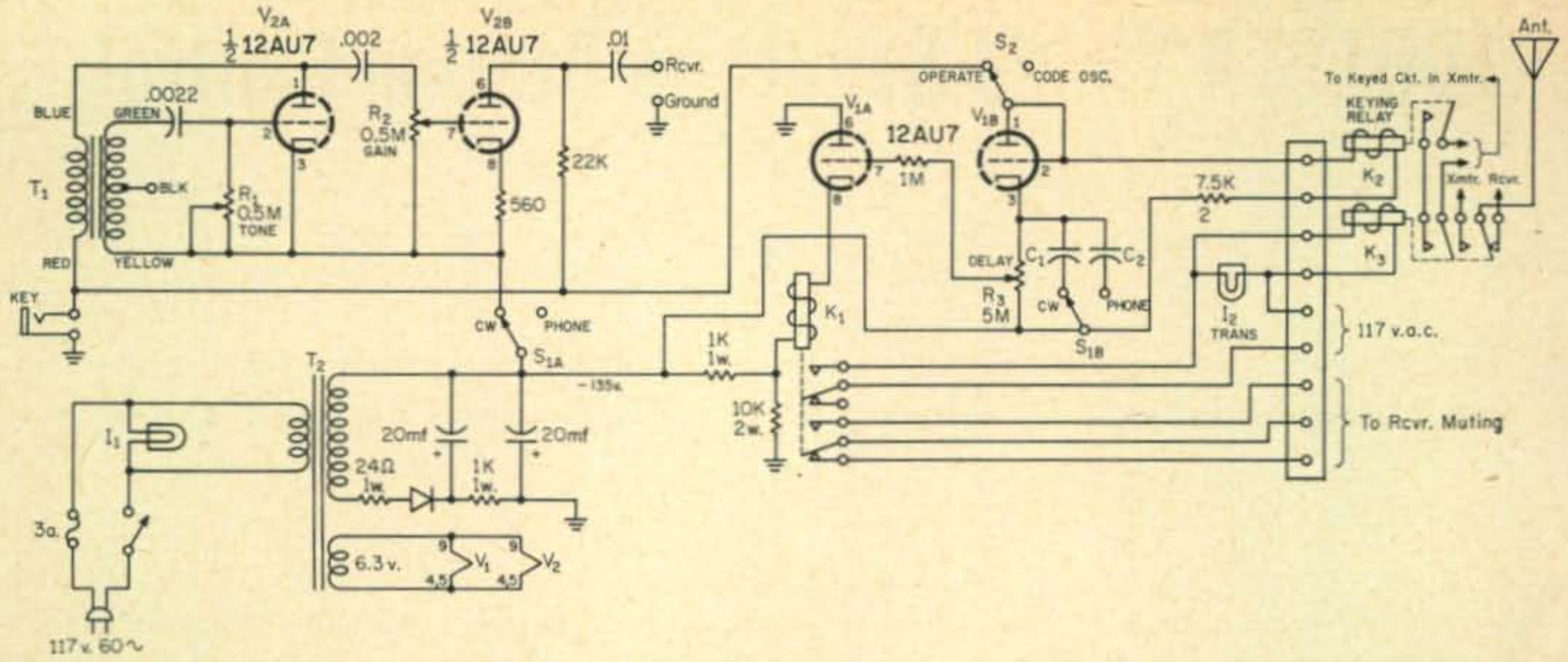


Fig. 1—Circuit of the on-off timed sequence station control unit. It contains an adjustable time delay as explained in the text, an audio oscillator (V_{2A}) for monitoring and a relay control system. All capacitators are in mf and all resistors are ½ watt unless otherwise noted. Transformer T_1 is a 2:1 audio interstage, Thordarson 20A16.

and all the protection to the receiver and transmitter that is provided by TOOTS would be lost.

In TOOTS this is the sequence of operation caused by that short tap on the key: Relays K_1 and K_2 close. Relay K_2 opens again immediately, but K_1 holds closed for a quarter second to several seconds, depending on the capacity of C_1 and the adjustment of R_3. Contacts on relay K_1 can mute the receiver by any one of the common methods such as placing a cutoff voltage on the grid of the r.f. amplifier tube or opening the receiver plate voltage circuit. When the receiver is safely muted, the antenna relay K_3 is actuated by K_1, transferring the antenna from receiver to transmitter; and only then is the keying circuit closed so that the keying relay K_2 can key the transmitter.

By selecting the proper capacity for C_1, almost any speed of sending can be accommodated by correctly adjusting the potentiometer R_3. With a capacitor for c.w. keying (C_1) of 0.25 mf, the hold-in time of relay K_1 can be adjusted by R from approximately one second to three seconds which will permit sending speeds as low as five w.p.m.

Monitor

The second 12AU7, V_2, provides a sidetone generator for monitoring sending. The half of the tube marked V_{2A} is the audio oscillator, and the other triode in the envelope functions as an amplifier for the oscillator. The grid leak, R_1, of the first triode provides a wide selection of audio frequencies for monitoring, so the operator can select the tone most agreeable to him. The potentiometer R_2 is the volume control. Sufficient volume is available to operate a small loud speaker connected between the terminals marked RCVR and GND; or the terminal RCVR can be connected to the ungrounded side of the loud speaker in the receiver. If more volume is required, a connection can be made from the terminal RCVR to the grid circuit of one of the audio amplifier stages in the receiver.

Phone

When operating on phone, the switch S_1 is thrown to the PHONE position. This disconnects the sidetone generator and connects a smaller capacity, C_2, in the time-delay circuit in place of C_1. A 0.047 mf capacitor provides a delay time of approximately one-half to one second. The key circuit must be held closed during phone transmission, of course. This can be accomplished by closing the switch that is a part of most keys, by a foot switch connected across the key contacts, or by connecting the switch on the microphone stand across the key.

The question may be asked, why C_2? It has been incorporated in the circuit so that at the end of a phone transmission there will be a slight delay after the switch is opened before relay K_1 releases and allows the antenna to be switched back to receiving by the antenna relay K_3, and the receiver muting to be cancelled by the deactivation of relay K_1. This is a precaution to avoid the possibility of burned antenna relay contacts or a flash-over in the transmitter, or that "bat in the ear" at the receiver, which could occur if one of the relays operated faster than the others.

The values of C_1 and C_2 were chosen by experiment and have worked out perfectly at KH6CU, but since all amateurs are rugged individualists, some operators might find other capacities more desirable. Also, there is a lack of uniformity in the values of capacitors, particularly those that come out of the junk box; so it is possible that more than one unit may have to be tried at C_1 and C_2.

If a wide variation in sending speeds is expected, as in a multiple-operator station, several different size capacitors can be provided for C_1,

[*Continued on page 98*]

What Makes The Ham Tick ?

BY V. M. VICTOROFF*, M.D.,
W8GAS

This article has been condensed from an after-dinner speech given at the Single-Sideband Dinner of the ARRL Great Lakes Division Ham Convention in Cleveland, Ohio, October 13th, 1961.

As a student of human nature, who is incidentally a thoroughly brain-washed ham, I am grateful to amateur radio and to those who infest—I mean—inhabit its house, for offering at any time of day or night, so wonderful a conglomerate of raw clinical material.

Acquaintance with hams reveals to a psychiatrist every imaginable aberration. There is the brute, with malice to all and charity to none, who prowls like a predator on 14.335 to 14.350 mc from which DX signals should come, but can't, since he blankets the frequencies. He is followed by a purveyor of prolix prattle who has discovered 365 ways of saying, "I." The obsessive-compulsive personalities can be illustrated by their hour-by-hour search for one more state for WAS or one more country to fill the last line on the page in the log.

Paranoia is represented by the expression of delusions of persecution. When a ham finds something wrong with his rig, at once he starts to "other blame." First he accuses the manufacturer of maliciously building faulty components into the v.f.o., or he complains that the vibrations from the refrigerator cause solder joints to crystallize, or may dash off a letter to the Illuminating Company accusing them of using stale electricity.

Mechanisms for satisfaction become obsessive as he becomes involved with complicated equipment to push his s.w.r. another 0.1; to shove the modulation closer to a mythical 100%; to skirt the edge of a maximum allowable kilowatt.

This pursuit leads to increasingly complex rituals to serve and service the equipment. The electronic nightmare is dependent upon him for its existence, but as monsters are prone to do, it monopolizes the master, occupies his time to the exclusion of all other interests and eventually may eat him up.

* Director, Associates on Neuropsychiatry, 2231 Taylor Road, Cleveland, Ohio, 44112.

A curious sign of mental disturbance is the fanatical sense of loyalty which the ham exhibits to his own kind. Neither kith nor kin, nor vocation, nor any flag that flies can move the amateur to more inconvenience than when a fellow ham calls.

If ever I ask for assistance, even with six inches of snow on the ground, any of the fellows will heed The Call. Before I finish telling him that the filaments look a little crooked, or the flickering of the dial light makes me anxious, or that parallax causes me to read the frequency a few kc off, there he is in his beat-up station wagon complete with tool kit.

There is mathematical relationship (probably linear) between technical proficiency and degeneracy of human characteristic that is really depressing in the ham. The mastery of phase networks, 2,000 watt p.e.p., home-brew antenna switching arrangements and that uncanny technique of keeping the drive at minimum, yet securing full modulation and signal for the final, is accomplished at terrible cost.

Appalling deterioration of dress, social presence and physical well-being occurs. The old timers walk with a shambling gait. They wear clothes like a shaggy dog just back after a good run in a nearby swamp. They talk so illiterately that even purveyors of singing commercials would find them offensive. Something blisters in their minds when confronted with a simple, grammatical sentence. Did you ever notice their all-over, peculiar, glazed look? They appear a bit oxidized. I'm sure we will someday determine that too much exposure to suppressed carrier and rejected side-band results in some secondary radiation product that has a subtle transmuting effect on human tissue.

He derives so much illicit ecstasy from that punchy signal he puts out on the air, that he has to find some justification acceptable to his conscience. The radio amateur spends much of his life in the twin paradoxical pursuits of cultivating his neurotic fixations while at the same time trying to camouflage his symptoms from conscious view.

In compensation, the ham desperately seeks ways to be demonstratively useful. At home he may set up an inter-com between the playroom and the kitchen, despite the fact the XYL and harmonics have learned that a loud yell suffices.

But he really comes into his own when the sirens sound, the church bells ring, and the alarms clang. When that red alert sounds, look for that Fifth Horseman of the Apocalypse, the amateur radio op, among the speculators, looters and camp followers.

When things are dull, and there are no crashes, bent over stop signs, or juveniles throwing snowballs at passing traffic to report to the police department, I am personally so concerned for the gloom that falls over our traffic net on 10 meters, that I employ an effective therapeutic device. I profess to get lost and urgently request somebody with a street map to show me the way to go home.

The apparition of a tornado is scary for everyone but the ham who watches joyfully as the whirling funnel sucks up roofs, and knocks over trees, and telephone poles. The ravaging hurricane and the flood that washes out roads, collapses bridges, disrupts ground line communications and isolates a community is a source of dazzling happiness, and the ham races to his shack with, "Now we'll see about those TVI complaints."

In a tremendous attempt to bring feelings under control, a man on the West coast not long ago, ventilated his grief at the death of his wife. He was handled as gently and considerably by those who spoke with him as any professional could do. This tenderness is exemplary of the very best in ham radio.

I began in amateur radio because as a physician interested in electroencephalography, I needed to know something more about electronics in order to talk to the engineers who helped set up research experiments and design equipment.

I did learn a bit about electronics, but nothing of this secret stuff that those marvels of Marconi seem to know. When I call up Ray Kacprzak, W8ICS, president of the Indian Hills Radio Club, he always has an answer. I'll ask about my sick DX-100, "Ray, my audio is gone." He'll interrupt his seance on 40 meters and advise, "Check out that 0.2 microfarad 1.6 kilovolt disc ceramic capacitor in the secondary of the modulator transformer circuit." And he's right. I objected furiously and cried "unfair tactics," when my NC-300 just quit talking one afternoon. Andy Summerville, of Bud Radio, a visitor who had never been in my shack before, walked in, tapped the front of the receiver with his forefinger and said, "Let's put in a new 4H4C." How could he see that the filaments in that ballast tube were strung out like taffy?

With one or two important exceptions, every time I have called upon amateur radio to enhance my prestige, or pull me out of a tight spot, to rescue me from harassment and danger, it has always let me down. When people come to the shack and amazedly look at the profusion of knocked out chassis, interlinked adapters, surplus meters, discarded baluns, and cigar boxes full of chicken bones and rabbit feet, which I use to make my NC-300, the DX-100 and SB-10 work, I say, "With all this electronic gear and the telephone, I can call the corner drugstore and order a couple of Cokes."

Once I set up a QSO with M.D., Walter Mickle, KØEOE, a neurologist who then was engaged in brain research at Tulane University Medical School. I arranged to play host to our local Cleveland Electroencephalographic Society in my shack. The technicians and doctors were interested in fascinating work Dr. Mickle was doing with depth electrodes in the brain. I planned to hold a QSO with Walter during the meeting of the Society. He could then tell us about his work via radio directly from Louisiana.

The previous Sunday—to prepare against the possibility we couldn't get through on 20 meters, Walt and I had painstakingly recorded on tape a review of the material. With every eventuality prepared for, I looked forward to an exciting evening mixing medicine, amateur radio, coffee and cake in about equal proportions. On this particular evening the Aurora Borealis hit the area harder than it has in 20 years and all signals were blanked. Pulling my ace out of the hole, I triumphantly showed the tape and started up the Wollensak. It was completely dead. Nothing worked. I dragged out an older tape recorder, a Revere, but this had capstan trouble which caused the tape to sound so wobbily that no one could understand it. Someone should have brought a guitar.

But I have had a few vital experiences on ham bands which have made it all worthwhile. There was the time when I was taking care of Debra, at that time six-months old. Those were the days when I logged my best hours on radio between 2 and 3 A.M. A real challenge to technical proficiency is the task of tuning up the final of the DX-100, nulling the carrier, balancing the drive and the audio on the outboard s.s.b. adapter so that the unwanted sideband won't become obnoxious, all the time feeding a lively baby with a free-running nipple.

Once, while tuning aimlessly around 14.380 mc, loud and clear came the signal from what seemed to be a local. He was on frequency, and seemed to have answered my CQ which was astonishing in itself. I came alive, "Yes, this is W8GAS, QRZed?" He identified himself as a VP8 in the Falkland Islands near Antarctica.

I blurted out, "The hell you say," dropped the baby, but luckily saved the mike. Then I proceeded in a most exciting QSO with a flier who had been on duty for approximately 18 months at the South Pole with a real flair for dramatizing his work.

On another occasion, also early in the morning, I picked up a MARS station in the Marshall Islands and put through a long distance call from Cleveland to Detroit. A young soldier had made arrangements to meet his wife in Honolulu. They had been separated for two years. His tour of duty was almost up, and their phone patch was a moving emotional experience for all of us, but particularly useful since the girl had misunderstood her shipping and boarding instructions. It was indeed a pleasant feeling, one of the few charities not deductible from income tax, which left a warm residue long after the phone patch had concluded.

Whatever may be said about hams, the hobby and the science of electronics exists because of a universal yearning to communicate with all humans everywhere. The ham with his 100 watt station, who makes a transitory contact with a UA1 in Leningrad and commiserates with him about a problem of matching impedances, is 'way ahead of the U.S. State Department and the Politburo in devising terms for friendly relations between states.

[*Continued on page 96*]

Artist's conception of CQ's new offices.

CQ To Move General Offices

CQ takes pride in announcing a move to spacious new quarters in Port Washington, Long Island. The new *CQ* offices will be 50% larger than our present facilities, allowing much-needed extra room for our growing organization.

One feature of interest to readers will be a completely new lab under Bill Scherer's supervision, for the building of construction projects and the testing of commercially built equipment. *CQ* has quite a few new books for hams on the way and our larger offices will certainly provide for getting them out on schedule.

Our change of location, however, comes on the heels of our invitation last month, to amateurs visiting the World's Fair. The new offices are a bit further out of the way, but still only about a half-hour's drive from the Fair Grounds. We'll have a new map and directions in June *CQ*.

The new address will be 14 VanDerventer Ave., Port Washington, Long Island, New York. Mail should not be sent to the new address until after June 15th, 1964.

DX DX DX DX DX

URBAN LE JEUNE, JR.*, W2DEC

The following certificates were issued between the period from February 4th, 1964 to and including March 3rd, 1964:

CW-PHONE WAZ

1922	W8CUT	Daniel F. Parks
1923	W8KSR	Jon T. Hodgin
1924	JT1CA	Vladimir V. Belousov
1925	K3HQJ	Ken J. Phillips
1926	VK3KS	Mavis Stafford
1927	DL7HU	Wolfgang Preusse
1928	ZS6LW	A. D. van der Watt
1929	F2PO	Felix Lacrouts
1930	K8AJK	Jerry Gadowski
1931	OK1BP	Jaromir Kucera
1932	K4HJJ	Glenn R. Blackwell
1933	LZ1KPZ	Radio Club of Pazardjik
1934	W5EJV	L. F. Wanja
1935	W3AFM	Paul D. Rockwell
1936	XE1AE	Fernando L. Vallarta
1937	W9RDI	Dean Sargent
1938	F8KJ	Raoul Soulie
1939	DL1IP	Detlef Missfeldt
1940	W6WGC	Winfred H. Wileman
1941	ZS2U	A. F. Akers
1942	W4EJN	James Weldon Fields
1943	WØGNG	W. L. Schuckhart
1944	VQ2WR	George W. Ripley
1945	ZL2JO	Thelma Souper

ALL-PHONE WAZ

228	JT1CA	Vladimir V. Belousov
229	VE5JV	Allan Chesworth
230	VK5QR	Reg Galle
231	VK2JZ	A. S. Mather
232	DL7HU	Wolfgang Preusse
233	XE1AE	Fernando L. Vallarta

TWO-WAY SSB WAZ

214	JT1CA	Vladimir V. Belousov
215	VK5QR	Reg Galle
216	UA1CK	Vladimir Cuploon
217	DL7HU	Wolfgang Preusse
218	SP9FR	Wladylaw Dubno
219	XE1AE	Fernando L. Vallarta
220	W7BTH	Elwood R. Johns
221	W4ANE	Calvin Des Portes

CW WPX

522	OE5LX	Leo Mis
523	KØJPL	Paul L. Haefner
524	DJ5GG	Gunther Pilipp
525	YO3CR	V. Ilias
526	YO6XI	Kovanda Ladislau
527	K5UYF	John C. Kanode
528	LA2MA	Finn Roll
529	K1LWI	F. Wendell Boyden, Jr.
530	VK3TL	J. K. L. Matchett
531	DL1RK	Klaus J. Doering
532	UC2AW	Valery I. Tomkunus
533	UC2WP	Anatol I. Prokhoroy

PHONE WPX

108	G3WW	R. F. G. Thurlow

SSB WPX

166	WØLBB	Harris A. Fromhold
167	DL5AO	Richard H. McCaffrey, Jr.
168	KP4AOO	Roger Burt
169	K4LYG/7	Marcus E. Rinks
170	W3DJZ	Arden B. Hopple
171	TG9SC	Cesar A. Siu

MIXED WPX

87	W5EJT	Eugene A. Jank

Silent Key

We regret to record the passing of Ray, KH6PD. He will be well remembered for his KH6PD/KG6, Marcus Island, activity.

Here And There

CR4 Cape Verde Islands: CR4AD has s.s.b. crystal frequencies of 14,105, 14,121, and 14,127 kc. He uses all rather infrequently. He announces his listening frequencies. *(Tnx WGDXC).*

CR5 Sao Tome: DXpedition of the month is now handling QSLs for CR5SP. He is presently active on 15 and 20 meter c.w. and a.m. Hammarlund s.s.b. gear will be sent to him in May. QSL via P. O. Box 7388, General Post Office, N. Y., N. Y.

CR8 Portuguese Timor: CR8AD left Timor in March which leaves this rare country without ham coverage. *(Tnx VERON).*

FB8XX/ZZ/WW Kerguelen/Amsterdam/Crozet: The HB9TL s.s.b. rig has left FR7ZD and should now be on the air from FB8ZZ. After a stay of several months it will proceed to FB8XX and then to FB8WW. Speaking of FB8WW, operator Marcel has been doing a wonderful job dishing out QSOs from this new country. He uses 14,040 kc on c.w., 14,145 kc on a.m. phone. His signals on the east coast have been almost unbelievably strong on the long path. Marcel is not a "ham" but a very competent commercial c.w. operator. He caught on to ham procedure very rapidly. I only hope the scars don't show. QSLs for all three stations via 5R8BC.

FR7 Reunion Island: Maurice, FR7ZJ, now has an HX-50 and is the only station on s.s.b. on Reunion.

*Box 35, Hazlet, New Jersey 07730.

WPX HONOR ROLL

CW WPX

W2HMJ	685
W8KPL	652
W5KC	647
W2AIW	617
W2EQS	605
W4OPM	600
W6KG	596
ON4QX	579
W2NUT	571
W8LY	570
W9UXO	566
K6CQM	565
W5OLG	564
W2HO	563
W5LGG	558
W9DWQ	556
DL1QT	552
K2ZKU	552
W1EQ	549
W1IJB	546
K2UKQ	546
W9YSX	544
W9GFF	538
IT1AGA	536
SM7MS	534
G2GM	526
OK1SV	517
K9AGB	515
KP4CC	515
W6WO	511
DJ2KS	511
W2KIR	511
W2GT	510
K9EAB	510
DL3RK	509
W8RQ	505
W9UZS	505
PAØLOU	505
G3EYN	503
YU1AG	503
W3GJY	503
W6YY	502
DL7CS	502
K2CPR	501
W9SFR	501
W2EMW	500
W2FXA	500
W2MUM	495
W1WLW	494
LA3DB	491
OK3DG	488
SM5CCE	488
W4BYU	487
W8PQQ	481
ON4FU	479
W4HYW	478
W8IBX	476
W5BUK	475
WØMCX	472
SP6FZ	468
W3OCU	466
K6SXA	464
PY4OD	462
JA2JW	461
VE4OX	461
W9WIO	460
W9WCE	458
W3BCY	457
W7HDL	457
OE1FF	457
F9MS	457
OK3EA	456
UC2AR	456
K4TEA	451
W3PGB	450
DL1YA	450
DL9KP	450
W8JIN	449
W8KSR	449
W3AYD	443
W6UNP	442
VK3XB	439
W3BQA	437
LA5HE	437
VE3ES	433
G3HIW	433
W8UMR	429
WØAUB	429
W2RA	428
K5LIA	428
OK1MB	428
W3CGS	426
W1EIO	425
OE3WB	425
KL7MF	424
SM5WI	424
WØPGI	420
W7ABO	419
HB9TT	419
KH6BLX	418
UA4IF	417
K2PFC	415
VK3XB	415
W1DGT	415
W5AWT	412
W5DA	412
WA2DIG	411
W2PTD	411
K5LZO	411
W4DKP	410
W1CKU	408
K4IEX	408
K4JVE	407
W5AFX	407
W4CKD	407
SM5AJR	406

Phone WPX

W9WHM	605
CT1PK	603
W8WT	589
G3DO	583
CT1HF	565
MP4BBW	506
DJ3CP	473
W9YSQ	471
W9UZC	462
PAØHBO	453
G3NUG	451
K9EAB	450
W6YY	448
G8KS	430
VK6RU	421
W3AYD	420
F8PI	418
PZ1AX	413
K2CJN	409
DL3TJ	404
OE1FF	404
W1ORV	404
W1UOP	402
W6USG	400
VE3BQP	386
SP7HX	381
TG3AD	381
DL6VM	376
W3DJZ	374
PAØSNG	369
G3FKM	366
W8UMR	363
SM3AZI	362
DL2UZ	361
SM3EP	361
W1DGJ	358
W5ERY	358
W6CHY	358
W8JIN	356
G3GHE	356
CX2CN	354
PY2CK	354
5A5TO	353
LA5HE	351
ZS6IW	350

SSB WPX

W4OPM	506
MP4BBW	462
HB9TL	452
W3NKM	451
G8KS	450
K9EAB	439
G3AWZ	428
G3DO	424
G3NUG	423
W3MAC	403
W1ORV	370
W2HXG	359
TI2HP	356
W6YMV	354
I1AMU	346
PZ1AX	345
K1IXG	344
W6RKP	343
VE3BQP	334
W4RLS	322
W2VCZ	320
W1UOP	318
W2YBO	318
W8PQQ	315
WA2EOQ	315
K4PUS	305
DJ3CP	304
WA2SFP	300
K2TDI	300
W3VSU	300
W4NJF	300
KØRDP	300
VE3BKL	300
K1SHN	300
K2POA	300
WØCVU	291
GI6TK	278
K5OGP	277
K8ONV	275
VE3ES	274
K2JFV	266
K2MGE	263
W3AYD	262
W4EEU	262
DL1PM	257
XE1CV	256
G3FKM	255
UR2AR	255
W1EQ	253
W6USG	252
K2ZKU	251

Mixed WPX

W4OPM	658
G3DO	624
W9YSX	622
W8WT	621
K9EAB	606
W8JIN	605
W3NKM	605
W3OCU	588
W9DWQ	571
W6YY	570
W5LGG	565
W4BYU	557
K2ZKU	555
W3AYD	552
YU1AG	552
HB9EU	551
WØMCX	529
W2GT	528
DL3RK	525
DJ2KS	524
G8KS	520
OE1FF	519
K9AGB	510
PAØLOU	510
HK3LX	508
W4BQY	505
W3KPD	501
W8UMR	500
LA5HE	500
KP4AOO	500
ST2AR	489
JA2JW	480
W3CGS	475
W9FVU	474
G3HDA	469
G3FKM	463
DL1YA	456
W1ORV	455
VK2DI	454
WØZBQ	452
G3NUG	452
GI6TK	450

HL9 Korea: Aug, K2UVU/HL9, reports the following via the NEDXA. "Thought I would drop you boys a line and tell you a little about the hot DX over here, Hi, I just got the info on how to get a license, so will soon be putting in my application. Looks like I may have to wait a while in order to get my ticket; however, there is a good chance of getting a license right away if all goes well. The Korean Government, in conjunction with the U. S. Armed Forces only issues 32 HL9-licenses and right now they are all in use. There is a waiting list of about fifteen. I set up the KWM-2 this afternoon and stuck a piece of wire about 20 feet long in the antenna jack. On 14 mc s.s.b., I heard KG6SA working KC6AO about 0600 GMT. I was tuning the rig around the 40 meter c.w. band and here is what I heard in the last ten minutes—JT1AB, VS6FC, UAØKZD, UAØEJ, VS4RS, and now as I'm writing this, UA9RW is calling CQ with no takers. Well, guess that's about it for now. Will keep you informed about the licensing situation and how fast I get a ticket. 73."

HZ Saudi Arabia: "Bing" Crosby, ex-G3NMQ, 5A3BC, ZC4BC, etc., will be in Dhahran, Saudi Arabia for an extended stay and hopes to be active as HZ2BC. *(Tnx W2GT)*

JT1 Mongolia: JT1KAA is active on 14,103 kc s.s.b. on Mondays, Thursdays, and Sundays from 0000 GMT to 0300 GMT. *(Tnx WGDXC)*

KC6 Western Carolines: A new station is now active from Yap. KC6AA operates s.s.b. after 0600 GMT on frequencies between 14,280 and 14,290 kc. *(Tnx VERON)*

OHØ Aland Is.: OHØNC is fairly active every morning around 1300 GMT on 14,285 kc s.s.b. Sam would appreciate quick exchanges in order to give contacts to as many callers as possible. *(Tnx PRDXC)*

TA Turkey: The *Puerto Rican DXer* reports that TA2NK was a phony. This via his alleged QSL manager, DJ2NY.

SSB DX HONOR ROLL

W2ZX	288
W8PQQ	288
TI2HP	283
PY4TK	279
K9EAB	279
K4TJL	279
W2VCZ	279
W2BXA	278
W8EAP	278
WØQVZ	278
K8RTW	276
W2TP	276
VQ4ERR	275
K2MGE	272
W2FXN	272
W6UOU	270
HB9TL	269
WØQVZ	268
W4OPM	265
W6RKP	265
W3LMA	261
PZ1AX	261
G8KS	261
G3FKM	261
W5IYU	260
DL1IN	258
MP4BBW	256
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W2ZX	300
W6USG	200
W3FWD	200
K1SHN	200

WAZ and WPX

The WAZ and WPX certificates are awarded by the *CQ* DX department. WAZ is issued for proof of contact with the 40 Zones of the world as shown on the official WAZ Zone Map. WAZ is issued in three classes, *i.e.* Any mode, all phone and all s.s.b. For complete rules, see the January, 1962 *CQ*, page 50.

WPX is issued in four classes, *i.e.*, all c.w., all phone, all s.s.b. and Mixed. The number of prefixes required are: C.w.-300; Phone-300; s.s.b.-200; Mixed-400. For complete rules, see January, 1962 *CQ*, page 52. WAZ applications, Zone Maps and WPX applications may be obtained from the DX Editor at the address shown at the head of this column. Please send a self-addressed, stamped envelope or a self-addressed envelope and an IRC. All applications should be sent directly to the DX Editor.

VKØ Heard Island: A scientific and mountaineering party, including a radio operator, is planning to visit Heard Island in November to climb "Big Ben" a 9,000-foot, ice-covered peak. *(Tnx LIDXA).*

VS5 Brunei: Michael Heincen, ex-VQ1MH, should not be QRV on 14 and 21 mc as VS5MH. Mike lost all his gear in VQ1-land. *(Tnx Geoff Watts).*

VS9M Maldives: VS9MG has been busy on 14 mc c.w. helping VS9MB dispense Maldive Island QSOs. *(Tnx VERON).*

YA Afghanistan: YA4A (Dick, K4UTE) whose Collins rig was shipped via slow boat, may take several months before operating. However, Dick has located a Geloso transmitter and if he can locate a decent receiver he will be on 14,070 kc c.w. and 14,080 kc a.m. from 1030 GMT until 1930 GMT daily. He will listen 10 up on c.w. and 14,205 on a.m. After the Collins gear arrives, he will use the same frequencies but add 14,110 kc for s.s.b. listening 14,250-60 kc. All mail, including QSL cards, should go to K4KMX and Dick requests *no* attempts be made to write him direct because of the nature of his Peace Corps work there. Dick reports band is open to W/K for only about 15 minutes at present, usually between 1200-1300 GMT but improvement is expected shortly via long path. Our Friday is their Sunday, therefore, it is the best time since Dick does not have to work and has full time to ham it up. Dick will be in YA-land for about 10 months then proposes to QSY to YI, YK and 9K3-lands before going on to the Pacific area. *(Tnx WGDXC).*

ZL3 Chatham Island: The Hammarlund equipment which was used by VR9DR is now on its way to ZL3VB on Chatham Island. *(Tnx VERON).*

ZS2MI Marion Island: Oliver, ZS5JY, is sending a Collins S-line and antenna to Tony, ZD9AM, who will be the new operator on Marion Island. Tony will be on Marion Island for one year. *(Tnx LIDXA).*

4W1 Yemen: "Beat" 4W1B, who also operated as HB9YZ/4W1, will be active until June when he returns home to HB9-land and a big pile of QSLs. He is active almost daily around 14,255 kc about 2030 GMT. *(Tnx WGDXC).*

9K3 Neutral Zone: LU2XL/9K3 has been active during his time off which comes one week out of every month. He has also been active as LU2XL/MM.

