ourt Ruling Legalizes Phone Patches - Page 75

CQ

ICD

August 1968

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The Radio Amateur's Journal

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See page 126 for New Reader Service

AUGUST, 1968 VOL. 24, No. 8

CQ

The Radio Amateur's Journal

TABLE OF CONTENTS

DEPARTMENTS

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

CQ—(Title registered U. S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Miami, Florida. Subscription Prices: one year, $6.00; two years, $11.00; three years, $15.00. CQ does not assume responsibility for unsolicited manuscripts. Please allow six weeks for change of address. Printed in the United States of America.

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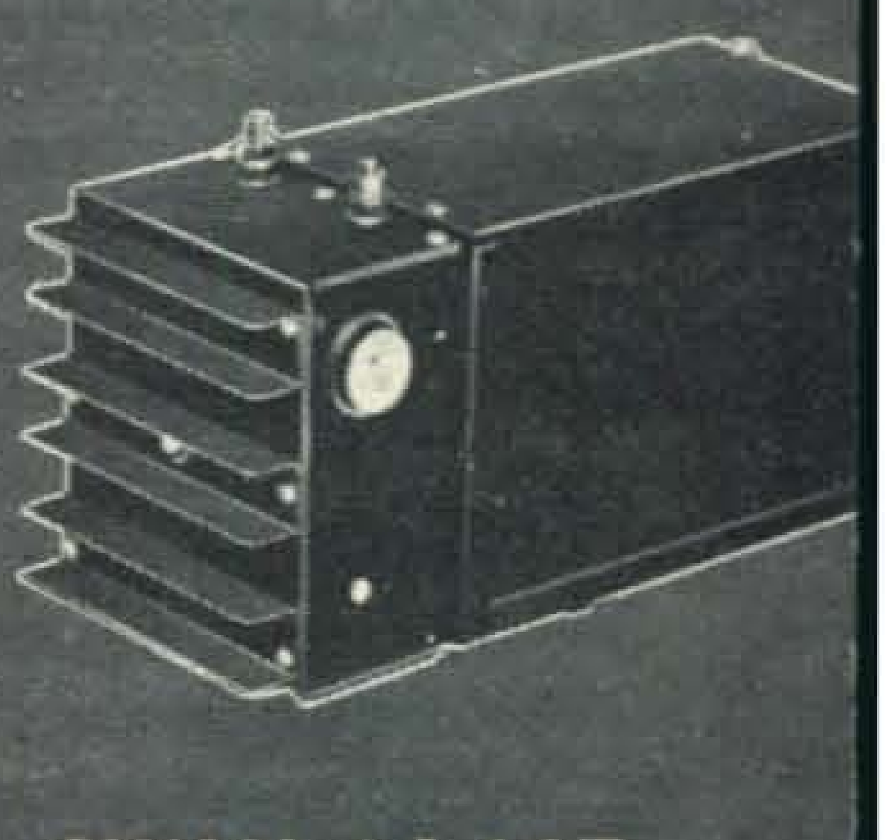

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SWAN SPEAKS YOUR LANG

ASK THE HAM WHO OWNS

ZERO BIAS

An out-of-court settlement agreement has been signed by Don Miller and John Huntoon of ARRL in the matter of a libel suit filed by Mr. Miller. As reported earlier in *CQ*, the suit was in the amount of $550,000. Don charged that malicious and libelous statements were made and published by the ARRL Awards Committee in 1967, and that these published statements were distributed widely to ARRL members and non-members.

The settlement agreement, printed below, has since been approved by the ARRL Board of Directors.

We're pleased with the outcome of this suit. It was handled with great discretion and in a mature and gentlemanly manner. It seems doubtful that amateur radio will suffer from the pursuit of justice by one man against ARRL, as has been suggested. Thankfully, the day has not yet arrived when an amateur must not dare question his own organization. The American legal system works here, too.

Worth mentioning are the facts that the suit was not against the membership of ARRL, but against the staff of ARRL, and that Don Miller is an ARRL member.

SETTLEMENT AGREEMENT

WHEREAS, the Awards Committee of the American Radio Relay League, Incorporated, reported in statements dated February 20, 1967, March 10, 1967, May 4, 1967, and July 6, 1967, certain decisions and actions taken by it concerning certain amateur radio activities and operations of Doctor Donald A. Miller, W9WNV; and

WHEREAS, Dr. Miller instituted suit against the League and its Secretary and General Manager, John Huntoon, in the United States District Court of the Northern District of California on February 19, 1968, Civil Action File No. 48726, alleging that the statements and actions of the Awards Committee and certain related statements and actions of Mr. Huntoon were malicious and libelous and requesting judgement in the maximum amount of five hundred fifty thousand dollars ($550,000.00); and

WHEREAS, service has been obtained on the League but not on Mr. Huntoon; and

WHEREAS, the League, in an answer to Dr. Miller's complaint, filed on May 7, 1968, denied each and every allegation of said complaint of which it has knowledge; and

WHEREAS, Dr. Miller, the League's Secretary, the League's General Counsel, and California Counsel for both parties to the action have met in Hartford, Connecticut, for five (5) days, beginning on June 11, 1968, to prepare for trial of the action; and

WHEREAS, the parties recognize that this and similar actions and controversies are not conducive to the advancement and enhancement of amateur radio in the United States and throughout the world; and

WHEREAS, the parties, being desirous of terminating, once and for all, their differences and the related controversies, have explored at length during the said five day period the manner in which this action and their differences and related controversies may be resolved by mutual agreement; and

WHEREAS, there are no unresolved complaints concerning any of Dr. Miller's operations now pending before or known to the League's Awards Committee;

NOW THEREFORE, in consideration of their mutual promises and other valuable considerations, the parties hereby agree as follows:

1. Dr. Miller shall dismiss with prejudice his suit against the League and Mr. Huntoon within ten (10) days after the conditions precedent hereinafter contemplated have occurred; and

2. Dr. Miller shall not institute any suits or other litigation in any other jurisdictions against the League or any of its Officers, Directors, Employees, or Agents based upon any of the actions or matters which were the basis for or subject of the instant suit; and

3. The parties hereto shall execute appropriate releases to carry forth the intent of this agreement; and

4. Except for certain expenses incurred in connection with or related to the said meetings, which shall be the subject of separate agreement between counsel, each of the parties shall bear and pay its own costs, including attorneys' fees; and

5. Copies or reports of this agreement may be published in the League's official journal, *QST*, and/or in any other publications should either Dr. Miller or the League so desire; and

6. This agreement shall not be binding upon any of the parties hereto unless and until the following conditions precedent have occurred;

(a) The Awards Committee has approved as separate country credits for the DX Century Club the 1968 operations of Dr. Miller from Blenheim Reef, Geyser Reef, and Chagos Is. (Nelson's Island); and

(b) Ratification and approval of this agreement within forty-five (45) days of the date of this agreement by either or both the League's Executive Committee or Board of Directors.

This agreement, entered into this 15th day of June, 1968, at Hartford, Connecticut, by the following:

DONALD A. MILLER, M.D.
(signed) DONALD A. MILLER, M.D.
THE AMERICAN RADIO
RELAY LEAGUE, INCORPORATED
By *(signed)* JOHN HUNTOON
Its Secretary
JOHN HUNTOON
(signed) JOHN HUNTOON

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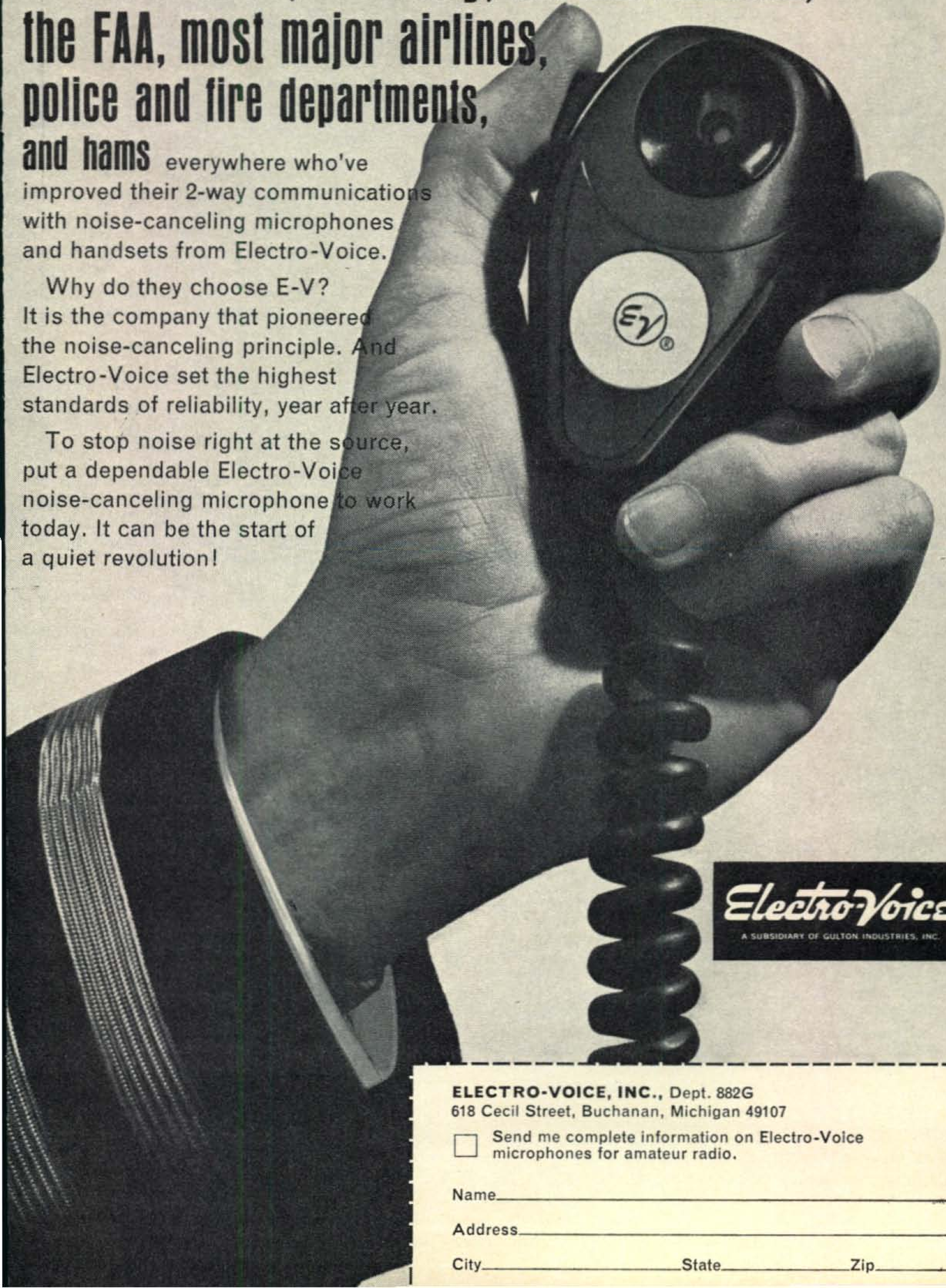

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OUR READERS SAY

$30 Mobile Power—Again

Editor, *CQ:*

In *CQ* for July 1968, page 8, reader Lou Schornack takes the author of one of your articles to task for making the suggestion that the Heath MP-10 power supply can be parelleled.

While I'm certain that he is correct about the trouble this can cause in many semi-conductor supplies, in the case of the MP-10 he is mistaken. First, the Heath Co. makes this same suggestion in their catalog. Second, as expedition member in charge of communications on the 1963 American Mr. Everest Expedition, I selected the Heath MP-10 as our source of 100 v. a.c. We had two supplies and on occasion did run them in parallel with no hint of trouble. The method works and works very well.

I suspect that the problem is from his not being familiar with the circuit of the MP-10. This supply includes the m.v. feedback windings on the same core that supplies the output power. Therefore, the feedback windings are always aware of what is going on "outside the box." As a result, with two (or more) units paralleled, one will take charge of frequency control while the other(s) follow(s).

With an inverter m.v. that drives a power amplifier for the output, reader Schornack is correct. In this case, each unit would have to be controlled from a master oscillator to maintain proper frequency and phase between units. Otherwise, the supplies would furnish power plus heat and smoke.

Allen Auten, WØECN
Denver, Colorado

Re: A Radical Proposal II

Editor: *CQ:*

May I please add a few comments in connection with "A Radical Proposal Part II". appearing in the March issue.

It would seem that any time the matter of tests for the amateur service is discussed, someone will always suggest doing away with the code portion. This displays a great lack of understaning on the part of the person doing the suggesting. As we all know, the FCC is charged with the enforcement of all the regulations pertaining to communications in this country. What perhaps is not so well known is the fact that the FCC does not make these laws. Our laws come from twosources —the first is the Congress, the second is from treaties with foreign nations ratified by Congress. The matter of a code test comes under the second heading. In short, the U.S. is a party to treaties with foreign nations in which we have agreed along with the other countries to require a code test for licensing persons in the amateur service. The treaties don't say how much of a test, allowing the five word per minute Novice requirement. But we are required to have some test. With new treaties this could be changed, if there were agreements among the nations involved that it would be to their best interests. Note their interests, not ours.

On the point of moving class D citizens radio service to some higher frequency, this is rather amusing. The suggestion was to allow another period before making the change to allow the amortization of the cost of present gear. It also allows the manufacturers a chance to unload their present stocks. By the time the waiting period is over and all this comes about, we will once again have entered a period of minimal sunspot activity. This simply means that by then, 27 mhz will again be suitable for a service using ground wave and low power. Isn't it too bad that FCC didn't forsee the problems before making the present assignments?

I hear talk of allowing persons operating under citizens radio service to take part in various civil defense efforts or other public functions. Persons making these suggestions should pause and reread their copy of the regulations. Citizens radio service says very clearly that it is set up for passing private communications related to the licensee. In other words, under present law, you cannot legally handle messages for someone else. But then, what CBer reads or obeys the law?

I would make a suggestion. Let's have the FCC begin to enforce the laws it already has. To date, there has been a great wail from the Commission that it is badly under-staffed and under-budgeted. This is doubtless true, but it also is true that there has been little effort to make do with what it already has. For instance, any night of the week I can tune 27 mc and hear almost any sort of violation. If the FCC would make a minimal effort at finding only a few of these stations, the word would very quickly get around to the others. Within perhaps eight weeks, much of the problem would be settled. Not enough staff? Ridiculous—members of the local radio club with home built equipment regularly find ten-meter stations during our weekly transmitter hunts. It generally takes about an hour. The hunters must all start from the same place and follow a few rules. Surely the FCC is not so lacking in talent that it would not be able to do at least as well.

The Commission says that they must record the violation and then walk in while it is taking place. Perhaps this is true if their purpose is to arrest and prosecute the violator to the fullest extent of the law. As a practical matter it should be obvious to even a rather dense bureaucrat that even if no charge were ever filed, the effect would be to clean up the present mess on 27 mc. Simply proving to these operators that they could be found should give them pause.

There is another important factor, often overlooked. Amateur and Citizens radio is now big business. It used to be that a ham would buy parts and make his own equipment. He also used to know something about radio. Now, he simply writes a check and buys his gear already built. This does two things. It supports a lot of manufacturers and distributors and it gradually errodes the amateur's understanding of what it is he is actually doing. There is something else it does. It makes it very important that the present system be preserved. People are making a living from us now.

All these manufacturers and dealers have congressmen and they all pay taxes. My guess is that there will be little done to stem the very plush business of selling equipment to either CBers or

[*continued on page 115*]

See page 126 for New Reader Service

"Drake 4-Line is the most satisfying...totally efficient..."

says WØYDB, Minneapolis...

To quote in part from a letter received from W. C. Higgins, WØYDB, Minneapolis, Minn., dated May 10, 1968 . . .

". . . Enclosed are several snapshots of my hamshack and equipment. Since the Drake 4-Line is so predominant, I thought that you might like to add to your photo collection of Drake-equipped stations. Granted, the gear is not the new B series but it is still the most satisfying and totally efficient that this old-timer has used in 32 years of amateur, military and commercial electronic experience. I earn my living as a Production Manager of (aerospace) electronic instrumentation production . . . and I think I can recognize excellence in electronic engineering design and performance when I see it.

"Again, congratulations for developing the 4-Line. 73 . . ."

(Signed) Bill, W. C. Higgins

Ask any ham who owns a Drake 4-Line Rcvr, Xmtr or Linear...

or write for detailed specifications:

Dept. 288 **R. L. DRAKE COMPANY** 540 Richard St., Miamisburg, Ohio 45342

See page 126 for New Reader Service

Announcements

Kentucky

On Sunday, August 11, 1968, the East-Kentucky Radio Society, Inc., will hold its Hamfest at Jenny Wiley State Park. The Hamfest will officially convene at 11 A.M.

Chicago, Illinois

The Six Meter Club of Chicago, Inc. will hold its 11th Annual Picnic and Hamfest on Sunday, August 4, 1968, at the Picnic Grove in Frankfort, Illinois.

Levelland, Texas

Ham and CB Swapfest, Sunday, August 4, at City Park in Levelland, Texas, sponsored by the Northwest Texas Emergency Net and Local CB Club. Registration begins at 9:00 A.M. Mobile talk in is the net Frequency 3950 kc and Channel 11 for CBer's.

Pittsburgh, Pennsylvania

The 31st Annual Hamfest of the South Hills Brass Ponders and Modulators, Inc. of Pittsburgh, Pennsylvania will be held Sunday, August 4, 1968 from 1 to 6 P.M. at St. Clair Beach on Route 19. Registration for door prizes $2.00 at the door or $1.50 in advance.

For further information or Pre-Registration, write Leonard R. Hendry, WA3GKL, 248 Skyport Drive, West Mifflin, Pa. 15122.

Springfield, Miss.

The Southwest Missouri Amateur Radio Club, Inc. will hold its annual Picnic and Hamfest for amateurs and their guests in the four-state area on August 25, 1968.

If you desire further information contact, Don Mullen, KØHUU, Secretary, Southwest Missouri Amateur Radio Club, P. O. Box 291, Springfield, Missouri 65801.

Huntsville, Alabama

The North Alabama Hamfest Assn., will hold their 1968 Hamfest on August 18. Complete details are available from James Brashear, Secretary, N. Ala. Hamfest, Inc., 3002 Boswell Drive, Huntsville, Ala. 35810.

Frankfort, Illinois

The Six Meter Club of Chicago will sponsor its 11th annual picnic and hamfest on August 4th at the Frankfort Picnic Grove, 1 mile north of Rte. 30 on U.S. 45 in Frankfort, Ill. For further information contact Michael Corbett, K9ENZ, 5215–73 Court, Summit, Illinois 60501.

Idaho

The 36th annual W1MU Hamfest is to be held at Mack's Inn, Idaho, 23 miles south of West Yellowstone, Montana, on highway 191. The dates will be August 2, 3 and 4. For further information contact David C. Wiley, W7WYG, 3100 6th Ave., S., Great Falls, Montana 59401.

Philadelphia, Pennsylvania

The Mt. Airy V.H.F. Radio Club is holding its 13th Annual Family Day and Picnic on Sunday, August 11 (rain date August 18) at Fort Washington State Park, Flourtown, Pa., in cooperation with the Delaware Valley Chapter of the QCWA. There will be games for the kids and activities for the YL'S and XYL'S. No reservation required. $2.00 per family.

Chicago, Illinois

The Hamfesters Radio Club will celebrate its 34th Annual Mid-Western Hamfest and Picnic on Sunday, August 11, 1968, at Sante Fe Park, Willow Springs, Illinois. Gates will open at 9:00 A.M.

The Third Annual "Illinois Amateur of the Year" award will be presented at the Hamfest.

For further information and tickets contact Charles Borkowski, WA9TWA, 1851 West 21 Street, Chicago, Illinois.

Sault Ste. Marie, Michigan

The annual Upper Penninsula of Michigan Hamfest for 1968 will be held this year in Sault Ste. Marie, Michigan, on Saturday and Sunday, August 3 and 4. The Swap-Shop will be in session both days.

Bangor, Michigan

The Annual Southwestern Michigan VHF Picnic will be held August 4, 1968 at the Allegan County Park, sponsored by the Van Buren County Amateur Radio Club.

Egg Harbor Lake, N.J.

The Southern Counties Amateur Radio Association is pleased to announce that it is holding its annual Picnic and Hamfest at Egg Harbor Lake, Egg Harbor City, N.J. on Sunday, August 25.

Huntsville, Alabama

The North Alabama Hamfest Association, Inc., will hold its hamfest in Huntsville, Alabama on August 17 and 18, 1968 at the Mall. For further information contact James A. Brashear, WB4EKJ

Lebanon, Tennessee

The ninth annual Hamfest of the MTARC will be held August 25, 1968, at the Cedars of Lebanon State Park on highway 231 south.

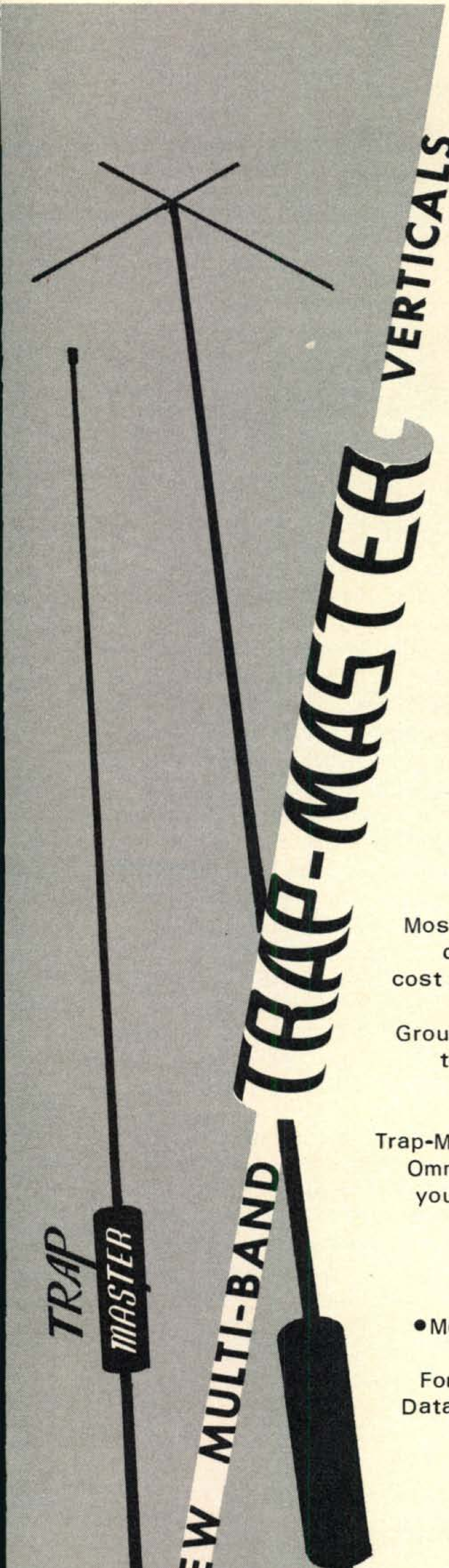
Rock Island, Illinois

The Quad City Amateur Radio Club has scheduled its annual Mississippi Valley Hamfest for August 18, 1968 at the Rock Island Arsenal, Rock Island, Illinois. The price for tickets is $1.50. Contact John E. Greve, W9DGV, 2210-30 Street, Rock Island, Illinois 61201 for advanced tickets. Frequencies to be monitored for talk-in are 3.90, 50.4, 146.94 mc.

Long Island, New York

The Federation of Long Island Radio Clubs, Inc. has announced that the date for the 1968 Long Island Hamfest has been set for September 1st. Complete details are available from Public Relations Director, Al Smith, WA2TAQ, 11 Irving Place, Lynbrook, N.Y. 11563.

See page 126 for New Reader Service



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Mosley Electronics, Inc. 4610 N. Lindbergh Blvd., Bridgeton, Mo. 63042

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

I reely not planning to riting to you this month, but then I thinking. Old lovable Hon. Ed. always feeling so good when he heering what kind trubble Scratchi getting in, so on second thought I riting to making you feel good on acct. Scratchi are having problem.

You see, I can't sitting down. At least not for cupple days, according to Hon. Doc. What happening? Well, it not to easy to rite standing up, but here goes.

It seems this are time of year that the Rip-Roaring Riding and Roping Society are having big trail ride into neerby mountains, and they thinking of idea to liven up the day's activity. They wanting me to put on hidden xmitter hunt for them.

They saying if I doing it for them, they happy to inviting my XYL-to-be Lil Watanabe, to join the RRRR Society. Well, this are reel classy group, and Lil have been dying to get invitayshun. So, what can a fellow doing? Natchurally I saying hokay.

I spend next cupple weeks fixing up pocket-size transistor radios which RRRR's are furnishing so they can working on 160 meters band. Also making up battery-powered xmitter, low power, to hiding somewhere in mountains.

One night RRRR president calling me on landline and telling me to be sure that xmitter are light enough to be carried by horseback. That are first I knowing I going to be on horseback myself, and it almost causing me to giving up the hole deal. Howsumever, it not every day Lil getting chance to being in high society, so I agreeing.

Last cupple days before big event I spending getting all equipment in first classy shape, and Lil are spending her time buying clothes for trail ride to get her chassis in first classy shape. I'm glad I not paying the bills for those riding clothes. Wowiee!!

On the Big Day, I driving Lil to starting point, and passing out radios to everybuddys and explaining how to use them. Then getting xmitter loaded, plus some food, on Old Paint. Horse they lending me used to be called Old Red, but cupple local hippies borrowing it last week and taking him to a paint-in; so now they calling him Old Paint.

Being all set, I nudging Old Paint into ackshun and about an hour later we into foothills. O.P. keeps on climbing, and Old Scratchi keeps hanging on and pretty soon we high up in mountains overlooking hole city of Feenix.

Desiding it time to stop, so getting off, tying up O.P. then stringing out end-fed longwire antenna from O.P. to some convenient cactus. Turning on xmitter, tooning it up, and retiring to bit of shade to take siesta.

Waking up later with sun in face, which meant noon and lunchtime. Getting out ice-cold cactus-jooce and peanut-butter and cucumber sandwiches and taking care of lunch in no time.

About then I noticing that Old Paint have come untied and he is moving so antenna not pointing right direckshun. So, mounting O.P. and starting him back to right spot, when suddenly everything happening so fast it hard to remember.

First big old jack-rabbit are jumping up and scaring O.P. so that O.P. making hard left turn in mid-air and when he doing this he catching antenna under his tail. The Hon. RF from antenna catching O.P. in sensitive spot and he taking off like drag racer.

Unfortunately direckshun O.P. going is straight down the mountain. Scratchi grabbing on to anything handy in order to stay on, and I'm so busy I can't turning off xmitter. It still on air, on acct. antenna still hooked up, and snaking along behind O.P.

Every few yards some RF reminding O.P. why he running so fast, and every stride Old Scratchi making like trampoline expert on that saddle. Whump—whump—whump all the way down the mountain.

Are about to call the hole thing a bad job and let go, when the antenna ripping loose from the rig and Old Paint are coming to a four-legged stop. Scratchi not stopping. Not having any choice about stopping or not stopping—I just sailing off over O.P.'s head, and landing in patch of prickly-pear cactus. Oh my aching final.

Are coming to in hospital, with Lil stand-

[*Continued on page 114*]

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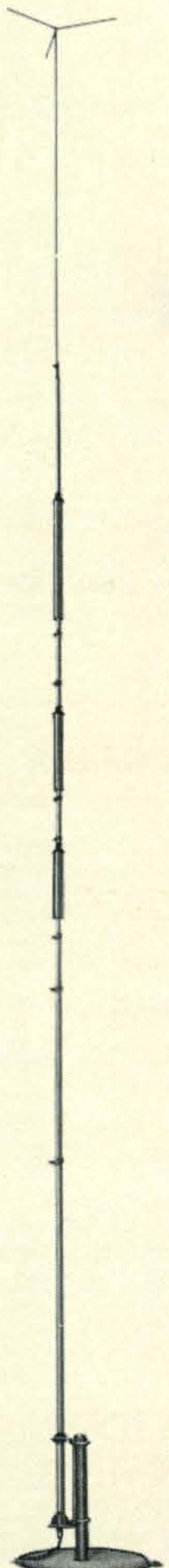

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If it's not worth risking the dough or your happy home for a beam, don't despair. Hy-Gain's got The Next-Best-Thing Antenna.

It's the 14AVQ, the most popular vertical under the sun.

We call it The Next-Best-Thing Antenna for a good reason. Because it is.

It develops an extremely low-angle radiation pattern, so you get a super powerful signal for short hauls or long ones.

Plus, you get low VSWR on all bands with the ability to adjust and readjust for top performance at any specific frequency.

"Hy-Q" low loss traps are each precision tuned to frequency to give true resonance on each band.

And the 14AVQ is the only trap vertical at DC ground. So you get practically no static or lightning problems.

If you want, you can phase two 14AVQs and get the signal directivity of a beam without the bother or worry of a tower or rotor.

The 14AVQ is built of high-grade, heat-treated aluminum using high impact polystyrene. So there's no rust, no deterioration. And, it's amazingly simple to install.

Get down to the best distributor under the sun (he stocks all Hy-Gain products) and look over the 14AVQ.

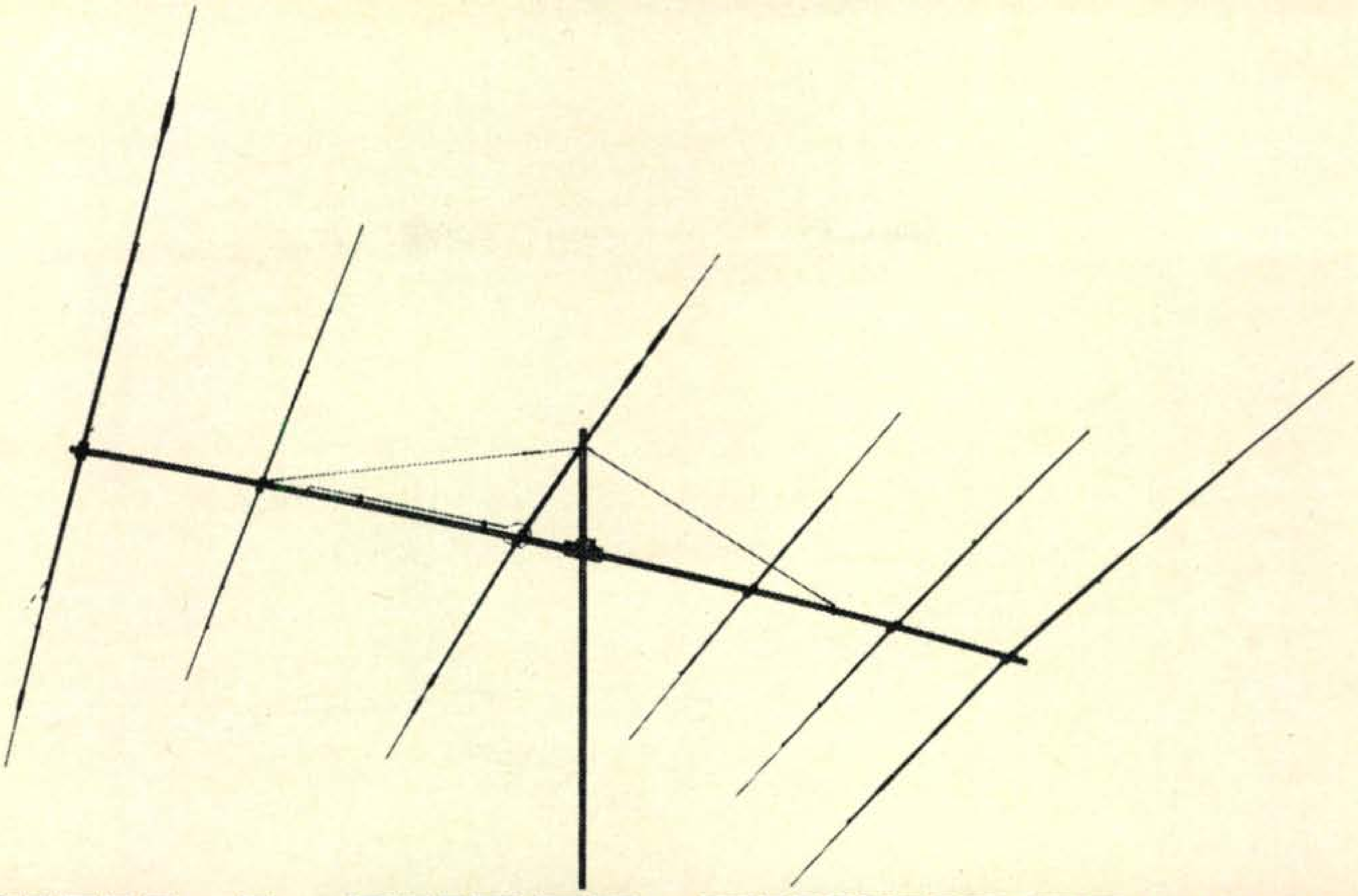
Compared to The Next-Best-Thing Antenna, there is no next best thing.

14AVQ from Hy-Gain

FOR THE STRONGEST SIGNAL UNDER THE SUN!

Hy-Gain Electronics Corporation, N.E. Highway 6 at Stevens Creek, Lincoln, Nebraska 68501 AC-8

 See page 126 for New Reader Service



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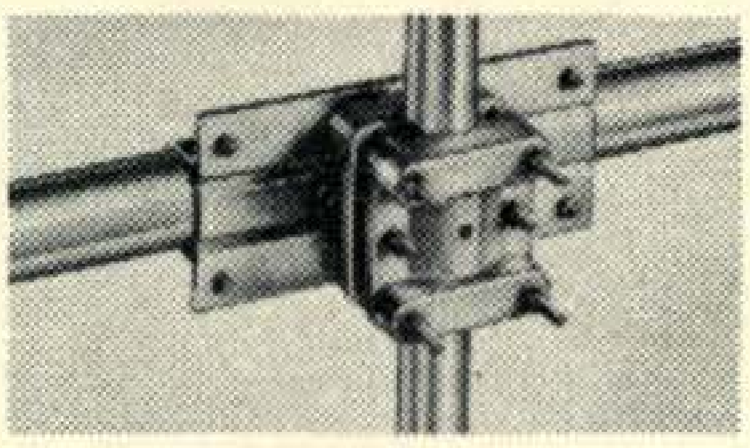

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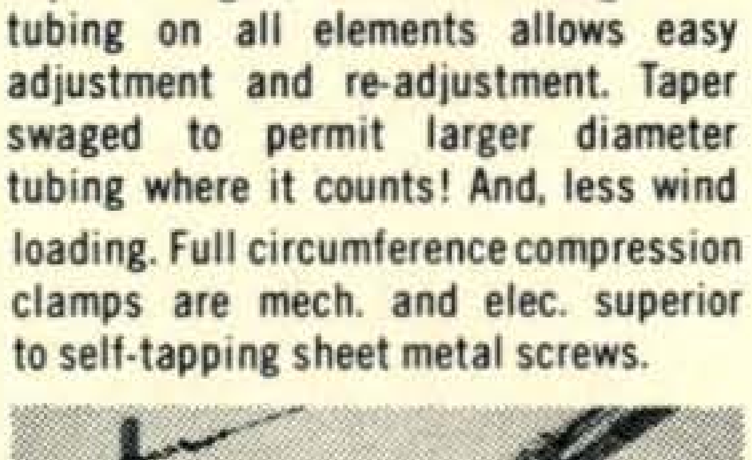

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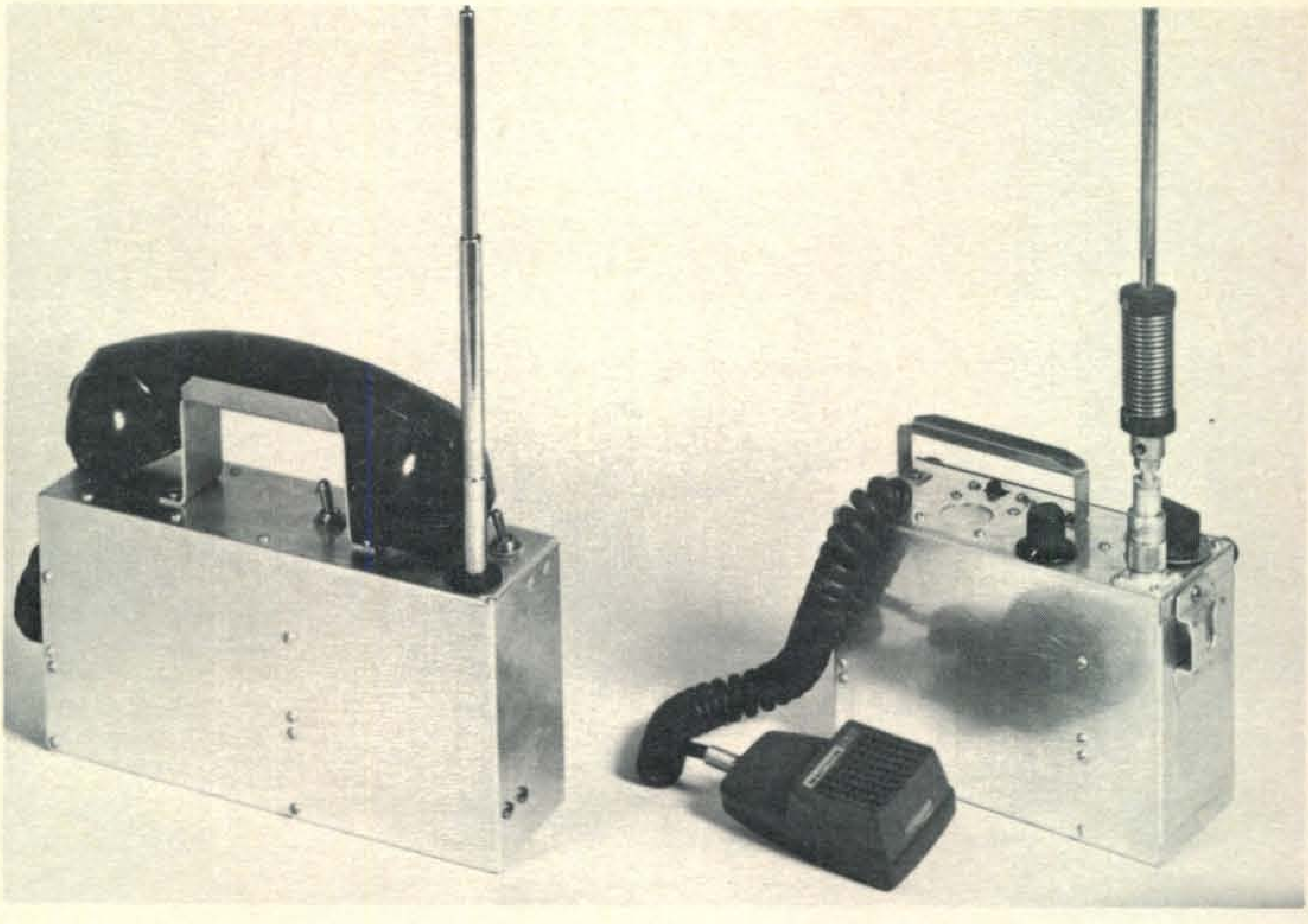
See page 126 for New Reader Service



The K9LAJ SST's (Solid State Transceivers) for 6 or 10 meters. On the left is a push-to-talk version with the p.t.t. switch in the handset handle. The version to the right uses a 4-pole double throw T-R switch, and separate speaker and mike. Both units are built around commercially available circuit boards requiring a minimum of interconnecting wiring.

THE SST SERIES

Solid State Transceivers for 10, 6 and 2 Meters

PART I

BY DAVID F. PLANT,* K9LAJ/2

MANY articles have been written to demonstrate the usefulness of walkie-talkie type portable gear for emergency use, mountain topping, or just plain fun; so we won't renumerate here. But some new things have been added, and they are worth talking about.

In the last decade the transistor has taken over most of the functions performed by the vacuum tube, and in the process has enabled the electronics designer to develop circuitry with previously unheard of reliability, economy, efficiency and compactness.

Hams were quick to pick up transistor design and adapt it to amateur equipment, first in audio and then in d.c. to d.c. power converters. As transistor technology advanced, frequencies went up and cost went down (witness 400 mc silicon transistors now less than a dollar apiece). Receivers became transistorized — and finally transmitter r.f. sections followed suit. All solid state design became the state of the art, and with it, reliability and economy unknown in vacuum tube system design became available to the builder who used the transistor. This builder also found unprecedent savings in power and size requirements.

This same technology also made popular the concept of modular construction because complete circuits could be built in the space

* 125 West 12th Street, New York, New York 10011.

See page 126 for New Reader Service

previously required for a single stage. Examples of the module approach can be found in most of the major catalogs now, with units such as audio amplifiers, wireless devices, code practice oscillators, etc., giving the builder a wide selection of circuits (or building blocks, if you will) with which to design a variety of devices.

The 10, 6 and 2 meter portable units described in this series of articles are the result of combining commercially available circuit boards with home-brew to achieve custom design of equipment with a minimum of actual circuit engineering. Time and money are saved with no sacrifice of performance.

Description of the Series

The SST's are all solid state transceivers for the 10, 6, and 2 meter ham bands with construction information for building the receiver portions for all three bands covered in this issue. Details are also given for building a complete ten meter portable in a choice of two models—one designed for either portable or fixed use with built-in speaker, and the other model featuring a handset with push-to-talk. Subsequent articles will give details for the 6 and 2 meter versions.

Receiver Section

The receiver for all three bands is of the super-regenerative type run at a very low power level to minimize radiation. The super-regen circuit is simple in design yet will respond to a signal less than 1 microvolt, meaning that the receiver can hear anything that the companion transmitter can work, plus. Receiver details are given for those who wish to build, or the receiver may be purchased.

Figure 1 shows the schematic diagram for the 10 and 6 meter transistor receiver developed for Round Hill Associates of New York. Note that a different value of feedback capacity (collector to emitter) is needed for 10 and 6 meter operation. The coil, L_1, is also changed. C_3 is a small variable capacitor with two or three plates and is used as a bandspread capacitor if front panel tuning is desired.

The receiver is built on a 2¼ × 2¼ inch perf board, keeping leads extremely short for reliable operation. The photograph shows the general layout for the prototype.

The popular 2N1177 RCA drift transistor works very well in this circuit up to about 70 mc. The transistor is PNP and the circuit is set up for a positive ground wiring system.

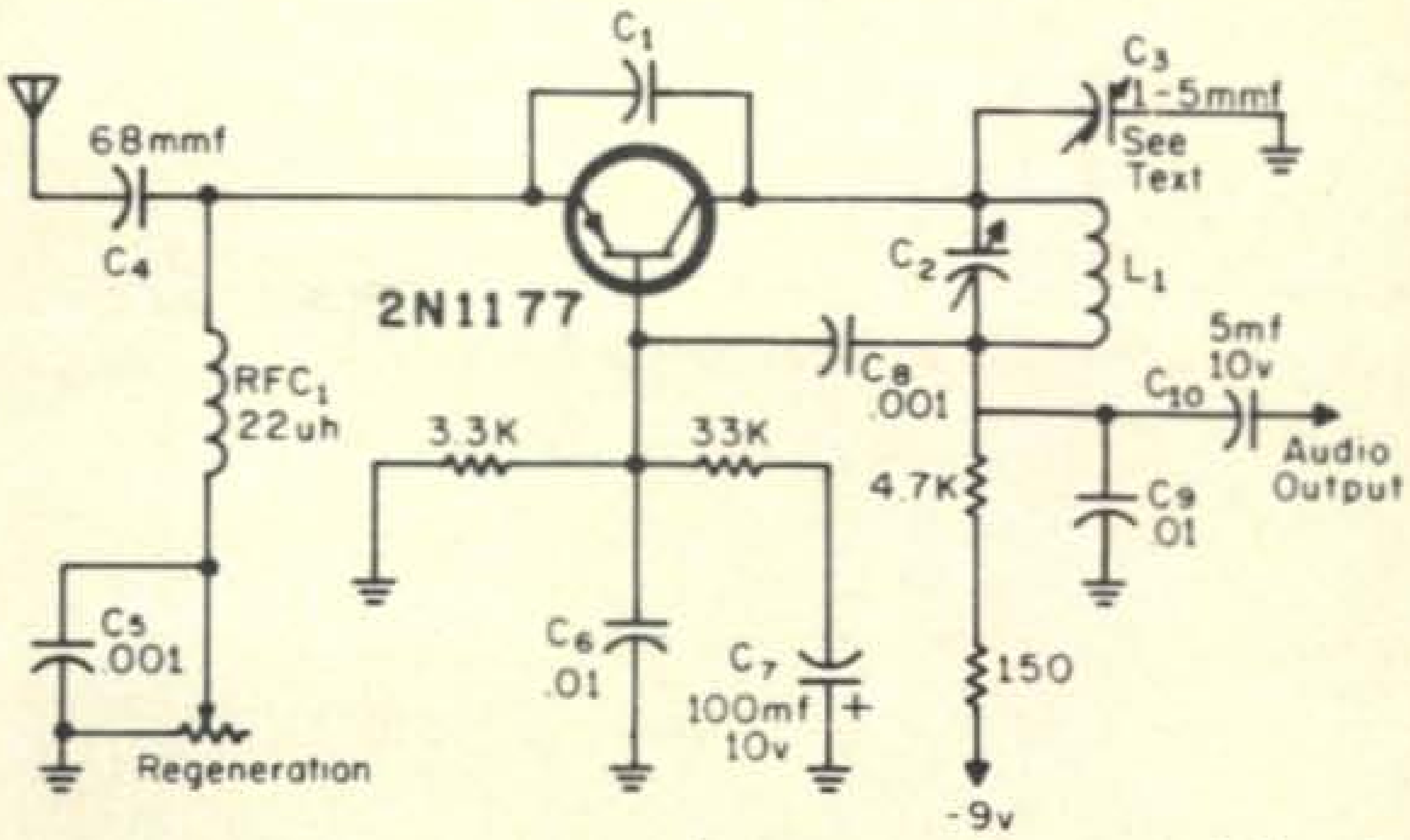


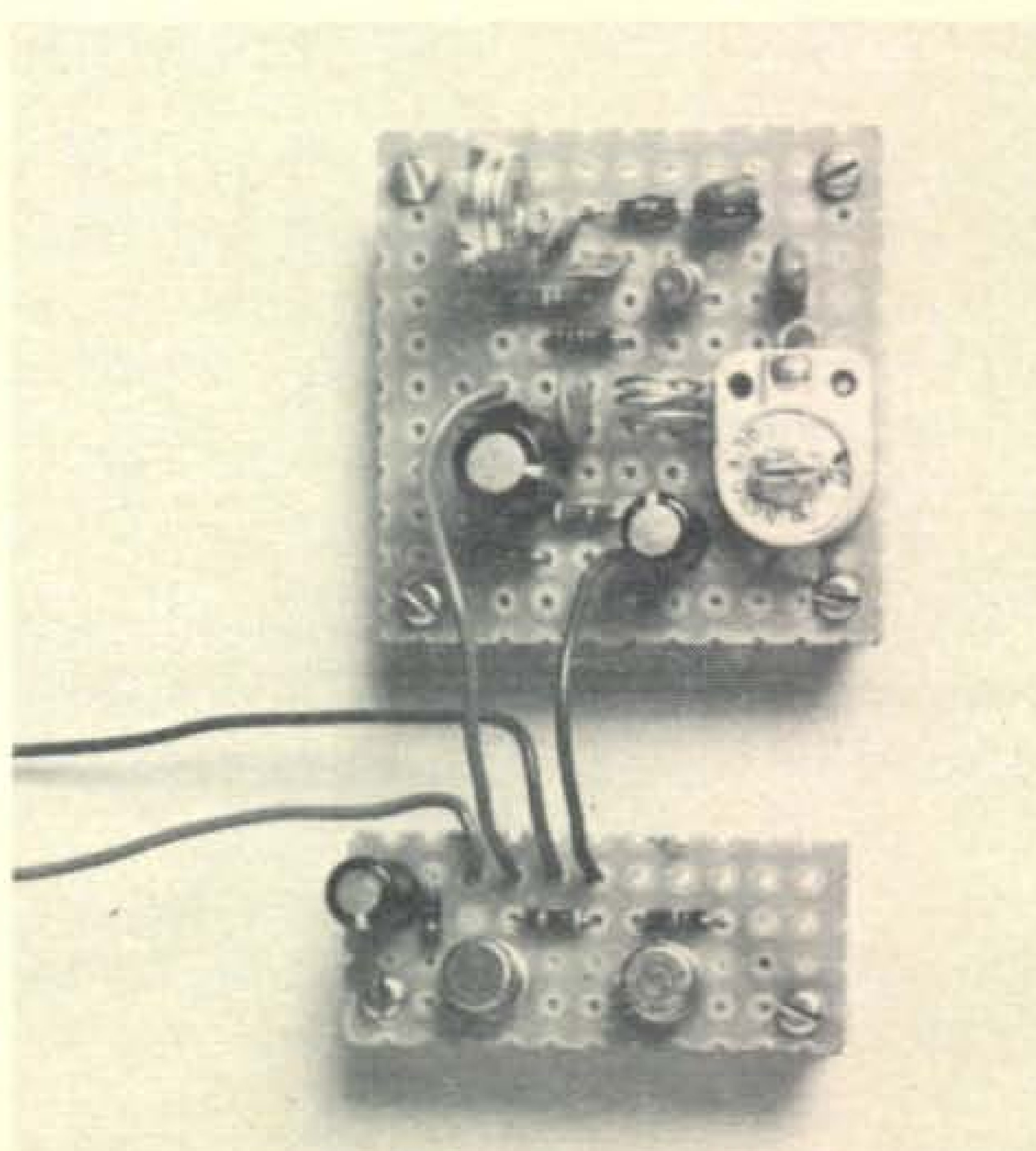
Fig. 1—RS-100 super-regenerative front-end for 6 or 10 meters as used in the K9LAJ SST's.

C_1—50 mc: 6.8 mmf disc ceramic. 28 mc: 39 mmf disc ceramic.
C_2—4-30 mmf mica compression trimmer.
C_3—Optional. 1-5 mmf variable capacitor.
L_1—50 mc: 7t. #26 e. 5/16" dia. 28 mc: 12t. #26 e. 5/16" dia.
R_1—10K printed circuit potentiometer. Mallory 14L1 MTC.
RFC_1—22 μh r.f. choke. Miller 70F225A1.

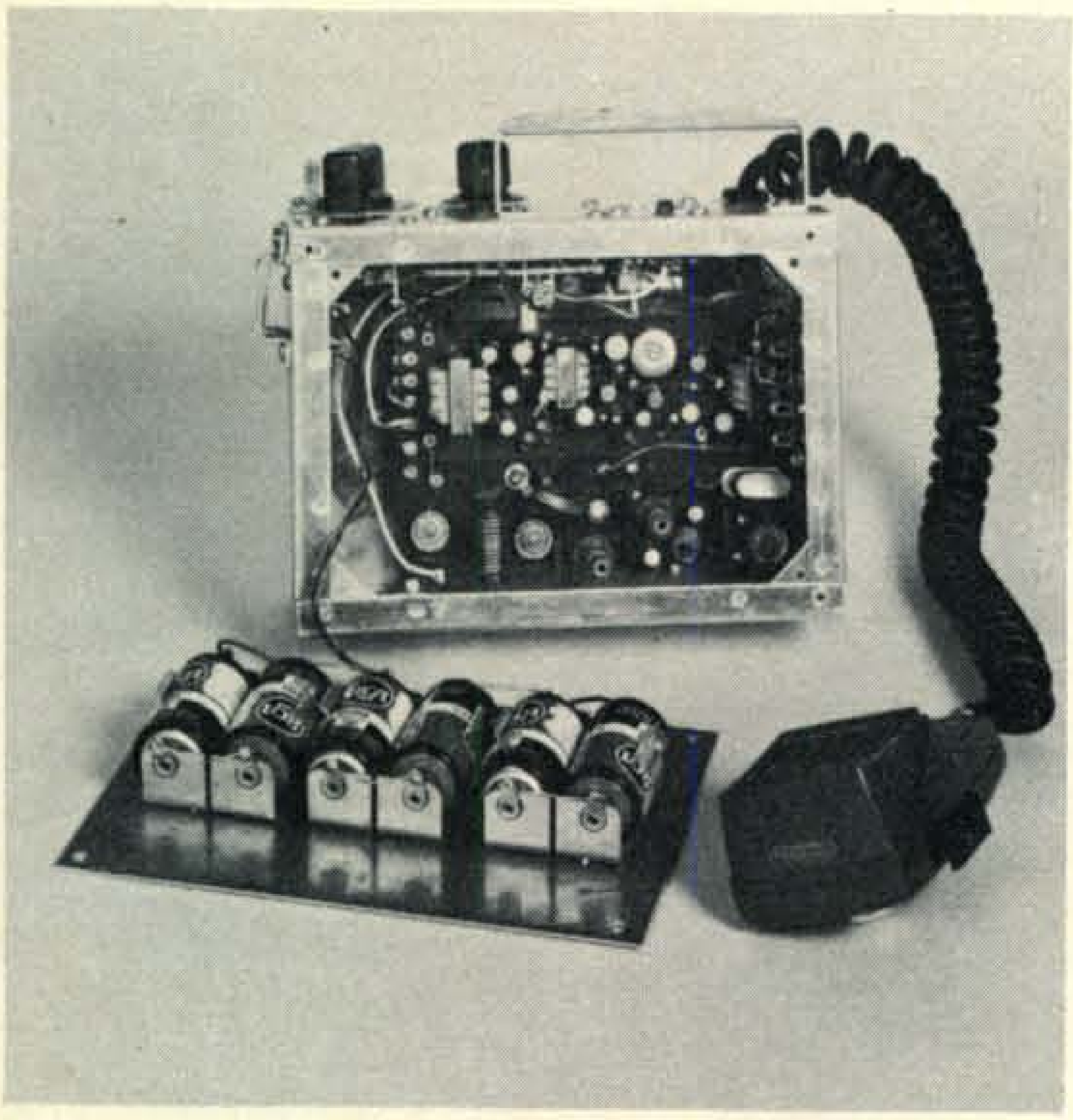
An inexpensive silicon high-speed switching transistor proved to be superior in the over 70 mc range and the circuit for this is shown in fig. 2. The transistor is a 2N706A.

With the values given, the receiver will tune approximately 90-160 mc giving good coverage of the amateur 2 meter band and miscellaneous aircraft, police, TV, and FM broadcasting.

The output from the super-regenerative type receiver is quite low so amplification is



Top view of the receiver and headphone amplifier circuit modules. Layout is not critical, although the above layout works well. Receiver input is through a soldered connection at the upper right.



Interior view of the ten meter transceiver shows circuit board placement. Six series connected "C" cells mount in holders on the back plate of the unit. Barely visible at the inside top of the chassis is the edge of the RS-100 super-regenerative receiver circuit board. In full view within the chassis are the AA-100 modulator board (top), and TR-100 transmitter board bottom.

required in most cases. Figure 3 shows a 2-stage direct-coupled amplifier that raises the receiver output to a comfortable earphone level. NPN transistors were used so that one of the headphone leads could be grounded with the push-to-talk circuit used with one of the current CB walkie-talkies.

The emitter resistor, R_1, is adjusted so the amplifier draws around 20 ma with the particular handset earphone used. A low impedance receiver gives the best load to the amplifier collector.

The two-stage headphone amplifier stage is not necessary in the loudspeaker model as the high gain AA-100 audio amplifier board provides the needed gain for loudspeaker operation.

The Ten Meter SST's

Two models of the ten meter portables are shown, each offering certain advantages. The transceiver with the built-in speaker was designed for fixed station or mobile, as well as portable service and has a coaxial antenna connector for fitting various antenna systems. Receiver tuning and a volume control are also featured for more versatility of operation.

Loudspeaker output is obtained with a 200 mw audio board which is used for both receiver audio and transmitter modulator by

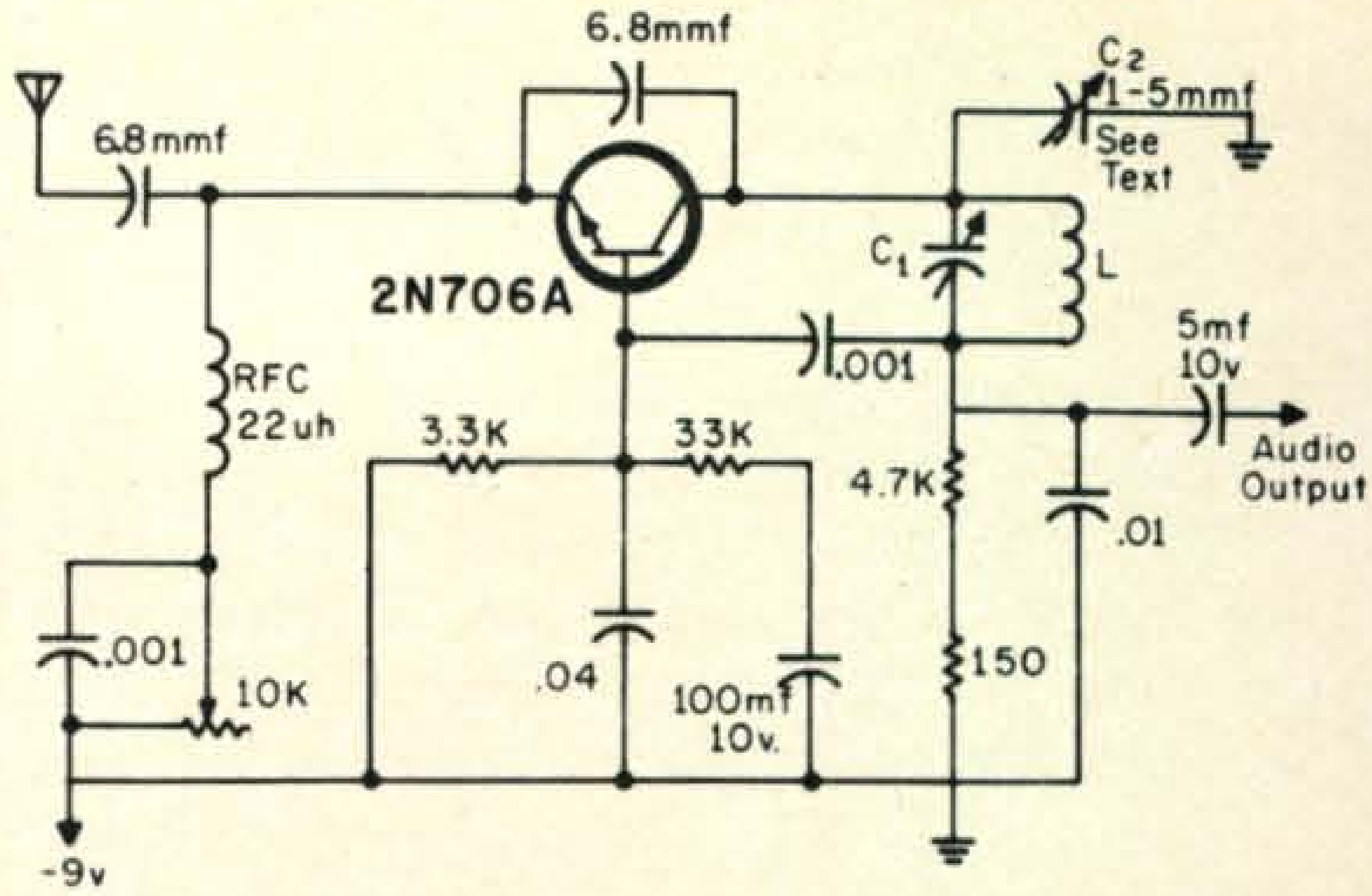


Fig. 2—Small circuit variations allow the super-regenerative receiver circuit of fig. 1 to be used on 2 meters.

C_1—100-160 mc: 4-30 mmf mica compression trimmer.
C_2—Optional. 1-5 mmf variable capacitor.
L_1—3t. #20 e. 5/16" dia. space wound.
R_1—10K printed circuit potentiometer. Mallory 14L1 MTC.
RFC_1—22 μh r.f. choke. Miller 70F225A1.

suitable switching. The amplifier (Round Hill Associates AA-100) was designed for this type of service and has built-in transformers for various inputs and outputs.

The other model was primarily intended for field use and is fixed tuned with a push-to-talk switch built into the handset. A two-stage headphone amplifier is used in conjunction with the receiver in order to simplify switching.

Both models of the 10 meter SST use a retuned 11 meter, 3 transistor r.f. section. This board (Round Hill Associates TR-100) provides a crystal controlled output in excess of 100 mw and is designed to match a 50 ohm load.

The receiver shown in fig. 1 is also available from Round Hill Associates under Part No. RS-100[1], or it may be constructed. In either case, it is also used in both models of the 10 meter walkie-talkie.

[1] Price List: AA-100, $7.95; TR-100, $10.95; RS-100, $10.95. From Round Hill Associates, 325 Husdson St., New York, N.Y.

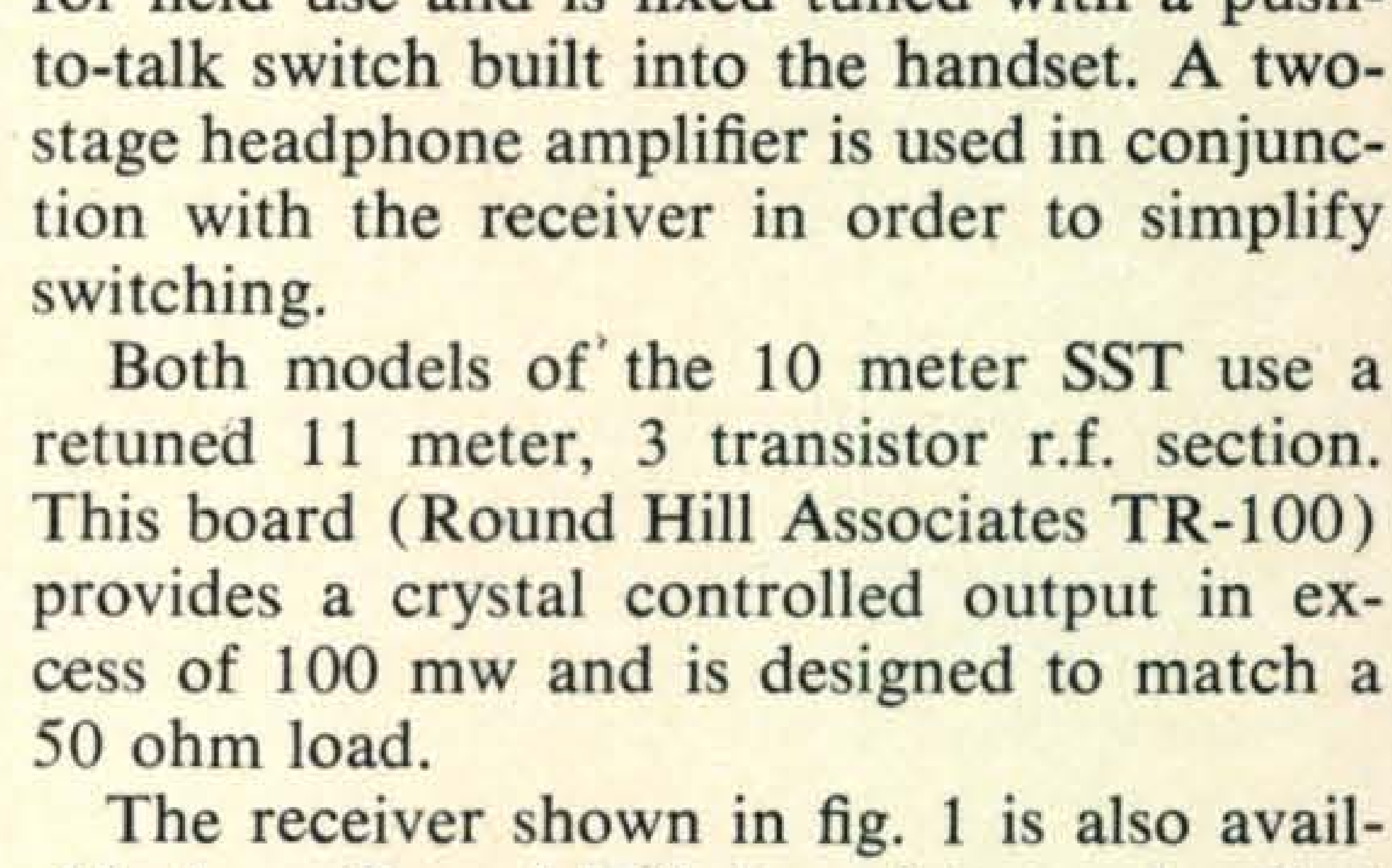


Fig. 3—Two stage headphone amplifier to follow the receiver front-ends of figs. 1 and 2.

See page 126 for New Reader Service

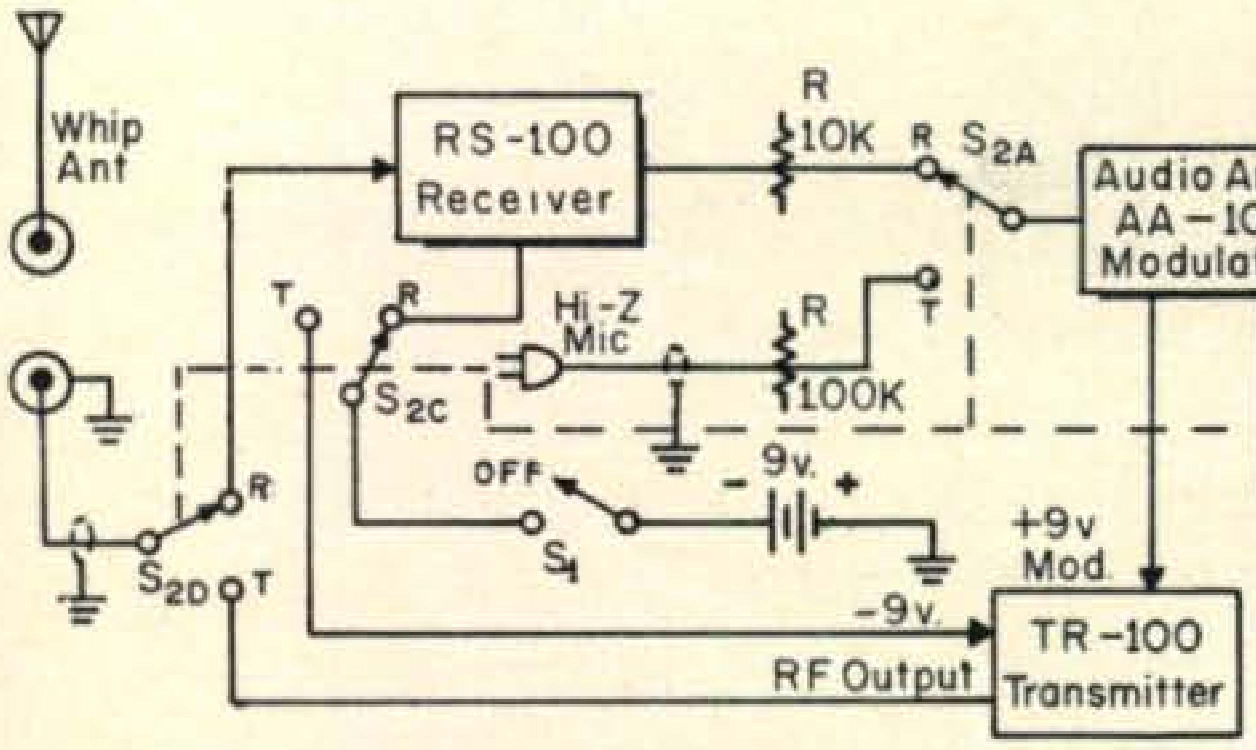


Fig. 4—Block diagram of the loudspeaker version of a K9LAJ SST showing simple circuitboard interconnections for switch-to-talk operation.

Loudspeaker Model

Figure 4 shows the wiring for interconnecting the various components that make up the loudspeaker model of the SST series. Switch S_1, mounted on the volume control, is used to turn on the transceiver; and S_2 provides the RECEIVE/TRANSMIT function by switching the audio amplifier board, changing the antenna, and turning on either the receiver or the transmitter.

The unit is housed in a 3 × 5 × 7 inch aluminum chassis with the receiver board, switches, coax connector, and speaker mounted on one of the 3 × 7 inch sides. The battery supply consists of six size "C" cells in series held by 3 Keystone Electronics No. 174 battery holders. The battery clips are fastened to a 5 × 7 inch aluminum plate which is fitted to the chassis. The photograph shows the location of the major parts.