9M2 Malaysia: G3HCL/VS1LX has received a KWM-2 from Virgil, WA2WUV, and it will be used to activate some of the rare spots around Malaysia by the RAF gang. The VU-islands are also planned. *(Tnx Geoff Watts).*

9Q5 Republic of the Congo: The following letter is self explanatory: "Our mission has three locations here in the Republique du Congo. The longest distance between any two is 600 miles. Because of the great distance, not too good roads, and rather poor communications we are setting up amateur radio stations at each mission station. We have received our license from the Congo government for our stations, but there is no equipment available in this country.

I am writing to you in the hope that you might know of some amateurs with good equipment that they would like to discard for a reasonable price. If you know of anyone, please have them address me at: L'African Christian Mission, BP, 1138, Stanleyville, Republique du Congo (Leopoldville) Afrique, telling what they have and their price."

9X5 Rwanda: Hans, 9X5MH, has been very active on 14,250 kc s.s.b. He is apparently transceive. Usual time is between 2000 and 2100 GMT.

Radio Society of Bermuda Contest offers free airline tickets and a week at the Carlton-Beach Hotel for two people plus certificate signed by the Governor for the winner of the contest slated for May 3-4 and May 17-18 with many added attractions—space prohibits publication of all rules and other data, however, you may address Cy Lindley, VP9L, at "Port Royal," Southampton, Bermuda, who will be pleased to send you full data.

Rare Prefixes

6O6BW has been very active on 14,030 kc c.w. on 14125 kc s.s.b. QSL via WA4FXE—The French Government has recently issued F5 calls for the first time.

New Numerical Prefixes

3A	Monaco	**5X**	Uganda
3B-F	Canada	**5Y-Z**	Kenya
3G	Chile	**6A-B**	Egypt
3H-U	China	**6C**	Syria
3V	Tunisia	**6D-J**	Mexico
3W	Vietnam	**6K-N**	Korea
3X	Rep. Guinea	**6O**	Somalia
3Y	Norway	**6P-S**	Pakistan
3Z	Poland	**6T-U**	Sudan
4A-C	Mexico	**6V-W**	Senegal
4D-I	Philippines	**6X**	Malagasy
4J-L	USSR	**6Y**	Jamaica
4M	Venezuela	**7A-I**	Indonesia
4N-O	Yugoslavia	**7G**	Guinea
4P-S	Ceylon	**7J-N**	Japan
4T	Peru	**7S**	Sweden
4U	United Nations	**7X**	Algeria
4V	Haiti	**7Z**	Saudi Arabia
4W	Yemen	**8A-I**	Indonesia
4X	Israel	**8J-N**	Japan
4Y	Canada	**8S**	Sweden
4Z	Israel	**8T-Y**	India
5A	Lybia	**8Z**	Saudi Arabia
5B	Cyprus	**9A**	San Marino
5C-G	Morocco	**9B-D**	Iran
5H-I	Tanganyika	**9E-F**	Ethiopia
5J-K	Colombia	**9G**	Ghana
5L-M	Liberia	**9K**	Kuwait
5N	Nigeria	**9L**	Sierra Leone
5P-Q	Denmark	**9M**	Malaysia
5R-S	Malagasy	**9N**	Nepal
5T	Mauretania	**9O-T**	Congo
5U	Niger	**9U**	Burundi
5V	Togo	**9X**	Ruanda
5W	Samoa		*(Tnx VERON)*

[*Continued on page 79*]

PROPAGATION

GEORGE JACOBS*, W3ASK

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for May

	Forecast Rating and Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **15, 20-21**	A	A-B	B-C	C
Normal: **1, 3-10, 14, 16-19, 22-24, 27-28, 30-31**	A-B	B-C	C-D	D-E
Below Normal: **2, 11, 13, 26, 29**	C	C-D	D	E
Disturbed: **12, 25**	D	D-E	E	E

How To Use These Charts

The following is an explanation of the symbols shown above, and instructions for the use of the *CQ* propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 8 and 13 days; (1) less than 7 days.

On the "Short-Skip" Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parentheses at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meanings: A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak with considerable fading and noise; E—poor opening, or none at all.

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 300 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

5—Local Standard Time for these predictions is based on the 24-hour system.

6—These Propagation Charts are valid through June 30, 1964. These Charts are prepared from basic propagation data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

DURING May, 20 meters is expected to be the best band for DX propagation conditions. The band is forecast to open shortly after sunrise, and remain open to one area of the world or another through the early evening hours. When propagation conditions are better than normal, the band may remain open to some southern and tropical areas during the hours of darkness.

Although some fairly good daytime openings are forecast to Central and South America, DX propagation conditions on 15 meters are becoming increasingly poor as summer nears. The band is likely to open on fewer days during May, and to fewer areas of the world than it did during the winter and earlier spring months. Except for an occasional daytime opening to southern or tropical areas, DX conditions on 10 meters are expected to remain poor during May.

Higher atmospheric noise levels (static), and fewer hours of darkness are expected to result in somewhat poorer DX propagation conditions on 40, 80 and 160 meters. Forty meter openings are forecast to most areas of the world from shortly before sundown, through the hours of darkness, and until shortly after sunrise. The band, however, is expected to be noisier, and signals somewhat weaker, than during the winter months. While fewer DX openings are forecast for 80 meters, some should be possible during the hours of darkness. Occasional 160 meter DX openings may also be possible on some nights during the month.

Short-skip propagation conditions increase considerably during May and the summer months as a result of sporadic-*E* propagation. Frequent short-skip openings between distances of approximately 750 and 1,400 miles should be possible on 10 meters during the month. On 15 meters, numerous short-skip openings, often with exceptionally strong signal levels, are forecast for distances between approximately 600 and 1,400 miles, and on 20 meters between distances of 350 and 2,300 miles.

Excellent short-skip openings are forecast for 40 meters between distances of approximately 150 and 750 miles during the hours of daylight, and up to 2,300 miles during the hours of darkness. During the daylight hours, 80 meter short-skip propagation should be possible up to distances between 50 and 250 miles, increasing to

*11307 Clara Street, Silver Spring, Md. 20902.

approximately 2,300 miles during the hours of darkness. On 160 meters, fairly good short-skip openings should be possible during the hours of darkness for distances up to approximately 1,200 miles, and occasionally up to 2,300 miles. During the hours of daylight, intense ionospheric absorption will limit 160 meter propagation to groundwave distances generally not exceeding approximately 50 miles.

For a more complete discussion of sporadic-*E* short-skip propagation, including tips for predicting band openings, see "Notes On Sporadic-*E* Propagation," appearing in the June, 1962 issue of *CQ*, p. 60.

VHF Openings

The *Aquarids* meteor shower is expected to occur during the first week of May. This is a major meteor shower, and millions of meteors are expected to enter the earth's atmosphere during this period. Fairly frequent meteor-type ionospheric openings are expected to occur on 10, 6 and 2 meters during the shower.

The seasonal increase in sporadic-*E* short-skip propagation is expected to result in occasional 6 meter openings during May. These openings are most likely to occur between 9 A.M. and 1 P.M., and between 5 P.M. and 9 P.M. local time, between distances of approximately 1,000 and 1,400 miles. Occasional 6 meter DX openings between stations in the southern tier states and Central America and the Caribbean area may be possible on 6 meters during May as a result of sporadic-*E* propagation.

While auroral activity is generally at a very low level during May, some displays may occur during periods of below normal of disturbed ionospheric conditions. During such periods, openings are likely to occur on 6 and 2 meters for distances up to approximately 1,200 miles, as a result of reflection or scatter from ionized patches produced by auroral displays. Check the "Last Minute Forecast" at the beginning of this column for periods during May that are likely to be below normal or disturbed.

Sunspot Cycle

The Zurich Solar Observatory reports a monthly sunspot number of 16 for February, 1964. This results in a 12-month smoothed sunspot number of 27 centered on August, 1963. A smoothed sunspot number of 15 is predicted for May, 1964, as the sunspot cycle continues its very slow decline. Solar-propagation relationships this month are expected to be similar to what was observed during May, 1953, and before that, during May, 1943 and May, 1932.

[*Continued on page 96*]

CQ Short-Skip Propagation Chart

May-June, 1964

Band Openings Given in Local Standard Time

At Path Mid-Point (24-Hour Time System)

Band (Meters)	*50-250 Miles*	*250-750 Miles*	*750-1300 Miles*	*1300-2300 Miles*
10	*NIL*	07-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-23 (0-1)	07-09 (1) 09-13 (3) 13-17 (1-2) 17-21 (2) 21-07 (1)	07-09 (1-0) 09-13 (3-0) 13-21 (2-0)
15	*NIL*	06-09 (0-2) 09-13 (0-3) 13-17 (0-2) 17-19 (0-3) 19-23 (0-2) 23-06 (0-1)	06-09 (2) 09-13 (3) 13-17 (3) 17-19 (3) 19-23 (2) 23-06 (1)	06-09 (2-0) 09-13 (3-0) 13-17 (2-0) 17-19 (3-1) 19-23 (2-0)
20	*NIL*	06-09 (0-2) 09-16 (0-4) 16-20 (0-3) 20-23 (0-2) 23-06 (0-1)	06-09 (2) 09-16 (4) 16-20 (3-4) 20-23 (2) 23-06 (1)	06-09 (2) 09-15 (4-2) 15-20 (4-3) 20-23 (2) 23-06 (1)
40	07-09 (0-2) 09-15 (1-4) 15-19 (2-4) 19-21 (1-2) 21-23 (0-1)	07-09 (2) 09-15 (4-2) 15-17 (4-3) 17-19 (4) 19-21 (2-4) 21-23 (1-3) 23-07 (0-2)	07-15 (2-1) 15-17 (3-1) 17-19 (4-2) 19-21 (4) 21-23 (3-4) 23-02 (2-4) 02-07 (2)	07-17 (1-0) 17-19 (2-1) 19-02 (4) 02-04 (2-3) 04-06 (2) 06-07 (2-1)
80	07-10 (4) 10-18 (4-3) 18-22 (4) 22-01 (2-4) 01-05 (2-3) 05-07 (3)	07-10 (4-1) 10-16 (3-0) 16-18 (3-1) 18-20 (4-2) 20-01 (4) 01-05 (3) 05-07 (3-2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-3) 22-01 (4) 01-05 (3) 05-07 (2-1)	07-18 (0) 18-19 (1-0) 19-20 (1) 20-22 (3-2) 22-01 (4-3) 01-05 (3-2) 05-06 (1) 06-07 (1-0)
160	05-07 (4-1) 07-09 (3-0) 09-18 (2-0) 18-20 (3-1) 20-22 (4-2) 22-05 (4-3)	05-07 (1) 07-18 (0) 18-19 (1-0) 19-20 (1) 20-22 (2-1) 22-00 (3-2) 00-03 (3-2) 03-05 (3-2)	05-07 (1-0) 07-19 (0) 19-22 (1) 22-00 (2-1) 00-03 (3-2) 03-05 (2-1)	05-07 (0) 07-20 (0) 20-00 (1) 00-02 (2) 02-03 (2-1) 03-05 (1)

Alaska To:

*Openings Given in Alaskan Standard Time**

	15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Eastern USA	*NIL*	15-17 (1) 17-19 (2) 19-20 (1)	*NIL*	*NIL*
Central USA	16-18 (1)	15-17 (1) 17-19 (2) 19-21 (1)	00-03 (1)	*NIL*
Western USA	16-18 (1)	15-17 (1) 17-20 (2) 20-22 (1)	01-05 (1)	*NIL*

Hawaii To:

*Openings Given in Hawaiian Standard Time**

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Eastern USA	12-15 (1)	04-05 (1) 05-07 (2) 07-14 (1) 14-16 (2) 16-18 (3) 18-19 (2) 19-21 (1)	18-20 (1) 20-23 (3) 23-02 (1)	20-21 (1) 21-23 (2) 23-01 (1) 21-23 (1)‡
Central USA	09-15 (1) 15-18 (2) 18-20 (1)	05-08 (2) 08-14 (1) 14-16 (2) 16-19 (4) 19-21 (2) 21-23 (1)	19-20 (1) 20-21 (2) 21-01 (3) 01-02 (2) 02-04 (1)	20-21 (1) 21-00 (2) 00-02 (1) 22-00 (1)‡
Western USA	13-18 (1)† 09-15 (1) 15-18 (2) 18-20 (1)	04-06 (1) 06-11 (2) 11-15 (3) 15-19 (4) 19-21 (2) 21-23 (1)	17-19 (1) 19-20 (2) 20-02 (4) 02-04 (3) 04-05 (2) 05-07 (1)	19-20 (1) 20-21 (2) 21-02 (3) 02-03 (2) 03-05 (1) 21-02 (1)‡

*Alaskan Standard Time (from Skagway to 141 degrees west longitude), is 4 hours *behind* EST; 3 hours *behind* CST; 2 hours *behind* MST; 1 hour *behind* PST and 9 hours *behind* GMT. Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST *and* 10 hours *behind* GMT.

†Possible 10 meter openings from Hawaii.

‡Possible 160 meter openings from Hawaii.

CONTEST CALENDAR

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

FRANK ANZALONE*, W1WY

CALENDAR OF EVENTS

May	2-3	*CQ* Spring V.H.F.
May	2-3	OZ CCA C.W.
May	3-4 & 17-18	Bermuda Party.
May	9-11	Georgia Party.
May	9-10	USSR DX C.W.
May	16-17	OZ CCA Phone.
May	23-25	QRP QSO Party.
May	29-June 1	CHC/HTH/FHC Party.
June	6-7	National Field Day.
June	6-7	ARRL V.H.F. Party.
June	27-28	ARRL Field Day.

CQ Spring VHF Contest

Starts: 1:00 P.M. Local Time, Saturday, May 2.
Ends: 1:00 P.M. Local Time, Sunday, May 3.

All the details on this annual v.h.f. event were carried last month on page 40. There are a few minor rule changes, but it's pretty much the same as last year.

Bermuda Party

Starts: 0001 GMT Sunday, May 3rd & 17th.
Ends: 0200 GMT Monday, May 4th & 18th.

Once again the annual Bermuda Party is sponsored by the Radio Society of Bermuda and open to all USA and Canadian amateurs. It's a two week-end affair, so if conditions are not favorable on one week they might improve the next one. However it would seem that a lot of space is being occupied by a small activity.

1. Use all bands, 3.5 thru 28 mc.
2. Both c.w. and phone and cross mode contacts are permitted. However, only one contact per band with the same station is allowed.
3. US and Canadian stations will send RS and RST reports; VP9 stations RS or RST plus their Parish.
4. Each completed contact counts 3 points.
5. Your multiplier is derived from the number of Parishes worked on each band (a possible total of 45).
6. The final score: total points multiplied by the total number of Parishes worked on all bands.
7. Competition is confined to single operator stations only and there are no equipment or power limitations.
8. A certificate signed by His Excellency The Governor of Bermuda will be awarded to the highest scoring station in each W/K and VE/VO call area. The top overall winner will have his certificate presented to him in person in Bermuda. Don't worry how you are going to get there. The VP9 boys will pick up the tab for your airline trip to Bermuda. And what's more they will put you and the XYL up at the plush Carlton Beach Hotel for a week. Wow!
9. Keep all times in GMT, carefully check your log and compute your score. Print your name and address in BLOCK LETTERS and sign a declaration that all rules and regulations have been observed.
10. All logs must be in the hands of the Contest Committee of the Radio Society of Bermuda, P.O. Box 275, Hamilton, Bermuda not later than June 30, 1964.

List of Parishes

Sandy's	SAN	St. George	GEO
Paget	PAG	Warwick	WAR
Hamilton	HAM	Smiths	SMI
Southampton	SOU	Pambroke	PEM
Devonshire	DEV		

Georgia Party

Starts: 2300 GMT Saturday, May 9.
Ends: 0500 GMT Monday, May 11.

Rules for the third annual Georgia QSO Party

Anyone who has visited the CQ offices in the past few years will recognize Toby Pollack. Without Toby's help at DX contest time, our job would be close to impossible. P.S.: Those are just a *few* 1964 C.W. logs on her desk!

*14 Sherwood Road, Stamford, Conn. 06905.

were covered in last month's CALENDAR. A better choice of a.m. frequencies would have been advisable.

Your logs go to: CARC c/o Clifford R. Watson, K4ADU, 5224 Morris Ave., Columbus, Georgia. 31904. Mailing deadline is June 15th.

OZ CCA

C.W.—May 2-3. **Phone**—May 16-17.
Starts: 1200 GMT Saturday.
Ends: 2400 GMT Sunday.

The OZ boys had to change their c.w. date at the last minute in order to avoid the USSR contest which presented a serious conflict. Both are world wide type contests. Rules in last month's CALENDAR.

Mailing deadline is June 15th and logs go to: The E.D.R. Contest Committee. P.O. Box 335, Aalborg, Denmark.

USSR C.W. DX

Starts: 2100 GMT Saturday, May 9.
Ends: 2100 GMT Sunday, May 10.

Rules in details with a few minor modifications were in last month's CALENDAR.

Besides contest awards, the following certificates are also available to participants who contact 100 different Soviet stations: 100 different Oblasts of the USSR, 10 radio districts or 15 Union Republics of the USSR; W-100-U, R-100-O, R-10-R and R-15-R respectively.

Mailing deadline for contest logs is May 30th to: The U.S.S.R. Central Radio Club, Att: Chief Judging Board, P.O. Box 88, Moscow, USSR.

CHC/HTH/FHC

Starts: 2300 GMT Friday, May 29.
Ends: 0600 GMT Monday, June 1.

There should be plenty of activity in this one. With the Certificate Hunters Club, Hunt The Hunters, and Flying Hams Club all going at it, how can it miss. With so many Hunters involved, the operating procedure gets a bit involved.

Exchange: 1. CHCers and FHCers will send a QSO Nr., RS/RST, name, CHC/FHC Nr., state and county. (DX stations give their DOK, LAAN, Province, *etc.*). 2. HTHers (all non-CHCers are HTHers) will send a QSO Nr., RS/RST, name/HTH, state and county. (DX stations give their DOK, LAAN, Province, *etc.*).

Scoring: 1. CHCers: CHC to CHC, 1 point per contact; CHC to HTH, 2 points per contact. YL contacts are good for 1 additional point. 2. HTHers: HTH to CHC, 3 points per contact and contacts with YL CHCers are good for 5 points. HTH to HTH, no value. 3. Contacts with FHCers count one additional point to all. 4. The same station may be contacted by different mode or on a different band as a new contact. (A.m. & s.s.b. are considered different modes). 5. S.w.l.s can also submit logs of stations heard in this activity, for s.w.l. awards.

Multiplier: Is determined by the number of different continents, countries, VE/VO provinces and US states worked. (Your own state/country can be claimed as a multiplier. KH & KL are both state and DX)

Final Score: Add accumulated QSO points; add total multiplier; multiply total points by the total multiplier.

Awards: 1st, 2nd and 3rd place certificates for each continent, country, US state and VE/VO province. Also special trophies for CHCers, HTHers and s.w.l.s.

Frequencies: C.W.; 3575, 7030, 14075, 21090, 28090. A.M.: 3810, 7235, 14250, 21330, 28800, (DX: 3675, 7075). S.S.B.: 3990, 7205, 14340, 21440, 28690, (DX: 3775, 7090).

A detailed and accurate log and summary sheet is requested. Inaccuracy in the scoring will be deemed sufficient cause for disqualification.

Besides contest awards your log can also be used for the many awards in the CHC program. Application for these awards can be made with your entry. It is highly recommended that you write K6BX for official forms so that you may get the most credits for your efforts.

Logs must be postmarked no later than June 30th and go to: Clif Evans, K6BX, Box 385, Bonita, Calif. 92002.

Editors Note

This is the issue when we normally announce the results of our World Wide DX Phone Contest. However, each year it has become more and more difficult for us to meet this deadline. This year we just couldn't make it.

With the ever increasing number of returns from countries where the fellows do not have a knowledge of how to score their logs, our small committee has been taxed to its limits. Many of these logs are in their native script. Have you ever tried to decipher a log in Russian?

What is hard to understand, however, is the lack of knowledge and interest from entries from our own country.

Some fellows are not contest minded and we respect their feelings. However, it's the many contest-active stations who consistently never send in a report that gripes us. They are either too lazy or too vain, if their call cannot appear at the top of the list they do not want to play.

Take a look at the listing of the DJ/DLs and JAs in the next two issues. These boys are not lackadaisical or proud. Think it over.

73 for now, Frank, W1WY

SPACE COMMUNICATIONS

GEORGE JACOBS*, W3ASK

AFTER more than a year's delay, ECHO II, a 13-story-high balloon satellite, was rocketed into space successfully on January 25, 1964. The 135-foot diameter, aluminum covered mylar balloon became the largest artificial satellite ever launched, and it will be used as an experimental passive reflector of high power radio signals. Radio signals in the v.h.f. and u.h.f. range of the spectrum will be reflected from the balloon's outer skin in much the same manner that light is reflected from a mirror.

Since launch, a large number of communication experiments have been conducted successfully with the ECHO II satellite, including the first exchange of satellite-reflected radio-telephone, teleprinter and radiophoto transmissions between the United States and the Soviet Union. This was accomplished by use of the Atlantic Cable and earth stations at Zemensky Observatory near Moscow and the Jodrell Bank Observatory in England. The earth stations communicated directly with each other via ECHO II, and the Atlantic Cable was used for relaying the transmissions between the United States and England.

Many readers of this column have reported reception of the beacon transmitters aboard ECHO II, operating on 136.020 and 136.170 megacycles.

Amateur Participation In ECHO II

In December 1961, under the leadership of Ray Soifer, K2QBW, the Office For Satellite Scatter Coordination was formed (OSSC). One of the main objectives of the OSSC was to plan and encourage radio amateur participation in communication experiments conducted with the ECHO II satellite.

Although theoretical calculations indicate that even the highest power 2 meter amateur installation will fall short by tens of decibels from attaining the signal level required to communicate via ECHO II, amateur spirit dictated that it might be worth a try.

Working closely with NASA, ARRL, and the Editor of this column, during the past three years Ray has managed to pull together some really first-class 2 meter amateur stations for participation in ECHO II experiments.

Shortly after ECHO II was launched, orbital predictions were carried over W1AW and the RSGB, and several OSSC member stations on both sides of the Atlantic went into operation in an effort to establish 2 meter communications via the satellite. As of March 4, however, Ray reports that successful communications via the satellite had not yet been achieved by radio amateurs. Antennas are being improved, and more stations are participating, and Ray is still confident that it won't be too long before that history-making first ECHO II amateur radio QSO is made.

K2LMG, South Lansing, N.Y., and WØIC, Denver, Colorado, have been conducting 2 meter test transmissions during almost every appropriate orbit of ECHO II, but so far no luck on this 1,500-mile path. Other stations available for test transmissions are, with frequencies where they might be found, W6DNG (144.002); W6PJA (144.012); W7JRG (144.008); W8KAY (144.300); W4FJ (144.070); K1KKP (145.038) and W9VX.

In Europe, G6BY reports that the European OSSC group has also "sprung to life." G2DHV is available for test transmissions on 144.250, G6BY likewise, with others to follow. In recognition of the importance of amateur participation in satellite experiments, British authorities have granted 1 kw input to amateurs attempting passive reflection in the two meter band, upon special application. G6BY further reports that RSGB cooperation in all phases of the ECHO II

A model of the OSCAR beacon satellite on exhibit recently in the town of Prato, Italy. Shown admiring the radio amateur satellite are young students, town and government officials, and local radio amateurs. Italian radio amateurs played an important part in tracking the beacon satellites *(Photo by Ranfagni)*.

*11307 Clara Street, Silver Spring, Md. 20902.

radio amateur experiments have been outstanding, as has that of the GPO.

From Italy, I1BMV reports that he is available to conduct test transmissions with other amateurs in Europe and Africa, via ECHO II.

As more and more radio amateurs participate in this challenging project, the greater is the possibility that communications eventually will be established via the satellite. If you have the long hours to devote to test transmissions, and have, or can build, the necessary first-class 2 meter equipment required for the experiments, you can sign-up for participation with the following group leaders:

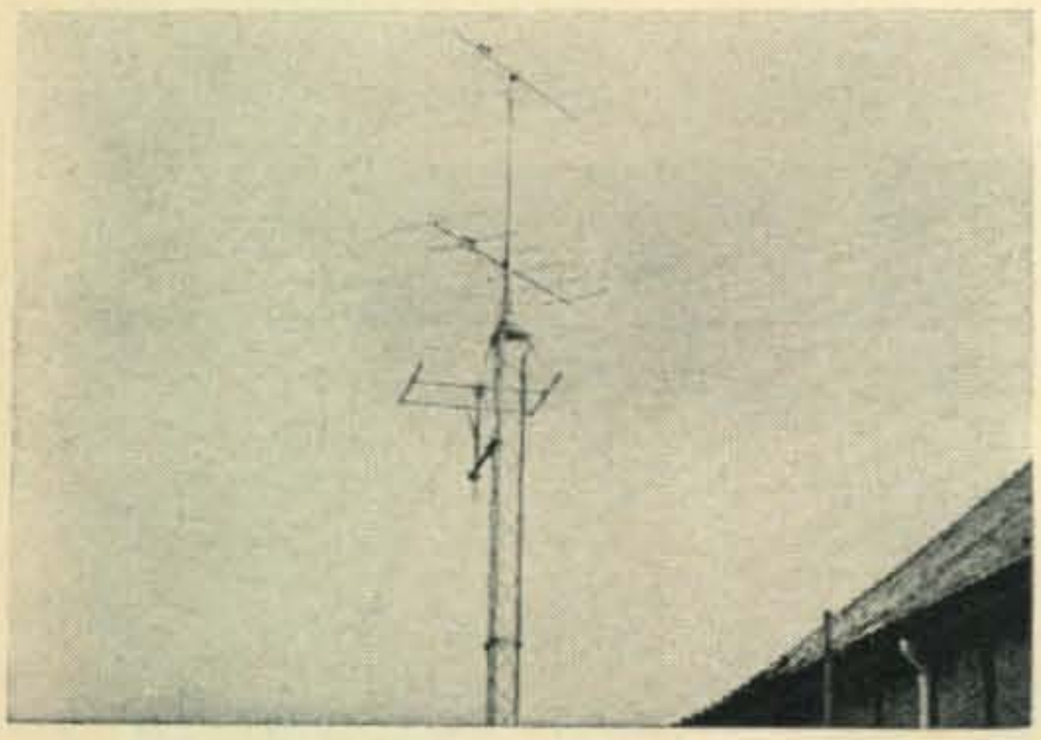
GROUP A—*(USA and Canada)*—David W. Bray, K2LMG, P.O. Box 81, South Lansing, New York

GROUP B—*(UK and Europe)*—Dr. W. E. D. Parker, G6BY, "Kaygor," Worlebury Park, Weston-super-Mare, Somerset, England

It must be emphasized, however, that it requires first-class equipment for these experiments. Transmitter power should be the legal maximum, antennas should be circularly polarized, with radiation maximizing 35° from the horizontal, and receiving equipment must be as sensitive and as noise-free as possible.

Amateurs believing that they may have already communicated on 2 meters via the ECHO II satellite should contact one of the above mentioned group leaders, or send their reports to ARRL, or the Editor of this column. Please describe the QSO in as much detail as possible, identifying the calls received and indicating the date and exact time of reception. State in the report whether circular polarization was used at either end and describe the tracking methods used with each station.

Through participation in the ECHO II experiments, amateur radio stands once more on the brink of challenging new breakthroughs in the art of communications.



The three Yagi arrays shown above are used by Bill Brady, ex-W2ABD, for tracking satellites at his English Channel QTH of Selsey, Sussex. With the above arrays Bill has logged almost every v.h.f. satellite signal on the air during the past six years. He also has tracked the ECHO II balloon satellite more than half-way across the North Atlantic Ocean.

OSCAR III Communications Network

Perhaps as important as the successful operation of the OSCAR III satellite itself, is the successful development of a radio amateur network which will be capable of flashing reception, tracking and orbital information to all corners of the world with an extremely high degree of reliability. Plans are now underway to establish such an OSCAR communications network on the h.f. bands.

The main control station for the OSCAR network, using the call W6EE, will be located in the OSCAR Control Building, Foothill College, Los Altos Hills, California. Bill Eitel, W6UF, has been designated Communications Manager and has the job of getting the network established in as short a period of time as possible. Working with him are Bob Walton, W6CYL and Walt Read, W6ASH.

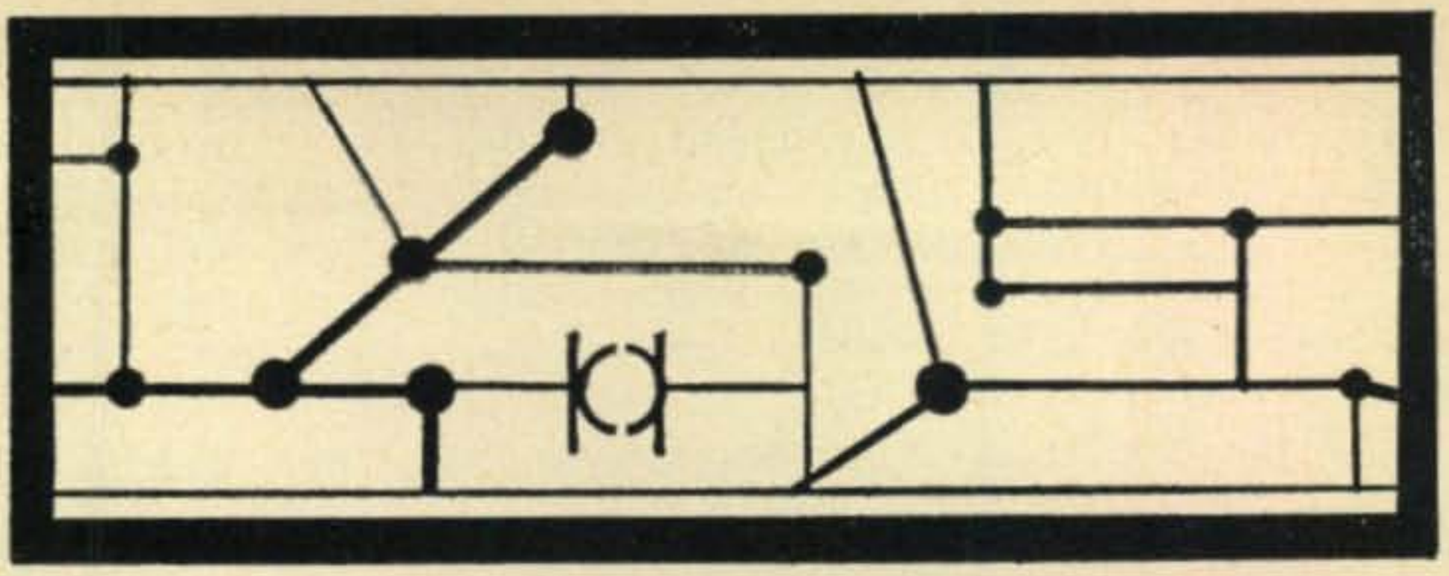
The OSCAR communications network will serve many purposes. Primarily, it will link the OSCAR Coordinators throughout the world with OSCAR Headquarters during the time of launch and once the satellite is successfully in orbit. The network will also be used to channel reception, tracking and orbital information into OSCAR Headquarters, and to flash OSCAR news and data from Headquarters to OSCAR Coordinators. The following is the latest list of OSCAR coordinators:

Germany: Edgar Brockmann, DJ1SB
Philippines: Elidore Clare, DU1CE
Spain: Jesse Cordova, EA4AO
France: Andre Bertemes, F3NB
England: W. H. Allen, G2UJ
Italy: Adolgo Carmimati, I1BBB
Japan: Kenzo Sano, JA1EC
Alaska: Peter Brown, KL7DMB
Puerto Rico: Tom Talpey, KP4AXX
Norway: Henning Theg, LA4YG
Argentina: Eugenio Fontana, LU9MA
Sweden: Olaf Karlsson, SM6PU
Austria: G. Schiffner, OE3SG
Netherlands: J. Lodeizen, PA0LOD
Canada: H. Wightman, VE2UQ
Australia: Ray Hart, VK2HO
New Zealand: W. Hamer, ZL2CD
Switzerland: B. Pellaton, HB9WB
Belgium: J. DeDycker, ON4-1024
South Africa: Al Solomon, ZS1SW
Tasmania: P. Frith, VK7PF
Finland: J. Velamo, OH2YV
Denmark: H. Rasmussen, OZ7BQ

Volunteer stations are requested to join the OSCAR network so that the above Coordinators can be linked to OSCAR Headquarters on a reliable basis. The main transmissions from W6EE will be on RTTY, c.w. and s.s.b. on 160, 80, 40, 20 and 2 meters. Stations desiring to join the network should be capable of receiving at least two of the transmission modes, and should be able to operate on as many of the h.f. bands as possible. In order to establish a high degree of circuit reliability, stations in the network will be required to use the highest power levels legally permitted, and directional antennas wherever possible. Most important, station operators must be available to operate the station over long periods of time, and whenever necessary. Requests to join the OSCAR communications network may be directed to William I. Orr, W6SAI, President, Project OSCAR Inc., 48 Camp-

[*Continued on page 96*]

NOVICE



WALTER G. BURDINE*, W8ZCV

As you know, many of the ideas for the column comes to me from the letters that you write. Some come from listening to the problems of amateurs that I speak to on my daily contacts and from listening to the problems of others that I tune in when listening. I always keep a receiver on one of the ham bands when I am around the shack. This way I keep track of the problems and the news of amateur radio operating. I generally know when someone gets a notice from the FCC and what he is going to have to do to cure the trouble. He will usually want to ask a more experienced ham what to do in this case and someone is always willing to help. One ham's problem in this matter affects all ham radio, we must clean our own sets before being told to do it. The more experienced ham tells a fellow ham when there is something wrong and may offer to help trouble shoot the rig.

The FCC is often more tolerant with the amateur simply because he *is* an amateur, new in operating techniques, maybe of limited technical knowledge, but willing to learn and striving to have a good, well operated rig at all times. This is to his advantage in many ways. The amateur radio service is the only radio service that is not assigned a special operating frequency or operating frequency tolerance, except at the band edges. Of course, we have band-width tolerances, but we are in effect told that we should use accepted engineering practices for checking our operating practices. This really sets our operating tolerances and techniques. For the homebrew enthusiast, we have many accepted circuit diagrams, which one should we use? Why? How do we combine them? How do we know if they are operating correctly? How do we check them and make them operate the way we hope they should. How do we get the most output from the least input; in other words, the greatest efficiency? I will try to answer some of these questions in future columns.

Planning That Rig

In planning a transmitter, one of the first steps is to decide the band we want to operate. One of the first steps is to decide the frequency at which the oscillator is to be operated and the type of control we intend to use. After the oscillator frequency has been chosen, the circuit, the tube and the component parts can be determined, this is often determined by the contents of the junk-box and the condition of the pocket-book. Many deviations of the numerical values of component and circuit values are often acceptable. Much knowledge can be gained by constructing a mock-up of the chosen circuit, loading it into a dummy load and checking stability and keying characteristics. The oscillator could be built on a piece of laminated printed circuit board and incorporated into the transmitter as a unit.

The second step is the choice of power output and the type of antenna coupling to be used. From the tube charts in the handbook, the tube to be used can be chosen. This, too, can be determined by the contents of the pocket-book or the junk-box. (I decided long ago to use tubes of the 807 power level as my main transmitter output. 1625 tubes have the same power output capabilities and can be bought for as little as 11¢ each. I have never ruined a 1625, but I do have plenty of spares.) This fixes the requirements for the final output stage drive, voltages and current values, and also sets the requirements for the preceding stages. The design is then followed from the output stage back through the transmitter stage by stage to the oscillator. For c.w. it will be necessary to decide where and how to break the carrier for keying. This should be done in one of the low-power stages, but the location of the key can be determined by your own ideas from diagrams in the Handbook. On the other hand, if the transmitter is to be voice the same procedure must be followed in selecting the modulator and modulating system to be used.

Buffer and multiplier stage circuitry will require considerable more research to determine the circuit needed. Multi-band transmitters require more complicated circuitry than the single or dual band transmitter, the switching of a number of coils and circuit values adds much of the complexity.

The type of coupling method must next be chosen. Capacitive and link coupling are the two most common methods used in the design of the homebrew transmitter. Each method has both advantages and disadvantages. The capacitive method requires only a capacitor between the plate and grid circuits. The capacitor serves the purpose of coupling and as a method of blocking the d.c. voltage of the preceding plate from the

*R.F.D. 3, Waynesville, Ohio 45068.

grid of the following stage. This capacitor can be used to control the drive to the following stage (exciting voltage) by changing its value, or by changing the location of the connection to the plate coil. Capacitive coupling is not often used in transmitters of the higher frequencies. Link coupling is used between stages on most higher frequency transmitters to reduce the effects of the tube input capacitances upon the L-C ratio of the driver tank circuit. Link coupling is best used when each stage is built as a separate unit. Better control of coupling can be obtained with links, since either one or both links can be made variable to control drive. Link coupled stages of the same transmitter can be separated by a greater distance, while capacitive coupled circuits must of necessity be in close proximity. Link coupling helps minimize the radiation of unwanted harmonics and parasitics.

Proper drive and operation of each stage in a completed transmitter can be determined by checking the output and quality of the emitted signal in a receiver. The typical requirement of drive can be determined from the tube chart in the handbook, but this may not be the exact value for your particular tube so check on the air.

I well remember the first station that I put on the air. The hams I contacted told me that I had an odd sound on the high frequencies of my modulation. I rebuilt the modulator, but still had the trouble. I was talking to W8OUV in Jamestown when I decided I needed more than the three ma of grid drive and, while adjusting the drive, it went to 6 ma. Max told me that was one of the best sounding signals on the air! My grid drive was simply not enough to take care of the grid losses. I learned then to adjust each stage of the transmitter for maximum output and adjust it anytime anything was changed. I adjust the drive, screen voltage, tuning and coupling of each stage for the maximum signal output. The transmitter should always be adjusted for upward modulation and the final grid drive is always adjusted for upward modulation.

Modulation percentages and coupling to the antenna should always be checked with suitable methods and instruments to ascertain the degree of quality and quantity used and needed.

You are known on the air by the quality of your emitted signal. Correct design and construction aid this quality, but remember that the operator is the main contributor to a quality signal.

Letters

"Dear Walt: Since I've obtained my Novice license I have read many interesting articles in *CQ*, particularly in the NOVICE section. I have read about the way a lot of men have built their own equipment and at the end of every page you ask for fellows to write in about their rigs. I think mine is about as irregular as anybody's so I will tell you about mine. I already had a receiver when I got my NOVICE license but no transmitter or anything else.

"I guess my dad, who is now WN2JAJ, knew about this, so a week later he called me down to the basement and told me to find a bunch of parts from old TV sets and things, so I found them and in a couple of days I had my first transmitter. It only had ten watts output but it was free and we had bought nothing from any store. This worked good for a month or so, but knowing that my dad wanted a better one we bought a copy of the *Handbook* and between three different schematics, he found parts of them he liked and started putting together our home-brew rig. It was hard finding the parts, substituting other parts and winding our own coils. He finally came up with a 75 watter and boy, did it work! I think we are putting out between 45 and 60 watts.

"The first call was answered by one of the Carolinas and a lot of other states. My XYL, who is now WN2JAI, on her first contact got Puerto Rico, so it must be good. I've been operating for 6 months and have 7 states on this transmitter that was made from parts in the cellar which cost me nothing. Walt, I doubt if you will publish this but at least I tried. 73. Your reader, Bob Hynes. WN2GPN."

You lost your bet Bob. I wish more dads and lads would work together like that and let us know about their results. I've always said that the operator and the antenna were the most important part of the successful amateur station. A good clean signal from a good antenna system in the hands of an excellent operator can run rough competition to higher powered boys who are sloppy operators. There is information in all the handbooks and magazines to train efficient and proficient operators if you read and heed the advice. Many things enter into a station's ability to work out well, these are taught by observation and experimentation. They can be learned by any one that makes ham radio a serious hobby and really, it should be so considered, even though we are having fun from our labors. More power can help, but it isn't the whole answer. I have been on 50.64 mc with 12 mw phone and have made a contact for 14 out of 15 days and the

Ted Goldblatt, WN4QKP, 11801—70th Avenue S.W., Miami, Florida is shown studying for his Technician license he hopes to get this summer. Ted operates all Novice bands, but spends most of his time on c.w. Ted is 7 years old and his dad is W4EMB. Look for me, Ted, and write when you get the new license.

closest station was 15 miles, that is quite a thrill.

Here is a letter along another vein of the bloodstream of amateur radio.

"Dear Walt: I have read your column with much interest from the time I first got interested in amateur radio. I feel you have done a fine job but I think you have made one mistake. The name of your column is "Novice" yet you are always writing on v.h.f. construction for six meters. It has been my experience that most of the fellows that go up on six meters forget about the code and proceed to rot up on six. This almost happened to me. I am now grateful that I had TVI and this convinced me to get the general. This was when I was on six. Getting the general was the greatest thing that ever happened to me in ham radio.

"My rig is a Heath HX-10, Marauder fed to an old Hy-Gain 14-AV vertical antenna or a home-brew vertical on 80, the receiver is the little giant Drake 2B. I don't get much time to operate because I am a Chemistry major at Brooklyn College. I have been bitten by the CHC bug and am now trying for a CHC certificate.

"With low-power, I have worked 46 states and 41 countries. Where are the 7's? All this was worked with low-power on 40, 20 and 15 meters, with a vertical. There is no need for a beam if you are there at the right time, that is if the beam is below 65 feet, HI. Keep up the good work. 73 ES DX, Ed Leviton, WA2ZVJ, 2115 East 27th Street, Brooklyn 29, New York."

Ed, when I first took over the column in 1955 it was called the NOVICE SHACK. It was written for the Novice and the Technician class licensee and it still is written for both class licensees, really we are all Novices or at least we should be. Webster says: "Novice—One who is new to the circumstances, work, *etc.* in which he is placed; a tryo: a novice in radio." I personally do not think any ham should just work one band, one mode, or even one power level. You will never learn to enjoy amateur radio to its fullest meaning if you do that. You can never become a sensible, well-rounded amateur until you have worked some DX, c.w., s.s.b., v.h.f., a.m., n.b.f.m., and maybe a little TV and RTTY. Of course you can't do this until you have been a ham for a few years and had some time to sling some solder and learned to unscramble your many mistakes, this, is the curing of a ham. Many letters are received from Generals who read this column and it has brought letters from 34 countries that have no Novices; yet they read the column. The low frequency ham has not been given many construction articles because I have not had facilities to power such equipment, but that has been taken care of and beginning very shortly, a complete series of low-frequency equipment will be described in this column. There will be something for everyone from the General to the short-wave listener. I will show photographs of these units. Just be watching; you asked for it.

Joe Miller Reporting

I really got a laugh out of a fellow worker last week when we were talking about the way people get mixed up about the ham lingo. It seems he had been going out to the shack for MARS meeting, and the next evening he was still hanging around the house. His wife asked him why he didn't go out to the shack as usual. He said that the band was dead. How much will *that* cost? she asked. Just get K8BUD to tell you what it cost.

Help Wanted: Aspiring Amateur Operators

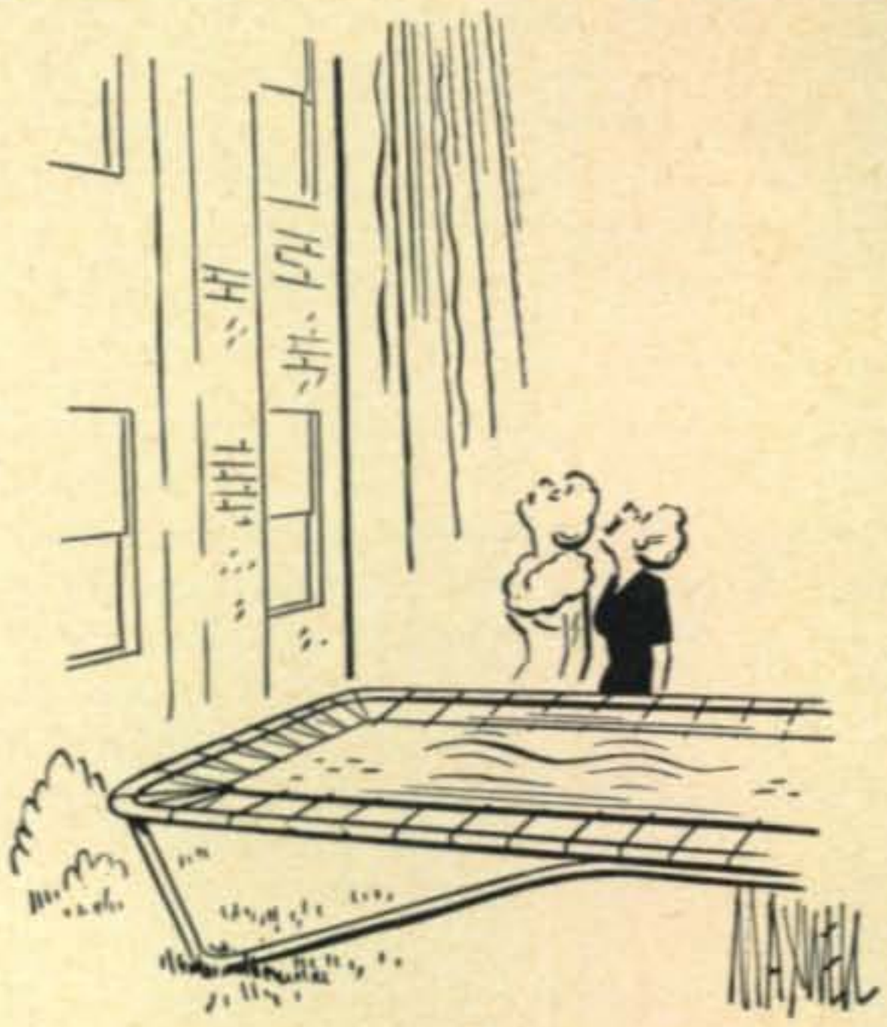
It seems that we have had very good results with our appeals for help with code and theory lessons for the would-be amateur operator. I've received many letters to the effect that as a result of help received through this column we have a new licensee. This sure is a good feeling. My thanks to all of you that have helped those would-be hams over the road of learning.

During a telephone call from New York last night, I find that many do not know of our service to those needing help. Just write the Help Wanted section and state your need of help in getting started. Send it to Walter G. Burdine, W8ZCV, R.R. #3, Waynesville, Ohio. Do not send it to the offices in New York as this only slows up the mail and makes more work for them.

Please try to help Saul Sloan, 421 Kingston Avenue, Brooklyn 25, New York. His telephone number is SL 6-3161. He said he wants very badly to learn ham radio. Thank you in advance.

That just about winds it up for this month. I'll get real busy on that new rig for all classes of license. If you hear me on either phone or c.w. in any of the bands from 160 meters to two meters give me a call, as I will be trying out the new set-up for our column. Good luck to you and much DX.

73, Walt, W8ZCV



"I guess he's going to work on his beam."

the USA-CA PROGRAM

CLIF EVANS*, K6BX

LUCKY 13 County Hunters bagged USA-CA-500 award during the short month of February, and Roy McCarty, W9KA added USA-CA-1000 to his take. Of these, all were for mixed band/mode operations except WA2WEE and K8OHS for all A1, and K5BTM for all A3.

Seems we busted down the line giving KØDEW No. 334 in lieu of correct 333, and for some unaccountable reason just never published W6KG's winning No. 3 USA-CA-1500, so, to make amends, we will relist, to pick up all errors. Confession, Old Man K6BX has slight vision problem.

The attractive Stampede City Certificate issued by the Calgary A.R.C. of Calgary, Alberta, Canada, measures 7 × 9".

USA-CA HONOR ROLL

1500		1000			
K9EAB	1	W9KA	24	W8DCH	338
K4BAI	2			K8OHS	339
W6KG	3	500		W9WUQ	340
W5NXF	4			WA2PMW	341
K8CIR	5	KØDEW	333	WA6UQS	342
W5EHY	6	W4VWW	334	KØGVA	343
K9UTI	7	PAØVB	335	W9KA	344
		K5BTM	336	WA2WEE	345
		K9IIQ	337	K9EGQ	346

Cliff Corne, K9EAB, still holds the lone USA-CA-2000 for contacting stations in over 2,000 U.S. counties. For any new readers, full details on the USA Counties Awards Program may be found in November 1963 issue *CQ* or may be obtained by sending s.a.s.e. to K6BX.

Stampede City Award

Pictured hereabouts is the very appropriate Stampede City Certificate sponsored jointly by the Calgary Amateur Radio Association and the Calgary Exhibition and Stampede Board, Canada, for working 10 Calgary amateurs. No time limits are in force. The Calgary Stampede Week, each July, is famous throughout the world. Here, again, is good evidence of how amateur radio can and does support and promote the public interest. During Stampede Week, C.A.R.A. sets up and operates the Association's station VE6NQ for operation from the Stampede Grounds. There is no charge for the certificate. Send full log data to the Secretary, C.A.R.A., Box 592, Calgary, Alberta, Canada.

Lake Erie Award

The Lake Erie Award is sponsored by the Lake Shore Amateur Radio Association for working counties bordering on Lake Erie. There are 13 counties involved in the states of New York, Penna., Ohio and Michigan. These are Monroe and Wayne counties in Mich.; Chautauque and Erie in New York; Erie in Penna., and in Ohio the counties are Ashtabula, Lake, Cuyahoga, Lorain, Erie, Sandusky, Ottawa and Lucas. Amateurs in the four states involved are required to contact 10 counties with all four states represented; rest of U.S. (and Canada), work 8 counties representing all four states, and DX including KH and KL, work 6 counties with at least three states represented. Award is available to s.w.l.s. No time limits. No endorsements. Send GCR list,

Lake Erie Award sponsored by the Lake Shore A.R.A. for working counties on the lake's shoreline.

*United States of America Counties Award Custodian, Box 385, Bonita, California 92002.

50¢ or 3 IRCs to Custodian, Gerald L. Struchen, K3PQH, Country Garden Trailer Court, RD #1, Lake City, Penna.

CHC and FHC Expand Operational Services

CHC and FHC always have been service organizations with purposes of supporting all concepts of Section 97, FCC Regulations (formerly Sec. 12), which state reason we enjoy our hobby in the first place. To better meet the tomorrow's challenge especially at the next international conference table, CHC and FHC have projected plans for vast expansion of *services*. The need for a world-wide CHC/FHC communication network is paramount to best success.

Effective April 15, 1964, CHC and FHC started operating international nets on all open bands and usable modes. Primary communications are maintained on 20 with controlled nets on 14,075 c.w., 14,230 a.m., and 14,340 s.s.b., commencing 1800 GMT daily until closed.

The primary purposes of the nets are to provide incentive for large numbers of amateurs to make themselves available on the nets for service functions. A natural by-product is that

Here is the OH-KY-IN VHF Radio Society Award for working 15 members. (Club members excluded) Send list with log data to Custodian, WA4AAJ, 5189 Madison Pike, Independence, Kentucky. Club has over 100 active members. Headquarters is Cincinnati, Ohio.

of making new contacts, new friends and racking up credits toward operating achievement awards, and increased operating proficiency.

While many services are directly related to organizational purposes and goals, many special services are also rendered to all hamdom. These include: 1. Handling all nature of emergency traffic within legal limitations; 2. Provision of free medical supplies and their transport to any stricken area or person in world where such services are otherwise unattainable; 3. QSP of high-interest hamdom information and news; 4. People-To-People Good Will Services; 5. Maintenance of international level Public Relations Program services promoting all aspects of amateur radio's welfare toward the future.

The CHC/FHC organization, now supported by 32 chapters, stands by to provide scores of other services including: 1. Operation of a DX QSL Manager Bureau Service through which any DXer may seek and find his choice of a U.S. amateur willing to be his QSL manager; 2. Call Book Good Will Program wherein any DXer may request and receive a gift Call Book

This is the VHF High Banders Award for working members of the Marion Hi-Banders, Inc. Ohio stations work 10 members on 50 mc or above; others work 5. Skip contacts are not excluded but net contacts do not count. Send list with log data only to Sect'y., K8ZES, 660 Willowcrest Lane, Galion, Ohio.

(not over 2-years old) from a U.S. amateur. DXers send requests to CHC headquarters; U.S. hams make application for names and make gifts in person to person contacts; 3. CHC/FHC/HTH QSL Bureau open to all members and hunters at cost only $1 a year with profits going to a crippled children's hospital; 4. CHC Awards Library through which any responsible person or organization may borrow selected sample awards for use in hamdom displays at conventions etc.; 5. Awards Standards Advisory Board Services.

Internal organization services also include: 1. Language interpreter; 2. News Roundup with information on new members weekly; 3. Awards general information; 4. Information on DX-P and County expeditions; 5. General awards information; 6. Master records, standings and statistics etc.

CHC/FHC chapters have own awards programs, nets, newsletters, and are the most active groups in their area supporting hamdom's welfare in the public relations and service fields. The goal of CHC/FHC is both a regular and a v.h.f. chapter in every state and every country. Six countries and three continents are now represented by chapters.

For further information on these two dynamic independent, non-affiliated, organizations and their world-wide services and programs, send s.a.s.e. to Secretary, K6BX, this writer.

Pictured here is the River Park Amateur Radio Club Award for working members. U.S. stations work 10; others work 5. Endorsements for all one mode. No charge. Send QSLs to Custodian, Richard Sylvan, W9CBT, 2731 Virginia Lane, Glenview, Illinois.

The Crossband Award sponsored by the Crossband Communications Club for working members after January 1, 1962; work 10 within 50 miles radius of New York City; over 50 miles work 5. No charge. Send large s.a.s.e. with GCR list giving full log data to Custodian, WA2PMW, 128-18th Ave., College Point 56, New York.

The Year's Biggest Awards Hunt

Once annually, the members of the Certificate Hunters' Club, CHC, and the Flying Hams' Club, FHC, team up in world-wide QSO Party with purpose to help all HTHers (all hunters are HTHers) rack up whatever contact points for whatever awards credits. This year's Party opens at 2300 GMT, Friday, 29 May and runs until 0600 GMT Monday 1 June. See Contest Calendar this issue for info.

YL International SSB'ers Are "Sexless"

Don't let the title throw you . . . there are more OMs in the YL SSB'ers than YLs, even though the YLs dominate the picture. Just a year old in February, this dynamic independent organization, has over 2,500 members including all 256 U.S. Navy ships at sea with active amateurs on board. Needless to say . . . the SSB'ers is the most active and the largest s.s.b. organization in the world, all in just one year . . . which, to the "enlightened" is proof of the puddin what a healthy Public Relations program can produce.

But all that is just braggin' and besides the point . . . what we really wanted to say is . . . these 2,500 members of the SSB'ers plan to hold their own QSO Party on their own frequencies concurrently with the CHC/FHC/HTH QSO Party. No, they are not competing . . . just mutual arrangement between respective headquarters with purpose many more active folks will join in on the fun.

Participants in SSB'ers QSO Party will receive 1st, 2nd and 3rd place winners awards for continent, country and U.S. state. SSB'ers will hold forth on following frequencies (plus or minus 10 kc) 3,805; 3,995; 7,205; 7,295; 14,331; 21,440; 28,440 kc and 50.20 mc. For further Party details, or info on SSB'ers, send s.a.s.e. to K4ICA, 428 S.W. 28th Rd., Miami 36, Florida.

Awards Library Service

Many have written, "How and where can we obtain groups of Amateur Radio Achievement awards for display at hamdom events and/or as background props for talks on the subject?" CHC provides the answer by establishment of an Awards Display Service with requisite CHC Awards Library.

Avis Miracle, W8WUT, 114 South Hoker Ave., Three Rivers, Michigan, is CHC Awards Library Custodian. Several hundred most publicized awards already are on hand. All awards sponsors are requested to forward Avis not less than two "dolled up" samples of duplicate awards already issued. Admonishment: awards with the word "Sample" scrawled across face are useless and is the reason many sponsors never have their awards pictured in magazines.

The Awards Display Service is *free!* Responsible persons or organizations desiring loan of select groupings of certificates will make arrangement with Library Custodian direct on basis all handling and postage costs are paid by those seeking the service, and further, that a prior deposit of 20 cents per certificate is made to "insure" safe return or replacement in case of loss. Such deposit will be *immediately* refunded when all certificates have been returned to the Library and/or costs for replacements are satisfied.

All correspondence with the Custodian must be accompanied by s.a.s.e. and in manner no burden of handling costs are imposed on the Library.

Help Needed

Ralph Barber, W2ZM, Executive Secretary QCWA, urgently needs old call books, either government or private, from and including 1915-1929. Ralph needs them to double check applicants' claims for QCWA membership. If you have been a ham for 25 or more years, then you are an "Old Goat" and eligible to join QCWA.

Doctors CHC Chapter 24 is preparing a Roster of all doctors who are hams. So far, close to 500 have been identified. If you are a doctor ham or know of same, send names, calls, QTH and doctor status, to Dr. Bill Sprague, WA6CRN. The Chapter has plans for sponsorship of an award for contacting doctors.

Send in all possible info on county expeditions. We will start putting out this information on the "hunter" nets. Be exact as to dates, frequencies, and GMT time.

If your club's award has never been pictured in our column, it is quite possible we have never been sent reproduceable copy. . . . We are at your SERVICE. Old Man, K6BX

Shown here is the W.E.N.S. Amateur Radio Club certificate for working members after December 1, 1962. DX work 5; others work 10. Send log data list to Custodian, Floss Drake, K3LPQ, 2143 E. Mammouth St., Philadelphia 34, Pa. W.E.N.S. 50.910 mc net meets each Tuesday at 2100 EST. Club call is K3RRB.

HAM CLINIC

CHARLES J. SCHAUERS*, W4VZO

ONE of the most frequent questions received by HAM CLINIC goes like this: "I have my eye on radio receiver brand 'A' but I am also thinking about putting together a set from a kit. Tell me, what do you think of brand 'A' as compared to a brand 'B' kit?" Most of these letters contain no other information.

We are happy to give our opinion but without more information from the reader we cannot advise him intelligently. Of course we stress brevity in letters to us, but it is only common sense that we be informed more fully when we must assist one in making a decision involving $200 or more.

First of all, an assembled set costs more than a set built from a kit—labor costs money. If both kit and assembled sets are about equal in quality and performance and the reader can afford the factory built job, we more than likely will recommend that he take it. On the other hand, if he tells us that he has a fine array of test equipment including a scope, signal generators, v.t.v.m., *etc.*, we may recommend the kit.

Most kits do not require that one possess elaborate test equipment, but having built many kits (especially those from Heath and Knight), I feel that a lot of construction and alignment headaches can be avoided and better performance obtained if one does own essential test equipment.

Purchasing a kit, one saves money and *does* improve his technical skill—if he carefully reads the technical descriptions of the various circuits found in his set and *understands* why and how they operate. These technical descriptions are generally located in the first sections of the kit assembly manual.

Every time I assemble a kit I get the same thrill I experienced when I built my first regenerative receiver 30 years ago.

For the ham who has no desire to put his own equipment together but prefers to buy factory assembled equipment from a reputable dealer, I must know how much money he desires to spend when he comes to HAM CLINIC for a recommendation. He should tell us the features he would like to have in a specific piece of ham gear.

Often we receive a letter from a ham who cannot make up his mind whether or not to buy a new or used receiver or transmitter. Unless money is the main consideration, we generally will recommend that he take the new item. However, many fine dealers sell reconditioned equipment with a good guarantee nearly equal to the original warantee. However, it is a nice feeling to know that you are the first owner.

So when you write to us asking that we recommend a set to you, please give us the following information: how much you can spend; what test equipment you own (if you are planning to buy a kit); the features you would like to have; what items you have built before and how long you have been in ham radio.

We certainly will do our best to help you and we will even recommend a dealer for new and/or used equipment in your area.

Correspondence

HAM CLINIC receives all sorts of letters and cards on a large variety of subjects—not all of which are even remotely related to ham radio. On the whole however, most letters and cards are from hams seeking specific technical information.