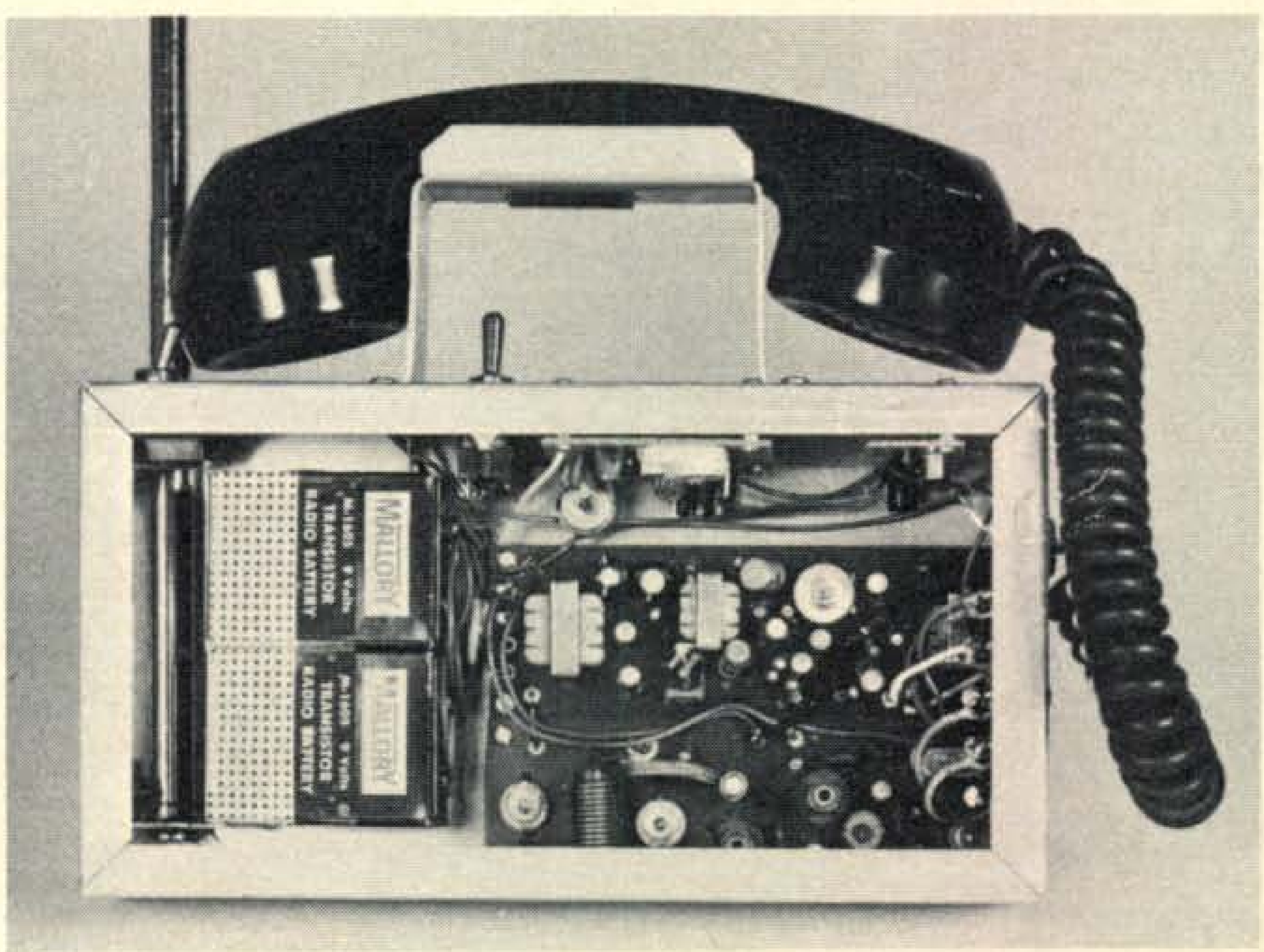
Push-to-Talk Version

The RECEIVE/TRANSMIT function can be accomplished with a s.p.d.t. switch if certain precautions are taken with the AA-100 and TR-100 boards. S_2 turns on the transmitter by connecting its +9v ground return to the chassis and lifting the receiver audio from ground; however, the transmitter and modulator *have to be insulated from the chassis* in order to enjoy the PTT feature. The method used by the author was to carefully scrape the underside copper foil away from the four mounting holes on each board. Wire jumpers were then soldered around the board corners to insure ground continuity without touching the ½" metal spaces used to support the two boards. With the boards thus mounted, they have no chassis +9v return until the PTT switch is activated.

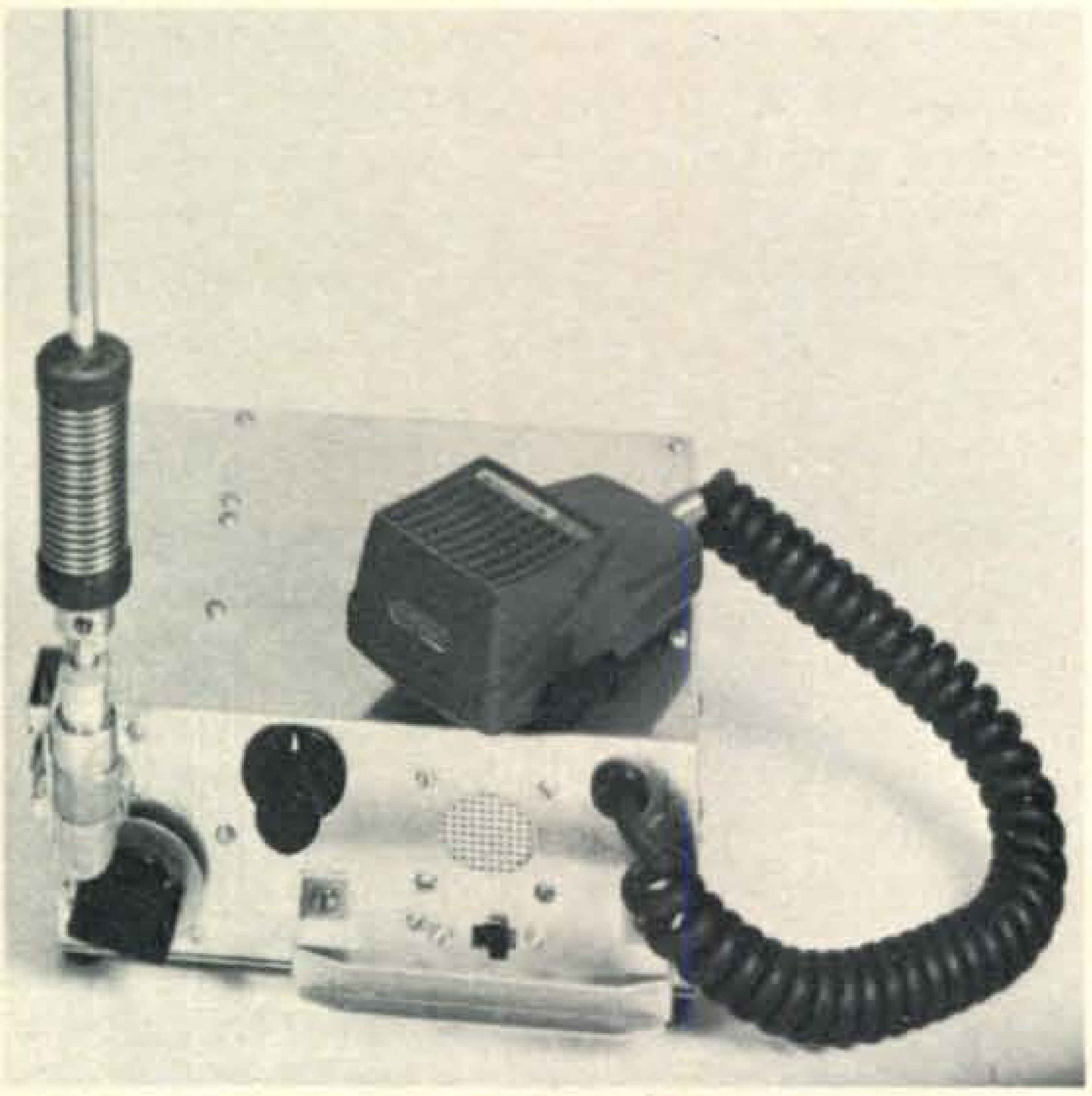
The photographs show the general layout for this model. Notice that two batteries are used in series for greater battery life. (The author's model is still doing fine after seven months of use.) The antenna is mounted within the case and passes through a grommet to insulate it from the case. A handle is made to fit the handset (fig. 6) and is mounted on the case along with ON-OFF switch, S_1.

Testing the STT Series

The testing procedures vary with the two models, and we'll cover the loudspeaker version first. The gain control on the AA-100 board should be turned to maximum (clockwise) for this application. With S_2 in the RECEIVE position, turn the panel mounted gain control, R_1, to maximum and adjust the regeneration control on the receiver board for proper setting—as noted by a hissing in the speaker. The receiver trimmer is then set to the proper frequency with a known signal source.



The push-to-talk transceiver is constructed in a shallower, but longer aluminum chassis than the loudspeaker version. The receiver board mounts at the top center with its two-transistor headphone amplifier to the right. Modulator and transmitter boards are below. The 8' collapsible whip antenna is mounted on a small bracket within the unit, and passes through an insulated bushing at the cabinet top.



Closeup of a ten meter switch-to-talk transceiver shows T-R switch under carrying handle, audio gain control near the panel center, and bandspread tuning control at the lower left. The antenna in this fixed/portable application is a modified CB base-loaded whip with two turns removed from the loading coil.

Once this has been done, the transmitter should be tuned. The tuning is tricky and the factory tuning procedure should be followed closely for best results. See chart for procedure.

Modulation level is then adjusted with R_2, a 100K printed circuit pot mounted near the audio board.

The receiver and the transmitter in the PTT model are adjusted the same way. There is no receiver volume control to set, however, and the transmitter modulation is set with the gain control on the AA-100 board.

In the Field

On 10 meter range has been found to exceed several miles between portable and fixed station. Range between units varies around a mile, although this distance is shortened in the city as should be expected. Battery life and reliability far outdistance their older vacuum tube counterparts.

Next month, the 6 meter r.f. section will be described. It is easy to duplicate, yet capable of ½ watt input.

And thanks to Miss Norma Vanden Hurk, who endured some pretty chilly weather while SWL'ing in Central Park, New York City, for our cover shot. ■

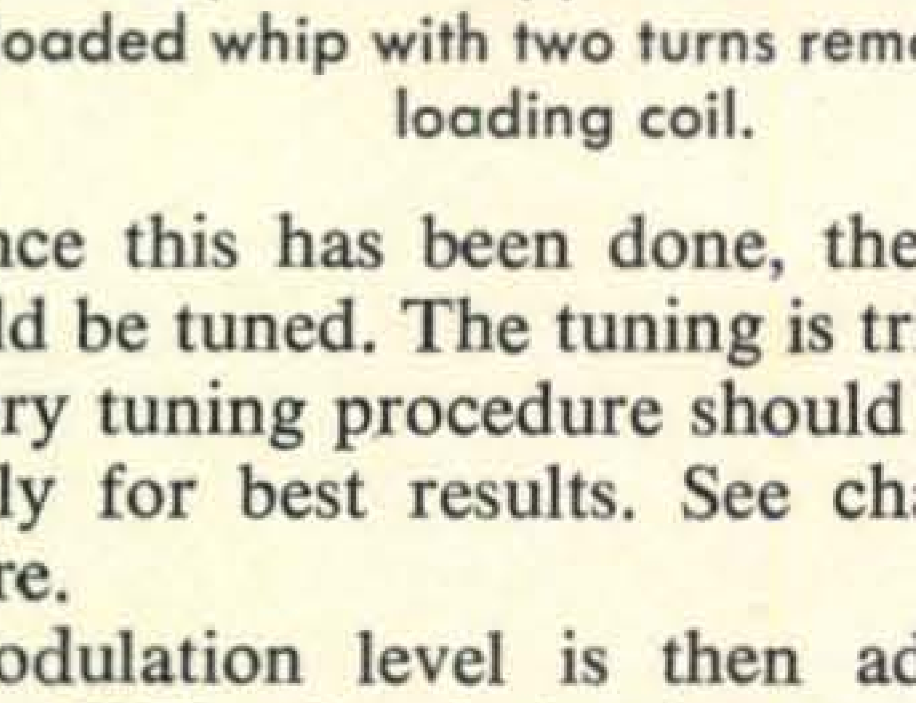
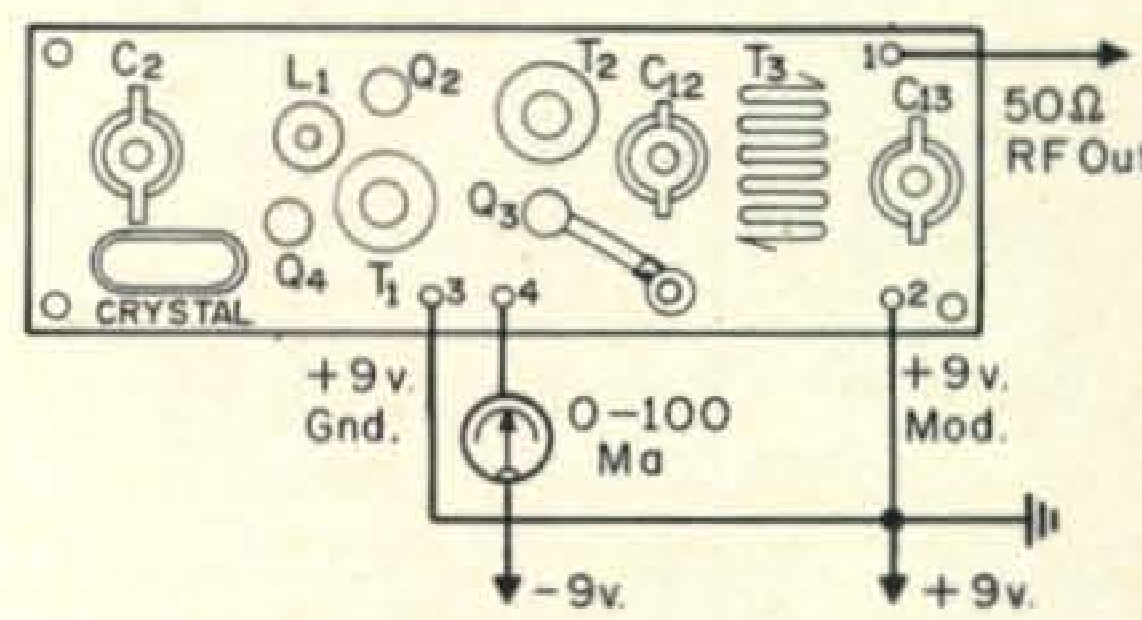


Fig. 5—Push-to-talk interconnections for the Solid State Transceivers. The p.t.t. switch S_2 is integral to the surplus telephone handset.

S_1—S.p.s.t. switch on R_1.
S_2—4 pole double throw slide switch.

TR-100 Alignment

Screw the 2 coil slugs into the coil winding until the top of each slug is level with the top of the actual coil windings. Tighten down (clockwise) the 3 trimmers. Tie the two +9 volt connections together and wire to +9 power source. Connect −9v power source in series with 100 ma d.c. meter to the −9 volt terminal on TR-100 board. Turn gain control down if modulator is connected.



Alignment Procedure

1. Turn oscillator slug (T_1) put of coil (counter clockwise) until current drain measures 30 ma on meter.

2. Then turn driver slug (T_2) out until second peak is reached on meter.

3. Readjust oscillator slug, if necessary, to maintain a total current drain of 30 ma.

4. The plate tuning trimmer (C_{12}) is tuned for a dip in current.

5. The oscillator slug is again adjusted, if necessary, for 30 ma total current.

6. Then using the field strength meter, adjust the loading trimmer (C_{13}) for maximum output. This will occur at the maximum setting (screw in) in some cases.

7. Finally, readjust the oscillator slug and plate capacitor for maximum output on the field strength meter. Very little adjustment should be needed.

8. Check total transmitter current. When properly aligned the TR-100 will draw between 30 and 40 ma as measured on a d.c. meter.

9. Oscillator crystal trimmer (C_2) is then used to bring unit to exact frequency when heterodyned with known standard.

See page 126 for New Reader Service

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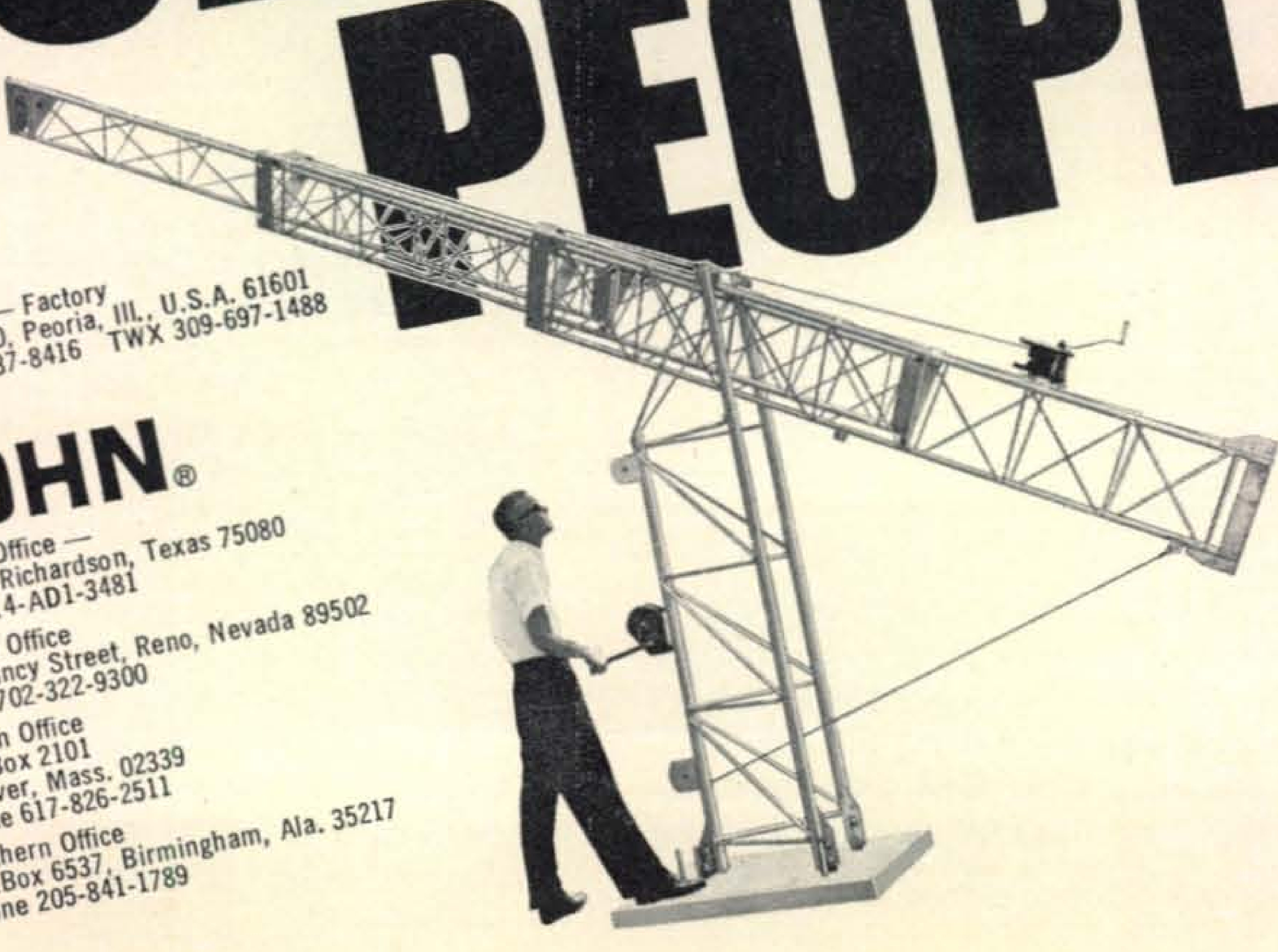

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See page 126 for New Reader Service

THE DXPEDITION

BY DON MILLER,* W9WNV

Part VII—St. Brandon via the Long Path

AUGUST 16th, 1530 hours local time; two hours out of Port Louis, our speed was reduced to a modest six knots by the mighty southeast trades once we left the protective lea of Mauritius. Skipper Jack explained our course as I drew first watch; 70° was all we could make on our east-southeast course; a persistent 20-knot wind, high seas, and a 2-knot current were all coming from 110°, our exact course to Rodrigues Island!

Contemplating the rough trip ahead, I was deep in thought when there came a mild rukus from below—seems the putty sealing on the windows above Bill's bunk had peeled away in the sun and provided my reluctant companion with an unexpected salt water bath! This must have been the last straw—Bill decided he'd had enough of this nonsense—after a hasty conference we agreed to drop Bill at Grand Bay, on Mauritius' north coast, re-putty the leaky windows, grab a hot dinner ashore (we were already soaked and shivering), and again set sail for Rodrigues. Bill agreed to seek a chater to St. Brandon if his license were approved before our estimated return.

The voyage was rough. Really rough. It doesn't take long, bucking the Indian Ocean's southeast trades in a tiny boat, before you're sick. And wet. But we seemed to be making respectable time, tacking first one way, then the other, never able to point closer than 50° into a doggedly persistent breeze from our very target.

We covered 135 miles, one-third of our course, in the first 24 hours, actually sailing much more due to our jagged path. *The Edward Bear,* heavily overloaded, was behaving like a true champion against the elements. By sunset on the 17th I had recovered my optimism and gastrointestinal tract and hit the sack in earnest. Then it happened. . . .

Zapp!! As I tried to sit up in the bunk I was hurdled across the narrow cabin by the broach. I thought we'd be flipped upside-down—only one hull seemed to remain in the water—but the tiny trimaran somehow righted itself, and I scrambled adeck behind Larry and Jack into the night amidst the flapping of sails and rigging. The waves seemed to spin us in two directions at once.

The turnbuckle anchoring the junior forestay, one of the few elements of rigging not replaced during the recent overhaulling in Mauritius, had snapped in two, the mast miraculously escaping damage. It was pandemonium, hanging on with one hand (Jack's right), lowering sail, and trying to light the kerosene lamps (no available a.c. or d.c. aboard) in the wind and drizzle. We kept them aglow long enough to discover the bad news: The snapping loose end of the steel stay had slashed the jib nearly in half, and the reefed mainsail had ripped badly as the loose boom scraped the aft hatch cover during the hassle. At this point, out of discouragement, exhaustion, and nausea, I went below to put the cabin in order and sack out, leaving good old Jack and Larry to handle everything and get us moving again.

A Decision

I must have been asleep for three or four hours before the lurching overcame my fatigue; we seemed to be tossing about like a child splashing in a swimming pool. Jack and Larry were collapsed on the bunks. Both sails were rolled in a heap on the cabin floor. I managed to reach the aft hatch and emerged into a howling wind and sleet-like rain. No sails were up. We were drifting back toward Mauritius at 3 knots!

I couldn't arouse either of my companions, except for a few groggy phrases from our

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Heathkit HW-17 in detail. It's really a separate eiver and transmitter in one compact, versatile kage (the only common circuitry are the power pply and the audio output/modulator). Frequency erage is 143.2 to 148.2 MHz. The solid-state dual version, superheterodyne receiver with a pre-built, -aligned FET tuner has a lighted dial with 100 kHz bration, automatic noise limiter, squelch, and 1 uV sitivity. Selectivity is 27 kHz at 6 dB down, a re that's consistent with band occupancy and easy eiver tuning. The front panel meter indicates reved signal strength and relative power output. A osition switch on the front panel has a "Spot" ition for finding the transmit frequency on the ing dial, a Receive/Transmit position, and a tery-Saver position that comes in handy during se long periods of monitoring while mobile (the eiver draws only 8 watts during this time). A 5" speaker is built in.

On the transmitting end is a hybrid circuit including transistors and tubes with a 25 to 30 watt power input and an AM power output of 8 to 10 watts. Modulation is automatically limited to less than 100%. A front panel selector switch chooses any of four crystal frequencies or an external VFO (the Heathkit HG-10B VFO at $37.95 is perfect for this job).

Front panel controls include Final Load, Final Tune, Crystal-VFO switch, Main Tuning, Squelch with ANL switch, Battery Saver-Receive/Transmit-Spot switch; rear panel has S-meter Adjust, Headphone jack, Power socket, VFO power socket, VFO input, and Antenna connector (50-72 ohms, unbalanced).

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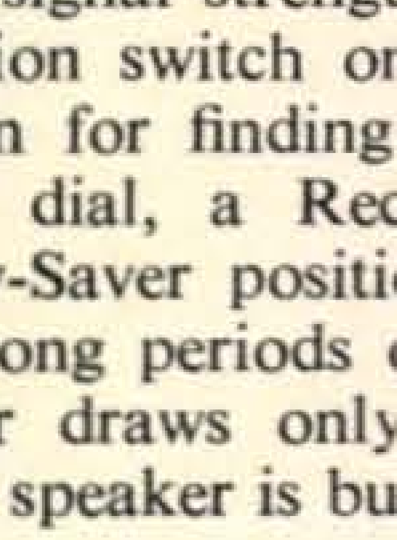

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Prices & specifications subject to change without notice. AM-199R skipper, muttering that he couldn't stitch sails with one hand and that Larry was sick and exhausted. Sailing into a stiff breeze on the high seas in a small craft is nauseating enough, but you really haven't tasted anything until the sails are lowered and you are tossed about in a rolling, swaying pitch. If you then try some fine reading or sewing, *be prepared!* Three hulls or not, it was rough, but I was wide awake and decided to try my minor surgery technique on the sails. I managed just three stitches before the unavoidable happened. You know, there's something stimulating about puking with the wind in a refreshing rain. But after half a dozen episodes, abdominal soreness and fatigue overcome the novelty. With a little practice I could make 5 or 6 stitches between deck visits, and by daybreak on the 18th, when Jack and Larry regained consciousness, I submitted the repaired mainsail for Jack's inspection and fell into the sack.

By evenng Jack and Larry had repaired the jib and rigging, and for the *third time* on that brief voyage we set sail for Rodrigues Island. But we had lost a good 60 miles and the winds and seas were getting stronger. Being on a main steamship line with no lights, we rotated watch during the night. Throughout the ensuing 24 hours the winds and seas became steadily worse. By morning on the 20th it became apparent that we were caught up in a respectable anticyclone. By midday Larry confided that he was, indeed, ill (he nearly died from an overwhelming case of hepatitis a year earlier in Somaliland and suffered symptomatic spells from time to time). By late that day the solution was quite obvious. What would *you* have done? Your skipper has a paralyzed hand. The only other sailor aboard is too sick to navigate. You are making about 1½ knots into an anticyclone at the expense of sail and rigging after already snapping a turnbuckle and slashing both your sails. Instead of improving, the weather persists in deteriorating—and from the wrong direction, yet!

We were about 350 miles from St. Brandon. DI2LE had already been ashore at Rodrigues for a week, awaiting his own VQ8 callsign; if it didn't materialize or if there were still a DX demand for that spot, we could sail from Mauritius in two weeks aboard a comparative luxury liner, the cargo ship, *M. V. Mauritius.*

The *Edward Bear* turned north at 10 knots, the elements astern, sails full, smooth and steady this time. There's something about the first week at sea that would do an insomniac good; we adjusted Larry's home-brew self-steering device and all three of us sacked out. For 24 hours!

Islands at Last

Awakening from what seemed like deep general anesthesia, I found Larry and Jack basking on the sunny deck and a steady breeze astern. By Larry's sightings we were only 90 miles from St. Brandon; Jack's figures showed a little over a hundred. It was probable we'd reach the shoals before sunrise, a thought none of us cherished, so Jack reefed in the mainsail and we slowed to about 7 knots.

"How about some chow?", I asked. Larry was still a little too green to welcome the idea, but it took Jack only a few minutes to fetch the fishing gear. Dropping a crude rag-and-silver bait on 50 yards of quarter inch rope, Jack hooked our dinner in less than ten minutes—a 60-pound yellow-tail tuna. I was already drooling—a fish like that could feed a crew of forty men, and we were arguing over how to prepare it—steaks, fillets and chips, or curry. But just as I prepared the gaff, there came a mighty swirl—at least two medium-sized sharks surfaced, having removed all but the head and gills of our dinner! "Survival of the fittest," I mused. It took 20 minutes to hook the next one, a 70-pound sea mackerel, and this time we wasted not a second in landing her. Within the hour Jack and I had devoured five pounds of fish, chips, and beaucoup hot chocolate. As a skipper, Jack was a fine one-armed chef! And by sack time we had gobbled mushroom omelets and spaghetti and meat balls, even Larry partaking in the grand feast to celebrate the eve of our St. Brandon landing. Each thought of the previous three days was accompanied by a wave of nausea, so I concentrated on the optomistic future as we hit the sack again.

An hour after sunup on the 22nd Jack and I spotted the islands. We threaded our way between those spectacular coral reefs and palm-covered shoals, anchoring at Raphael Island around 10 A.M. local time. Larry seemed to be recovering, but Jack's hand was still completely paralyzed. We had, indeed reached St. Brandon via the *long path!*

A Simple Solution

We had spotted *Le Siren* on our approach at the south end of the island group; she was a 70-foot motor-powered fishing vessel with a 25-ton refrigeration unit. Each month *Siren* would call at St. Brandon, collect the fifty fishermen camped at Raphael Island, and catch her 25 tons in 3 or 4 days in what has to be ranked among the world's most spectacular fishing areas. Fish sold for one to two rupees per kilo (US 10¢ to 20¢ per pound) in Mauritius, the fishermen were paid practically nothing and could live on half of that, and the entire operation is producing a small fortune for its owners in Port Louis.

No sooner had we dropped anchor when, as expected, the Island Manager's private outrigger approached. A small, bearded man boarded *Edward Bear* and greeted us in both French and English. Somehow, his welcome seemed a little on the desperate side. Inhabitants of small islands are always happy, sometimes overjoyed to have visitors, but this chap seemed to be overdoing it a bit. We soon learned why.

Since our original plan called for the voyage to Rodrigues and then one to St. Brandon two weeks later, and since they received data on our itinerary through the island's radio link with the fishing company in Mauritius and through the hook-up with St. Brandon's meteorological station, we had taken them by surprise. Moreover, we had been greeted by the Island Manager's Assistant; the Manager, Jaques Panin was dreadfully sick, possibly dying, from the tone of the conversation! Bearing the only doctor within 300 miles, our trimaran was given a royal welcome.

First things first. Mr. Panin had acute rheumatic fever. No doubt about it. Luckily, we had some penicillin aboard, and between our first aid kit and the island's medical supply, treatment was begun that morning. At some urging, we convinced all concerned that *Siren* should sail the following morning for Mauritius with Panin aboard, and we took advantage of the trip to return Skipper Jack Astley to Port Louis for wrist Xrays and possible physiotherapy—I was becoming increasingly more suspicious of a fractured navicular bone (Jack had been in a few recent scuffles), which could produce disastrous results if not properly treated.

Arrangements were made on c.w. via the met station's radio contacts with Port Louis and Diego Garcia, Chagos Islands, during which I was permitted to operate the hand key myself. Weather service c.w. men have a fist all their own, but I had been monitoring their French and English transmissions for our own weather reports and had already acquired a bit of the technique and rhythm. During the exchanges, I was informed that the Chagos operator was a ham; I introduced myself to VQ8CDC at the other end and we made a 20 meter sked for that night.

But it was already mid-afternoon and we had our hands full securing anchor, landing all the gear and supplies in a makeshift dinghy through a strong surf and current, and securing the *Edward Bear* half a mile from shore. Having arranged daily skeds with VQ8CC and VQ8AD on 40 meters before departure, I had exactly one hour to set up the station and antennas, and we gave it a good try, for I wanted to get word to Bill about our change of plans and find out when the freighter was leaving for Rodrigues.

The Amateur Radio DX Handbook

After a year and a half of writing and re-writing, I am joined by the staff of *CQ* and Cowan Publishing in proudly announcing *The Amateur Radio DX Handbook,* now available. I believe you'll be surprised to find that the *DX Handbook* is not, like so many other DX works, a collection of material available in other sources. Instead, you'll find it an original technical manual of data and operating aids, covering every facet of *how to work DX*, compiled from facts supplied by computer and over twenty of the world's leading amateur radio and DX authorities.

A chapter on *propagation* explains in step-by-step details how to assess your own DX opening on each band and how to calculate and predict when and by what path a DX opening will occur. It contains details and data on sunspots, MUF, ionospheric disturbances, long path propagation, WWV and other international forecasting services, great circle paths, scatter, predictions, and a band-by-band analysis.

A chapter on *international factors and local regulations,* written—like all material in the *Handbook*—so as to be of value to the DXer outside, as well as within the U.S.A., includes interpretations from the F.C.C. and other bodies published for the first time, outlining how close to the band edge you may operate, what call to sign from your friends' shacks, how to measure your power input on s.s.b., 2nd party *vs.* 3rd party traffic, recordings, secrecy, reciprocal licensing, unexpected visits from inspecting officials, and quite a bit more. It defines tailending, lists international prefix allocations both by prefix and country, and includes perhaps the only complete listing of amateur radio prefixes by prefix and country. The derivation and use of GMT and the 24-hour clock is included and world time conversion charts are provided.

The chapter on *equipment* explains what the DXer should look for in receivers, transmitters, transceivers, amplifiers, and antenna equipment and accessories. The value of transceivers is compared with the separate receiver-transmitter combinations. The true meaning of s.w.r. and its significance is explained. Yagi and quad design is outlined and a chart is included which gives all vital dimensions—boom length, spacings, and element lengths for proven quads and yagis up to eight elements! There are also tables comparing amplifier and rectifier tube specifications, and the various types of coaxial cable. The age-old question of quads-*vs.*-yagis is settled once and for all, believe it or not!

The chapter on amateur *frequencies* describes each band, including extensive sections on 160, 80, and 40 meters, and on v.h.f.-u.h.f. DXing, as well as a description of how the ITU and FCC establish and maintain amateur allocations and sub-allocations.

A long chapter on *how to work DX from the home station* includes some unusual tips for c.w., phone, and RTTY DXing, published for the first time. The c.w. section outlines suggestions and definitions you're probably not familiar with, and an outline on how to establish and maintain your c.w. proficiency. There's a complete listing of all telegraphic prosigns and abbreviations and a description of how "5NN" and other such short-cuts developed. The phone section includes translation of most expressions needed for DX contacts into Spanish, Portuguese, Russian, and French, and a new standardized, time-proven DX phonetic alphabet with alternatives, for DX work. Q-signals, calling CQ, signal reporting, and the use of your S-meter are discussed in detail. The RTTY section includes most of what you must know to establish your own station and work DX on that mode. The chapter explains how to *find* DX, including a chart of all available DX newsletters and publications, comparing their rates, formats, QTH's, and other details, and how to *call* DX most effectively.

There are also chapters on *how to operate from the rare location* and on *DXpeditions*.

There is a complete chapter on *QSLing and postal factors,* including original tables giving postal rates from the USA, Canada, Germany, the U.K., and other areas into each of the world's prefix zones, valid for airmail and surface QSL cards and letters. The DX Stamp Service, with availability and rates for foreign stamps to each DX country, is outlined. The use of IRC's, sending money through the mails, and QSL Managers are discussed. The complete W6GSV QSL Directory is reproduced, including over 2,000 listings and QTH's of the popular QSL Managers and services. Outgoing QSL services are also included.

There's a chapter on the *s.w.l.,* and a most interesting chapter on *mobile DXing,* written by DXers who have worked over 200 countries from their cars!

There's a chapter on *DX contest operating,* including a complete annual contest calendar, planning, operating, and logging suggestions, and band-by-band outlines. A new approach in the multiplier-*vs.*-contacts ratio is suggested.

A chapter on *DX awards* describes how to obtain the major certificates, and a chapter on *DX clubs and organizations* lists those already established throughout the world and describes how to start one in your area.

Finally, there is a section which includes *great circle bearing* charts valid for *130 different* world population centers into each of 340 prefix areas! These are the most accurate listings I've seen, being computer derived, and include the most complete listings of prefixes; for example, all alternate prefixes (YV & 4M, XE & 4A) and multi-prefixes (Antarctica) are included, where surprising differences exist into each individual prefix area (VKØ, ZL5, UA1, KC4, Etc.)

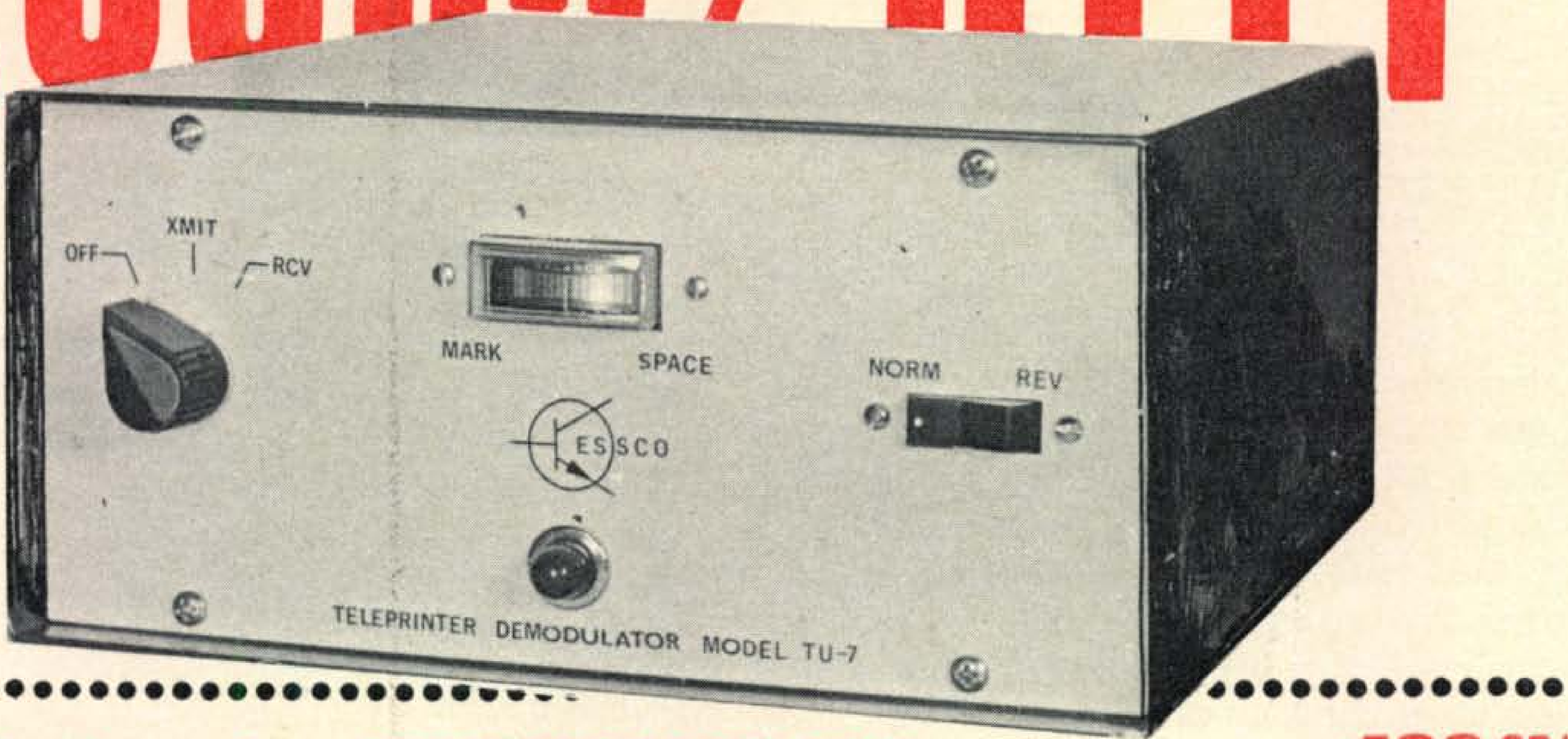
The Amateur Radio DX Handbook, an original work of 200 pages, sells for $5.00 US. I hope you will find it worthy of a place in your shack and will eventually send a copy to a DX buddy overseas. All this author's royalties have been, and will continue to be put back into DX and DXpeditions. The work is dedicated to Chuck Swain, K7LMU, and Ted Thorpe, ZL2AWJ. It will soon be available at your nearest amateur distributor and from Cowan Publishing, publishers of *CQ*. ■

Next month: Operating from St. Brandon and Rodrigues Islands.

See page 126 for New Reader Service

GET REALLY PRACTICAL . . .

ESSCO / RTTY



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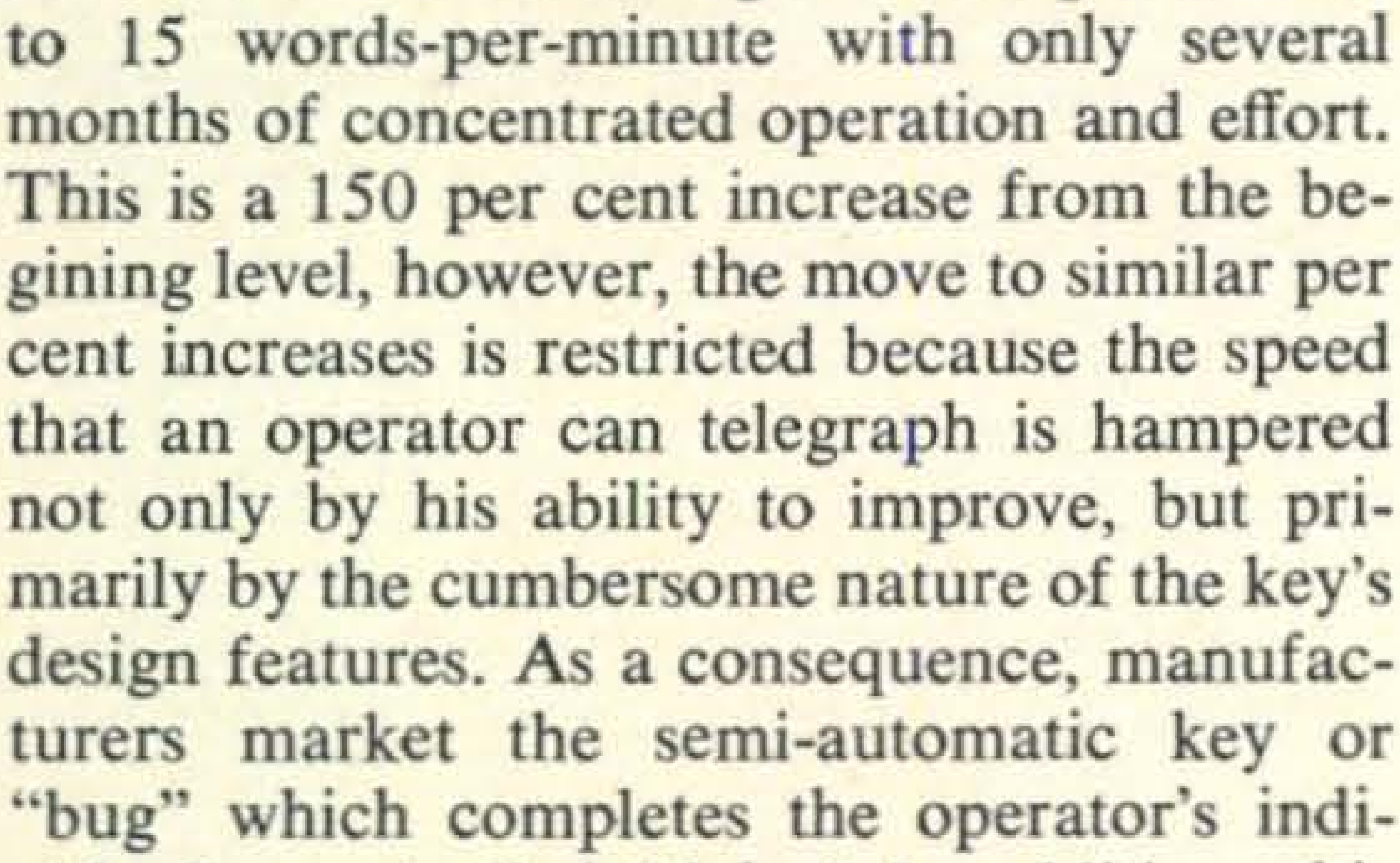
See page 126 for New Reader Service

THE QM KEYER/MONITOR

BY RONALD LUMACHI, *WB2CQM

As proficiency increases with straight key telegraphy, it becomes disproportionately more difficult to achieve additional higher transmitting speeds due to the inherent shortcomings of the straight, mechanically actuated key. For example, the Novice operator moves from transmitting 5 words-per-minute to 15 words-per-minute with only several months of concentrated operation and effort. This is a 150 per cent increase from the begining level, however, the move to similar per cent increases is restricted because the speed that an operator can telegraph is hampered not only by his ability to improve, but primarily by the cumbersome nature of the key's design features. As a consequence, manufacturers market the semi-automatic key or "bug" which completes the operator's individually controlled "dahs." In addition, this units sends out a series of rapidly completed "dits" once initiated by the sender. Unfortunately the dits do not continue indefinitely, nor are they perfectly equal in length since the principle of semi-automatic keying involves weights and springs which must, in the last analysis, defer to the forces of friction. It follows, therefore, that some form of generating dashes and dots, not restricted by any form of reciprocal motion, would allow the serious telegrapher to communicate at a speed governed solely by his own personal ability and skill.

*73 Bay Street, Brooklyn, New York 11214.



The front view of the QM Keyer Monitor showing control locations.

Project Philosophy

The following text describes an electrical keyer device designed to make an infinite number of dashes or dots, or any combination, at a predetermined speed and ratio for continuous wave communication. The electrical design insures that once the individual circuit for the dot or dash is completed, the waveform is electrically initiated, perfectly formed, and above all self-completing. As a consequence once the controls are adjusted for the normal dot-dash ratio of 3:1, they are formed as perfectly at the beginning of the transmission as they are at the end.

To insure a high telegraph quality, a monitor circuit is incorporated into the design which will simultaneously monitor the telegraphy as it is being sent by the transmitter, and will provide the operator with a "sound picture" of his communication. In addition, the keyer can simply be used as a code practice oscillator when not on the air.

Keyer circuitry is not new and many manufacturers market units on almost all price levels. The QM keyer/monitor is a result of experience with both commercial and home built models with improvements made both electrical and mechanical providing the serious, discriminating c.w. operator with a complimentary item of equipment.

Parts Selection

The keyer is housed in a two-tone sloping

 See page 126 for New Reader Service

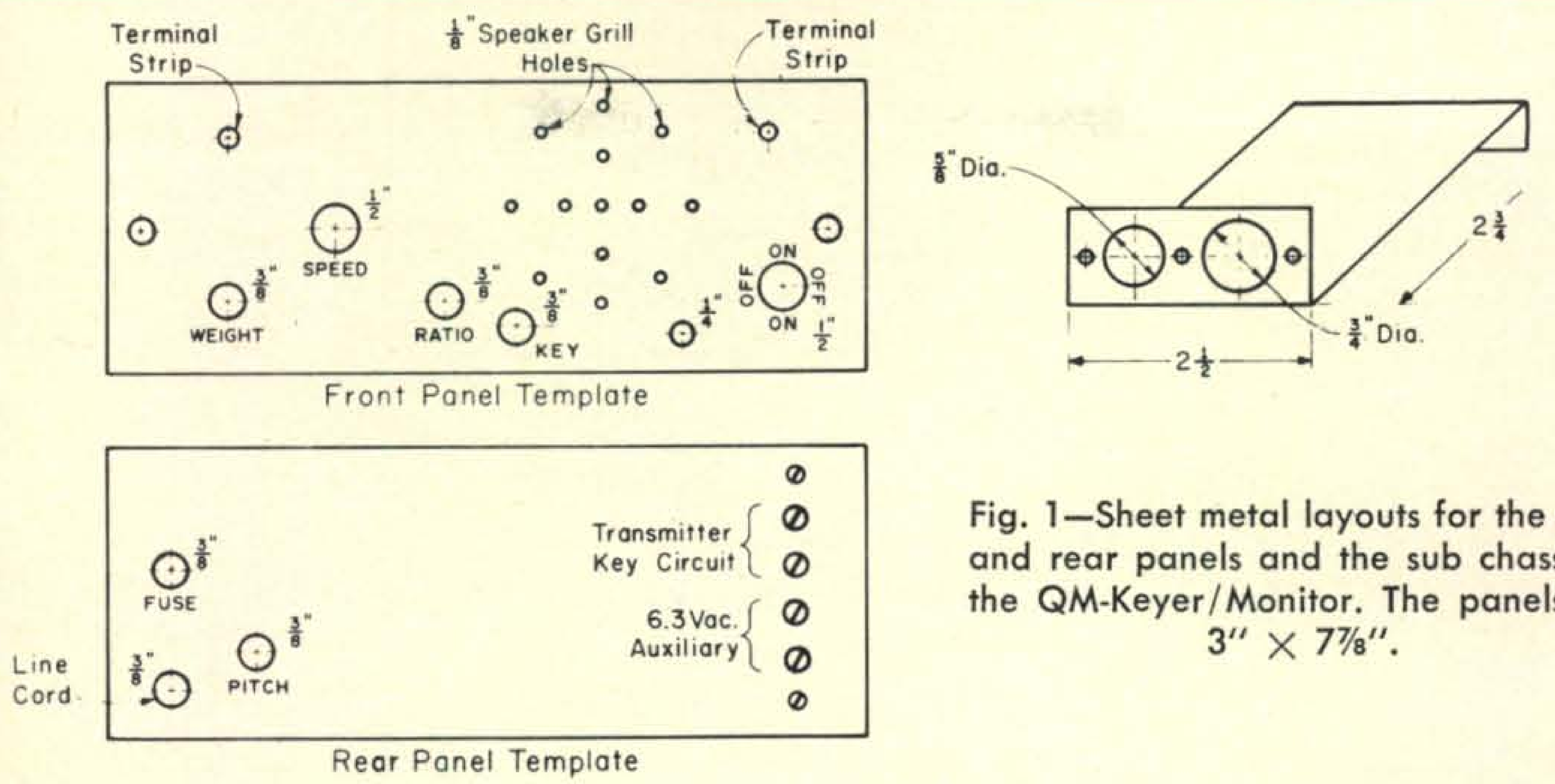


Fig. 1—Sheet metal layouts for the front and rear panels and the sub chassis of the QM-Keyer/Monitor. The panels are 3″ × 7⅞″.

steel cabinet which is admittedly somewhat more costly than a comparable Minibox, however, the intention was to add appearance to electrical refinement and remove the project from the realm of the common homebrew-looking equipment. Tubes V_1 and V_2 are dual and single triodes, 12AU7 and 6C4 respectively. The relay is an inexpensive d.p.d.t. Lafayette import activating both the c.p.o. module and the transmitter keying circuit simultaneously. The theory behind the keyer design was to use parts and material of a quality that will be both practical and economical and which will adequately perform its design function at minimum costs. Consequently, many components are catalog specials and TV salvage which tends to reduce the price yet complete the task expertly. The parts list indicates the most accessible and inexpensive source of supply.

Construction

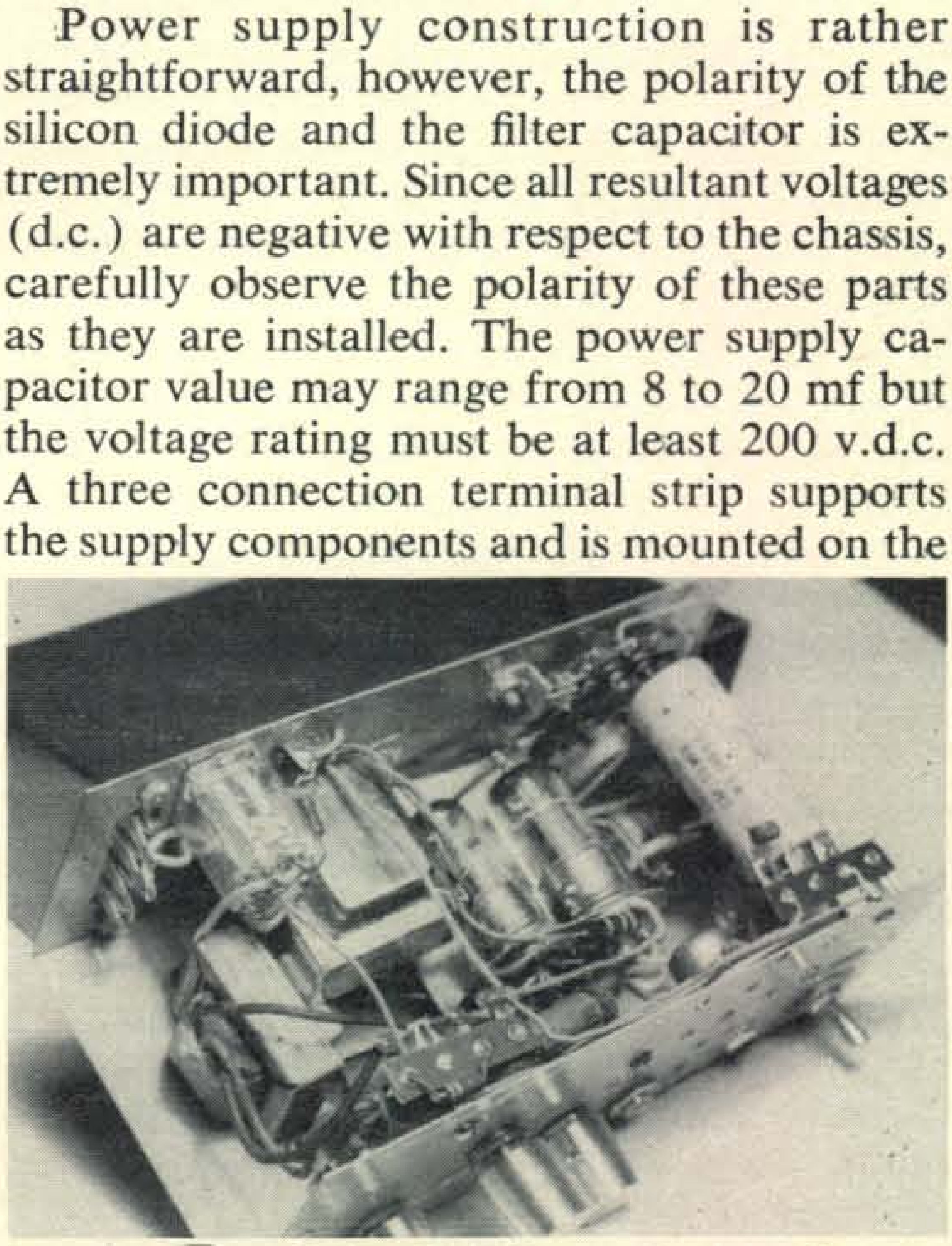
Form the sub-chassis from a thin sheet of aluminum for tubes V_1 and V_2 according to the specifications in fig. 1. Punch the larger hole for the 12AU7 and the smaller hole for the 6C4 and orient the sockets so that pin 4 (6C4) and pin 9 (12AU7) are close together. This will shorten filament wiring runs at a later step.

Drill several holes in a symmetrical pattern on the chassis face and mount the small p.m. speaker. Mount all front panel controls according to the layout shown in fig. 1. These include the three potentiometers, d.p.d.t. center off switch, neon indicator, and phono socket. Using the layout shown for the rear panel, drill and mount the 27 ohm potentiometer (PITCH CONTROL), fuse, line cord grommet, and the screw-type terminal strip.

In order not to mar the enamel finish of the chassis, it might be well to cover the front and rear face of the chassis with strips of masking tape. The part's location can be easily layed out, marked with pencil, and drilled. After all the holes are formed, the tape can be removed.

Wiring

Power supply construction is rather straightforward, however, the polarity of the silicon diode and the filter capacitor is extremely important. Since all resultant voltages (d.c.) are negative with respect to the chassis, carefully observe the polarity of these parts as they are installed. The power supply capacitor value may range from 8 to 20 mf but the voltage rating must be at least 200 v.d.c. A three connection terminal strip supports the supply components and is mounted on the



Interior view of the QM Keyer Monitor showing component location. The c.p.o. module is mounted upright on the right end under the filter capacitor.

See page 126 for New Reader Service

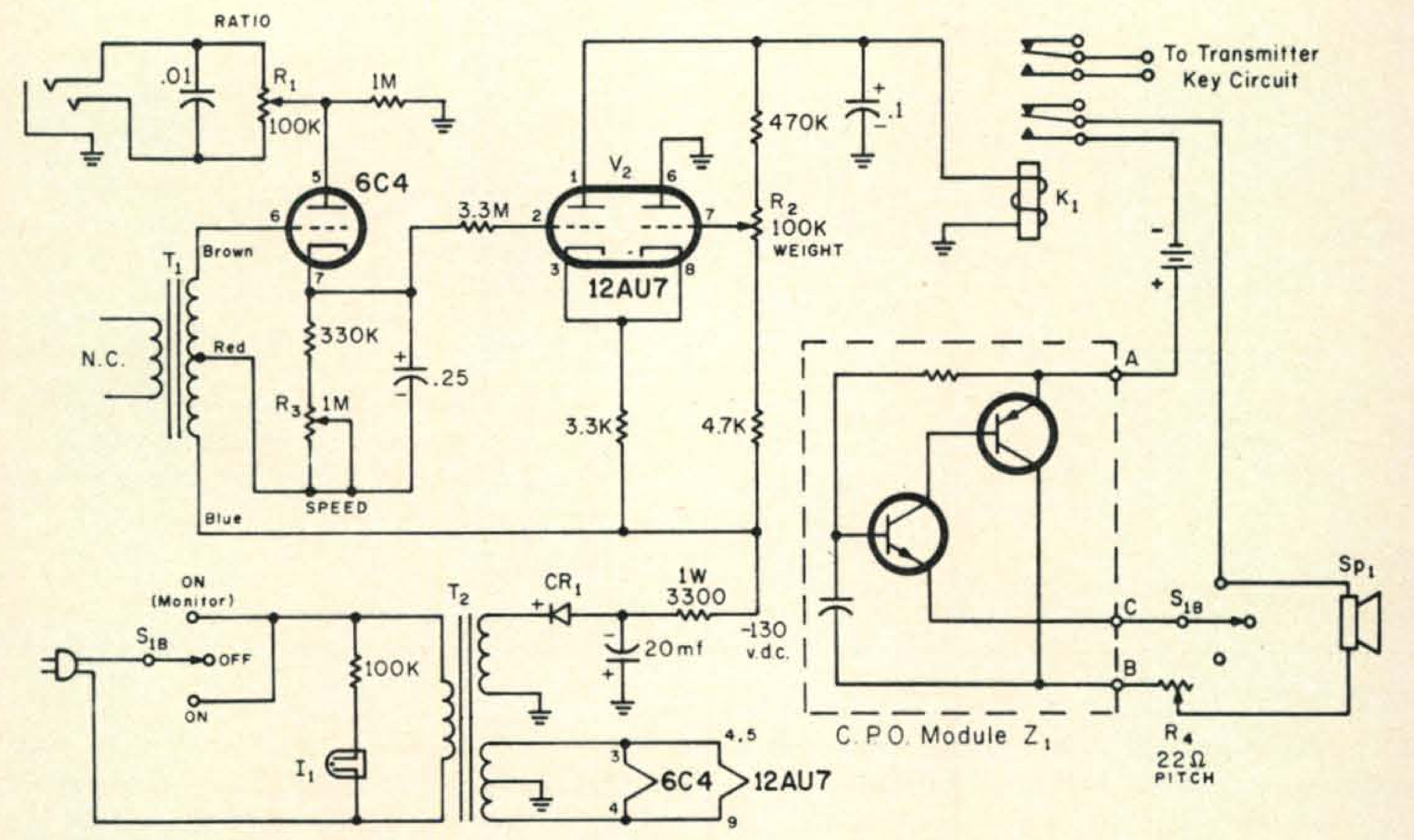


Fig. 2—Circuit of the QM Keyer/Monitor. Controls R_1, R_2 and R_3 have linear tapers but R_4 must have a log taper. All capacitors are in mf and all resistors are ½ watt except where indicated. The parts not listed below can be scrounged from old TV sets or the usual junk box.

B_1—Battery Holder	*(A)* 14B109	$ .23
CR_1—Silicon Diode	*(A)* 18B131	.39
I_1—Neon Indicator	*(B)* 99H6226	.39
K_1—Relay d.p.d.t. 5300 ohm coil	*(B)* 99H6093	2.95
R_1, R_2,—100K pots	*(A)* 18C433	.49 ea.
R_3—1 meg pot	*(A)* 18B226	.49
S_1—D.p.d.t. toggle	*(B)* 99H6148	.49
SP_1—2¼" p.m. speaker	*(A)* 22A350	.98
T_1—Output trans. 25K c.t.	*(B)* 33H8149	3.05
T_3—Power trans. 130 v. at 20 ma, 6.3v at 0.6A.	*(A)* 17C568	1.49
Z_1—Code Practice Osc. Mod.	*(A)* 41B43	.98

(A) Burstein-Applebee Co., 1012 McGee St., Kansas City, Mo.

(B) Lafayette Radio, 111 Jericho Turnpike, Syosset, New York.

inside right corner of the front panel. When soldering the diode, use a heat sink to protect the rectifier. When the power supply construction is completed it can be checked for about 130 to 150 v.d.c. output.

Monitor

The inexpensive, commercial code practice module chosen for the project is a two transistor unit mounted on a fibre board, 2" × 2", and powered by a battery [1½ to 6 v.d.c.]. Mount the module in a vertical position immediately behind the switch. (See photo.) A small amount of epoxy glue bonds the module to the cabinet base. Cut a small notch into the tube sub-chassis where the units intersect. This affords the module a degree of lateral support. A 1½ volt "A" cell holder is mounted immediately behind the c.p.o. board by drilling a hole and mounting the unit to the chassis with a small nut and bolt.

The c.p.o. module requires only two simple modifications to fully integrate this unit into the keyer circuit. Mount the single transistor wire (*C*) from the fibre board to the center terminal of S_{1B}. Connect a wire from the upper terminal of S_{1B} to one speaker terminal. As a consequence, the switch will only conduct audio from the module in the lower ON position. Here the operator has the option to energize the keyer with a monitor, or simply switch the unit to the KEYER-ON position without benefit of the monitor.

In order to establish a PITCH control, wire control R_4, mounted on the rear apron as shown in fig. 2. When the relay, K_1, is actuated, one set of contacts will close and power

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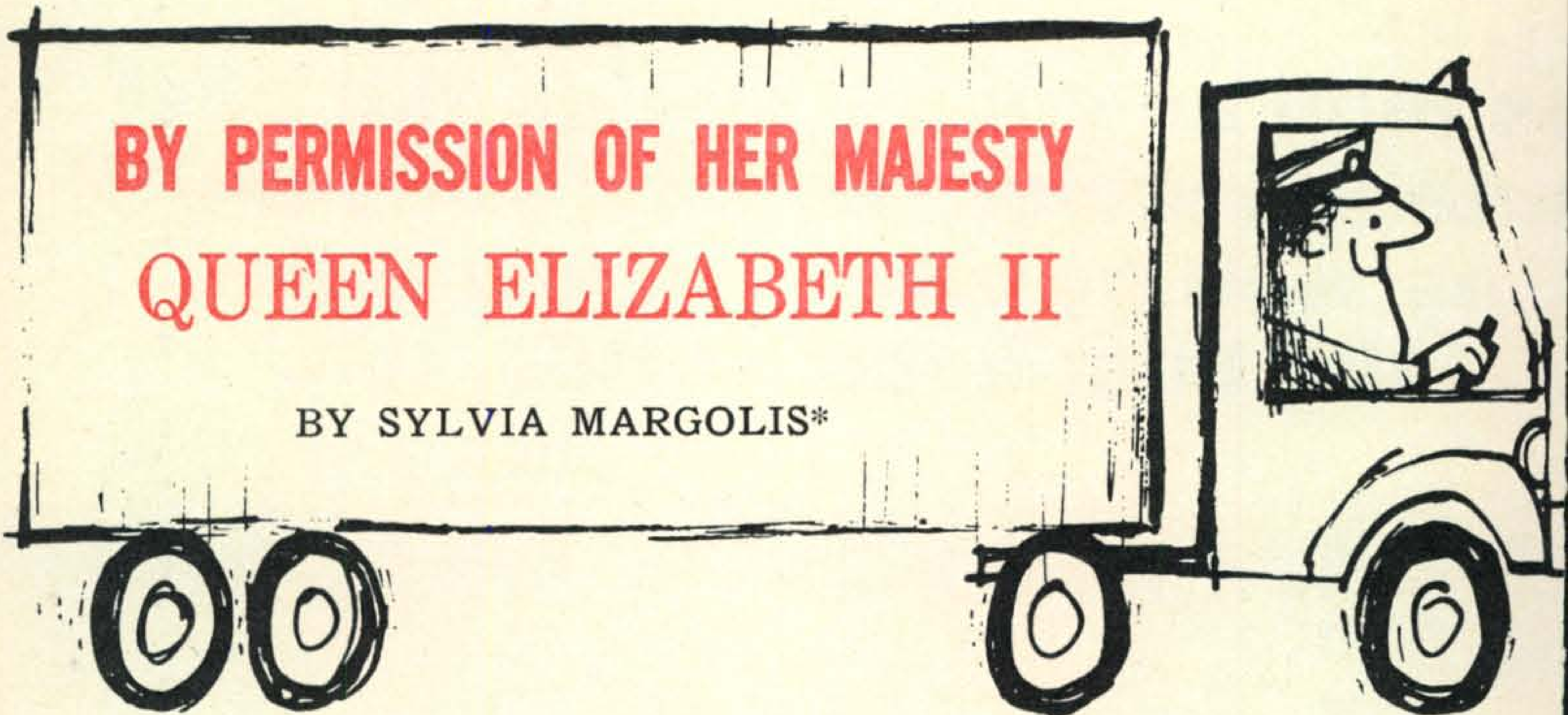
 See page 126 for New Reader Service



BY PERMISSION OF HER MAJESTY QUEEN ELIZABETH II

BY SYLVIA MARGOLIS*

NEVER let it be said that my family is obsessed with amateur radio. Because it's not true. Not entirely.

We have another hobby, our trailer. We have been known to spend hours washing it, or checking it, or planning routes, or exchanging it for a bigger, posher trailer. Of course, we washed it to make it pretty for a hamfest; checked it so that it should arrive safely at the hamfest; planned a route so that it should arrive quickly at the hamfest; changed it for a bigger trailer because at hamfests we have lots of guests and you can't feed 16 people in a small trailer, not when Gus or Don are likely to come up from some non-existent QTH and all 16 tumble out of the trailer at the same time, like Keystone Cops, to work him from the mobiles, in case—*just in case*—the operation is accepted by You-Know-Who.

Our trailer is an intrinsic part of amateur radio. We bought the first trailer because it was getting expensive going to hamfests each

* 95 Collinwood Gardens, Clayhall, Ilford, Essex, England.

The QSL commemorating the event.

weekend and having to pay hotel bills. Th trailer gives us mobility, versatility and an in dependence which enable us to go to mor and more hamfests in Europe and; possibl to the U.S.A. in 1969, too!

My American friends grumble that Clas Distinction is still rife in Britain. Myself haven't been kicked by a Duke. Owners o trailers in Britain, just as in the U.S., ar status-symbol conscious, like radio amateurs and the status of your symbols is in direc proportion to the price of your trailer. Thi is in contrast to the *British Way of Life* where extravagance is considered vulgar.

You can buy a new British trailer for $75(tow it with a $2,500 car and away you gc Or you can buy a trailer for $5,000, hitch to a $25,000 Rolls Royce and away you go— but faster and the police are more polite. Be tween these poles flourish as many gradation as there are between a home-brew 80 mete c.w. transmitter and the glossiest gear adve tised in *CQ*.

Every layer in the social cake can be see at the trailer rallies, all over the countr similar to hamfests, where enthusiasts me old friends, exchange gossip, admire or crit cize each other's rigs, encounter new idea and new gadgets. The Caravan Club of Grea Britain is the largest trailer organization i the world, founded in 1907. Once a year th Club organizes its king-sized National Rall in a place like Woburn Park, home of th Duke of Bedford, which is also popular for i R.S.G.B. Mobile Rallies.

The trailer events are tremendous occa sions, miracles of split-second planning. Th 1967 National Rally, celebrating the Club Diamond Jubilee, was sited at Sandringha

See page 126 for New Reader Servic

Park, in the grounds of Her Majesty the Queen's private palace.

When the Radio Society of Great Britain appointed me the first-ever Public Relations Officer to represent a national amateur radio organization, it was agreed that one of my terms of reference should be to promote the appearance of amateur radio at public events. At Sandringham we would have a captive audience of 12,000 people, staying in 3,400 trailers, a cross-section of the British public. It took little public-relations know-how to propose that an official R.S.G.B. station should be activated there, the first amateur radio operation from Royal property.

The Caravan Club was delighted with the suggestion and R.S.G.B. appointed a sub-committee of amateur radio trailer enthusiasts to liaison with them—my husband, G3NMR; G4DC, Bill Winsford; and G8KW, Rowley Shears. We would use the KW-2000A s.s.b. transceiver, a Hy-Gain Tribander, a KW Trap Dipole, and operate on 10, 15, 20, 40 and 80. The Caravan Club would erect the antenna tower. The G.P.O. issued the exhibition callsign GB2CC. R.S.G.B. would handle QSL's. The QSL bore the proud and unique legend:—*"GB2CC at Royal Sandringham, by permission of Her Majesty Queen Elizabeth II"*. It was another R.S.G.B. "first" to be proud of which no DX-er could achieve, nor ever hope to achieve, because they don't know the right people—*and I do!*

A week before the Rally we drove into Norfolk to check the arrangements. It was one of the wettest Mays on record. It's always one of the wettest somethings on record. Norfolk is on the east coast of Britain, statistically drier than elsewhere, but Nature had been profligate in her generosity and poured rain indiscriminately over the whole country, caring not for statistics, only for records.