For example—in one typical batch of mail (50 communications), we find queries from science students, "ham mothers," engineers, hams of all kinds, doctors, lawyers, teachers, clergymen, manufacturers, *ad infinitum*.

In every case we try to please all who write in, but everyone knows that this is a human *impossibility*.

Being a ham radio consultant has few advantages and is a time consuming job. We are grateful however, that so many of our readers express their appreciation for our efforts.

We mention correspondence with readers *often* because this is our main task connected with HAM CLINIC activities. One reader has suggested that we use a box at the head of the column giving rules and instructions on correspondence —this would be nice but *CQ*'s current format does not permit this.

At the present time (while I am residing overseas), we answer those letters sent by airmail *first* which include two IRC's or 25¢ in coin; these letters coming to us directly to our present QTH: 4 Lutzelmatt Str., Luzern, Switzerland. Next we answer letters sent to *CQ* Hqrs. and forwarded to us and which contain either two

*c/o *CQ*, 300 West 43rd St., New York, N.Y. 10036.

IRC's, 25¢ in coin or U.S. airmail postage. Last but not least, we answer the many letters and cards sent to *CQ* without return postage.

Again we repeat, time does not permit full circuit or set design. This is understandable when it is realized that 60 letters require *two* of us to spend about 8 hours out of a week-end. So when you write to us please remember this. Some questions only require flipping a card into the typewriter and writing a couple of lines (average time—4 minutes)—but the majority require about 10 minutes. At HAM CLINIC, (paraphrasing General Electric), "a reply to a reader's letter is our *most* important product."

Questions

Modulation for Solid State—"I am planning on experimenting with and building a couple of low power transistorized ham band transmitters. Can you refer me to a good article or book which gives me information on the modulation (a.m.) of a solid state r.f. final?"

Sure. I would like to suggest that you obtain a copy of *Electronics-World* for February 1964. Flip to page 28 and you will find an article which I feel every ham should read who is interested in a.m. Described in this article is a newly developed linearized base-modulation system. I think that the distortion level of the system (3 to 5.7%) can still be improved—but as shown, it is very good.

Automotive Alternator Information – "How about some 'down-to-earth' information relative to automotive alternator systems? I'm interested in installation, maintenance and performance."

See my two articles on the subject in *Radio-Electronics* for November 1962 and February 1964. These articles are based on the Leece-Neville 6000 series alternators.

AF Amp. for Racal Receiver—"Can you suggest an outboard a.f. amplifier for my Racal RA17C-3 MK II receiver which will give me at least two watts a.f. output and preferably more?"

Yes. See fig. 1. The RA17C-3 MK II uses a 6AU6 as the a.f. output tube (V_{22} on the diagram). The maximum a.f. output of the set is 50 milliwatts. Five a.f. outputs are available however. The input for the 6AQ5A amplifier in fig. 1 should be connected to the Racal 3 mw 600 ohm output tap. Sufficient power is available to drive the average eight inch speaker to full output. If the 3 mw output tap does not provide sufficient drive, you can use the 50 milliwatt tap.

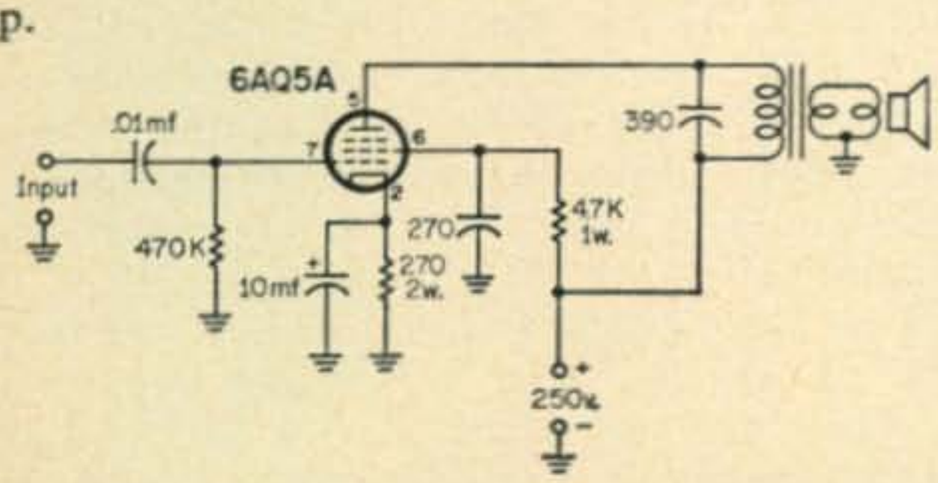


Fig. 1—An audio power amplifier suitable for the Racal receiver. Transformer T_1 is any standard 5,000 ohm to 3.2 ohm output transformer such as a Stancor 3-309. Capacitors are in mmf unless otherwise noted.

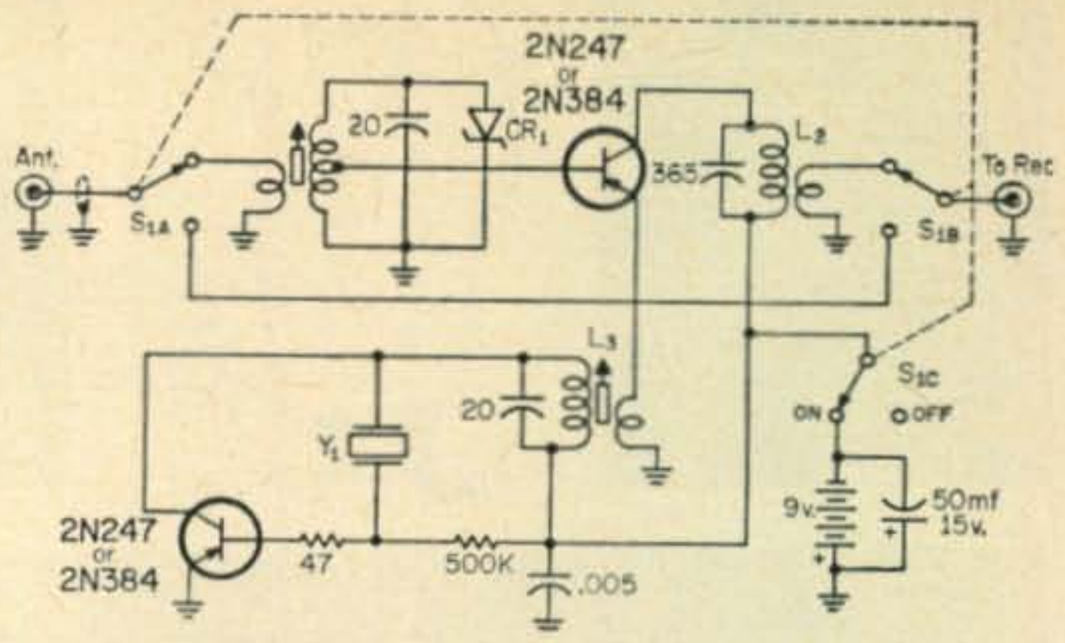


Fig. 2—A simple 21 mc converter with output in the BC band. Retuning L_1 and L_2 will allow operation on frequencies up to 50 mc, with appropriate changes in Y_1.

CR_1—Zener diode. Motorola ¼ MZ4AZ5.
L_1—12t. #18 e. on National XR-91 form. Tap 4t. from cold end. Link: 3½t. #18 e. at cold end.
L_2—Vari-Loopstick. Lafayette MS-11. Link: 12t. #18 e. at cold end.
L_3—12t. #18 e. on National XR-91 form. Link: 2½t. #18 e. at cold end.
S_1—3 pole 2 pos. rotary switch.
Y_1—3rd overtone crystal, 20.3 mc.

BC-779 Stability—"Where can I obtain full information on improving the stability of the BC-779 surplus receiver?"

See October 1952 *CQ*. It contains an article on improving the stability of the h.f. oscillator in the BC-779.

CRV-59AAE TV Camera—"Did *CQ* ever publish any information on converting the surplus TV camera, the CRV-59AAE?"

Yes, *CQ* did. May 1957, page 28 had an article by W6TNS on the subject. See also September '63 *CQ* for conversion to a Vidicon unit.

Transistor Converter for 21 mc—"Will you please publish a two or three transistor converter circuit for 21 mc? I wish to use it with a BC receiver. Please make it simple!"

Yes. See fig. 2. This simple but very efficient converter may be used on other bands too—up to 50 mc. Nearly any good h.f. transistor will work in the circuit. L_1, L_2 and L_3 are slug tuned coils wound on National XR-91 forms. Although a Motorola zener diode is used for transistor protection from r.f. overloads, an NE-2 neon may also be used. The i.f. range (tuning) of this converter will be in the segments 650 to 1100 kc on your BC receiver. Keep coils L_1, L_2 and L_3 separated at least 1½". Coils should not be placed close to shields either (if used). The

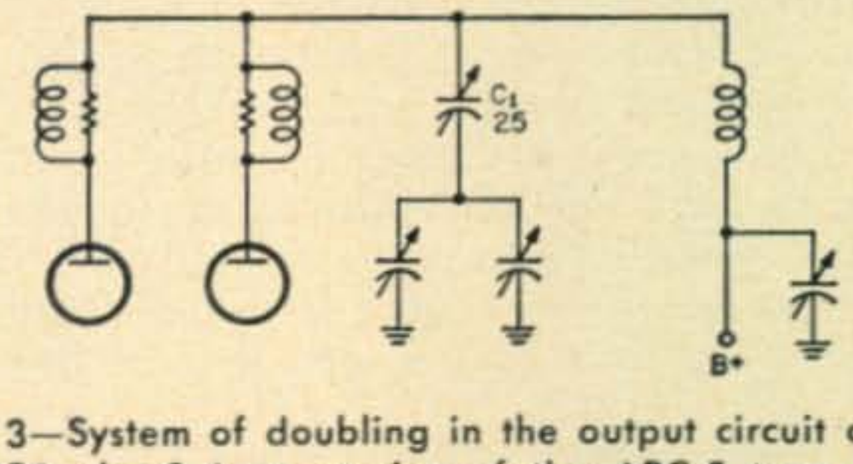


Fig. 3—System of doubling in the output circuit of the BC-696, the 3-4 mc version of the ARC-5 type transmitters. Capacitor C_1 is added in series with the existing plate tuning capacitors for 40m. output, and shorted out for normal output.

performance of the unit compared very favorably with a well-known manufactured tube model.

BC-696 as 40 Meter Driver—VE6SR Stan Read, uses his 696A transmitter both as a transmitter and v.f.o. for his higher powered rig. In order to work 10 meters however (with the BC-696 on 40) it was necessary to double in the 696 final. He did this as shown in fig. 3. A small air padding condenser (25 mmf or so) is inserted in series with the main tuning capacitor. A tip of one of the outside rotor plates is bent so that when the condenser is all the way in, it shorts out and permits normal 80 meter operation. When the condenser is opened up, the transmitter can be tuned to double to 40 meters. Thanks Stan!

Drake 2B to 160 Meters—"I have a Drake 2-B receiver. How about a converter for 160 meter operation?"

See *QST* for Jan. 1962 page 55. Also see *QST* for July 1962.

DDRR Antenna—"Listening in on the bands I heard a discussion going on relative to the 'DDRR' antenna. What is it and where can I obtain more information on it?"

The DDRR is a Directional Discontinuity Ring Radiator invented by Northrup. Information on it is contained in the Jan. 11, 1963 issue of *Electronics*. This antenna that looks like a hula-hoop offers a height reduction of up to 32-to-1 over verticals now in use and can range in size from 6 inches to 5000 feet in diameter, and 2 inches to 300 feet in vertical height. Tests have shown that a DDRR antenna only 2 feet high practically equaled the performance of a 60 foot vertical radiator. It makes a good mobile antenna for the higher frequencies too.

T–Filter for 455 Kc—"Would you give me a circuit for a T notch filter for a frequency of 455 kc? I want to insert it between i.f. stages."

See fig. 4. Resistor R_1 in the circuit is used as a selectivity and notch depth control. The variable capacitor shifts the notch in small increments.

Charging Mercury Batteries—"Can mercury batteries be charged?"

No. Chargers available for 9 volt transistor type batteries are not efficient and work only after a fashion. I do not recommend using one with mercury batteries.

Information Wanted—A high school science student (also a ham) is looking for information which we do not have. He wants data on constructing an *ionospheric sounding simulator*. Anyone offer any help?

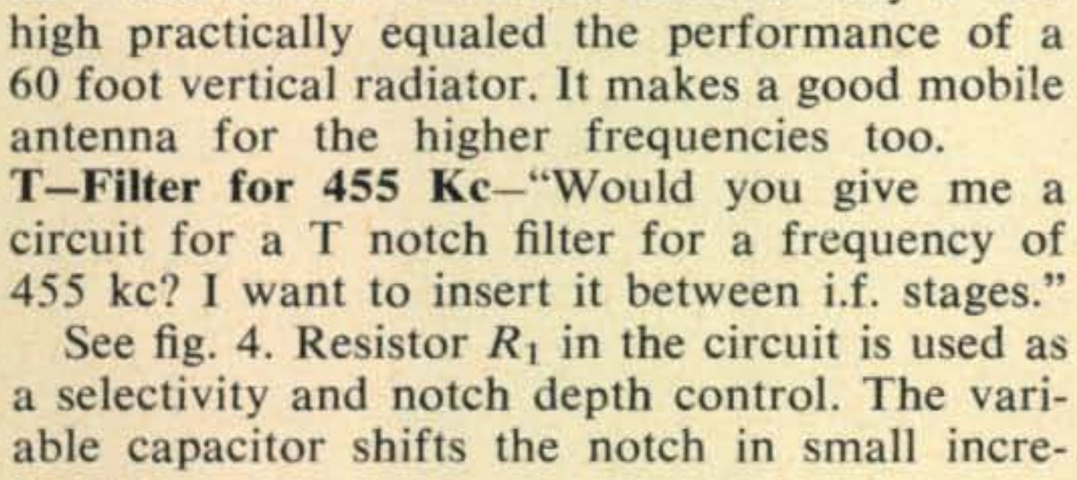


Fig. 4—Simple T-notch filter for 455 kc i.f.'s. Transformer T_2 is a conventional i.f. transformer, with T_1 being the existing 455 kc unit.

Ham Transistor Lab—"I'm 16 years old and a senior in high school. I have decided to go in for some very serious experimenting with transistors, but my finances are limited. Can you direct me to a company where I can purchase a lot of transistors, diodes, *etc.* for little money?"

It is too bad that most transistor manufacturers do not reserve the "seconds" for use in high schools and by hams, but this is not the case. The reason for this is that the manufacturers do not wish their rejected products in the wrong commercial hands. I would suggest that you contact Poly-Paks, PO Box 942, South Lynnfield, Mass. for their Spring bargain catalog (10¢). It lists a lot of fine bargains. For example, ten Raytheon CK722 transistors are going for $1.00, two 150 mc mesa transistors (2N703) are going for $1.00 and 20 top hat 750 ma rectifiers are being sold for $1.00. The latter units are untested, however. Incidentally, they list SB-100 type transistors at 5 for a $1.00. These are good up to 100 mc and can be used in the converter described earlier in the column. The voltage should be reduced however from 6 volts to 3 volts. Tell Poly-Paks that HAM CLINIC sent you.

PT688 Transistor for 5 Watts R.F.—'Recommend an r.f. transistor please to work at 21 mc which will give me at least 3 watts output (with around 5 watts input)."

Try the PT-688. It operates at 12 to 14 volts and will give you what you are looking for. By the way, the transistor will work fine at 28 mc too.

HX-50 As Driver for 30L-1—"Will the Hammarlund HX-50 s.s.b. transmitter drive the Collins 30L-1 linear amplifier?"

Yes, even though the HX-50 output is lower than the S-line.

DX Antenna—"I am new to ham radio, have my general class license and also the DX bug. What antenna do you suggest I use for best 'DX results' considering all of your past experiences?"

I would take the quad. This antenna is practical, easy to construct and the cost is low. Next in line would be a good, high 3 element beam.

Prop-Pitch Direction Indicator—"Would you please tell me where I can find the information on making a direction indicator for my prop-pitch beam rotator?"

See *CQ* for April 1948. This article describes a coupling system using selsyns, for remotely indicating the direction in which the antenna is oriented.

Thirty

We have had the pleasure of meeting many hams on our travels throughout Europe, the Middle-East and Africa. We hope that by the time you read this that the reciprocal (ham radio) operations bill will have been cleared and enable us to QSO with our old and new acquaintances around the world. For this month then, our very best to all of our fine *CQ* readers.

73, Chuck

YL

LOUISA B. SANDO*, W5RZJ

MORE highlights on the Fourth International YLRL Convention, June 19-21, Columbus, Ohio: K8MZT, Shirley, convention chairman, has announced that featured speaker for the banquet, Sat. evening, will be Enid Aldwell, W6UXF. One of the founding members and first secretary of YLRL (as W9NBX), Enid has held her membership continuously throughout the 25 years. Enid's hamming has been mainly in traffic nets and rag-chewing. Her OM, Bill, W6LBM, became a Silent Key four years ago. Other hobbies include puppetry, handweaving and folk dancing. (Those who attended YLRL's First Internat'l Convention will recall Enid with the "Alpine Dancers" who entertained at the banquet with Bavarian folk dances.)

Enid's main interest currently is in the field of human relations. Co-author, with Dr. William R. Parker, of the book, "Man: Animal and Divine," Enid now works with the Parker Foundation of Human Relations, doing writing and personal counseling in group therapy. Her new book, "Dear Anne," which deals with personality problems and how to overcome them, is in the process of publication. Enid's talk at the convention will be "CQ Happiness"—what makes us happy, why we often get off the track, and what we can do about it. She also will talk a bit about the "old time" in YLRL.

K8MZT requests that *each* YL attending the convention *bring her QSL card*. A large map will be set up in the lobby of the Nationwide Inn, and as part of registration each YL will place

[*Continued on page 79*]

*4417 Eleventh St., N.W., Albuquerque, New Mexico, 87107.

1964 Officers, CHC Chapter 4

W1YPH, Leona, secretary of CHC Chap. 4, has been licensed since 1953. Her OM is W1GAG, son Norm is K1IJU, dau.-in-law Jean is K1IJV, YL Editor for QST. Leona has two other sons and 7 grandchildren. She works mostly c.w., likes DX certificate collecting, enjoys handicrafts and bird watching.

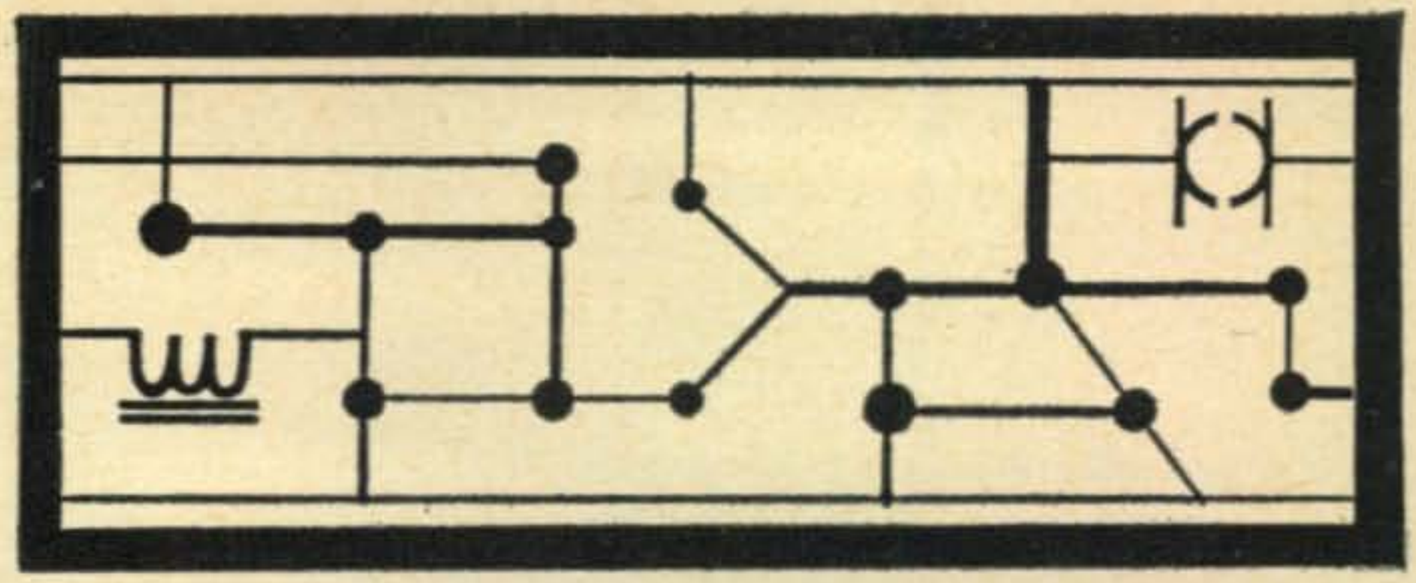
K5BTM, Dot, 1964 president of YL Chap. 4 CHC. Licensed in 1960, she holds 52 certificates, is active in YL nets and clubs. Dot, a grandmother ten times, has four sons, one is K5WWL, another K5YFD and dau.-in-law K5YFC. Other hobbies include ceramics, china painting and dressing antique dolls.

Margie Ann, jr. YL of K8ITF, displays some of the embroidered sections for the bed cover, main prize at YLRL's 25th Anniversary Convention in June.

W7GGV, Helen, is CHC Chap. 4 vice president. Licensed in 1957, her OM is K7CXP and daughter Carol holds radiotelephone first class license. Helen enjoys traffic nets, is RACES R.O. for Idaho Dist #1, was SCM 1959-63. She enjoys handicrafts and club work.

W5LGY, Helen, is treasurer of CHC Chap. 4. Licensed in 1945, she has been EC for 16 yrs., OBS for 16 yrs., OPS for 12 yrs.; holds three public service awards. A retired hardware store merchant, Dot writes magazine articles, enjoys philately, constructing and operating puppets.

RTTY



BYRON H. KRETZMAN*, W2JTP

RTTY Operating Frequencies

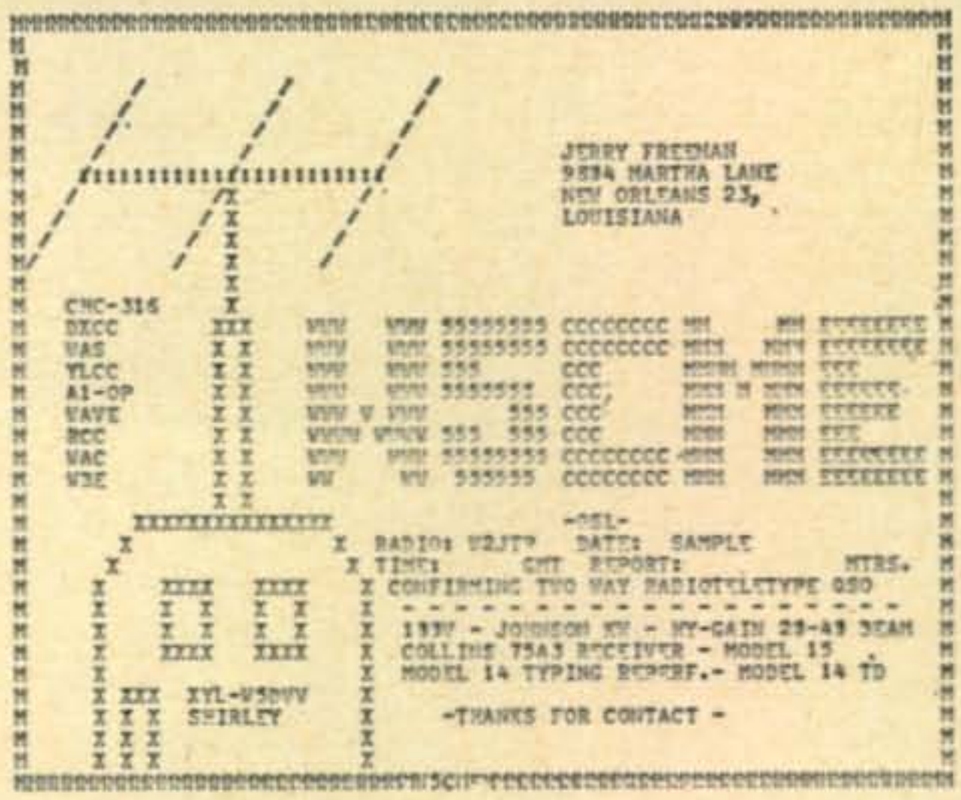
Nets centered on frequencies given; operation usually ± 10 kc on h.f.

80 meters	3620 kc
40 meters	7040 kc
20 meters	14,090 kc
15 meters	21,090 kc
6 meters	52.60 mc
2 meters	146.70 mc

RADIOTELETYPE operation was discussed in the December '63 RTTY Column, and we received quite a few letters of appreciation from newcomers, for which we are grateful. Sometimes those of us who have been operating RTTY for some years forget that there are always hams who have just discovered how fascinating this particular mode can be and who are eager to get going in the right way. So, you old-timers, forgive us if we devote some space to the fundamentals of RTTY theory and operation. (Remember, only *CQ* has a monthly RTTY Column.)

Machines

The first question the interested ham invariably asks is, "What machine should I get?" First of all, we suggest that you stick to machines made by the Teletype Corporation. Sure, there are a few other-make teleprinter machines kicking around, but be careful; these most likely are for slightly different speeds, such as those made for Western Union. Don't forget, too, that the availability of Teletype parts is exceptionally good. Besides being well stocked by all the user telephone companies, they appear in government surplus. So, stick to the well-known Models, 14, 15, 19, 26, and 28. Some military versions are the TG-7, TG-26, and TT-7. The major difference between the commercial and military versions is that the military machines are provided with variable speed series-governed a.c. motors instead of synchronous motors. (The series-governed motors are apt to radiate noise and they require a special tuning fork to set the speed.) See Chapter 2 in the *New RTTY Handbook* for the details.



RTTY QSL card of W5CME.

The second question we get is, "Where can I get a machine?" Most everyone knows that telephone companies are the biggest users of Teletype machines, and that they are gradually replacing the older models with the newer Model 28 and Model 32 machines. These companies

RTTY The Hard Way...No. 31

"I haven't been able to break in, and Net Control has been sending the tape through backwards for five minutes!"

*431 Woodbury Road, Huntington, N.Y. 11743.

K9CNG of Vandalia, Illinois operated by Al Hourigan, uses a Model 28ASR and a Model 14 typing reperforator. Receiver is a 390A and the TU is a CV-89 and the transmitter is a 200-V.

dispose of their older machines through long-established channels; not to individuals. Some of these channels are the organized amateur teleprinter societies across the country. They can be contacted through W6AEE, W6VPC, W7WWG, K9KNJ, WØATM, WØAUS, W4RWM, and W2ORX. In addition, there are several individuals who rebuild machines for their fellow-amateurs, such as W9GRW, W7HRC, W8DLT, WØNOY, and VE2ATC. Above all, do *not* contact either a telephone company or the Teletype Corporation. You might ruin a pending deal with a society.

FRXD, More

Further to the February and March RTTY Columns about the FRXD tape equipment, K6ZBL of Oakland, Califcrnia, takes some issue with the information from W9YVP that we passed along in somewhat butchered form. Of course he caught the error in the main diagram that we mentioned in the March column, and says that pin *5* should be jumpered to pin *4* besides. Russ also suggests that the two clutch coils be connected in series and thence directly to the 120 volt d.c. supply, eliminating the dropping resistors. He further suggests that everyone keep away from the universal contacts and the tape feed indicator contacts. Original schematics are available from W9YVP and the K6ZBL connection information is available by sending to him (2816 Delaware Street, Oakland 2, Calif.) a stamped, self-addressed, envelope.

On the Bauds

W1MVH of Hamden, Conn., uses tape on 80. K1PLP of Wilmington, Mass., has motor problems. *(Contact W2ZKV for parts, Jerry.)* W1BGW of Boston, Mass., is on the narrow net Sunday mornings on 7140 kc. W1LAS of Waterbury, Conn., works 80. K1HOP of North Haven and K1YZG of Ridgefield, both Connecticut, also work 80. W2BQB of New York City is on 20 as is W2IDX of Westbury, N.Y. WA2-LKF of Hammonton, N.J., uses narrow shift on 7140 kc. W2HJX of Barnveld, W2FAN, and K2AMI of Lewiston, all in New York State, are on 80.

K3NKL of Wallingford, Pa., chases the quick brown fox with 80 meter tape. W3YPI of Millersville, Pa., works 80 Sunday mornings with a Valiant. W3IJr of Yellow Springs, Md., is on 80. W4MGT of Lexington, Ky., can work either narrow shift or wide shift on both 80 and 20. W5SH of Fort Worth, Texas, works 20. W7ZT of Carson City and W7CTK of Las Vegas, Nevada, are on 20 as is W7VKO of Phoenix, Arizona.

W8UUS of Kalamazoo, Mich., is a steady customer with tape on 80. K8DDC of Chillicothe, Ohio, is on 80 also. K9CNG of Vandalia, Ill., has a few Model 14 printer covers for sale. W9UE has left just a few Auto-Mate 26 automatic carriage return and line feed kits at $17 postpaid. W9GDW of Eau Claire, Wis., works 80. WØEBW of Grand Junction, Col., has a CV-57 (455 kc) that he is trying to marry to an SX-101A which has a 50 kc i.f. *(Not worth it, Milt. See page 77 in the New RTTY Handbook.)* WØLOE of Kansas City, Mo., is on 20.

VE2HY of Montreal, Quebec, uses a Viking I, a 75A-4, and a Model 15 on 7140 kc narrow shift and can transmit tape at 65 w.p.m. SM6CSC operates 14,100 to 14,110 kc after 1600Z with a Model 15 donated by California RTTYers (*via* K6ZBL). DL4IA (ex-KV4CX) is on 80. VE3DTY uses narrow shift on 7140. DL9EX of Bad Essen and DL3IR of Munich are on 20. ZL1WB was sent an a.c. synchronous motor by NCARTS and W6DTN.

Comments on 7140 kc

We still are getting quite a few letters asking us why the heck the 40-meter operating frequency was changed from 7140 to 7040 as listed in the box of Operating Frequencies at the head of this Column. (See the RTTY Column, page 98, May '63 *CQ*.) After many months back in the East we still never hear anyone on 7040; but, we *do* hear considerable activity around 7140 kc, especially during the daylight hours. It is most interesting to note that the stations heard are using only narrow shift (170 cycles) on this frequency. This sure simplifies the QRM problem. Crank the selectivity down to 500 cycles and notch out the interfering station. Presto! Perfect copy.