We chugged gingerly over the wet grass. Delivery trucks and tractors had churned up the ground a little, but the 200-acre Rally site was lovely, unspoilt parkland stretching into the distance, marked out into 3,400 pitches. When we returned next week 3,400 caravans would be arriving in a steady stream, and slotting into position without thrombosis, in a precision that distinguishes Caravan Club Rallies. A town of tents had been erected. One complex of connecting marquees, with a parquet floor for dancing, was big enough to house the largest banquet, for 2,000 people, ever served under canvas.

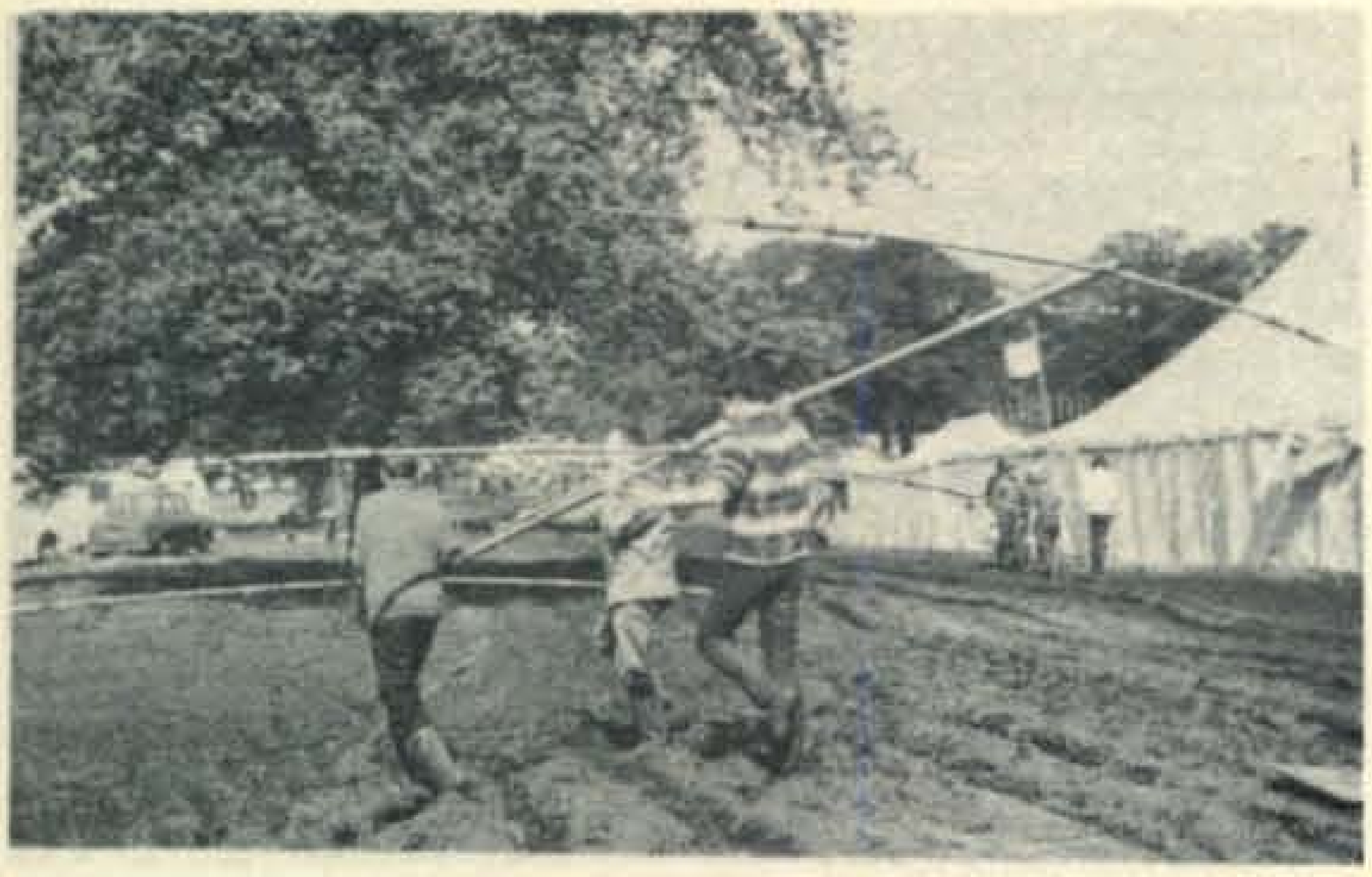
We discussed the siting of the tower with the Rally Organizer, then he asked our help. He needed radio communication to link the Marshalls at the various gates so that, if too many trailers arrived at one time with instructions to enter by a certain gate, some could be diverted to another gate, where there was less congestion. On the Friday night, they expected to receive trailers at the rate of one per minute.

The Hygain Tribander. The station GB2CC was located in the small tent behind the signpost.

We had to explain that the British amateur license won't permit this kind of traffic, any more than any other kind of traffic, but we knew somebody who could help. This was my friend, who commands a U.S. Air Base in the area, and I knew that the Bases compete for an annual trophy, awarded to the Base that has done most that year to keep the Natives happy.

The Colonel had the equipment and the men and they could have done the job standing on their heads, which might have been a kinky way to operate. But the U.S. Occupation Forces in Britain are meticulous about protocol and protocol demanded that only the Royal Air Force could ask their assistance and only the Police could ask the R.A.F. And of course the Police were perfectly equipped to radio-control the traffic, once somebody thought to ask them in the first

English Bank Holiday.

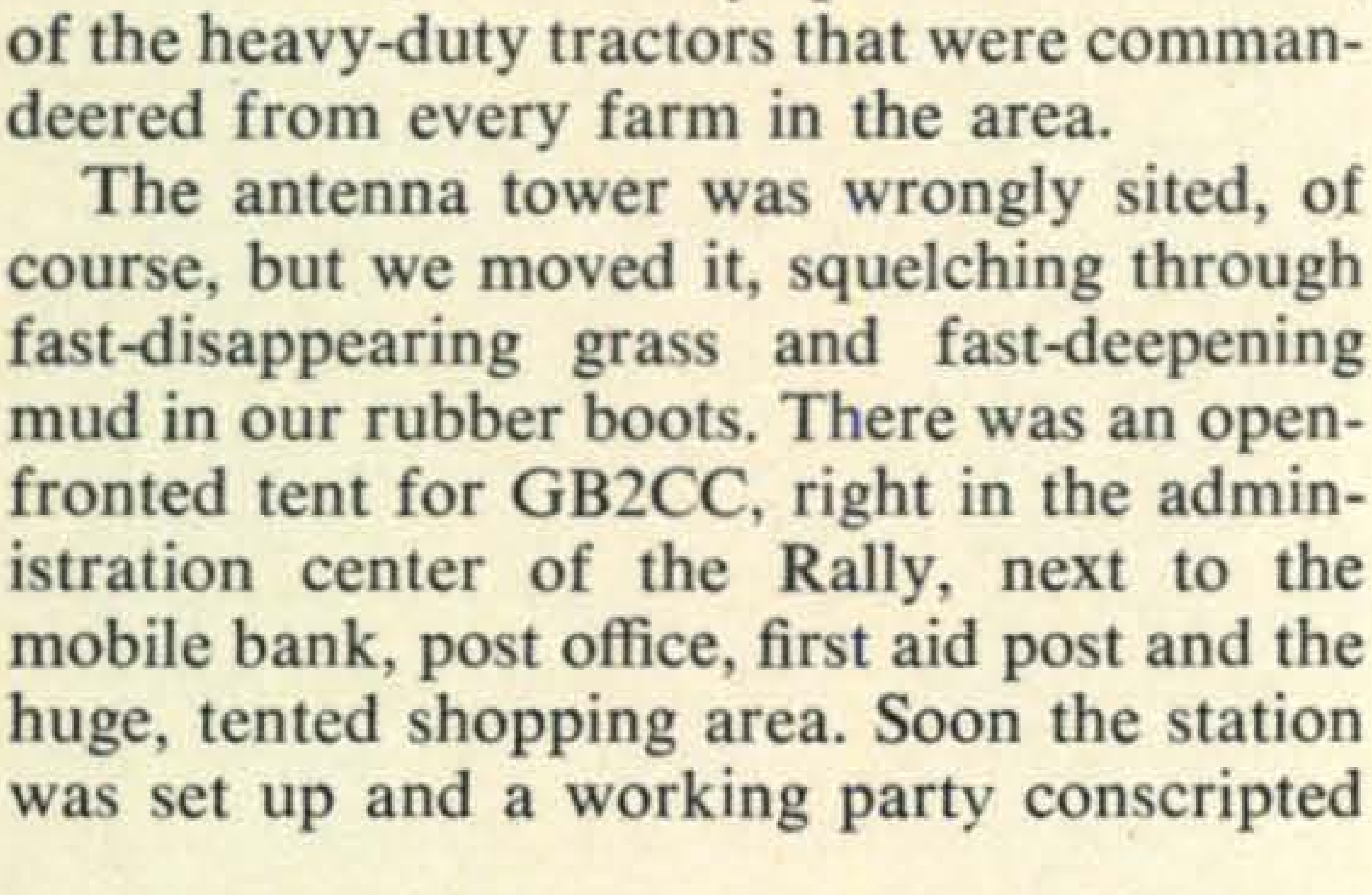


Up goes the beam out of the 15-inch-deep mud.

place. But we did introduce my Colonel to the Caravan Club and we drove home, feeling smug, like the Matchmaker in *Fiddler on the Roof*. Little we realised how useful a contact it was, for the Colonel, later that week, supplied the thousands of tank tracks without which the 1967 National Caravan Rally would have sunk in the mud without trace.

Next Friday we drove back to Sandringham, with our beautiful, new trailer. Arriving early, we were probably the last trailer that was able to nudge into position under its own power. The whole of that nightmare night we were kept awake by the rattle of cars making a fast approach over those tank tracks, then the revving as they got bogged down, the noise of the jeeps called to tow them out of the mud and, when the jeeps became useless, of the heavy-duty tractors that were commandeered from every farm in the area.

The antenna tower was wrongly sited, of course, but we moved it, squelching through fast-disappearing grass and fast-deepening mud in our rubber boots. There was an open-fronted tent for GB2CC, right in the administration center of the Rally, next to the mobile bank, post office, first aid post and the huge, tented shopping area. Soon the station was set up and a working party conscripted



It took a jeep and a farm tractor to pull this heavy delivery truck out of the mud!

from bystanders to help hoist the antenna. A Hy-Gain Tribander looks enormous and ungainly on the ground, like a washed-up whale and, like that whale, it attracted a lot of attention. Again and again we were asked:—"What's that supposed to be?"

At first we answered patiently and politely, even warmly and with interest. But the explanations got shorter and terser, as we got muddier and colder. The English language is the richest in the world and I think I have as good a command of it as most people, but I tended to forget my sweetness and light and revert to type and say:—"Why don't you get lost?" or even:—

"Do you want a punch up the 'ooter?" which, being translated, meaneth:—"Why don't you get lost?" only more so!

But the traps looked so *silly*, coated with mud! A yagi should float free and proud, up in the wild blue yonder, not flounder, faintly ridiculous, in evil-smelling, cocoa-coloured mud. Then, at last, up she went and up with her nearly went a small boy who had been hanging around all morning, and tried for a free ride. Nobody knew who he was, and I shall aways think it was Her Majesty's second son, who is turning out to be that kind of child, to our national pride and delight.

The questions went on. This was Public Relations under stress, like no Public Relations was ever meant to be. At the 23rd "What's that up there?" I snapped:—

"The Russians are coming. The Russians are coming."

"Really?" said the enquirer. So the Russians were coming. So what?

Historic GB2CC went on the air—for 30 seconds, by when the operators had cause to thank their heavy rubber boots for their very lives. The whole installation was live, giving out killing-type shocks like Gus giving out reports. We hauled the over-worked, harrassed camp electricians away from their cups of tea and, with the help of the R.S.G.B. party and their sophisticated test gear, it took them two hours to isolate every circuit and detect the rogue. The heating element in one of the banquetting caterer's water boilers had shorted to the frame and caused the whole earthing system to become live with about 200 volts above true ground, which ground was wetter than Everglades.

By noon on Saturday all casual vehicle movement in the park area was forbidden. The paths round the center, where there was as much pedestrian activity as you'd get in a fair-sized shopping area on a Saturday, were 15 inches deep in liquid mud.

GB2CC was in business, though. We scrounged straw for the floor of the tent. A crowd gathered and we chalked up a "Countries Contacted" score board, had a cup of tea to gather strength and began to take Public Relations seriously.

There's always the Clever Joe in these audiences who knows it all. This character is always a Humorist, too, and provides a facetious running commentary for his entourage. And there's the old lady who is certain it's the rig that's spoiling the weather. And the Sharp Operator, who wants to buy the whole deal, there and then for cash, no questions asked, to use in his business. And the teenage girl, who takes a shine to one of the amateurs and stands for hours, *hoping*. And the joker who brings in his transistor radio which has a nasty buzz, so, maybe, you would fix it. But then you find the keen youngster, who asks intelligent questions, rushes away, excited, comes back with his Dad, who also asks intelligent questions, and you watch the spark of enthusiasm kindle and you've made a valuable recruit.

We were DX. We didn't know it until WA6ZIQ/G5AAM, Bob Lane, beamed in, from his home, 30 miles away. Trust a DX-er to know when something's going. We programmed him and sat him down at the rig, whilst we had a cup of tea. Overseas stations queued up to work us. It was very exciting. We could even invoke that professional technique, used only by the most exclusive DX-ers, the cold, laconic "GO" or the even snootier:—"I'll take W6's and 7's only. All other call areas stand by!" with the hint that we would flounce off and go fishing if they didn't step into line, pretty smart-ish.

And of course our operators had one advantage which they exploited with a panache that I can describe only as—you should excuse me—*ham*:—"This is GB2CC calling CQ-DX from Royal Sandringham . . . !" The sonorous phrase rolled nicely, especially in Bob's Californian accent, as he operated, sustained by cups of good, strong, English tea. Let Gus and Don cap that one!

We had reckoned on a captive audience, but never one quite so captive as this, up to its calves in mud.

"Can I help cook lunch?" asked Bob.

"No, luv, you're doing a grand job. You stay put and have another cup of tea. We girls will cook lunch."

GB2CC operator, G8KW, Rowley Shears.

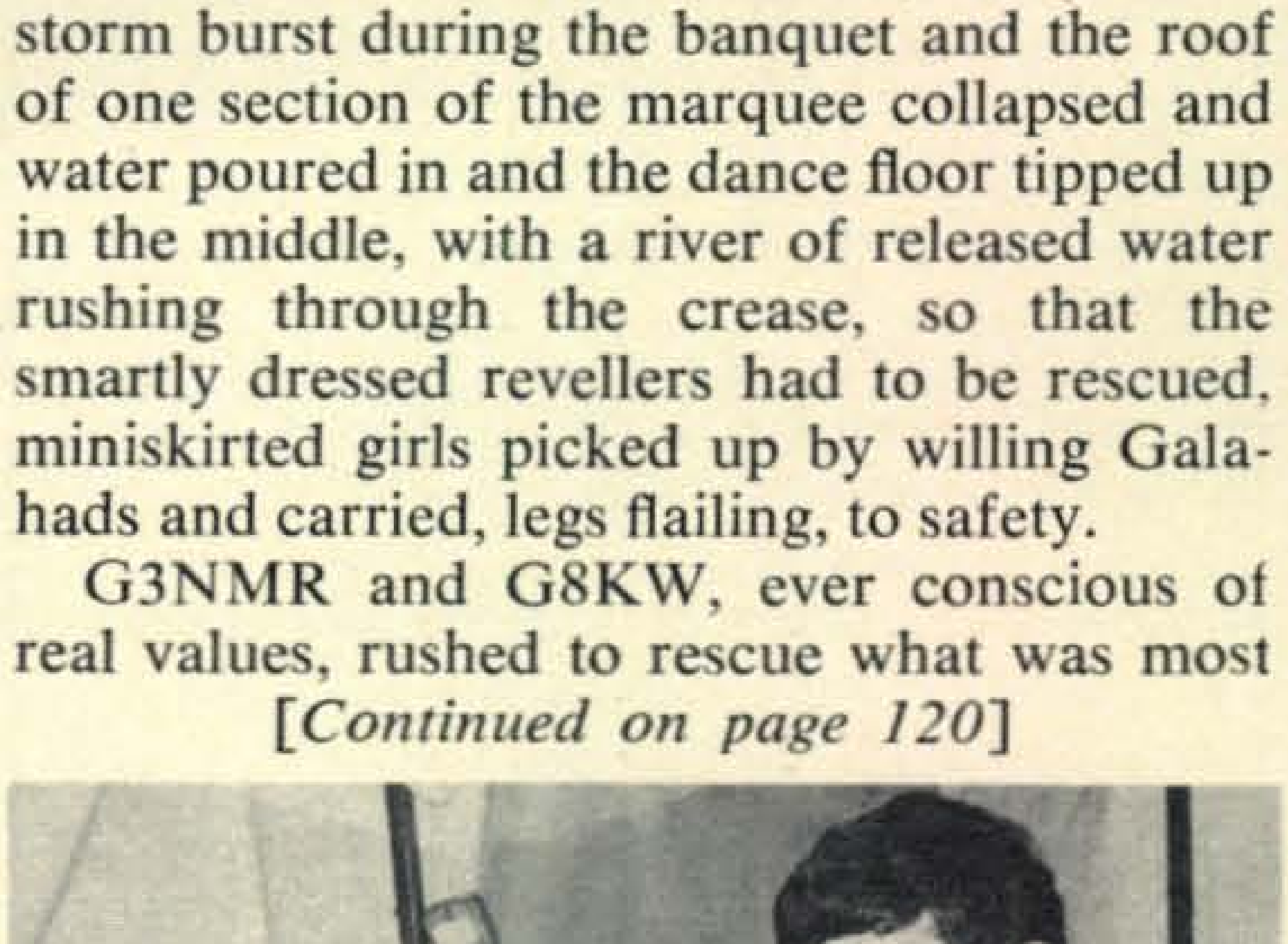
We girls cooked dozens of hamburgers and the older children formed a ration party to carry trays of food, slithering and sloshing through the oozing ruts, to where their valiant sires were upholding the banner of amateur radio, although their operating chairs were now sinking through the straw into the goo beneath. But the Show had to go on and the Show was wowing them in the aisles. Sometimes the audience exceeded 100 people, pushing and jostling, getting their umbrellas tangled up, the lucky ones in front passing reports through to the under-privileged at the back. We worked a JA.

"It's raining in Tokyo!" he told us and everybody was very happy indeed to learn it was raining in Tokyo.

The British thrive on adversity and here was adversity, the stuff of Dunkirk, as another storm burst during the banquet and the roof of one section of the marquee collapsed and water poured in and the dance floor tipped up in the middle, with a river of released water rushing through the crease, so that the smartly dressed revellers had to be rescued, miniskirted girls picked up by willing Galahads and carried, legs flailing, to safety.

G3NMR and G8KW, ever conscious of real values, rushed to rescue what was most

[*Continued on page 120*]



GB2CC operator, G3UML, Laurie Margolis, the author's elder son.

 See page 126 for New Reader Service

MODULATION UNLIMITED

Part II

BY FREDERIC C. DOUGHTY,* W3PHL

Part II of a two part series describes the modifications made to the final of a DX-100 making it capable of c.w., d.s.r.c. and d.s.b. operation. A detailed analysis of the operation of the circuit and its power capabilities are also covered.

PART I of this two part series described the need for and basic concept of a circuit that would permit audio modulation voltages greater than those used for 100% modulation. A practical approach (a modified DX-100) is shown in fig. 6.

The Output Circuit

Figure 6 is a diagram of a modified a.m. circuit. In the d.c. and audio a.c. circuitry, the two tubes are shown connected in the same manner as the tubes in fig. 4(C), that is, the plate of V_2 and the cathode of V_1 are returned to the same point (ground). The plate of V_1 and the cathode of V_2 are returned to the same point (output terminal of the modulation transformer). With switch S_1 in the D.S.B. position, no d.c. voltage is impressed on the r.f. final amplifier, and the tubes are balanced (*i.e.*, treated equally at all electrodes respectively). An a.c. voltage across the secondary of the modulation transformer applies a plate-to-cathode voltage to V_1 during positive phases and to V_2 during negative phases, to which the tubes respond respectively. Since the tubes are driven by opposite phases of r.f. (push-pull grid tank circuit), they generate, at their common r.f. plate connection, opposite phases of r.f. in accord with the opposite phases of applied audio. Thus the circuit generates an r.f. envelope which reproduces the original modulating waveform, not only in shape but also in phase.

When switch S_1 is in the A.M./D.S.R.C. position, a d.c. voltage is impressed on the r.f. final. Tube V_1 responds to the positive voltage and generates carrier power. Tube V_2 not only does not respond but is reverse biased. This condition prevents V_2 from acting as a rectifier of the r.f. voltage present at its plate, which is a result of the action of V_1. During a period of positive peak modulation, V_1 responds while the reverse bias of V_2 increases. These conditions persist as long as the voltage applied to the r.f. final is positive. At the precise moment that tube V_1 is overmodulated by a negative peak of modulation in excess of 100%, and ceases to respond, tube V_2 is forward biased by the presence of a negative voltage at the cathode. Throughout the period of overmodulation of V_1, tube V_2 produces an r.f. output of the proper phase and shape of the excess negative peak of modulation.

The Input Circuit

The r.f. input applies push-pull drive to the separately shunt-fed grids. R.f. voltages are impressed on the two grids in opposite phase. The cathode elements of both tubes are at r.f. ground by direct connection or bypass capacitors. In each case, the r.f. grid voltage causes grid current to flow from cathode to grid through the grid choke and resistor and back to the cathode. A d.c. grid bias is developed across the grid resistor. It should be noted that the grid cathode circuit performance is in no way affected by the application of power to the plate-cathode circuit of either tube. Therefore, each tube may be considered to be plate modulated and may be operated Class C. Sufficient grid drive must be provided with an appropriate grid resistor to assure Class C condition.

* P.O. Box 157, Valley Forge, Pennsylvania 19481.

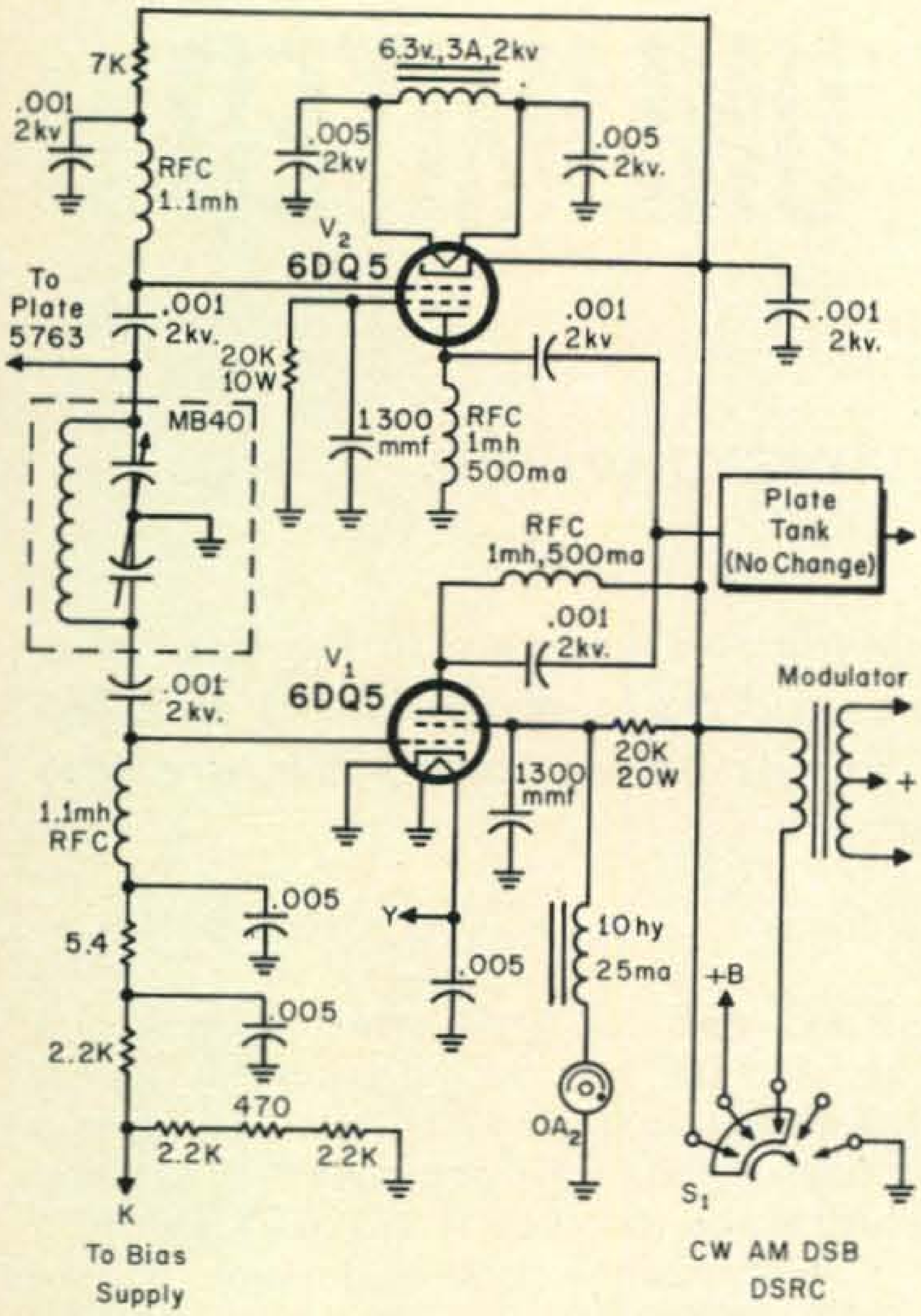


Fig. 6—Circuit of a modified DX-100 final. One 6DQ5 replaces two 6146 tubes. Further details on the V_2 filament transformer is given in the text.

Special Components

All of the electrical components associated with the normal tube circuit, V_1, have the same value as the parts associated with the upside down tube, V_2, however, the voltage rating differ. Normal ratings may be used for the components connected to the "normal" tube. All of the components connected to the "upside down" tube must have voltage ratings that are appropriate for the maximum voltages expected during modulation. The filament transformer for the "upside down" tube, V_2, should have a low primary to secondary capacitance, but it is not absolutely necessary. All of the capacitors associated with the "upside down" tube as well as the plate blocking capacitor of the normal tube, are in shunt to ground across the modulation transformer secondary. Basically these capacitors perform an r.f. function and the values should be selected to be no greater than adequate so as not to bypass all the higher audio frequencies.

Operation

The circuit should be operated as follows. With the modulator turned off and S_1 in the D.S.B.S. position, apply grid driving power. Tune the input tank to resonance as indicated by a maximum grid current reading at V_1. Measure the bias voltage for each tube at the cold end of the r.f. grid chokes. These voltages should be approximately equal. Switch S_1 to the A.M./D.S.R.C. position and V_1 will draw plate current. The plate tank should be tuned and loaded, using the plate meter, to a value which matches the secondary impedance of the modulation transformer. This completes the tune-up of the circuit.

Now check the balance using a modulation monitor scope. Return S_1 to the D.S.B. position and turn on the modulator. Put a single-frequency audio voltage into the speech amplifier so that it appears across the secondary of the modulation transformer. Both tubes will respond and produce r.f., but the plate meter will read zero" (the average value of an a.c. waveform). The envelope pattern should appear on the scope as shown in fig. 7. If adjacent half cycle period are not of the same shape and size, the two tubes are not performing the same for the same conditions, and the envelope will not represent a single modulating frequency.

Symmetry of component layout for the two tubes it desirable. As shown in fig. 6, no components are required for neutralization. If the layout is poor, some r.f. output may be observed in the absence of d.c. plate power and audio power. The classic D.S.B. envelope will not be possible with carrier present and the adjacent half cycles will not have the same amplitude. A small value capacitor from plate to grid of one of the tubes will correct the unbalance.

Power Capability And Operating Conditions

Power input to a transmitter is limited, in part, by the plate dissipation capability of the output tubes. The power input may have a d.c. component (the carrier) and an a.c. component (the audio). The audio power (sine wave tone) of a conventional plate modulated a.m. transmitter is limited to one half the carrier power. The circuit shown in fig. 6 is a Class C plate modulated amplifier circuit, but is unconventional. It is a circuit which will respond to d.c. power, or d.c. modulated with a.c., or pure a.c. power. Sidebands are generated only by the a.c. power and the maximum permissable a.c. power input for a particular tube type is reduced by inclusion of carrier power, which is supplied

See page 126 for New Reader Service

See page 126 for New Reader Service

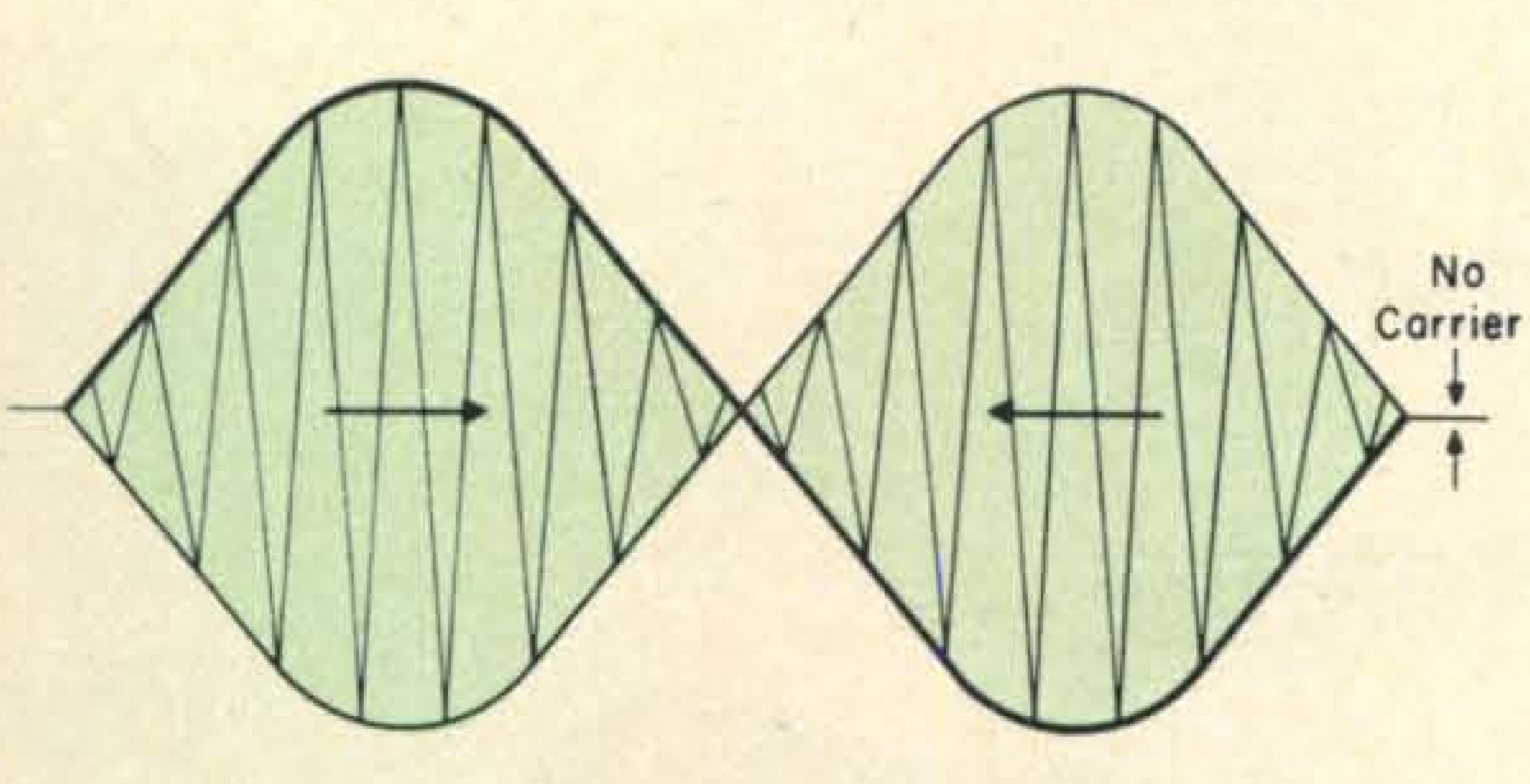


Fig. 7—Resultant output when the normal and upside down tubes, V_1 and V_2, are balanced.

only by the "normal" tube. The "upside down" tube is used at maximum capacity only in the pure a.c. (or d.s.b.) mode. At the point where the d.c. power (carrier) is increased so that it is modulated 100%, the "upside down" tube action is decreased to zero.

For maximum communications capability with a given tube type, d.s.b. must be used. However, since d.s.b. is not compatible with a.m. receiving techniques, some level of carrier is desirable. The question is, how much?

D.S.B.

The maximum power input is determined by the tube plate dissipation, the class of operation, and the duty cycle. For d.s.b. operation the maximum power input is equal to eight times the plate dissipation rating of one tube, times the reciprocal of the duty cycle. The duty cycle cannot be equal to or greater than one, since no one talks in a continuous, steady tone. It is assumed that the duty cycle is between 0.5 and 0.7, therefore, 0.6 will be used. Maximum audio power input to the r.f. final for the circuit shown in fig. 6, operating Class C, with speech as the audio source, is approximately 13 times the plate dissipation rating of one tube.

Assume that the rating for the tube type is 100 watts. Thirteen hundred watts of speech audio output power may be injected into the final. If the transmitter is initially tuned up using 1200 volts d.c. plate voltage and loaded to 100 ma, the plate load impedance is 12,000 ohms. Since $P = E^2/R$, with 1300 watts of audio output going into the final. $E_{r.m.s.}$ equals 4000 volts. When $E_{r.m.s.}$ equals 4000 volts, $E_{peak\text{-}to\text{-}peak}$ equals 11,000 volts (5500 volts positive and 5500 volts negative). The 5500 volt peak is equivalent to the positive peak of a 100% modulated d.c. voltage of 2750 volts. The tubes must remain in Class C throughout the entire applied audio waveform of 5500 volts. To assure Class C operation, the bias voltage and grid current must be at lease the same as it would be for a 100% modulated plate voltage of 2750 volts d.c. and Class C operation.

D.S.R.C.

In the pure d.s.b. mode each tube shares half of the 1300 watts of speech output power, or 650 watts each (400 watts average). Assuming a carrier input of 120 watts (*i.e.* 1200 volts at 100 ma, 12,000 ohms), carrier dissipation in the "normal" tube is 30 watts, leaving 70 watts for audio dissipation. The 70 watts represents 1/4 of the average audio power which is 280 watts times the duty cycle factor, or 450 watts of audio for the normal tube. Part of this power is in the positive peak that is superimposed on the 1200 volts d.c. and it represents half of the total audio power that may be impressed on the 120 watt carrier.

Calculation of this power is complicated. Assume, therefore, that the part of the negative modulation of the d.c. voltage from 1200 volts to zero volts is equal to 60 watts. This is the power necessary to generate a negative peak of 100% using a perfect square wave. This leaves 390 watts for the positive peak. Thus, maximum audio output power on the 120 watt carrier is equal to 780 watts, which is 13 times the audio needed for 100% modulation.

The audio required for a given percentage of modulation varies as the square of the change in the modulation index. A modulation index of 1 is at 100% modulation. A modulation index of 2 is at 200% modulation. (Remember that 100% modulation means a peak-to-peak audio voltage of twice the d.c. voltage and that 200% modulation means a peak-to-peak audio voltage of four times the d.c. voltage.) The example of the 120 watt carrier reached a maximum at 13 times the 100% audio. The modulation index equals the square root of 13, or approximately 3.60. A carrier of 120 watts modulated with approximately 780 watts of audio will be modulated 360%. The 1200 volts of d.c. will be modulated to a positive peak at 5500 volts with the audio signal of 8600 volts peak-to-peak. This positive peak voltage is the same as occurs when 2750 volts d.c. is modulated 100%. Therefore, the grid bias and grid current must be the same as for a.m. operation at 2750 volts for the tube type used.

The 780 watts of audio would modulate a 1560 watt carrier 100% in a conventional circuit. Use of a 120 watt carrier instead of a

See page 126 for New Reader Service

1560 watt carrier, is carrier suppression of approximately 11.4 db. The question now arises as to whether or not sufficient carrier is present for reception by a.m. techniques. The 11.4 db carrier suppression may be too much, and therefore more carrier will be needed.

A.M.

A carrier of 300 watts, 100% modulated with speech having a 0.6 duty cycle will impress 400 watts on the normal tube and no power on the upside down tube. This can be considered the maximum possible 100% modulated carrier for the circuit, when using tubes which have a plate dissipation rating of 100 watts.

If, for any set of conditions, the normal tube will be used at maximum dissipation, then no conditions permit a carrier level in excess of 300 watts or an audio level in excess of 1300 watts.

The procedure for determining a given carrier suppression of less than 11.4 db would be (1) select an audio power output of less than 780 watts, (2) solve for a new (higher) maximum carrier power, and (3) solve for the suppression in decibels from the d.s.r.c. formulas given in the appendix.

Other Circuits

The circuit shown in fig. 6 is a balanced modulator (r.f.). A balanced modulator may be designed as shown, or with parallel grids and push-pull plates.

Another method which may lend itself more readily to an individual situation is shown in bock form in fig. 8(A). This circuit may be considered as a conventional transmitter with a balanced modulator circuit inserted in the drive cable to the final and a rectifier circuit placed between the modulation transformer and its load. The balanced modulator circuit contains two tetrode (or pentode) tubes, each of which can independently drive the r.f. final. The screen voltages of the tubes are controlled in a step fashion by a flip-flop in the same circuit. The plates of the two tubes in the flip-flop each share one of the screen resistors of the two balanced modulator tubes. In the flip-flop, one tube draws a large plate current while the other tube is off. The condition is reversed in less than a microsecond when a trigger signal is applied to the "off" tube. Trigger signals are derived from an audio signal in the audio amplifier which relates to the phase of the modulating voltage.

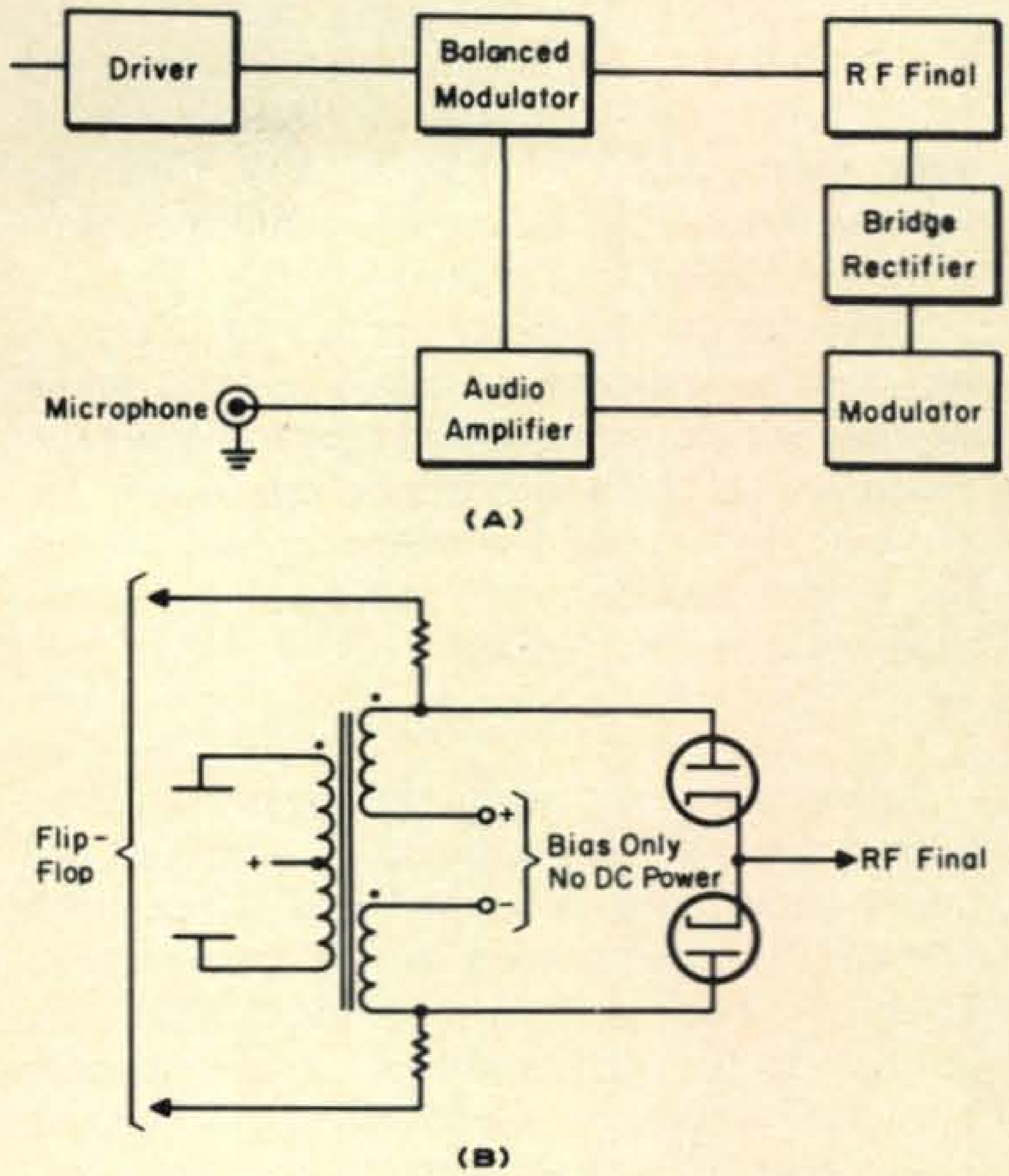


Fig. 8—Two other methods of increasing the modulation capability of a transmitter. The details are given in the text.

The rectifier circuit is a bridge type. The positive output is connected to the conventional r.f. final and the negative output is connected to ground. With the flip-flop acting at the moment of phase reversal of the rectified audio, the phase of the balanced modulator output reverses, and the d.s.b. envelope as shown in fig. 7 results.

D.s.r.c. operation of this circuit, with the negative output of the bridge connected to a d.c. voltage is not suggested. Phase reversal in the d.s.b. mode occurs at the instant that the voltage impressed on the final is at zero volts. For d.s.r.c. as above, phase reversal occurs at the point where the plate voltage is modulated to the d.c. voltage. A rapid change in phase of a carrier would in itself constitute modulation and many sideband frequencies would appear. A modulation transformer with two secondary windings (each winding separately matching the r.f. load) connected to two equal d.c. voltages of opposite polarity and connected to the final through diodes, will permit d.s.r.c. operation. (See fig. 8b.) The trigger signals for the flip-flop circuit must be developed from the voltage at the modulation transformer output terminals so that the r.f. phase reversal occurs at the point of "zero" volts applied to the r.f. final.

See page 126 for New Reader Service

This method for achieving class C plate modulated d.s.b. or d.s.r.c., is more involved in circuitry and adjustment. It is however, very convenient because at any time the added circuits may be removed and the transmitter is back to its original state.

The circuits discussed in this article may be used in conjunction with low-level audio devices which improve average audio power. However, as the audio duty circle factor approaches a value of 1 with speech processing, the power capability of audio and r.f. components must be derated.

Conclusions

A circuit that cannot be overmodulated with respect to the polarity of a modulated voltage has been described and it has been shown that there need be no d.c. voltage. High efficiency is maintained throughout the entire circuit response to carrier and/or modulation power. Conversion of existing equipment is straightforward and inexpensive and no other radio telephone system presently in use offers the same communications capability to the amateur.

The advantages of low-level speech processing may be fully appreciated. Output power in the sidebands can be more than competitive with other systems, while the transmission mode can be compatible with either linear or product detection. The system retains the proven communications benefits enjoyed by the simultaneous transmission of synchronous sidebands. ■

Appendix

If a fixed amount of plate dissipation power is available and a carrier suppression of so many db is desired, then:

$$C_s = 10 \log 2 P_a/P_c$$

$$P_c = \frac{100/(100-E)\ P_d - \frac{1}{2}\ d\ P_a}{1 + G}$$

where:

C_s = Carrier suppression desired in db.
P_a = Audio output power available.
P_c = Carrier power to be used.
P_d = Carrier tube plate dissipation.
d = Syllabic duty cycle of 0.6.
E = Efficiency of class of operation (Class $C = 75\%$).
G = Negative peak factor for 100% sine wave, $G = \frac{1}{4}$. For 100% square wave, $G = \frac{1}{2}$. (½ should be used for d.s.r.c.)

Reworking the example given earlier, we have:

$$C_s = 10 \log 2 P_a/P_c = 10 \log 2\ (780)/120 = 10 \log 13 = 11.4$$

$$P_{c\,max} = [100/(100-E)\ P_d - \tfrac{1}{2}\ d\ P_a]/1 + G = [100/(100-75)\ 100 - \tfrac{1}{2}\ (0.6)\ (780)]/1 + \tfrac{1}{2} = 400\text{-}234/1.5 = 120$$

$C_s = 0$ when $P_c = P_a$ 100% mod.
$C_s = 11.4$ when $P_c = 0.15\ P_a$ d.s.r.c.
$C_s =$ infinity when $P_c = 0$ d.s.b.

Maximum Conditions (P in watts)

$P_c = 300$	100% a.m.	$P_a = 150$
$P_c = 120$	d.s.r.c. (11.4 db)	$P_a = 780$
$P_c = 0$	d.s.b.	$P_a = 1300$

"I built everything here to harmonize with the furniture . . ."

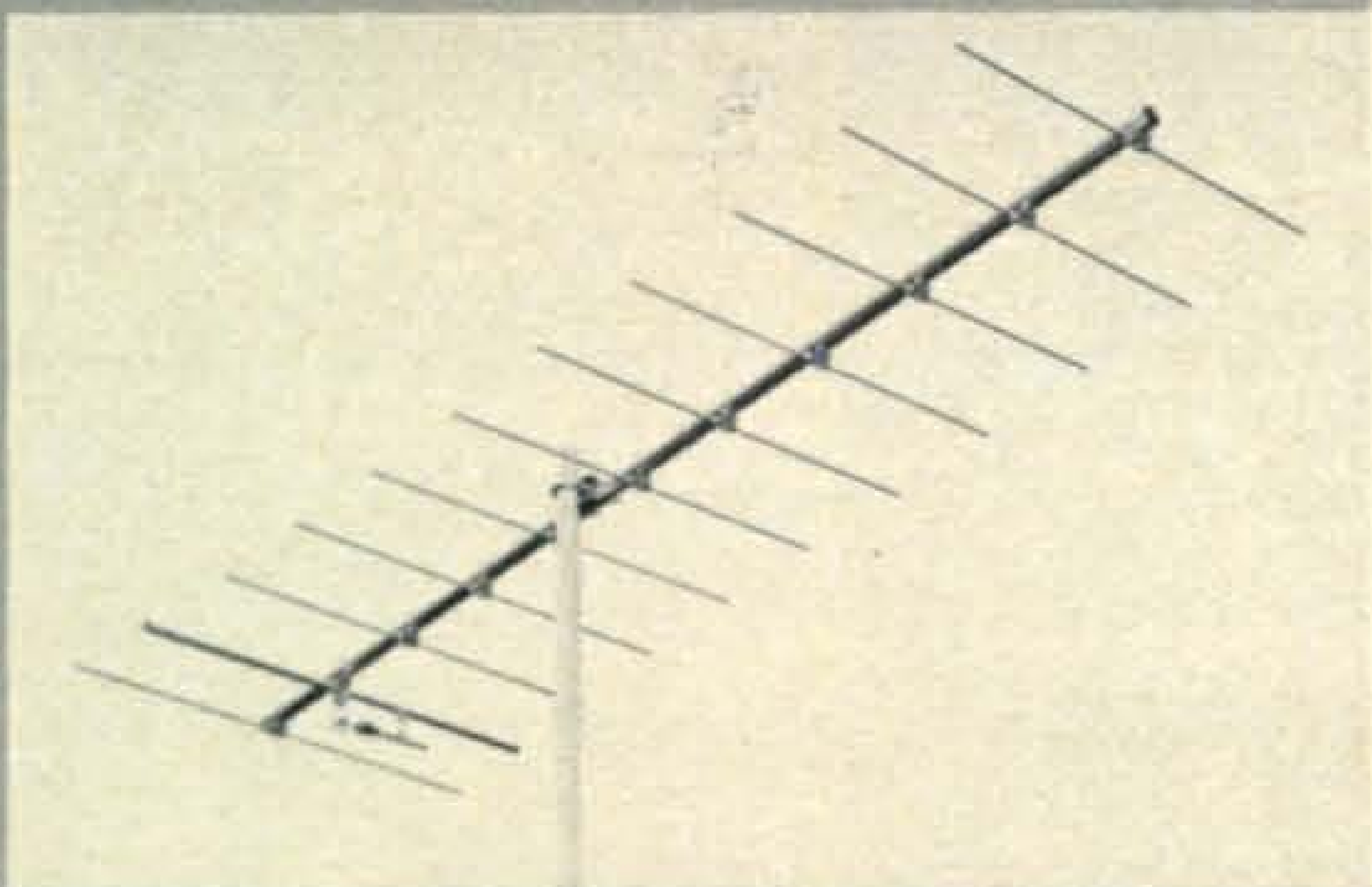
". . . and when I finish operating everything stows away neatly."

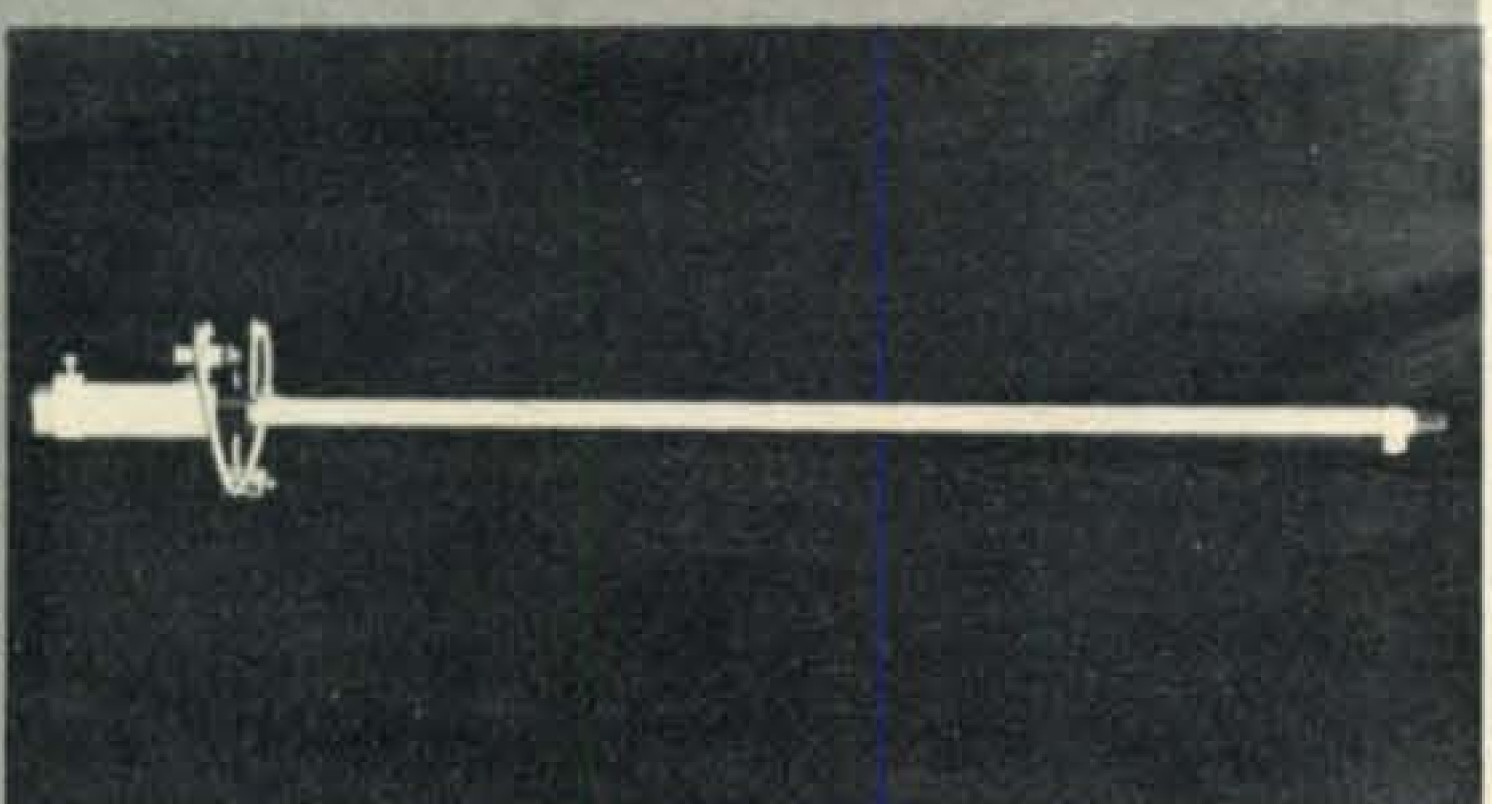
See page 126 for New Reader Service

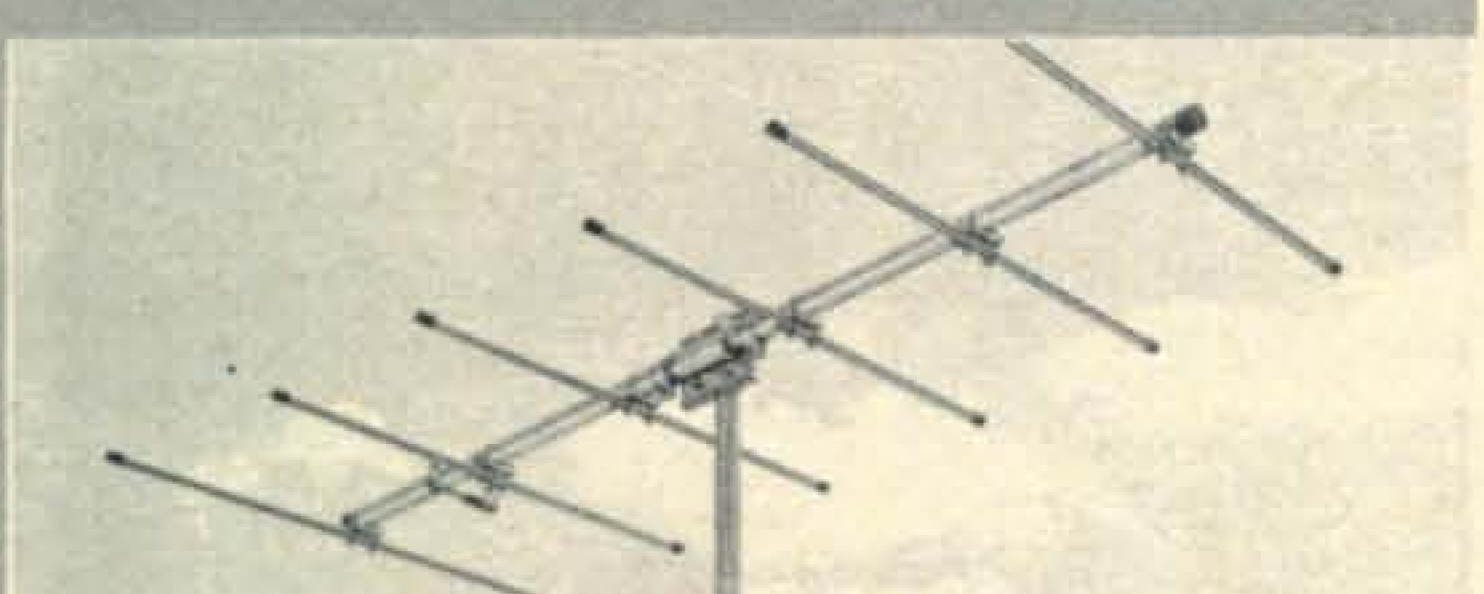
See page 126 for New Reader Service

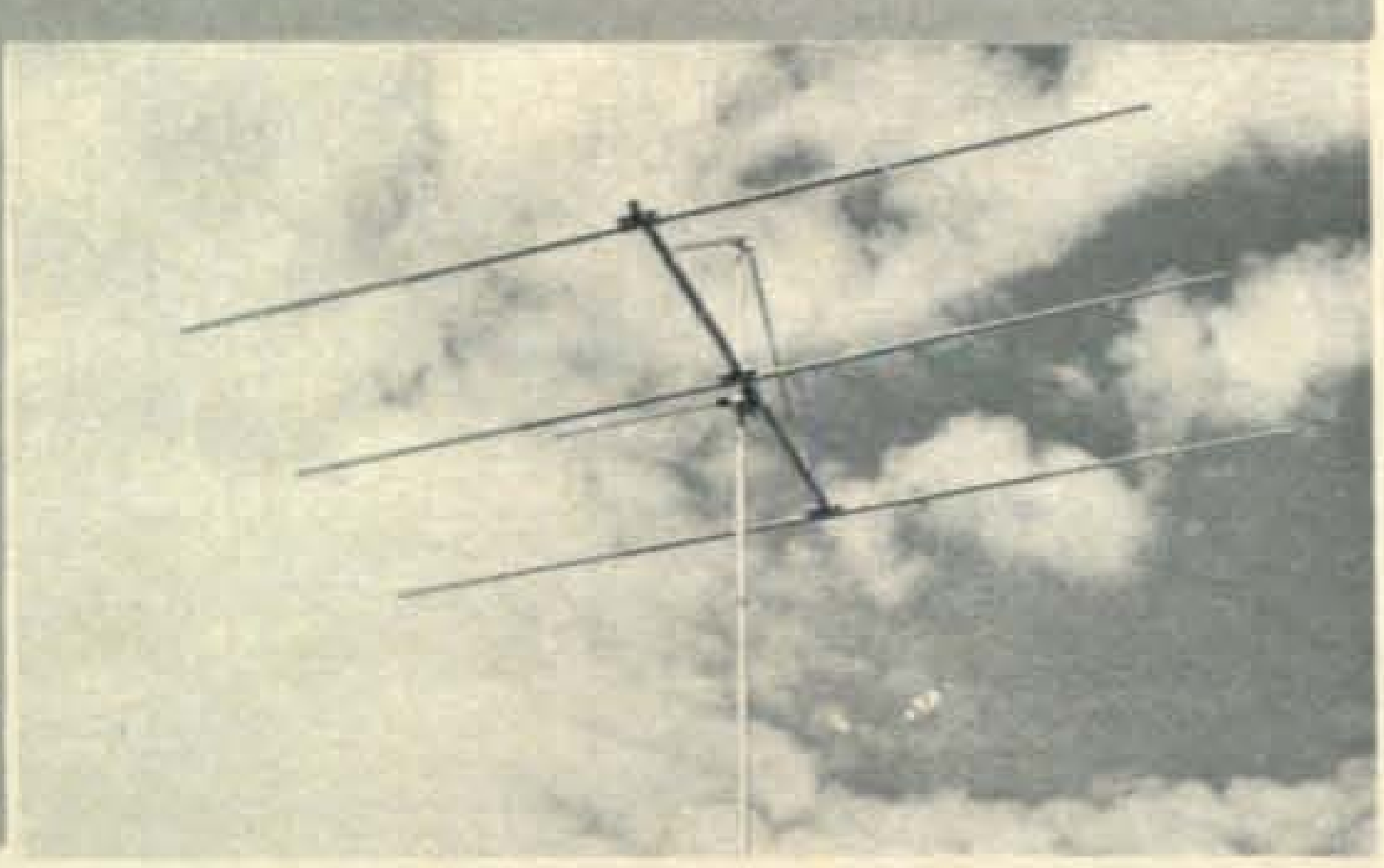
Cush Craft

ANTENNAS IN STOCK AT ARROW









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See page 126 for New Reader Servic

CQ Reviews: The Heathkit HW-100 Transceiver

BY WILFRED M. SCHERER,* W2AEF

A RECENTLY introduced piece of gear that has stirred up considerable interest is the Heathkit HW-100 Transceiver. It provides full coverage of the 3.5-28 mc amateur bands on s.s.b. (upper or lower sideband) and on c.w. with 180 watts p.e.p. transmitter input; and is a job that fulfills the need for a comparatively low-cost package.

Although the Heath Company describes the HW-100 as a five-band version of the popular HW Series of "single-banders", the nearest resemblance to this group of models is its appearance and styling along with a similar-type of v.f.o. dial. Otherwise it is a modified copy of the SB-101 Transceiver with a number of compromises that enable the cost to be bought lower, yet without sacrificing the essential features and performance expected in a first-rate transceiver. Except for these modifications, it has virtually the same circuitry, same type of internal construction and the same circuit boards as for the SB-101.

The principle change is the v.f.o. which, instead of being a vacuum-tube unit factory assembled and aligned with linear tuning and 1 kc calibrations, is one that employs a field-effect transistor and which must be assembled and aligned by the purchaser. Tuning, although not exactly linear, is almost so, and the dial calibration is in 5 kc steps.

Another change that holds down the tariff is a 4-pole crystal-lattice filter with a shape factor of 3:1 in place of a six-pole job with a 2:1 shape factor.

Other minor differences are that there is no provision for switching to an external v.f.o. for independent frequency control of either the receiver or transmitter (although such could be worked out by the user) and that there are no facilities for switching in an accessory sharp crystal filter for c.w. Also, slide switches are used for some functions instead of rotary types and there are two less meter functions. The size of the HW-100 is about the same as that of the SB-101.

Besides those already mentioned, other features such as found in the SB-101 are built-in v.o.x. or p.t.t. operation, v.o.x. type c.w. break-in, c.w. sidetone, offset c.w. carrier, crystal calibrator, identical 500 kc tuning range and calibrations for each band (four 500 kc segments for 28 mc band), triple-action level control (TALC), input for a.l.c. from linear amplifier, meter switch for a.l.c., relative power or plate current, Pi-network with adjustable output loading for 25-100 ohms. Operation may be had from accessory external 120/240 v.a.c. or 12 v.d.c. power supplies, the HP-23 and HP-13 respectively.

Basic Line-Up

Since we have not previously reviewed the SB-101, a run-down of the circuitry in the HW-100 is as follows:

Double conversion is used for receive and

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See page 126 for New Reader Service

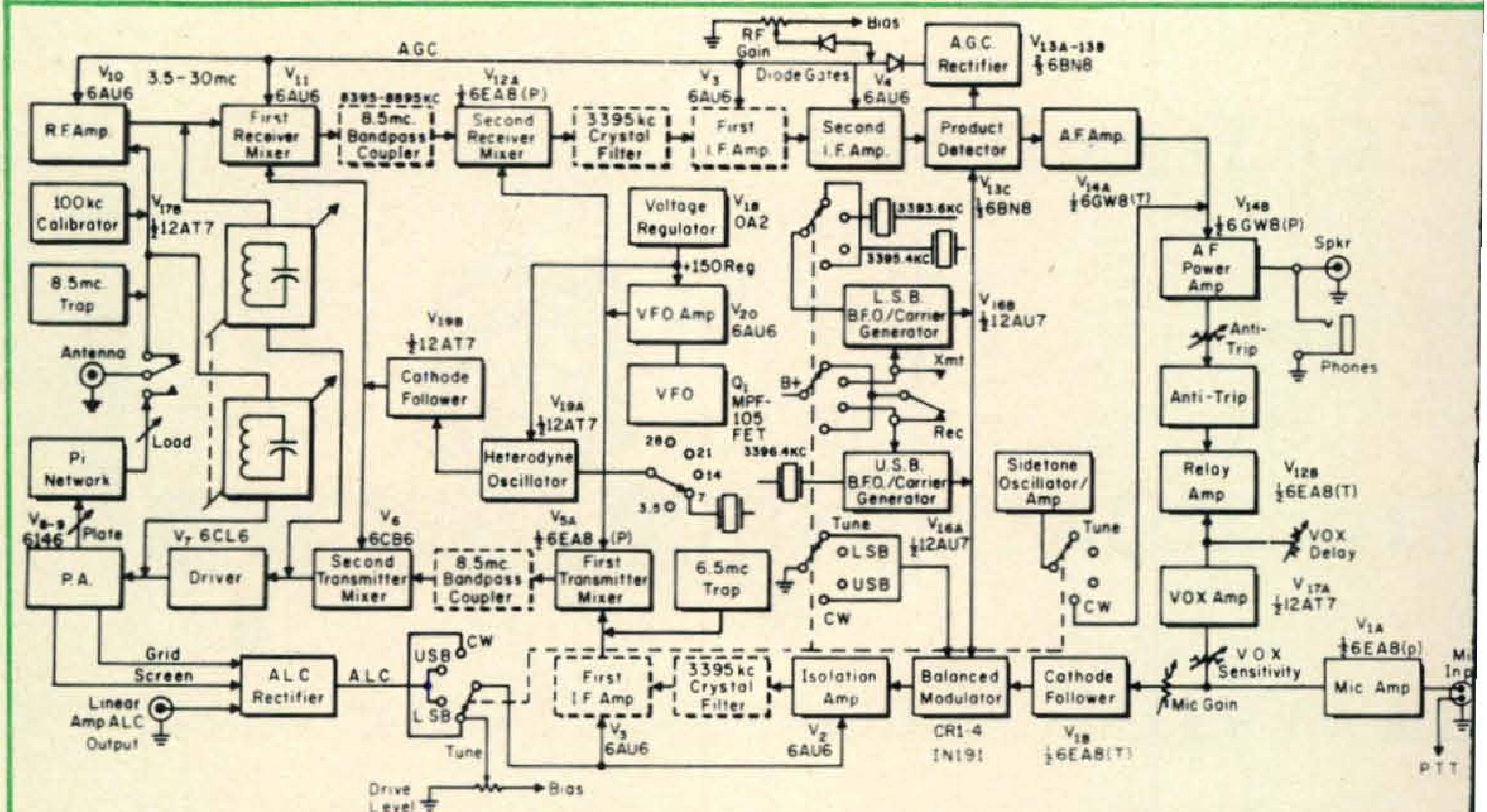


Fig. 1—Composite block diagram of lineup and circuitry used in the HW-100. Blocks outlined with dashes are common to both receiver and transmitter functions.

transmit with many of the same circuit elements employed for both modes of operation. Referring to the block diagram at fig. 1, on receive a crystal-controlled front-end heterodyning oscillator converts the amateur-band signals to a variable i.f. of 8395-8895 kc. A 5-5.5 mc v.f.o. converts these i.f. signals to a 3395 kc fixed i.f. where the sideband filter is employed. Demodulation is obtained with a product detector in conjunction with a crystal-controlled b.f.o.

On transmit, the s.s.b. signal is produced at 3395 kc with the b.f.o. as the carrier generator and the 3395 kc filter for sideband selection. The s.s.b. signals are then converted, by mixing with the v.f.o., to the 8395-8895 kc variable i.f. which in turn is translated to the various amateur-band frequencies by mixing with the crystal-controlled heterodyning frequencies.

Circuit Details

For receiving, the antenna is inductively coupled to the 3.5 mc inductor for the r.f. amplifier grid which is "pre-selector" tuned using a multi-section variable capacitor ganged to a similar circuit at the r.f. tube plate which is capacitively-coupled to the 1st receiver mixer. Bandswitching is accomplished by shunting one or more series-connected inductors across the 3.5 mc ones and changing additional sections of the tuning capacitor along with appropriate padders to provide the required bandspread.

The crystal-controlled heterodyning oscil- lator is a conventional tuned-plate affair wit the resonating inductors and capacitor switched as needed for the various crystal fre- quencies which for each range are equivalen to the low-frequency end of the particula band segment *plus* 8895 kc. The oscillator signal injection is applied to the mixe cathode from a cathode follower after th oscillator.

The output of the 1st mixer is fed to th input of the 2nd mixer through an 8395-889 kc bandpass circuit to provide a uniform vari able-i.f. response while highly attenuatin signals outside of the i.f. range. An 8.5 m trap at the antenna input minimizes r.f. signa feed through at this frequency and thus en sures good i.f. signal rejection.

The 3395 kc sideband filter follows the 2n mixer and the circuitry from thereon is quit conventional.

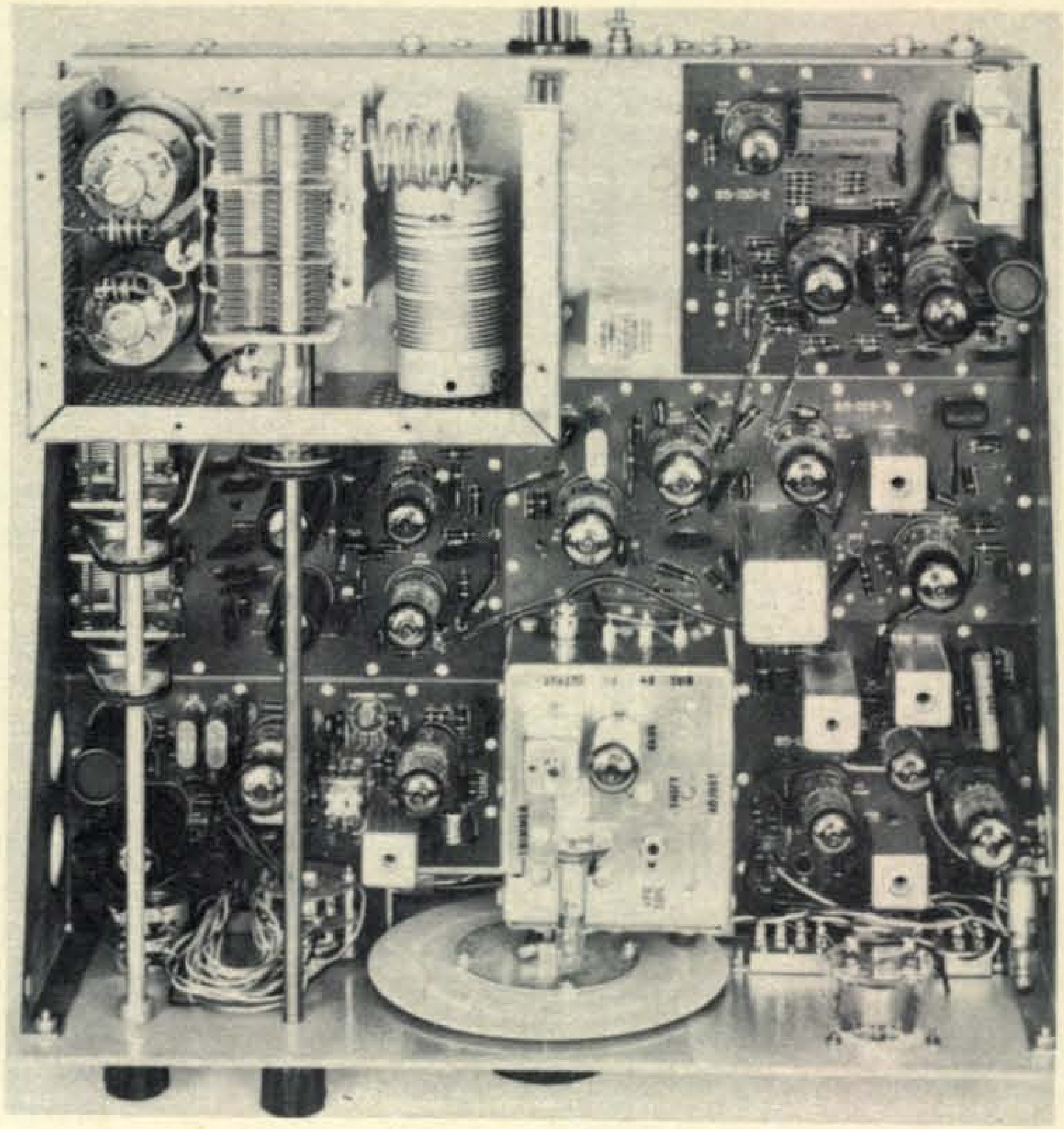
The b.f.o. consists of two separate osci lators with crystals 2.8 kc apart in frequenc placed so that the carrier falls at either sid of the filter as needed. Sideband selection i obtained by switching the B-plus from on oscillator to the other. The frequency of th v.f.o. is simultaneously altered by the sam amount of frequency difference. Retunin therefore is not required when sidebands a changed.

A. G. C.

The a.g.c. employs the two diodes in th 6BN8 product detector tube as a voltag

See page 126 for New Reader Servi

Top view of the HW-100 with the cover removed from the p.a. enclosure at lower right. The v.f.o. is near upper center. Other stages are assembled on five printed-circuit boards.



doubler with the rectified i.f. signal voltage applied through a diode gate to the a.g.c. line which controls the bias at the grids of the r.f. amplifier, 1st mixer and the two i.f. stages. Appropriate R/C circuits provide fast-attack, slow-release time constants. The r.f. gain also is tied into the a.g.c. line through a diode gate and provides an adjustable control voltage from the bias supply for the set. The diode gates prevent interaction between the r.f. gain control and the a.g.c. rectifier.

Transmitter

A cathode follower after the speech amplifier provides an impedance match to the balanced modulator which is a ring type using four diodes. The carrier balance or null is obtained with a potentiometer and a differential capacitor that is connected across opposite junctions of the diode ring and with its rotor grounded. Use of the latter compared to a single-ended capacitor on only one leg of the ring ensures the attainment of excellent balance without necessitating re-connecting the balancing capacitor to the opposite leg as might be needed if a satisfactory null were not otherwise obtainable.

The amplifier after the balanced modulator is a grounded-grid stage that provides isolation and matching between the modulator and the sideband filter. A series-tuned shunt-connected trap is installed at the output of the following amplifier to attenuate the 2nd harmonic of the 3395 kc signal. The 8395-8895 kc bandpass circuit after the transmitter mixer also attenuates harmonics as well as other possible spurious responses or mixing products.

The tuned circuits at the input and output of the driver stage are the same ones used for the receiver r.f. amplifier grid and plate and are permanently connected to the associated tubes for each mode. The PRE-SELECTOR TUNING on receive thus sets up the DRIVE TUNE on transmit and vice-versa. V_7 is neutralized by feedback between the plate and input circuit using a gimmick-type capacitance.

The p.a. is conventional with parallel-connected 6146's in Class AB1, capacitance-bridge neutralization, and Pi-output tank with adjustable loading for low impedances.

A.L.C.

A.l.c. bias voltage controls the gain of the isolation amplifier and the 1st i.f. (when used for transmit) and originates from several sources as shown at fig. 2.

One voltage is obtained in the usual manner by use of a voltage-doubler to rectify any a.f.

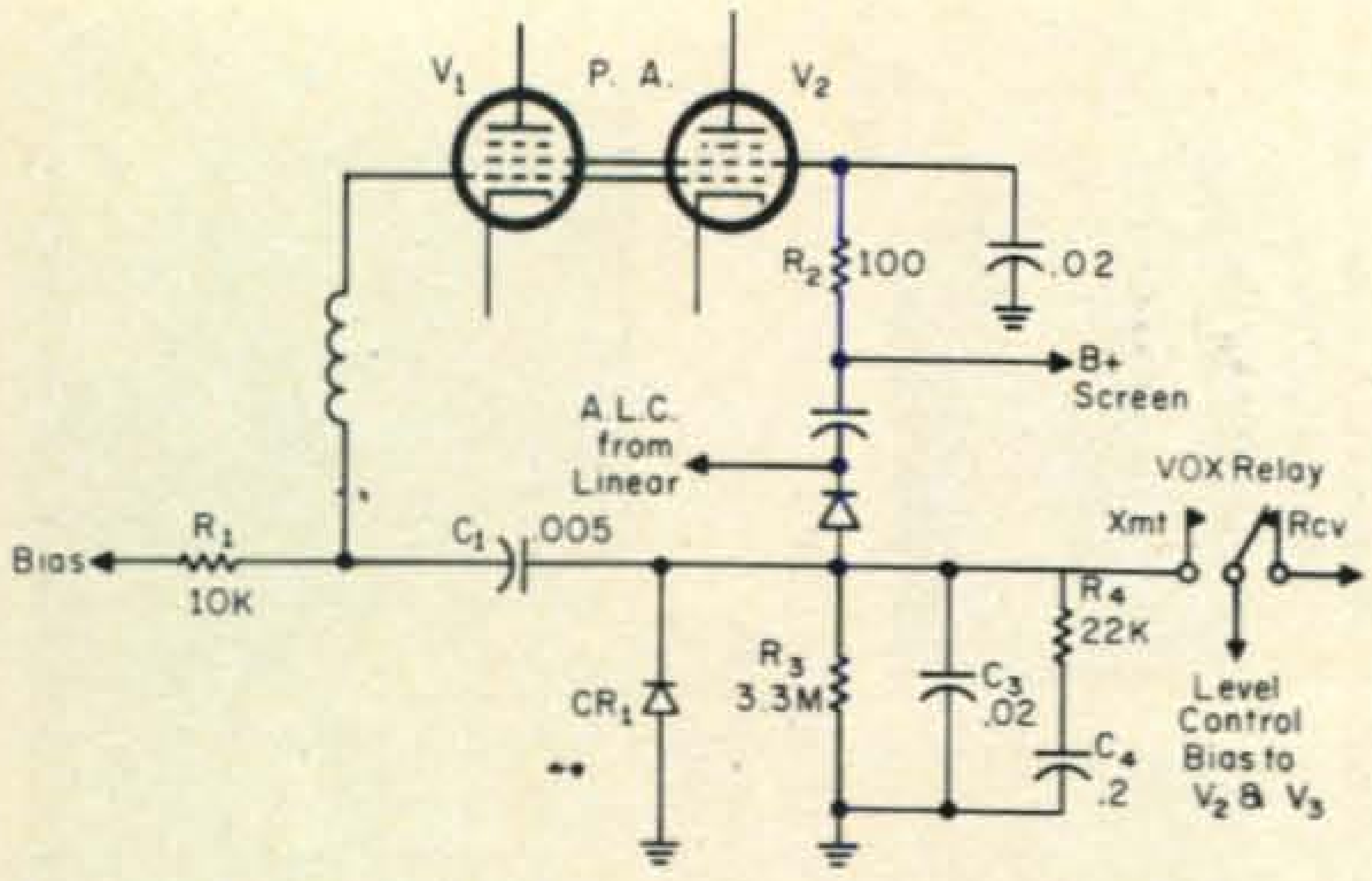


Fig. 2—A.l.c. circuitry used in the HW-100. Multiple action is obtained from a.f. voltage drops across R_1 and R_2 developed due to current flow when overdrive is approached. These voltages are converted to a d.c. control bias for V_2-V_3 by the voltage doubler CR_{1-2}. A.l.c. bias from a linear also can be simultaneously applied to V_2-V_3 through CR_2. C_3, C_4, R_3, R_4 provide filtering and time constants for a fast attack, slow decay. The v.o.x. relay switches level-control bias for V_2-V_3 between a.g.c. and a.l.c. See text for other details.

component that appears whenever a tendency toward p.a. grid current causes a voltage drop across a resistor in the grid return.

A second voltage, derived from any audio component developed across a resistor in series with the screen-grid supply (due to the sharp rise in screen current when overdrive is approached), also is applied to the a.l.c. rectifiers.

Finally, when a linear amplifier is in use, a.l.c. voltage obtained therefrom also can be applied to the a.l.c. setup through a rear connector. These three sources of control voltage thus furnish triple a.l.c. action.

C.W. and Tuneup

For tuneup and c.w. a different crystal is switched in on the oscillator for the lower-sideband carrier generator, V_{16B}, the frequency of which is such that places the carrier within the filter passband and thus allows it to be passed unattenuated by the filter.

In order to obtain a c.w. carrier, the mode switch (at c.w.) grounds one side of the balanced modulator, upsetting the balance and negating the null. The r.f. drive level is adjusted by varying a d.c. bias applied to the a.l.c. line.

When c.w. is to be received, the control relay removes B-plus from V_{16B} and activates V_{16A}, placing the b.f.o. on the upper-sideband frequency which is 1 kc higher than the c.w. transmit-crystal frequency. A 1 kc offset is thereby automatically obtained for an audible beat on receive when the transmitter is tuned to the received-signal frequency.[1]

Transfer

Transfer between receive and transmit is handled by a conventional v.o.x. system which has six sections on the control relay to switch screen and/or cutoff bias on or off as needed in certain receiving or transmitting stages. It also switches the level control for V_2-V_3 between a.g.c. and a.l.c. A second v.o.x.-actuated relay transfers the antenna and has auxiliary contacts for control of external gear such as a linear amplifier.

On s.s.b. the v.o.x. is activated by the speech input. On c.w. it is activated by a keyed 1000 c.p.s. tone obtained from a phase-shift type oscillator that is provided for sidetone monitoring. The v.o.x. relay closes as soon as the oscillator is keyed. It remains closed for a time dependent on the setting of the v.o.x. delay control (adjustable about ¼ to 1 second). Blocked-grid keying for c.w. is used at the transmitter-mixer stages and the r.f. driver. The sidetone is automatically applied to the receiver output stage for headphone or speaker use.

V. F. O.

Of special interest is the v.f.o. which employs a field-effect transistor. The setup is described at fig. 3.

Assembly and Construction

The assembly of the HW-100 is greatly simplified by the use of printed-circuit boards of which there are nine. Separate ones are used for various sections, such as the modulator, driver, heterodyne oscillator, i.f., audio, etc. Even each section of the bandswitch is installed on a circuit board, eliminating extra work and possible errors in the switch wiring. A color-coded wiring harness is supplied for most of the control, power-supply runs etc. Interconnections between circuit boards or other elements are made either directly or through shielded leads.

The v.f.o. is built in a separate box using point-to-point wiring. No circuit boards are used here. The p.a. is similarly constructed.

A convenient and time-saving feature is that the parts are packaged in envelopes individually numbered for each particular sec-

[1] In order to avoid out-of-band operation with c.w. or tuneup near a band edge, it should be kept in mind that the transmitter frequency is 1 kc *lower* than that to which the receiver is tuned.

See page 126 for New Reader Service

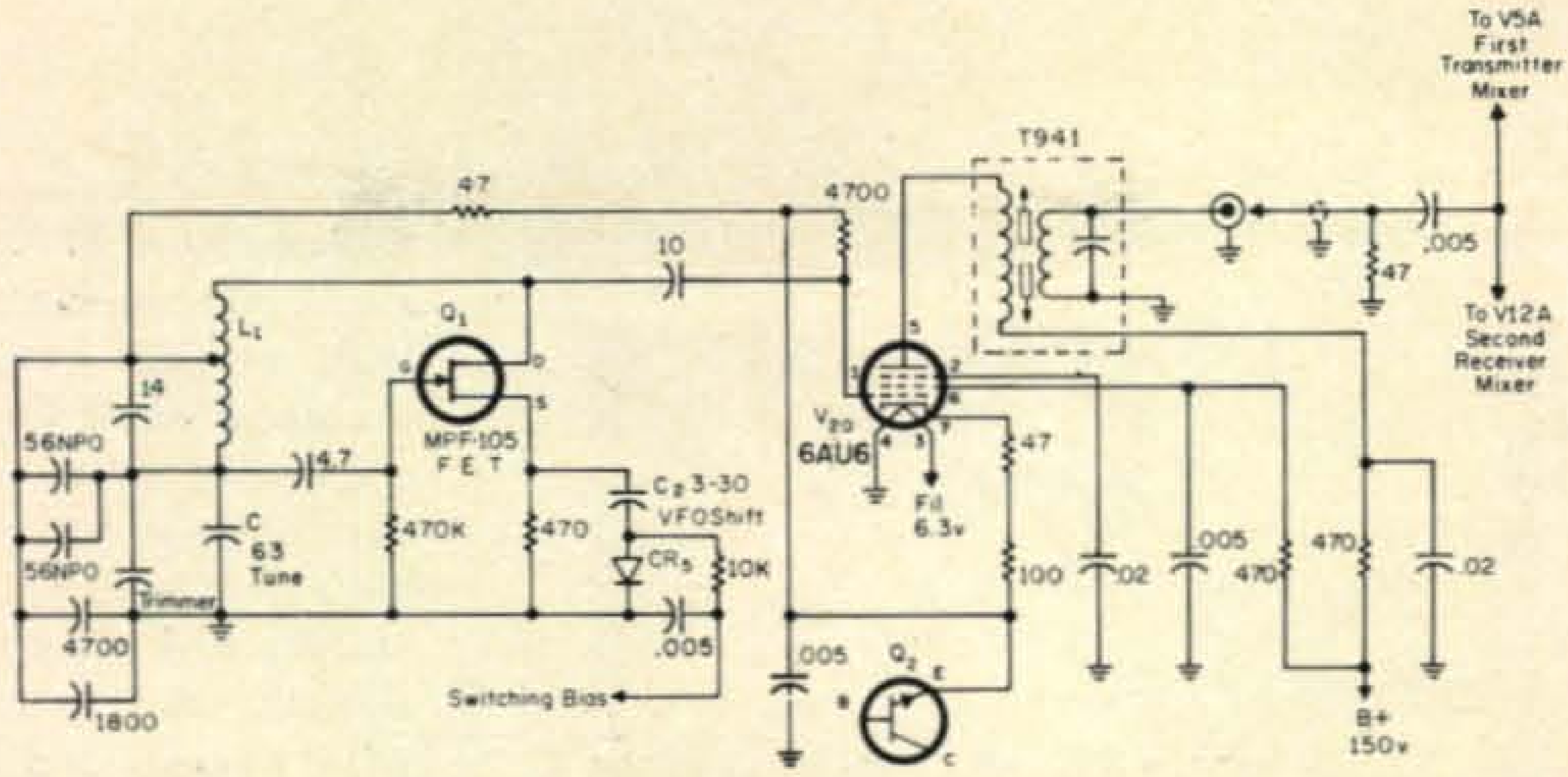


Fig. 3—Circuitry for the HW-100 v.f.o. An f.e.t. functions as a Hartley-type oscillator with a tap on L_1 at r.f. ground and one end connected to the f.e.t. gate. The oscillator frequency is determined by this portion of L_1 in conjunction with C_1 and the associated padders and temperature-compensating capacitors. Feedback for oscillation is obtained through the other section of L_1 which is connected to the f.e.t. drain. Output from the drain is fed to V_{20} which is fix-tuned to the v.f.o. range. Regulated operating voltage for the f.e.t. is obtained from across Q_2 connected as a zener diode in V_{20} cathode return. When sidebands are changed, C_2 is switched in or out by diode switch CR_5 to shift the v.f.o. frequency by the same amount as is the b.f.o./carrier-generator frequency.

tion of the set. You then open up only the packages numbered for the corresponding section that is to be next assembled. It is not necessary to pore through a large number of other components when looking for the needed ones, as might otherwise be the case if they were all unpacked and gathered in one spot.

Working one or two hours per evening, our unit went together quite easily in 30 hours time by following the step-by-step instructions. No special difficulties were encountered; however, a few points of caution should be noted.

When installing the components on terminal strip FH in the v.f.o., be sure they are positioned so that they will not interfere with the installation of the chassis-base cover.

It also was found desirable to solder the terminal-strip end of the 470-ohm resistor, that is connected to terminal 2 of capacitor FG, to the eyelet hole of lug 2 on the terminal strip, rather than to the top of the lug itself. More room is then left on the lug for easier installation and placement of other leads and components.

On the driver-grid board, the form for one of the inductors extended over the edge of the board, in our case. This had to be cut off to permit the board to be properly seated.

Special note should be taken as to the position of the notch on each band-switch wafer when the switch shaft is passed through them. The notch is *up on all but one wafer,* where it should be downward.

There are quite a few unused interconnection holes in the circuit boards. These are needed when the boards are installed in the SB-101. Some of these holes are grouped quite closely together with the ones that are used here and although identifying numerals or letters appear near them, close examination may be needed to determine exactly to which one a connection should be made. We missed on the proper holes for the connections at *both* ends of the 10,000-ohm resistor between the bandpass and i.f. boards!

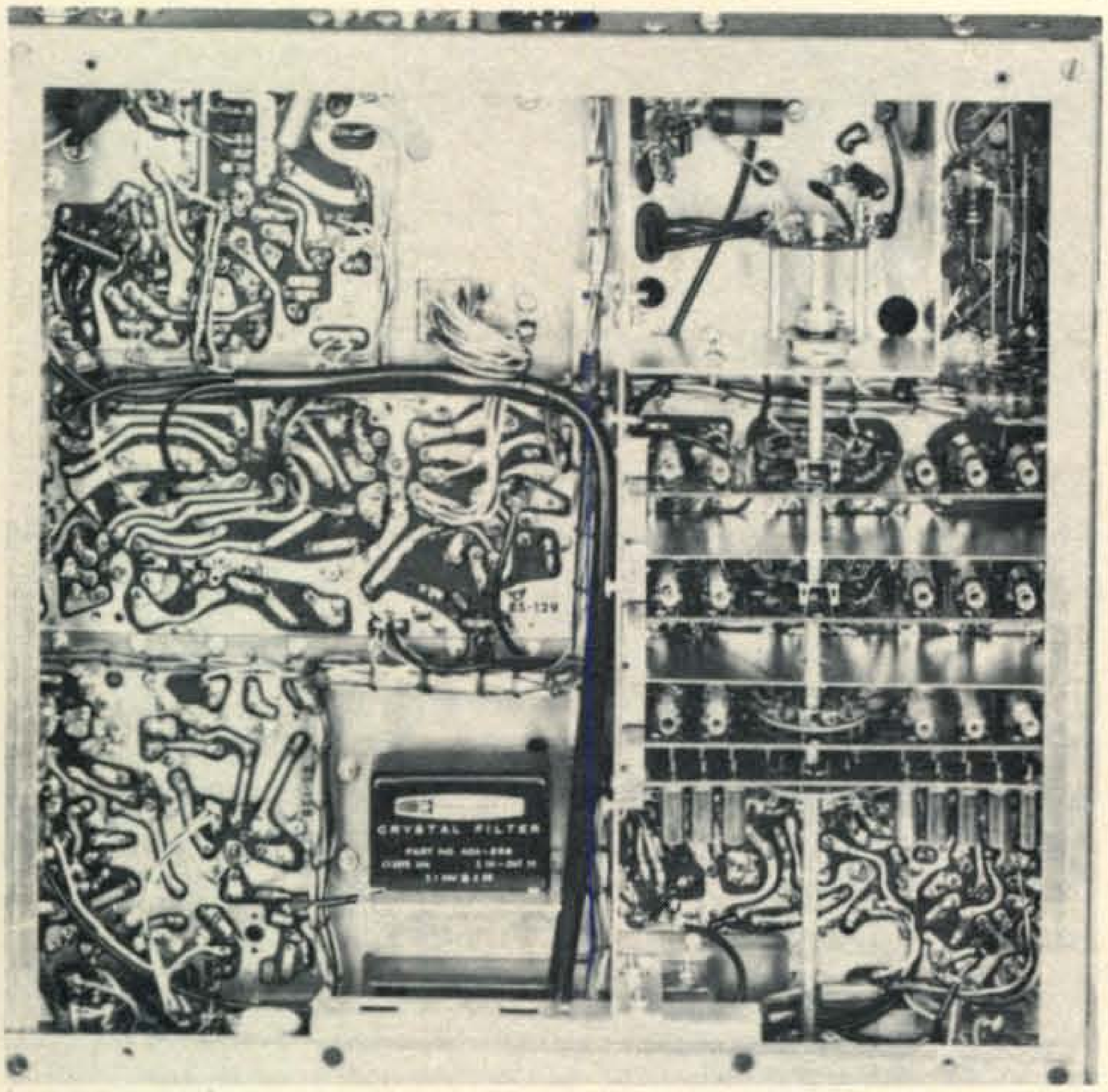
It may require several attempts to get the tuning knob on properly. This must be seated so that the dial does not wobble during rotation. Removal of the knob requires prying with a screw driver. If so needed, we suggest this be done at the bottom end of the decorative skirt to avoid visibility of possible marring by the tool.

Alignment requires the use of a v.t.v.m. or 20,000-ohm-per-volt v.o.m., a dummy load and accurate 100 kc source such as the calibrator. Receiver and transmitter alignment is quite simply accomplished therewith. More work may be needed for calibrating the v.f.o. dial, before the 100 kc points all fall in line with the least deviation.

V.F.O. Tuning

The v.f.o. is tuned with a very high-ratio mechanism, a patented affair made of plastic and called "Harmonic Drive." An average of only 18 kc is covered with one rotation of the knob.

The dial, on which the 5 kc calibration points are spaced about 1/8" apart, is mounted



Bottom view of the HW-100. Four r.f. and oscillator circuit boards, with shields between them, are mounted vertically at the right. An aluminum cover (not shown), with access holes for the coil cores, fits over the boards. The bandswitch wafers are installed and soldered directly on the boards, as are the r.f. inductors and crystals. The rear switch wafer is for the taps on the p.a. tank which is above the chassis. Bottoms of other circuit boards are shown at the left. The crystal filter is near bottom center.

on the v.f.o. shaft between a collar and a star-spring washer held by an E-ring clip. The collar is adjusted so that the compression tension of the star-spring holds the dial in place, yet which allows the dial to be slipped to any circular position on the shaft. When the dial is to be indexed for calibration during the course of operation, a zero-set button on the panel is depressed and bears against the face of the dial to keep it from rotating as the v.f.o. shaft is turned to the calibrating signal. Releasing the button then allows the dial to rotate with the shaft.

Operation and Performance

The receiver in the HW-100 has excellent sensitivity and appears to be less subject to overload and cross modulation than usually found. The a.f. quality is clean and pleasant sounding, while the a.g.c. time constants do away with pumping on strong signals and eliminate dynamic a.g.c. distortion.

The high ratio of the drive for the v.f.o. provides good vernier tuning and smooth operation; however, when rotation of the knob is started, there is some stickiness encountered until the knob gets going. Where tuning is required in small increments, such as may be needed for precise adjustment to an s.s.b. signal, this condition can be an annoying hindrance and spoil what otherwise might be an arrangement having a "nice feel" to it. We understand that a new lubricant is in the works for overcoming this difficulty, so no future problems should arise in this respect.

The transmitter tunes up easily as indicated with the meter switch set to read either relative-power output or plate current. The v.o.x. works very smoothly and with little interaction between the various control settings as otherwise found in many cases. The anti-trip action is excellent, even in the presence of strong signals from the calibrator.

The a.l.c. system is one of the best seen to date. With only double action (that is, without the benefit of the 3rd a.l.c. source from a linear) no flattopping at all could be observed on an oscilloscope even with maximum mic gain. Furthermore, no audible distortion was evidenced at full operating level as usually occurs with most a.l.c. systems. The result is more like adding a linear amplifier to the exciter. As a matter of fact, the a.l.c. appears to function as a true instantaneous compressor in contrast to the so-called compressors which actually are no

[*Continued on page 122*]

See page 126 for New Reader Service

See page 126 for New Reader Service

VERTICAL ANTENNAS

Part III

BY CAPT. PAUL H. LEE, *W3JM

In Part III of this series, the author discusses short vertical antennas, their limitations and ways to overcome these limitations. Several practical designs and methods of feeding are shown.

SHORT vertical antennas are of interest to many amateurs. Every mobile whip antenna is short, much too short, at frequencies in the 7, 4 and 2 mc bands. Also, not everyone is blessed with sufficient clear space for erection of horizontal dipoles at those frequencies. For such amateurs, the short vertical is a solution which may be attractive, especially for use on 4 or 2 mc. This discussion is for those who care to know something about how such antennas can and do work, and what their limitations are.

Since this type of antenna is electrically short, something has to be done to lengthen it so that it will resonate and take power from the transmitter. One of the simple ways of resonating a short antenna is by use of a series loading coil at the base of the antenna. Why is a coil used? Reference to figs. 13(A) and 13(B) of Part II of this series[21] will show that the input impedance of an antenna shorter than ¼ wavelength consists of a fairly low resistance and a capacitive reactance. The shorter the antenna, the lower the resistance and the higher the reactance. Thus, the shorter the antenna, the more loading coil is required, and, since loading coils have inherent loss resistance, the lower will be the efficiency of the antenna system. Remember these facts, for we shall talk about them later on.

* 5209 Bangor Drive, Kensington, Maryland 20795.

21 Lee, P. H., "Vertical Antennas, Part II" *CQ*, July 1968, p. 25.

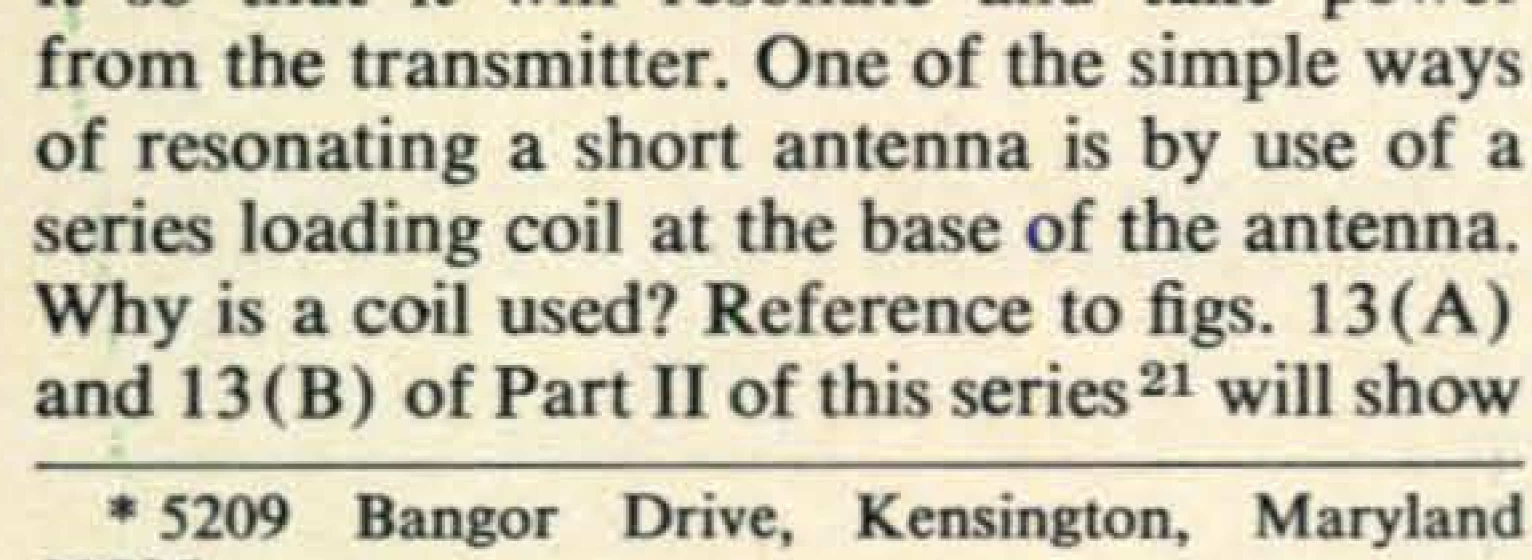


Fig. 17—Top loading a vertical by the use of guys. The rear guys, also broken by insulators, are not shown for the sake of clarity.

One of the common forms of short antennas is the mobile whip. Early mobile whips were built with base loading coils, and for changing bands it was possible to change loading coils by unscrewing the whip and the coil from the spring mount. These worked after a fashion, but were quite inefficient at 7 and 4 mc. They were inefficient because the current distribution on the vertical whip was poor. With the antenna in resonance the point of maximum current, or "current loop", was at the bottom of the loading coil. In any antenna, the portion which carries the greatest current does most of the radiating. Thus with the base loaded whip, the greatest current was in the loading coil, merely creating an inductive field, while a relatively small current was flowing in the whip itself. The answer to this dilemma was to make the whip in two parts, and put the loading coil up in the whip itself, thus giving at least the bottom portion of the whip a chance to carry some appreciable antenna current and do some radiating. Most mobile whips today are made in this fashion. You can see them in the ads in this and other magazines, and in distributor catalogs. In spite of all the claims made by the manufacturers, however, even this type of whip which is so very short elec-

See page 126 for New Reader Service

trically is quite inefficient on 7, 4 or 2 mc. Factors which contribute to the inefficiency are lack of adequate ground plane, losses in the loading coil, and the short length of the portion of the radiator carrying greatest current.

Top-Loading

A better approach to the problem of increasing the radiation from a short antenna is by use of top loading. In some cases of m.f. and l.f. high power installations, an actual top hat has been constructed on a tower by using steel structural members, supporting a horizontal web of connecting wires. A much more practical approach is the use of the upper portions of top level guys as top loading by connecting them to the tower and breaking them with insulators a certain distance down from the top. There have been many studies made in an effort to determine optimum configurations of top loading cable length, angle of top loading cables from the tower, number of top loading cables, and interconnection of the lower ends of the top loading cables. One of the most extensive of these was done by Smith and Johnson.[22] That article contains many graphs of resistance and reactance for various top loading guy configuration, plus discussions of the effects of insulator losses and ground system losses. The results of this study showed that substantial gain in radiated power can be realized by this "umbrella" type of top loading. Connection of a wire skirt around the lower ends of the top loading cables shortens the length of cables required to produce a particular result. In cases of high power at l.f., use of the skirt wire reduces corona losses. Top loading gets the current up in the antenna, where it belongs.

Another study which showed substantially the same thing was one made on a 1200 foot tower at Forestport, N. Y.[23] Optimum configuration of top loading cables for maximum resistance and lowest reactance (best efficiency and bandwidth) is shown in fig. 17. The tower is shown being guyed in six directions at the 1040 foot level, with the guys at a 45 degree angle with the tower. A skirt cable is used, and between each pair of guys there are two additional top loading cables,

[22] Smith, C. E., Johnson, E. M., "Performance of Short Antennas," *Proc of IRE*, Oct. 1947.

[23] "Forestport Antenna Study," Technical Report 42-F Contract AF 30 (602)-2588, 31 Jan. 1962. Available to defense contractors through D.D.C. (Unclassified)

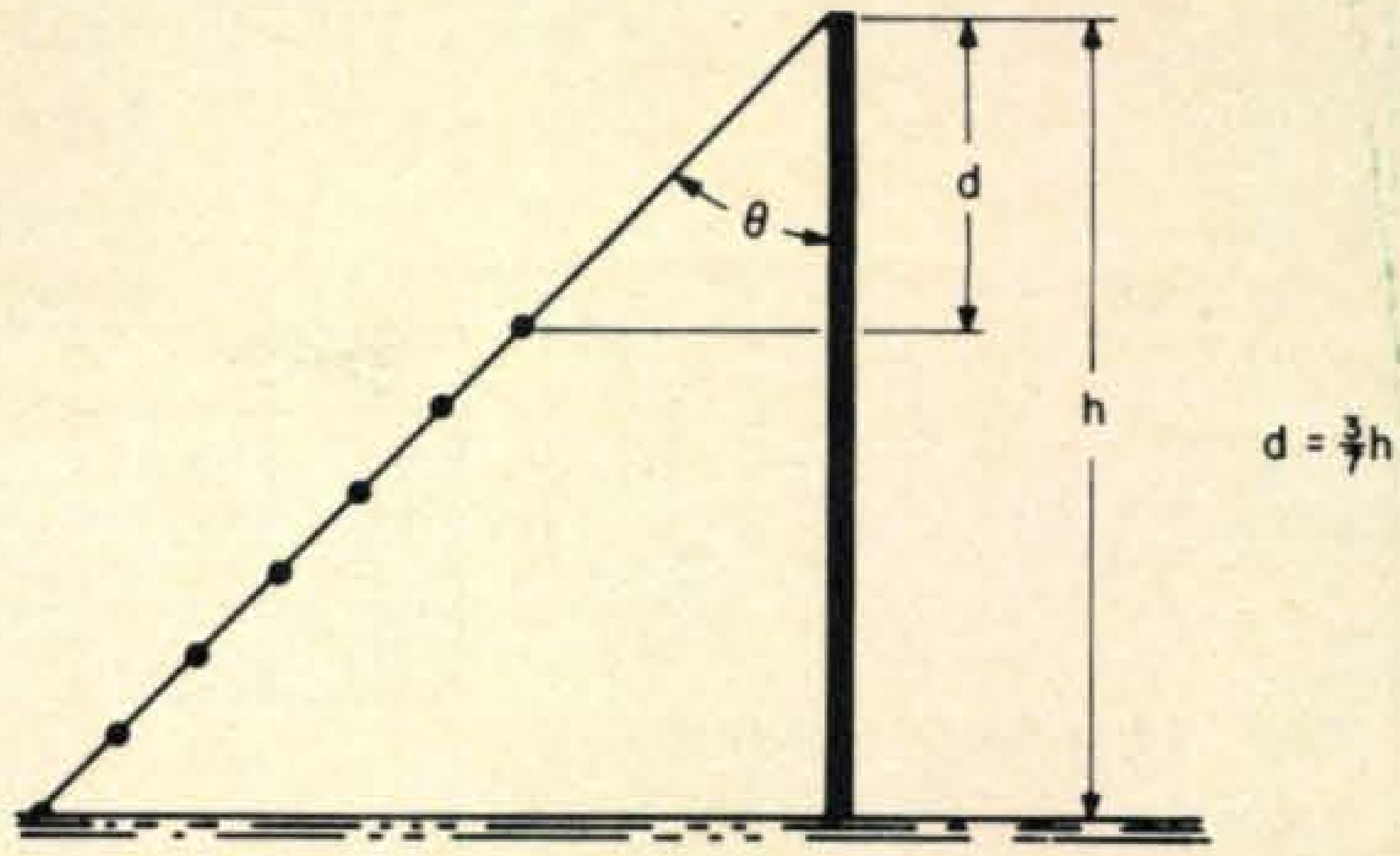


Fig. 18—Critical dimensions for the top loaded antenna.

thus making a total of eighteen top loading cables. The top loading portion of each guy is 805 feet long. The study shows the 1200 foot tower to be resonant (zero reactance) at 80 kc with this top loading configuration. Now, scaling the dimensions down for use on 2 mc, the tower height becomes 48 feet, and the top loading guy cable length becomes 32 feet. This is a reasonable size for amateur use on 2 mc. For 4 mc these dimensions would be halved. The importance of an adequate ground system under such a radiator cannot be overemphasized. As shown in Part I of this series,[24] the number and length of radials has great effect on radiation efficiency, especially in the case of short vertical radiators.

Belrose conducted a study of top loading parameters[25] and determined that radiation resistance was maximum when $d = 3/7h$

[24] Lee, P. H., "Vertical Antennas, Part I," *CQ*, June 1968, p. 16.

[25] Belrose, *et al*, "Engineering of Communications Systems for Low Radio Frequencies," *Proc of IRE*, May 1959.

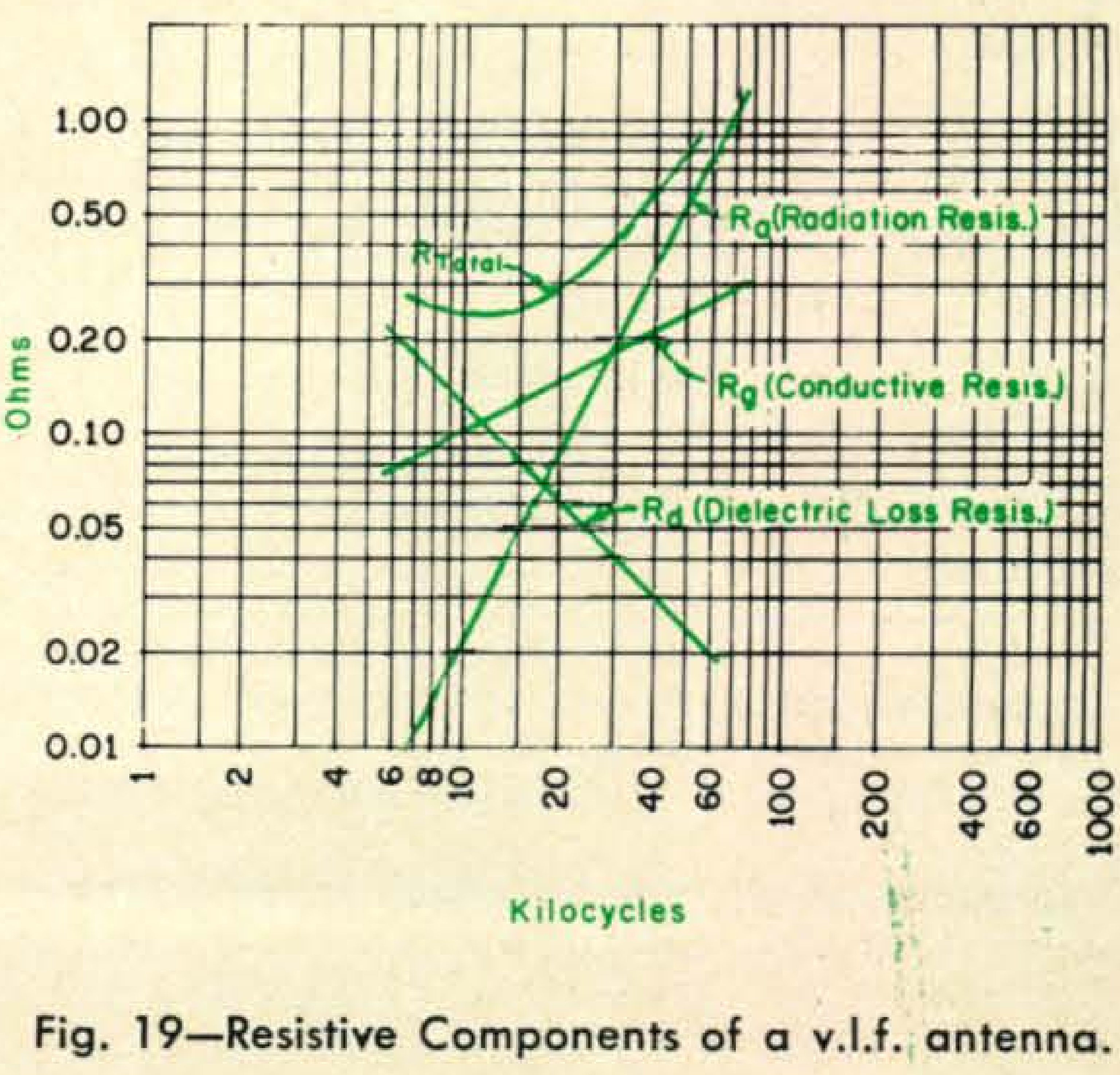


Fig. 19—Resistive Components of a v.l.f. antenna.

Type A 3 Guys
Type B 6 Guys
Type C 6 Guys With Skirt Wire

Type	H	L_1	L_2	S	d_1	d_2
A	.124λ	.122λ	.172λ	.013λ	.0012λ	.000187λ
B	.104λ	.102λ	.144λ	.011λ	.0010λ	.000156λ
C	.081λ	.079λ	.112λ	.0036λ	.00078λ	.000121λ

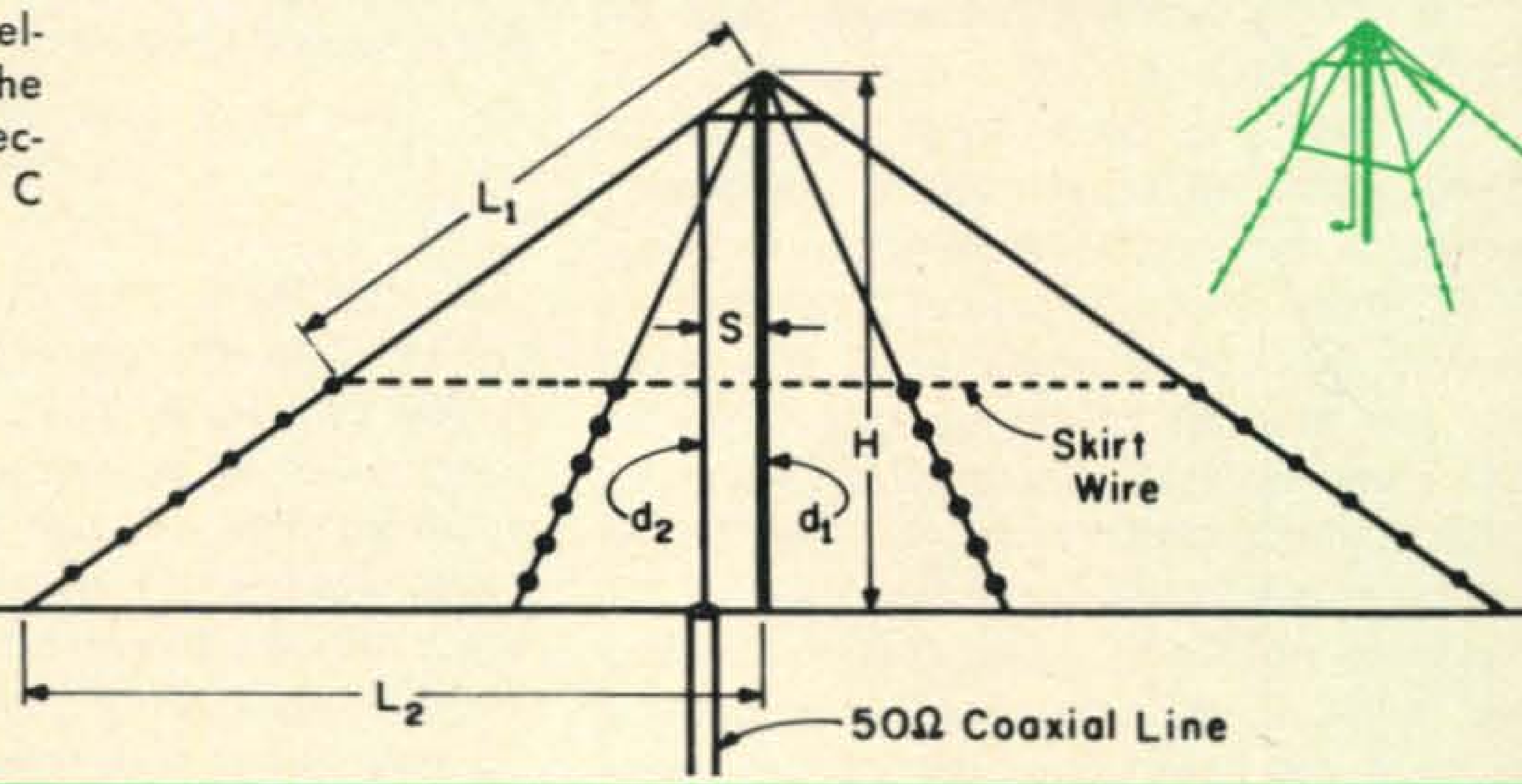


Fig. 20—Top loaded Folded Unipole developed at the N.O.L. The insert shows a perspective view of a Type C antenna.

and Θ is 45 degrees, in fig. 18. It can be seen that this confirms the results of the Forestport study. Smith did the design work for the 837 foot vertical radiator used on 173 kc by the Voice of America at Munich, Germany.[26] In this case Θ was made approximately 55 degrees, and twelve top loading cables 512 feet long were used. The measured base impedance was $29.5 + j135$ ohms. The measured unattenuated field at one mile was 178.9 mv/m for 1 KW, which is quite good efficiency. Scaling this antenna for 2 mc use, its height would be 73 feet, and the top loading guy cables would be 44 feet long. As may be seen from the measured base impedance, the vertical radiator is slightly over ¼ wave in electrical height, the reactance being positive. There have been other studies made on this subject, some of which are those by Monser[27] and Gangi.[28]

Resistances

Unless one goes to the amount of top loading used on the Munich antenna, the resistance will be low, and the reactance will be capacitive. As will be seen from fig. 13(A) of Part II,[21] the base resistance of an antenna shorter than about 0.15 wavelength is less than 10 ohms, and the shorter the antenna the lower the resistance, and the higher the negative reactance. Adding the optimum top loading to the Forestport tower, while it brought the reactance to zero (resonance) at 80 kc, left the resistance at only 4 ohms. In other words, top loading is effective in reducing capacitive input reactance of a vertical radiator which is quite short, but it does not have much effect on input resistance, which remains quite low. This means that antenna system Q is quite high, and particular care must be paid to keeping losses to a minimum. Base input resistance includes losses, of course.

The reasons for this can be seen in fig. 19, which shows the composite resistance characteristics of a v.l.f. antenna which is extremely short electrically. The loss components R_g and R_d are considerable when compared to radiation resistance R_a. R_g is conductive resistance, which represents power lost in conductors and earth due to current flow. R_d is dielectric loss resistance, which results from hysteresis losses in insulators, nearby trees, vegetation, and wood or masonry. John Walter, one of our experts in the v.l.f. and l.f. field, has written an excellent paper on this subject.[29] It may

[26] Smith, *et al*, "Very High Power Long Wave Broadcasting Station," *Proc of IRE*, August 1954.

[27] Monser, G. F., Sabin, W. D., "Antenna Design for Maximum L. F. Radiation," *Electronics*, June 3, 1960.

[28] Gangi, *et al*, "Characteristics of Electrically Short, Umbrella Top-Loaded Antennas," *IEEE Transactions on Antennas & Propagation*, Vol. AP-13, No. 6, Nov. 1965.

See page 126 for New Reader Service

thus be seen that it behooves the antenna designer to make the radiator as tall as possible, so that radiation resistance may be high enough to make the losses of little consequence when compared with it.

Folded Unipole

So far in this chapter we have been speaking of series fed vertical radiators. There is another way in which the efficiency can be improved, and that is by use of the folded unipole principle of feed.[30, 31] We shall not go into the details of how a folded unipole works as that subject is well covered in the references. Let it suffice to say that the folded unipole is the upper half of a vertical folded dipole, with the lower half replaced by a ground plane. If you are not using one on the amateur bands, you probably are using one as the driven element of your home TV antenna. They are very common in this application.

The folded unipole feed principle may be easily applied to the short, top loaded vertical radiator. The transformer action of the folded unipole is used to give a more favorable input resistance than can be obtained with series feed. Another thing that the folded unipole feed does is to reverse the sign of the input reactance. The input reactance of a series fed tower shorter than ¼ wavelength is always capacitive. This means that a series loading coil (spoken of in high power as a *helix*) must be used to resonate the tower. With folded unipole input the feed point reactance is always positive. (Consider the tower and feed wire to be a shorted transmission line less than ¼ wave long. Its input reactance is positive.) Thus the folded unipole may be fed with a simple low-loss capacitive feed network, rather than through a loading coil or helix which is lossy. Also, because with the folded unipole feed the resistance will be stepped up by transformer action and the reactance will usually be lower, the Q of the antenna will be lower, and its bandwidth will be greater, than with series feed.

Studies of this type of feed have been made by the Naval Ordinance Laboratory, Corona, California in an effort to reduce the size of l.f. antennas for ship and shore use.[32, 33] A simple design which evolved is shown in fig. 20. Dimensions are shown in the accompanying table in terms of wavelength. It may be seen from the table that height H can be lower when 6 guys with skirt wire are used (Type C). Other dimensions are also smaller with Type C. For 2 mc use, a Type C configuration would have the following dimensions:

$H = 39.8$ feet
$S = 50.5$ inches
$L_1 = 39.1$ feet
$d_1 = 4.6$ inches
$L_2 = 55$ feet
$d_2 = 0.72$ inches

For 4 mc the above dimensions can be halved. The antenna can be fed with 50 ohm coaxial line.

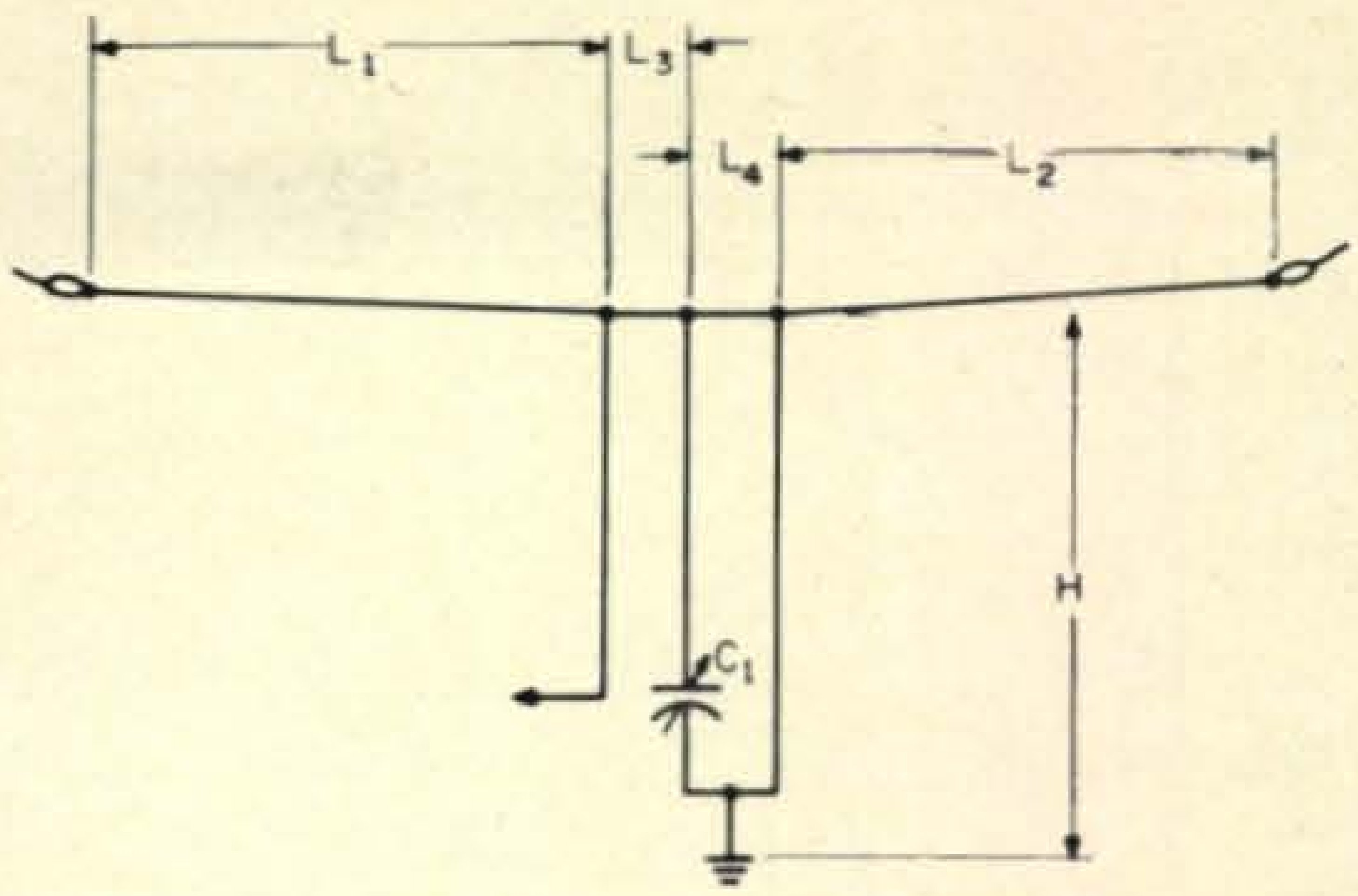


Fig. 21—Configuration of the UG® antenna. The dimensions are given in the text.

Type UG

Another allied type of antenna which was developed several years ago is one called the Type UG.®[34] This type was devised to improve the feed point impedance and the bandwidth of some of the "inverted L" or "T" antennas used at l.f. The configuration of the Type UG is shown in fig. 21. Typical dimensions for 2 mc would be:

29 Walter, J. C., Capt. USNR (Ret.), "Practical Analysis of LF and VLF Antenna Resistance," *Naval Engineers Journal*, Feb. 1966.

30 Leonhard, *et al*, "Folded Unipole Antennas," *IEEE Transactions or Antennas and Propagation*, Vol. AP-3, No. 3, July 1955.

31 Monser, J. G., "Calculating Folded-Unipole Antenna Parameters," *Electronic Industries*, Jan. 1960.

32 Walters, A. W., "Antenna Miniaturization," (Naval Ordnance Lab., Corona, Calif.) in *"A Decade of Basic & Applied Science in the Navy,"* Supt. of Documents, U.S. Government Printing Office, Wash., D.C.

33 Seeley, E. W., "Small Antenna Study," NOL, Corona, Calif. Unclassified Report. (Not available for public distribution.)

34 "Engineering Appendix-Type UG Antenna." Private communication from John H. Mullaney & Associates.

See page 126 for New Reader Service

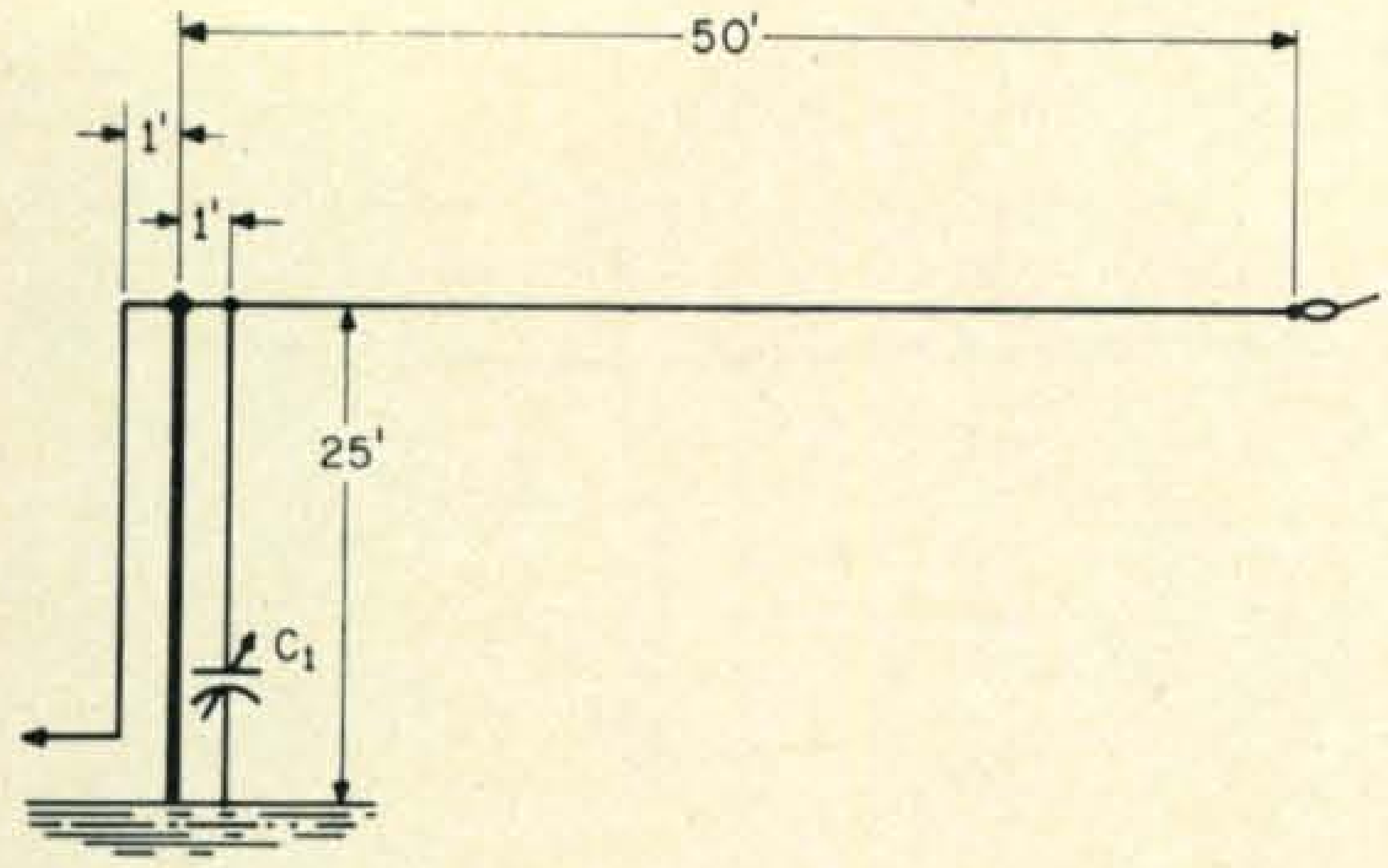


Fig. 22—Configuration of an end fed UG® antenna.

$L_1 = 25.0$ feet
$H = 25$ feet
$L_2 = 25.0$ feet
$L_3 = L_4 = 1$ foot

The feed can also be applied to one end, if desired, as shown on fig. 22.

By study of these two figures it will be seen that the transformer action of the folded unipole has been made variable by the use of an extra downlead and capacitor C_1. In tuning up this antenna for a specific frequency, C_1 is varied until a favorable feed point impedance $(50 + j\,x)$ is seen at the feed point. This may then be matched to the coaxial line by use of the matching techniques described in Part II. One word of warning, capacitor C_1 should be a high voltage type if powers of 1 KW or so are used. Considerable current flows in this wire, and also in the grounded vertical wire, when the antenna is tuned up. In fact, the grounded vertical wire does not have to be a wire at all. It can be a metal mast such as a short tower or pipe, suitably guyed, and well-grounded at its base. Ground connections linking tuning unit, mast or tower, and C_1 should be heavy and well-made. I used an aluminum pipe mast for my end fed Type UG. The downleads should be rigidly mounted to the mast.

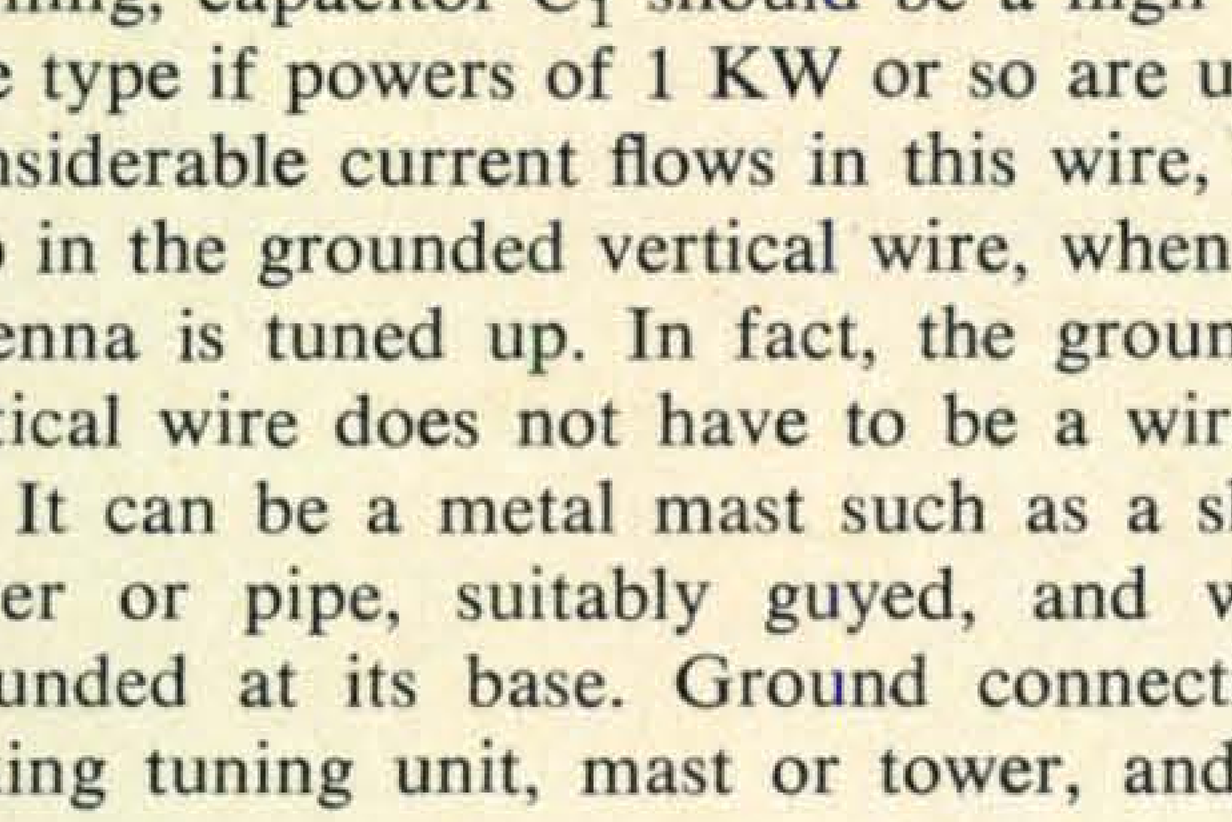


Fig. 23—Feed systems used in the Mark IV DX Antenna.

Another possible way of using the folded unipole feed principle for a six-band antenna was described in the article on the Mark IV DX Antenna.[35] In this one, which is still in use, the 40 foot tower is used as a top-loaded vertical radiator on 2, 4 and 7 mc, and the tri-band beam on top of it is the top-loading. On 2 and 4 mc the tower is fed as a true folded unipole, with the feed line going to the top of the tower. On 7 mc this tap point is too high, and therefor a feed rod is connected to the side of the tower at the 20 foot level. The schematics of these two feed arrangements for 2, 4 and 7 mc are shown in figs. 23 (A) and 23 (B) respectively. This antenna is ideal for the amateur who has a beam on a tower of reasonable height in his backyard, and who would like to get on 2, 4 or 7 mc without putting up wire antennas.

NORD

There is yet another type of short vertical antenna which has recently come into use. This is the NORD®. The original NORD was designed for shipboard use, for radio broadcasting in the m.f. band in European waters. It has since been built for shore use at high power, in the l.f. band. To date, NORDs are in use at Naval Communication Stations in Japan, Guam, Philippines, Hawaii and Annapolis, Md., providing l.f. multichannel transmitting capability. A schematic of the NORD is shown in fig. 24. A center tower is used, with its base grounded. The tower is fed by the folded unipole method, with a feedwire going to the top of the tower. The upper set of guys (three of them) is connected to the tower, and they extend out to three short perimeter towers, where they are secured to strain insulators. From these the cables drop down to tuning units which consist of capacitors.

For sake of clarity in fig. 24, the perimeter towers are not shown. The NORD is basically nothing but three over-coupled tuned circuits with a common element, the center tower. The purpose of the NORD for l.f. is to provide sufficient bandwidth for multichannel teletype transmissions, while still retaining reasonable radiation efficiency. The electrically short series fed tower cannot do this at

[35] Lee, P. H., "Mark IV DX Antenna," *CQ*, Feb. 1967, p. 60.

See page 126 for New Reader Service

high power. Its Q is very high and its bandwidth is limited. Also, with top-loading, the top-loading guys are corona-limited due to the very high voltages which are developed on them. The NORD has no such problems. By adjusment of the capacitors C_a, C_b, and C_c, optimum bandwidth and/or efficiency can be obtained, with reasonable input impedance being provided by the folded unipole feed. For Naval l.f. purposes we require bandwith. For amateur c.w. and voice at h.f., efficiency is paramount. The NORD can fulfill both of these, by suitable adjustment, in a tradeoff of efficiency for bandwith or vice versa. By going to the NORD at l.f. we have rid ourselves of the high voltage helix with its inherent losses, and its bandwidth limitations. The input coupling unit with the NORD can be nothing but low loss capacitors. In fact, in the high power NORDs vacuum capacitors are used throughout.

A full-size NORD, designed for 50 to 150 kc., now in use, has dimensions as follows:[36]

Height of center tower—450′.

Height of perimeter towers—150′.

Spacing of center to perimeter towers—500′.

For use on 2 and 4 mc by amateurs, the NORD would not have to be so short electrically. It could have the following dimensions:

Height of center element—30′.

Height of perimeter supports—10′.

Spacing of center to perimeter—33′.

This antenna would have excellent efficiency on both bands. Guy tuning capacitor values would have to be determined by experiment, but should be of at least 1500 mmf total capacity, adjustable in steps, with a portion variable. The input impedance at the feed point will be $R + jX_L$ of a reasonable value, and this can be matched to coaxial line by a simple capacitor network. The antenna is tuned by connecting an impedance bridge to the input, then starting with the guy tuning capacitors at minimum they are brought up in value simultaneously until a good $R + jX_L$ is obtained. It may be possible to obtain $50 + jX_L$, in which case only a series capacitor will be required for matching to the line. Heavy ground busses must be used to link perimeter tuning units with the center tower.

There is another type of short vertical radiator that can be used at h.f., and this is the

[36] "NORD Antenna Model Report," Private communication from John H. Mullaney, Multronics, Inc.

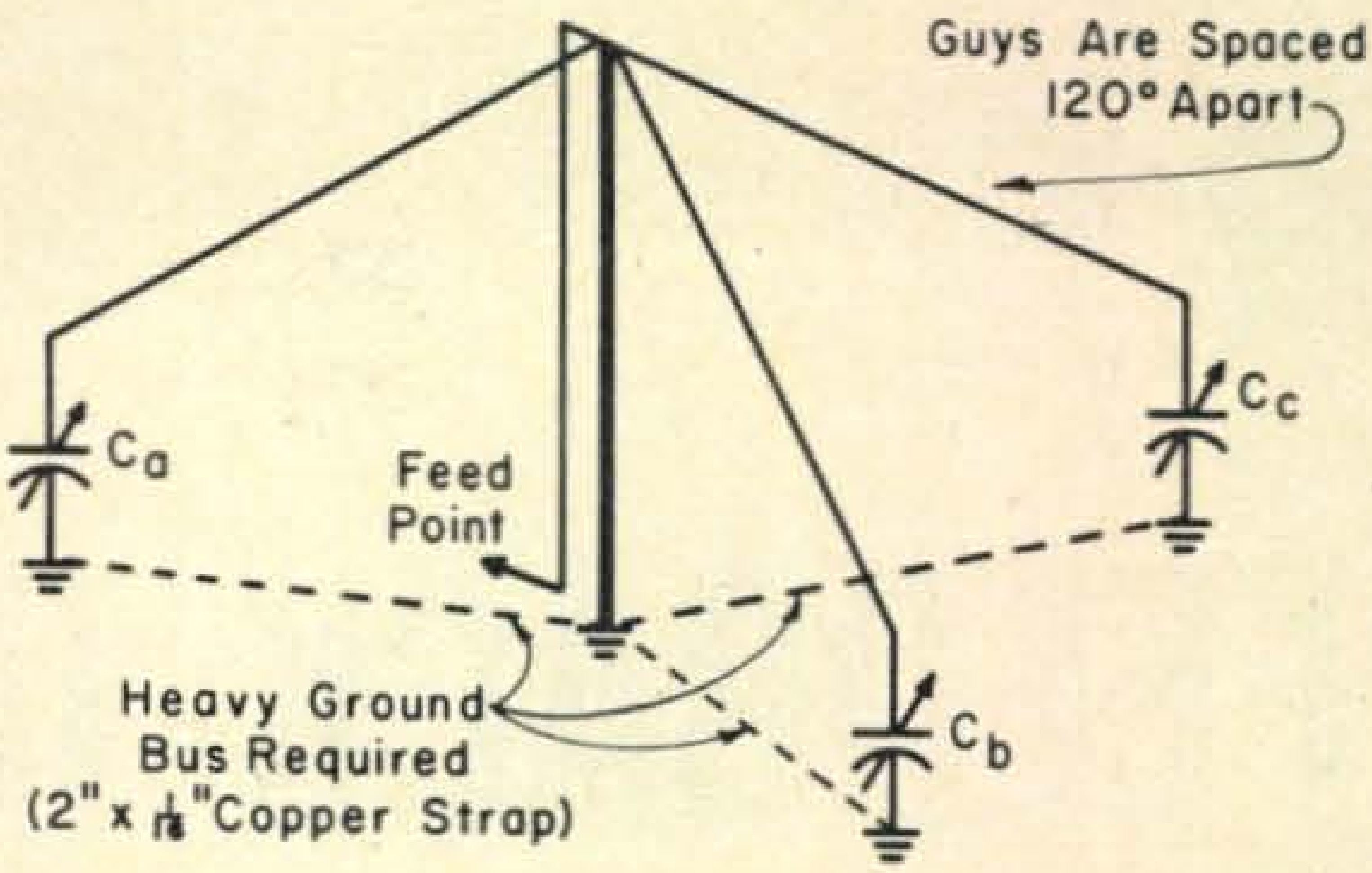


Fig. 24—Layout of the NORD® Antenna. A heavy ground buss is needed, at least a 2″ × 1/16″ copper strap.

wound whip. These are made commercially by the Shakespeare Co. in South Carolina. A wire is wound around and imbedded in the outside of a fiberglass whip. The winding greatly increases the electrical length of the antenna. In fact, one might consider it to be a loading coil which has been stretched out to become *the* antenna itself. Whips of this type find great use on small boats, fishing craft, yachts, etc., for use with ship-shore radiotelephone in the 2 to 3 mc band. Any amateur can easily build one by winding wire around a bamboo pole, wrapping the thing with waterproof tape, and varnishing it. Such an antenna would suffice to handle several hundred watts, but for 1 KW or more I would not recommend it. Considerable voltage can be developed between turns in some places on the whip, and it could easily go up in smoke.