73, Byron, W2JTP

VHF AMATEUR

Vol. 6, No. 5—May, 1964

BOB BROWN, K2ZSQ

PROBABLY no other event affects all radio amateurs in this country as much as the coming hearing on the 50 mc restriction imposed by the FCC on "Butch" Seaman, K3IOP. This case revolves around the fact that a license was issued with a specific restriction against operation on a regular amateur assignment normally available to the holders of such a license. If allowed to stand, this case sets a precedent which could be applied to *any* amateur on *any* band if pressure is brought to bear against an amateur by irate neighbors.

The original Pittsburgh hearing date, March 4th, was changed at the last moment. At this writing no one seems to know where or when. A preliminary meeting of FCC attorneys, Mr. Tyron, W3WFR, of Pittsburgh, and Mr. Booth, ARRL attorney, will have been held in Washington by the time you read this. Results will be available at a later date.

Because all of you have a stake in this proceeding, financial support in the form of a donation is heartily solicited. It costs money to fight these things. During the past few months contributions totaling $95 have been received from the following readers: K1OMJ, WA2UKY, WB2DML, W3DLL, K3IPW, K3KLP, W3NYH, K3HRE, K3WNZ, K2WTL, WA4PTD, K5ADV, W6IBS, W6SKM, K7IWQ, WA8FLF, K8GSN, W9PIH, KØPWS, the Western Pennsylvania Mobileers, Virginia Beach Amateur Radio Club, PJ2AE (Aruba), and s.w.l.'s Frank Yarussi (Pittsburgh, Pa.) and Dan Fletcher (New York).

But much more will be needed before it is over. It should be noted that Mr. Tryon is not charging any legal fee for his services—a big contribution in time and effort. Money is needed for travel, telephone, telegraph, postage, printing and other miscellaneous items. If you wonder about ARRL, they, too, are involved in this case —by request of the League's council. Under FCC hearing rules, however, the ARRL can only participate as an interested party. The burden of proof still lies with the licensee.

W3BWU is acting as contributions agent in the case and supplied the above information. If you are able, please send your donations to: Edward C. Lips, W3BWU, 3302 Hazelhurst Avenue, Pittsburgh, Pennsylvania 15200.

It Could Have Been You

Just heard through W3SAO's XYL (editor of Mt. Airy VHF Society's club paper, *"Cheese Bits*) that Richard Pattison, K3ACR, is in Abington Memorial Hospital in Abington, Pa., in critical condition after having fallen off his roof the night before.

K3ACR does not use a ladder to reach the roof when working on his v.h.f. antennas. There is a tree close to the shack window and he uses the tree to gain access to the roof. This time, however, he reached for the tree and missed and fell 15 feet and landed on concrete. Luckily, K3LOM was there at the time. He called the police and then wrapped Rich in a blanket.

At the hospital a tracheotomy was performed to permit breathing. At this writing we are informed that Rich has a concussion, a shattered right wrist, contusions of the left side of the face, a broken nose, a large gash under the chin and a broken left wrist. Right now they are checking for broken jaw.

Safety First may sound a bit old-fashioned, but it should still be the foremost concern in *all* our endeavors, electronic and otherwise . . . ■

Here is the CQ Spring V.H.F. Contest Club Aggregate Honors Trophy, now held by the Peninsula Amateur Radio Klub of Bayonne, New Jersey. The P.A.R.K. walked away with the honors in the May 1963 affair. It's a revolving award—a club must win for three consecutive years to keep it. See page 40, last month's CQ, for details. Contest date: May 2-3. Who will get it this year?

A 45 Watt Transistorized 144 MC C.W. Transmitter

BY GILBERT BOELKE*, W2EUP,
LEMAN W. DOLBY*, W3UDT/2 and E. R. MOSS*

This article describes a c.w. transmitter, designed for the amateur band at 144 to 148 mc, which operates with a power input to the final stage of approximately 45 watts. It is expected that prices of the now state-of-the-art devices used in this transmitter will be substantially reduced in the future. When this comes about, the techniques described in this article should prove invaluable to the amateur.

SINCE the invention of the transistor, development has been directed toward higher frequency, higher power devices. Two of the main drawbacks of early transistors were their limited frequency response and small power handling capabilities. Later came high frequency units with very low power handling capability and high power transistors with poor frequency response. Potential military and space oriented applications have hastened development over the past few years, and today devices are capable of generating appreciable power at frequencies over 200 mc.

The purpose of this article is to acquaint the amateur with the present potential of existing transistors when they are properly applied in high frequency, high power amplifiers and to illustrate some of the techniques used to obtain optimum performance.

A transmitter was constructed, using the latest developmental transistors, for operation on the 144-148 mc amateur band. For simplicity, it was decided to design it for c.w. operation. The unit, shown in the photographs, runs about 45 watts input to the final amplifier, which has an efficiency of about 46%. Eight mc crystals are used, and the efficiency including oscillator, multipliers, drivers, *etc.* is approximately 35%.

Notice that the difference between power amplifier efficiency and overall efficiency is relatively small. This is one of the characteristics of a transistorized transmitter since the devices don't draw any heater power and the oscillator and frequency multipliers run at very low power levels. Only the more efficient amplifier stages are run at appreciable power levels.

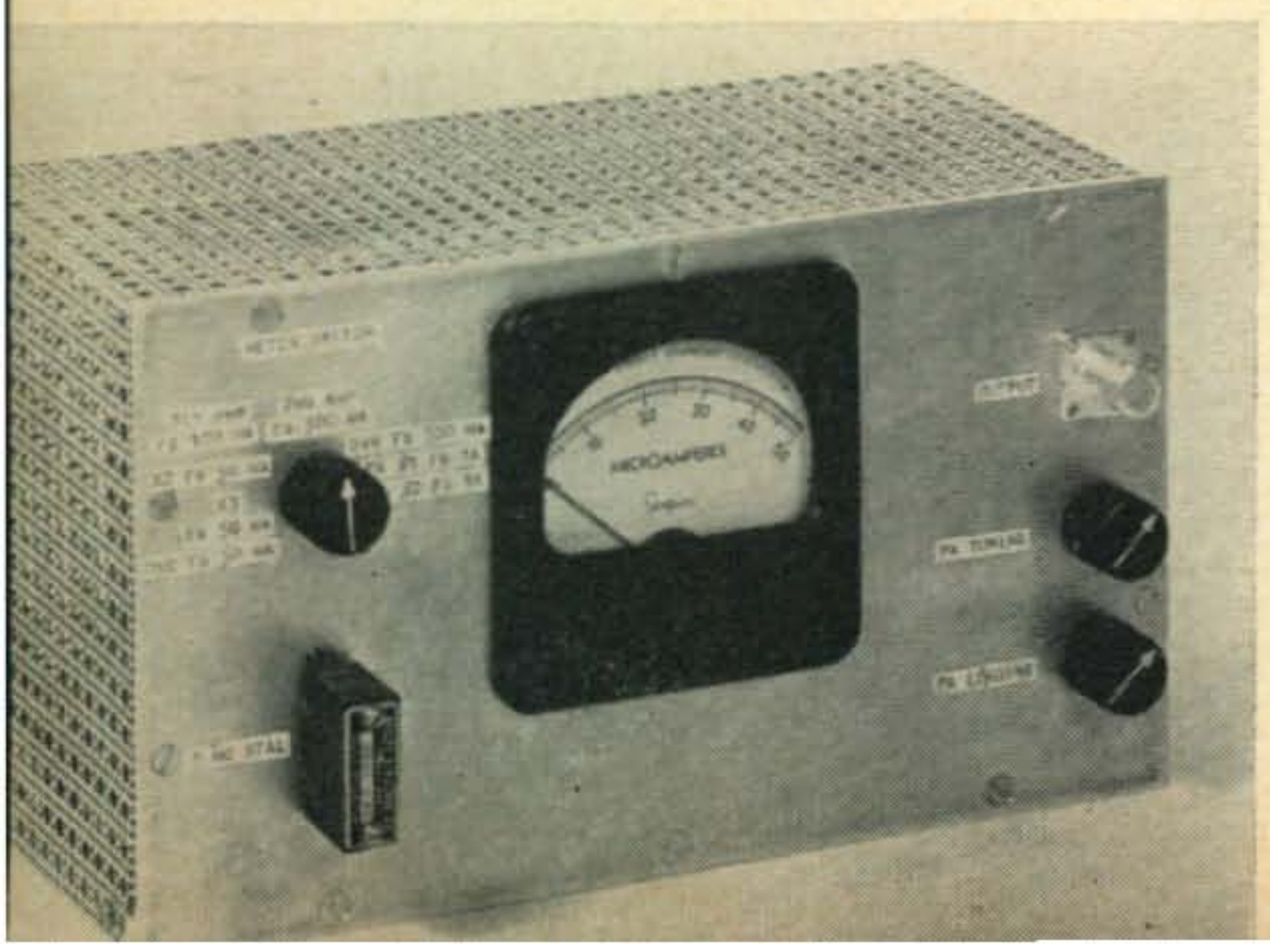
*Sylvania Electronic Systems, a division of Sylvania Electric Products Inc., Williamsville 21, New York.

Transmitter Description

The transmitter was constructed in two separate units, an exciter and a power amplifier. The exciter is a complete 1.5 watt output transmitter in itself, and was constructed as a subassembly as may be seen in the photographs.

Exciter—The exciter schematic is shown in fig. 1. An overtone crystal oscillator is used in the exciter to generate power at 24 mc from 8 mc fundamental cut crystals. A tripler stage multiplies the frequency to 72 mc and amplifies the oscillator output of 6 milliwatts to about 12 milliwatts. Doubling to 144 mc is accomplished in the following stage, with amplification to about 35 milliwatts. Both frequency multipliers operate in the grounded base configuration which provides improved high frequency performance over a grounded emitter stage.

Once at the required frequency, it is desirable to amplify power to the necessary level in as few stages as possible. The first amplifier is a grounded base 2N834, which delivers about 160 milliwatts to the second stage, an SN103, a de-



Front view of the transistorized 144 mc transmitter. To the left of the meter is the meter switch with the 8 mc crystal below it. On the left side of the panel are the output connector, P.A. TUNING and P.A. LOADING. The front panel is heavy gauge aluminum and the cover is made of perforated "do-it-yourself" aluminum.

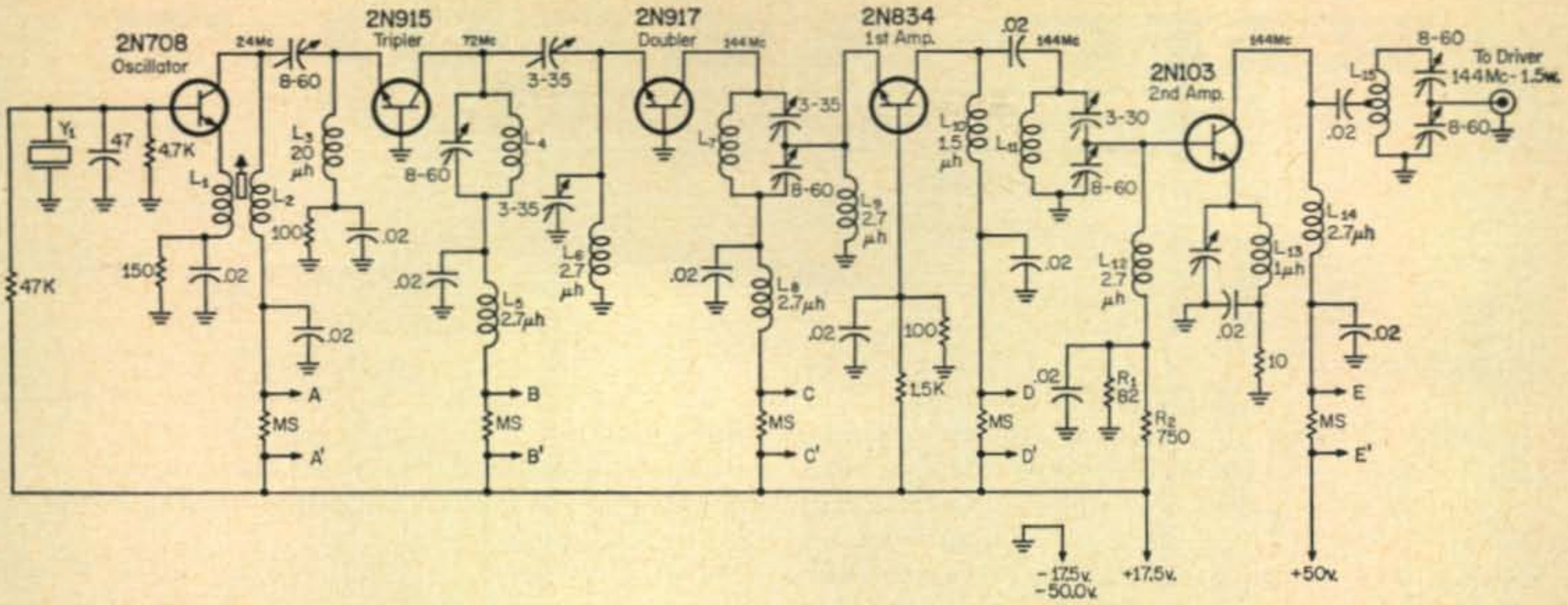


Fig. 1—Circuit of the exciter section of the 144 mc c.w. transmitter; its output is 1½ watts needed to drive the power amplifier shown in fig. 2. All capacitors are in mmf except the 0.02 mf units. All inductances are in microhenries and all resistors are ½ watt units in ohms. Resistors marked MS are meter shunts and must be calculated to suit the desired range and the meter being used. The meter switching circuit is shown in fig. 2.

velopmental mesa transistor which delivers approximately 1.5 watts into a 50 ohm load.

At the frequency involved, inductance in the emitter lead from the transistor is appreciable, and results in degeneration which reduces the stage gain. The old trick of series-resonating, as many a v.h.f. man has done to screens of vacuum tubes, is used to effectively ground the emitter. Stage gain is increased sharply as a result, allowing this stage to amplify about 10 db. Notice that this stage is also forward biased by bias network R_1 and R_2. Biasing causes the stage to operate closer to class A, with higher gain, but at the cost of efficiency. Individual stage efficiencies could be increased by using two stages in Class C, but the two stage combination would have a comparable overall efficiency.

Power Amplifier—The power amplifier schematic is shown in fig. 2. Two stages comprise the power amplifier section of the transmitter. The first, the driver, utilizes an SN103. The 1.5 watts from the exciter drives this stage into Class C to an output power of 5.5 watts. Emitter tuning was used in this stage, but is not necessary and could be omitted. This stage has a base resistor which serves a function exactly analogous to a grid leak resistor in a vacuum tube Class C stage. Resulting collector efficiency is about 55%.

Power is coupled from the driver to the final power amplifier through a tuned matching network, similar in principle to an antenna coupler, then through balance capacitors C_1 and C_2 which are adjusted to deliver equal drive power to each of the parallel output transistors. Since transistors are not sufficiently uniform for direct parallel

[*Continued on page 82*]

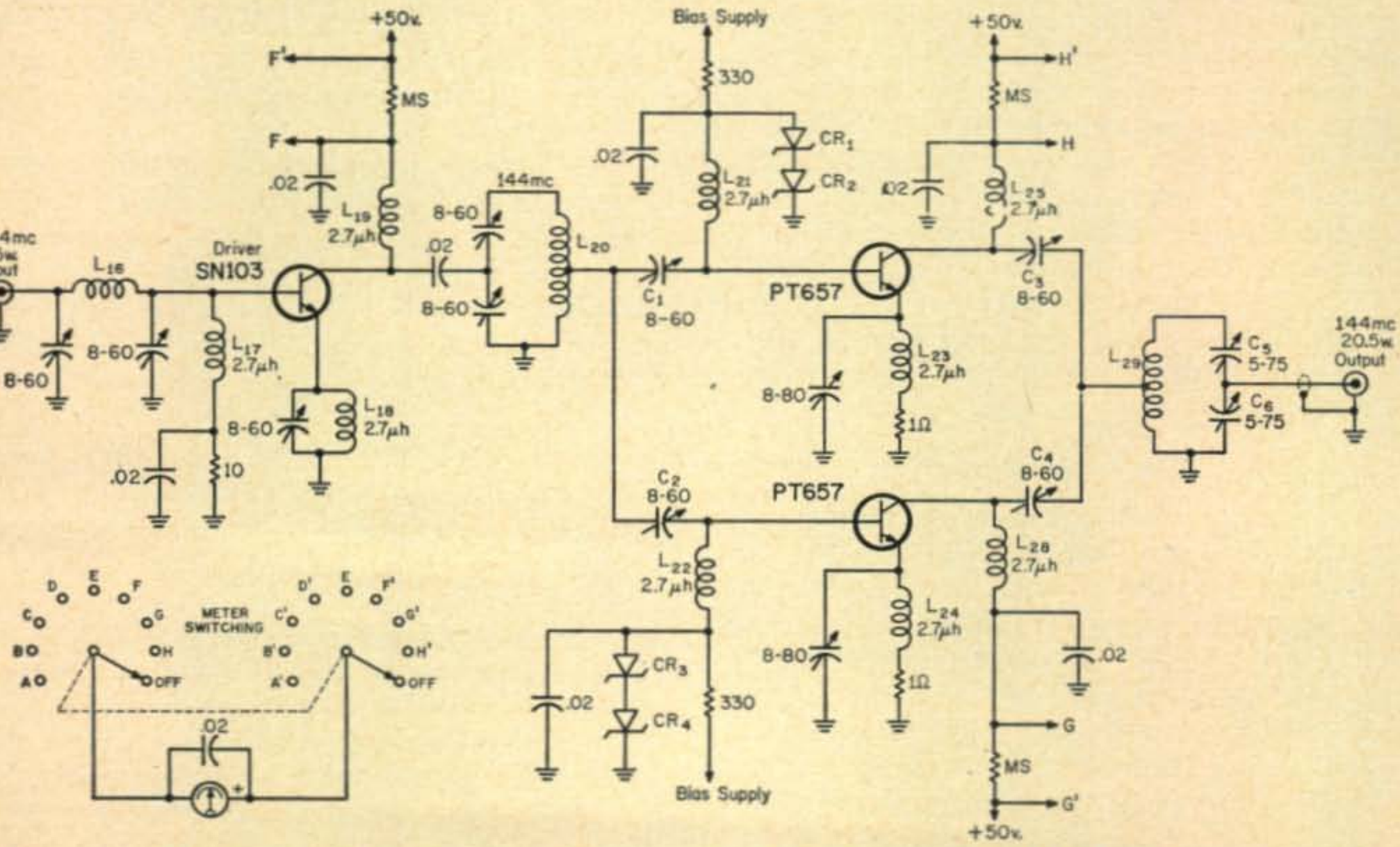


Fig. 2—Circuit of the driver and power amplifier stages that deliver an output of 20.5 watts at 144 mc for an input of 45 watts. All resistors are ½ watt and in ohms; all capacitors are in mmf except the 0.02 mf bypasses; all inductances are in microhenries. The full scale meter range and switch positions are listed on page 82.

VHF REPORT

an exclusive feature of The VHF Amateur

BY BOB BROWN*, K2ZSQ

YESTERDAY the phone rang. On the other end was W8KNC calling from upstate Connecticut. Ira mentioned that he was on his way to Camden, N.J., and would I mind if he dropped in! Well, to make a long story short, three hours later we were honored with a visit from this well known six meter DXpeditioner. Seems he's now under new assignment and his mobile travels may extend to KL7 very shortly. As many of you know who have followed this column for the past year, W8KNC has been active in North and South Dakota and Wyoming, providing these rare states to all comers during the skip season. And last August Ira put Montana on the *CQ V.H.F.* Contest maps for the first time in many a moon.

"V.h.f. activity is sparse, to say the least," comments W8KNC about his stays in the West. Questioned about v.h.f. club activity: "There is none." But the few Wyoming six meter signals that are heard are strong, evidence of the true DXing spirit.

The XYL was naturally enough interested in the countryside and people, who to us city folks sound fascinating. W8KNC hopes some day to be able to settle in Wyoming, "where the people combine the best attributes of Southern hospitality with their own brew of warm informality." And to top it all off, what rarer state for six meter DX?

Ira tells of many long hours spent atop a 7000 foot peak in northern Wyoming. His Chevy wagon is just the ticket, too. He has a 3 element portable beam in the back, at least 40 feet of interlocking sections of thick-wall tubing, a complete under-the-dash homebrew 50 mc rig, a 1½ kw generator, sleeping bag and snake bite kit! And as if that wasn't enough, his crankcase in the auto is electrically heated (a help in the frequent *35 degree below zero* blizzards that accompany a Wyoming winter).

VP7CX was heard several times last year from that mountaintop with over S9 signals. But so far no luck. Perhaps a KL7-VP7 QSO is in store for sixty-four?

F.M. in Spokane?

They talk about tough nuts to crack . . . For years the Spokane, Washington, area has been famous for its died-in-the-wool two meter DX men. With their kilowatts and 144.100 mc sideband many weak-signal scatter enthusiasts have been able to put a pin in Washington on their maps. Sideband and c.w. have long been the predominating facts of life in Spokane.

About four years ago, however, W7LWX moved into town from Seattle. And with him came his fervent enthusiasm for 144 mc f.m. As could well be expected, Ted had a bit of a rough time of it. But Seattle f.m.'ers die hard and eventually, by employing one trick after another, four amateurs joined the cause. Questionable tactics quickly forgotten, the big switchover came at last.

Today there is an f.m. repeater on a 5300 foot mountaintop which "listens" on 146.340 and retransmits on 146.760 mc. This, coupled with another fifty solid enthusiasts in Spokane, has put the entire area for 100 miles around on our nationwide f.m. map. And methinks it will be there to stay.

The frequency of 146.760 used by the Spokane repeater is utilized throughout most of Washington, from Portland up through Canada, and in northern Idaho.

One final note: It is extremely difficult to obtain 2 meter f.m. gear in Ted's area. The Spokane gang is interested in Motorola, G.E., Comco, RCA, *etc.*, equipment (and will pay up to $50 per unit), but don't know of mail-order availability. If you can help in securing an outlet, please write Ted Caesar, W7LWX, 627 East 23rd Avenue, Spokane, Washington.

Nevada Expedition

Vic Weissbrodt, W9JFP, recently dropped a line to tell of an up-and-coming contest DXpedition to Observation Point, Nevada, just inside the border. Four other hams will accompany Vic on the 10,000 foot climb. Event: the June ARRL VHF Contest. They will be running 800 watts on six and two meters, 20 watts on 220 mc, and 250 watts on 432!

"As Nevada is a tough one to get on any v.h.f. band," adds Vic, "we would like to try to give the state to some of the boys. I waited for 2½ years to work it on six meters and it was my last for Worked All States. We will bring all the gear from Milwaukee plus a 4 kw generator for the trip." Okay, fellows, go to it!

500-Contact Century Club?

"Upon receiving *CQ*," writes David Braun, WB2FZV, of Laurelton, New York, "I usually glance through it, looking at the awards given out by clubs. I was surprised to see that you give an award for 150 QSLs on 50 mc.

"As I am active on six meters, I think your amount of QSL is quite high. Looking over my own collection, for every five sent out, I've received one. These odds aren't so good!

"Most hams on the v.h.f. bands don't QSL. I have nice cards and still no replies. I think it would be a better idea to just make 500 contacts in one year, instead of asking for QSLs.

**The VHF Amateur, CQ,* 300 W. 43rd St., New York, N.Y. 10036.

See what you can do."

Well, Dave, I'd rather us see what you can do. Personally, I feel the Century Club rules are fine just the way they are. Steady streams of club applications have been flowing in for years. And there are more today than ever before. From my own experience I have found that QSLing on the bands above 50 mc is many times more rewarding than on the lower frequencies. There will always be those few who consider the QSL card to be of nothing more than nuisance value. But for every ham who treats his hobby that way there are always half a dozen or so others who will go through the trouble of clearly printing on their card the oft-quoted phrase, *"The final courtesy of a QSO is a QSL."* And on this premise the Century Club was founded. I'd hate to have to guess what would happen to the organization should we destroy the very ideals upon which it was built. But so much for my feelings.

Let's hear from club members and column readers. What do *you* think?

Club Notes & Quotes

The VHF Repeaters of Oakland, California, held the second election of officers since their inception. Elected were: W6YAM (Pres.), WA6HSL (V.P.), WA6GPB (Treas.), WB6BHC (Sec'y.), WA6OJR (Chief Op), WA6JTY (Parlimentarian), K6BLS (Sergeant-At-Arms), and WB6CYO (Publicity Director).

Their six meter repeater is in good operating condition now as witnessed by the entire Bay Area following several check-outs on the SACEN SIX Net. Fundamental frequency was 50.390 and repeating frequency was 51.500 mc.

At the present time the VHF Repeaters have two repeaters functioning. Both are f.m., Link Type 1498's. K6PXT modified both for 120 watt ratings utilizing 5894's. For details, contact Paul DeMoss, WB6CYO, 3622 Kingsley Street, Oakland, California. 94610.

Mid-South VHF Association: Al Hemmalin, WA4IRX, is now lino-printing a fine little club magazine, *VHF Club News*. The book has an interesting feature I wish I had room to reprint, "How to Become A Lid." It's a series, with various versions every month. Excellent.

June 21st is the date for the Greater Memphis Hamfest, co-sponsored by the Mid-South VHF Association and the M.A.R.A. DX Club. Memphis Fairgrounds is where. Suggest you immediately contact W4YEL for full details.

Shore Area A.R.C.: Here's a brand new group in New Jersey, predominantly attended by v.h.f. men. The group meets the 2nd and 4th Friday of each month at the Community Center, Middle Road, Hazlet, New Jersey. K2OEI is Pres., K2YWG, V.P., and WA2MFF, Sec'y.-Treas. Present membership is about 30. For details contact: Bill Bender, K2OEI, 816 Poole Avenue, Hazlet, New Jersey. Telephone: 264-8160 after 6 PM.

Help Wanted—Fast!

Certificate winner in last year's Summer VHF Contest, Steve Sauer, WA9ASZ, of Indianapolis, will not be able to participate in this month's affair without immediate help.

Steve writes, "I have spent hours trying to fix the transmitter to no avail. I am operating as an s.w.l. until I can get a new rig in June . . . *after* the contest—hi!" Any local hams who want to help the competition? If you can donate a rig to the cause, or help Steve get fired up again, contact him today. Okay? Address: Steve Sauer, WA9ASZ, 6102 Grandview Drive, Indianapolis, Indiana. Good luck!

DX Doings

Just about everything under the sun was uncovered by Harry Blakeman, K1WYS, in Whitman, Massachusetts, a short while back. He's been spending a good deal of time snooping on the low end of six. Here's his report: "Jan. 24: A good groundwave 'opening' due to refraction to Me., N.Y., N.J., Penn. Jan. 26: Heard in this area were 2's, 3's, N.C., Ohio, Tenn., Ala. and Mo. K9HMB running a kilowatt in Chicago.

"On Feb. 1st, 8's sporadically 2100 EST. Feb. 2, 8's morning. Feb. 8, aurora during the evening. Feb. 9, 2's and 3's around noontime. Feb. 11, 2's and 3's evening. Feb. 12, W2LOY and other 2's and 3's. Feb. 13, several 3's.

"The Whitman Amateur Radio Club Net is now meeting on 50.70 mc Sunday mornings at 1030 EST. All stations welcome to join in. (Mass.)."

A note from Ron Toller, WA4FVD, of Marathon Shores, Florida, tells: "Look for Jack, VP6AQ, all this v.h.f. season from St. Peter, Barbados. He will be on with 75-100 watts; has transmitter completed and is now building his beam from aluminum irrigation pipe. He runs a nursery down there—that's ingenuity, isn't it?"

Three new Hawaiians on s.s.b.! Well, actually only two are *new*: K6QKL/KH6 and KS6BB/KH6 as reported by Mike Forman, WA6LHA. KH6UK rounds off the lot. "I will be running scatter skeds with KS6BB this summer," adds Mike. "He runs 1000 watts on six meters, but has trouble with Channel 2 TVI." *This* is a v.h.f.'ers island paradise?

Ken Thompson, K7UZQ, (also K6RBR) is now situated in Curry County, Oregon, and is going great guns with his 8 watts. Antenna is makeshift, but 19 states have been logged already. Ken uses 1½ watts for local work.

"This year when the band bands opens up I will be set up on six meters with a new high power rig," comments K7UZQ, "that'll put a full 10 watts into a 4 element beam. I will be transmitting around 50.33 mc most of the time."

Wrap Up

No two meter DX news this month. What happened? Don't forget to fire up for the contest: May 2 and 3. Full details on page 40 last month. So take along your camera and note pad when you head for the hills and we'll pack the next "DX Doings" section like it's never been filled before! See you in the contest.

73, Bob, K2ZSQ

UHF ROUNDUP

an exclusive feature of The VHF Amateur

BY ALLEN KATZ*, K2UYH

JUDGING by the weight of correspondence on the subject of very weak signal detection (it's in the pounds), you might think that sync detection is the hottest item on the u.h.f. horizon. It might very well be, but at present its addicts are perhaps noted more for their enthusiasm than by their numbers.

As for the reams of paper on my desk, they are a necessity. You have to communicate on common ground. One's definitions must be in phase with the next fellows. It can take over a paragraph just to define "noise" properly, such as: "Total non-coherence of amplitude and phase; two sets of noises cannot be added or subtracted under linear conditions."

However, even tougher than getting the semantics straight, is getting everyone to agree about the principles. I do not know of even two amateurs who see under-the-noise detection in the same way. But strange as it may seem, this is how progress is made. There are few guideposts in this field; it is more of a never-never land which should more than whet the appetite of a true u.h.f.'er.

If you are interested, drop us a line for more information. If you have some ideas of your own, send that, too. Ideas breed ideas—that's the policy of this column.

On the Technical Side

Talking about new ideas, here is K2TKN's latest system for putting the phase-sensitive detector described in our February *CQ* column to work. He calls the hook-up a "Flying Noise Lock."

"The 50 kc i.f. of my receiver directly feeds the signal input of the sync detector. The local oscillator at 50 kc feeds the sync input. The d.c. output from the sync detector (very short time constant) is used to a.f.c. the same local oscillator. There is a lot of gain in this loop, so that during conditions of no signal the oscillator is swept across the whole i.f. pass-band in a random fashion by the random noise fluctuations at the output of the sync detector. But the oscillator locks on every one of these pulses . . . and the output of the sync detector indicates either negative or positive, depending on whether the oscillator had to jump higher or lower in frequency. Because noise is random, every positive hit averages out the negative hits. If for some reason, there are more noise pulses on one side of i.f. center, the output of the balanced modulator swings that way. In this manner the balanced modulator acts like an integrator. It does not integrate the random information. But a delightfully small amount of coherent signal in the noisy i.f. registers a surprisingly large + or — d.c. output. This system acts like it is searching for a place to rest, and if anything happens twice in the same place, it locks in and narrows down."

We are going to reserve comments on this system. To be frank, we do not quite understand the principle upon which this system is based. According to Bill use of a non-linear element in any part of the receiving system destroys its usefulness for weak signal detection in the presence of large noise. Prime questions in my mind concern the mixer stages before the i.f. and the sync detector itself; all these are non-linear devices. The answers to these questions are probably already at hand. I know that he is already contemplating straight-through operation on 400 mc.

Activities

In keeping with the present trend, the majority of activity reports this month are on the subject of Ham-TV. Al, K7VQI, sent in a fascinating report about the activities of his group in Tucson, Arizona. Since Al's last report, he has been able to establish solid two-way TV communication with K7JQJ. Both he and John are running transmitters in the 40 watt range. However, their future plans are hampered by the 440 mc power limit which is in force in Arizona. Another group of TV-oriented amateurs in Phoenix have obtained permission to use 500 watts. Among this group are Sid, K7GBE; Dick, K7DZG; and Rosie, W7OUE. Their operation is centered on 441.450 mc video and 144.9 audio, although Sid has subcarrier sound. Al has been looking for a picture over the 135 mile path between his QTH and Phoenix. Thus far all he has been able to receive are carrier and sync buzz. *Give a bigger antenna a try. We are going to get a bigger one up here. It is almost a universal cure-all.* Other stations interested in ATV include K7VUB, K7KYQ, K7KHN, and W7ZNS. Both K7VUB and K7KYQ are able to copy K7VQI's TV signals.

Bob, W9NN, reports that another Bob, W9JEC, gave a demonstration of amateur TV before the North Shore Amateur Radio Club in Deerfield, Ill. The demonstration was a tremendous success and much interest was displayed on the part of the members. Bob suggests that such demonstrations go a long way for the ATV cause, and uses himself as an eamxple—a confirmed 40 meter DX chaser, who may give u.h.f. a look. By the way, W8JEC has 80 elements up to poke his video about the country side.

Another TV report comes from John, WA8-

*48 Cumberland Avenue, Verona, New Jersey, 07462.

DXW who is working on a TV system with Greg, WA8FJK. The path between their two homes is 11 miles, and to date it looks like they are in the flying spot scanner stage. At any rate they would like to hear from other hams interested in TV.

Final Note

We would appreciate besides the usual activity reports comments on a possible u.h.f. (220 up) contest. Is there any interest? We are also pushing for up-dating the v.h.f. Century Club awards to give the APX-6 and Ham TV boys a chance. Comments here would also be appreciated.

73, Al, K2UYH

YL [*from page 70*]

her QSL on the map so others attending will know at a glance who is there.

YL clubs or nets that wish to display certificates, scrapbooks, trophies, *etc.*, can make arrangements for this with Betty Kisel, K8WZF, 37955 Aurora Rd., Solon, Ohio.

Again the Buckeye Belles, hostess club, request advance registrations *as soon as possible*. The various committees have many lovely things planned, and to have all ready by June 19 they need your registration *now*. Registration is $10 for complete convention ticket; $5 for OM banquet (if accompanied by LYL attending convention). Mail to "Zip" Isham, 474 Darbyhurst Rd., Columbus 14, Ohio.

CHC'ers—SSB'ers QSO Parties

The YL International SSB'ers will hold their 1964 Annual QSO Party simultaneously with the CHC/HTH/FHC Annual QSO Party begin-2300 GMT May 29 and ending 0600 GMT June 1, 1964. The SSB'ers Party is open to all amateurs for two-way s.s.b. contacts. Awards will be given for 1st, 2nd & 3rd place Continent, Country, U.S. State & VE-VO Province (SSB'ers and non-SSB'ers members scored separately). See CONTEST CALENDAR elsewhere in this issue for more details on both events. Incidentally, the YL International SSB'ers now number more than 2000 members in over 200 countries on all six continents.

YL Chap. 4 of CHC now includes over 100 members. Current 1964 officers for this club are: Pres., K5BTM, Dot; V.P., W7GGV, Helen; secy, W1YPH, Leona; treas., W5LGY, Helen.

SAWRC Officers

Officers during 1964 for South Africa W.R.C. are: Pres. and editress of *YL Beam*, ZS1RM, Margery; V.P., ZS1NQ, Gwen; secy, ZS1MU, Pat.

33, W5RZJ

DX [*from page 54*]

The Radio Club of Guatemala has elected the following officers for 1964-1965: President, TG9JP; V.P., TG9SB; Secretary, TG9AG, and Treasurer, TG9GS.

OARC Award

The Okinawa Amateur Radio Club Award is given for working Okinawa stations (KR6 and KR8) as follows:

KR6/8 stations work 25; JA, W, K (including KA thru KZ) work 10. All other work 5.

Endorsements for all one band/mode will be made upon request. No charge. (Return postage will be appreciated, otherwise, certificates will go by surface mail.)

Send GCR list to: Awards Manager, Okinawa Amateur Radio Club, Box 37, Kadena, Okinawa, or Awards Manager, Okinawa Amateur Radio Club, APO 331, San Francisco, Calif., U.S.A.

QTHs & QSL Managers

CN8FE via W2CTN.
CN8FW via W2CTN.
CR6FW via W8GIU, Box 97, Mt. Cory, Ohio.
CR7GF via VE4OX.
EL2AC via K5SGJ.
EL2AD via K5SGJ.
ET3LM Lyle W. Mabbott, POB 1014, c/o U.S. Embassy/AID, APO 319, N.Y.
FP8CB/FO8 via W2JAE.
FY7YE via W5JLU.
HK7BE via K3EUK.
KA2KD via W2CTN.
KC4USB via W1UFW.
TI9FG via VE4CP.
VP8GX, HR S. R. Stringer, 57 Eltham Gardens, London, S.E. 9, England.
W4KKA/VK9 via K4SCT.
XT2AU via VE4OX.
XW8AW via W4ECI.
YA4A via K4KMX.
ZE4JS via W3HNK.
4W1B via HB9YZ.
5Z4JU Box 30125, Nairobi, Kenya.
6O6BW via WA4FXE.
6W2AE Box 3028, Dakar, Senegal.
7X2NJ via REF.
7X3GW Roger Vichy, 7 Rue des Transformateurs, Colomb-Bechar, Algeria.
9G1DV via W2CTN.
9L1HX Police Hdqtrs., Freetown, Sierra Leone.
9X5MH via DL1ZK.

73, Urb, W2DEC

Announcements [*from page 14*]

Virginia

The Roanoke Valley Amateur Radio Club will hold its annual hamfest May 23-24 at the Vinton War Memorial, Vinton, Va. Open house at 7:00 P.M. Saturday followed by a dance lasting until midnight. Contests, a technical session, and informal meetings of the Virginia nets will begin at 10:00 A.M. Sunday. Fried chicken buffet at noon. Advance registration $1.00; $1.50 or four for $5.00 at the door. Buffet ticket $1.25. Mail advance registration to the RVARC, Box 2002, Roanoke, Virginia.

New York

The annual Western New York Hamfest sponsored by the Rochester Amateur Radio Assn., is scheduled on May 23rd. The site has been moved this year to Vince's Fifty Acres, nine miles south of downtown Rochester, N.Y. and four miles south of N.Y. Thruway exit 46 on U.S. Route 15. Registration at door for all events except banquet $2.50. Send checks or money order to Hamfest ticket chairman, William Ehlers, WA2JMH, 64 Keating Dr., Rochester, N.Y., 14622. For additional information, write Rochester Amateur Radio Assn., P.O. Box 1388, Rochester, N.Y., 14603.

Florida

The St. Petersburg Amateur Radio Club will sponsor their hamfest on May 17 (9 A.M. rain or shine). Phillippe Park, near Safety Harbor, Florida, will be the location. Additional information can be received from the club at P.O. Box 4026, St. Petersburg.

South Carolina

The 5th annual Hamfest sponsored by the Blue Ridge Radio Society Inc., of Greenville will be held Sunday, May 3rd at Greenville, S.C. There will be prizes

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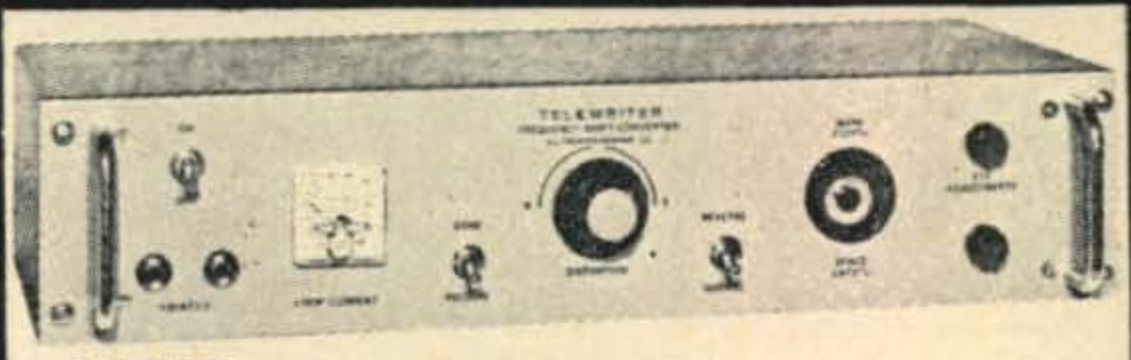

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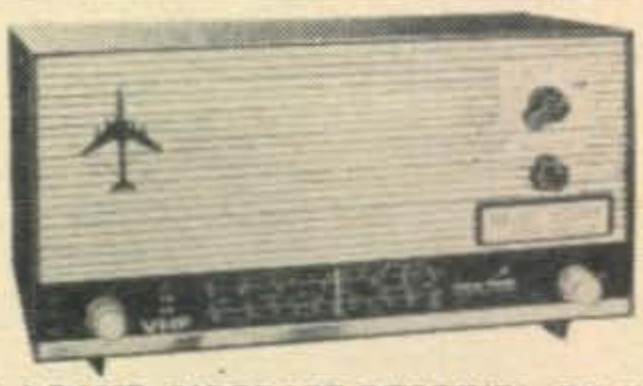
Polar Relay **24.50**
Model L with CR tube indicator **279.00**



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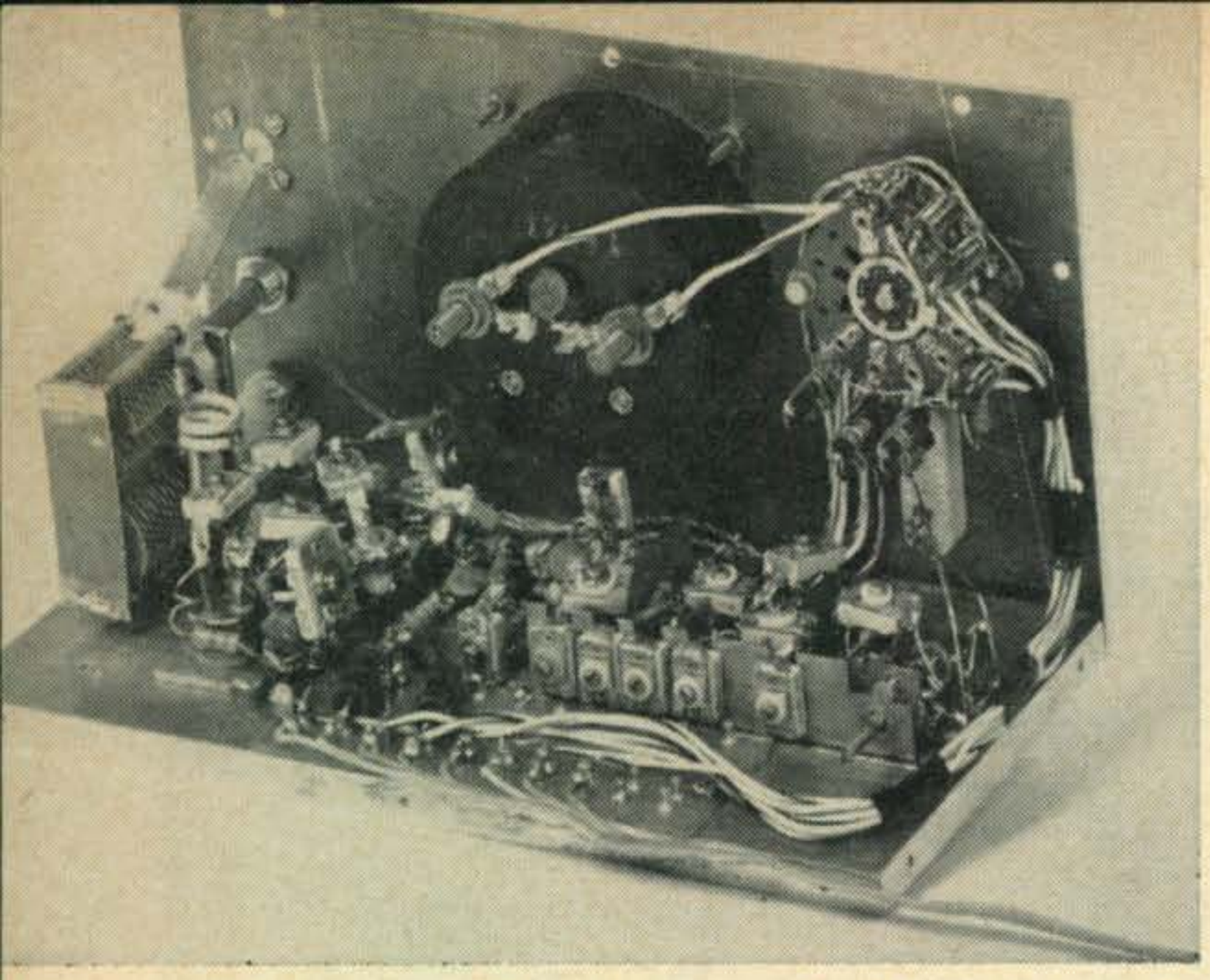


Rear view of the transistorized 144 mc transmitter shows the output tank on the left side. The two output transistors and the driver transistor are under the compression trimmers on the power amplifier sub-chassis along side the tank circuit. The exciter sub-chassis is on the right of the board.

Meter Functions and Ranges

A—Oscillator	— 50 ma.	E—2nd Amp.	—500 ma.
B—Tripler	— 50 ma.	F—Driver	—500 ma.
C—Doubler	— 50 ma.	G—Final #1	— 1 Amp.
D—1st Amp.	—100 ma.	H—Final #2	— 1 Amp.

45W. on 144 mc [*from page 75*]

connection at this frequency, such a balance control is desirable.

The two developmental transistors, PT657's, used in the final amplifier are operated in the grounded emitter configuration for maximum power gain. Here again series tuning of the emitter lead is used to ground the emitter effectively. Without this feature the power gain of the stage would be considerably lower. Another advantage of emitter tuning is that it decreases the interaction between input and output tuning usually encountered with transistor amplifiers. Output power is over 20 watts.

The final stage transistors are provided with forward bias to increase gain. In this stage forward biasing is necessary since the drive power available is not sufficient to drive the transistors into the optimum collector current range in Class C. Class C operation with reasonable power gain would be feasible with transistors of greater high frequency current gain.

The final output circuit is similar to that of the driver. Power from each transistor collector is coupled to the matching network through balancing capacitors C_3 and C_4. These capacitors compensate for the differing collector characteristics of the transistors. The coil tap on L_{29} and the the ratio of C_5 to C_6 is adjusted for optimum match to the 50 ohm load.

Construction

The transmitter described here was constructed in a breadboard fashion to find out what problems would be encountered in v.h.f. high power transistor circuit design. Generally, the problems encountered were the same as those in a vacuum tube transmitter operating at the same frequency, but they are modified by the fact that transistor circuit impedances are considerably lower than those encountered in a tube circuit.

One of the most critical problems is bypassing. The lower circuit impedances require bypass capacitors of very low impedance. The low impedance can be obtained by increasing the value of the capacitor, but the internal and external lead inductance of the capacitor must be kept at an absolute minimum. For example, the collector impedance of the output transistors is just over 60 ohms. Ceramic capacitors of 0.02 mf—with a capacitive reactance of approximately 0.06 ohms—are used to bypass the collector circuits. This value of reactance would normally provide adequate bypassing; however, the leads of some disc ceramic capacitors are insulated for an eighth of an inch or more within the ceramic coating before they contact the capacitor element. The few milli-microheneries of inductance in these leads may raise the total capacitor impedance to several ohms. The capacitor is then no longer an effective bypass.

Short leads have always been critical in v.h.f. circuits but are even more so in high powered transistor circuits. Parts should be physically oriented to minimize lead length, and should be connected together with short lengths of metal strap. In this regard the low cost mica compression trimmer is ideally suited to v.h.f. transistor circuitry. There is very little inductance in its internal construction and the terminals are broad metal tabs. Rarely are voltages encountered in transistor circuitry sufficient to rupture the mica insulation. Compression mica trimmers have the further advantage of low cost. Where lead inductance cannot be avoided series resonance can be used to advantage as illustrated earlier with the series resonance of the transistor emitter lead.

Neutralization

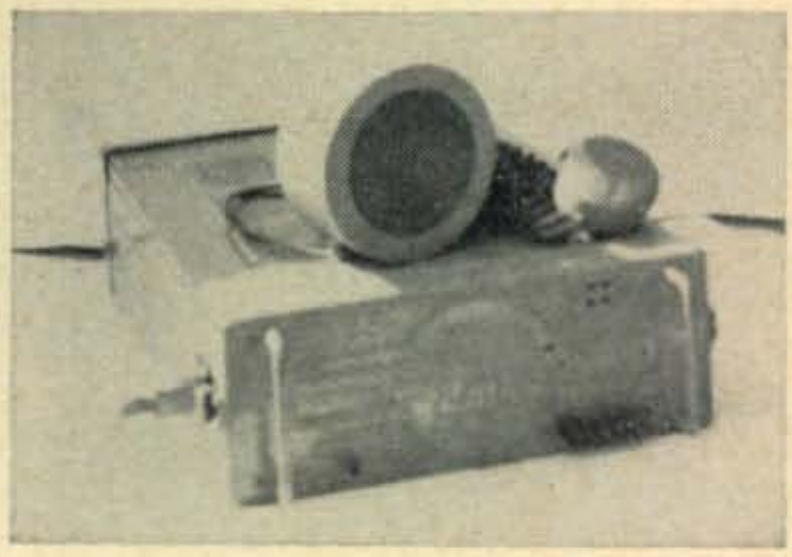
Parts placement and avoidance of feedback paths is just as critical in transistor amplifiers as it is in tube circuitry. Although capacitive feedback should be avoided, inductive feedback tends to be more critical in transistor amplifiers. With present transistors stable power amplifiers can be built without the need of neutralization. However, as high frequency transistor power gains improve it is expected that high gain, high frequency power amplifiers will require neutralization techniques.

Heat

Heat is a problem with high frequency, high power transistors just as it is with their low frequency counterparts. Similar thermal design is necessary. The transistors must be mounted directly on a heat sink capable of conducting away the heat generated within the transistor to prevent an excessive temperature rise. In the transmitter shown, the power transistors are mounted directly to the ⅜ inch aluminum base plate. The

420 Mc Transceivers!

Manufactured by Link for use in the 450-470 Mc commercial band. But it can easily be converted for use in the 420 Mc amateur band. These units contain two 6V or 12V vibrator-type power supplies (one for receive, one for transmit).



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12AX7—Speech Amplifier
6AL5—Modulation Limiter
12AT7—Crystal Oscillator & Modulator
6CL6—First Doubler
6CL6—First Tripler
5763—Second Doubler
5894A—Tripler Driver
5894A—Power Amplifier

Receiver Line-Up

6J4—RF Amplifier
6BH6—First Hi I.F. Amplifier
12AT7—Receiver Oscillator & Quadrupler
12AU7—First Doubler & Second Doubler
6AK5—Tripler
6BJ6—Second Hi I.F. Amp.
12AT7—Second Mixer & Int. Osc.
6BJ6—First Lo I.F. Amplifier
6BJ6—Second Lo I.F. Amplifier
6BJ6—Third Lo I.F. Amplifier
6BJ6—Fourth Lo I.F. Amplifier
6BH6—First Limiter
6BH6—Second Limiter
6AL5—Discriminator
6BH6—Noise Amplifier
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5894A tripler and final use tuned lines. All preceding stages are slug-tuned.

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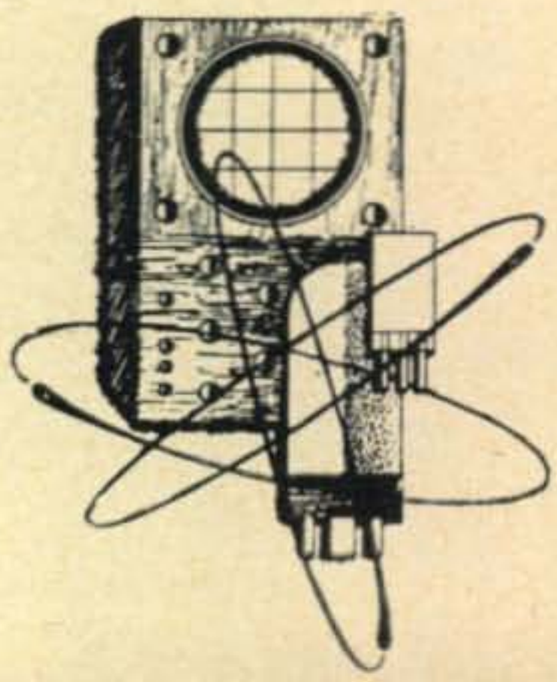

For further information, check number 66, on page 110

PT 657's are constructed so that the transistor element is electrically isolated from the case. This feature allows the transistor stud mount case to be screwed directly to the base plate. The SN103 collector is connected to the case requiring an insulator between the case and the base plate. This transistor is clamped to the base plate with a disc of beryllium oxide between the case and the base plate. Beryllium oxide is an electrical ınsulator but conducts heat readily thus providing a good thermal mount while insulating the transistor electrically. The transistor base plate runs fairly hot unless some external cooling is provided, such as a blower or the addition of fins. Even though transistors are capable of handling high power, they are very susceptible to burn out from overload and caution should be exercised.

The transmitter is constructed on a 4½" × 8½" × ⅜" aluminum base plate with a ⅛" aluminum panel 5" high. A cover made of perforated "do-it-yourself" aluminum enclosed the remaining sides of the transmitter.

This transmitter indicates the present state-of-the-art in v.h.f. transistor technology. The price of the transistors used are out of the reach of the average amateur ($100-200 range) but as in the past the price of these developmental transistors will drop considerably as their production increases. However, the techniques described are applicable to v.h.f. power amplifiers in general and can be used with the lower power devices now being used by some amateurs. By applying these techniques in lower powered circuits now, the amateur will be prepared for the big ones as they become more readily available. ■

Announcements [*from page 80*]

galore and food will be served. Those who have equipment for swap or sale should arrive early. Tickets will be on sale at the gate for $3.00 which will include chances at prizes and dinner. Inquiries should be directed to WA4KLU, 4 Blackstone Dr., Greenville, S.C.

California

The Fresno A.R.C., Inc., proudly announces their annual hamfest to be held May 16 at the Towne & Country Lodge in Fresno. Main prize will be a Swan s.s.b. transceiver. Tickets are $6.50 which includes banquet and must be postmarked no later than May 11 to be eligible for the pre-registration prize (a Drake 2-B receiver). Write to the club at P.O. Box 783, Fresno, California.

Washington

The Foundation for Amateur Radio, Inc., with headquarters in Washington, D.C., announces its intent to make the third award of the John Gore Memorial Scholarship for either graduate or undergraduate study, full or part time. The scholarship pays $250 for the academic year, and is subject to renewal. Licensed amateurs intending to make a career in electronics or related sciences may now apply for the academic year 1964-65. To be eligible, applicants must have completed one year in an accredited college or university and must be enrolled in a course of studies leading to a degree. They must also be radio amateurs holding a valid FCC license of at least a General class. Preference will be given to applicants from the area served by the Foundation although those living elsewhere are not excluded. Requests for application should be made not later than May 20, 1964, and should be addressed to: Chairman of Scholarship Award Committee, FAR, Inc., 7605 Westfield Drive, Bethesda 14, Maryland. The Founda-

[*Continued on page 94*]

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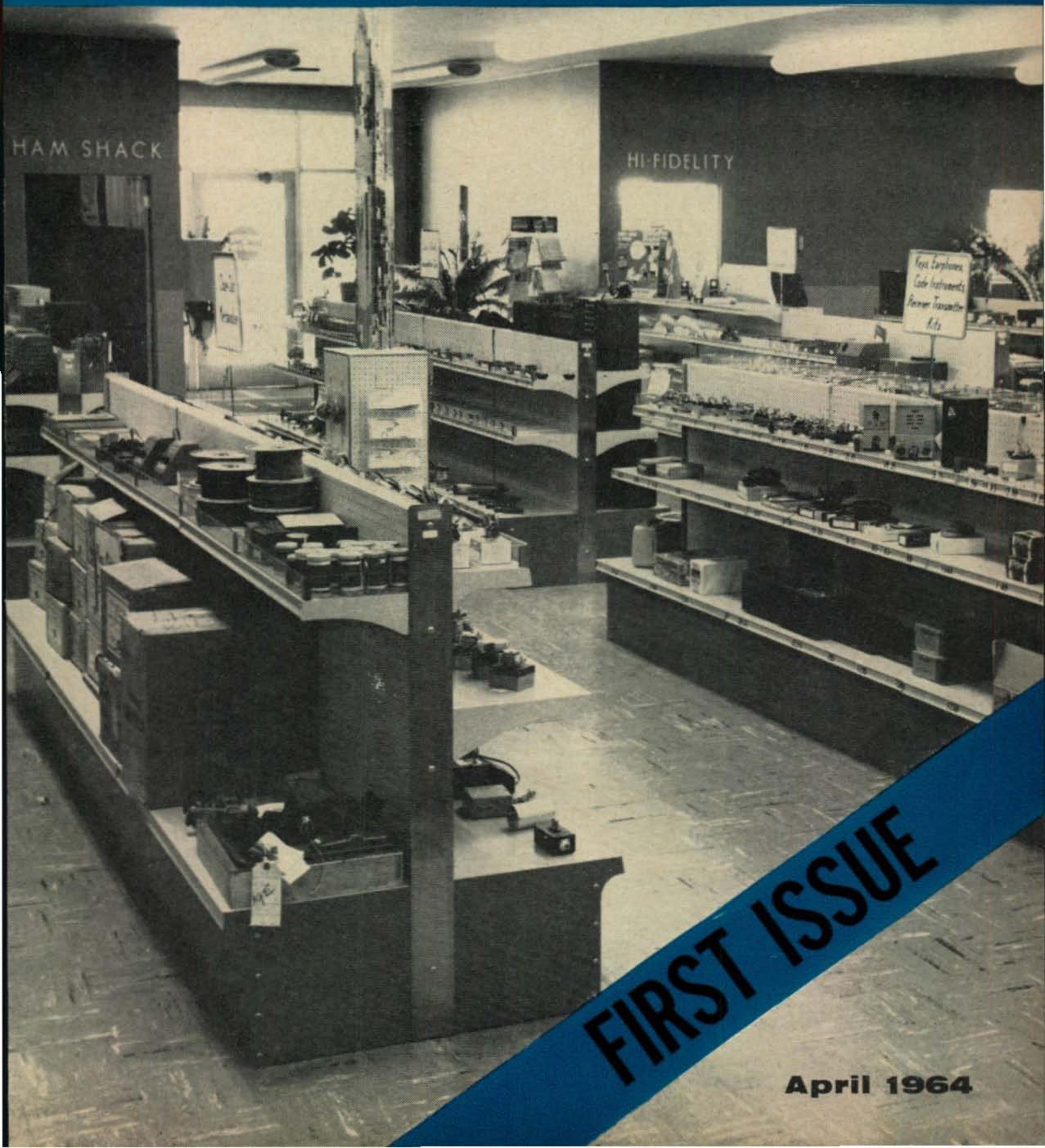

FIRST ISSUE

April 1964

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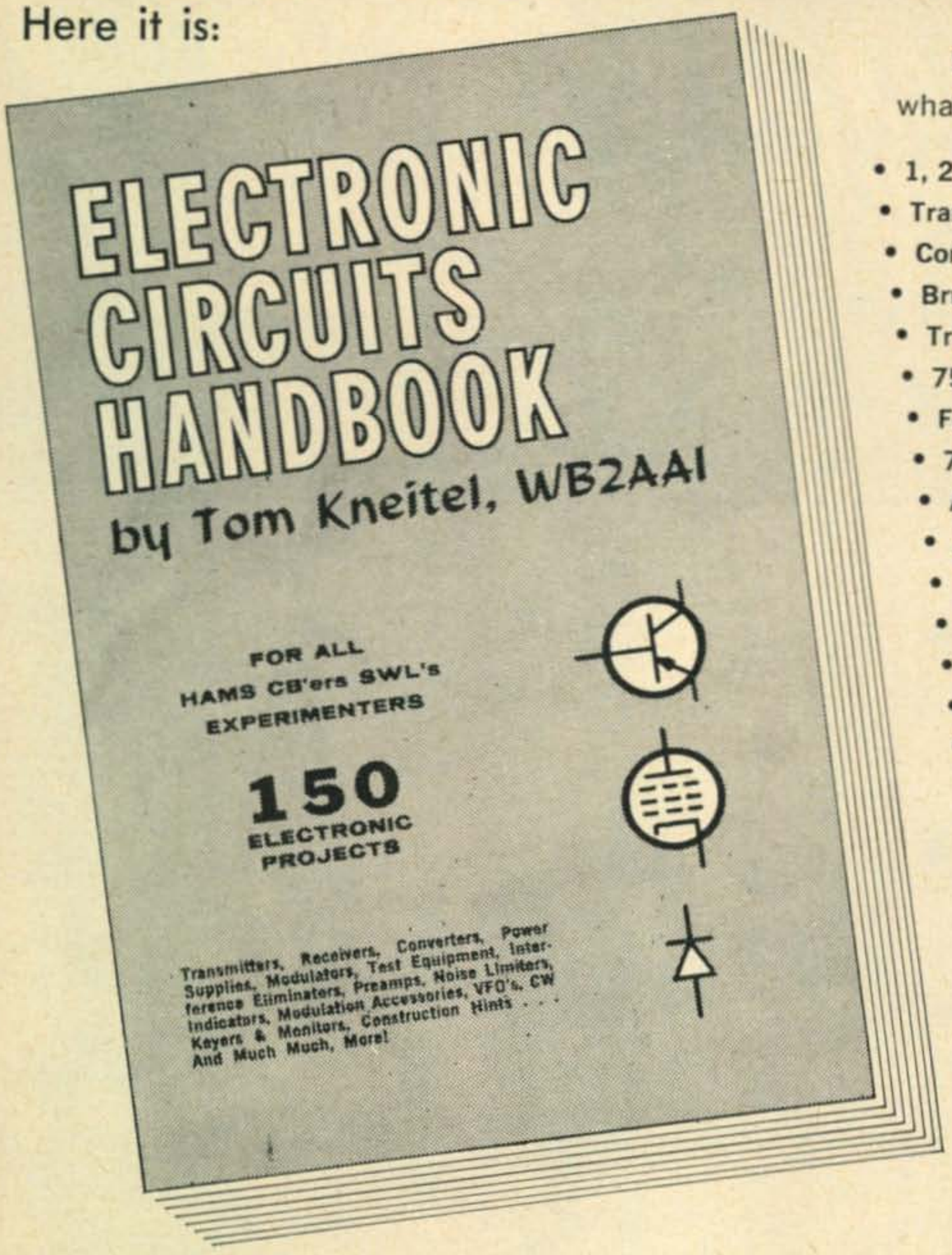