Slinkey

For low power there is another similar type, fed in the folded unipole manner. This one can be made of a child's "Slinky Toy", the coiled steel spring which stretches itself and "walks" downstairs by itself. The spring can be stretched out on any suitable support such as a fiberglass tube, anchored in place, and fed like a folded unipole, against ground. Its length can be varied to produce almost any input impedance and degree of loading desired. Such an antenna, experimentally built, would be an ideal thing for indoor use, or sticking out from an apartment window, suitably supported. It offers endless opportunity for the enterprising amateur to surprise himself with the amazing results which can be obtained. Communications have been maintained between this area and ZS stations

[*Continued on page 114*]

R.F. FEEDBACK IN AUDIO COMPRESSORS

BY K. C. AGRELIUS, *K6SHA

DON'T discard, trade off or sell your audio compressor, limiter or clipper because it works OK on two or three bands and has feedback problems on another band. This is a good indication that the problem is r.f. feedback due to a high s.w.r. on one band, poor match to the transmitter or possibly a poor ground system. Even the proximity of one end of the dipole antenna near the shack will cause trouble even though the s.w.r. is quite low.

Due to the high additional audio gain involved when a compressor, limiter or clipper circuit is connected in series with the mike, the unit is very susceptible to r.f. feedback and it takes only a small r.f. voltage on the input of the mike circuit to cause trouble.

* 274 Hiram Avenue, Newbury Park, California [illegible]0.

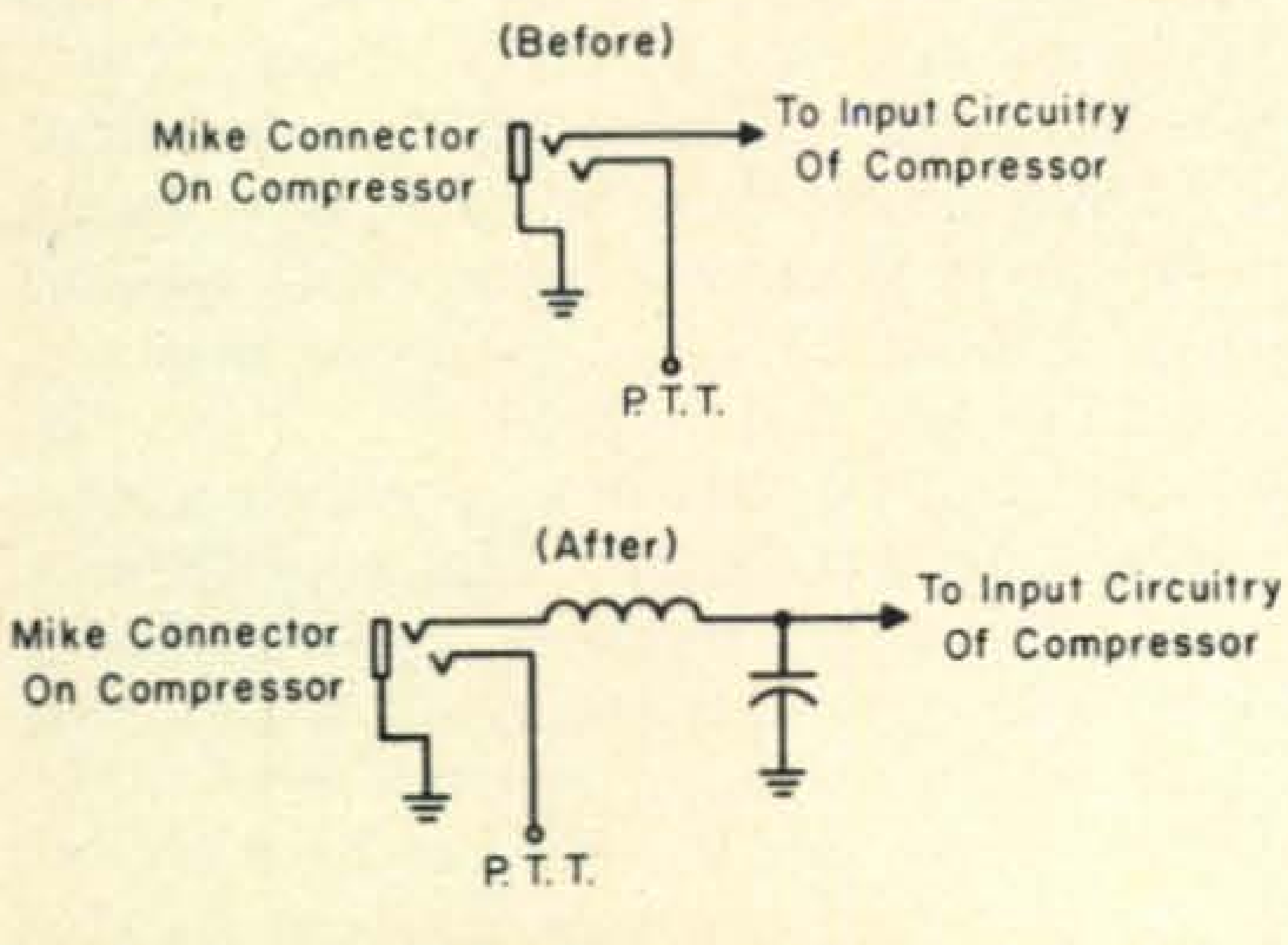


Fig. 1—Circuit of the low-pass filter used to eliminate r.f. feedback caused by the addition of an audio compressor. The component values are from 1 to 2.5 millihenries for the r.f. choke and from 100 mmf to 1000 mmf for the capacitor.

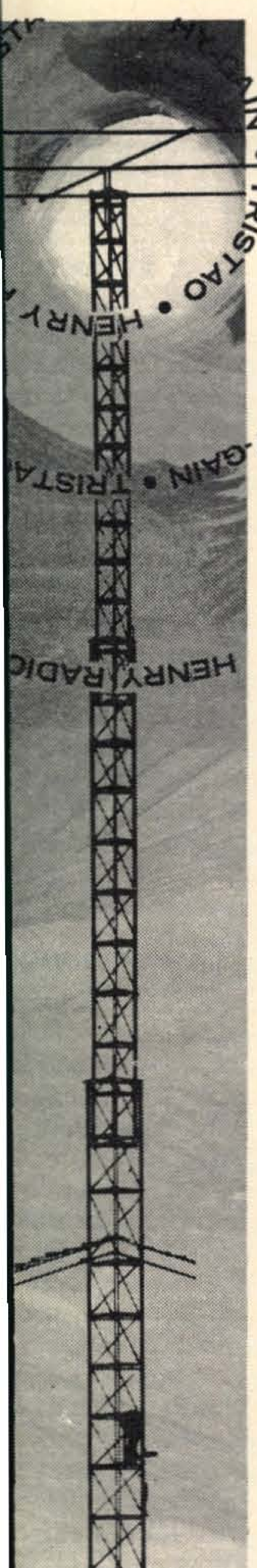
It is surprising that few if any manufacturers of this type of equipment provide an adequate filter which will bypass any stray r.f. voltage at the input of the unit before it is amplified and can cause trouble.

Solution

The solution to the problem is very simple. The installation of a small r.f. choke and capacitor as shown in fig. 1 will provide an effective filter network which will attenuate the stray r.f. voltage to a level where it is not harmful. The value of the r.f. choke may be from 1 mh to 2.5 mh and the bypass capacitor can be from 100mmf to 1000 mmf. The r.f. choke should be installed with the input lead as close to the mike connector as possible. All leads of the choke and the capacitor and ground lead should be kept as short as possible.

It should be pointed out that the above modification will only prevent r.f. feedback from causing distortion in the output signal but will not have any effect toward reducing or eliminating the inherent distortion which is characteristic of the compressor, limiter or clipper type circuit. Naturally, some circuits have more audio distortion than others and very few if any operate properly without causing some deterioration to the audio modulation. To distinguish between the r.f. feedback distortion and the inherent distortion, load the transmitter into a good dummy load and monitor the signal. If the distortion is still present it is inherent in the unit. If the distortion clears up then it is caused by r.f. feedback. ■

See page 126 for New Reader Service



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See page 126 for New Reader Service

THE SHOEBOX SYMPOSIUM

BY JOHN J. SCHULTZ, W2EEY/1

The author has received many letters related to the Shoebox Linear article which appeared in the November, 1966 issue of CQ and the Shoebox Linear II article which appeared in the July, 1967 issue of CQ. This article is an attempt to clarify all those fine points which were apparently not adequately covered in the original articles describing these very popular linears.

THE Shoebox linear articles described a type of linear amplifier construction originated by the author, which was distinguished by extreme ease of construction and economy for the power level involved. The reader should refer to the November 1966 and July 1967 issues of *CQ*[1] for details concerning these linears because even today their construction represents one of the simplest ways to build a high power linear.

The basic construction for both linears utilized a 8 × 10 × 10 inch steel utility cabinet (Premier C-8101). All the components for the linear were arranged so they could be mounted on the cabinet walls, thus obviating the need for any internal chassis. The power supply was mounted within the enclosure and the entire unit formed a self-contained 800 to 2,000 watt p.e.p. linear amplifier.

Figures 1 and 2 are the schematic diagrams of the Shoebox I and Shoebox II designs. The Shoebox I design utilized a relatively simple grounded-grid amplifier circuit and a voltage doubling power supply circuit. The basic circuit was presented as being applicable to a number of tubes—837's, 6JE6's, 6HF5's, etc. The Shoebox II design settled upon the use of 6HF5's because these seemed to be the best and most economical of all the tube types tried. The amplifier was designed so that from 4 to 10 tubes could be used in parallel to achieve any desired power level.

The circuitry of the Shoebox II linear was somewhat more complicated than that of the original Shoebox linear but cost was not significantly increased and a much more versatile linear was developed which could be driven by exciters from the ten watt to hundred watt class—depending upon whether a tuned or passive input circuit was utilized.

Shoebox I Details

One of the most frequent questions received by the author concerning this linear had to do with the pi-network coil which was utilized (2¼" diameter, 4 turns/inch). Although the coil used by the author was a standard Air Dux type, it apparently was very difficult to obtain from small supply houses. Various substitutions were possible, however, including the Air Dux (Illumitronic Engineering) type 2004 and B&W type 3905-1. These coils do not have the exact dimensions specified but are close enough so that no circuit modifications are required. Alternatively, the pi-network output circuit used in the Shoebox II linear could be utilized.

Most builders used 6JE6 tubes and had good success with them. Others utilized the old fashioned 837 tubes which often could be obtained very cheaply. These tubes will perform just as well as more modern TV type tubes in this linear and when the sides of the cabinet are in place, it is impossible to tell, from an operational viewpoint, which tube type is used.

The most frequent adjustment problem inquired about was that the linear would not load to full input power. Invariably, the prob-

* 40 Rossie St., Mystic, Conn. 06355.

[1] Schultz, J., "The Shoe Box Linear," *CQ*, Nov. 1966, p. 62. Schultz, J., "The Shoe Box Linear II," *CQ*, July 1967, p. 76.

See page 126 for New Reader Service

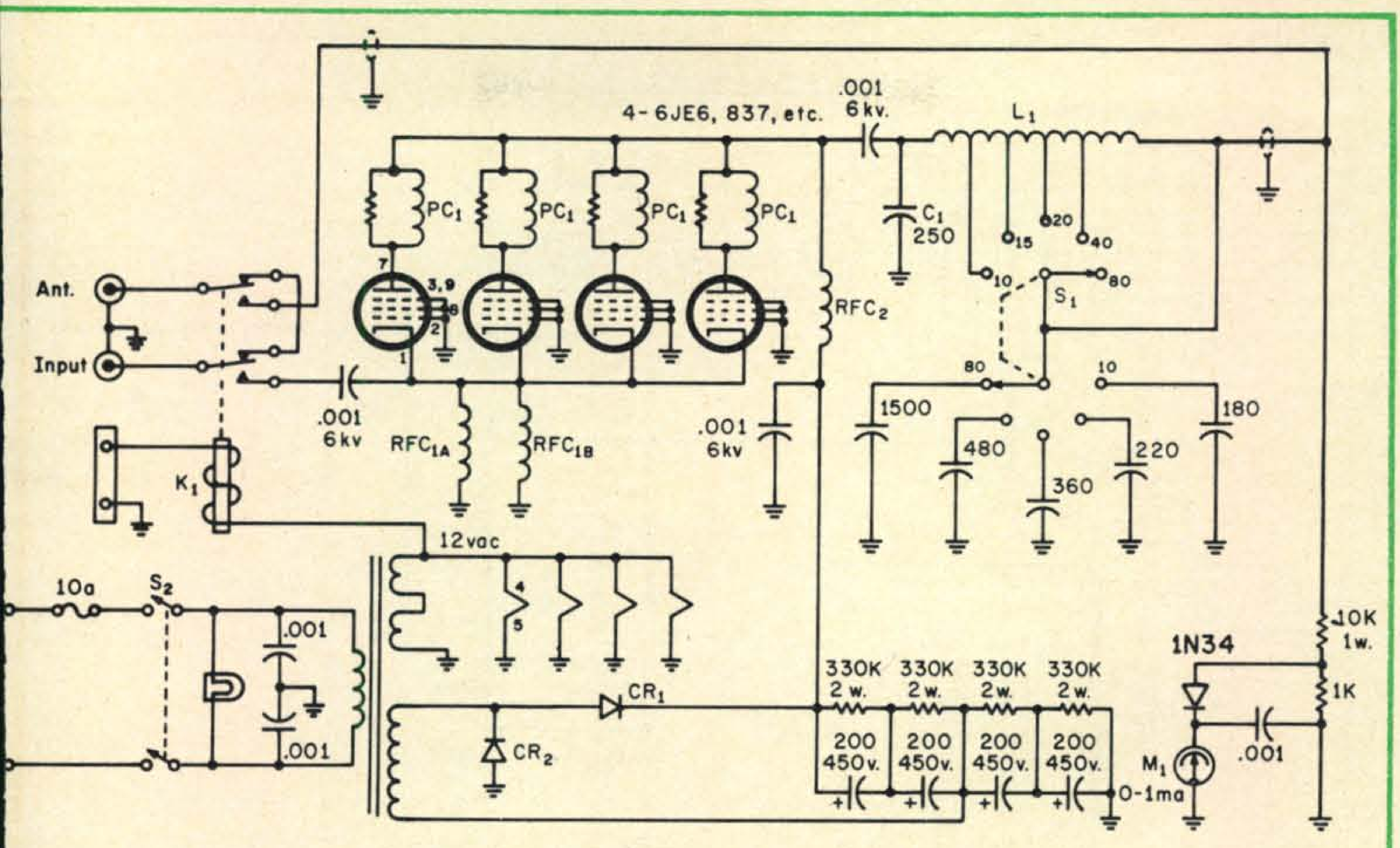

Fig. 1—Circuit of the original Shoebox Linear.

lem was traced to inadequate plate voltage regulation under load conditions. This, in turn, was due to use of an inadequately rated power transformer or skimping on the size of the filter capacitors in the power supply. Apparently, many builders considered the 200 mf/450 volt units specified (Cornell-Dubilier BR200-450) as being too "generous." However, being used in series in a doubling circuit, the total output capacitance of the four units used amounts to only 50 mf.

Various tests by the author have shown that a total output capicitance of 40 mf is the absolute minimum for satisfactory performance so, the 200 mf units were not really over-generous.

The power transformer used was a "Green Band" brand but any similar transformer can be used as long as its ratings are the same—especially the current rating of the high-voltage winding. A few inquiries were received about the source of the power supply diodes used but the availability at very low cost of diodes of almost any rating from suppliers such as Polypaks, Lynnfield, Mass. should solve that problem.

Shoebox II Details

The Shoebox II design was presented as using only 6HF5 tubes. It is *not* suggested that any other types be used. With some shopping around, 6HF5's can be located selling for $2.00 or less.

Many inquiries centered again on the power supply circuitry and components. The circuit used three of the same 200 mf/450 v. capacitors as in the Shoebox I (two in the plate voltage circuit and one in the screen voltage circuit). The high-voltage bridge circuit used two of the capacitors in series for a total 100 mf output capacitance. Apparently this design was overdone and good reports were received from those using only 50 mf total output capacitance (two 100 mf/450 v. units in series). There also appears to be no reason why the screen voltage capacitor cannot be reduced to 100 mf.

Again, because of the decreasing cost of diode rectifier assemblies, it would appear to be just as economical and simplify construction to replace the individual diodes in the high-voltage and bias-voltage bridge circuits with molded bridge rectifier packages.

The metering circuit can be considerably simplified by using a 0-1 ampere d.c. meter directly from the high-voltage diode bridge negative terminal to ground, thus eliminating the need for the 0-1 ma meter with its associated series and shunt resistors. Likewise, considerable simplification and cost is

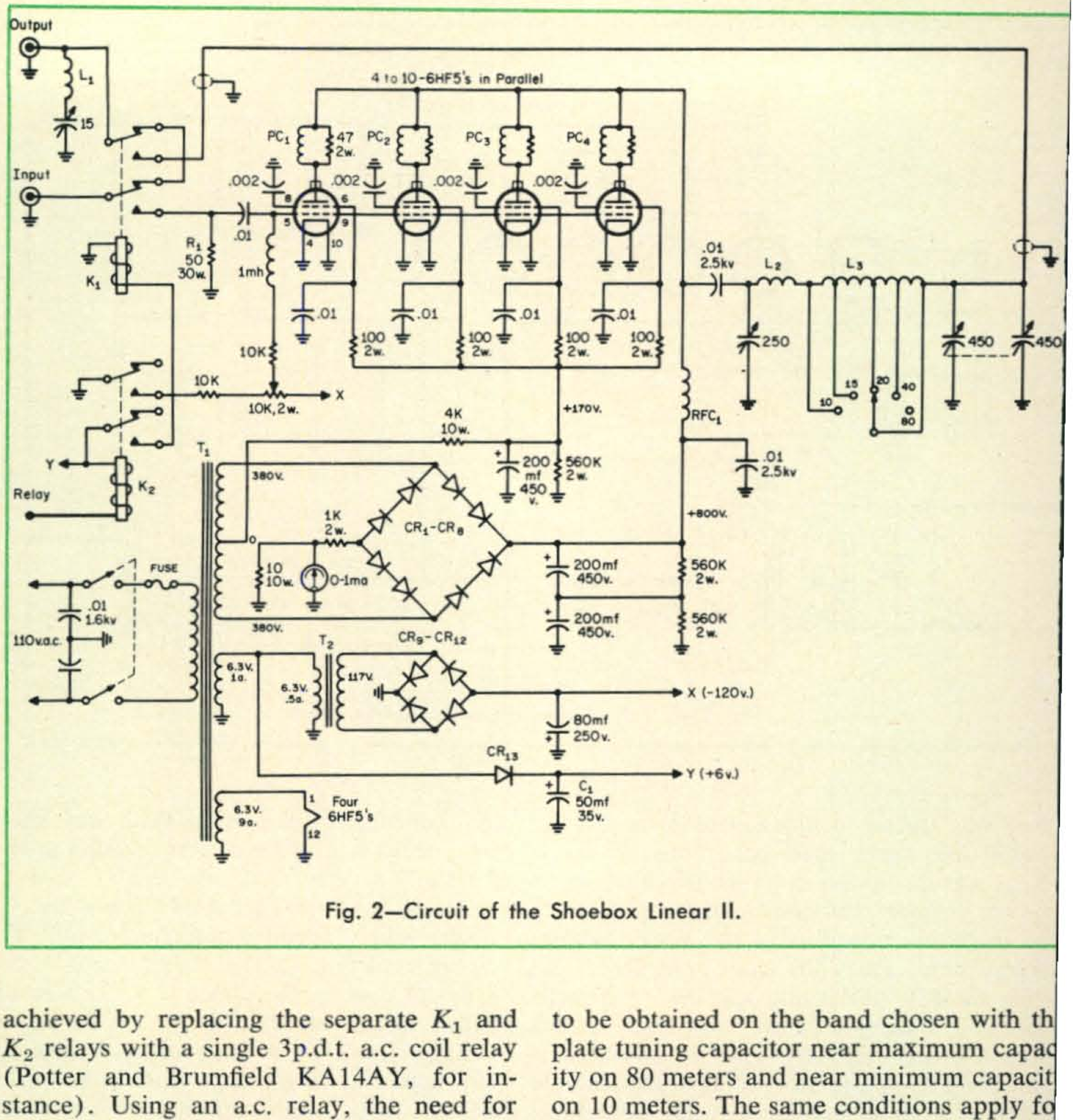

Fig. 2—Circuit of the Shoebox Linear II.

achieved by replacing the separate K_1 and K_2 relays with a single 3p.d.t. a.c. coil relay (Potter and Brumfield KA14AY, for instance). Using an a.c. relay, the need for CR_3 and C_1 is eliminated.

Various inquiries were received concerning how to proceed in finding the correct band tap points on the pi-network coil if a coil similar to, but not having the exact same dimensions as the specified coil, was the only coil available. One could, of course, refer to design literature on pi-networks and calculate the required inductance for each band. However, if the substitute coil used is approximately the same size as that specified, the following procedure will suffice. The output of the linear is first terminated in a 50 or 70 ohm dummy load, corresponding to the impedance of the transmission line being used. A coil tap for a particular band is made corresponding to that specified in the article. A grid-dip meter is coupled to the active section of the pi-network coil and checked for a dip to be obtained on the band chosen with th plate tuning capacitor near maximum capac ity on 80 meters and near minimum capacit on 10 meters. The same conditions apply fo the output loading capacitor. The taps ma have to be changed as necessary (½ turn a a time) to achieve this condition.

After this adjustment, the linear amplifie should be energized and drive applied. Moni toring the relative power output into a dumm load, it should be optimum for about the sam plate tuning capacitor and output loadin capacitor settings as found previously. If no the linear should be de-energized and the ta position for a specific band varied a ½ tur at a time until this condition is achieved. Th overall objective in changing tap positions to achieve the maximum relative power ou put with a fixed input drive. These conditior apply whether a fixed output loading circu is used, as in the Shoebox I, or a variable ou put loading circuit, as in the Shoebox II.

[*Continued on page 116*]

See page 126 for New Reader Servi

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S.S.B. RECEPTION WITH SIGNAL FREQUENCY INJECTION

BY LARRY WALROD, *VE7BRK

SIGNAL frequency carrier injection is not often discussed in amateur circles due to the fact that it does not fit in too well with modern equipment and it is not versatile enough for convenient use by miltiband operators. The principle, though, of s.f.i. is probably as old as sideband and is shown in fig. 1.

With the development of v.x.o. circuits and particularly of transistorized v.x.o. circuits, there exists a means of producing a satisfactorily stable signal frequency source with very little complication which is usable over a frequency range of five or ten kc with only one crystal. Just a few crystals would likely be enough to make this system useful over the range of frequencies that interest the average amateur.

Performance

Probably the most pertinent advantage of s.f.i. is that it can be used with reasonable satisfaction with communications receivers of only moderate stability and with ordinary receivers of the short wave broadcast type. The writer has even tried this system with inexpensive pocket type transistorized receivers with surprisingly good results. Variations of up to a kc or two in the receiver's h.f. oscillator, which would put you right out of business under normal circumstances go practically unnoticed.

* Nasuli Malaybalay Bukidnon, Philippines.

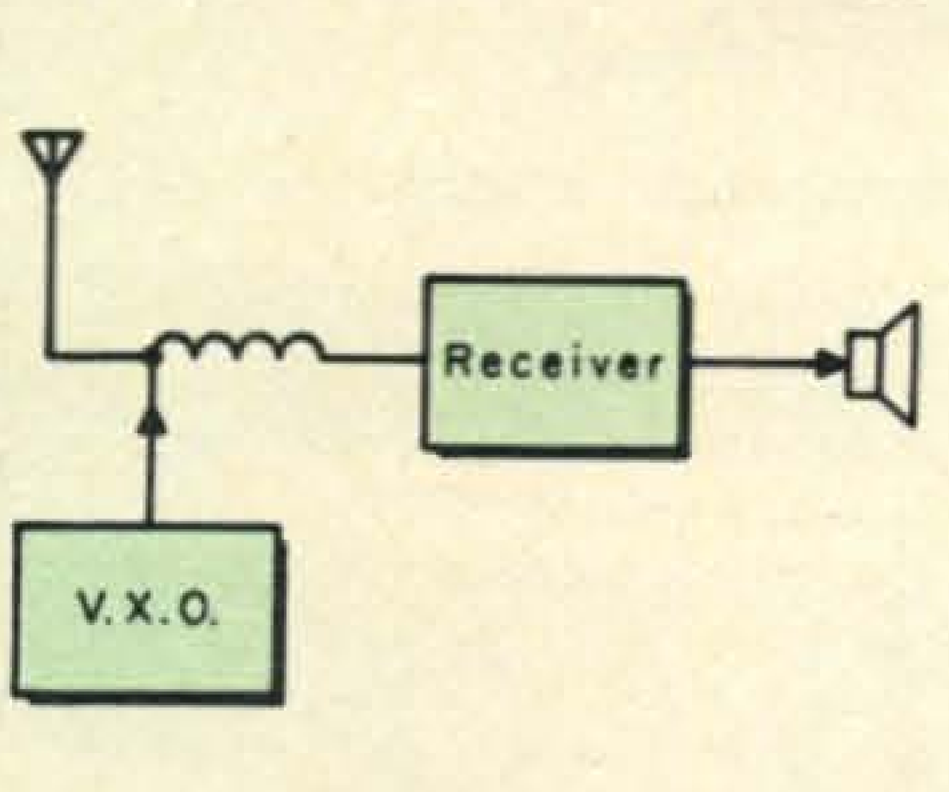


Fig. 1—S.s.b. reception using signal frequency injection s.f.i., is shown above. The v.x.o. must be tuned to the frequency being received. Use may be made of the harmonics of the v.x.o. for reception on the higher frequencies.

To get the most use from s.f.i., arrangement must be incorporated to adjust the amount of signal injected into the receiver to suit various received signals. In the unit shown in the accompanying photograph, the input voltage to the transistor oscillator is controlled over a range of about 10 to 1 which permits securing an output signal which varies over approximately a 25 to 1 power range. Further amounts of adjustment, if necessary, can be had by varying the coupling to the receiver. This is done in the model shown simply by varying the amount of "antenna" which is attached to the terminal shown on the left side of the case. Approximately one foot of wire is usually used here for this purpose.

Even when used with a good stable receiver it is interesting to note the variations in audio response which can be received from an s.s.b. signal by tuning the receiver around the signal a bit (with the regular b.f.o. off of course). This is sometimes an advantage if there happens to be interference on a channel adjacent to the one in use. Similar results can, of course, be achieved with the usual type of b.f.o. but with more control juggling. When using s.f.i., it is sometimes an advantage to leave the a.v.c. system in operation in the receiver. When this is done the sensitivity of the receiver can be controlled to some degree by the amount of local injection used since the local signal plus the incoming signal combine to produce the a.v.c. voltage in the detecting system. An additional capacitor, so connected that it can be switched in or out of the a.v.c. line, will assist to produce a result for s.s.b. use such as is achieved by the conventional slow a.v.c. systems in modern receivers.

Harmonics, at least up to the 8th, from a unit such as this are usable for s.f.i. on the higher frequency bands. This assumes that the original unit is operating in the 3 to 4 mc range.

 See page 126 for New Reader Service

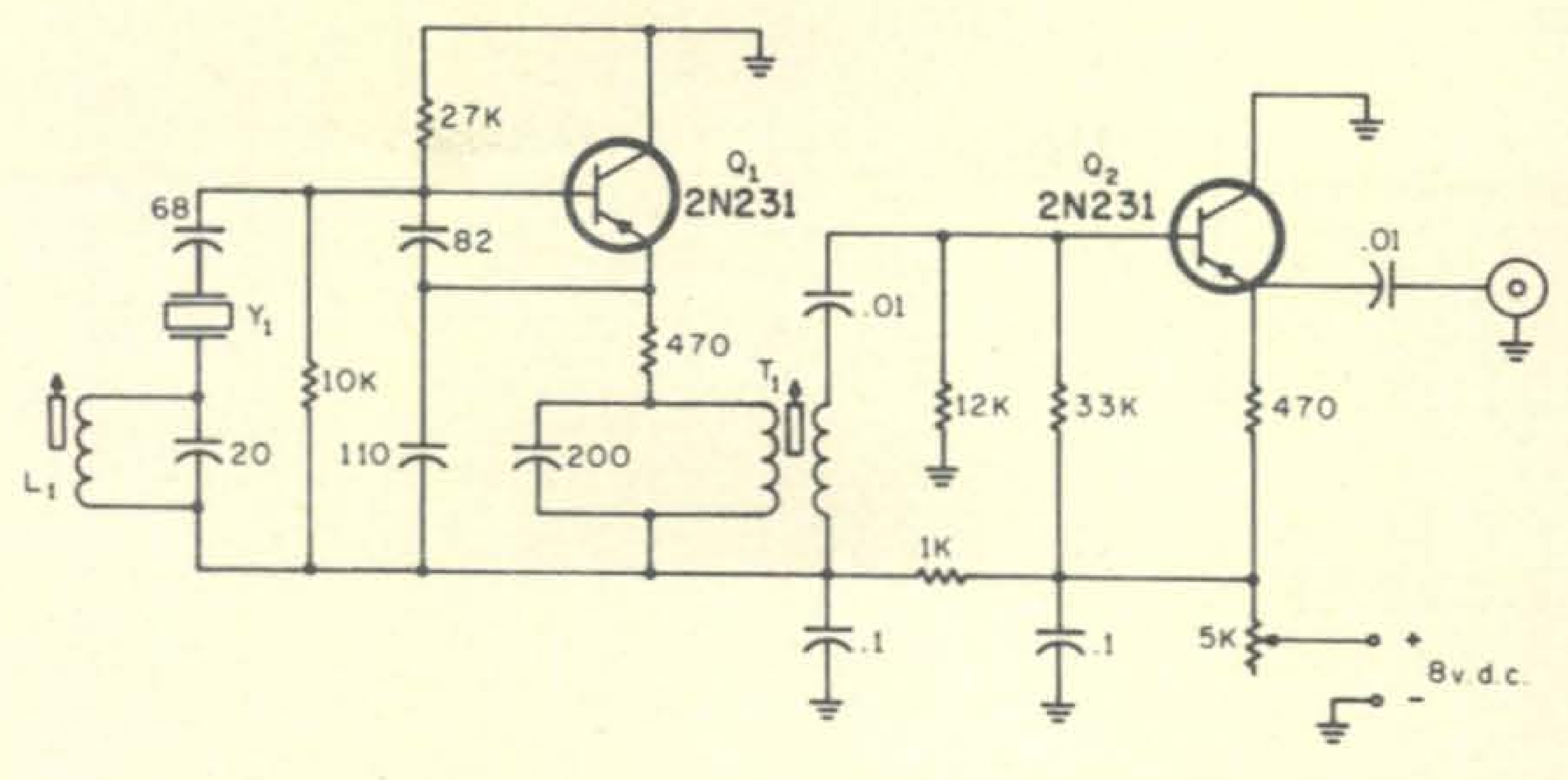


Fig. 2—Circuit of a suitable v.x.o. and emitter follower used in the author's 40 meter QRP transceiver.[1]

L_1—40t #35 e. on a 5/16" slug tuned ceramic form closewound in two layers.

T_1—9t #40 e. and 2t #40 e. wound on a 455 kc i.f. transformer form taken from a transistorized b'cast receiver.

Y_1—Crystal at or close to the range of reception desired in the 3 to 4 mc band.

V.X.O. Circuit

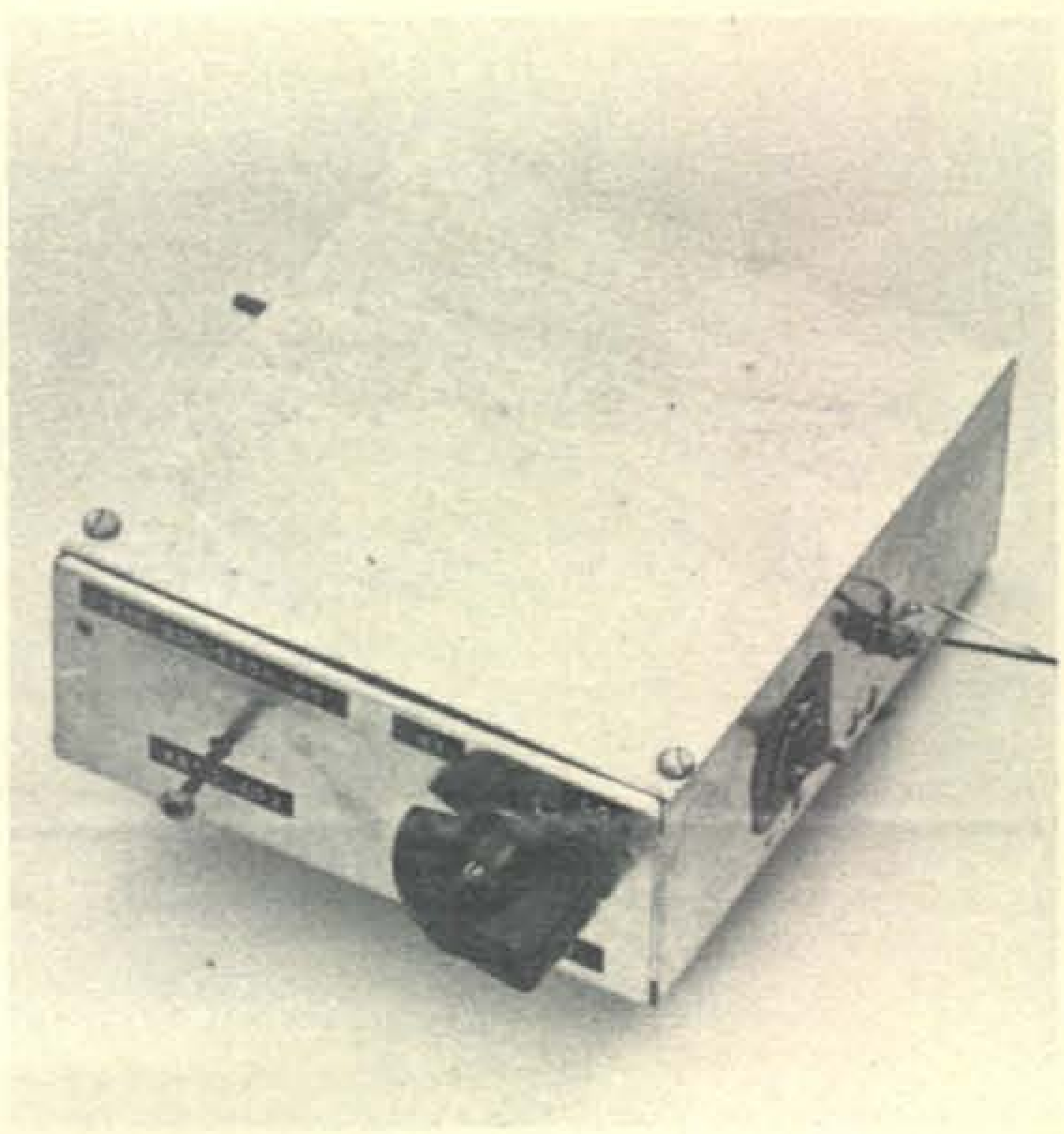
A circuit diagram is included here (fig. 2) though we suspect many amateurs will have their own favorite circuit. This circuit can be found in a former article by the author in *CQ*, August 1967.[1] Both the oscillator and emitter follower stages were used in the unit shown in this photograph. The small shaft protruding from the front panel is the adjusting screw from the slug tuned coil, L_1. To this we soldered A hex nut to serve as a knob. The pointer knob on the right is attached to a 5K potentiometer which controls the input voltage to the oscillator circuit. The two terminals on the right are the ground and battery terminals. A ground wire is connected to the receiver frame.

Conclusion

No doubt there are some newcomers to amateur radio who have not yet been able to purchase a receiver of sufficient quality for good s.s.b. reception. This gimmick could give them a good taste of s.s.b. listening. Maybe there are still a few dyed in the wool a.m. men who have been resisting the swing to s.s.b. for economic or other reasons. Some of them might like to try this little deal to clear up all of that "Donald Duck chatter" into readable signals.

In the course of converting an extensive communications network from a.m. to s.s.b., we have found this little injector very helpful in copying s.s.b. on the older receiving equipment. ■

1 Walrod, L., "A 40 Meter QRR SSB Transceiver," *CQ*, August 1947, page 12.



View of the v.x.o. and emitter follower housed in a small case. The Frequency and Output Level controls are on the front panel.

See page 126 for New Reader Service

A HOME-BREW BROAD BAND TRANSMITTING BALUN

BY JOHN J. SCHULTZ, W2EEY/1

The author discusses the problem of transmission line radiation in general and the use of baluns to improve transmission line conditions. A practical example is shown of a home constructed multiband balun using only coaxial cable.

A NUMBER of false ideas exist regarding transmission lines, the need to have them balanced and radiation from lines. Probably the most common false idea is that a high s.w.r. in itself creates a transmission line which radiates and that one reason to achieve a low s.w.r. is to avoid such radiation. With a very widely spaced line there will be some radiation but with close spaced lines or co-axial lines where the current flow is equal and opposite there is *no* radiation with increasing s.w.r. A line with a high s.w.r. is not, because of that reason, a source of interference radiation any more than a so-called "flat" line with an s.w.r. near 1:1. S.w.r. increases the *loss* in a transmission line and that is one prime reason to avoid high s.w.r. on a line. The power loss, however, is in terms of heat, not radiation.

*40 Rossie St., Mystic, Connecticut 06355.

Transmission Line Radiation

There will be radiation from a transmission line when so-called antenna currents exist on a line and the effect can take place with either parallel line or coaxial lines. If, as is shown in fig. 1, a parallel wire transmission line is connected to a balanced antenna system (symmetrically located feed point; the center for a dipole), the currents in the line will balance, regardless of the s.w.r., and there will be essentially no line radiation. If a coaxial transmission line is used, however, each terminal of the antenna encounters a different termination and the current flow in the two

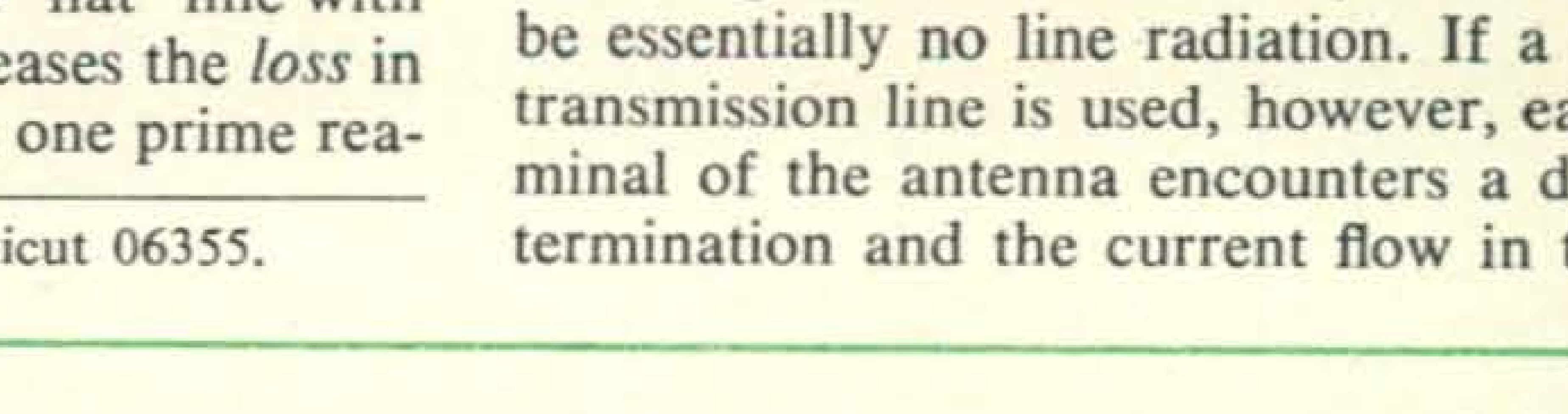


Fig. 1—Balun used with coax feed will equalize antenna currents but it is still necessary to prevent antenna currents on line after the balun by running the line at right angles to antenna.

See page 126 for New Reader Service

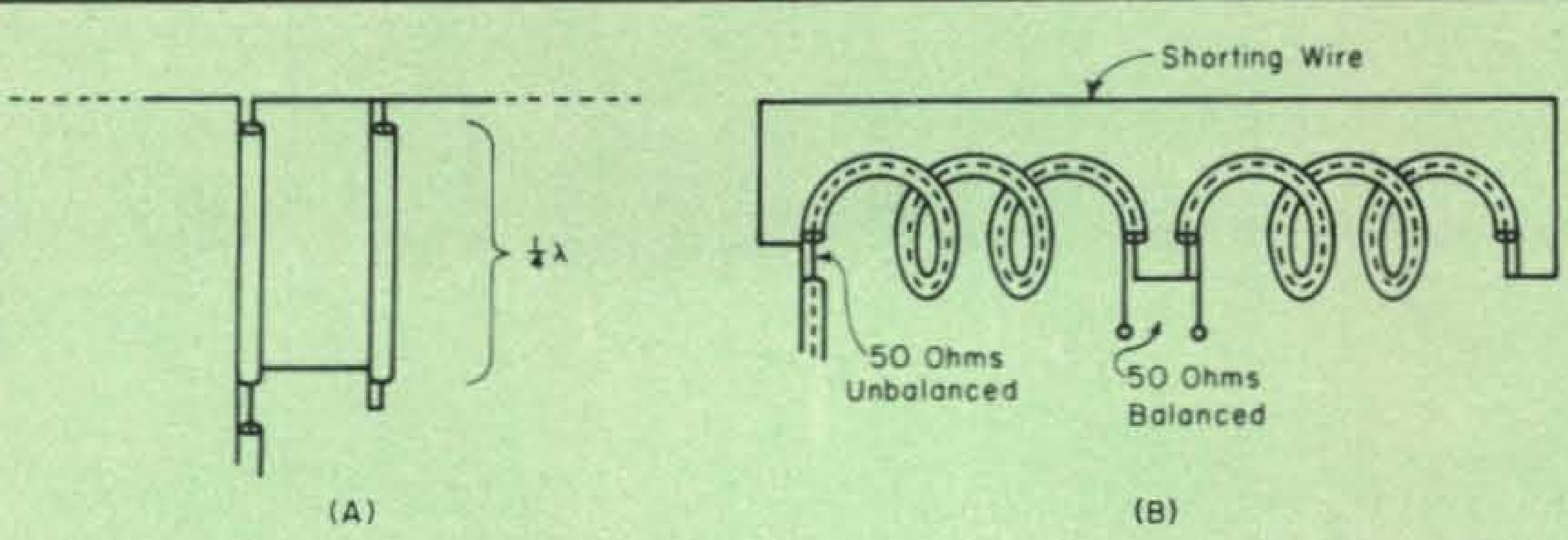


Fig. 2—Conventional single-band balun (A) is converted into broadband form of balun (B) by coiling sections.

conductors of the coaxial line will not be equal. A larger current will flow on the outside conductor (shield) and since the line currents are then no longer equal, radiation can result.

Cure

One common method to cure radiation problems when a coaxial line is used with a balanced antenna is to insert a balun (balanced to unbalanced) transformer between the antenna and line. Does the balun really cure the situation of unequal line currents? Yes, so long as an unbalanced condition or line currents are not re-introduced on the line after the balun. The most common way in which this occurs is when the transmission line is not run away at right angles from the antenna. If the line is run parallel to one leg of the antenna currents can again exist on the line, because of its unsymmetrical placement in the field of the antenna, and the line can radiate. The use of a balun can do nothing to correct this condition. It should be noted that the same condition can occur with a parallel-wire transmission line that does not come away from an antenna for a ½λ or longer.

The Problem

How serious really is the problem of unbalance and when is a balun really useful? The author knows of no definitive engineering study which has been made that answers this question. The problem certainly becomes more acute with an increase in frequency as the coaxial cable diameter becomes larger in proportion to the wavelength involved.

In a built-up area and an antenna near the ground there are likely to be so many unbalanced effects and radiation pattern distortions, that worrying about using a balun is gilding the lily. In a more open location and an antenna reasonably well elevated, there would seem to be little reason to waste even a little power through line radiation and a balun would serve a useful purpose. In multiple transmitter installations where receivers and transmitters operate simultaneously on different frequencies the use of baluns and other devices to prevent unnecessary radiation from causing cross-interference becomes very important.

In general, with RG-8 cable the use of a balun with a symmetrical feed antenna should be considered down to 20 meters; with RG-58 cable, consideration should extend down to 15 meters. The 80 and 40 meter bands are question marks unless one is using a really large diameter coaxial cable. A balun on these bands may be useful but of at least of equal importance is keeping the transmission line at right angles to the line of the antenna and choosing a line length which does not resonate in one of the bands.

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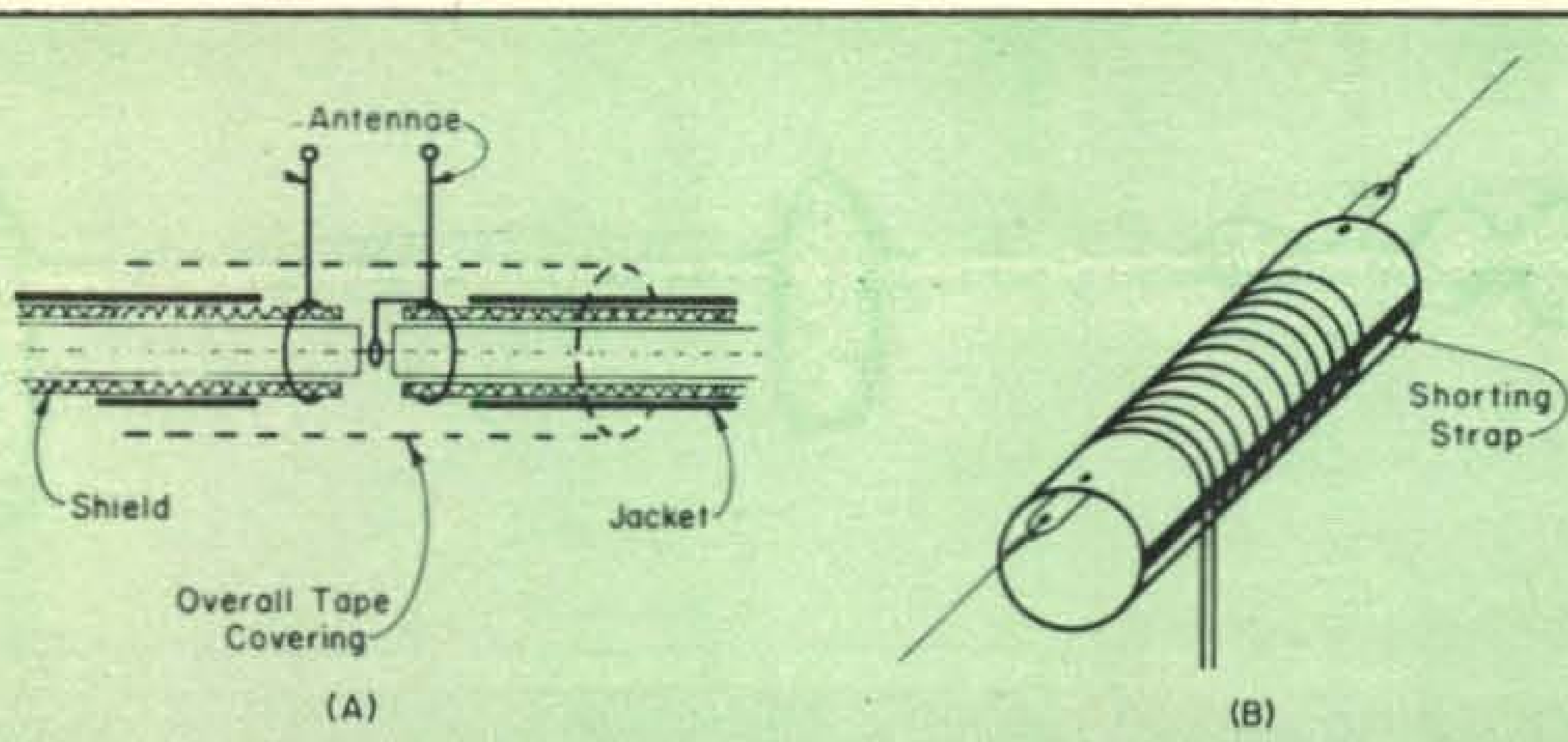

ig. 3—(A) Details of center connections on coaxial coil. (B) One method of placing the balun over a long home made antenna center insulator (B).

CHRISTINE HAYCOCK, WB2YBA, SURGEON AND HAM

BY LOUISA B. SANDO,* W5RZJ

How often we hear a YL say, "I don't have time for hamming any more." (We know, we're guilty, too!) Now here is a gal who not only has a home and OM, but a career as a surgeon with office and hospital schedules to meet, and she not only finds time to operate but sets up her own gear as well! She is Christine E. Haycock, M.D., F.A.C.S., of Newark, N.J., who operates as WB2YBA. And that is only part of the picture. Before getting her M.D. she was a nurse. She also is a photographer and writer, for many years was a softball pitcher and fencer, and now plays golf.

Christine's early interest in ham radio began at age 11 when she built a crystal set and spark gap gear to communicate with a boy down the street. Put off the air by FCC, they then strung telegraph wire between their homes, and a few years later she used to listen in from W2NDM's shack. Several years ago the installation of C.B. gear in her car to keep in touch with her office revived her interest in ham radio and in June '66 she got her Novice, Tech license that November, and General in May '67.

Christine received her R.N., in 1945, and worked as a nurse in Chicago and N.Y. until her graduation from the State Univ. of N.Y. College of Medicine, Brooklyn, in 1952. She was the first woman to take an internship at Walter Reed Army Hospital in D.C., then spent a year in Japan with the Army Medical Corps. She is now a Lt. Col. in the Army Reserve. After returning to the States she took her residency in general surgery at St. Barnabas Hospital in Newark and was senior resident in surgery at St. John's Hospital in Brooklyn. She received her certification by the American Board of Surgey in '61, and became a Fellow of the American College of Surgeons in '63. She was president of the N.J. Women's Medical Assn. in '67, chairman of the Exec. Comm. Essex County Chap. of American Cancer Society in '67-'68, and is chairwoman of the Legislative Comm. of the American Medical Women's Assn. for '68.

For many years Christine was one of the outstanding women softball pitchers in the U.S. She also was N.J. State Open Fencing Champion in '49 and '50 and currently plays golf. Her color photographs have won her numerous honors in competition and she is secretary of the Vailsburg Camera Club and member of Hillside C.C. and Photographic Society of America.

Christine has had a number of articles published in medical journals and one on popular medicine in national publications. Her OM is Sam Moskowitz, editor of *Quick Frozen Foods* magazine, and an authority on science fiction.

Another interest is collecting miniature elephants and her office and home contain literally thousands of them. Christine also is a member of the Board of Managers of Newark's YM-YWCA, member of Business & Prof. Women's clubs, Zonta International and Women's Forum of Newark.

And still she finds time for ham radio! Christine decided to put her ham shack in the attic and this involved refinishing the

[*Continued on page 107*]

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

Christine Haycock operates as a Ham, WB2YBA, and also as a surgeon, earning her M.D. in '52 and becoming a Fellow of the American College of Surgeons in '63. On the table behind her is a 2 & 6 meter set-up and she also works mobile.

See page 126 for New Reader Service

REDUCING BLOWER NOISE

BY K. C. AGRELIUS, *K6SHA

ABOUT four years ago, after listening to the blower noise of the Hallicrafter HT-33B Linear Amplifier for a period of about one month, I decided to investigate the possibility of reducing the noise in some way. I first considered the possibility of replacing the existing fan with a quieter fan which would also provide adequate cooling. Because of the mechanical mounting problem involved, I discarded this idea and decided to reduce the speed of the existing fan on receive mode only. This was accomplished by replacing the existing 60 ohm 10 watt resistor, R_{26}, with a 100 ohm 20 watt resistor as shown in fig. 1. The circuit changes on J_1 allowed me to run two wires from pins 4 and 8 of J_1 to an external relay contact which shorts out the 100 ohm resistor, R_{26}, in transmit mode. This allows the blower to run at a fast speed in the transmit mode, and run quite slow in the receive mode. This slow speed still provides adequate cooling for the tube, the fan noise is much less, and it is possible to hear weak DX signals without blasting the audio all over the shack.

* 274 Hiram Avenue, Newbury Park, California 91320.

Modification

Locate and change R_{26} to a 100 ohm 20 watt resistor. Connect pins 8 and 4 of J_1 to a pair of external relay contacts that will short out R_{26} in the transmit mode. Remove both bias jumpers (between pins 3 and 4, 1 and 8) and remove the connection between pins 4 and 5. Connect a wire from pin 4 of J_1 to the junction of J_4 and S_6 as shown in fig. 1.

The external relay should be used to ground pin six with a second set of contacts when in the transmit mode.

Measurements were made of the air flow in both fast and slow speeds and even in slow speed the amount of air flow required at maximum plate dissipation of the PL-172 tube is provided by the fan.

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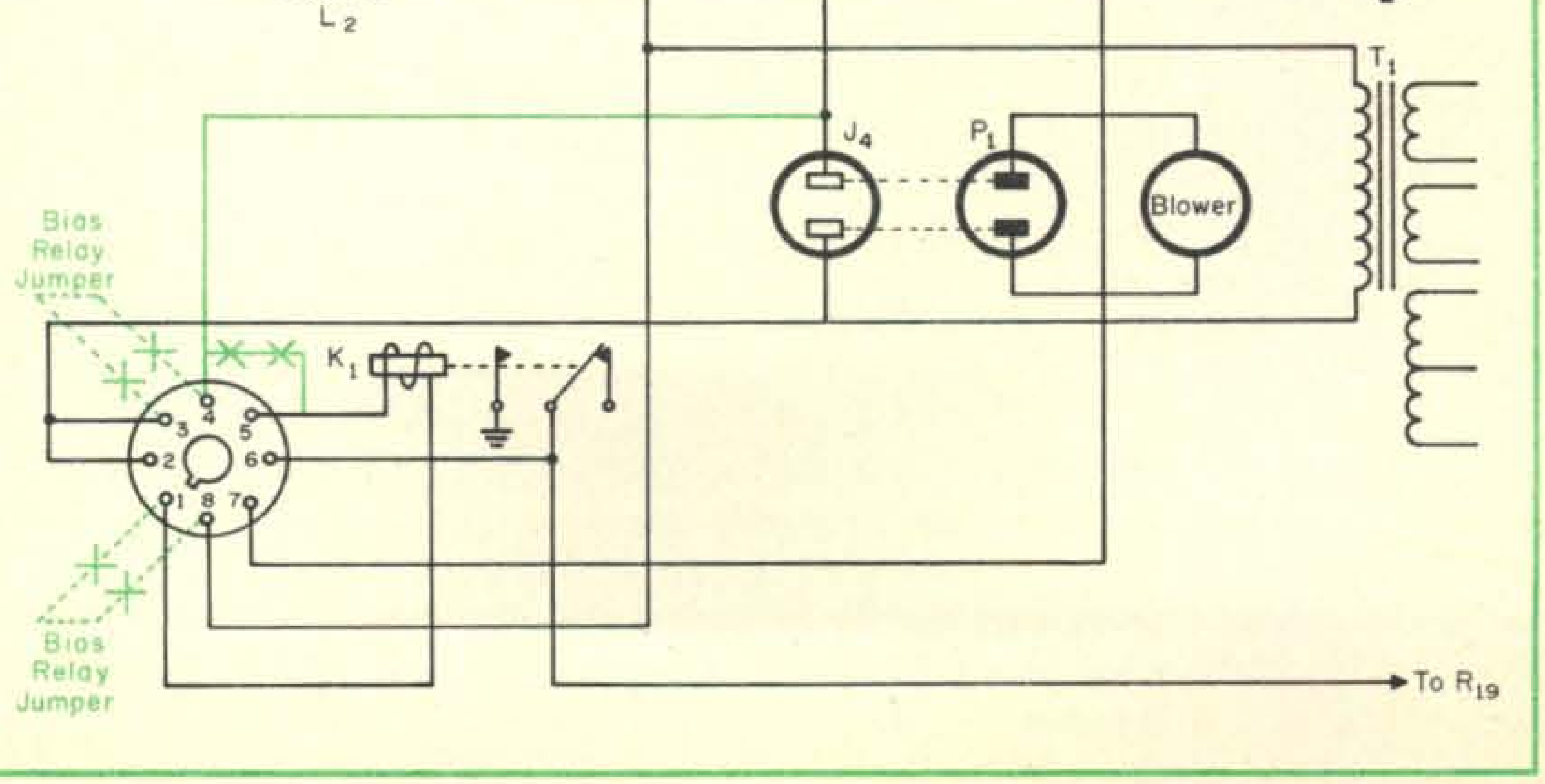

Fig. 1—Partial circuit of the Hallicrafters HT-33b is shown above with the changes described in the text. The changes allow reduction of blower speed in the receive mode thus reducing the air noise. All modifications are shown in color.

A WIDEBAND RF PREAMPLIFIER

BY WILLIAM J. ONESKY,* W6DYD

DOES your receiver work fine on the lower frequencies but lack pep on 10 and 15 meters? If so, this article is for you. Your receiver's mediocre sensitivity is either caused by insufficient r.f. gain on the high frequencies or a noisy r.f. stage. In either case, to hear all the DX that's coming in these days, you need a better r.f. stage. One way to improve your receiver is to build, or buy, a low-noise "outboard" preamplifier or preselector. It isn't really necessary, however, to add another bulky accessory to your shack, since this article describes a transistorized preamp that is small enough to tuck into your receiver's chassis wiring. It will give any receiver more than 15 db of *added* low-noise r.f. gain from 1 to 30 mc. Best of all, no bandswitching or adjusting is required; you can just install it and forget it. Installation is easy, and at trade in time it can be removed in a few minutes and no one will be the wiser. The total cost of parts is well under $10. Are you interested? Then here are the details.

*737 North Inglewood Ave., Inglewood, California 90302.

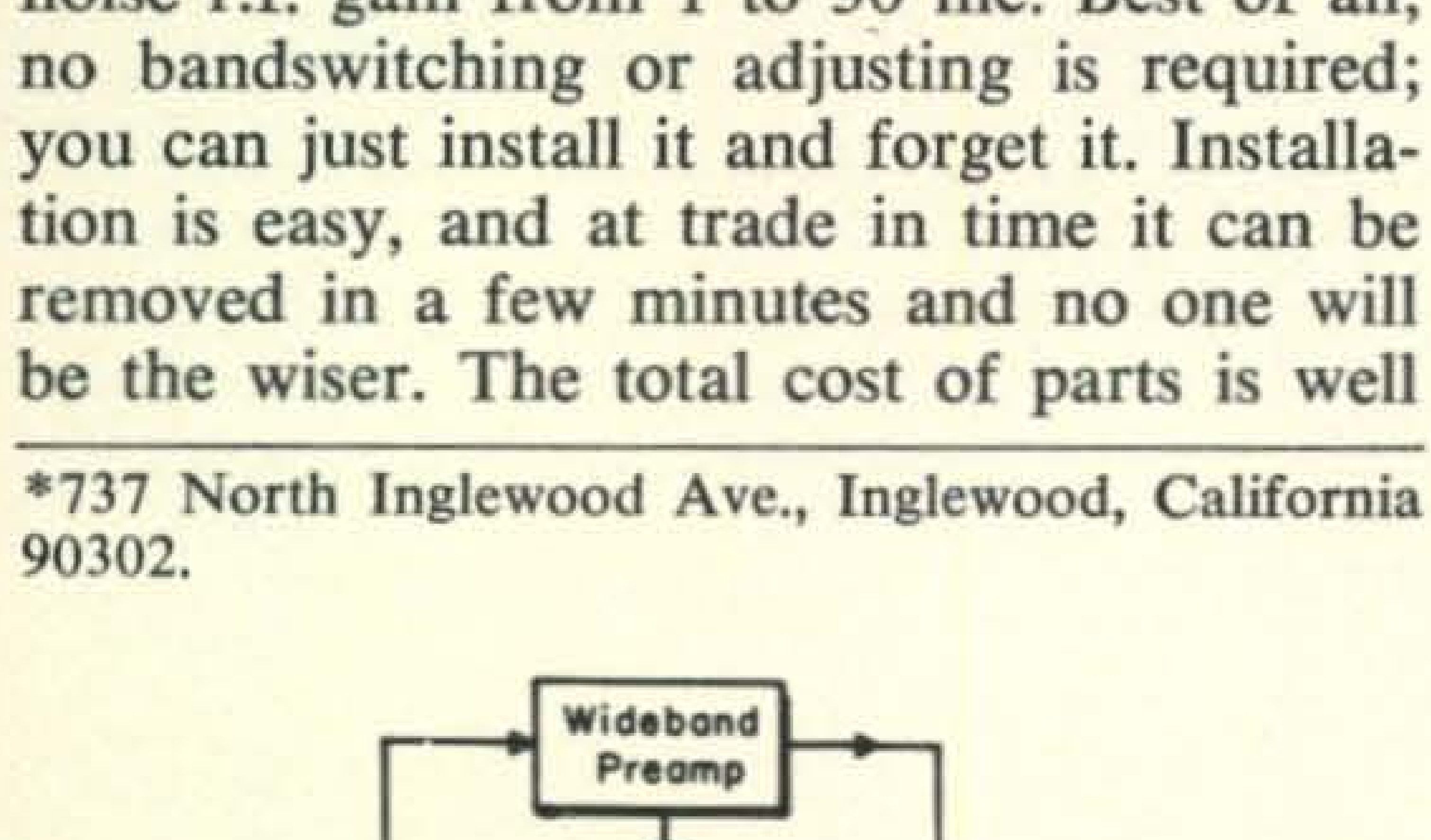

Fig. 1—Block diagram of an installation of the broadband low noise preamp is shown above. Only one lead has to be unsoldered; it runs from the antenna coil bandswitch to the r.f. amp grid (or mixer grid if there is no r.f. amp). Be sure the grid return circuit components remain connected to the grid of V_1.

Noise Figure

The preamp installs between the antenna coils and the control grid of your receivers first r.f. stage (or mixer, if your receiver has no r.f. stage), as shown in fig. 1. The preamp takes signals from the antenna coil, amplifies them with a low noise figure, and delivers them to the grid of your receivers first r.f. stage for further amplification. In effect, it gives any receiver an additional, low-noise r.f. stage. After installation, the noise figure of your receiver should be determined by the preamp noise figure, which is excellent, and the receiver r.f. gain will be increased as well.

We all know the importance of a low noise r.f. stage, but the r.f. gain increase is important, too. It's been my experience that simply reducing the noise figure of the r.f. stage in an insensitive receiver usually doesn't make the receiver any more sensitive! This apparent contradiction occurs because an insensitive receiver usually doesn't have enough r.f. gain at higher frequencies to hear the r.f. stage noise above the mixer noise. So reducing the noise figure of the r.f. stage does no good at all unless r.f. gain is increased at the same time. This preamp, in conjunction with your present receiver r.f. stage, should provide enough r.f. gain to allow you to hear preamp noise above your receivers mixer noise, and, thus, make it possible to take advantage of the preamps low noise figure.

Circuit Description

Figure 2 is the circuit diagram. The MPF102 field effect transistor (f.e.t.) input stage has a high input impedance which does not load down or noticeably affect the tuning of the antenna coils. The diode at the f.e.t.

See page 126 for New Reader Service

input protects it from burnout by stray transmitter r.f., and has no effect on normal circuit operation. The voltage gain of the f.e.t. stage is very low, due to loading by the low input impedance of the following stage, a 2N2997 transistor. The low voltage gain and loading of the f.e.t. stage make it very wideband and stable, as well as keeping the f.e.t. input capacitance low. The 2N2997 transistor provides most of the circuit voltage gain. Both transistors have excellent high frequency capability and low noise.

Figure 3 shows the gain of the preamplifier versus frequency. The db values are true gain values, not S meter readings. Like most S meters, mine is optimistic and indicates a gain of 25 db on 10 meters. The exact gain values shown in fig. 3 depend on how "hot" the two transistors are. However, substituting several different transistors of the same type produced only a few db gain change in my preamp. Therefore, it appears that no transistor selection is necessary to produce excellent gain. The high frequency gain rolloff is due to a combination of transistor gain rolloff and receiver capacitance at the preamp output shunting R_1. Increasing the value of R_1 increases the gain at lower frequencies but does not affect the high frequency gain, which is limited by the transistors and stray capacitance across R_1. The value of R_1 was made as small as possible without reducing gain on 10 meters to avoid having too much gain at low frequencies where it isn't usually needed. The gain begins to fall off below 1 mc due to the small 0.005 mf coupling capacitors.

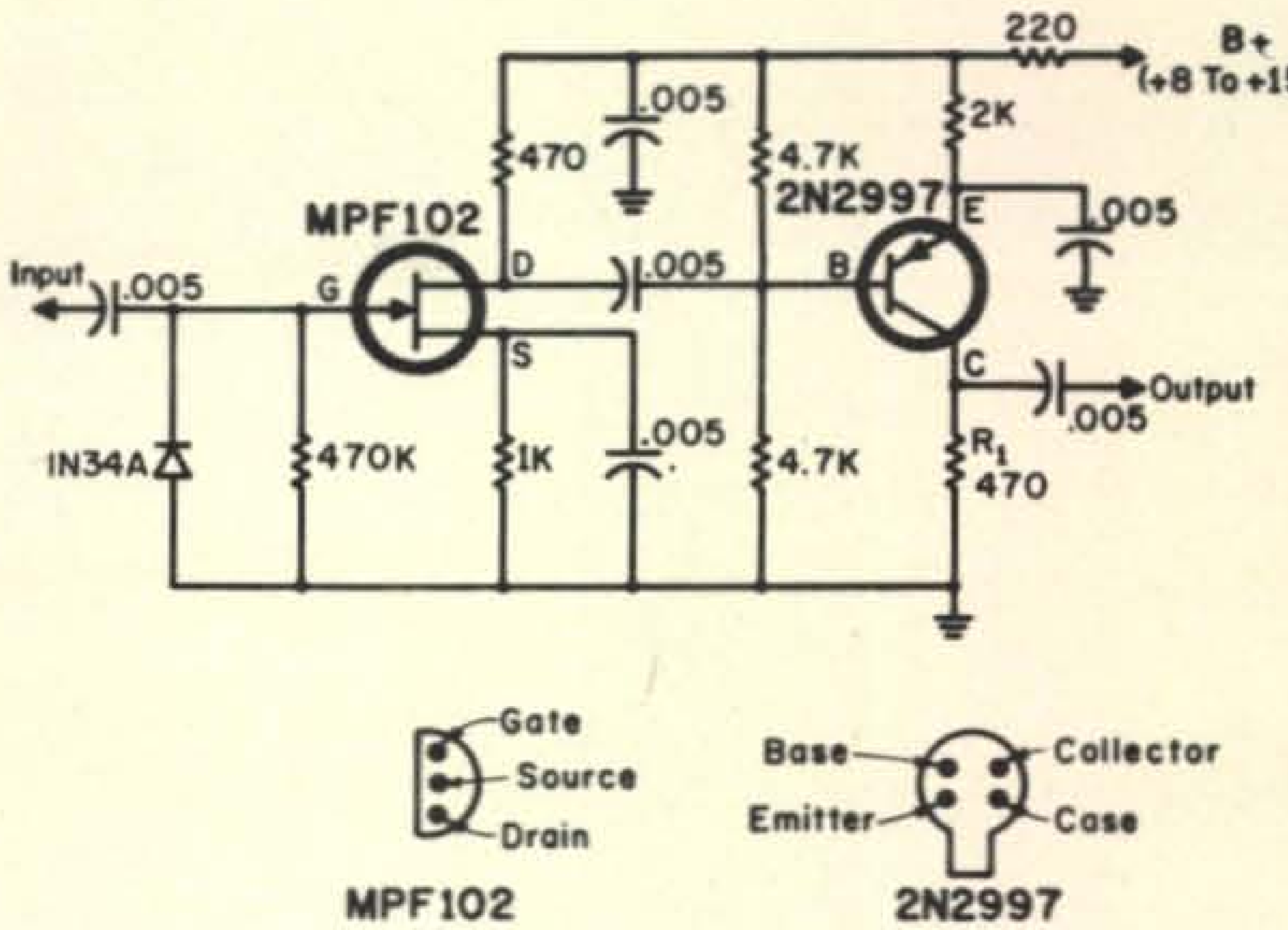

Fig. 2—Circuit of the wide band preamplifier. The f.e.t. input transistor does not load the tuned circuits as a bipolar transistor would. All resistors are ¼ watt and all capacitors disc ceramics rated at 100 volts.