Here's just a sample of what you'll find in its chapters:

- 1, 2 and 3 tube transmitters
- Transmitting tube rejuvenator
- Comprehensive coil winding data
- Brute force power line filters
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- 750 watt linear amplifier circuit
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- Complete sub-miniature ham rig
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- A kilowatt final amplifier circuit
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- CPO to CW monitor conversion circuits
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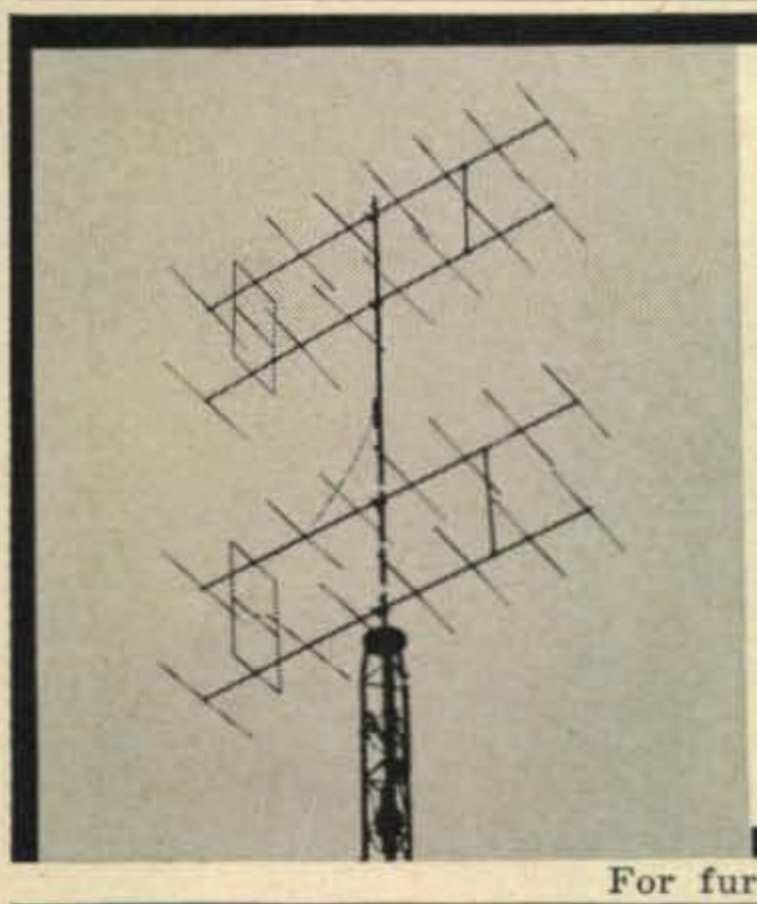

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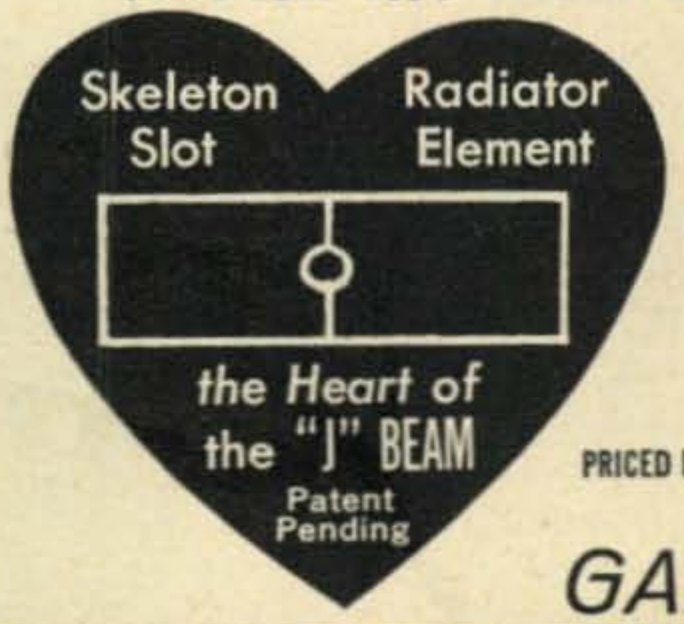

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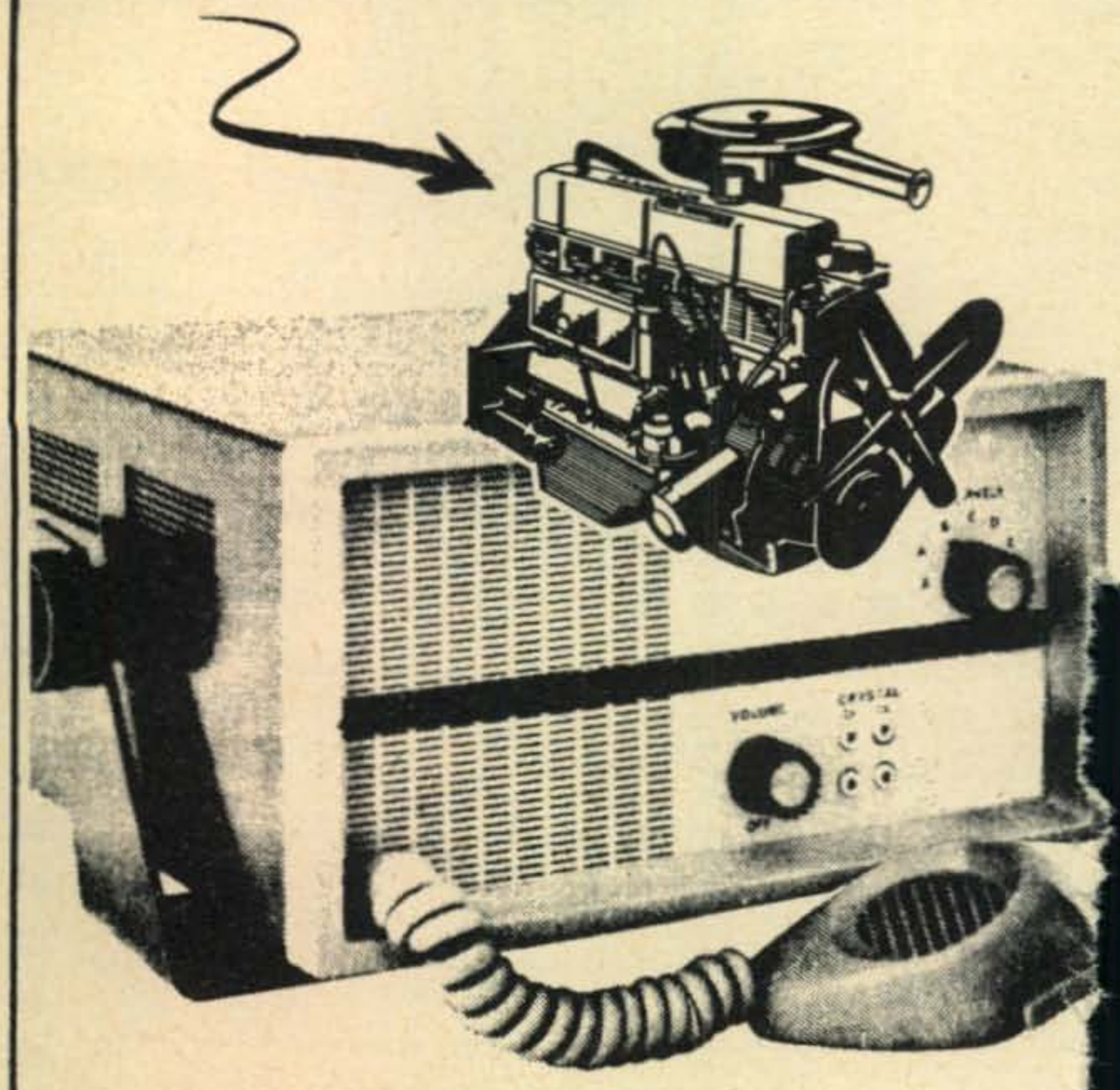

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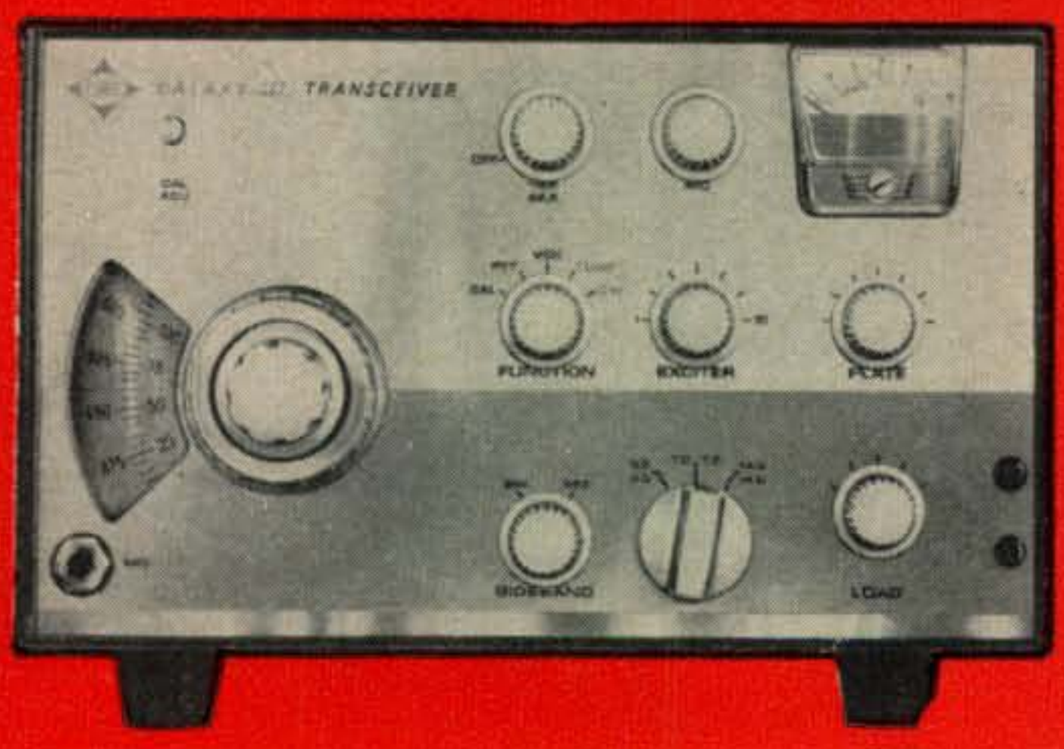

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For further information, check number 27, on page 110

Announcements [*from page 84*]

ation for Amateur Radio, Inc., is a non-profit organization devoted to the advancement of amateur radio. It is composed of trustees representing radio clubs in the Washington-Baltimore area.

New License Renewal Procedure
Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of

Amendment of Parts 1, 81, 83, 85, 87, 89, 91, 93, 97 and 99 of the Commission's rules to implement Public Laws 87-439 so as to permit early renewal of licenses in the Safety and Special Radio Services.

ORDER

By the Commission: Commissioners Bartley, Ford, and Loevinger absent.

At a session of the Federal Communications Commission held at its offices in Washington, D.C., on the 19th day of February, 1964;

The Commission having under consideration certain of its rults in Parts 1, 81, 83, 85, 87, 89, 91, 93, 97 and 99 which pertain to grants of renewal and/or renewal and modification of radio station licenses; and

IT APPEARING, That, Public Law 87-439, approved April 27, 1962, (76 Stat. 58) amending Section 307(*e*) of the Communications Act of 1934, as amended, authorizes the Commission to renew radio station licenses in the Safety and Special Radio Services more than 30 days prior to the expiration of the original license; and

IT FURTHER APPEARING, That the rules governing these services should be amended to implement Public Law 87-439; and

IT FURTHER APPEARING, That the amendments ordered herein are procedural in nature and would remove a restriction and hence the prior notice and effective date provisions of Section 4 of the Administrative Procedure Act do not apply; and

IT FURTHER APPEARING, That authority for adopting the amendments herein is found in Sections 4(*i*) and 303(*r*) of the Communications Act of 1934, as amended;

IT IS ORDERED, effective March 18, 1964, that Parts 1, 81, 83, 85, 87, 89, 91, 93, 97, and 99, are AMENDED as shown in the appendix attached hereto.

FEDERAL COMMUNICATIONS COMMISSION

BEN F. WAPLE
Secretary

APPENDIX

* * * * *

13. In Section 97.13, paragraph (*d*) is amended and a new paragraph (*e*) is added to read:

§97.13 Renewal or modification of amateur operator license.

* * * * *

(*d*) Application for renewal and/or modification (change of address, etc.) of an amateur operator license shall be submitted on FCC Form 610 and shall be accompanied by the applicant's license. Application for renewal of unexpired licenses must be made during the license term and should be filed during the last 60 days of such term. In any case in which the licensee has, in accordance with the provisions of this chapter, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(*e*) If a license is allowed to expire, application for renewal may be made during a period of grace of one year after the expiration date. During this one year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of its expiration. Application for renewal shall be submitted on FCC Form 610 and shall be accompanied by the applicant's expired license.

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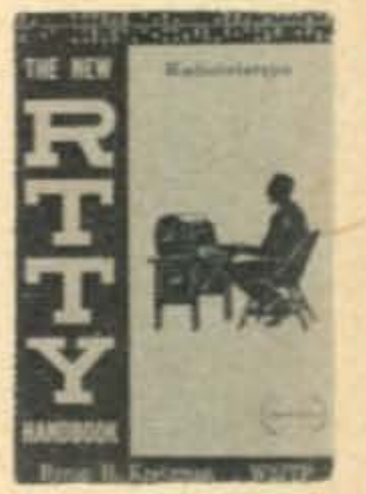

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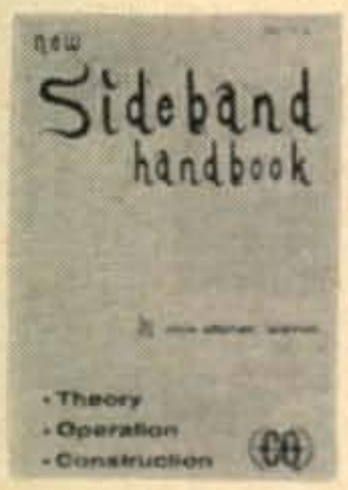

SIDEBAND HANDBOOK

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This new Mobile Handbook by Bill Orr, W6SAI, has been getting raves from top experienced mobile operators. Written for advanced, as well as beginning mobile operators, much of this information cannot be found anywhere else. This is NOT a collection of reprints.

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14. Section 97.47 is amended to read as follows:

§97.47 Renewal and/or modification of amateur station license.

(*a*) Application for renewal and/or modification (change of address, etc.) of any station license shall be submitted on FCC Form 610. In every case the application shall be accompanied by the applicant's license. Applications for renewal of unexpired licenses must be made during the license term and should be filed during the last 60 days of such term. In any case in which the licensee has, in accordance with the provisions of this chapter, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(*b*) If a license is allowed to expire, application for renewal may be made during a period of grace of one year after the expiration date. During this one year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of expiration. Applications shall be submitted on FCC Form 610 and shall be accompanied by the applicant's expired license.

* * * * *

What Makes The Ham Tick [*from page 50*]

This earnest desire to relate to fellow humans, to reach out a tentative finger to touch a man on the other side of the world and recognize he is like ourselves, lies behind the silly, bumbling QSOs you hear on the air. Amateur radio stands for human togetherness and reasonable co-existence at its imperfect best, and is a good example for the rest of the world to follow. You might think about this briefly next time you crank up the r.f. ■

Propagation [*from page 56*]

The *CQ* Propagation Charts contained in this month's column include predictions for short-skip openings between distances of 50 and 2,300 miles for May and June, as well as forecasts centered on Hawaii and Alaska. DX Propagation Charts for May appeared in last month's column. Instructions for the correct use of these Charts appear directly beneath the "Last Minute Forecast" at the beginning of this column.

73, George, W3ASK

Space [*from page 60*]

bell Lane, Menlo Park, California. A complete description of the station should be forwarded with the request.

It is hoped that many more stations will join the network in the near future so that test schedules can be established to pass news quickly to the Coordinators for rapid dissemination to local participants in the OSCAR program. To date, test schedules on 7 mc c.w. are being maintained on a weekly basis by W6ASH with KP4TIN, KC4USK, VK2EO, VR2DK, KG6AAY and W1AW. During the spring months it is expected that additional Coordinators will be appointed in other countries, and additional stations will be required for the OSCAR communications network. Schedules will be on a weekly basis prior

For further information, check number 42, on page 110

For further information, check number 43, on page 110

to launch, with W6ASH or W6EE transmitting general information bulletins at first, followed by specific launch information and tracking data as the "great-day" comes closer. Once OSCAR III is in orbit, schedules will be maintained on a more frequent basis.

The remaining problem of international third-party traffic restriction is still a knotty one. It is hoped that some sort of temporary permission may be granted by the various administrations for handling OSCAR III third-party traffic, as was done during the orbital life of OSCAR II.

As more information on the OSCAR communications network becomes available, it will be reported in this column. It is now reliably estimated that the launch of OSCAR III may occur during late summer or early fall. Remember, OSCAR III will be an active repeater, with a 50 kc bandwidth, "listening" centered on 144.1 mc, and "transmitting" centered at 145.9 mc. The satellite will carry at least one, and possibly two beacon transmitters that will be located near each edge of the transmitting passband. The satellite will be battery-powered, with a life expectancy of about 3 weeks, and is designed to repeat amateur voice, c.w. and f.m. transmissions on the internationally allocated amateur 2 meter band.

73, George, W3ASK

Toots [*from page 48*]

with one small capacitor connected permanently in the circuit and a switch arranged to add other values in parallel.

A switch, S_2, is included so that TOOTS can be used for code practice without disturbing the other station equipment. When this switch is open, only the sidetone generator is controlled by the sending key.

If the antenna relay in use in the station does not have an auxiliary pair of contacts to connect in series with the transmitting keying circuit, and many coax antenna relays are not so equipped, an additional spst 110 v.a.c. relay can be installed to provide the auxiliary key circuit contacts.

To minimize the noise of the relays, they can be mounted by bolting them through rubber grommets installed in the metal chassis.

A 110 volt one inch pilot lamp with a red jewel is mounted in TOOTS' panel to indicate when the transmitter is on the air, and it is controlled by relay K_1. An external "ON THE AIR" lighted sign can also be connected across relay K_2.

Any type of power supply providing 100 to 150 volts d.c. at 50 ma and 6.3 volts a.c. is satisfactory for TOOTS. Figure 1 shows a typical power supply circuit. It should be noted that the power supply must have a grounded positive terminal, as this is necessary to place the sending key and microphone switch at ground potential.

There are no tricks or complications in wiring this extraordinarily useful piece of equipment; and most of the components are not critical and can be found in the junk box. ■

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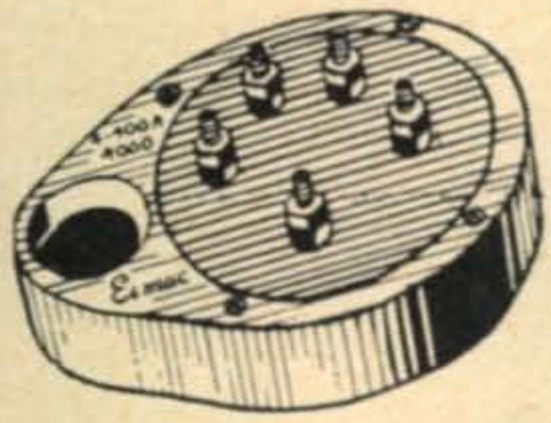

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Diversity Reception [*from page 46*]

so that the two sets stay in synchronism for long periods when tuned to an s.s.b. signal or an a.m. signal in the s.s.b. mode.

In addition to the usefulness of diversity for long-haul amateur reception, it is also very useful for short-wave listening. The SWL and tape recording enthusiast, who likes to record many of the good musical shows from the BBC or other overseas stations will find it greatly reduces fading and provides much better audio quality than reception with one receiver on one antenna. On the BBC it is often possible to use frequency diversity in addition to the polarization diversity, when both the 6 and 7 mc signals are coming through. With the 51J-2's it is also possible to add the element of sideband diversity. On a.m. the two sidebands often fade separately, after several ionospheric reflections. Each receiver is equipped with a 3 kc half-lattice crystal filter on the first crystal switch position, like that originally installed in my old Super-Pro[3], and I sometimes copy one sideband on one receiver and the opposite sideband on the other receiver. This feature is especially useful in the case of interference to one sideband. This technique is used by the Voice of America at their overseas relay stations in receiving the programs from their U. S. transmitters for relay broadcasting. One sideband is often interfered with or jammed.

It has been my purpose here to direct attention to the practical aspects of diversity receiving as applied to the amateur and short-wave listener's needs. For the theoretical aspects, such as the results of diversity on error rate of copy, or improved signal-to-noise ratio, or improvement in percent usable time on circuit, one should consult the many excellent papers that have been written on the subject. As early as 1931 RCAC was using diversity[4,5]. It is not new, by any means. There have been more recent studies directed at improvements of military communications which bring out the degree of increase in usable circuit time to be expected from various types of diversity.[6,7,8] Applications to tropo scatter circuits have also been covered in the literature[9], and will be of interest to amateurs involved in u.h.f., microwave, and moon bounce work. Various aspects of combining have been investigated. There is an excellent paper on base-

[3]Lee, P. H., "Save Your Super-Pro for Sideband," *CQ*, Sept., 1958, p. 52.
[4]Beverage, H. H., Peterson, H. O., "Diversity Receiving Systems of RCA Communications, Inc., for Radiotelegraphy," *Proc. of IRE*, April 1931.
[5]Beverage, H. H., Peterson, H. O., Moore, J. B., "Diversity Telephone Receiving System of RCA Communications, Inc.," *Proc. of IRE*, April 1931.
[6]Van Wambeck and Ross, "Performance of Diversity Receiving Systems," *Proc. of IRE*, March 1951.
[7]Glasser and Van Wambeck, "Experimental Evaluation of Diversity Receiving Systems," *Proc. of IRE*, March 1951.
[8]Lacy, Acker and Glaser, "Performance of Space and Frequency Diversity Receiving Systems," *IRE Convention Record 1953*, Part 2.
[9]Long and Weeks, "Quadruple Diversity Tropo Scatter Systems," *IRE Transactions on Comm. Systems*, Dec. 1957.

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☐ Check for latest reconditioned bulletin.

For further information, check number 62, on page 110

band combining[10]. The effect of various antenna configurations (polarization diversity) on u.h.f. shipboard communications has been studied[11]. In addition to the wealth of information contained in the various IRE publications which are available, there are, from time to time, articles dealing with this and other aspects of long distance radio communications in the British "Post Office Electrical Engineers' Journal" and "Post Office Telecommunications Journal", as well as the Marconi Company's "Point-to-Point Telecommunications". The IT&T magazine "Electrical Communication" is another fertile source of information. The serious minded amateur and engineer-amateur who wishes to keep abreast of latest developments would do well to subscribe to these publications. Much can be found of interest and application to our amateur DX work. ■

[10]Adams, "Simplified Baseband Diversity Combiner," *IRE Transactions on Comm. Systems*, Dec. 1960.
[11]Altman and Nail, "UHF Diversity Systems for Long Range Ship-to-Air Communications," IRE 1954 Convention Record, Part 8.

Ranger and SB-10 [*from page 42*]

none while the 6146 plate current should be dipped at 140 to 150 ma. If there is any grid current reduce the drive further.

Repeak the SB-10 controls and the Ranger GRID TUNING for maximum output on the SB-10 meter. Now, null the carrier on the SB-10 and check the 6146 plate current; it should drop to the idling current previously set. Connect the microphone to the SB-10. With the SB-10 still in the MANUAL position, slowly advance the MIC. GAIN control from full ccw while talking into the microphone. An upswing on the SB-10 meter should be apparent as well as on the 6146 plate current meter. The voice peaks should produce currents of 100-125 ma while the grid of the 6146 should draw practically no current, just a tiny wiggle at the low end of the scale. If grid current is flowing, back off on the DRIVE control. Use only enough Mic. Gain to produce *peaks* of 100-125 ma.

General

The SB-10 is operated from a separate power supply as recommended by Heath as it would load the Ranger supply down to a dangerous point.

Some optional modifications for the Ranger concern its power supply and provide better dynamic stability. Replace the 10 mf, 750 volt filter with two 40 mf, 450 volt units placed in series. These may be mounted by replacing the original bolts holding the choke in place, with long screws and spacers. Use a routine electrolytic clamp but insulate it with several layers of tape.

A second possible modification is to replace the 5R4 and 6AX4 rectifiers with silicon rectifiers. This provides cooler operation and a somewhat increased B plus output.

The Ranger v.f.o. is acceptably stable after

warm up. The unit converted had some play in the planetary drive that lead to difficulty in zero-beating. Johnson makes a planetary drive tightner that cured the problem.

Operation of the combination proved to be very nice. The rig will run its normal 65 watts of Ranger quality a.m., 75 watts c.w. and 75 to 90 watts p.e.p. of s.s.b. So here it is fellows, a quick and inexpensive way to go s.s.b. I wish to thank John, WØAQZ, for his help and the use of his Ranger. ■

C.W. Paine Killer [*from page 34*]

Operating With The Filter

When using this filter system you will find that you will have to be very careful when tuning the receiver. Otherwise you will go right past the station you want and not even know it is there. Tune in the station you want to copy with the SPOTTING switch in the position that lets you hear the signal from the receiver speaker. Adjust the pitch from the receiver to around 900 cycles. Advance the R.F. and AUDIO controls until the relay is triggered. Use as little r.f. gain as possible. You will hear the signals from both speakers. Now operate the SPOTTING switch to disconnect the receiver speaker. You will be surprised at how quiet the band seems to be. Only the station you want to copy comes through. If there are no stations producing a beat note higher in frequency in the receiver, the filter switch can be operated in the OUT position. You will still have attenuation of the low frequencies.

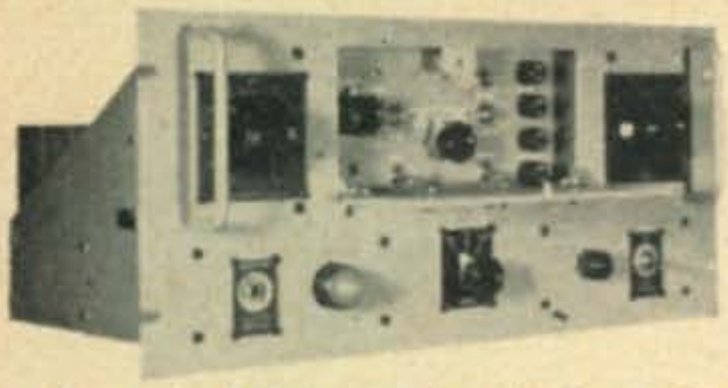
It will seldom be necessary to use the filters already in the receiver. However, if you have a lot of junk coming in with the receiver set in BROAD condition, tighten it up a bit. I have found that a 3 kc wide setting is tight enough most of the time. It stands to reason that the less junk that the filter has to get rid of, the better it will work. It will take a few sessions of operating with this filter to get the most out of it.

This device has been used with several different receivers, some of only fair quality, with uniformly good results. Just have patience and really learn to use it. A few hours of on the air, operating with it, will teach you more than could be written in a big book.

If you have a good c.w. monitor in the shack it may not be necessary to build the oscillator or power supply sections. Power of a few milliampers at 250 volts and 300 mils at 6.3 v.a.c. can usually be borrowed from the accessory terminals on the receiver. Be sure to wire the 12AU7A for 6.3 volts when using the receiver power source. I have had a lot of pleasure using this device in my own station and believe that you will too. Be sure to use the indicated values, as some are quite critical.

The power supply shown in fig. 1 is a transformerless type of voltage doubler and a shock hazard exists. Note that care is taken to insulate and isolate both input jacks and it would also be wise to wire all B minus returns to a bus bar floating above the chassis. ■

TELETYPE
REGENERATIVE REPEATER



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U. S. Gov't Surplus

- Accepts teletype signals in audio (on/off) form or in DC from a loop (polar or neutral) having up to **45% bias distortion** and regenerates them electronically to perfect signals.
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For further information, check number 57, on page 110

CONVERTER SALE

New model series 300 with 3 VHF transistors, crystal, and more than 30 high quality parts. Carefully assembled and tested. Measures only 3" x 2¼" x 2". Low noise and better than 1 microvolt sensitivity. Made in USA and guaranteed. Available in the following models for 12 volts DC:

Model	Input mc.	Output mc.	Price
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300-C	50-54	14-18	$10.95 ppd.
300-D	144-148	50-54	$12.95 ppd.
300-E	144-145	.6-1.6	$12.95 ppd.
300-F	144-146	28-30	$12.95 ppd.
300-G	14.0-14.35	1.0-1.35	$10.95 ppd.
300-H	5.0 (WWV)	1.0	$10.95 ppd.

300-X Choice of 1 input freq & one output freq between .6 & 160 mc..... $14.95 ppd.

Note: All above converters have a tuned R.F. Stage.

All above converters are supplied with Motorola type connectors. For two SO-239 connectors instead, add 75c. N.Y.C. residents add 4% sales tax.

Order now while prices are still low.

VANGUARD ELECTRONIC LABS Dept. CQ-5
190-48—99th Ave. Hollis 23, N. Y.

For further information, check number 58, on page 110

Ham Shop

Rates for the Ham Shop of 5¢ per word for advertising which in our opinion, is non-commercial in nature. A charge of 25¢ per word is made to all commercial advertisers or organizations. Since we do not bill for Ham Shop advertising, full remittance **must** accompany all orders.

Closing date is the 15th of the 2nd month preceding date of publication. Your copy should be typewritten, double spaced on one side of the page only.

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QSL's? WPE's? CB's? Finest samples 25¢. De-Luxe 35¢. (refunded). Sackers, W8DED, Holland, Michigan.

QSLs At last! Something new in QSL cards! All original designs. Send 25¢ for samples. Yarsco Box 307, Yorktown Heights 2, N.Y.

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QSLs large selection including photos, rainbows, cuts, etc. Fast service. Samples 25¢, includes beautiful 4-inch call letters for your shack. Ray, K7HLR, Box 1176, Twin Falls, Idaho.

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CREATE a QSL with a Sampler Instruction Kit, 25¢. Cards $1.50 up per 100. Samco, Box 203 Wynantskill, N.Y. 12198.

Q-STAMPS Now $1.50! Postage stamp size photographs for QSL's! 50 large or 100 small, $1.50 per gummed-backed, perforated sheet. Free Samples. Q-Stamps, Box 149, Dept. 4A, Gary, Indiana. 46401.

QSL's Samples 25¢. Rubber Stamps; Name, Call, Address, $1.55. Harry Sims, 3227 Missouri Avenue, St. Louis, Mo. 63118.

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QSL's 100/$4.00 High gloss, three color. Free samples, quick service. B&R Printing, Box 8711, Orlando, Fla.

QSL's, CB, WPE samples 10¢. Nicholas & Son Printery, P.O. Box 11184, Phoenix, Arizona. 85017.

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QSL's-SWL's or what have you. You name it and we will do it for you as you wish. Expert art work at nominal cost, enough said? R. McGee, 6258-103rd St., Jacksonville, Fla. 32210.

PICTURE of yourself, home, equipment, etc., on QSL cards, made from your photograph. 250—$7.50 or 500—$10.00 postpaid. Samples free. Write to Picture Cards, 129 Copeland, LaCrosse, Wis.

QSLs SWLs XYL-OMs (Sample assortment approximately 9¾¢) covering designing, planning, printing, arranging, mailing, eye-catching comic, sedate, fantabulous. DX-attracting. Protopay, snazzy, unparagoned cards. (Wow!) Rogers, KØAAB, 961 Arcade St., St. Paul 6, Minn.

QSLs free samples. Fast service. Bolles, 7701 Tisdale, Austin, Texas.

RUSPRINT QSLs—SWLs 100 2-color glossy $3 postpaid. QSO file cards $1 per 100. Rusprint Box 7507, Kansas City, Mo. 64416.

QSL's 3-color glossy. 100 $4.50. Rutgers Vari-typing Service. Free Samples, Thomas Street, Riegel Ridge, Milford, N. J.

CALL CARDS Badges, decals, goodies, illustrated literature with samples 25¢. Errol Engraving Att: K1VRO, Westfield, Mass.

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QSL CARDS $2.50 per 100 in three colors. Samples and catalog free. Garth, Box 51C, Jutland, New Jersey.

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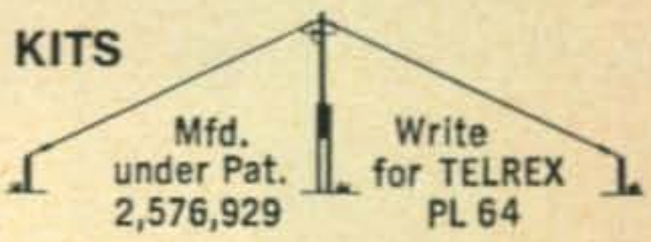
*Kit comprises, encapsulated, "Balun," copperweld, insulators, plus installation and adjustment instructions for any Mono-band 80 thru 10 Meters. Also available 2, 3, 4, 5 Band Models.



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For further information, check number 59, on page 110

BULLETIN BOARDS for QSL cards. Now tack your cards on cork tack boards. These boards are trimmed in aluminum and come in all sizes and colors. Cork samples are 25¢. Robert Williamson K2UWM, 124-37th Street, Union City, New Jersey.

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G-76 with a.c. p.s. best offer over $200. SX-71 $100. Complete all band mobile $100. Supersix, Superceiver, TBS-50D, Heath vfo, 12v genemotor power supplies, 25 watt modulator, cheap. W8DRV, 7716 Big Creek, Cleveland, Ohio, 44130.

EXCELLENT KWS-1 and 75A-4 with three filters and speaker. All for $1100.00. cash and carry. K4UMC, 107 Chatham Lane, Oak Ridge, Tennessee.

WANTED Precision Royal Scintillator and preamplifier also Esterline Angus Recorder 0-1 ma. Will pay cash or trade new amateur equipment. W5DON, Bryan Edwards 2430-33 St., Lubbock, Texas.

RTTY gear for sale. Write for list. 88 or 44 Mh Toroids. Five for $1.75 postpaid. Elliott Buchanan, W6VPC, 1067 Mandana Blvd., Oakland, Calif. 94610.

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NEW YORK area hams—Sell your used gear for cash through Amatronics PPA Service. We have the customers. See page 87.

COMMUNICATIONS teletype, unusual surplus bargains. Free flyer, MDC, 923 W. Schiller, Phila. 40, Pa.

ANTENNA tuning unit, brand new $3.00 postpaid (cost Navy $85.00). MDC, 923 W. Schiller, Phila., 40, Pa.

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BUY used equipment with confidence. See Amatronics ad page 87.

FOR SALE Complete instructions including 28 page booklet and 22" × 36" schematic for converting the ART-13 transmitter to a.m. and s.s.b. Satisfaction guaranteed. $2.50. Sam Appleton, 501 No. Maxwell St., Tulia, Texas.

FOR SALE New and used CB and 2-way F.M. radio equipment. Send for list. Dealer inquiry invited. Becom Co., Seminary Heights, Weatherford, Texas. 76086. 817 LY 4-5172.

FOR SALE: Heavy duty 80 foot tower, 20 foot sections, 30 inch sides, galvanized, $200. Larry Pensel, WØUST, Guttenberg, Iowa.

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CW AUDIO FILTERS Excellent skirt selectivity, sharp adjustable band pass. Prices start at $6.95. Write for free information. Dept. 2, T. W. Holden, 301 West 16 Place, Chicago Heights, Illinois.

WANTED: Teletype equipment, Collins R-390A/URR, 51J-3 R-388/URR. Cash or trade for new amateur equipment. Alltronics-Howard Co. Box 19, Boston, Mass. 02101 (Tel: 617 742-0048).

SWAP OR SELL: Like new GPR-90 new B&W model 370 ssb receiving adapter, DB-23 preselector, Dow-Key relay. Desire linear amplifier, 6 meter transceiver, or make offer. Ron Roche, 13 Anne Park, Sumter, S.C.

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CODE PRACTICE OSCILLATOR Tiny two-transistor unit gives clean, stable audio tone. Doubles as keying monitor. Just connect batter, speaker and key, $2.95 postpaid. Communications Specialties, Box D, 210 San Lorenze, Pomona, California.

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WANTED: Commercial, military, all types, ARC, ARN, ARM, GRC, PRC, URR, URM, TS, 618S-T, 51R, 51X, APN, others . . . Ritco, P.O. Box 156, Annandale, Va.

SX-71 Hallicrafters, double conversion, general coverage plus 6 meters, very good. $85. f.o.b. Ray Kesselring, 111 Fallstaff Road, Rochester, New York 14609.

FOR SALE: Complete 6m ssb station, 20A $90; h.b. het. unit $15; driver $5; elec. reg. pwr. sup. $15; 1 kw linear $50 (as per Nov, '61 73), 2500 v. supply $75; Screen & Bias sup. $35; 2 MBF's $40 ea. W. Cronkhite, 1250 Cresthaven Dr., Pasadena, Cal., 91105.

FOR SALE: Hammarlund SP600JX10. Serial 6009. Good condition $395. Harry Pearson 202 Jamesville Rd., DeWitt, New York.

SELL: Kilowatt linear amplifier, custom deluxe, push-pull 250TH TVI-suppressed final. Will easily deliver 2000 watts p.e.p. input ssb; 1000 watts c.w.; 1000 watts am linear. Fully metered and 2" rf analyzer scale, 160 thru 10 meters. Complete with deluxe 6 foot commercial rack. Extra pair 250TH's included all for $285. Fully guaranteed. Paul W. Brunk, RT. 6, Harrisonburg, Va., Tel: 434-4007.

SELL: Johnson Signal Sentry $12. W2EQS.

SELL: SX-101 Mark III excellent condx, like new, $189. W2ACC, Horace Brokaw, Neshanic Station, N.J.

WANTED: PP-109/GR. 12 vdc power supply for RT-68/GRC. State price and condition or will swap. T. H. Scamardo, 312 Trant, Bryan, Texas.

SX-111 RECEIVER mint condition, speaker, manual, $170; DX-20, spotless, manual, $20; 4-1000A deluxe linear kit, write. cleaning shack, stamp for list of bargains. WØLWZ 1030 So. Dudley, Denver, Colorado 80226.

SELL: Complete antenna system including the following: 40' EZ-Way crank-up crank-over tower with wonder ground post mount model No. RBS40G, Galvanized, at $225, TH-4 Hi-Gain Thunderbird triband beams $90, Ham-M rotator with indicator $90; balun for TH-4 $10, and 200' control cable at $10. All like new and perfect for $400 f.o.b. Pittsburgh. K3MVP, 8258 Brittany Place, Pittsburgh, Pa., 15237 or phone 366-0277.

SELL: 6 mo. old, Heath 6 m Shawnee. Factory aligned plus all spares and inst. book. Also 6 mo. old Hy-Gain halo. Both for $175. 860 14th, apt #4, Beaumont, Texas.

COLLINS complete station, 75S-1 with Waters Q-multiplier/notch filter, matching speaker $350; 32S-1 wih 516F-2 power supply, $495; 30L-1 linear with 110v or 220v tap $450; TH-4 Hy-Gain 4 element tri-bander, $75; Purchased new and kept in air conditioned quarters. Absolutely perfect, mint condition. Will bear most scrupulous inspection. Late "Proof of Performance" sheet on 32S-1 from Collins. K9DMG Perry Mowery, 21 Waibel Rd., Bartonville, Illinois. Phone 697-6597.

L&N GALVANOMETER wanted, type PI-24-C. Eico 320 for sale $13. Lucey, 725½ Porter, Glendale, California.

PAIR 813's G.G. linear amplifier with heavy duty power supply, bandswitching. Further details, Lou, Box 244, Lexington, N.C.

SWAP Back copies CQ for QST. Exchange lists. W2DTE.

CQ FOR SALE: 1945 to 1962 short one each, 53, 56, 62, $60, or offer, FOB Denver. WØJRN, 5985 South Milwaukee Way, Littleton, Colorado 80120.

JOHNSON Invader 2000 recently returned from Johnson with all modifications and adjustments, clean, new condition, $795. All replies aswered. W1TF, Elmer Turner, 2 Virginia Circle, Reading, Mass.

COLLINS Estate of W3KPP; 32S-1 and 516F2, $400; 75S-1, $300; 30S-1, $850; new 4CX1000A, $125; all $1600; HT-32, $350; HT-33A, $475; Both $800; G-76 with ac and dc supplies, $300. W3VRZ, Beaver Falls, Pa. 412-843-3144.

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SELL: TR-3 with solid state supplies. No time to operate. First $550. Prepaid. W4DJJ. 1101 Retlaw St., N.W., Huntsville, Alabama.

METER MATCHING PROBLEM. Need General Electric model DO-71 with 0-1 ma movement. Ed Ray W1WWN/1, USNRS Cutler, East Machias, Maine.

WANTED: Navy surplus Link model 886 remote control. Ralph Villers, Box One, Steubenville, Ohio.

KWM-2 exc. condition, $750; noise blanker, $60; mobile mount, $60; 516E1 d.c. supply, $145; KWM-1, $325; Mobile mount, $35; a.c. supply, $100. W7HCJ, E.6904 Sprague Ave., Spokane, Wash.

SELLING 2000 watt p.e.p. table top linear amplifier. From special lot by Hunter Mfg. Co. Uses four UE 572As in grounded grid. Self contained solid state power supply. Operates 80-40-20 meters. Brand new with factory warranty. $325. KØCKX, 511 5th Ave., Coralville, Iowa. 52241.

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DX-100B Not a scratch. Professionally wired, $125. Ben Finnell, 4209 N. Ridgeway Ave., Chicago, Ill., 60618.

SALE: Central 20A, vfo, Millen amplifier, Central slicer, Heath Twoer. K2HFL, Arthur Lawler, 507 Colonia Blvd., Colonia, N.J.

SELL Gonset Communicator 4, 2 meter xcvr. Good condition. WB2IKI, Albermarle Road, Brooklyn, New York, 11226.

FOR SALE: Heathkit Hybrid prone patch, model HD-19. $25. Excellent condition. Used ½ hour. WAØCZS, Route 1, Box 59 Arvilla. N. Dakota.

FOR SALE: Viking II vfo. NC-270 almost new. Viking mobile, 12 or 6 v. supply, vfo, 10M5 mike, Dow relay, Master whip, 75m coil, PMR 6A rec. (12 volt). VE3DQP, Box 2411 Postal Stn. "D" Ottawa, Ont., Canada.

FOR SALE: Viking Invader 360. Hammarlund HQ-170C with matching speaker, $225.00. Both in original cartons with manuals and in new condition. E. Miles, W3NNQ, 350 W. Main St., Kutztown, Pa.

SPECTRUM ANALYZERS: Fit your receiver. Brochure. Halco, Box 283, Saxonville, Mass.

WANTED: BC-221 or LM less book, xtal and power supply but otherwise complete in case. Use of manual for Lolar Exameter, model c.f. Will return manual within five days. State prices. George A. Masden, WØLPW, 717 Lincoln, Mt. Pleasant, Iowa.

75A3, crystal calibrator, speaker, product detector, two filters, $300. TG10 keyer with 5 Army tape code lessons, $20. Apt #1, 424 W. Prairie, Decatur, Ill.

JOHNSON DESK KILOWATT—new side band modification kit—Ranger PTT sequence keying—factory wired—Kilowatt Match Box swr bridge—new tubes—extra spares 4—400A's—810's—872 A's—not surplus—complete cables ready to operate—condition like new—$900.00 cash. Ted Brix—5573 No. Van Ness Blvd, Fresno 5, California.

TOROID RTTY KIT Mark-Space discriminator and bandpass filters. Includes 4-88 mh and 1-44 mh uncased, like new toroids; information sheet, mounting hardware and six mylar capacitors. $5.00 Postpaid. Toroids: Specify 88 or 44, less capacitors, $1.00 ea. 5/$4.00 Postpaid. KCM Products, Box 88, Milwaukee 13, Wis.

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PHOTOSTAMPS 100—$1.50, Brochure, samples 10¢. Hank W8NLW, 443 Euclid, Akron, Ohio.

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TOP QUALITY QSL's. 500—$6.50, 1000—$9.50 Postpaid. Send dime for brochure and samples. Adcock Printing, Marion, N. C.

QCWA If licensed 25 or more years you are eligible for membership in Quarter Century Wireless Association. Over 3,300 current members. Write Executive Secretary W2ZM for information and application.

Dealers
See Page 86.

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NCXA	AC Supply	110.00	3.79
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STAY ON THE AIR PLAN—I will give you a good trade-in allowance for your old equipment, and you can use it until you get my shipment. Then send me your trade-in.

AMATEUR ELECTRONIC SUPPLY

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MILWAUKEE 8, WISCONSIN • WEst 3-3262
VISIT OR PHONE—do not write—our branch stores (they have no mail order facilities)

CHICAGO 31, ILL.
6450 Milwaukee Ave.
ROdney 3-1030

ORLANDO, FLORIDA
23 Azalea Park Sh. Center
Phone 227-8231

IMPORTANT! Be sure to send all mail orders and inquiries to MILWAUKEE STORE Dept.
3832 WEST LISBON AVENUE, MILWAUKEE 8, WISC.

Ship me .....
I enclose $.....; I will pay the balance
☐ C.O.D. ☐ 1 year ☐ 2 years ☐ 3 years
I want to buy ..... and want to trade
..... What's your deal?
Name .....
Address .....
City ..... Zone ..... State .....
☐ Send reconditioned equipment and sale bulletin

For further information, check number 63, on page 110

For further information, check number 61, on page 110

READER SERVICE

CQ Magazine, Dept. RS

300 WEST 43rd STREET Void after
New York 36, N. Y. May 24, 1964

Please send me more information on your ads in the May 1964 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	A
11	12	13	14	15	16	17	18	19	20	B
21	22	23	24	25	26	27	28	29	30	C
31	32	33	34	35	36	37	38	39	40	D
41	42	43	44	45	46	47	48	49	50	E
51	52	53	54	55	56	57	58	59	60	
61	62	63	64	65	66	67	68	69	70	
71	72	73	74	75	76	77	78	79	80	

Total Inquiries ☐

NAME_____
(Please Print)

ADDRESS_____

CITY_____

ZONE____ STATE_____

advertisers index

CHICAGO AREA HAMS

Make A.E.S. Your

COLLINS Headquarters

"DOC", W9HJS and this **OPERATING COLLINS DISPLAY** are waiting for you at our **CHICAGO STORE.** Stop in for **FREE** Demonstration.

STORE HOURS

Mon., Wed., Thurs.: Noon to 9 p.m.
Tues. and Fri.: Noon to 5:30 p.m.
Saturdays: 10 a.m. to 4 p.m.

AMATEUR ELECTRONIC SUPPLY

6450 MILWAUKEE AVE., CHICAGO, ILL.

"Chicago's New HAM HEADQUARTERS"

For further information, check number 68, on page 110

from ALLIED

Get the Most Out of Your Rig and Antenna with this knight-kit® SWR/Power Meter!

Flexible 2-Unit Design

LOOK AT THIS BIG ARRAY OF "MOST WANTED" FEATURES...

- **Provides accurate readings of relative power from 0 to 10, and SWR from 1:1 to 20:1**
- **For use on ALL TEN Ham Bands from 160 Meters to 420 Mc—and other transmitters in the 1.8 to 432-mc range**
- **For 50-72 ohm unbalanced lines**
- **Withstands full kilowatt input**
- **"In-Line" type—can be left in line as constant monitor**
- **Accuracy better than 10%**
- **No batteries or power needed**
- **SO-239 RF coaxial connectors**
- **Sensitive 100 microamp meter**
- **Built-in sensitivity control**
- **Amazingly easy to build!**

Prices F.O.B. Chicago)

Model P-2 SWR/Power Meter Kit

ONLY

$15.95

Want to experience that wonderful feeling that comes from knowing you're getting maximum power into your antenna? The easy-to-build Knight-Kit Model P-2 "in-line" type SWR/power meter makes it a breeze to eliminate the power waste occurring in transmission lines with high SWR. It measures relative power being fed to your antenna, and SWR reflected from it. Negligible insertion loss permits unit to be left in the line permanently—providing a constant check on your rig's efficiency. The P-2 SWR/power meter is actually two separate units—a coupler and an indicator connected by a 4-foot shielded cable. Units are designed for unbalanced 50-72 ohm lines. They handle a full kilowatt from 1.8 to 432 mc (require 35 watts for full-scale deflection on 80 meters). Meter reads SWR from 1:1 to 20:1 and relative power from 0 to 10, with better than 10% accuracy. Sizes: coupler, 2 x 5 x 2½"; indicator, 2⅞ x 6¼ x 3". Complete with all parts and easy-to-follow instructions. Shpg. wt., 2 lbs. Get maximum signal punch from your rig—order today!

83 Y 627 AA. P-2 SWR/Power Meter Kit, only..... **$15.95**

83 Y 546 AA. As above, but factory assembled. Was $22.95—now only..... **$19.95**

GET MORE FOR YOUR MONEY WITH KNIGHT-KITS...

OVER 100 MODELS, INCLUDING OUTSTANDING AMATEUR, SHORTWAVE AND CITIZENS BAND EQUIPMENT

ALLIED RADIO

ORDER TODAY

ALLIED RADIO
100 N. Western Ave., Chicago 80, Ill.

Ship me the following:

- ☐ **P-2 SWR/Power Meter Kit 83 Y 627 AA**
- ☐ **Factory-Assembled P-2 SWR/Power Meter 83 Y 546 AA**

$.....enclosed (check) (money order)

Name_____
PLEASE PRINT

Address_____

City_____ Zone_____ State_____

For further information, check number 70, on page 110

$~~1~~585

Up to now you've had to pay at least $1585 for a commercial grade 2 KW amplifier. No longer. The brand-new National NCL-2000 maximum kilowatt is only $585, including its built-in power supply. Up to now most amplifiers in the price range of the NCL-2000 have been 500 watt jobs, usually using a whole string of low power tubes straining to deliver a peak kilowatt. Not now. The new NCL-2000 is a real brute of a desk-top amplifier for the 80 through 10 meter bands that was designed from power supply to output tubes to loaf along at a "D.C." kilowatt . . . 2000 watts PEP input and 1300 watts of peak output into your antenna on any band. Operate CW? AM? RTTY? The National NCL-2000 is rated for full kilowatt operation in these services.

The output tubes in the NCL-2000 are a pair of RCA 8122 ceramic tetrodes designed specifically for high power SSB service, and 800 watts of available plate dissipation assure low distortion, linear operation at full output. The NCL-2000 utilizes a passive, untuned grid circuit, so that it may be adjusted to allow excitation to full output from any transmitter or transceiver providing from 20 watts to 200 watts of peak drive. The passive grid circuit in the NCL-2000 allows its use as a dummy load for easy exciter tune-up with amplifier plate voltage removed!

The National NCL-2000 is a particularly handsome unit . . . styled to complement any ham shack or equipment (of course we think it looks best next to our own NCX-3)! Compare these features with any unit on the market at <u>any</u> price ☐ one kilowatt average input, 2000 watts PEP on all bands ☐ may be driven to full output with 20 to 200 watts from the exciter ☐ ALC output for use with exciters incorporating such provision ☐ separate plate and multi-meters ☐ tune-up at 1 KW level to comply with F.C.C. ☐ built-in dummy load with multi-meter relative power indication for optimum exciter tune-up with amplifier plate voltage removed ☐ all changeover relays incorporated for use with either transceiver or transmitter-receiver combinations ☐ automatic switchover to exciter-only when plate voltage is removed ☐ most complete safety and overload protection, including interlock, automatic shorting bar, time delay and current overload relays ☐ National's exclusive one-year warranty.

Your National Dealer will have the NCL-2000 in June . . . why not call him today to reserve yours for immediate delivery.

NEW NATIONAL 2000 WATT LINEAR AMPLIFIER

ONLY $585

ADDITIONAL NCL-2000 SPECIFICATIONS
Frequency Range: 80 through 10 meter bands plus overlap at band edges. Output Impedance Matching Range: 40-60 ohms. Input Impedance: 50 ohms nominal, unbalanced. Distortion Products: 30-45 db signal to distortion ratio at full rated output. Noise: NLT 40 db down. Ambient Temperature Range: to +45°C. Ambient Humidity Range: to 90%. Altitude: To 8,000 ft. Primary Power: 115/230 V. A. C. 60 cycle single phase, 3 wire, neutral ground; current 15 amperes max. at 230 V. Tube and semi-conductor complement: 2 RCA 8122 output tubes, 13 semi-conductors for rectification and regulation. Size: 7⅝" H, 16¼" W, 12¾" D. Weight: 62 lbs.

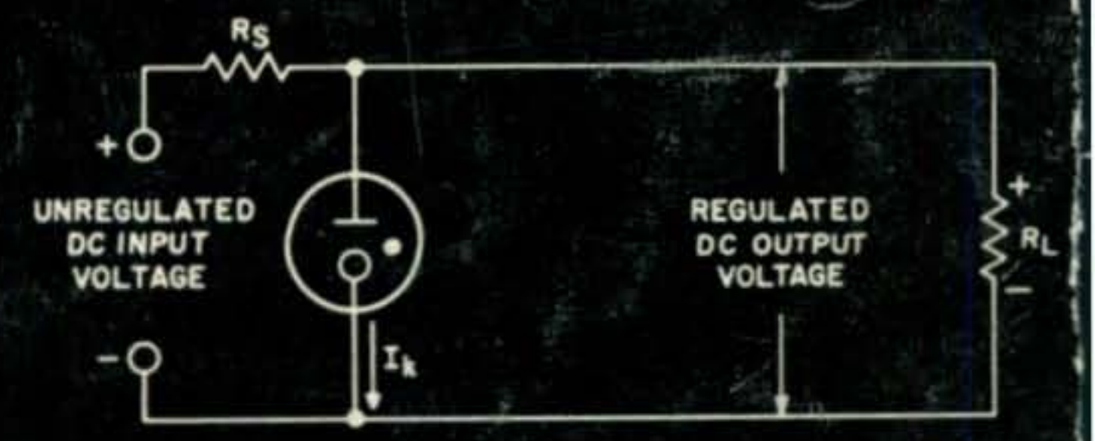
50 YEARS OF LEADERSHIP · NATIONAL COMPANY, INC. · 1914-1964 50

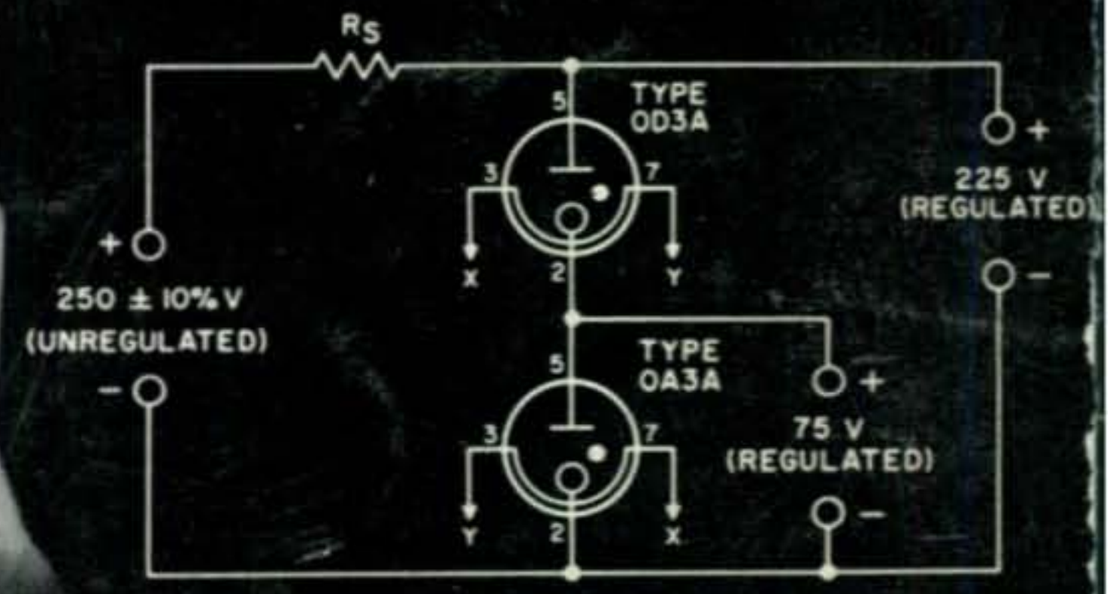
NATIONAL RADIO COMPANY, INC. NC

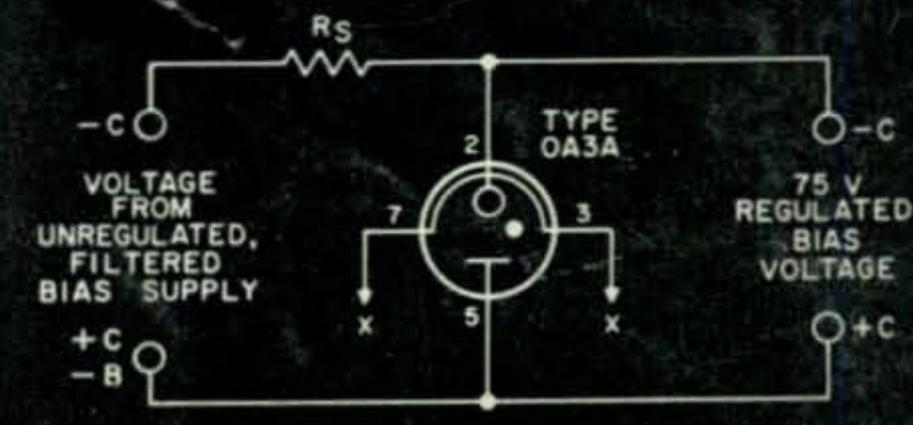
37 WASHINGTON STREET, MELROSE, MASS. 02176

Export: Ad Auriema Inc., 85 Broad St., N.Y.C.; Canada: Tri-Tel Associates, 81 Sheppard Ave., W. Willowdale, Ontario

For further information, check number 7, on page 110







STEADY DC FOR BETTER SIGNALS
—with RCA VR Tubes

Stability of transmitted and received radio signals requires good dc-supply-voltage regulation.

RCA Voltage-Regulator (VR) Tubes provide a simple and inexpensive way to stabilize the unregulated dc supply voltages for control grid, screen grid, and plate. DC output voltage across the VR tube remains virtually constant—with normal load and ac-line-voltage variations.

Check the chart for the RCA VR Tube that meets your need. If your requirement calls for a higher regulated dc output voltage than that obtainable from a single tube, two or more tubes may be connected in series. Different types may be used, if the current is kept within the rating of the lowest-rated tube.

Available Through Your Authorized RCA Industrial Tube Distributor.

RCA VR TUBES FOR AMATEUR EQUIPMENT				
DC Output Volts	DC Operating-Current Range (mA)	DC Starting Volts	Maximum Regulation Over Specified Current Range (Volts)	R Ty
75	5 to 30	115	4.5	C
	5 to 40	105	6.5	C C
105	5 to 30	133	4	C
	5 to 40	133 127	4	C C
150	5 to 30	185	6	C
	5 to 40	185 180	5.5	C C

■ New RCA Type. Short version of Glass-Octal proto
▲ 7-Pin Miniature

The Most Trusted Name in Electronics