Construction

The preamp was built on a 1½" × 1½" phenolic circuit board. You may want to use a larger or smaller layout, depending on your skill at miniaturization and the available space in your receiver. No shielding of any sort is necessary, or desirable. In wiring the unit, leads should be kept short, preferably less than ½ inch, and the input should be well separated from the output. No other precautions are necessary, since the circuit is remarkably stable for a high frequency amplifier. This is probably due to the absence of tuned circuits.

The circuit was laid out in several ways while being developed, including the original breadboard design that was spread out over 40 square inches of circuit board. No trouble was experienced with oscillation using any of the layouts as long as the input was not brought near the output. You have to really "try" before you can get this amplifier to oscillate. If you want a systematic approach, laying out the components in a physical configuration similar to the placement of the component symbols on the schematic diagram will produce good results.

Installation

To install the preamp, refer to fig. 1. Find the control grid of your receivers first r.f. tube (or mixer tube, if your receiver has no r.f. stage). Disconnect the lead from the antenna coils at the control grid, being careful not to disturb the other components connected to the grid, such as biasing resistors, a.g.c. connections, *etc*. If the grid receives its bias through the antenna coils, as evidenced

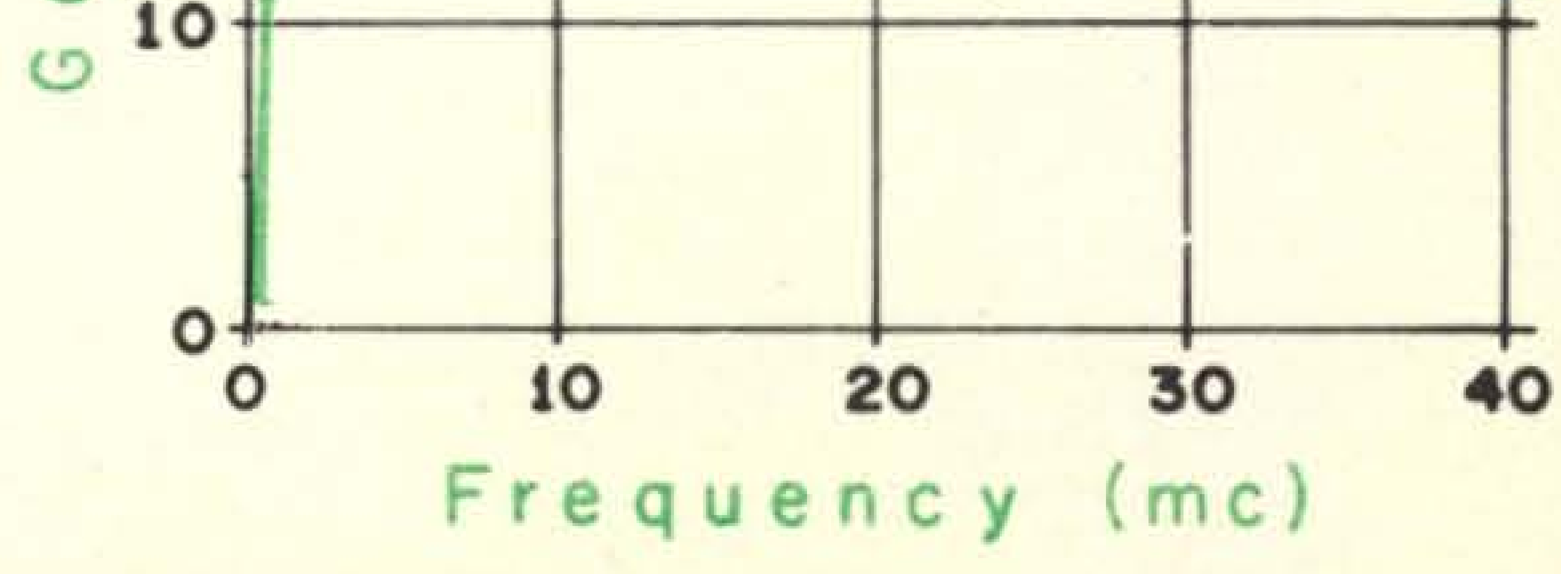

Fig. 3—Preamp gain *versus* frequency plot. Ample gain is provided up to 30 mc without the use of tuned circuits.

See page 126 for New Reader Service

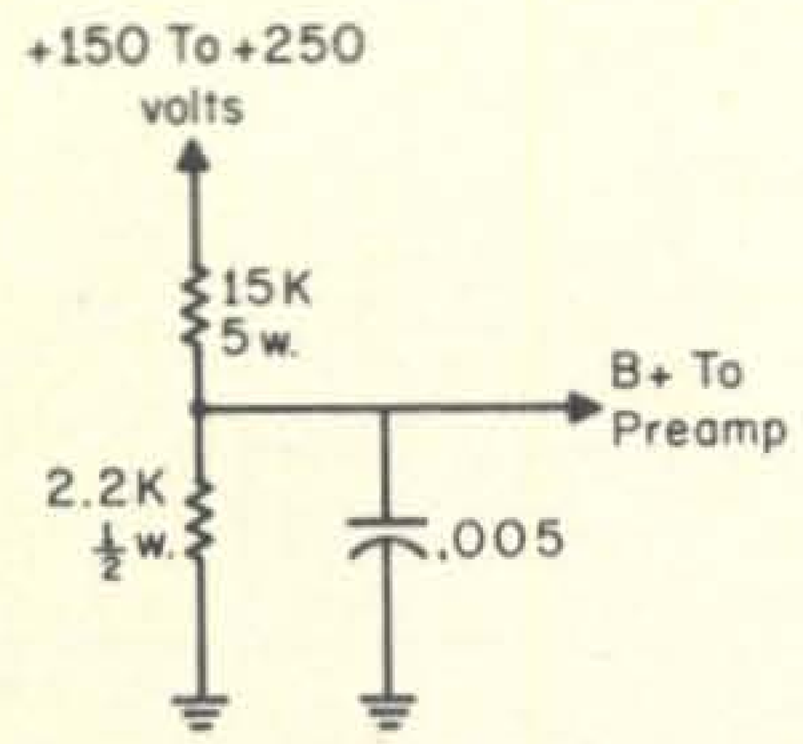

Fig. 4—Simple voltage divider provides preamp voltage from the receiver high voltage supply.

by a d.c. path to ground in the lead coming from the antenna coils, it may be necessary to connect a 470K ohm resistor from the control grid to ground, or to the a.g.c. buss, to maintain the proper grid bias.

Install the preamp circuit board on the chassis so that its output terminal is within a few inches of the control grid. Installing the board perpendicular to the chassis allows it to fit in a very small space, and a nearby mounting screw will probably be available for holding the preamp so that no extra hole need be drilled. Next, connect the preamp output to the control grid using a short, direct lead. Connect the lead from the antenna coil to the preamp input and dress it so that it is well separated from the preamp output. Finally, ground the preamp to the chassis near the receiver r.f. stage with a short lead.

The preamp is designed to work with a power supply of +10 volts at 4 ma. Voltages from 8 to 15 volts, however, are satisfactory. If you don't have a suitable low voltage supply in your receiver, fig. 4 shows a method of getting the power from the receiver high voltage supply. The voltage dropping resistors can be installed at a convenient point on the chassis and a lead run to the preamp. Don't apply more than 25 volts to the circuit, since this can ruin the transistors.

Results

The preamp has been installed in two receivers. One is a five-band s.s.b. transceiver, the other is a relatively inexpensive general coverage communications receiver, vintage 1956. Both these receivers have r.f. stages, and the transceiver is specified to have better than one microvolt sensitivity. As you can see, neither receiver is in the "crystal set" category. Nevertheless, the preamp is able to improve significantly the high-frequency sensitivity of both receivers. Without a preamp, these receivers can receive quite a few 10 and 15 meter stations, but a large number of weaker stations are just barely discernable in the noise. With the preamp installed, the weaker stations come up out of the noise and become Q5, and a whole new "layer" of stations is heard clearly. Operations of both receivers is unchanged, except for the livelier S meters, and a very worthwhile increase in sensitivity. If you build the preamp, be sure to rig up some way of switching it in and out before you connect it in permanently. When you see the difference, you'll probably wonder how you ever got along without it.

The noise figure of the preamp has not been measured but my old outboard preselector, a very low noise cascode 6BK7 amplifier, is now gathering dust in the closet since it no longer improves the sensitivity of either receiver. Also, its quite a pleasure not to have to tune the preselector each time bands are changed, and the rats nest of cables and relays necessary to use a preselector with the transceiver has been eliminated.

Another obvious improvement with both receivers is that receiver noise on all bands can now be peaked with the "antenna trimmer" capacitor, with or without the antenna connected. (Try this with your receiver on 10 meters!) This wasn't possible before the preamp was installed, and it indicates that r.f. gain is now sufficient to hear front-end noise above mixer noise.

One final note. To keep the circuit simple, a bipolar transistor, the 2N2997, had to be used. Bipolar transistors are known to be more sensitive to crossmodulation than either tubes or f.e.t.'s. However, if you don't have a station down the street operating on the same band, this shouldn't be a disadvantage. Crossmodulation hasn't yet caused any problem at my QTH in the crowded Los Angeles basin. I haven't had any reason to try it, but if you want to be ready in case another ham moves in next door, using a 2N3995 in place of the 2N2997 should reduce any tendency for crossmodulation to occur. The 2N3995 is especially designed for low crossmodulation, but, since it costs about $5 more than the 2N2997, it isn't specified in the circuit diagram. ■

See page 126 for New Reader Service

UPGRADING THE SB-100

BY JACK YEOMAN, *W8VHY

Improving the A.V.C. System

SOMETIME ago the author was fortunate in obtaining a used SB-100 transceiver. After correcting a few loose connections and bad solder joints the unit seemed to work reasonably well. All tube, voltage and resistance checks were made; no defective parts were found, nor, have any part failures occurred after several months of use.

The features found on this transceiver are not obtainable on any other rig in this price range; however, after building three of the HW series, the author was surprised to find the SB-100 a.v.c. system inadequate. This certainly was not the case with the HW series rigs. It has been noticed that some other rigs also suffer from this inadequacy, while it seems impossible to overload others.

The SB-100, with factory circuitry, requires the operator to ride herd on the r.f. gain control. If this is done the incoming signals sound okay. It is most annoying to be in a roundtable (who isn't on 40 and 75?) and have the good strong signals sound distorted and almost miss the weak signals. As a matter of fact, on some signals, with the SB-100 r.f. gain wide open, it is almost impossible to zero.

The circuitry of the SB-100 was studied with thoughts toward modifying the a.v.c. circuit. As in most rigs, the a.v.c. line, mute circuit and r.f. gain circuit are interconnected. This makes the possibility of converting to many types of a.v.c. circuits a little bit sticky, unless you want a major rewiring job.

The circuit shown in fig. 1 was designed and installed in such a way that the SB-100 could be returned to its normal state, if desired, in about five minutes.

* Route #4, Washington C. H., Ohio 43160.

Modification

The first step is to remove two small parts. This is the only step that changes the existing wiring, the rest is simply addition of wiring. Both parts to be removed are on the board with the product detector. First, remove C_{112}. This removes i.f. signal from the existing a.v.c. rectifier. Second, remove D_{101}. This removes the existing a.v.c. output from the a.v.c. and mute line. Make a mental note of the locations from which you remove these parts, as one solder connection will later be made at each of these locations.

Next, bend a small aluminum bracket as shown in fig. 2. Drill two holes in the ½" lip which will pass two 6/32 screws. Drill or punch a hole in the center of the 1⅛" lip to fit a 7 pin socket for the 12AV6.

With the SB-100 chassis removed from the cabinet and upside down, carefully position the small bracket under the 6BN8 tube in such a way that the new 12AV6 tube will lie horizontal and pointed away from the outside of the chassis. This bracket should fit very nicely under the existing rail at the bottom of the chassis. Mark this location on the rail with a pencil. Remove the two screws holding the rail to the chassis in order to drill two holes in the rail without damaging the rig.

All that remains is to wire the simple circuit of fig. 1 on the small bracket which will hold all additional parts. Bolt this bracket, after wiring, to the rail, and bolt rail back on the chassis.

You now have only five wires to solder directly to the printed circuit under the SB-100 chassis. Four of these wires are only a few inches long.

1—Two 12 volt a.c. leads are soldered, one to pin 4 of V_3 and one to pin 4 of V_4.

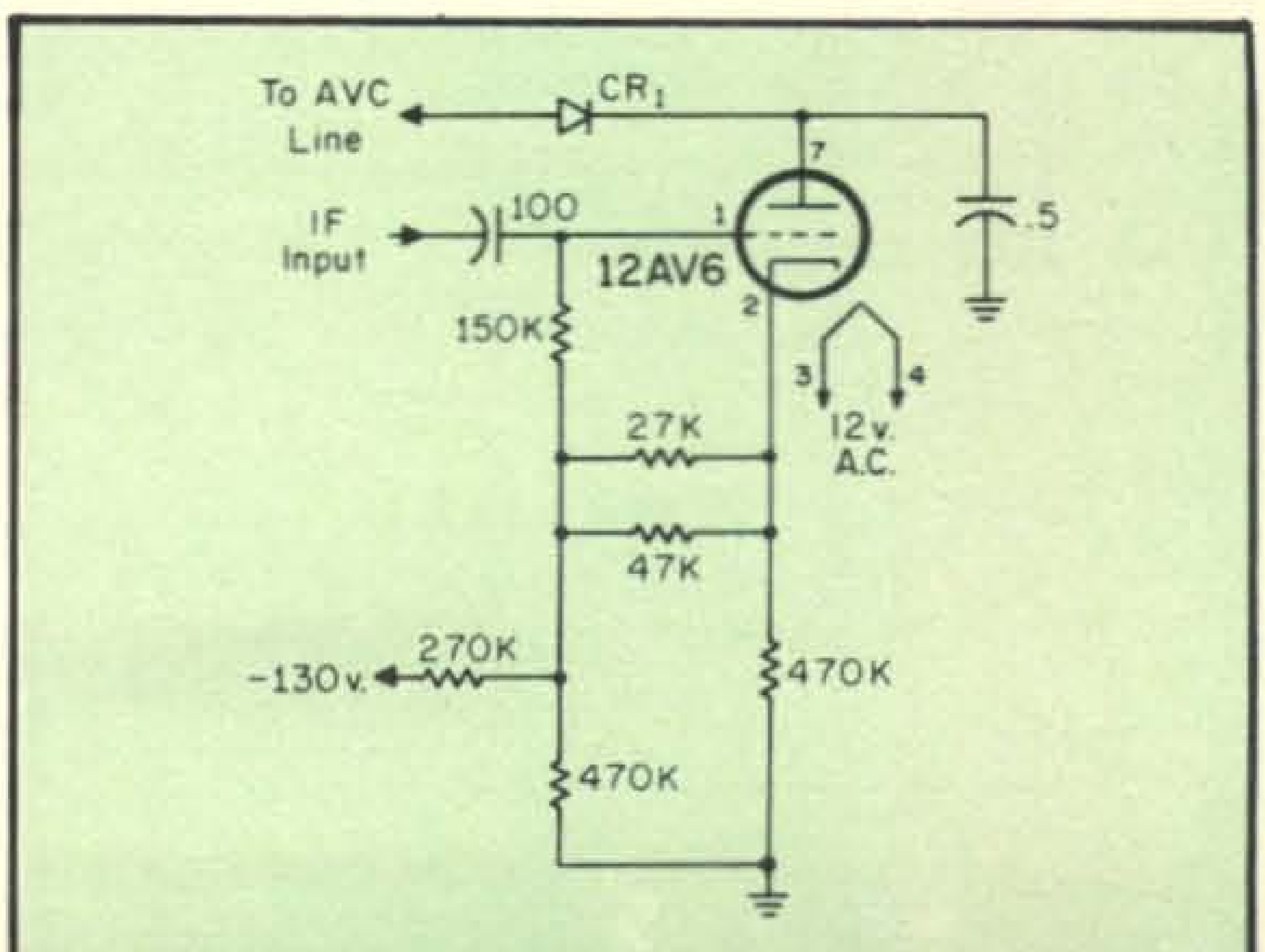

Fig. 1—Schematic of the added a.v.c. circuit for upgrading the performance of the Heath SB-100.

See page 126 for New Reader Service

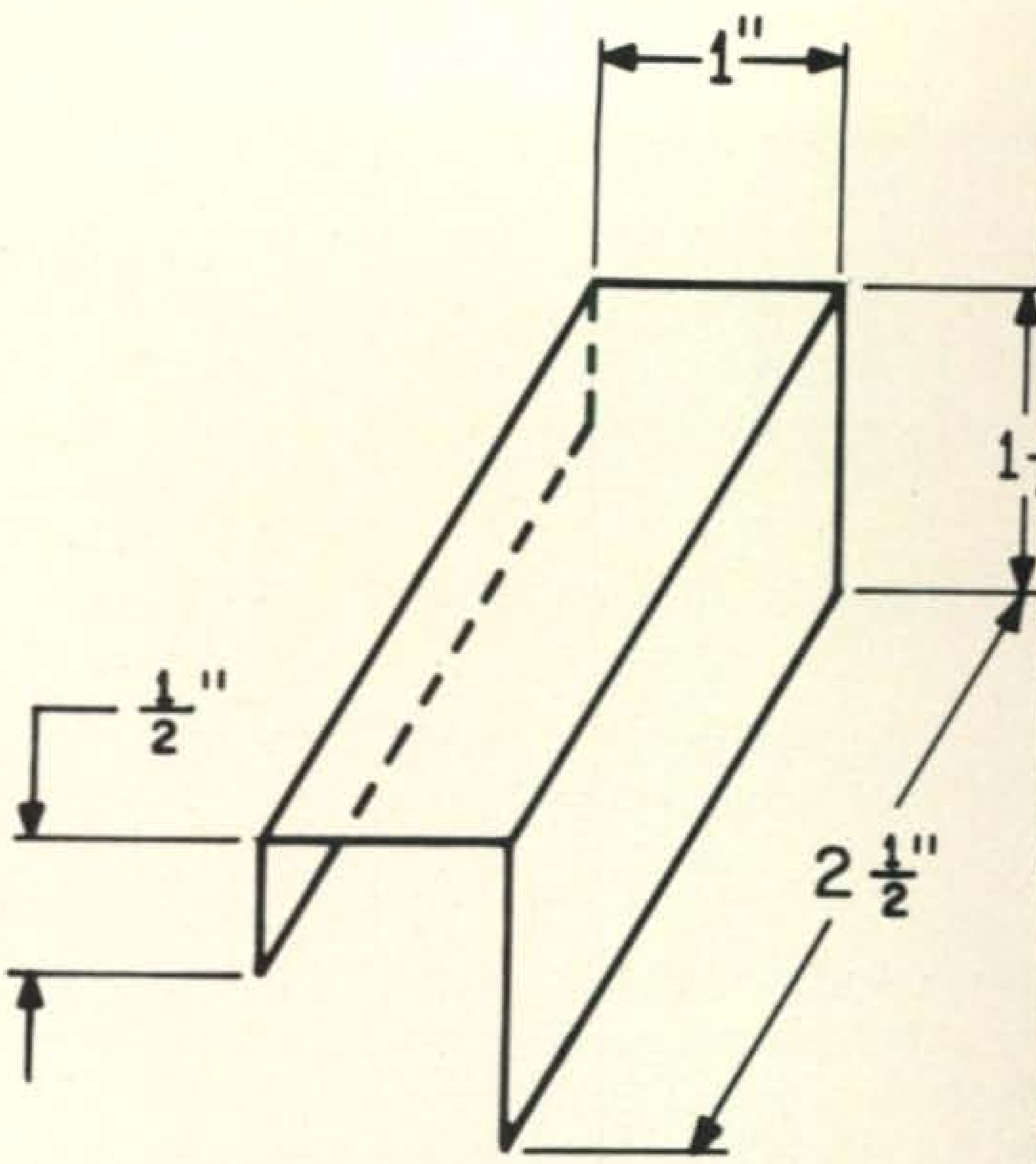

Fig. 2—Dimensions of the sub-chassis used to mount the a.v.c. amplifier.

2—I.f. input wire to one of the points from which C_{112} was removed. This connection goes to the point towards the i.f. section, *not* the point towards pin 6 of the 6BN8.

3—The lead from CR_1, the new a.v.c. output, (being careful not to install CR_1 backwards) goes to one of the connections from which D_{101} was removed. If desired, D_{101} may be reused here. This connection goes to the junction of D_{905} and R_{415}, *not* the connection to C_{124}.

4—The only long wire is the −130 volt lead which goes towards the back of the chassis and connects at the junction of R_{302} and R_{303}.

Adjustment

You are now in business with delayed amplified a.v.c. Place the two parts removed in a small box. If ever desired, these two parts can be reinstalled, bracket and wiring removed and the SB-100 is back to normal in five minutes.

The only critical value is the 27K resistor. In our experimental model, a pot with clips leads, was connected across the 47K resistor. The pot was adjusted for best a.v.c. delay; the pot resistance was then measured and found to be 28K. This was then replaced with a fixed 27K resistor. The results have made me very happy; I hope it does the same for you. ■

See page 126 for New Reader Service

The Phone Patch And The Law... REVISITED

BY MAURICE J. HINDIN,* W6EUV

ON June 26, 1968, the Federal Communi-
tions Commission by a six-to-nothing vote[1] ndered a ruling which, from a legal point of ew, may be the most significant decision er handed down affecting phone patch op-ation in the history of amateur radio. The ses involved did not directly involve the use amateur phone patches but the language of e decision indicates that the rules enun-ated are equally as applicable to amateur one patch operation as to commercial plication. The landmark case is entitled *"In e Matter of the Use of the Carterfone Device Message Toll Telephone Service"* and *"In e Matter of Thomas F. Carter and Carter ectronics Corporation, Dallas, Texas,* Com-inants vs. *American Telephone & Tele-ph Company, Associated Bell System mpany, Southwestern Bell Telephone mpany and General Telephone Company the Southwest."*[2] The two cases were con-idated for decision.

In order to understand the significance of Carterfone and Carter decision as it is plicable to amateur phone patch operation, s necessary to understand something of the kground of the legal problems in connec-n with the use of phone patches.[3]

Background of Law Applicable to Phone Patch Operations

Despite considerable talk heard on the ateur bands with reference to the illegality phone patches and the refusal of the ARRL recognize phone patches as traffic,[4] legal research has indicated that there is no FCC restriction as such on the use of phone patches by amateurs. The absence of FCC regulations or prohibitions, however, does not mean that use of the phone patch prior to the Carterfone and Carter decision was not complicated by other legal involvements. To understand the basis for the uncertainty that phone patches were legal it is necessary to go back to the original regulations from which the legal problems arose.

The basic restrictions and prohibitions are found not in the regulations of the FCC, but in the laws regulating commercial communication systems including telephone companies.

Under the Communications Act of 1934,[5] all telephone companies handling interstate calls are required to file with the Federal Communications Commission Tariff schedules. When Tariff schedules are filed with the Federal Communications Commission by the telephone companies, they become regulations binding not only upon the telephone companies, but the general public, and failure to comply with the requirements of the Tariff provisions as contained in the schedules filed with the Federal Communications Commission subject the user of the telephone to appropriate enforcement proceedings.[6] The FCC has from time to time in public notices restated the proposition that unless and until provisions of Tariff schedules filed with the Commission by the telephone companies are set aside by the Commission or a court of competent jurisdiction, the schedules are binding upon the company and the public.[7]

*471 Le Conte Avenue, Los Angeles, California 24.

page 126 for New Reader Service

With the fact in mind that Tariff schedules as filed by telephone companies constitute regulations which are binding upon both the company and the public unless and until modified by the FCC or the Courts, it now becomes important to see just what the Tariff schedules have to say about phone patches, if anything. Virtually every telephone company's Tariff schedule filed with the FCC contain what has become known as the prohibition against "foreign attachments." For example, the section of the Tariff schedule involved in the Carterfone and Carter cases was a typical section of the American Telephone & Telegraph Company contained in their Tariff schedule number 132.[8] The provision reads as follows:

> "No equipment, apparatus, circuit or device not furnished by the telephone company shall be attached to or connected with the facilities furnished by the telephone company, whether physically, by induction or otherwise, except as provided in 2.6.2 through 2.6.12 following. In case any such unauthorized attachment or connection is made, the telephone company shall have the right to remove or disconnect the same or to suspend the service during the continuance of said attachment or connection, or to terminate the service."

The Federal Communications Commission is empowered by law to resolve the questions of justice, reasonability and validity as well as the effect of tariff regulations and practices. Thus, while the law in the first instance permits the telephone companies to establish rules and regulations by means of the filing of Tariff schedules, such rules and regulations are subject to review by the Federal Communications Commission and until the Federal Communications Commission or a court of competent jurisdiction has ruled otherwise, the Tariff regulations as contained in the telephone companies' Tariff schedules are presumed to be valid and effective.[9]

The Public Utilities Commissions in various states have for some time operated similarly to the FCC with reference to the matter of filing of Tariff schedules. Generally, telephone companies servicing intrastate calls, as distinguished from interstate calls, are subject to Public Utility Commission regulations by the individual states in which they operate. Where contested in court, the foreign attachment regulations contained in Tariff schedules filed with the State agencies have been approved by the State courts.[10]

The Carterfone and Carter Cases

With the foregoing background of the legal problems involved in connection with the use of the phone patch, an analysis of the Carterfone and Carter case decision establishes strong precedent in support of amateur pho patch operation. The decision also provid the framework, guidelines and limitatio which may be expected to be applied in t future to amateur phone patch operation. T facts of the Carterfone and Carter cases stated by the Federal Communications Co mission in the decision, is as follows:

> "The proceeding involved the application o American Telephone & Telegraph Company tariffs to the use by telephone subscribers of th Carterfone.
>
> "The Carterfone is designed to be connecte to a two-way radio at the base station serving mobile radio system. When callers on the radi and on the telephone are both in contact with th base station operator, the hand set of the operator's telephone is placed on a cradle in the Carterfone device. A voice-controlled circuit in th Carterfone automatically switches on the radi transmitter when the telephone caller is speakin and when he stops speaking the radio returns to receiving condition. A separate speaker is attached to the Carterfone to allow the base statio operator to monitor the conversation, adjust th voice volume, and hang up his telephone whe the conversation has ended. The Carterfon device invented by Thomas F. Carter has bee produced and marketed by Carter Electronic Corporation, of which Mr. Carter is president since 1959. From 1959 through 1966 approximately 4,500 Carterfones were produced an 3,500 sold to dealers and distributors throughou the United States and in foreign countries. Th defendant telephone companies, acting in accordance with their interpretation of Tariff FCC No 132, filed April 16, 1957, by American Telephone & Telegraph Company, advised their subscribers that the Carterfone when used in connection with the subscriber's telephone, is prohibited inter-connecting device the use o which would subject the user to penalties provided in the Tariff. The Tariff provides that
>
> 'No equipment, apparatus, circuit or device not furnished by the telephone company, shall be attached to or connected with the facility furnished by the telephone company whether physically, by induction, or otherwise . . . '."

After reciting the history of the litigati between Carter and the American Telepho & Telegraph Company and the issues p sented by the cases, the decision went on follows:

> "The examiner found that there was a nee and demand for a device to connect a telephon land line system with mobile radio system whic could be met in part by the Carterfone. He als found that the Carterfone had no material ad verse affect upon the use of the telephone syster He construed the Tariff to prohibit attachment o the Carterfone whether or not it harmed th telephone system, and determined that futur prohibition of its use would be unjust and unrea sonable."[11]

The Opinion continued:

> "We agree with and adopt the Examiner Findings that the Carterfone fills a need and th it does not adversely affect the telephone syster They are fully supported by the record. We als agree that the Tariff broadly prohibits the use c inter–connection devices including the Carte fone. Its provisions are clear as to this. Finally, i

See page 126 for New Reader Servi

view of the above findings, we hold as did the Examiner that application of the Tariff to bar the Carterfone in the future would be unreasonable and unduly discriminatory. However, for the reasons to be given, we also conclude that the Tariff has been unreasonable, dicriminatory and unlawful in the past and that the provisions prohibiting the use of customer-provided inter-connecting devices should accordingly be stricken."

The Opinion continued:

"We hold that the tariff is unreasonable in that it prohibits the use of inter-connecting devices which do not adversely affect the telephone system. See, *Hush-A-Phone Corporation* v. *U.S.*, 99 U.S. App. D.C. 190-193, 238 F.2d 266-269 (D.C. Cir. 1956) holding that a Tariff prohibition of a customer-supplied 'foreign attachment' was 'in unwarranted interference with the telephone subscriber's right reasonably to use his telephone in ways which are privately beneficial without being publicly detrimental.' The principle of *Hush-A-Phone* is directly applicable here, there being no material distinction between a foreign attachment, such as a Hush-A-Phone, and an inter-connection device such as the Carterfone so far as the present problem is concerned."[12]

Continuing its decision, the FCC declared as follows:

"Even if not compelled by the *Hush-A-Phone* decision, our conclusion here is that a customer desiring to use an iner-connecting device to improve the utility to him of both the telephone system and a private radio system should be able to do so so long as the inter-connection does not adversely affect the telephone company's operations or the telephone system's utility for others. A Tariff which prevents this is unreasonable. It is also unduly discriminatory when, as here, the telephone company's own inter-connecting equipment is approved for use. The via of the present Tariff here, as in *Hush-A-Phone* is that it prohibits the use of harmless as well as harmful devices."

Continuing the Opinion later declared:

"We are not holding that the telephone companies may not prevent the use of devices which actually cause harm or that they may not set up reasonable standards to be met by inter-connection devices. These remedies are appropriate. We believe they are also adequate to fully protect the system."

Further, the Commission declared:

"In view of the unlawfulness of the Tariff there would be no point in merely declaring it invalid as applied to the Carterfone and permitting it to continue in operation as to other inter-connection devices. This would also put a clearly improper burden upon the manufacturers and users of other devices. The appropriate remedy is to strike the Tariff and permit the carriers if they so desire to propose new Tariff provisions in accordance with this Opinion. We make no rulings as to damages. That relief has not been requested. As noted above, the carrier may submit new Tariffs which will protect the telephone

[Continued on page 115]

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[1]Commissioner Loevinger did not participate in he decision.

[2]The Carterfone device case carried FCC Docket No. 16942 and the Carter v. American Telephone & Telegraph Co. case carried FCC Docket No. 17073.

[3]An extensive article was published in *CQ* in September, 1954 covering the applicable background of the law. See Hindin, "The Phone Patch and the Law", *CQ*, September, 1954, page 13.

[4]Inquiry to the ARRL regarding the eligibility of phone patch traffic for recognition as messages either originated or delivered has uniformly brought the reply that since phone patch operation is "illegal" no recognition of such traffic can be accepted. Since 1956 when the *Hush-A-Phone* decision was handed down many legal authorities felt amateur phone patch operation was entirely legal.

[5]47 U.S.C., Sec. 151 ff.

[6]See Section 401 and 411 of the Communications Act of 1934, as amended. 47 U.S.C., Sections 401 and 411.

[7]See, for example, Public Notice 60591 issued by the FCC on March 28, 1951, which used the following language: "It should be noted that under the provisions of the Communications Act of 1934 as amended (47 U.S.C., Sec. 151 ff, and Sec. 203, 47 U.S.C. 203) thereof in particular, the tariff schedules filed with the Commission by the telephone companies are binding upon those companies and the public unless and until they are set aside as unlawful by this Commission or a court of competent jurisdiction."

[8]This schedule was filed April 16, 1957. It has been superseded by Tariff Schedule No. 263 issued January 2, 1968 and effective February 1, 1968.

[9]*Arizone Grocery Co.* v. *Atcheson T. & S.F. Ry.*, 284 U.S. 370.

[10]For example, see *Northeastern Telephone and Telegraph Co.* v. *Department of Public Utilities*, 262 Mass. 137, 159 N.E. 743; *Gardner* v. *Providence Telephone Co.*, 23 R.I. 262, 49 Atl. 1004.

[11]In the course of the proceedings before the FCC, evidence was submitted to a Hearing Examiner with reference to he facts involved in the case. The Hearing Examiner, after considering the facts, made findings which in turn were submitted to the Commission. The Examiner made further findings which are not material to the case as it applies to amateur phone patches.

[12]In 1956 litigation arose involving a device known as a *Hush-A-Phone*. It was a cup-lie device mechanically fastened to the mouthpiece of the telephone hand set. Carterfone, however, achieves inter-connection between the telephone system and the private mobile radio system by means of acoustic and inductive coupling.

[13]After the Hush-A-Phone decision in 1956, the telephone company filed an amended Tariff regulation numbered B24 of Tariff FCC No. 132. In 1968 this section was incorporated in substance in the new Tariff No. 263 as Section 2.6.9. It provided as follows:

"2.6.9. Miscellaneous Devices Provided by the Customer

The provisions of paragraph 2.6.1 preceding shall not be construed or applied to bar a customer from using devices which serve his convenience in his use of the facilities of the Telephone Company in the service for which they are furnished under this tariff, provided any such device so used would not endanger the safety of Telephone Company employees or the public; damage, require change in or alteration of, or involve direct electrical connection to the equipment or other facilities of the Telephone Company; or interfere with the proper functioning of such equipment or facilities; or impair the operation of the telephone system or otherwise injure the public in its use of the Telephone Company's services."

This section was also stricken by the Carterfone and Carter decisions.

[14]*Hush-A-Phone Corp.* v. *U.S.*, 99 U.S. App. D.C. 190, 238 F. 2d 266.

DX

BY JOHN A. ATTAWAY,* K4IIF

The WAZ Program

Good propagation conditions and increased activity from Zone 23 are making themselves felt in the WAZ program these days. Last month we authorized an all-time record of 34 new WAZ certificates, only to turn around and completely shatter this record with no fewer than 50 this month. Anyone who says that DX isn't good these days has to be full of the proverbial prunes when 50 ops qualify for the toughest of all DX awards in one month. In addition, it's possible that a lot of you may be missing a bet in not qualifying for WAZ Phone. Combinations of s.s.b. and a.m. contacts are good for WAZ Phone so you A3 enthusiasts who still lack a few zones on s.s.b. better check back into your a.m. QSL file. You could be eligible for WAZ and not know it.

The breakdown this month was 21 WAZ S.S.B., 28 WAZ C.W.-Phone, and 1 WAZ Phone. The winners were:

WAZ S.S.B.: K4OEI–539, SM5YV–540, DL3DB–541, JA7JH–542, K4GXO–543, WA5LOB–544, W9TKD–545, W4IC–546, OA8V–547, DL7CM–548, WB6POP–549, W6PTS–550, W6EUF–551, WØLBS–552, WA5DAJ–553, VE6PL–554, K5BXG–555, W6OHU–556, VE6AQL–557, VE3MR–558, VE3AAZ–559.

WAZ C.W.–Phone: WA8LSO–2424, W6PGM–2425, DJ1XP–2426, LA8F–2427, VO1FB–2428, WAØCPX–2429, YV5ACP–2430, WØAO–2431, K4THA – 2432, OZ4FF – 2433, OZ5DX – 2434, W2GA – 2435, WØPAH – 2436, HB9ADO – 2437, WA2IDM – 2438, YU2AKL – 2439, W3RT – 2440, OE8KR – 2441, W8EW – 2442, DL1FL – 2443, K2DJD – 2444, W7YBX – 2445, W1YRC – 2446, WB6MLG–2447, W4YDD–2448, W4GYP–2449, UA9JH–2450, OZ3PO–2451.

WAZ Phone: W9PQA–380.

The WPX Program

The prefix award program maintained it's pace also this month with 16 new WPX certificates and 1 new WPNX certificate authorized, and 30 endorsement stickers issued.

* P.O. Box 205, Winter Haven, Florida 33880.

The stations qualifying for these honors wer the following:

WPX S.S.B.: WA5DAJ–335, WAØOTE–336.

WPX C.W.: W5CYE–848, ItBOL–849, W9MLR-850, YU1SF–851, OK1BV–852, OK1IQ–85 OK1AFN–854.

WPX Mixed: WAØCPX–167, K4ELK–168.

WPX Phone: W1OKG–151.

WPX S.S.B. Contest: LAØAD–6, W3TLN– SM5CEU–8, SMØCER–9.

WPNX: WN9VYI–3.

Endorsements: *Continent*–Europe: SP8AJK, W4H OK1BV. Africa: SP8AJK, W4HA. Asia: SP8AJK *Band*–21 mc: W3TLN. 14 mc: ON4QX. 3.5 m YU1AG. 7 mc: OK3EA, YU1AG.
Mode – Mixed: W9WHM – 850, G3DO – 70 YU1AG–600, WA6GLD–500.

S.S.B.: W4IC–400, WA5DAJ–350, W8FPM–30 LA4DJ–300, WA2CCF–250.

C.W.: W2EQS–750, YU1AG–600, W3PVZ–60 OK3EA – 550, OK1AFN – 400, OK2DB – 40 W9HDR–350.

Phone: W9WHM–850, G3DO–700, W9ZTD 400.

S.S.B. DX Awards

The following country chasers qualifie for new certificates during the month o May:

100 Countries: OK3EA–511, G3BDS–512, G3RW –513.

200 Countries: PAØSNG–154, K4OEI–155.

300 Countries: VK3AHO–30, DL9OH–31.

CQ S.S.B. DX Award Manager, Louis W8HDB, plans to have a complete summar of the rules for the S.S.B. DX Awards read for publication in next month's DX colum Anyone needing an application blank for o of these awards should send a self-addresse stamped envelope to Mrs. Louise Ripp W8HDB, 3785 Susanna Drive, Cincinna Ohio 45239. Questions regarding your Hon Roll status should also be addressed to Mr Rippe.

More Prefixes for the Honor Roll List

The DX column in the April issue of C contained a list of up-to-date prefixes to us

S.S.B. DX Honor Roll

VK3AHO	318	KP4CL	301	W1LLF	282	W6YMV	26
W9ILW	318	5Z4ERR	301	W6UOU	282	G2BVN	26
WA8AJI	312	W4PAA	301	W3KT	282	W3OJZ	26
WA2RAU	311	W8PQQ/		I1AMU	282	G3DO	26
W2TP	311	W8BT	300	K4OEI	280	DL3RK	26
G8KS	310	W8EVZ	300	K4HYL	277	W4RLS	26
DL9OH	310	W4QCW	300	W7DLR	277	W6WNE	26
WA2IZS	309	W4SSU	300	DL1IN	276	WA2EOQ	25
K6CYG	308	W4OPM	299	HB9TL	276	PZ2AA	25
W5KUC	308	K2MGE	297	PZ1AX	275	K6CAZ	25
W2ZX	307	W2RGV	296	W6RKP	274	W6BAF	25
TI2HP	306	W3NKM	296	K9EAB	274	PAØSNG	25
WØQVZ	305	W2FXN	294	W2LV	271	K6LGF	25
K4TJL	305	W3MAC	293	K8ONV	270	W1AOL	25
W2BXA	304	W2VCZ	291	G3NUG	270	W3NKM	25
G3AWZ	303	K1IXG	289	MP4BBW	270		
G6TA	303	K8RTW	288	W2MJ	267		
G3FKM	301	W9EXY	286	G2PL	266		

See page 126 for New Reader Servic

in compiling the WPX Honor Roll. Only prefixes on that list plus the additional prefixes shown below, will count for your WPX Honor Roll standing. A special form to use in applying for the WPX Honor Roll is now being prepared. A copy of this form may be obtained by sending a self-addressed, stamped envelope to DX Editor, K4IIF.

The remainder of the standard prefixes are as follows: AIØ (AIR), CN9, FL5, HB8, HZ4, HZ5, HZ6, HZ7, HZ8, HZ9, HZØ, IC1, ID1, IE1, II1, IP1, IR1, IV1, IZ6, JH2, JH3, JH4, JH5, JH6, JH7, JH8, JH9, JHØ, JT2, JT3, JT4, JT5, JT6, JT7, JT8, JT9, JTØ, JY1, JY2, JY6, LF2, LF3, LJ2, LJ3, LUØ, NPØ, (NPG), NSØ, (NSS), OR5, OZ9, PE1, PE2, PK1, PK8, PX2, PX3, PX4, RAØ, RH8, SK1, SK2, SK3, SK4, SK5, SK6, SK7, SK8, SK9, SKØ, SV5, TJ8, TZØ, U3, U5, WG6, WJ6, WM6, WN1, WN2, WN3, WN4, WN5, WN6, WN7, WN8, WN9, WNØ, WS6, WV6, WW6, WX6, WZ5, XTØ, YA6, YA7, YA8, YA9, ZA1, ZA2, ZA3, ZAØ, 4A1, 4A2, 4A3, 4A4, 4J2, 4J7, 5L1, 5L2, 5L3, 5L4, 5L5, 5L6, 5L7, 5L8, 5L9, 5LØ, 5VØ, 8F1, 8F2, 8F4, 8F5, 8F6, 8J1, 8J2, 8J3, 8J4, 8J5, 8J6, 8J7, 8J8, 8J9, 8JØ, 9I3, 9K3, 9L2, and 9M4.

We are aware that the list isn't perfect. Many of the over 1200 prefixes have never been activated, and some, G7 for example, may never even be assigned. However, we prefer to have the maximum number of foreseeable possibilities on the initial list. Of course there will be some new prefixes which we haven't anticipated, and as a consequence the list will be updated annually.

De Extra

The following is courtesy GC8HT in Issue No. 4 of his 1968 sked list. Please read and take heed.

"To send a QSL when requested is a rule in our code of courtesy which we expect each other to observe. So be it! However, there is a *limit* beyond which one cannot press for this courtesy. This limit applies when one one DX station—or a mere handful of ops in places like GD, GC, 7Q7, 9L1, etc.—are facing 280,000 ops in the U.S.A. plus 145,000 in the rest of the world. If only *one third* of these 425,000 hams are active it means that 142,000 will be wanting a QSL card from one or a few lone ops in a rare country. The rare station will already have hundreds of cards from the more populated countries such as CT1, D, EA, F, G, HA, HB9, I, JA, LA, OE, OH, OK, OZ, PA, PY, SM, UA, VE, XE, and W, so if you live in such a country

Cho Dong-In, HM1AJ, of Seoul, Korea. QSL this OM via CQ DX Hall of Fame member W2CTN.

it is seldom that the rare DX will require your QSL—but you will want his. The only solution to the problem is for you to help by telling your friends and club members to follow QSL instructions. Contributions are not requested, but an extra stamp or IRC is for a rare DX station a very welcome help. He could QRT or ignore QSLs, but no one likes to do that, so please play your part to help with the QSL problem. Always send a self-addressed, stamped envelope (s.a.s.e.), or a self-addressed envelope (s.a.e.) with IRCs (International Reply Coupons)."

New CQ DX Award's Advisory Committee

The committee has recently been reorganized on a more representative basis. Our original plan was to have the Committee composed of the presidents of major DX clubs in each section of the country. This was not always possible so in some instances the presidents designated outstanding individuals from within their clubs. Naturally it wasn't possible to have representatives from all clubs, so preference was given to those who have shown the most interest in the *CQ* DX Awards program. The membership of the Committee and the club's they represent is as follows:

CHAIRMAN: JOHN A. ATTAWAY—*CQ* DX Editor & Florida DX Club.

RON KREGER, VE3DLC—Canadian DX Association.

HERB KLINE, K1IMP—North Eastern DX Association.

HOWARD KLEIN, WB2EPG—Long Island DX Association.

BEN STEVENSON, W2BXA—North Jersey DX Association.

JOE HILLER, W4OPM—Virginia Century Club.

ee page 126 for New Reader Service

FRANK CAMPBELL, W5IGJ—West Gulf DX Club.

DAVE BAKER, W6WX—Northern California DX Club.

BILL HOVERMAN, W6FW—Southern California DX Club.

LOUISE RIPPE, W8HDB—*CQ* S.S.B. DX Award's Charman and Ohio Valley Amateur Radio Association associate.

BOB THIBERT, W9ARV—Northern Illinois DX Association.

RICHARD C. SPENCELEY, SR., KV4AA—Former *CQ* DX Editor and Member-at-Large.

FRANK ANZALONE, W1WY—*CQ* Contest Editor and Member-at-Large.

MIKE FERGUSON, WA8GGN—Member-at-Large for WPX.

In addition, the Western Washington and Utah DX Clubs have been asked to name representatives in order to have more representation in the northwest.

The first order of business of the new Committee will be to evaluate the present status of the DX Hall of Fame. If you know of someone whom you feel should join Gus Browning and Jack Cummings in receiving this honor, please advise either the Committee member nearest your QTH, or the *CQ* DX Editor. A resume of the candidates contributions to DX would be most helpful.

Our special thanks to W4NJF, W5KUC, W6LDD, W6WB, and W8JIN who served with distinction on the original committee.

As of Aug. 1, 1968, only *CQ* Editor

Jim Gracias, CT1OF, CQ DX Award's Representative in Portugal. Jim was born in CR9—Macao, and has his B.Sc. in Electrical Engineering from the Lisbon Institute of Technology. He is Vice-President of R.E.P., the Portuguese amateur radio society, and a member of ITT Worldwide Amateur Radio Club.

K2MGA or members of the CQ DX Award' Committee may check cards for WAZ an the S.S.B. DX Awards for W/K/VE appli cants. It is strongly advised that cards be sen to the DX Editor, Box 205, Winter Haven Fla. 33880 for WAZ, and to Mrs. Louis Rippe, W8HDB, 3785 Susanna Drive, Cin cinnati, Ohio 45239 for the S.S.B. D Awards. However, anyone wishing to sen their cards to a Committee member near the home QTH may do so after making arrange ments with said Committee member prior t sending the cards.

Rules and Application Blanks for CQ DX Awards

Complete rules and application blanks f WAZ and WPX may be obtained by sendi a self-addressed, stamped envelope to D Editor, Box 205, Winter Haven, Fla. 3388 Application blanks for the S.S.B. DX Awar may be obtained by sending a self-addresse stamped envelope to Mrs. Louise Ripp W8HDB, 3785 Susanna Drive, Cincinna Ohio 45239. Rules for the S.S.B. DX Awar will be published in the DX column of th September issue of *CQ*.

Authorized Overseas Checkpoints for CQ DX Awards

As a convenience and courtesy to our D friends we have made arrangements for t checking of cards for WAZ and the S.S. DX Awards in the home countries of the a plicants. Generally these arrangements ha been made through the national society the home country. In some instances whe the national society was not interested have invited outstanding individuals to p form this duty and many have respond For those interested overseas DXers t names of those working with us as of Ju 15, 1968 are as follows:

ARGENTINA — C. L. Hardy, LU1DJ Awards Manager, Radio Club Argenti

AUSTRALIA—G. J. Wilson, VK3AMK, F eral Awards Manager, WIA, 7 Norm Avenue, Frankston, Victoria, 3199, A tralia.

BENELUX—G. Vollema, PAØLV, G. Do traat 57, Leeuwarden, Netherlands.

CENTRAL AMERICA—Camilo A. Casti HP1AC, P. O. Box 9A-737, Panama 9 R.P.

CZECHOSLOVAKIA—Central Radio Club, P. Box 69, Praha 1, Czechoslovakia.

DENMARK—B. Petersen, OZ2NU, Tra

See page 126 for New Reader Ser

Dept. of E.D.R., P. O. Box 335, Aalborg, Denmark.

ENGLAND—Dr. John Allaway, G3FKM, 10 Knightlow Rd., Birmingham 17, England.

FRANCE—Claude Ronsiaux, F9MS, 63, rue Voltaire, Suresnes (Seine) France.

GERMANY—Walter Geyrhalter, DL3RK, P. O. Box 262, 895 Kaufbeuren, Germany.

MOROCCO N. AFRICA—H.L.-Tommy-Hall, CN8AW, Gen. Delivery, USNTC, FPO, N.Y. 09544.

NEW ZEALAND—Jock White, ZL2GX, 152 Lytton Road, Gisborne, New Zealand.

POLAND—Zygmunt Jacyk, SP5AD, Polski Zwiazek Krotokofalowcow, Skrytka Pocztowa 320, Warsaw 1, Poland.

PORTUGAL—J. H. Gracias, CT1OF, Rua do Parque 46, Lisboa 4, Portugal.

SPAIN—Luis Segura Rodriguez, Secretary General U.R.E., Apartado 220, Madrid.

SWEDEN—John I. Winblad, SM7CRW, P. O. Box 24, Waggeryd, Sweden.

SWITZERLAND—Etienne Heritier, HB9DX, or Joe Keller, HB9PQ.

USSR—Central Radio Club, P. O. Box 88, Moscow, USSR.

If your country is not listed perhaps your national amateur society has been contacted but has not been interested. We are always happy to cooperate with societies of other countries in making these arrangements.

Many of the above are fellow editors. For example, John Allaway, G3FKM, is DX Editor of *Radio Communication*, the official RSGB publication; Claude Ronsiaux, F9MS, is DX Editor of *REF*; Walter Geyrhalter, DL3RK, is editor of *DX-MB*; and CT1OF is editor of *Boletim da REP*.

Club News

With much regret we report that the West Gulf DX Club Bulletin has ceased publication. This venerable DX-Sheet was an institution 10 years ago when this editor was first licensed. Apparently the boys didn't keep up their dues and you can't publish and mail a paper on good intentions alone.

However, as the sun sets on one bulletin it rises on another. The Marin County, California DXers have recently begun publication of the West Coast DX Bulletin (WCDXB). It is a weekly sheet very similar to that put out by the West Gulf club and should fill a real need on the Pacific coast. A 6 month trial subscription is available for only $3.00. One full year is $7.00. As the West Coast boys say, "Knowledge is better than 2 kilowatts, and we sell it." For further information write: West Coast DX Bulletin, 77 Coleman Drive, San Rafael, CA 94901.

ZEICX at his home station. Photo courtesy W4NJF.

Another newcomer, to us at least, is the Utah DX Association Bulletin edited by Ron, K7ZIA. We are not certain if this bulletin is circulated to other than club members. The Utah club made an expedition to Mountain View, Wyoming in July for the purpose of providing contacts for DX stations needing this rare state.

The Southern California DX Club announces that it is open to prospective new members. The meetings are always held on the first Thursday of each month, unless a holiday, on the third floor of Cliftons Cafeteria, 649 S. Broadway, in downtown Los Angeles. For further information contact WA6GLD or W6EJJ.

New president of the Long Island DX Association is Dr. Howard Klein, WB2EPG. Howie is also a member of the CQ DX Awards Advisory Committee.

ATTENTION NOVICES— Complete WPNX Rules

WPNX is *CQ*'s special DX award for Novices only. It can be earned by Novices who work 100 different prefixes prior to receiving a higher class license. The application may be submitted after receiving the higher license providing the actual contacts were made as a Novice. The rules are as follows:

1. All applications for WPNX certificates must be made on the official application form *CQ* 1051. This form can be obtained free by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, Fla. 33880. A business size envelope is preferred.
2. All call signs must be listed on the form in alphabetical order.
3. All entries must be clearly legible.
4. QSL cards need not be sent, but must be in

See page 126 for New Reader Service

the possession of the applicant.

5. Include with application $1.00 for certificate.

A prefix may be defined as the 2 or 3 letter/numeral combinations which forms the first part of any amateur call. There are several prefixes in each U.S. call area, each of which can count toward your 100. For example, W2, WN2, WA2, WB2, WV2, K2, and KN2 are 7 different prefixes. Some typical DX prefixes are VE1, XE2, KL7, KH6, KP4, WP4, VP7, HK3, YV5, G2, F3, DL7, DJ6, 5N2, 9Q5, etc. Portable prefixes count for the area where the operation takes place, *i.e.*, K4IIF/KP4 counts as KP4.

All you good DXers with buddies in the Novice ranks give a hand and lets get them started in DX.

WPX and WAZ Rules Sheets Available

Anyone interested may obtain a printed list of the complete rules for WPX and WAZ by sending a self-addressed, stamped envelope to DX Editor K4IIF, P.O. Box 205, Winter Haven, Fla. 33880.

Asiatic USSR Prefixes

Knowledge of the area in which various Asiatic USSR stations are located is frequently of value when making applications for DX awards. A combination of the prefix and the first letter following the prefix will usually tell you the area if you know the combination. Soviet club stations have the letter K after the prefix, and for these the letter following the K is also necessary. The following list, which also includes arctic and antarctic stations, was prepared by Dennis Ratcliffe, VE3DDR, of the Canadian DX Association and originally published in "Long-Skip."

Area/Zone	*Prefix and Letter Following*
Chelyabinsk (17)	UA9A, UA9B, UA9KA, UA9KB
Sverdlovsk (17)	UA9C, UA9D, UA9KC, UA9KD
Perm & Tagil (17)	UA9E, UA9KE, UA9KG
Tomsk (18)	UA9H, UA9I, UA9KH, UA9KI
Tyumen & Hanti (17)	UA9J, UA9KJ
Omsk (17)	UA9M, UA9KM, UA9KN
Novosibirsk (18)	UA9O, UA9P, UA9KO, UA9KP
Kurgan (17)	UA9Q, UA9KQ, UA9KR
Orenburg (16)	UA9S, UA9T, UA9KS, UA9KT
Kemerov (18)	UA9U, UA9V, UA9KU, UA9KV
Bashkir (16)	UA9W, UA9KW
Komi & Vorkutu (17)	UA9X, UA9KX
Altai & Barnaul (18)	UA9Y, UA9KY
Krasnoyarsk & Nobilsk (18)	UAØA, UAØB, UAØKA, UAØKB
Cape Chelyuskin (18)	UAØKAE, UAØB
Dickson Island (18)	UAØKAR, UAØAZ, UAØBC, UAØBD, UAØBF
Khabarovsk (19)	UAØC, UAØG, UAØKC, UAØKE, UAØKG
Sakhalin Island (19)	UAØE, UAØF, UAØKF
Cape Schmidt, Bering, Magdan, Pevek and Wrangel Island (19)	UAØI, UAØKI
Blagoveshchensk (Amur) (19)	UAØJ, UAØKJ
Vladivostok (19)	UAØL
Ussuriisk (19)	UAØM
Buryat-Mongolia, Ulan-Ude, and Yakutsk (18)	UAØO, UAØKO, UAØKP
Olenek (19)	UAØQ, UAØR, UAØKQ
Irkutsk (18)	UAØS, UAØT, UAØKS
Chita (18)	UAØU, UAØV, AØKV
Tannu-Tuva (23)	UAØY, UAØKY
Kamchatka, Petropavlovsk (19)	UAØZ, UAØKZ
North Pole Drifting Stations (40)	UPØL
Alexander Island, Franz Josef Land (40)	UA1KED
Mirny Base Antarctica (29 or 30)	UA1KAE
Vostok Base, USA & USSR (29 or 30)	KC4VOS

This photo VR2FF and FW8RC was taken at Suva in 1967. It is one of the only photographs available of FW8RC and was sent by Jerry, WA6NFI, QSL Manager for VR2FF who mentions that Ron, 5W1AS, may DXpedite to ZM7 and ZK1 in late October or early November.

From the Mailbag

de Gerrit, PAØSNG: "I am sorry to have to tell you that my father, PAØGMU, died on March 3, 1968 after one week in the hospital. He was only 54 years old and as you know a very active amateur who took part in many *CQ* contests. In 1966 he was sixth high for the world in the *CQ* WW DX Phone Contest. You can understand that it was a very hard shock for us. It was my father's wish that the PAØGMU callsign be on the air again, used by my brother who plans to take the test soon."

de Peter, ex-HL9TM, W8QZ: "The arrival of another misdirected QSL card prompts me to clear up the confusion regarding some HL9 calls. HL9T- and HL9K- calls are part of a block issued by the U.S. army to military and civilian U.S. government personnel. These calls are in great demand and are usually reissued 3 months after the licensee departs from Korea. Naturally this creates a great deal of confusion for those seeking QSLs. I operated as HL9TM from April 9-

See page 126 for New Reader Service

Dec. 9, 1967 and will be happy to confirm QSOs during this period except for the *CQ* WW DX contest. Unfortunately my contest logs were lost in Taiwan. For most of 1966 HL9TM was operated by Joe, WA2SPL. One further note, the Korean Amateur Radio League Bureau does *not* handle HL9 cards. They are passed along irregularly, if at all, to the HL9 bureau."

de Charlie, K4PHY/YV5: "After a year's wait I was given permission to operate as K4PHY/YV5, the first license under the reciprocal agreement. The license was presented to me on June 5, 1968 by the Minister of Communications and Marie Richardson of the American Embassy. The presentation was made at a meeting of the Caracas Amateur Radio Club. I would also like to mention that Tony, YV5AGD, just had an eye operation for cataracts and is doing fine."

de Jeff, WA8YPG: "I would like to become a DX station's QSL manager. My address is 15904 Corsica Ave., Cleveland, Ohio 44110."

de Kenneth Smyth: "The prefix chasers will be interested to know that there are 3 active WG6's on 15 meters and will be 4 soon as I have applied for my Novice license."

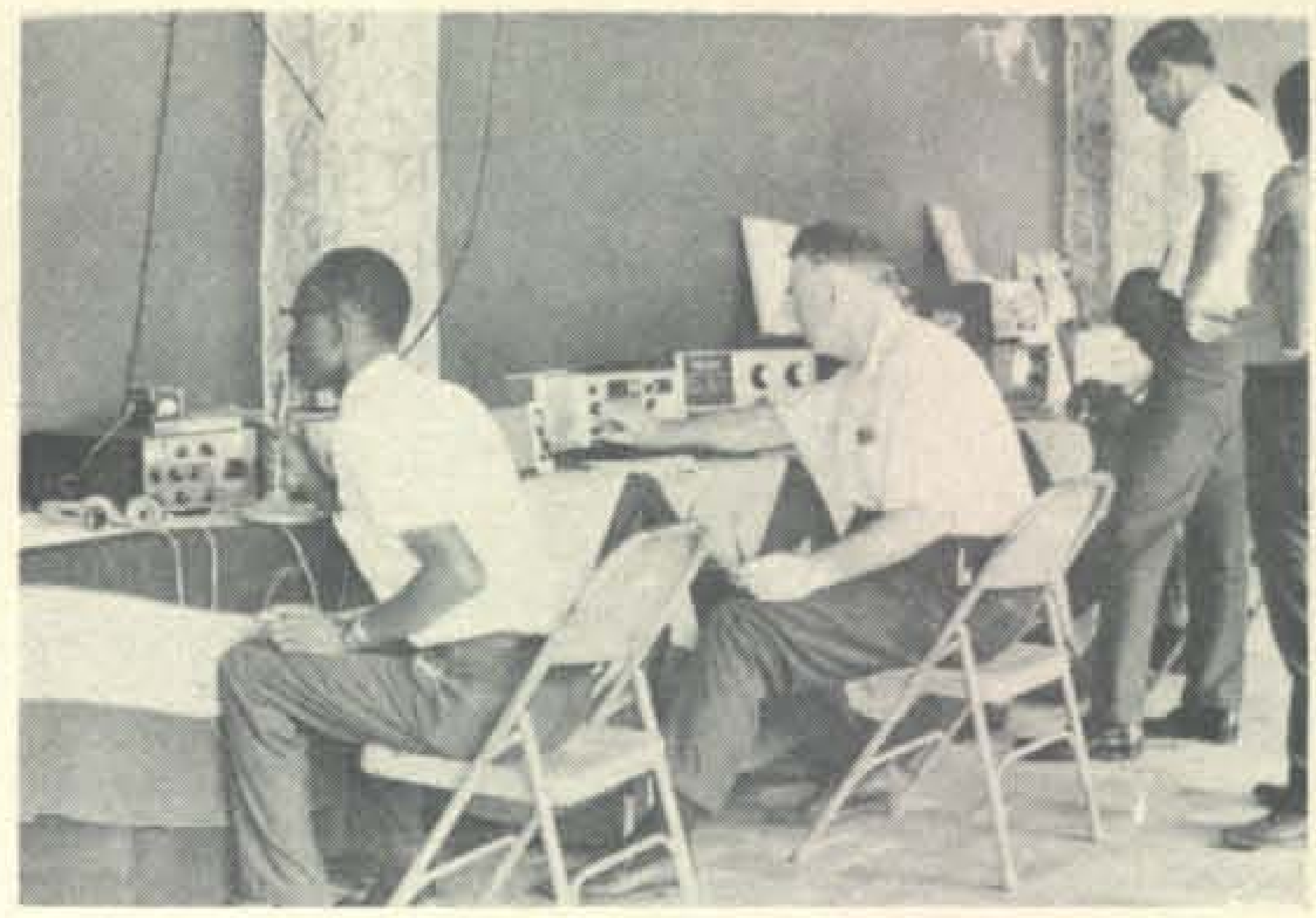
de Willie, W5LEF: "Through the very kind offer of Georges, TT8AN, it was possible for Dick Lambert, ET3REL, and Herman Olarte, TJ1QQ, to guest operate from TT8AN for the period June 2-June 10, 1968. I will receive logs and will QSL all contacts where s.a.s.e.'s accompany the card. Contacts before June 2 or after June 10 will be handled directly by TT8AN, Box 443, Fort Lamy, Rep. of Chad.

de Cho Dong-In, HM1AJ: "I operate on 20 meter s.s.b. with Heath HW-32A running 180 W. p.e.p. ad 2 el. cubical quad 30 ft. high. I look for U.S.A. at 1000-1300 GMT on 14195 listening 14220, and for Europe at 2000-2200 GMT on 14170-195 kc. My QSL Manager is W2CTN but I QSL myself if the card is sent to my home QTH, Shindaebang-dong 360-38, Seoul, Korea."

de Ron, K6OZL: "VU2DIA is now VU2DI and his address is Mr. B.S. Hedge, I.S.P.W. Station, Panjim, Goa, India. I continue to handle his cards, and have just received 51 cards from Panjim for a total of over 400 since November, 1967. If there is still someone in need of a card please have them send me a QSL with s.a.s.e."

Here and There

Thanks to the following DX publications for thses items: *DXers Magazine* (Gus, W4BPD), *DX News-Sheet* (Geoff Watts), *Long-Skip* (VE3DLC), *West Coast DX Bulletin* (WA6AUD), *DX-Press* (VERON, PAØLOU, *et al*), *North Eastern DX Association Bulletin* (K1IMP), *Long Island DX Association Bulletin* (W2GKZ), *Florida DX Club DX Report* (W4BRB), *DX-MB* (DL3RK), *Utah DX Association Bulletin* (K7ZIA), *FEARL News* (KA2LL), and *Southern California DX Club Bulletin* (WA6GLD).



Operators hard at work during one of the many pileups at last years Liberian field day. From left to right Sewell, EL2S, Hank, EL2O, and observing is Jim, EL2AF.

AP, West Pakistan: AP5HQ listens for W/VE stations daily around 14010—14030 kc (*Tnx VE3GTW*).

CR4, Cape Verde Islands: Julio, CR4BC, has strong signals in W6-land near 14200 kc around 0700-0800 GMT.

CR8, Portuguese Timor: CR8AM is occasionally active 21190-195 and 21260 kc at 1200-1330 GMT.

CT1, Portugal: CT1FAT is a special station at Fatima and may be operated by visiting amateurs. Contact CT1MP for further information.

HC8, Galapagos Islands: Rolf, HC8RS, is now active from this rare QTH.

HV3, Vatican City: HV3SJ has been heard regularly on Tuesdays and Fridays between 2100 and 2150 GMT on 14210 kc.

ITU Meeting: There are rumors of a possible frequency allocation conference in Geneva in 1970. It has been said that some consideration may be given to moving the 15 meter band from 21 to 23 mc.

IZ6, Ponza Island: I1KDB reports that 1800 QSOs with 103 countries were made during the recent IZ6KDB operation with I1CZW and I1AJ.

[*Continued on page 118*]

Propagation

BY GEORGE JACOBS,* W3ASK

A seasonal change in shortwave radio propagation conditions generally takes place during the mid-August to mid-September period. During this time, conditions are neither typically summer nor typically fall. For this reason, and to present a more accurate forecast to readers of this column, this month's DX Propagation Charts cover only the *one month* period August 15-September 15, 1968. Short-Skip Propagation Charts for August appeared in last month's column.

During this transitional period, improvements should occur in DX propagation conditions on all amateur shortwave bands except 20 meters, where conditions are expected to be much the same as they have been for the past month or two.

During most of the period fairly good north-south openings are predicted for 10 meters during the daylight hours to such areas as Latin America and Africa. Some openings to Europe, Australasia and possibly the Far East are also expected.

Excellent DX openings are forecast to almost every corner of the world on 15 meters during the daylight and early evening hours. Signal levels are expected to be exceptionally strong during many of these openings, and 15 meters should be the optimum band for DX openings during most of the daylight hours.

Good-to-excellent world-wide DX propagation conditions are forecast around-the-clock on 20 meters during this period. During the early evening hours, the hours of darkness and the sunrise period, 20 meters should be the optimum band for DX propagation conditions to most parts of the world.

Despite seasonally high static levels, some fairly good DX openings are forecast for 40 meters beginning with the early evening hours and continuing through the hours of darkness and the sunrise period. Some fairly good DX openings to many parts of the world should also be possible on 80 meters during the hours of darkness, with conditions peaking just as the sun begins to rise on the "light" side of the path. High static levels are expected to make DX openings on 160 meters difficult during the mid-August to mid-September period, but some may be possible during the hours of darkness and the sunrise period.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for August 15 through September 15, 1968

Days	*Forecast Rating & Quality* (4)	(3)	(2)	(1)
Above Normal: **12, 15, 18-19, 23, 26-27,** 8, 10-11, 14	A	A-B	B-C	C
Normal: **2-4, 9-11, 13, 16-17, 20-22, 24-25, 29-30,** 5-7, 9, 12-13, 15	A-B	B-C	C-D	D-E
Below Normal: **1, 5, 8, 14, 28, 31,** 1, 4	C	C-D	D	E
Disturbed: **6-7,** 2-3	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.

3—With the forecast rating noted above, start with the numbers in parenthese 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 and considerable fading and noise; E—poor opening, or none at all.

4—This month's DX Propogation Charts are based upon a transmitter power of 250 watts c.w.; 500 watts s.s.b., or 1000 watts d.s.b., into a dipole antenna a quarter-wave above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain 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—The Eastern USA chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9, and Ø areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid from Aug. 15, through Sept. 15, 1968, and are prepared from basic propogation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

See page 126 for New Reader Service

V.H.F. Ionospheric Openings

August will be an active month for meteor showers, with at least five different ones expected to take place during the first three weeks of the month. At least one of these, the *Perseids*, should be an intense shower with a great deal of activity. It is expected to last for five days, with maximum intensity occurring on August 11. Maximum periods for other meteor showers expected during the month are August 1, 3, 5 and 18.

Ionization produced by the millions of meteors entering the earth's atmosphere during these showers, especially during periods of maximum intensity, is expected to make possible numerous meteor-scatter type openings over distances of several hundred miles on 10, 6 and 2 meters.

Sporadic-E ionization is expected to continue to occur fairly frequently during August, resulting in some good short-skip openings on 6 meters over distances of approximately 750 to 1300 miles. During periods of very intense sporadic-E ionization, two-hop 6 meter openings may be possible up to distances of about 2600 miles. An occasional 2 meter sporadic-E opening may also be possible over distances ranging between 1000 and 1400 miles. While this type of propagation may occur at any time of the day or night during August, there is a tendency for sporadic-E ionization to peak between 8 a.m. and noon and again between 5 and 8 p.m., local standard time.

Auroral displays produce ionization in the earth's atmosphere which is capable of reflecting v.h.f. radio signals over distances ranging upwards to 1000 miles, or so. Auroral displays and auroral-scatter propagation are most likely to occur when h.f. radio conditions are disturbed or below normal. Check the "Last Minute Forecast" appearing at the beginning of this column for the days that are expected to be in these categories during August.

There is a fairly good chance for some 6 meter transequatorial openings during late August, between the USA and Latin America. The optimum times for such openings are the early evening hours, shortly before and just after sundown.

Sunspot Cycle

Sunspot activity continues to edge slowly towards a maximum value. The Zurich Solar Observatory reports a monthly sunspot number of 129 for May, 1968. This was the highest level of monthly sunspot activity recorded thus far during the present cycle. The May figure results in a 12-month smoothed sunspot number, upon which the cycle is based, of 96 centered on November, 1967. A smoothed sunspot number of 114 is forecast for August, 1968. ■

AUGUST 15 - SEPTEMBER 15, 1968

Time Zone: EST (24-Hour Time)

Eastern USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	08-14 (1)	07-08 (1) 08-11 (2) 11-15 (3) 15-17 (2) 17-18 (1)	05-07 (3) 07-09 (2) 09-12 (1) 12-13 (2) 13-15 (3) 15-19 (4) 19-21 (3) 21-23 (2) 23-03 (1) 03-05 (2)	18-20 (1) 20-22 (2) 22-01 (3) 01-02 (2) 02-03 (1) 20-22 (1)* 22-00 (2)* 00-02 (1)*
Northern Europe & European USSR	08-12 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-13 (2) 13-15 (1)	02-05 (1) 05-08 (2) 08-11 (1) 11-13 (2) 13-18 (3) 18-02 (2)	19-21 (1) 21-23 (2) 23-02 (1) 21-01 (1)*
Eastern Mediterranean & Middle East	10-13 (1)	07-08 (1) 08-12 (2) 12-15 (3) 15-17 (2) 17-18 (1)	06-08 (2) 08-13 (1) 13-15 (2) 15-19 (3) 19-21 (2) 21-00 (3) 00-02 (2) 02-06 (1)	18-20 (1) 20-22 (2) 22-23 (1) 21-23 (1)*
West & Central Africa	09-12 (1) 12-16 (2) 16-17 (1)	06-08 (1) 08-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-21 (2) 21-23 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-22 (4) 22-01 (3) 01-05 (2) 05-08 (1)	19-22 (1) 22-01 (2) 01-03 (1) 00-02 (1)*
East Africa	11-14 (1) 14-16 (2) 16-17 (1)	09-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-18 (3) 18-19 (2) 19-20 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-20 (4) 20-23 (3) 23-00 (2) 00-02 (1)	20-00 (1)
South Africa	08-10 (1) 10-12 (2) 12-13 (1)	08-10 (1) 10-11 (2) 11-12 (3) 12-14 (4) 14-15 (2) 15-16 (1)	05-07 (2) 07-14 (1) 14-15 (2) 15-18 (3) 18-20 (2) 20-23 (1) 23-02 (3) 02-03 (2) 03-05 (1)	20-22 (1) 22-00 (2) 00-02 (1) 22-00 (1)*
Central & South Asia	09-11 (1) 19-21 (1)	08-11 (1) 19-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-18 (1) 18-21 (2) 21-00 (1)	04-06 (1) 18-20 (1)
Southeast Asia	12-14 (1) 17-20 (1)	07-08 (1) 08-10 (2) 10-18 (1) 18-20 (2) 20-21 (1)	05-07 (1) 07-09 (2) 09-10 (1) 18-21 (1) 21-23 (2) 23-00 (1)	*Nil*

* Predicted times of 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a forecast rating of (2), or higher.

Far East	17-19 (1)	07-08 (1) 08-10 (2) 10-12 (1) 15-17 (1) 17-19 (2) 19-21 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-12 (1) 18-22 (1) 22-00 (2) 00-02 (1)	05-07 (1)
South Pacific & New Zealand	08-14 (1) 14-17 (2) 17-18 (3) 18-19 (2) 19-20 (1)	08-09 (1) 09-10 (2) 10-15 (1) 15-17 (2) 17-20 (3) 20-22 (2) 22-23 (1)	11-19 (1) 19-21 (2) 21-23 (3) 23-01 (4) 01-04 (3) 04-07 (2) 07-09 (3) 09-11 (2)	00-01 (1) 01-02 (2) 02-05 (3) 05-07 (2) 07-08 (1) 03-07 (1)*
Australia	08-10 (1) 15-16 (1) 16-18 (2) 18-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 15-17 (1) 17-19 (2) 19-20 (3) 20-21 (2) 21-22 (1)	05-07 (2) 07-09 (3) 09-11 (2) 11-15 (1) 15-17 (2) 17-21 (1) 21-23 (2) 23-01 (3) 01-03 (2) 03-05 (1)	02-04 (1) 04-06 (2) 06-07 (1) 04-06 (1)*
Northern & Central South America	07-09 (1) 09-12 (2) 12-14 (3) 14-17 (4) 17-18 (2) 18-19 (1)	05-06 (1) 06-07 (2) 07-11 (3) 11-13 (4) 13-15 (3) 15-19 (4) 19-21 (2) 21-22 (1)	02-04 (2) 04-06 (3) 06-09 (4) 09-15 (2) 15-18 (3) 18-23 (4) 23-02 (3)	19-20 (1) 20-21 (2) 21-03 (3) 03-05 (2) 05-07 (1) 21-01 (1)* 01-03 (2)* 03-06 (1)*
Brazil, Argentina, Chile & Uruguay	07-08 (1) 08-11 (2) 11-13 (1) 13-15 (2) 15-17 (4) 17-18 (2) 18-19 (1)	06-07 (1) 07-10 (2) 10-13 (1) 13-15 (2) 15-16 (3) 16-19 (4) 19-21 (3) 21-23 (2) 23-00 (1)	09-15 (1) 15-17 (2) 17-19 (3) 19-00 (4) 00-03 (3) 03-05 (2) 05-07 (3) 07-09 (2)	20-23 (1) 23-04 (2) 04-06 (1) 03-05 (1)*
McMurdo Sound, Antarctica	15-17 (1)	12-14 (1) 14-17 (2) 17-20 (3) 20-21 (2) 21-22 (1)	15-17 (1) 17-21 (2) 21-00 (3) 00-04 (2) 04-06 (1) 06-08 (2) 08-09 (1)	00-04 (1)

Time Zone: CST & MST (24-Hour Time)

Central USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	10-12 (1)	08-09 (1) 09-11 (2) 11-14 (3) 14-16 (2) 16-17 (1)	07-12 (1) 12-15 (2) 15-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-00 (1) 03-05 (1) 05-07 (2)	19-22 (1) 22-00 (2) 00-03 (1) 21-01 (1)*
Northern Europe & European USSR	*Nil*	07-08 (1) 08-12 (2) 12-14 (1)	04-05 (1) 05-07 (2) 07-11 (1) 11-13 (2) 13-16 (3) 16-18 (2) 18-22 (1) 22-00 (2) 00-02 (1)	19-01 (1) 21-00 (1)*
Eastern Mediterranean & Middle East	10-12 (1)	08-10 (1) 10-15 (2) 15-16 (1)	05-06 (1) 06-08 (2) 08-15 (1) 15-17 (2) 17-21 (3) 21-23 (2) 23-00 (1)	19-22 (1) 20-22 (1)*
West & Central Africa	09-11 (1) 11-15 (2) 15-16 (1)	06-09 (1) 09-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-20 (2) 20-21 (1)	12-14 (1) 14-16 (2) 16-19 (3) 19-21 (4) 21-00 (3) 00-01 (2) 01-08 (1)	19-23 (1) 23-00 (2) 00-01 (1) 22-00 (1)*
East Africa	13-15 (1) 15-17 (2) 17-18 (1)	10-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-19 (1)	12-14 (1) 14-17 (2) 17-22 (3) 22-23 (2) 23-00 (1)	20-23 (1)
South Africa	08-10 (1) 10-11 (2) 11-12 (1)	07-08 (1) 08-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	05-07 (2) 07-14 (1) 14-15 (2) 15-18 (3) 18-20 (2) 20-22 (1) 22-02 (2) 02-05 (1)	19-20 (1) 20-22 (2) 22-23 (1) 21-23 (1)*
Central & South Asia	07-09 (1) 18-20 (1)	08-10 (1) 17-18 (1) 18-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-10 (1) 16-18 (1) 18-21 (2) 21-00 (1)	05-07 (1) 18-20 (1)
Southeast Asia	11-13 (1) 16-19 (1)	07-08 (1) 08-11 (2) 11-14 (1) 16-18 (1) 18-20 (2) 20-21 (1)	05-07 (1) 07-09 (2) 09-12 (1) 18-20 (1) 20-22 (2) 22-00 (1)	05-07 (1)
Far East	15-18 (1)	08-10 (1) 12-15 (1) 15-16 (2) 16-20 (3) 20-21 (2) 21-22 (1)	18-21 (1) 21-00 (2) 00-05 (1) 05-07 (2) 07-09 (3) 09-10 (2) 10-12 (1)	02-05 (1) 05-06 (2) 06-07 (1) 05-06 (1)*
South Pacific & New Zealand	10-14 (1) 14-16 (2) 16-18 (3) 18-19 (2) 19-21 (1)	08-12 (1) 12-16 (2) 16-18 (3) 18-20 (4) 20-21 (3) 21-23 (2) 23-00 (1)	06-08 (4) 08-09 (3) 09-12 (2) 12-17 (1) 17-19 (2) 19-22 (3) 22-00 (4) 00-03 (3) 03-06 (2)	23-00 (1) 00-02 (2) 02-05 (3) 05-07 (2) 07-08 (1) 01-03 (1)* 03-05 (2)* 05-06 (1)*
Australia	08-10 (1) 13-15 (1) 15-18 (2) 18-20 (1)	07-08 (1) 08-10 (2) 10-15 (1) 15-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	07-09 (3) 09-12 (2) 12-18 (1) 18-22 (2) 22-02 (3) 02-07 (2)	01-03 (1) 03-06 (2) 06-08 (1) 03-04 (1)* 04-06 (2)* 06-07 (1)*
Northern & Central South America	08-10 (1) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-18 (4) 18-19 (3) 19-20 (2) 20-22 (1)	06-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-23 (4) 23-01 (3) 01-04 (2) 04-06 (3)	18-19 (1) 19-20 (2) 20-02 (3) 02-05 (2) 05-06 (1) 20-23 (1)* 23-02 (2)* 02-05 (1)*
Brazil, Argentina, Chile & Uruguay	07-08 (1) 08-12 (2) 12-15 (3) 15-17 (4) 17-18 (2) 18-19 (1)	06-07 (1) 07-10 (2) 10-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-21 (2) 21-23 (1)	08-15 (1) 15-17 (2) 17-19 (3) 19-23 (4) 23-02 (3) 02-04 (2) 04-05 (1) 05-08 (2)	20-22 (1) 22-02 (2) 02-05 (1) 01-04 (1)*
McMurdo Sound, Antarctica	16-18 (1)	12-15 (1) 15-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	16-18 (1) 18-20 (2) 20-00 (3) 00-03 (2) 03-06 (1) 06-08 (2) 08-09 (1)	00-05 (1)

Time Zone: PST (24-Hour Time)

Western USA To:

Western Europe & North Africa	10-12 (1)	07-09 (1) 09-13 (2) 13-15 (1) 21-23 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-18 (3) 18-20 (2) 20-22 (1) 22-00 (2) 00-02 (1)	19-20 (1) 20-22 (2) 22-23 (1) 21-22 (1)*

[*Continued on page 110*]

Q AND A

BY WILFRED M. SCHERER,* W2AEF

READERS have wondered about discrepancies in s.w.r. readings, particularly between those obtained at the antenna and at the transmitter. Also, many amateur-radio operators think they have a unity or very low s.w.r. on the transmission line when such is not the actual case.

There are many factors that determine whether or not the s.w.r. instrument is indicating the actual line s.w.r. The complexity of their influence is such that space does not allow a detailed discussion at this time, so we'll limit our comments to a few statements and some suggestions that may lead to more realistic and meaningful readings.

The degree by which the load mismatches the surge impedance of a transmission line determines the standing-wave ratio on the line and the relative amount of power absorbed by the load. The closer the match the lower is the s.w.r., and the greater the power delivered to the load. When the load is matched to the line, all the power applied to the line is absorbed by the load (neglecting line losses). Under this condition the s.w.r. is 1:1.

Hence, an instrument that indicates the s.w.r. on the line can be a useful tool for determining whether or not the most effective load match is obtained and maximum power is delivered to the antenna.

This is all well and good, but unfortunately the instrument may not always be telling the truth. As previously mentioned, this depends on many factors, but by employing the following procedures, possible errors may be minimized, assuming the instrument itself is working properly.

Use of the s.w.r. instrument directly at the antenna will produce the most accurate indication of the expected s.w.r., since this will eliminate errors that may be introduced by factors involving the transmission line. This often can quite readily be done when the antenna is initially set up and adjusted, but from an operating standpoint it would be somewhat inconvenient. Besides, leaving the instrument permanently installed here might alter the actual match to the line by a degree dependent on the residual s.w.r. of the device itself.

The next best bet is to install the indicator in the line at a point nearest the antenna that is a distance equal to a multiple of an electrical half-wave length ($492f_{mc}$ × velocity-constant of the line. The constant for most coax cable is 0.66). The load characteristic is reflected at the half-wave points, so the match can also be indicated thereat.

The readings also may be taken at the transmitter end of the line if it is a half-wave multiple; however, where the overall length of *any* line is long, with line loss and attenuation high and with a mismatched load, the indicated s.w.r. may be lower than the actual value.

The s.w.r. indicator also may be used at quarter-wave multiples; however, in the case of a mismatch, the reflected impedance will be inverted by the same ratio of mismatch, but it may be in the direction that causes the impedance seen at this point to fall out of the loading range of the transmitter p.a.

If an s.w.r. of 1:1 is indicated in any case, confirmation of this being the actual situation may be obtained by altering the line length in steps of approximately one-eighth wavelength and noting if the s.w.r. indication is still 1:1. If the load is matched to the line and the s.w.r. really is 1:1, it will be so indicated *regardless* of the line length. This will not necessarily be true with a mismatched line and a higher s.w.r.

In order to avoid errors due to the change in the relative linearity characteristics between the forward and reflected diode detectors of the device at various power levels, particularly in the frequency-sensitive type indicators, each measurement should be made using the same forward-power level or sensitivity setting for the meter.[1] The transmitter output should be adjusted for the same initial reference reading in each case, rather than resetting the meter sensitivity control.

Errors can be introduced by harmonics, so it would be preferable to use a low-pass filter (with cutoff between the fundamental and

* Technical Director, *CQ*.

[1] A high power level also should be used, particularly at the lower frequencies where the sensitivity is low, since the linearity of the reflected-power detector will deteriorate at low levels.

See page 126 for New Reader Service

2nd harmonic) between the transmitter and the instrument or the line.

Once the actual s.w.r. has been determined, during operation the meter may be installed at the transmitter with any line length and the resulting reading (no matter what it turns out to be) used only as a relative reference for monitoring possible changes that may occur in the antenna system.

Regardless of the line length, the actual s.w.r. and whether or not the readings obtained at this point indicate the actual s.w.r., the readings at least will be indicative of the s.w.r. as it "appears" to the transmitter and thus may be useful in determining or making adjustments for matching the line to within the loading capabilities of the transmitter. This often can be accomplished simply by changing the line length in small steps.

Several articles by other authors will be presented in *CQ* with detailed information on the relationship between transmission-line characteristics and s.w.r. measurements. Look for them in a future issue.

Distortion in KWM-2 Transmitter

QUESTION: When the v.o.x. gain on the Collins KWM-2 transceiver is set for high sensitivity, a.f. distortion is experienced on the transmitter. How can this be cured?

ANSWER: The grid of the a.f. cathode follower, V_{3A}, used for matching the mic amplifier to the balanced modulator, and the grid of the v.o.x. amplifier, V_{14B}, are directly connected together. With the v.o.x. gain, R_{39}, set near maximum, the speech level under certain conditions will be high enough to cause the v.o.x. amplifier to draw grid current. This produces a voltage drop across the v.o.x. gain which biases the cathode follower to a point that allows this stage to distort the signal.

A solution is the installation of a .01 mf d.c. blocking capacitor connected in the circuit between the high end of the v.o.x. gain and the ungrounded terminal of the mic-off switch S_{14}. See fig. 1.

Thanks to W1TFH for this information.

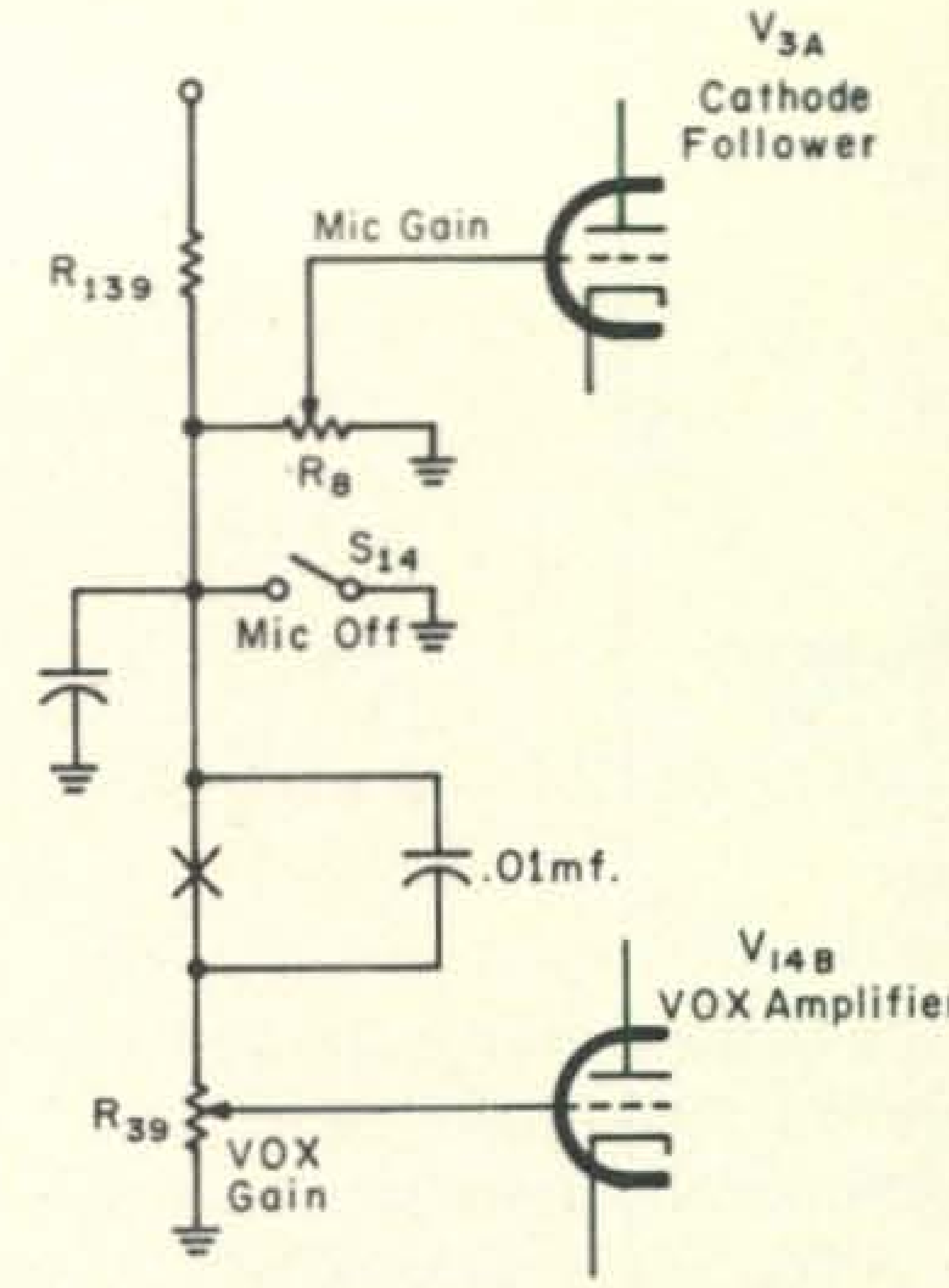


Fig. 1—Distortion, under certain conditions, in the KWM-2 transmitter can be avoided by insertion of a .01 mf d.c. blocking capacitor at point X in the v.o.x. input circuit shown here.

Harvey-Wells TBS-50C Manual

QUESTION: I've recently obtained an old Harvey-Wells Model TBS-50C Bandmaster, but have been unable to locate a manual for it. Have you any data on this equipment or information on procuring a manual?

ANSWER: A number of similar requests regarding this gear have been received, but unfortunately we have no useful operating information nor manuals on this job. Perhaps some of our readers can help. If so, we'd appreciate hearing from such. How about it, gang?

Mounting Toriods

QUESTION: I should like to know if the position of the toroids is critical in the audio filter described on page 32 in March '68 *CQ*. Can they be mounted in any other way than stacked?

ANSWER: A toroid-wound inductor has virtually no external magnetic field, and thus can be placed in almost any manner; however, it would be well to avoid allowing the winding to rub against a metallic surface.

Souping Up The Two'er

QUESTION: In a recent issue you had an article on increasing the power in a Clegg 99'er and it was mentioned that there are articles on fixing up the Heath Two'er. Can you let me know about these articles?

ANSWER: The article you recently saw on the 99'er did not appear in *CQ*. In respect to modifying the Two'er, an article entitled "Souping Up The Two'er," was published in March '65 *CQ*, page 35. Back copies are available from the Circulation Dept. at $1.00 each.

Omni-Directional Antennas for 144 Mc

QUESTION: I am a new amateur operator. What do you recommend for the best all-

See page 126 for New Reader Service

around omni-directional antenna for both mobile and fixed-station use on 144 mc?

ANSWER: Horizontally-polarized antennas are usually used on the 144 mc band. This rules out omni-directional jobs such as the vertical ground-plane, etc. Good results can be obtained from the "Halo" antennas which are horizontally polarized and are fairly omni-directional; that is, equally effective in all azimuthal directions. These jobs have been quite popular for mobile use.

Somewhat better results might be obtained with the "Turnstile" antenna, such as described in *QST*, April '59 and in the ARRL *Handbook*. It also can be used mobile.

Still better performance might be realized with the "Big Wheel" described and discussed in *QST*, Sept. and Oct. '61.

Another popular antenna is the "Squalo." For more information on this and the Big Wheel, I suggest you write to the manufacturer of such: Cush-Craft, 621 Hayward Street, Manchester, N.H. 03103.

Key Clicks with Eico 753

QUESTION: I am told that on c.w. my Eico 753 Transceiver creates loud key clicks. I have tried filtering the key circuit, but there also is a 0.1 mf capacitor across the key internally, so no improvement resulted. What do you suggest trying?

ANSWER: Under normal conditions the key clicks can be reduced by inserting a small size 5-6 henry filter choke in series with the hot leg to the key to provide some wave shaping.

A cause of bad clicks also may be due to self-oscillation or parasitics in the driver or p.a. Make sure the p.a. is properly neutralized. This may vary slightly from band to band. Clicks due to parasitic oscillations usually sound sort of warbly or bubble-like. There also may be a bad tube in the driver or p.a.

A cause of instability and poor keying may be traced to r.f. feedback due to improper lead dress around the p.a. The effect will show up mostly as chirp or a variation in frequency as the exciter drive is tuned through its range.

Make sure that the leads routed through the chassis cut out for the output-loading capacitor do not pass near the exposed end of the inner conductor from the shielded cable connected to terminal 1 on TB-19.

S.W. Broadcast Converter for 75S-3

QUESTION: I have a Collins 75S3B and would like to listen to the shortwave broadcast bands with it. Where can I find a diagram of a crystal-controlled converter (hopefully similar to the one in the ARRL *Handbook* for 20-15-10) which would use the 3.4-4 mc bands on the 75S-3B as an i.f. and allow coverage of the 9.4-10, 11.4-12, 15-15.6 and 17.4-18 mc bands?

ANSWER: You can employ the same converter referred to in the ARRL *Handbook*, with the following changes:

For tuning the r.f. and mixer stages, use a dual-section 365 mmf variable capacitor and Miller inductors C-5495-A (at r.f. input) and C-5495-RF (mixer input). This will cover the 5-18 mc range.

In the crystal oscillator use the following crystals: 6 mc for 9.4-10 mc; 8 mc for 11.4-12 mc; 11.6 mc for 15-15.6 mc; 14 mc for 17.4-18 mc. For the oscillator plate use Miller 4405 (3.1-6.8μh) with 15 mmf for 14 mc; 4405 with 22mmf for 11.6 mc; 4406 (6.7-15 μh) with 33 mmf for 8 mc; 4406 with 52 mmf for 6 mc.

Instead of the converter, you can obtain coverage on most of the desired frequencies by substituting auxiliary crystals in the 75S-3B, but will require quite a handful and will be less convenient.

Substituting NPN for PNP Transistors

QUESTION: How should I rewire negative-ground system solid-state gear for a positive-ground system?

[*Continued on page 115*]

Drake Converter-Review Corrections

On page 47 of July '68 *CQ* the suspicion stated near the top of the first column was erroneous. The actual reason why the crystals are provided for a 500 kc gap in the coverage of the low-frequency end of the band when the converter is used with a 14-14.5 mc 500 kc of the band for General class receiver, is to allow coverage of the first licensees and the first 500 kc of the segment designated for Novice-class operators.

In respect to paragraph 6, column 2, page 49, the measured noise figure for the SC-6 was 3.5 db.

At fig. 2B on page 49, the unbalanced skirts are due to sweep-generator non linearity in the 144 mc range.

VHF TODAY

BY ALLEN KATZ,* K2UYH

In our first column, April 1968, we briefly discussed an amateur radio station from the system point of view. This month we intend to go into the details of the receiving portion of that system.

The copyability of a signal is judged by the ratio of the received signal power to the received noise power. The absolute level of a received signal at the antenna terminals is very small. In order to be audible, it must be amplified to a level sufficiently high to drive head phones or a speaker. Noise is also present at the terminals of an antenna. It is the ratio of the signal power (at the antenna terminals) to the noise power (at the antenna terminals) which sets a limit on the ability of the best receiver to detect a signal; since amplification makes both the incoming signal and noise louder, see figure 1A.

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

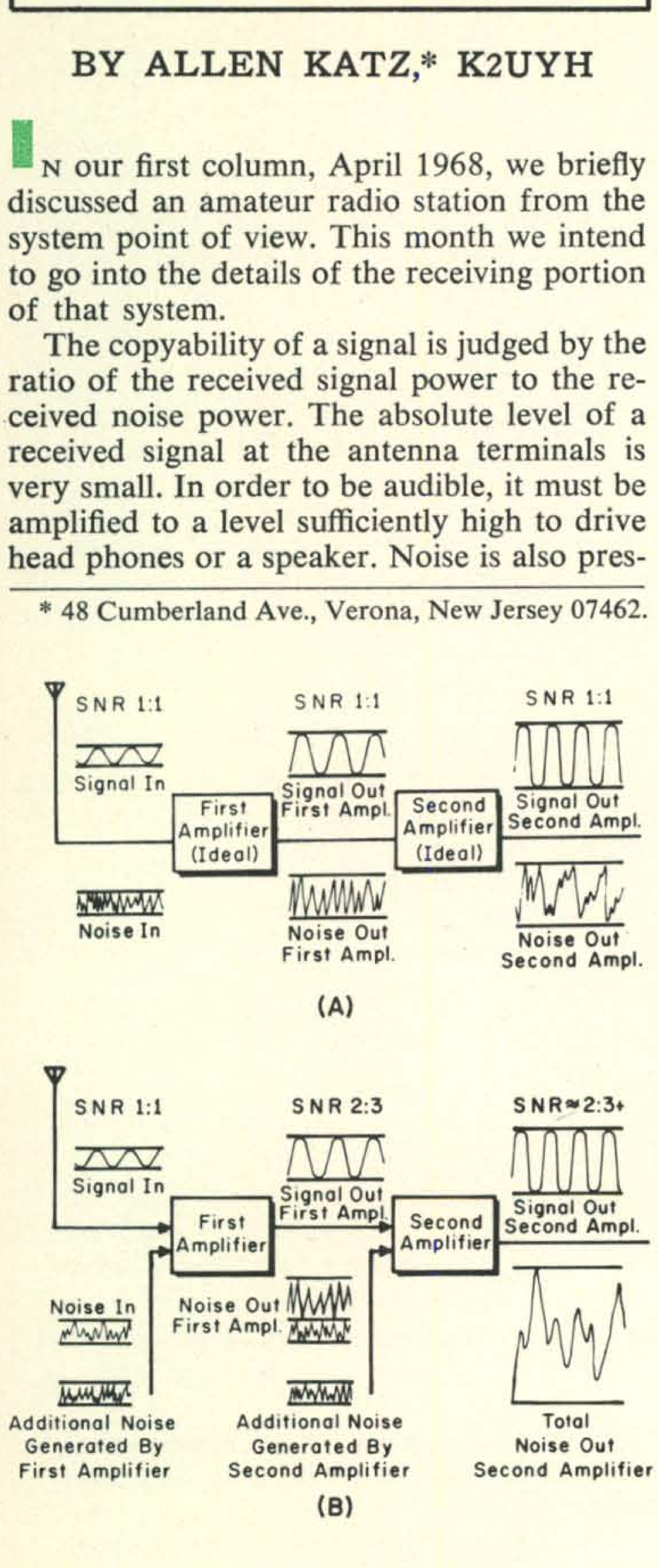


Fig. 1—Signal to noise relationship in a receiver. (A) shows a perfect receiver and (B) depicts an actual receiver.

A good receiver amplifies the signal and the noise from the antenna while adding very little noise of its own. A perfect receiver is one which amplifies the signal (and the input noise) while adding *no* noise of its own. Perfect receivers do not exist, although some devices approach them.

A measure of how well a receiver performs is the receiver's noise figure. Noise figure is defined as the input signal to noise ratio (SNR) of the device being considered divided by its output SNR. A perfect receiver would have a noise figure (NF) of unity or 0 db. Operating on the above definition mathematically, see figure 2A, we see NF is also equal to one plus the ratio of the noise added by the device to the noise into the device. Thus we must conclude that the NF of a given device (amplifier, mixer, etc.) depends on the level of the input noise. To avoid confusion NF is normally defined for an input noise power of 3.66×10^{-21} watts/cycle. This value is equal to the noise power generated by a resistor due to thermal agitation of its atomic structure at room temperature (270°K). In many cases it will be more convenient to think of noise power in terms of equivalent noise temperature (in degrees Kelvin) rather than in terms of watts/cycle. Noise temperature can easily be converted into watts/cycle by multiplying by *Boltzmans Constant*, see figure 2B.

It is the first stage of amplification which usually determines the overall NF of a receiver. Figure 1B illustrates this point. It shows that if the gain of the first stage is large, the noise added by the second stage will be almost negligible compared to the amplified noise of the first stage. The effect of noise of additional stages is of course even less. An idea of the amount of gain needed by the first stage to overcome the noise of the second stage can be obtained from the equation in figure 2C. This equation expresses the overall NF of two stages in cascade in terms of the individual NF's of the two stages and the gain of the first stage.

In terms of the system, we are not so much interested in the absolute noise figure of the receiver as we are interested in what a given NF can buy in terms of overall system SNR.

 See page 126 for New Reader Service

(A) Noise Figure:

$$NF = \frac{S_{in}/N_{in}}{S_{out}/N_{out}}$$

Letting $S_{out} = AS_{in}$ where A is the amplifier gain.
$N_{out} = A(N_{in} + \Delta N)$ where ΔN is the additive noise of the amplifier.

$$NF = \frac{S_{in}/N_{in}}{AS_{in}/A(N_{in} + \Delta N)} = 1 + \frac{\Delta N}{N_{in}}$$

(B) Noise Power in watts:
$N = KTB$
where:
$K = 1.38 \times 10^{-23}$ (Boltzmans Constant).
T = Equivalent noise temperature in degrees Kelvin.
B = Receiver bandwidth in cycles.

(C) Overall Noise Figure of Two Amplifiers:

$$NF_O = NF_1 + \frac{NF_2 - 1}{G_1}$$

Where:
NF_O = Overall noise figure of two amplifiers.
NF_1 = Noise figure of first amplifier.
NF_2 = Noise figure of second amplifier.
G_1 = Gain of first amplifier.

(D) From (B) we see that:
$\Delta N = K\Delta TB$
Where ΔT is equivalent Noise Temperature of the noise added by the receiver.
Similarly
$N_{in} = KT_{in}$
Where T_{in} is the equivalent noise temperature of the input noise.

$$\frac{\Delta N}{N_{in}} = \frac{\Delta T}{T_{in}}$$

and $$NF = 1 + \frac{\Delta T}{T_{in}}$$

But NF is defined for $T_{in} = 270°K$

Thus $$NF = 1 + \frac{\Delta T}{270}$$

$$\Delta T = 270\ (NF - 1)°K$$

(E) Overall Noise Temperature of a good 144 mc receiver with a 6CW4 front end:

$$T_{O1} = T_{in} + T = 800 + 290$$

$$T_{O1} = 1090°K$$

Overall Noise Temperature of a similar receiver with a transistor front end:
$T_O = 800 + 75 = 875°K$
System improvement in db is

$$10 \log \frac{SNR_2}{SNR_1} = 10 \log \frac{S/N_2}{S/N}$$

$$= 10 \log \frac{N_1}{N_2} = 10 \log \frac{T_1}{T_2}$$

$$= 10 \log \frac{1090}{875} = 0.9 \text{ db}$$

(F) Overall Noise Temperature of a system wi. a lossy transmission line (referred to antenna terminals):

$$T_O = (L-1)\ T_1 + L\Delta T$$

Where L = line loss.
T_1 = line temperature in degrees Kelvin.

Fig. 2—Receiver system equations.

As has already been pointed out the noise part of the SNR is due to two sources. One being the noise received from the antenna. This noise originates from several places. At low and medium frequencies, atmospheric noise predominates; as one proceeds into the h.f. and v.h.f. frequencies where the atmosphere becomes transparent to radio waves, Cosmic noise, extraterrestrial noise from radio stars, etc., dominates. At u.h.f. frequencies Cosmic noise drops off and the radiation of the Earth itself becomes important. At still higher frequencies the resonance of oxygen and water vapor molecules are the

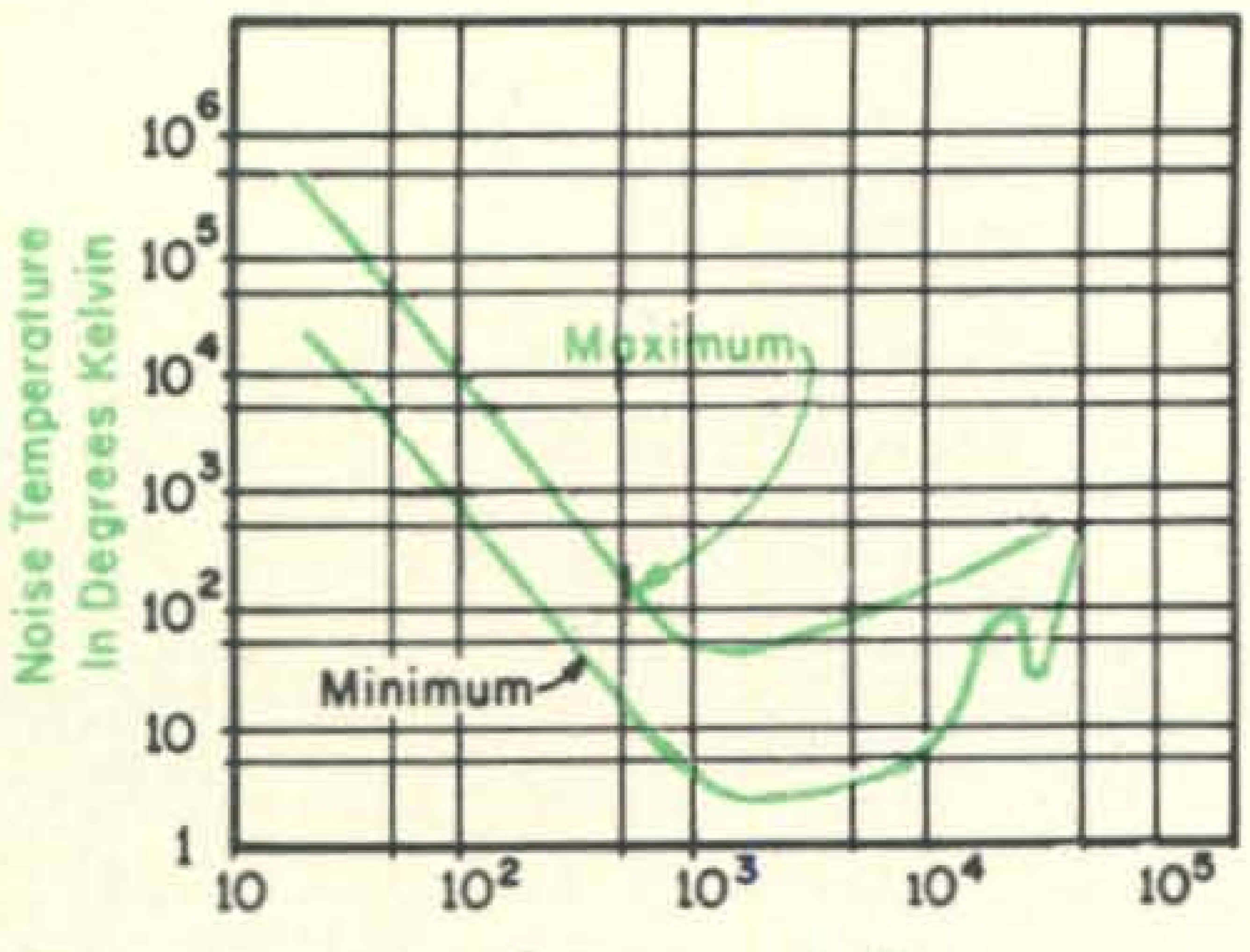


Fig. 3—Sky noise as a function of frequency.

major factor. Figure 3 is a plot of equivalent sky noise temperature versus frequency. Between 1 kmc and 10 kmc there is a broad valley where the sky noise is extremely low. Unfortunately for most amateur communication we can not take advantage of these low noise temperatures, since our antennas are normally pointed along the horizon and see the Earth's surface at its hot (approximately 300°K) temperature. Only for satellite or moon bounce communication are our antennas pointed at the sky, and even here we must be careful that our antenna does not have bad side lobes which can contaminate at low sky temperature by picking up ground radiation.

Adding to the noise coming from the antenna is the noise generated in the receiver. From the math of figure 2D we see that every

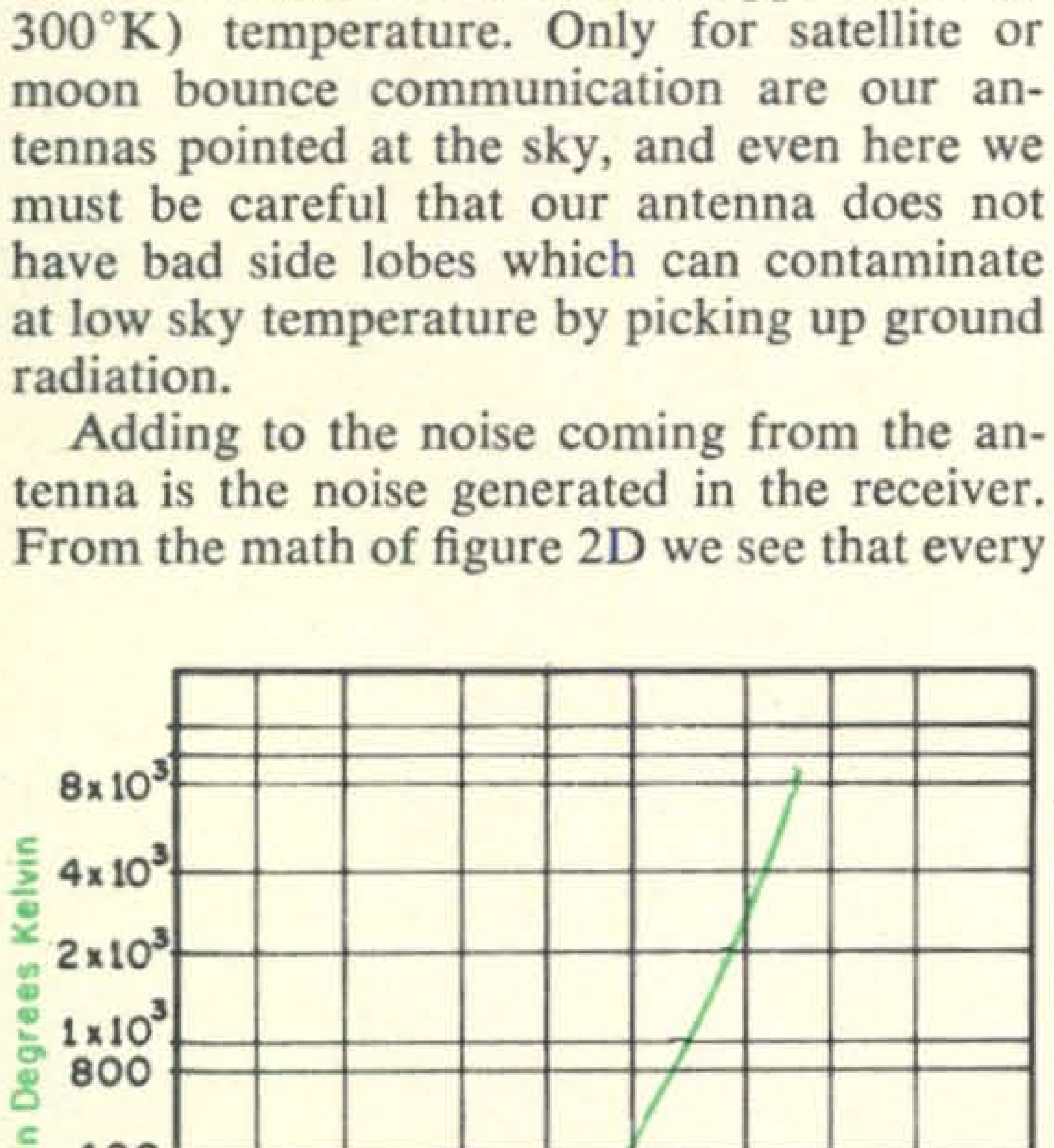


Fig. 4—The relationship between noise figure and noise temperature.

value of NF corresponds to a certain level of added noise (power) temperature. The relation between added noise temperature and NF is shown in figure 4. From the information of figures 3 and 4 one can make useful conclusions about the performance of various NF front ends.

Let's take the 144 mc band for an example. A good 6CW4 can produce a noise figure of about 3 db, or from figure 4, a noise temperature of 290°K. Adding this to the average two meter antenna noise temperature of about 800°K (from figure 3), we obtain 1090°K. This is the quantity which must be multiplied by K_B (see figure 2B) and divided by the received signal power to obtain the overall system SNR. It is interesting to calculate the gain in system performance obtained by going from a nuvistor preamp to a state of the art transistor preamp with a NF of 1 db, or 75°K noise temperature. The overall system noise temperature with the transamp is 800° plus 75° which equal 875°K. The system improvement as calculated in figure 2E is .9 db. Thus in this example a 2db improvement in noise figur nets us only a .9 db improvement in systen performance. On a quiet night with an an tenna pointed into the sky (as during moo bounce tests) the sky noise temperature ca be as low as 150°K on 2 meters. On these rar occasions a 2.9 db system improvement obtained for the above 2 db noise figure im provement. This figure is close to what on would regularly expect for a similar NF im provement on 432 mc. For terrestrial worl however, even at microwave frequencies th antenna noise temperature can not go muc below 300°K. On noisy nights, the antenn temperature on 144 mc can go as high 2,500°K. On these days the advantage gaine by going to the transamp is only .33 db. An tenna noise temperature on the h.f. bands a considerably poorer then the above wor case on two meters. Antenna noise so swam out the noise generated by h.f. receivers th one rarely if ever hears talk of h.f. receiv NF.

In the discussion thus far we have for t sake of simplicity left out one source of noi and that is the noise generated by a los transmission line. In attenuating both the si nal and antenna noise, it tends to make t noise added by the receiver appear large Further more in acting like a resistance at finite temperature, it adds some noise of

[*Continued on page 110*]

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

August	3-4	Romania Contest
August	3-4	Maryland/D.C. QSO Party
August	10-11	DARC WAE C.W. Contest
August	10-11	LABRE C.W. Contest
August	17-18	Indiana QSO Party
August	17-18	New Jersey QSO Party
August	24-25	QRP QSO Party
August	24-25	All Asian DX Contest
Aug. 31 - Sept. 1		LABRE Phone Contest
September	7-9	Wash. State QSO Party
September	7-8	VU2/4S7 C.W. Contest
September	14-15	VU2/4S7 Phone Contest
September	14-15	DARC WAE Phone Contest
September	14-15	SAC C.W. Contest
September	14-15	ZERO District QSO Party
September	21-22	SAC Phone Contest
September	21-23	Pennsylvania QSO Party
September	26-28	YLRL Howdy Days
October	5-6	Massachusetts QSO Party
October	5-6	C.A.R.T.G. (RTTY) Contest
October	5-6	WADM C.W. Contest
October	5-6	VK/ZL/Oceania Phone
October	12-13	VK/ZL/Oceania C.W.
October	12-13	RSGB 28 mc Phone Contest
October	16-17	YLRL Anniv. C.W. Party
October	19-20	Boy Scout Jamboree
October	**26-27**	**CQ WW DX Phone Contest**
October	26-27	RSGB 7 mc C.W. Contest
November	2-3	Okinawa (KR6) Contest
November	6-7	YLRL Anniv. Phone Party
November	9-10	OK C.W. DX Contest
November	9-10	RSGB 7 mc Phone Contest
November	9-11	ARRL SS Phone Contest
November	16-18	ARRL SS C.W. Contest
November	**23-24**	**CQ WW DX C.W. Contest**

Maryland D.C. QSO Party

Starts: 2200 GMT Saturday, August 3
Ends: 2200 GMT Sunday, August 4

Rules in last month's CALENDAR. Mailing deadline Sept. 1st and logs go to: Carl E. Anderson, K3JYZ, 14601 Claude Lane, Silver Spring, Maryland 20904

DARC WAE Contest

C.W.–Aug. 10-11 **Phone**–Sept. 14-15
Starts: 0000 GMT Saturday. Ends: 2400 GMT Sunday in each instance.

Complete rules and the WAE country list in last month's CALENDAR. Two new items in this year's rules. Operation is limited to 36 hours for single operator stations, and a "newcomers" division for those licensed less than a year.

Mailing deadline is Sept. 15th for C.W. and Oct. 15th for Phone. Logs go to: Walter Skudlarek DJ6QT, An der Klostermauer 3, D-6471, Hirzenhain, West Germany.

QRP QSO Party

Starts: 0200 GMT Saturday, August 24
Ends: 2300 GMT Sunday, August 25

Complete rules and power limitations listed in last month's CALENDAR.

Logs go to: Jim Loring Jr., WA1BEB, RFD 2, Bethel, Maine 04217

Wash. State QSO Party

Starts: 2300 GMT Saturday, September 7
Ends: 0500 GMT Monday, September 9

Rules for this one are of the conventional state party type and will be covered in next month's CALENDAR.

Romania DX Contest

Starts: 1800 GMT Saturday, August 3
Ends: 2400 GMT Sunday, August 4

Unfortunately this information was not received in time for the July issue.

Its the world working the YOs in this one, all bands, c.w. only.

There are four categories: Single and Multi-operator, both on one band and all bands.

Exchange: RST plus a progressive QSO number starting with 001.

Scoring: Each completed QSO counts 2 points.

Multiplier: The number of YO regions worked on each band. The YO regions are: AG, BC, BT, BU, BV, CJ, CR, DB, GL, HD, IS, MR, MS, OL, PL, RB, SV. YO stations will indicate their region, i.e. YO8RL/BC.

Final score: Sum of QSO points times the total multiplier from all bands. (max. of 85, 17 per band)

* 14 Sherwood Road, Stamford, Conn. 06905.

See page 126 for New Reader Service

The 4L3A Contest Expedition to Georgia in the foothills of the Caucasian mountains. The new Champions, L. to R.—UQ2IM, UQ2-0371, UQ2NX, UQ2LL, UQ2MS, George of UA6KAF, UQ2GA, UW6BA, UQ2CC, UQ2AO and Gunar of UQ2KCC.

Awards: Certificates to the top scorers in each country in each category. A Cup goes to the highest scoring foreign station. Contest QSOs can be applied to the many awards in the YO program, but must be made under a separate application. (Write for list.)

Mailing deadline is Sept. 1st and logs go to: Romanian Radio Amateur Ferderation, P. O. Box 1395, Bucharest 5, Romania.

LABRE DX Contest

C.W.–Aug. 10-11 **Phone**–Aug. 31-Sept. 1
Starts: 0001 GMT Saturday. Ends: 2400 GMT Sunday in each instance.

A better selection of dates for the c.w. section would have been advisable.

This is a world wide contest with operation on all bands, 3.5 thru 28 mc.

Exchange: The usual 5 or 6 figures, RS/RST plus a progressive QSO number starting with 001.

Contacts: (a) Between stations in the same country, O points, but OK as a multiplier. (b) Between stations of different countries *outside* the American continents, 1 point. (c) Between stations of different countries *within* the American area, 2 points. (d) Between stations in the American area and the rest of the world, 3 points.

Multiplier: Two types, 1 for each American area country worked on each band and 1 for each Brazilian call area. (PY1-PY9)

Final Score: Sum of QSO points times the sum of the two multipliers on a single band or from all bands.

Awards: Certificates to the top scorer in each country and Brazilian call area. (a) On each single band. (b) On all bands. (c) Multi-operator stations on all bands only. A station is eligible for one award only.

Logs must be received no later than Dec. 1st and go to: LABRE Contest Commission, Caixa Postal 2353, ZC-OO, Rio de Janeiro, Brazil.

Indiana QSO Party

Starts: 2300 GMT Saturday, August 17
Ends: 2300 GMT Sunday, August 18

Certificate hunters will find this party sponsored by the Indiana Radio Club Council, an excellent time to work for the Hoosier "500" Award. Particulars for this award may be obtained from Hewitt Mills, WA9LTI, 289 West Sumner Ave., Martinsville, Ind.

The same station may be worked on different bands and modes for QSO credits. (No suggested frequencies mentioned.)

Exchange: QSO nr., RS/RST and QTH County for Ind. stations, state, province or country for others.

Scoring: Ind. multiply total number of contacts by sum of states, provinces and countries worked. Others multiply contacts by total of different Ind. counties worked. (max of 92)

Awards: Plaques to the highest scoring stations within and outside Indiana. Certificates to leaders in each Ind. county, state, province and country. Multi-operator stations are also eligible for awards.

Include a summary sheet and a signed declaration with your log and also a s.a.s.e. if results are desired.

Mailing deadline is Sept. 16th and logs go to: Robert A. Lyles, K9HYV, 706 Spring Street, Michigan City, Ind. 46360

New Jersey QSO Party

Two Periods:

1900 to 0600 GMT Sat./Sun. Aug. 17-18
1200 to 2300 GMT Sunday, August 18

This is the ninth annual Party sponsored by the Englewood ARA. Phone and c.w. are considered the same contest. The same station may be worked on each band and mode.

Exchange: QSO nr., RS/RST and QTH County for N.J., ARRL section or country for others.

Scoring: Out of state, multiply number of completed contacts by the N.J. counties worked. (max. of 21) New Jersey stations W/VE QSOs count 1 point, DX QSOs 3 points. Multiply total QSO points by ARRL sections worked. (max. of 74) N.J. stations may work in state stations for QSO and multiplier credits.

Frequencies: 1810, 3530, 3740, 3900, 7030, 7250, 14075, 14275, 21100, 21300

28800 and 50-50.5, 144-146.

Awards Certificates to the 1st place winner in each N.J. county, ARRL section and each country. Second place awards if four or more logs received from that section. There are also Novice and Technician awards.

Indicate the multiplier *only* the first time worked and include a summary sheet with log.

Logs must be in the hands of the Englewood A.R.A., 303 Tenafly Road, Englewood, N.J. 07631 no later than Sept. 14th. Include a s.a.s.e. if results desired.

All Asia DX Contest

Starts: 1000 GMT Saturday, August 24
Ends: 1600 GMT Sunday, August 25

The 9th annual All Asian contest is again sponsored by the JARL. Its the Asians working the non-Asians, on all bands, c.w. only.

Two classifications, single and all band. Operation limited to single operator only.

Exchange For OM stations, five figures, RST plus your age. YLs, RST plus OO.

Scoring One point per contact. Asians use non-Asian countries for their multiplier, non-Asians count Asian countries as their multiplier. Use the DXCC country list.

Final score For a single band, total QSO points times the countries worked on that band. All band, total QSO points multipled by the sum total countries from all bands.

Awards Certificates to the top scorer on each single band in each country. And the three highest scorers on all bands in each country. There are additional awards for each continental leader on all bands. (*Still no awards by USA call areas.*)

Use a separate log for each band, include a summary sheet showing the scoring, your name and address in BLOCK LETTERS, and the usual signed declaration that license and contest rules have been observed.

Entries must arrive no later than November 30th and go to: JARL Contest Committee, P. O. Box 377, Tokyo Central, Japan.

VU2/4S7 DX Contest

C.W.—Sept. 7-8 —Sept. 14-15
Starts: 0600 GMT Saturday. Ends: 0600 GMT Sunday in each instance.

The object of the contest is for DX stations to work as many VU2/4S7 stations as possible. Use all bands or a single band. The same station may be worked once on each band. C.W. and phone are separate contests.

A view of the lay-out of 4L3A. The tents in the foreground were used for living quarters. The three large tents housed the equipment and operating positions. Those mountains in the background look mighty cold.

Exchange The conventional five or six figures, RS/RST plus a progressive QSO number starting with 001.

Scoring For DX stations, 2 points for each contact on each band with a VU2/4S7 station. There was no mention of a multiplier. The final score therefore would be the total QSO points. (A separate scoring system is used by the VU2/4S7 stations.)

Awards Certificates to winners on a single band and on all bands, in each country and call areas of W/K, JA, SM, UA, VK and ZL. There are also awards for SWLs. (They score 2 points for each VU2/4S7 and 1 point for each DX station reported in the contest.)

Include a summary sheet with the scoring, a signd declaration that all rules and regulations have been observed and your name and address in BLOCK LETTERRS.

Mailing deadline is October 15th to the ARSI Contest Committee, Post Box 534, New Delhi 1, India.

SAC DX Contest

C.W.—Sept. 14-15 —Sept. 21-22
Starts: 1800 GMT Saturday. Ends: 1800 GMT Sunday in each instance.

Its the world working the Scandinavians on all bands, 3.5 thru 28 mc. The same station may be worked on each band for QSO and multiplier credits. There are two classes, single and multi-operator.

Exchange The conventional five or six figure serial number, RS/RST report plus a progressive QSO nr. starting with 001.

Scoring Each completed QSO counts 1

[*Continued on page 98*]

CQ Announces
PROJECT UP-STEP

EXACTLY ONE YEAR AGO CQ changed printers—and with that change we instituted many improvements and new features in the magazine. Included in those improvements were more pages, full color covers, color inside the magazine, perfect binding, and a general improvement in the quality of paper and printing production.

WE'RE NOW READY to go ahead with phase two of our long-term plans for a better CQ. This phase will directly benefit our readers with more articles, more features, and more pages. Our present plans are to enlarge CQ in number of pages as follows: August, 128 pages; September, 136 pages; October, 144 pages; November 152 pages. What happens after that will depend on how you, our readers, respond to what we're doing.

IT'S NO SECRET that the ham radio field is getting more competitive every month, and we intend to keep CQ on top by giving our readers more good material than the other magazines. To do this we need more subscribers, especially among those readers who are buying their copies on newsstands and jobber counters. That will free the single copies for even more new potential readers.

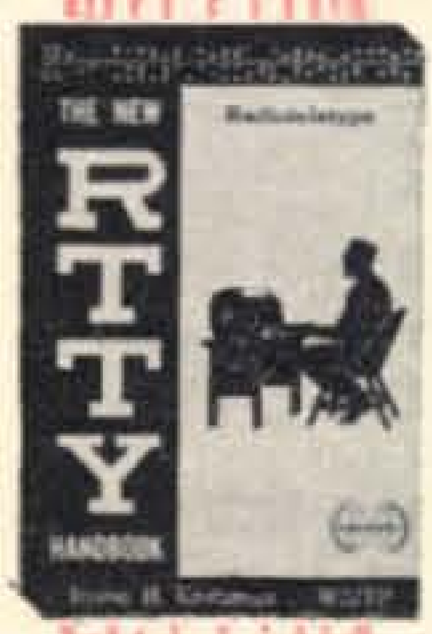
SO HOW ABOUT JUMPING on the CQ Bandwagon with your subscription. You'll be assisting us in the bigger and better CQ that we have planned for the months ahead. And get your friends and fellow club members to subscribe as well. Remember, what comes in from subscriptions will be spent to give you more great reading.

See page 126 for New Reader Service

CQ BOOK MART

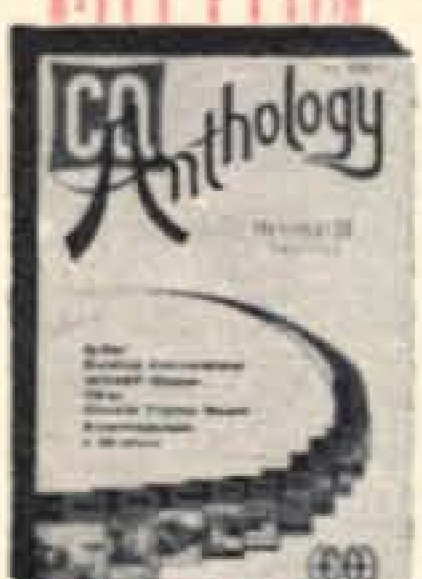
ANTENNA ROUNDUP Vol. II

Cat. #119-2. Here's your chance to get a copy of one of the most comphensive books on antennas ever offered to the Amateur. Ten big theory articles backed up by 82 detailed and illustrated construction projects for VHF on into microwave, from long-wires to 17 element beams and Sterba Curtain arrays.



THE NEW RTTY HANDBOOK

Cat. #116. A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section on getting started, written by Byron Kretzman, a well known authority in the field.



CQ ANTHOLOGY I

Cat. #102-1. We've looked back through the years 1945-1952 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out and are unavailable.

SURPLUS SCHEMATICS

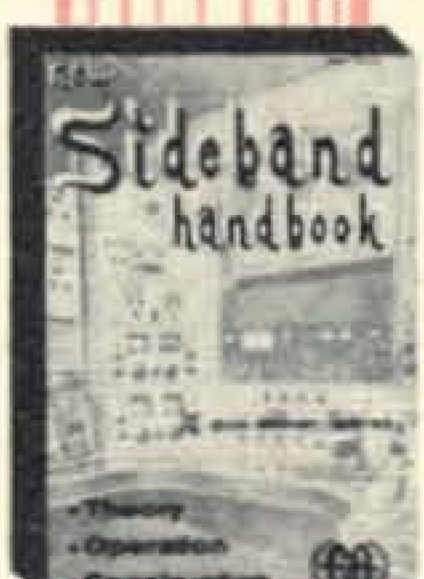
Cat. #117. This is a book literally loaded with schematics for all the currently popular pieces of surplus gear. Most amateurs are well aware of the problems encountered in purchasing seemingly inexpensive surplus units, only to find that no schematic diagram is available.

VHF FOR THE RADIO AMATEUR

Cat. #115. If you are, or are planning to be a VHF operator you can't afford to be without this dynamic new handbook written especially for you. Filled from cover to cover with all new and original construction material presented so you can understand it.

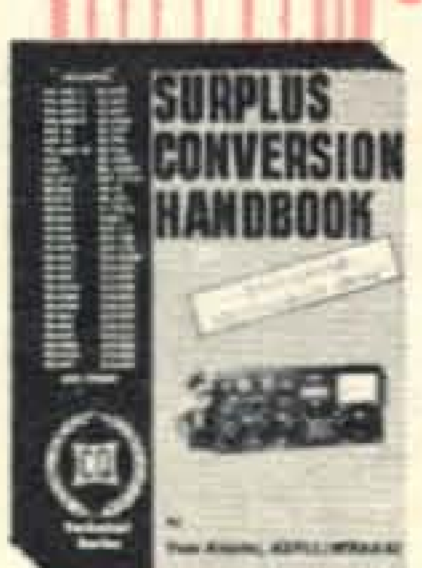
ANTENNA ROUNDUP Vol. I

Cat. #119. A common denominator for all ham stations is the antenna. Here at last is the cream of antenna information packed into a 160 page book. Forty-seven information-packed articles that will dispel much of the mystery surrounding antennas.



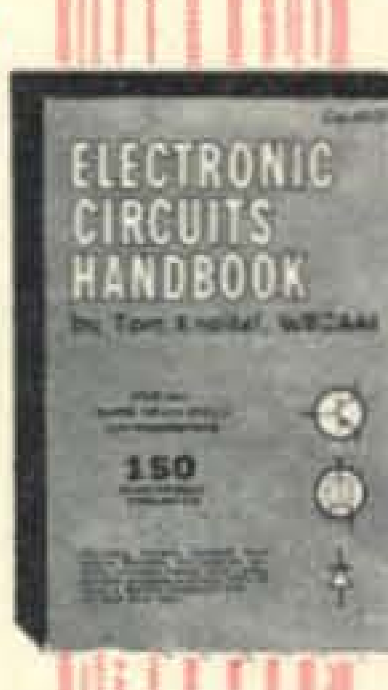
SIDEBAND HANDBOOK

Cat. #103. One full year in the preparation of this terrific volume. This is *not a technical* book. It explains sideband, showing you how to get along with it . . . how to keep your rig working right . . . how to know when it isn't . . . and lots of how to build-it stuff, gadgets, receiving adaptors, exciters, amplifiers.



SURPLUS CONVERSION HANDBOOK

Cat. #122. Contains 192 pages of conversion articles including the famous Command Set's plus a whole slew of the most popular military surplus gear including such gems as: SCR-522, ART-13, BC603, BC659, ARC 1, ARC 3, etc. Actually, it covers almost every piece of surplus gear worth the effort to convert for ham use.



ELECTRONIC CIRCUITS HANDBOOK

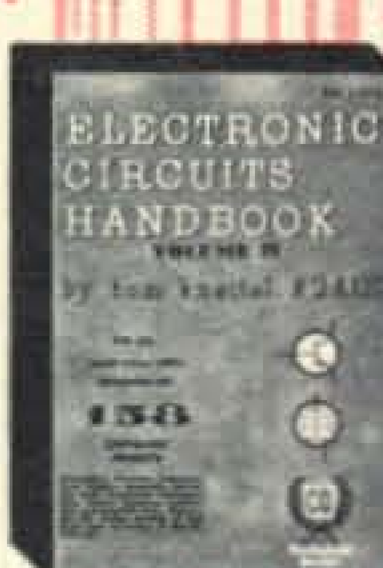
Cat. #121. Describes and discusses in detail 150 of the most often needed circuits around the shack. Novices and old-timers alike will find many valuable circuits here ideal for construction projects. Eleven great chapters cover a multitude of circuits for all.

SHOP & SHACK SHORTCUTS

Cat. #120. Here is a collection of hundreds of hints, kinks and short cuts which should be part of the library of every experimenter ham and CB'er. A veritable gold mine that will help save time, improve their shop techniques, dress up their shacks, and increase the efficiency of their equipment.

CQ ANTHOLOGY II

Cat. #102-2. Top favorite CQ articles from 1952 to 1959 . . . including some you may have missed . . . compiled into one new information-packed book! No more need to try to locate sold out back copies of CQ. This Anthology includes past articles of lasting interest to every amateur radio enthusiast. Over 250 pages of text.



ELECTRONIC CIRCUITS HANDBOOK VOL. II

Cat. #121-2. Tom Kneitel, K2AES, does it again with this sequel to his best selling Volume I. This time it's 159 additional circuits which will appeal to all Every shack will have a spot for this book. All circuits fully described in text with complete detailed construction steps plus schematics.

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Cat. No.	Name	Price	Order	Cat. No.	Name	Price	Order
99	TVI Handbook	1.75		115	VHF for the Radio Amateur	3.50	
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103	New Sideband Handbook	3.00		119-1	Antenna Roundup vol. 1	3.00	
105	New Mobile Handbook	2.95		119-2	Antenna Roundup vol. 2	4.00	
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Contest Calendar [*from page 95*]

point. The multiplier is determined by the SAC countries worked on each band. (LA, JW, JX, OH, OHØ, OX, OY, OZ, SM/SL/SK, 9 per band.)

Final Score: Total QSOs times the total multiplier from all bands. Max. of 45.

Awards: Certificates to the two top scorers in both classes in each country and each USA call area.

Logs: Date/time in GMT, station worked, number sent/rec'd, band and each new multiplier as worked. A summary sheet showing the scoring, name and address in BLOCK LETTERS and a signed declaration that all rules and regulations have been observed.

Mailing deadline is October 15th. This year logs go to: SSA Contest Manager, Karl O. Friden, SM7ID, Valhall 26200, Angelholm, Sweden.

CQ World Wide DX Contest

Phone–Oct. 26-27 **C.W.**–Nov. 23-24
Starts: 0000 GMT Saturday. Ends: 2400 GMT Sunday in each instance.

Rules will remain the same as previous years and will be given in details next month. Following brief rundown for the benefit of our friends in remote areas.

1. All bands may be used, 1.8 thru 28 mc.
2. Exchange, RS/RST plus your Zone.
3. QSO point value: (a) 3 points between stations in different continents. (b) 1 point between stations on the same continent but in different countries. (c) Contacts between stations in the same country are permitted for Zone and/or Country multiplier but have NO QSO point value. (d) Exception: Contacts *between* stations in the North America (WAC) boundaries count 2 points. (This applies to stations in North America *only*.)
4. Your multiplier is determined by the number of Zones and Countries worked on each band.
5. Final score: (a) Single band, Zones plus Countries multiplied by QSO points. (b) All band, sum of Zones plus sum of Countries multiplied by the total QSO points.
6. Competition: Three divisions. (a) Single operator, single band or all band. (b) Multi-operator, single transmitter. (c) Multi-operator, multi transmitter. Multi-operator stations judged on all band *only*.
7. Definition of a multi-operator station: Single transmitter, only *one* signal permitted. Multi Transmitter, only *one signal per band* permitted.
8. Use separate log for each band, 40 contacts to the page. Indicate the zone and country *only* the first time worked.

Official rules including a list of 12 or more Trophies donated by prominent hams and Clubs all over the world will appear in next month's issue. These rules as well as official log forms and summary sheets are now available from *CQ*. Include a large s.a.s.e. with sufficient postage or IRCs to cover your request. NOW is the time to make your request, not the week before the contest. Our address: CQ World Wide DX Contest, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050

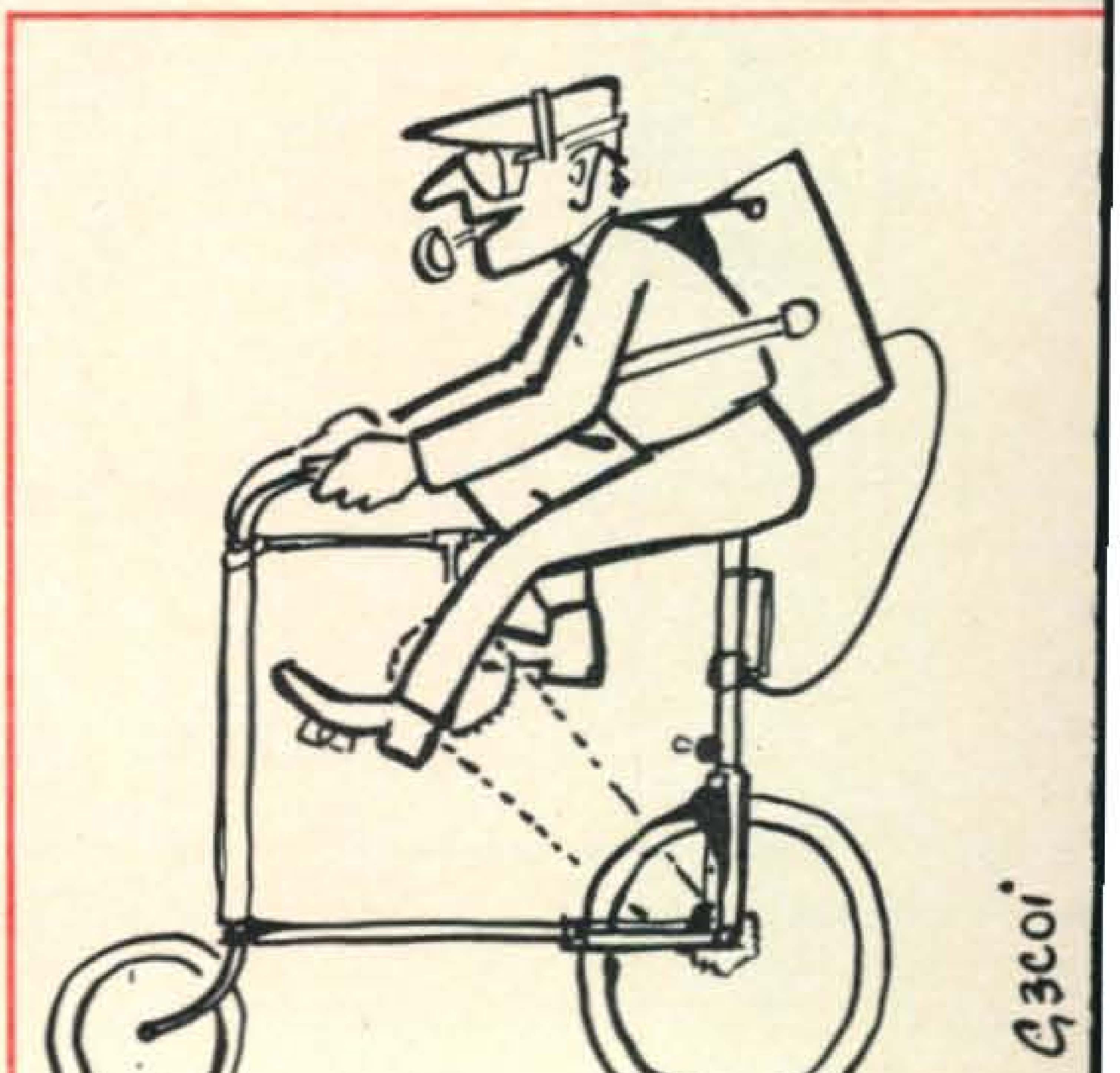
Editor's Notes

The week-ends are really getting crowded, aren't they? Actually the bands are not as full of contest activity as it would appear from the list of events. Most of the listed contests do not generate the activity to make them objectionable to the non interested, and the state parties usually confine their operation to a narrow band of frequencies.

So when it comes down to actual facts there are only a handful of activities that take over the bands on a week-end.

A better choice of dates however would be advisable in some cases. I only report these events, not dictate when they should be held. A check of the CALENDAR should prove helpful in deciding on a good date.

73 for now, Frank, W1WY



"... and the antenna here is a single element quad, gamma matched ..."

See page 126 for New Reader Servic

THE awards PROGRAM

BY ED HOPPER,* W2GT

THE August, "Story of The Month" is about Corwin Arndt, WAØLRQ.

Corwin Arndt, WAØLRQ

Ham radio had its beginnings as far as nterest was concerned with a tour of Vic's WØGYM) shack as a Cub Scout over 20 ears ago. However, the Novice ticket did not rrive until April of 1965 and the General month later.

The first rig was a Heath HX-20 and HR-0. After being hit by lightning, this was eplaced by the present rig, a Galaxy 5, Aark II.

After graduating from Peru State College 1958, Corwin taught biology and general cience for seven years. A master's degree as earned from the University of Nebraska 1964 and from 1965 to February of 1968, e was the superintendent of schools at Pleasnton, Nebraska. Recently he has been a part f a management training program with an l company, but as this article is being read, orwin should again have a contract with a hool in an administrative capacity.

Three future hams have arrived from a arriage in 1959.

Mike, WAØKGD, and Corwin took a 17 ebraska county trip last December and orked over 440 contacts. Corwin has made trips through the western part of Nebraska, cently, giving out well over 700 contacts. early February a trip was made to Seattle, ashington and over 1100 contacts were ade before the rig blew up.

At the time of this writing, Corwin has er 1300 counties confirmed, the first 500 ere on 75 meters and all confirmed in less an a year. In his travels through Colorado, ansas, Nebraska and the Washington trip, more than 4000 contacts have been made within the past year, with county hunters. About the only gripe about the mobile trips is that many fail to use the regular county hunter QSLs with s.a.s.e.'s, and there is just not enough time to copy from the logs for those who don't use them, try filling out 500 or more QSLs and you will realize how much work it is. But if you make out a card for him to check against his log and then sign and put in the s.a.s.e. you sent, everyone will be happy.

Operation at present is as WAØLRQ/Ø and the present QTH is: Box 348, Westminster, Colorado 80030. Oh yes, having been a School Super., most hams think Corwin is along in years, what a surprise to learn that he is but 31. (Those county hunter QSLs mentioned may be obtained from Cliff

Corwin Arndt, WAØLRQ
(That young school super.)

* 103 Whittman St., Rochelle Park, N.J. 07662.

New York State County Award

Corne, K9EAB, 711 West McClure Ave., Peoria, Illinois 61604 for $3.50 per 500, postage paid in the USA).

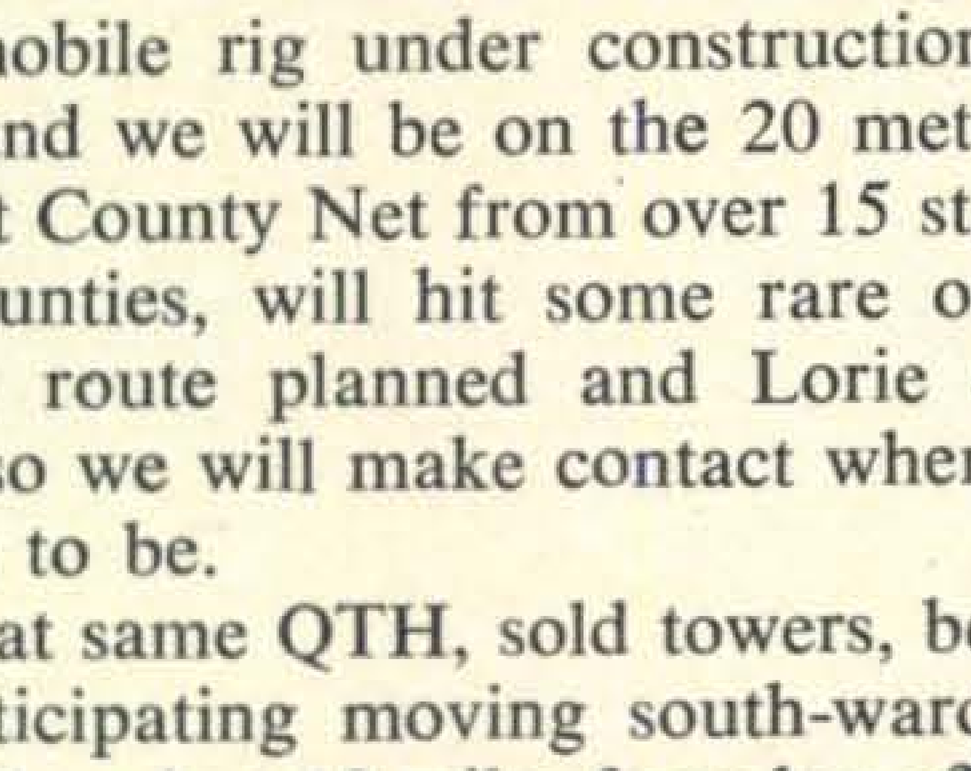
Letters

Otts, K8CIR, writes: "USA-CA Plaque hangs with pride in my shack. Completing spring term shortly, but will attend summer session at college to obtain degree. Completing school after 20 years.

Lorie, K8CTY and I plan vacation after summer school term which ends August 30th. New mobile rig under construction (HW-32A) and we will be on the 20 meter Independent County Net from over 15 states and 200 counties, will hit some rare ones. No definite route planned and Lorie says no skeds, so we will make contact wherever we happen to be.

Still at same QTH, sold towers, beam and rig, anticipating moving south-ward, but a new college just 18 miles from her offered the courses I wanted, so have remained. Sure miss the six element beam, "S" line, etc. . . . Have a temporary vertical and low power, but school for the last year has taken every second of my free time. Best regards to your many readers".

Cliff, WAØKXJ writes: "For the Nebraska QSO Party, I took a trip with a couple of friends, one Novice and one General. Perhaps your readers would be interested in some of the details.



Worked All Boroughs Award
(NYC & LI)

The other operators were Jay, WAØPKE and Dan, WNØTGK. We rented a 1½ KW genny and operated "mobile" with 3 vertical antennas mounted on the station wagon, rigs on the tailgate and nearby picnic tables. Total QSOs were about 300, as a great amount of time was taken in moving from county to county. We operated from Otie, Johnson, Pawnee, Richardson and Nemaha counties—several of these are especially rare. The following stations were worked from all 5, K4ARF, K4YWX, W4RNL, VE1AE and VE3BMR; with an additional seven worked from 4 of the five. It pays to re-check a mobile station's QTH!

Several other stations made trips in this contest. KØQIX/M operated from a total of 19 counties for 600 QSOs. Also WAØOMY, WAØGVJ, and WAØKGD operated either mobile or portable from rare QTHs.

Although I had planned Missouri QSO Party activity, I will be graduating from high school and will probably be too busy for this. However, this summer, Minnesota and Illinois QSO Party trips are planned. I will also be operating as /2 in the New York QSO Party with a tiny 30 watt homebrew transceiver en-route to England and Ireland where I will operate with a G5 call in England and in Ireland as E12VAE/P.

I received my USA-CA Award a few months ago and am very impressed with the certificate, thanks, Ed.".

Marv., WB2SJQ writes: "It was a real pleasure to hear from you so quickly in response to my letter. At that time, I mentioned I had 1950 counties confirmed, but now I have a total of 2027. I can see that my biggest mistake was not starting off with the original 500 and work my way up the ladder, I must admit it was a lot of work transposing 2000 entries from my original book.

I started this county hunting strictly by accident about January 1967. I accidentally came across the county hunters on the 20 meter net. I thought it was strictly a contest but a few inquiries put me wise to what was happening. I remember that I had my 1[illegible] year old son check all my QSL cards in my possession for the various counties, and much to my chagrin I had only 127 counties confirmed.

Needless to say, I've put in a lot of hours on the net and I am starting to reap the rewards. I feel I have made good ham-friend[illegible]

See page 126 for New Reader Servi[illegible]

through this, and I look forward to coming home after a hard day in the salt mines and help participate with the group."

Awards

Worked All Boroughs Award: Sponsored by the New York City, Long Island Chapter of the National Awards Hunters Club. Requirements: For stations in 2nd Call Area—Work 25 stations in the following proportions: 2 Bronx county, 7 Kings county, 2 New York county, 7 Queens county, 2 Richmond county = total of 20 stations. PLUS one member of the NAHC International Club in each borough for a grand total of twenty five (25) stations. Requirements: For stations over 25 miles from New York City—Work 15 stations in the following proportions: 1 Bronx county, 5 Kings county, 1 New York county, 4 Queens county, 1 Richmond county = total of 12 stations. PLUS three (3) members of the NAHC International Club representing any of the five borough for a grand total of fifteen (15) stations. All band and mode endorsements. Mail GCR and $1.00 to Awards Chairman, Phil Velders, WB2MRK, P. O. Box 60, Bronx, New York 10453.

New York State County Award: Sponsored by the New York City, Long Island Chapter of the National Awards Hunters Club. This Award is issued in five classes. Class 5 (Basic Award) for working fifteen (15) New York counties; Gold Seal endorsements for each additional 15 counties up to the total of 62. Thus: Class 4 is for 30 counties; Class 3 for 45 counties; Class 2 for 60 counties and Class 1 for 62 counties. For Basic Award, send GCR and $2.00 to: Awards Chairman, Phil Velders, WB2MRK, P. O. Box 60, Bronx, N.Y. 10453. For additional Gold Seal endorsements, send GCR.

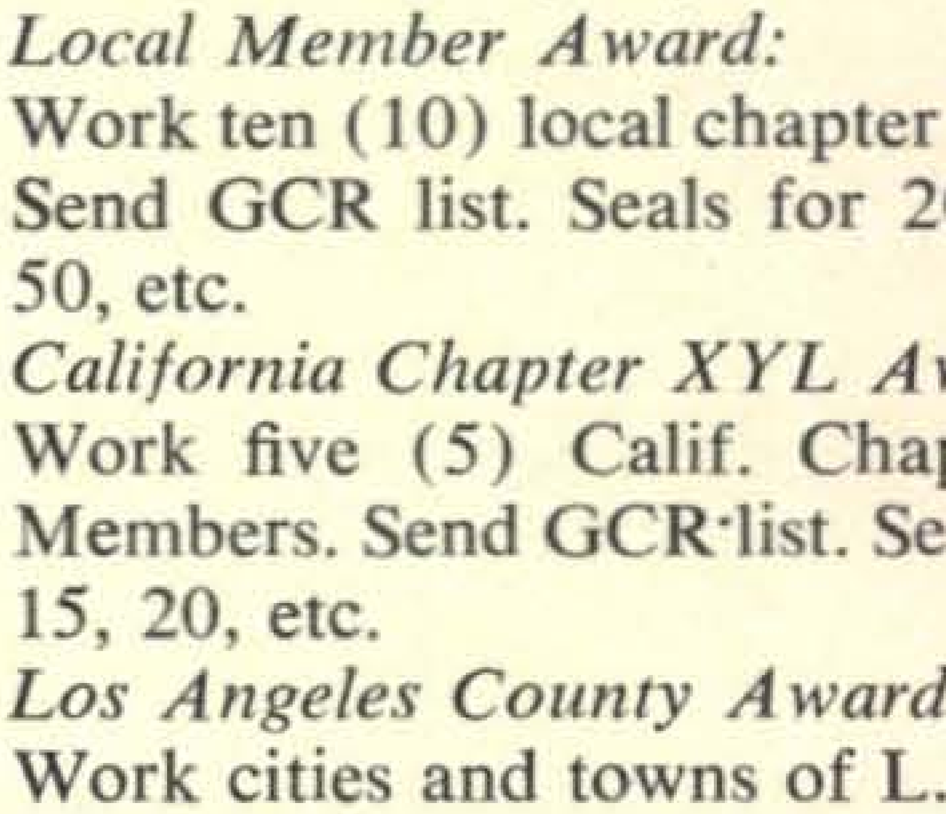
Building Managers Award: Also sponsored by the NYC, Long Island Chapter of the NAHC. Requirements: For stations in the 2nd call area, work 5 building managers for basic award, and 5 more for Gold Seal endorsement. Requirements: For stations outside the 2nd call area, work 3 building managers within a 35 mile radius of their QTH, and 1 additional one for the Gold Seal endorsement. Outside of the 35 mile radius, the requirements are: work 1 manager for basic award and gold seals for 3. Send GCR and $1.00 to: Awards Chairman, Phil Velders, WB2MRK, P. O. Box 60, Bronx, N.Y. 10453. Known Building Managers are:

General Certificate
(Calif. Chapter NAHC)

K1VST, K1TYM, W1DFR, K1UHU, WA2YNA, WB2YBT, WB2YUL, WB2TPV, WB2RVF, WB2HMS, WB2GOM, WA2QNH, WA2SAZ, and WA2SNT.

Revised Program for California Chapter of National Awards Hunters Club: per Awards Chairman—Mildred Fox, WB6FND, 5610 Gifford Ave., Maywood, California 90270.

1. Initiation fee and lifetime chapter membership dues, $3.00
   a. Licensed XYL free with OM registration.
   b. Jr. operator of same family, $1.00.
2. Cost of certificates $1.00 each.
3. Ways to earn certificates.
   A. *California Charter Member Award:* Work five (5) charter members and send GCR list.
   B. *National Full Member Award:* Work any five (5) FULL MEMBERS (N.A.H.C. # req.). Send GCR list. Seals for 10, 15, 20, etc.
   C. *Local Member Award:* Work ten (10) local chapter members. Send GCR list. Seals for 20, 30, 40, 50, etc.
   D. *California Chapter XYL Award:* Work five (5) Calif. Chapter XYL Members. Send GCR list. Seals for 10, 15, 20, etc.
   E. *Los Angeles County Award:* Work cities and towns of L.A. county as listed on map of metropolitan Los



Net Award
(Calif. Chapter NAHC)

See page 126 for New Reader Service

Criminal Summons
(for non-QSLer)

Angeles. Stations to count would have to be permanently located or established portables. Mobiles do not count. Basic award for fifty (50) cities/towns. Send GCR list. Seals for 75, 100, 125, 150, etc.

F. *California Counties Award:*
There are fifty eight (58) counties, stations to count must be permanently located or established portables. Mobiles do not count. Basic award for ten (10) and Seals for each additional eight (8). (6 seals). Send GCR list.

G. *Local Net Award:*
Free certificate for 25 check-ins to Net. Send list of dates and s.a.s.e. Seals for 25, 50 and 75.

H. *Booster Award:*
Free certificate for signing up five (5) new members. Send list and s.a.s.e. Seals for 10, 15, 20 and etc.

I. *General Certificate:*
Stations over 150 miles from L.A. City Hall, or DX Stations work 5 members of Calif. Chapter. Send GCR List.

J. *General Certificate:*
Stations outside continental United States work two (2) members of Calif. Chapter NAHC. Send GCR list and 3 IRCs.

K. *Net Certificate:*
DX stations need only ONE check-in to Net for FREE Net certificate.

Notes: All AWARDS count 1 point, and if endorsed for Band & Mode (except Net award) add one more point. All Seals count 1 point. Maximum number of Seals on any one certificate is 6. Seals require s.a.s.e. when earned at a later date. No date or time limits for certificates. GCR means General Certification Rule—which requires a list signed by two Amateurs with the following information: date, time, band & mode, city/town or county (if required for certain certificates). For any additional information, send s.a.s.e. to WB6FND.

Editors Notes

New Awards Custodian for **Worked All Parishes of Lousiana Award** as pictured and described in *CQ* September 1967 and for **Worked All Lafayette Award** as pictured and described in *CQ* November 1967—Bill Allen, W5NQR, 308 Karen Drive, Lafayette, Louisiana 70501. Another new idea to help get QSLs, put up by Darrel, W8TIN. It is made like a Justice Court Criminal Summons, and should sure jolt the recipient into sending a QSL by return mail, but fast!

Regarding our USA-CA Award, *YES*, I will be pleased to endorse them for *All Fixed Stations* or *All Mobile Stations*.

Regarding rare Kalawao county, Hawaii. In a letter from Ross, KH6GJW to Jim, K1QZV, the following information was given—as this is being written, Ed. KH6GLU (*perhaps with the help of Ross*) will be active from Kalamao during NFD. KH6TS is the only active resident ham in Kalawao county and seems to operate only on 7 mc.

Oh yes, the NEW QTH of Ed. DeYoung, KH6GLU/K6CAA/KP6AP/VR3DY, is: P. O. Box 762, Kaunakakai, Molokai, Hawaii 96748.

Be sure to check CONTEST CALENDAR for all data on (my Garden State), the Ninth New Jersey QSO Party, August 17-18.

I still receive much interesting and important data that arrives weeks and weeks too late, may I repeat that my deadline is 2 months prior to printing—material for my October column should be in my hands by August 1—so take a minute right now and send that data to me, also tell me—How was your month? 73, Ed., W2GT. ■

"Helloooo, world!"

See page 126 for New Reader Service

SURPLUS sidelights

BY GORDON ELIOT WHITE*

Time marches along, and much as we may feel nostalgia for the old BC-348's, AN/ART-13's, and even SCR-522's, the state of the electronic art has moved eons since the World War II era, which after all, ended 23 years ago. Many WWII designs, as for example the AN/ARC-5, were ahead of their day, and survived for nearly a quarter-century, but even these are thoroughly obsolete now except as a basis for construction projects or as a portable or Novice receiver.

Receivers do last longer than any other type of surplus, since they will serve their purpose, to a degree, until their transformers melt or their capacitors molder away. Mil Spec equipment seems to go on forever, but crowded radio bands, jamming, general QRM, requirements to reduce spurious signals, RTTY, Twinplex, MUX, synchronous transmission, computer techniques, etc., demand 1968 equipment.

Though Surplus is inherently a few years behind the state of the art, it is surprising how rapidly new equipment is becoming available. And when Viet Nam is over . . .

Changing commercial or military demands, such as the narrow bandwidth now required of mobile f.m. gear, and the elimination of most tubes in military equipment, has sent tons of still-usable electronic goodies to the surplus depots, for example the FCC-3 which was replaced by the transistorized AN/FGC-61 which has a fraction of the power drain and still handles 16 channels of multiplex RTTY in a quarter of the space.

* 5716 N. King's Highway, Alexandria, Virginia, 22303.

State-of-the-art equipment now can pack 60 channels of multiplex communications into a terminal the size of a small footlocker, using integrated circuitry. New receivers, using sophisticated noise-blanking logic circuits, can handle adjacent-channel transmitter interference without cross modulation with optimum selectivity, and signal-to-noise ratios unknown a few years ago.

If this sounds like the future talking, it is the result of two days of wandering through the annual Washington Armed Forces Communications and Electronic Association show. About-to-be-surplus goodies included: a constant current rheostat, for RTTY loops, capable of stabilizing loop current at 60 ma despite wide variations in loop voltage or resistance. Using one of these, if you pull out a couple of printers, the reperf magnets won't start to smoke.

Also in the RTTY line, a new "isographic plotter" will drive a Teletype machine to produce maps or charts. Developed to "draw" military maps via teleprinter lines, the I.C. logic circuits involved may within a few years become available to us in surplus.

New direction-finding techniques are now in being that use a different principal than the old null method—now the use of highly-directional miniaturized antennas permit homing on the *peak* signal—for instance in the AN/ARD-19 ADF now going into USAF planes. The set can "DF" up to four different frequencies at once—feature that for a four-dimensional transmitter hunt! Actually, the

Fig. 1—A Sigma light-sensitive relay.

Fig. 2—The Rixon Electronics frequency meter.

See page 126 for New Reader Service

unit was built to use in searching for downed airmen in Viet Nam.

If RTTY equipment seems to dominate all this futuristic material, well, that's right. Almost all communications users are concentrating more and more on production of hard-copy, *i.e.* teleprinter output. It is more precise than voice, leaves a written record, and is easier to process and has a better capability to get through interference than voice communications. Possibly most important, the advent of computers, and the rise of digital signal use, provides a compatibility between the mode of communication and computer processing. A teleprinter can be used interchangeably as a readin-readout device for a multi-purpose computer, or for human-to-human communications.

Transistors, and their offspring, integrated circuits, make excellent high-speed switches, much better than tubes, and lend themselves to processing of binary signals such as on or off keying of a teleprinter selector. By comparison, voice, even single sideband, is becoming old hat. We have seen how even voice may be "digitalized" into "bits" for transmission via pulse code modulation, but the ability to talk to a computer directly, rather than through a keyboard, is difficult, and the technique remains unperfected.

What this means, of course, that in the reasonably near future, surplus, both commercial and military, will contain new material, designed for the new methods of communication. It won't be a 1968 version of the BC-348. It will be far more complex, harder to "convert," but it will be smaller, require less power, and do sophisticated jobs most of us have not dreamed of.

I expect to discuss in the next few months, some of the logic, i.e. computer, designs now reaching the stage where they may show up in surplus. Some of this is beautiful gear, for which the surplus hound should be looking, for some of it is already coming on the market.

Other goodies of the future to look for—this is quite a way ahead—include the d.c. current transformer. One has been built by General Electric, using superconductive techniques. Another, now in production is the crystal-printing teleprinter. Motorola has one that uses Piezoelectric crystal techniques to directly convert electrical energy into mechanical energy for printing. It does work!

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See page 126 for New Reader Service

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energy. Heat is applied through a thin film print head, in a matrix technique which offer better reception through redundancy: loss o a single bit means only one portion of one let ter is affected—the rest of the letter is printed and synchronism is not lost for later char acters.

This month I want to mention two smal items which may be of interest, though the are not as sophisticated as the material show at the AFCEA exhibit.

Fig. 1 is a Sigma light-sensitive relay, i.e a photocell. Unlike the usual experimente photocell, this one is mounted in a plasti dome, equipped with a three-prong a.c. plu base, ready to be inserted in a 115 volt a.c power line. The unit will trigger a light, o other a.c. device, when the light shown o its cell is reduced past a certain point. I us it to control an outside light in my yard whe the sun goes down. Although it is not a com munications device, uses may suggest them selves to many readers. These are availabl at a dollar plus 50¢ postage from SASC Electronics, 1009 King Street, Alexandri Virginia.

Fig. 2 is a Rixon Electronics frequenc meter, of the reed type, calibrated in Bau for directly reading RTTY signals. It show the speed of the incoming beep-beeps an will let you know what speed that mysteriou signal is running—possibly you can identif those 100 wpm MARS channels with this de vice. It is available from Ritco Electronic Box 156, Annandale, Virginia. I am still loo ing for details on this meter, and hope to hav them available—input specs chiefly—how put the unit in a RTTY loop—by the time th column is published.

The meter itself is much like the standa power-line frequency meters using vibratin reeds, but is calibrated in words per minu and baud, rather than cycles per second.

Christine Haycock *[from page 68]*

attic and building her own desks (she also likes carpentry).

The least of her troubles began with her antennas, which she put up herself with help from her OM and friends. She began with indoor dipole, then diploes strung to neighbors' trees, then a vertical on the roof. Finally she got a Rohn 54-ft. crank-up tower and TH6 tribander, which took some months to get set up. She had bought used equipment and says she has been too busy fixing and building to have much time for operating, but finds that half the fun anyway. She adds, "There are problems in being a female ham. It's not easy to get help with problems, insofar as getting someone to come over, though they will give you plenty of advice on the air!"

WB2YBA is active on mobile, using a Swan 500. She keeps in touch with her parents in Galesburg, Ill. via WA9KKU and is very busy with MARCO—Medical Amateur Radio Council. Last summer she spoke to the Women's Aux. of AMA about getting donated equipment for MARCO to send to remote medical areas. She is also a member of Newark Civil Defense Radio Emergency Corps.

Christine adds that a good deal of credit for her hamming goes to Dave, WB2RQH, who taught her theory, gave her the Novice and Tech exams and egged her on when she thought she'd never get her code speed up. But Dave can be proud of his "student", for her aim now is to learn to repair or build *all* of her own equipment and when she completes a current Army Command course, she plans to go after her advanced license and eventually amateur extra.

Congrats, Christine; all YLs can be proud of your achievements also! ■

Broad Band Balun *[from page 67]*

Balun Construction

A balun serves to equalize the current amplitude in the two conductors of a transmission line so, since they are already of opposite polarity, their fields will cancel. The homebrew balun described in this article is a development of the conventional single-band balun shown in fig. 2(A). Such a balun performs antenna current amplitude equalization by connecting both conductors together but also using a ¼ λ isolating section between conductors so as not to upset the normal transmission line current flow. The unbalanced current in the main transmission line is matched and cancelled by an equal but opposite current in the ¼ λ isolation section.

Normally, such a balun is strictly a one band affair. However, if the sections of the balun are wound in the form of two coils as shown in fig. 2(B), the balun exhibits a broad band characteristic similar to that exhibited by an r.f. choke. Because of the effect of the winding, however, the total length of the two coils need be only ¼ λ at the center of the frequency range to be covered. The length used also need not take into account velocity factor since the true currents in the coax are not of concern but the current flowing on the outside of the cables. When cut to ¼ λ at about 15 mc, the balun will be useful on the 40 through 10 meter bands. For 20, 15 and 10 meter usage, the balun should be cut to ¼ λ on 15 meters. The power handling capability is determined by the cable used and, logically, should be the same cable as is used for the transmission line to the antenna.

Construction

The balun constructed by the author for use on 40-10 meters consists of a 16 foot length of RG-58 wound on a 5" diameter form. The connections at the center of the coil for the antenna are made as detailed in fig. 3(A). The connection point can be sealed with tape or heat shrinkable tubing to prevent moisture from entering at this vulnerable point. Note that it is not necessary to cut the center conductor at the center of the coil. A heavy ground strap is used to connect the shorted end of the coax coil to the beginning point of the coil.

There appears to be nothing critical about the diameter of the coil but it should be kept in the range of 4 to 6 inches. The form on which the coil is wound must, of course, be made of an insulating material, not metal.

One simple method to place the balun in the center of a multi-band wire antenna is shown in fig. 3(B). A long home-made plexiglass rod is used as a center insulator. Extra holes are drilled in it to fasten the balun form to it. The antenna terminals of the balun can be brought out inside the balun form to facilitate connections and provide some measure of weather protection for them.

Assuming that one can find some suitable stiff form on which to wind the balun, the only cost is that for the coaxial cable. A less expensive form of transmitting balun is hard to imagine. ■

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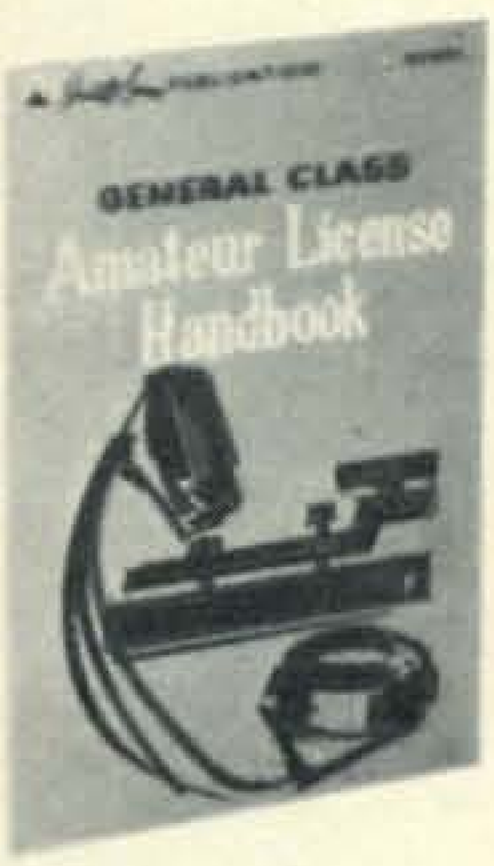

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See page 126 for New Reader Service

See page 126 for New Reader Service

VHF Today [*from page 92*]

own. The easiest way to handle the effect of a lossy transmission line is to refer all noise temperatures to the antenna. To do this, the receiver noise must be multiplied by the line loss (L). A transmission line with a 3db loss thus has an L of 2. To this is added the noise generated by the transmission line itself which when referred to the antenna turns out to be $(1—L)\,T_L$ where T_L is the transmission line temperature (usually around 270°K). To these temperatures is added the antenna noise temperature to obtain the overall system noise temperature. From here on the system calculations are the same as described earlier. However when calculating the received signal power be careful not to include the receiving transmission line loss, since we have already considered it by referring the receiver noise to the antenna terminals.

There is much more to receiver system theory than we have presented here. Hopefully we will get into some of its other interesting features in the months to come.

73, Allen Katz—K2UYH.

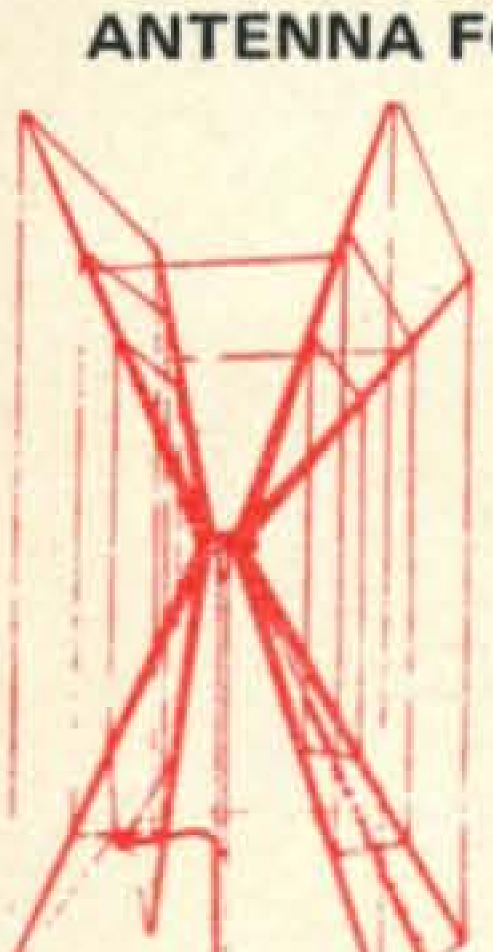
Propagation [*from page 86*]

Central & Northern Europe & European USSR	*Nil*	07-08 (1) 08-10 (2) 10-12 (1) 21-23 (1)	05-07 (1) 11-13 (1) 13-16 (2) 16-20 (1) 20-22 (2) 22-00 (1)	18-23 (1)
Eastern Mediterranean & Middle East	*Nil*	07-08 (1) 08-10 (2) 10-11 (1) 19-21 (1)	04-05 (1) 05-07 (2) 07-14 (1) 14-16 (2) 16-18 (1) 18-21 (2) 21-22 (1)	19-21 (1)
West & Central Africa	10-12 (1) 12-14 (2) 14-16 (1)	07-10 (1) 10-12 (2) 12-17 (3) 17-18 (2) 18-19 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-20 (4) 20-22 (3) 22-00 (2) 00-06 (1) 06-08 (2) 08-09 (1)	22-00 (1)
East Africa	13-17 (1)	08-12 (1) 12-16 (2) 16-19 (1)	12-14 (1) 14-17 (2) 17-20 (3) 20-21 (2) 21-23 (1)	02-04 (1)
South Africa	08-10 (1) 10-12 (2) 12-14 (1)	06-08 (1) 08-10 (2) 10-12 (3) 12-13 (2) 13-15 (1)	00-05 (1) 05-07 (2) 07-10 (1) 12-14 (1) 14-16 (2) 16-18 (3) 18-19 (2) 19-21 (1) 21-00 (2)	19-21 (1)
Central & South Asia	17-19 (1)	07-08 (1) 08-10 (2) 10-12 (1) 15-17 (1) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 18-20 (1) 20-22 (2) 22-00 (1)	05-07 (1)

[*Continued on page 112*]

See page 126 for New Reader Service

See page 126 for New Reader Service



South-east Asia	15-18 (1)	08-09 (1) 09-12 (2) 12-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	23-00 (1) 00-01 (2) 01-03 (3) 03-06 (2) 06-08 (3) 08-10 (2) 10-12 (1)	02-06 (1)
Far East	14-18 (1)	08-10 (1) 12-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-22 (1)	06-08 (2) 08-10 (4) 10-12 (2) 12-14 (1) 18-20 (1) 20-22 (2) 22-00 (3) 00-03 (2) 03-06 (1)	01-02 (1) 02-07 (2) 07-08 (1) 02-06 (1)
South Pacific & New Zealand	11-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-21 (1)	08-10 (1) 10-16 (2) 16-18 (3) 18-21 (4) 21-23 (3) 23-00 (2) 00-02 (1)	05-06 (2) 06-08 (4) 08-10 (3) 10-12 (2) 12-16 (1) 16-18 (2) 18-20 (3) 20-00 (4) 00-02 (3) 02-03 (2) 03-05 (1)	21-22 (1) 22-05 (3) 05-06 (2) 06-07 (1) 22-01 (1) 01-04 (2) 04-06 (1)
Aus-tralia	12-14 (1) 14-17 (2) 17-19 (1)	06-07 (1) 07-08 (2) 08-10 (1) 12-17 (1) 17-18 (2) 18-20 (4) 20-21 (3) 21-23 (2) 23-00 (1)	12-18 (1) 18-20 (2) 20-22 (3) 22-02 (4) 02-04 (3) 04-07 (2) 07-09 (3) 09-12 (2)	00-01 (1) 01-02 (2) 02-05 (3) 05-07 (2) 07-09 (1) 01-03 (1) 03-05 (2) 05-06 (1)
North-ern & Central South America	08-10 (1) 10-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	05-07 (1) 07-09 (3) 09-11 (2) 11-14 (3) 14-17 (4) 17-18 (3) 18-20 (2) 20-22 (1)	05-08 (4) 08-10 (3) 10-15 (2) 15-17 (3) 17-23 (4) 23-01 (3) 01-05 (2)	18-20 (1) 20-00 (3) 00-02 (2) 02-06 (1) 19-21 (1) 21-02 (2) 02-04 (1)
Brazil, Argen-tina, Chile & Uru-guay	07-10 (1) 10-13 (2) 13-16 (3) 16-17 (2) 17-18 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-21 (2) 21-22 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-22 (4) 22-02 (3) 02-05 (2) 05-08 (1)	20-00 (1) 00-02 (2) 02-04 (1) 00-03 (1)
Mc-Murdo Sound, Antarc-tica	16-18 (1)	11-15 (1) 15-17 (2) 17-19 (3) 19-21 (2) 21-23 (1)	08-10 (1) 16-18 (1) 18-19 (2) 19-23 (3) 23-02 (2) 02-03 (1)	22-02 (1) 02-04 (2) 04-06 (1)

Blower Noise [*from page 69*]

Conclusion

I have operated the HT-33B Linear Am plifier with this modification for over fou years with the same tube in the final and th power output of the Amplifier is still th same on all bands as it was originally whe brand new. I did not submit this modifica tion for publication previously because wanted to make sure the tube would not b harmed over a long period of time.

This same idea can be implemented o any Linear Amplifier which has an excessiv blower noise if the air flow of the fan a slow speeds is sufficient to adequately coo the tube or tubes so that a safe operating ten perature is maintained.

Scratchi [*from page 13*]

ing by the bed. When she seeing I can heering her, just like a woman, she starts talking—all about how she coming up in desert and finding me, and how the rest of the RRRR crowd are helping get me to a car and to the hospital, and how on acct. she finding me she winning the hidden xmitter contest, for which she getting big trophy with horse on top, and how she now being new member of RRRR's and how everybuddy liking her new clothes, and wasn't it all so wonderful, and doctor saying he think he getting out all cactus spines, and I can going home next day, and for me not to worrying, and when I feeling better she will making it all up to me for that wonderful day I giving her.

So that's why I standing up to riting you, Hon. Ed. And Lil says that tomorrow we going out and having fun on a real nice picnic. Hon. Ed., how much you want to bet that Lil decides we ought to go on horseback?

Respectively yours,
Hashafisti Scratchi

Vertical Antennas [*from page 57*]

and other DX locations using a short "Slinky" on 21 mc s.s.b. The little thing never ceases to amaze me.[37]

To sum up this chapter, there are many ways in which the serious amateur can use short vertical antennas and obtain good results. One need not be limited by space or height restrictions in getting on 2, 4 or 7 mc. A major consideration is the ground system, however. Reference to figs. 9 and 10 of Part I (4) will show the importance of having sufficient radials of great enough length when the antenna is shorter than 0.15 wavelength. The shorter the antenna, the more important the ground system becomes in obtaining the highest possible radiation efficiency.

The types UG and NORD are covered by patents held by John H. Mullaney, and the "Slinky" technique is covered by a patent application pending. This does not prevent any amateur from building one for his own use, however.

In Part IV of this series, we shall discuss driven vertical arrays of two or more elements, which can be used to produce and control directional radiation patterns. There are amateurs who are using such arrays at h.f. with considerable success.

[*To be continued*]

[37] Private communication from John H. Mullaney, Multronics, Inc.

See page 126 for New Reader Service

Q&A [*from page 89*]

ANSWER: This can be done by disconnecting all the d.c. ground-return leads from battery ground, connecting them together and by-passing them to battery ground with .01-1 mf. Then connect all the other d.c. supply leads (those formerly connected to the hot side of the battery) to battery ground. If the equipment has an antenna connector with one side grounded, lift the direct ground connection and bypass the connector ground terminal or shell to battery ground.

Phone Patching [*from page 77*]

system against harmful devices and may specify technical standards if they wish. Accordingly, we find that Tariff FCC No. 263, paragraphs 2.6.1 and 2.6.9 are and have since their inception been unreasonable, unlawful and unreasonably discriminatory under Sections 201 (b) and 202 (a) of the Communications Act of 1934, as amended."[13]

Effect On Amateur Phone Patches

Ever since the decision in 1956 in the *Hush-A-Phone* case,[14] it has been felt by some lawyers, including this writer, that phone patches would be upheld as a legal operation and that the foreign attachment section would not prohibit its use so long as the use of the patch did not interfere with normal operation of the telephone system. A legal question, however, still existed since the *Hush-A-Phone*, a non-electrical device, was a sound box mechanically attached to the mouthpiece of the telephone hand set. Phone patchesd, however, involve electrical connection between the radio and the telephone lines. Hence, while there was precedent for non-harmful mechanical foreign attachments, the Commission had not clearly spoken in the case of electrical inter-connections.

The language of the Carterfone and Carter cases however, is broad enough we think to clearly establish the validity and legality of phone patches for amateur use. The decision, however, makes it clear that the telephone company is not required to permit the use of devices which interfere with the proper operation of the telephone system, nor is it required to permit any attachment whether mechanically attached, inductively coupled or otherwise connected to the telephone system which causes damage to the telephone system or harm to the telephone company's equipment or impairs the operation of its services.

Fortunately, it has been repeatedly demonstrated that a well-designed and properly operated phone patch will not interfere with the normal operation of the telephone company's facilities, nor cause damage to the telephone system. It would therefore appear that on the basis of the authority of the Carterfone and Carter cases, any doubt as to the principle of amateur phone patch operation has been removed.

As a result of this Opinion it is reasonable to expect that the telephone companies will eventually file schedules which will specify technical standards which the telephone companies believe are necessary to protect their telephone system against harmful devices. Another possibility, of course, is that the case will now be carried to the Federal Courts in an attempt to avoid the effect of these cases. Unless and until the Courts invalidate the Commission's rulings it will be the controlling law. At any event, these cases have done much to clarify the status of amateur phone patch operation.

Letters [*from page 8*]

hams and letting them play with it any way they want. After all, it's the congressmen who determine the size of the Commission's budget.

Allen Auten, WØECH
Denver, Colorado

Second League

Editor, *CQ:*

My attention was drawn to the remarks made in the June letter of K7GOM which seems to be urging a second organization to oppose the ARRL; and to use the expression, "form a second party."

This comment is not to criticize or compliment the statements made, but to call attention to the mess that just such a split brought on about 20 years ago, before sideband had become popular and when the phone and c.w. boys were going at it hammer and tongs about the way the bands were split.

At the time this was going on, the ARRL was being blamed for the division of the bandsand for not doing something about giving the phone boys more room.

While the phone men were organizing to petition the FCC for more room in the ham bands at the expense of the c.w. operators, the c.w. operators were organizing a group to fight them.

All this was being done without the use of the bargaining facilities of the ARRL and so the petitions went into the FCC. Out of all this these two groups brought upon the hams one of the worst proposals for ham radio that the FCC ever thought up. It was really frightening. It made this incentive licensing bit look like a picnic.

Some of the members of these factions now advocating a separate organization were probably not even in ham radio at that time, and if they were, they have extremely short memories.

For the general good of the game, let's not stir up the cauldron again and give out with another witches' brew. In other words, for gosh sakes lay off! Cool off!

C.E. "Gene" Hoover, WØKWY
Ames, Iowa

See page 126 for New Reader Service

The Shoebox Symposium [*from page 62*]

Summary

The author has answered numerous individual letters dealing with the construction of the Shoebox linears. It is realized that for every letter received probably three or four amateurs hesitated to write. Therefore, the purpose of this article was to clarify those points concerning construction of the linears which were asked most frequently. It is still the author's opinion that the method described for construction of a homebrew linear, especially the Shoebox II, represents the most economical and satisfactory approach for the average amateur. ■

The QM Keyer Monitor [*from page 30*]

the module producing a pleasing 800-1000 c.p.s. note. The remaining relay contacts are wired to the terminal strip at the rear to key the transmitter.

Keyer Wiring

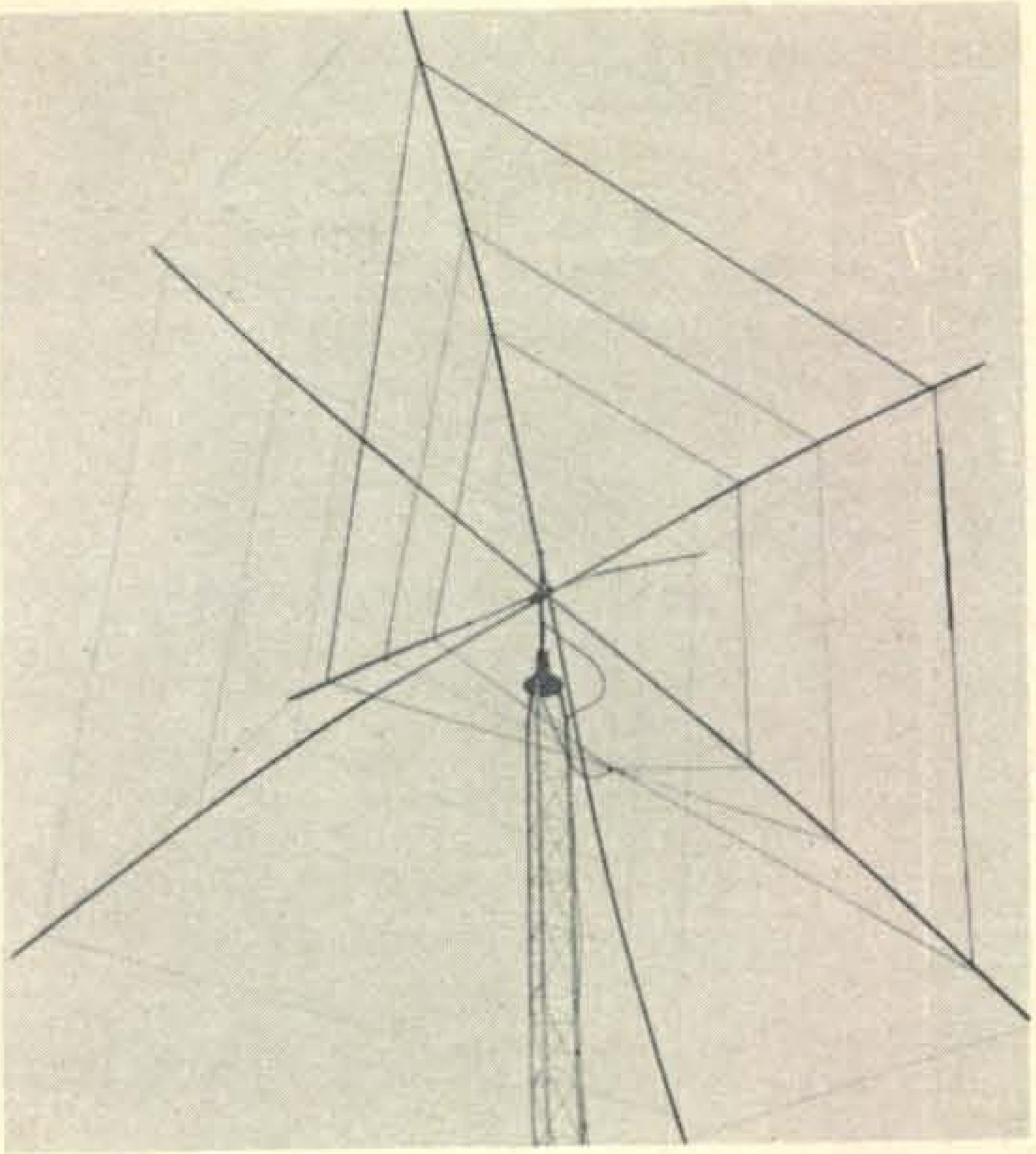
Wire the remaining components in the locations shown in the photographs. Although the circuitry is not critical, and haphazard wiring will not cause the keyer to operate any less effectively, it does, however, lend a professional air to the entire project it wired neatly. Observe the basic rules governing professional methods of engineering, and you will most assuredly produce a keyer on the level of any commercial unit at a relatively small cash outlay.

Operation

Connect the transmitter key input to the appropriate screws on the terminal strip on the rear apron of the keyer. Wire a three conductor phone plug to the standard keyer paddle and insert this unit into the open circuit mating jack on the front panel. Turn the unit on with the monitor in the circuit. Energize the paddle and turn the ratio control for a clearly discernible difference between the dots and dashes. Normally, professional operators stress a three to one ratio, however, the individual operator will tend to adjust the ratio to what he feels is compatible to the ear. The weight control simply compensates for the duration or dwell of the relay before release. The operator will find that this control lends the personal aspect to keying since some operators prefer staccato c.w. whereas others prefer to stretch their transmission notes. The speed control knob can slow the rate of keying to about 5 w.p.m. and as high as 60-70 w.p.m. ■

See page 126 for New Reader Service

Why the Reginair 321 Quad is Important to You!



Present day transceiver and transmitter designs require an antenna match with as flat a resonant response as possilbe. In the olden days a typical 500 watt rig required a relay rack and 500 pounds of gear. The physical spacing and voltage parameter of the tank circuits were such that one never worried about VSWR; indeed, that term had not yet been coined! Flash over and mismatch were laughed at and tolerated.

What a difference today! In a table top box scarcely 1½ cubic feet and weighing less than 50 pounds we find a modern sideband transmitter and receiver thrown in as well. Take a good look at the components: fixed capacitors smaller then ½ a postage stamp; a loading capacitor with .005 inch spacing; and transmitting tubes that are in reality TV horizontal outputs. These, then, are what you find. Do you wonder then why the manufacturer tells us we must operate into loads of 2.5 to 1 or better? Do you wonder then why the factory says to tune up in less than 30 seconds? Is it a surprise to you to find that new finals are required so quickly? Good engineering tells us that at 2.5 to 1 we have 20% of our forward power coming back to stay as circulating current and heat.

The danger comes into the picture because the average ham can't or won't confine his operation over that narrow spectrum where his antenna is in resonance and where his VSWR is less than 2.5 to 1.

Sure–new SSB designs are in the works: transceivers whose receivers will have variable selectivity; whose transmitters will use better tubes; rigs that can take more guff. But can you wait that long or afford that much money?

There is an alternative now–in fact, two choices. You can either be more mindful of the frequency tolerances of your setup, or better still, you can obtain one of our *Reginair Quads.* This is the only commercially available product that gives three band operation with one 52 ohm feed line and absolutely guaranteed low, low VSWR over the entire 10, 15, and 20 meter bands.

Our new quad is constructed of 2 different dimensioned poly vinyl chloride (PVC) tubes made into a 10 foot arm with an aluminum coupler. The PVC is especially selected for temperature and mechanical stability. Hardwood stiffeners additionally are inserted within the PVC. The hub of the quad is a virtually indestructible acrylomitrile butadiene styrene (ABC) which can withstand salt water, and the atmosphere for years and years.

The quad is furnished complete with easy to understand assembly instructions, at only $89.95 FOB Harvard, Mass. Study the box score and see if this antenna isn't the answer to your operating and maintenance problems. You might even find that DXing can be fun now that you are hearing the rare one.

Forward gain over dipole	**5.9 db**
Forward gain over isotropic dipole	**8.0 db**
Front to back ration	**.25 db**
VSWR over 28-29.7 MHz; not more than	**1.5:1**
VSWR over 21-21.45 MHz; not more than	**1.5:1**
VSWR over 14-14.35 MHz; not more than	**1.5:1**
Maximum RF input	**2 kw**
Maximum mast dimension	**1¾" dia.**
Wind resistance	**4.5 sq. ft.**
Feed line	**52 ohms**
Outside dimensions	**18'x18'x12'**
Turning radius	**9½'**
Net weight	**35 pounds**
Shipping weight	**40 pounds**
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Frontal lobe	**75°**
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DX [*from page 83*]

KC6, Eastern Caroline Islands: Fred, KC6CQ, is frequently heard on 14250 kc around 1350 GMT. He is in the Peace Corps.

PYØ, St. Peter & Paul Rocks: PY4BLR plans a trip to this very rare country in September.

TA1, Turkey: Reyhan, TA1RT, is the first YL operator in Turkey. She is 20 years of age. (*Tnx K4EPI*).

TJ1, Cameroun: TJ1AL operates every day *except* Tuesdays and Fridays on 14170 and 14200 between 1900 and 2200 GMT, and 28520 kc between 1200 and 1300 GMT when the band is open. On Tuesdays and Fridays he has skeds on 21340 at 2030 GMT. His skeds should not be interrupted.

UA1, Franz Josef Land: UA1KED is active from this rare DX country near 14010—14020 kc around 1400—1500 GMT.

VK4, Willis Island: VK3AEJ should be on now from Willis using 20 meter s.s.b. He will have a 6 month tour of duty ending about December 31.

VKØ, MacQuarie Island: VKØIA is frequently heard on s.s.b. between 1300 and 1400 GMT near 14105 kc. His signals are never very loud. This would be a good catch for the S.S.B. DX Award.

VP2, British Virgin Islands: Sammy, VP2VO, is reported to be quite active.

VP2, Grenada: VP2GAI, VP2GN, and VP2GBG have been logged on 20 meter s.s.b.

VS6, Hong Kong: This seems to be the best bet these days for Zone 24. Many newly licensed stations are heard mornings on 20 meters. Herb, VS6AD, is heard frequently around 14212 kc from 1100 GMT on.

VU2, Andaman Islands: VU2DIA QSLs may be sent to Hedge's new address: B. S. Hedge, I.S.P.W., Panjim, Goa, India.

4M7, Venezuela: The 4M7AV operation during the Venezuelan Independence Day Contest was by YV7AV. Pedro will confirm your QSOs.

5R8, Malagasy Republic: 5R8AS is active around 14240 kc at 1300 GMT.

QSL Information

When sending your card to a rare DX station or QSL Manager always remember to send a self-addressed, stamped envelope or self-addressed envelope with IRCs.

AP5HQ—*Not* via W4RLN. Send direct to Comdt Signal, Training Center, Kohat, West Pakistan.
DL5JX—Via DL5 Bureau or DARC Bureau.
DU7SV—To WA6KGP, Box 1261, Chula vissa, Cal. 92012.
EA6ITU – c/o W3ASK (W3MR).
EAØAH – Rumor says W4DQS is *not* QSL to CBA.
ET3FMA—*Not* via W5LEF.
FG7TI/FS7 – Via VE3EUU.
FH8CF – To Noel Antoine, B. P. 304, Moroni, Archipel Comoroes (Via France).
FP8CS – c/o K20JD.
FP8CZ – Via W2IEG.
FP8CZ – Via W2IEG.
G3IOR/p – To G3IOR.
G5AGA c/o WA4IKU, 1018 Woodburn Road, Spartanburg, S. C. 29302.
GC8HT – Via W6UNP.
GC3VZT/A, GC5AFS/A, and GC5AKD/4 – To WB2YRU, 3538 Centerview Ave., Wantagh, N.Y.
HC8RS – c/o SM5EAC.
HK9GQ – Via HK3GQ.
HL9KQ – To W4YWX.
HM1AJ – Via W2CTN.
IZ6KDB – c/o VE3ACD.
KØILI/KG6 – Via Orian D. Johnson, 1854 B C/H, APO, San Francisco, Cal. 96334.
LJ2X (QSO's after May 28, 1968) – To W4NJF.
OA7MP – c/o Box 538, Lima, Peru.
OD5BA – Via Joseph Attar, 879 Rue Hamra, Beirut, Lebanon.
PA6AA – To PAØVB.
PA9GC – c/o ON5JM.
PYØDX—Vio PY7ACO.
SK1AQ – To SM1CXE.
SK3AK – c/o SM3CZS.
SK4AV – Via SM4CLU.
SK6AB – To Box 25049, Gothenburg, Sweden.
SKØAL – c/o SL1CF.
SVØWP (QSO's between October and December, 1967 *only*) – Via W4YDD.
SVØWV – to W4YDD.
TA1IM, TA1AB, TA1RT, & TA2SC – c/o K4EPI, 750 Lily Flagg Road, Huntsville, Ala. 35802.
TP1AL – Via W2MES.
TL8DL – To David L'Heureux, 5201 38th St., N.W., Washington, D.C. 20015.
VK9RJ – c/o K6UJW.
VP2GBG & VP2GBH – Via VE3DLC.
VP2VO – To VE3ACD.
VP5CB – c/o K3NAU.
VR2FF – Via WA6NFI, 2437 Irma Way, Castro Valley, Cal 94546.
VR3DY – To Ed DeYoung, KH6GLU, Box 762, Kaunokakai, Molokai, Hawaii 96748. (New QTH).
VS5RCS – Dennis Bowden, 1 Regt., Malaysian Signals, c/o G.P.O. Kuala Lampur, Malaysia.
VS6AD – Box 97, Hongkong.
VU2DIA – Via Ron Hill, IT60ZL, 1029 Geary St., San Francisco, Cal. 94109.
YA1DAN—c/o KP4CL.
YA2HWI – Via W9FLJ.
YS1THM – To W6GGR.
ZD8Z (stateside call W6BHY) – c/o W6CUF.
ZL1TU – Via WA6NFI.
4M7AV – To YV7AV, Pedro N. Marcano, Box 512, Carupano, Sucre, Venezuela.
4X4UF (QSO's after 4/8/68) – c/o WA4WTG.
4Z4DX – Via WA4WTG.
5R8AF, 5R8AS, & 5R8CJ – To K7HCD, 3930 S.W. Lake Grove St., Lake Oswego, Ore. 97034.
5U7AN – c/o W4WHF.
5W1AT – Via W4ZXI.
6W8DY – To VE4SK.
8X8AA – *Not* via VE2DR.
9M8MS – Via K1UHY, RFD 1, Box 129, Chester, N.H.
9Q5GE & 9Q5EL – c/o W8WBT, 1952 Norwood Rd., Grosse Points Woods, Michigan.
9V1MS – To K1UHY.
9X5GG – c/o W2GHK (DOTM).

73, John, K4IIF

See page 126 for New Reader Service

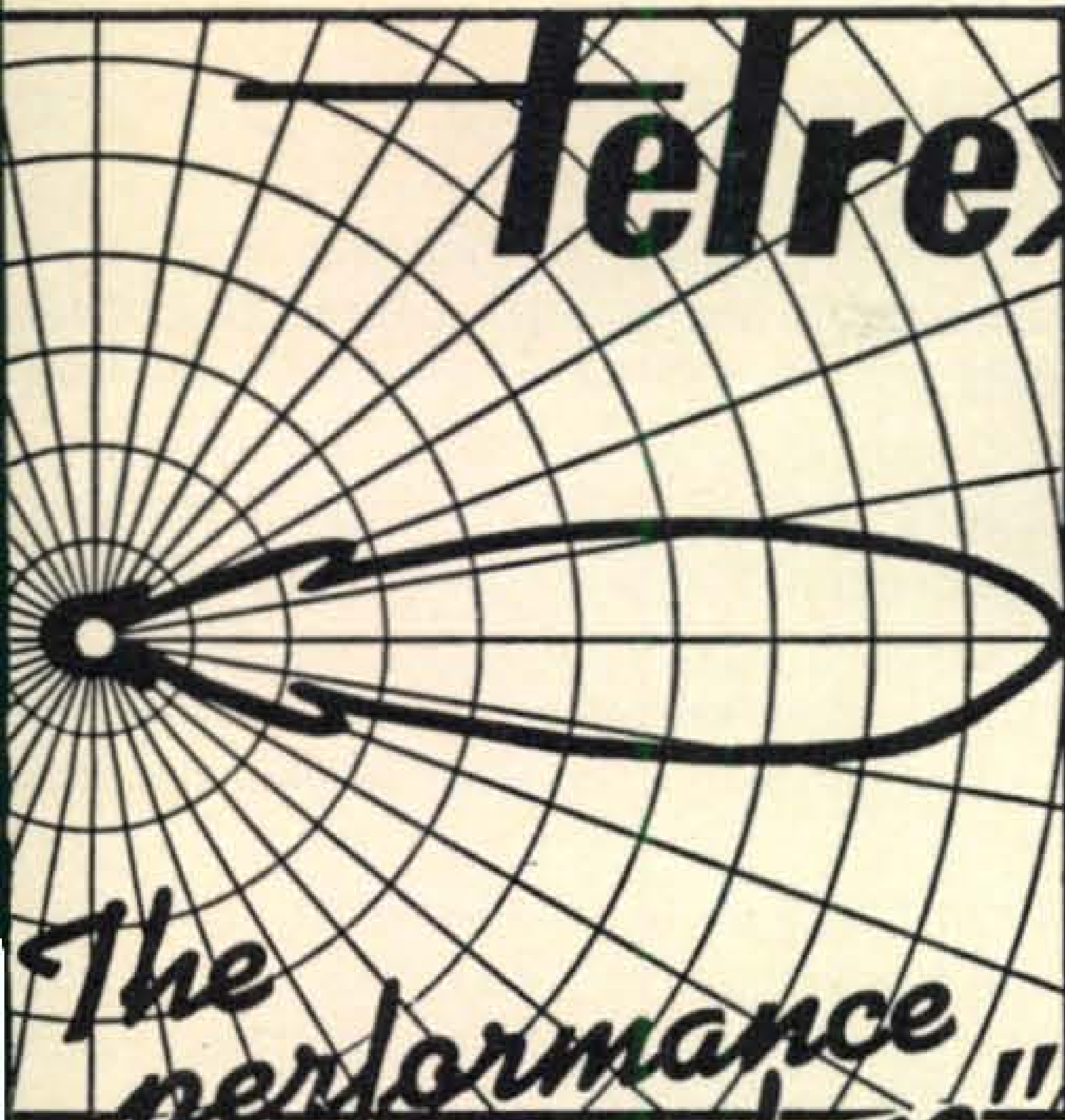
Sylvia [*from page 35*]

precious to them—GB2CC, but GB2CC was doing very nicely, thank you, if listing slightly to starboard, guarded by a patrolling policeman who wanted to know what it was all about, or perhaps he just fancied a cup of hot tea. So I made tea and we sat about describing amateur radio, from first principles. It was a very dramatic scene, rather kitchen-sinky, off-Broadway, the lightning flashing on the policeman's buttons and the thunder making the teacups reverberate, a lunatic scene that must have caused Ohm and Marconi and Hertz to turn in their graves. The storm abated and we gave the policeman a demonstration. Maybe he was destined to make detective, but he asked some very searching questions, like why it is desirable to talk to somebody on a bare rock in the middle of the ocean and why should that somebody risk his life to get onto that rock? Why did radio amateurs get so het up and start feuds that would benefit nobody but the lawyers, as if anybody would ever want to benefit a lawyer? And why did they use three syllables, "ex-wy-el," when they could so much more easily say "wife?" And what was the significance of "aitch-eye?"

To some of his questions I could frame no answers, no sane answers, that is, and I began to wonder if he was truly a British country policeman, or an *agent provocateur* from You-Know-Who. But next day I saw him directing the maelstrom of traffic as it shook the mud of Sandringham from its heels and made for home, and the poor lad looked so bewildered and frustrated and *inept*, he must have been a policeman. Aitch-eye.

So ended, in chaos and dreadful night, the historic and significant operation GB2CC, an operation which can never be repeated, Heaven forbid, so those who didn't work us will just have to make do with Don. Incidentally, if anybody seeks to question the validity of this operation, like suggesting that maybe we never went to Sandringham, but went fishing instead, or spent the weekend in Phoenix, Arizona, or on Chagos or Vladivostok—let him take the matter up with Her Majesty's Comptroller of the Royal Households, or with the Norfolk Constabulary or, if they want to play it that way, with my lawyer. ■

See page 126 for New Reader Service



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e page 126 for New Reader Service

CQ Reviews: HW-100 [*from page 50*]

more than clippers. The a.l.c. voltage may be read on the meter.

A panel switch selects either p.t.t. or v.o.x. operation, but when it is set for v.o.x., the p.t.t. control circuit is still in operation. Consequently, in cases where the p.t.t. switch on the mic cuts the mic circuit in or out besides operating the control circuit (as often is the situation with some mics) p.t.t. operation will prevail instead of v.o.x., since the mic button must be locked down to cut in the mic itself. In such cases it will be necessary to rewire the mic switch so that it will operate only the control circuit.

On c.w. the transmitter keys beautifully and the keyed v.o.x. pulls in quickly, producing a signal without shortened dots or dashes at the start as is often found with v.o.x. type control. With the delay set for minimum, the release is fast enough to permit your being broken at slow code speeds, but at higher rates a pause between characters would be necessary for break-in. The sidetone monitor keys cleanly and sounds pleasant. There is no provision for adjusting its level, but as is, the level is just about right for headphone or speaker operation.

As for statistics, the following measurements were obtained:

Receiver Sensitivity, rated at 0.5 μv for 10 db S+N/N: 0.3 μv. Selectivity: 2.1 kc @ 6 db, 7 kc @ 60 db as nominally rated. Image Rejection, rated at more than 50 db: 85 db on 3.5 mc band to 67 db on 28 mc band. I.F. Signal Rejection, rated at more than 50 db: over 100 db at 3395 kc, 56-76 db at 8.5 mc depending on band. Internal spurious signals: below 1 μv equivalent input, except 2 μv at 3740 kc and 10 μv at 21,200 kc. Band-to-Band Gain, not rated: within 3 db. A.G.C. Characteristic, not rated: 16 db a.f. output change with 20 db r.f. input change (1-10 μv), 8 db a.f. change with 66 db r.f. input change (10-20,000 μv), fast attack with 2-second release from S-9+40 db signal. S-meter: Approximately 45 μv signal input for S-9 reading on all bands.

Transmitter Power Output, rated at 100 watts on 80-15 meters, 80 watts for 10 meters: With c.w., 110 watts on 80-20 meters, 100 watts on 15 and 95 watts on 10 (using companion HP-23 power supply with 120 v.a.c. applied); p.e.p. 16% higher on all bands with s.s.b. Oscillator or mixer products: 55 db below maximum output as rated. Unwanted-Sideband Suppression, rated at 45 db at 1 kc: 50 db on l.s.b., 40 db on u.s.b. Carrier Suppression: slightly better than 45 db rating from maximum output. Distortion Products (3rd): 30 db below two-tone output as rated.

The frequency stability is rated at less than 100 c.p.s. per hour after 30-minute warmup from normal abient and less than 100 c.p.s for $\pm$10% line variation. The average stability after several runs on different bands starting cold at 70° ambient, was 740 c.p.s first 30 minutes (warmup period), 260 c.p.s next 30 minutes, 125 c.p.s. or less per hou thereafter. With $\pm$10% line-voltage variation, $\pm$25 c.p.s. on all bands except 21 m $\pm$75 c.p.s. The latter was greater probabl due to difference between heterodyning crystal characteristics.

Although banging the cabinet sometime caused a slight mechanical shift of the v.f.o shaft thus producing a little frequenc change, subjecting the HW-100 to vibratio in a vehicle driven over rough terrain, gav no indication of instability or frequenc modulation while listening to the crystal cali brator or during s.s.b. transmissions.

Dial Calibration: With the v.f.o. aligne so each end of the dial scale fell in line wit the calibrator signal, points along the cente portion of the range were too far out for ou liking. It was found better to line up th v.f.o. with the calibrator signal heard at th 300 kc calibration spot and with the trackin adjusted for the least error at the points eithe side. The maximum error at points near th extremes of the range then was 5 kc; whi indexing at any 100 kc interval produced maximum error of 2 kc at points betwee adjacent 100 kc intervals.

Power Requirements: 700-850 v.d.c. @ 250 ma with 1% max. ripple; 300 v.d.c. @ 150 ma with .05% max. ripple; −115 v.d. @ 10 ma with 0.5% max. ripple; 12 v. a.c d.c. @ 4.76 a.

The size of the set is 6 5/16" × 14 13/16 × 13⅜" (H.W.D.) and it weighs 17½ pounds.

All told, the HW-100 Transceiver is dandy package and should be a popular iten especially in view of the low kit price of $24 The HP-23 A.C. Power Supply is listed $49.95 (kit) and the HP-13 12 V.D.C. Pow Supply is $64.95 (kit). A mobile-mountin bracket also is available. These are produc of Heath Company, Benton Harbor, Mich gan 49022.—*W2AEF*

See page 126 for New Reader Servi

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $1.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day in the second month preceding date of publication.

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Direct All Correspondence & Copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I., N. Y., 11050.**

e page 126 for New Reader Service

CANADIANS: Radio amateur (and government licensed radio technician) will repair and/or align amateur radio equipment. B. Fransen, 227 Cottonwood Ave., Sherwood Park, P.O. Alberta, Canada.

RADIO amateur wants old radio transmitting and receiving parts, magazines, call books, handbooks early broadcast receivers for amateur museum. E. Radmussen, 164 Lowell St., Redwood City, Cal. 94062

WANTED: Two meter CW and SSB skeds in any portion of the band. D. Blystone, 812 Niles St., La Porte, Ind. 46350

FOR SALE: AMEO CN144W factory wired 2 m converter. Output 28-32 mc; easily changed. Almost new. Instructions $30 ppd. J. Herro, 1017 Pfingsten Rd., Glenvie, Ill. 60025

FOR SALE: Heliax Cable, special 3" O.D. 235' continuous length, $65 plus freight. R. Genaille, 719 Quarterstaff Road, Winston-Salem, N. Car. 27104

FOR SALE: Knight TR106 6 meter transceiver with built in 110/12V power supply; companion VFO; Base; factory wired, new, complete $125. S. Cohen, 4524 Michigan Ave., Miami Beach, Fla. 33140

FOR SALE: Large list of Radio tubes '30 to '43, vintage in sealed cartons. E. W. Edwards, 9609 W. 57th St., La Grange, Ill. 60525

WANTED: VFO HA5 or Gonset IV in good working cond. State price. J. Boritz, 1560 Unionport Rd., Bronx, N.Y. 10462

CASH: for 30S-1 must be clean-no modifications. WA1AWX, RD #2, Bob Hill Rd., Ridgefield, Conn.

WANTED: A junked national NC200 receiver. Don't need cabinet or tubes. C. Piester, 304 Alpert St., Ft. Collins, Colo. 80521

BECKMAN 7260 Digital time interval meter $190. APS-13 complete $15. Send sase for list good stuff. J. Green, Box 1038, Boulder, Colo. 80302

FOR SALE: National Radio Course bound 3 vol $5. Capitol Radio Course bound in four vol. $20. Calif. perf cabinets 8½ high x 5½ wide x 11 in. deep, suitable for ARC receivers $5 ea. E. Marriner, 528 Colima St., La Jolla, Calif. 92037

COLLINS Receiver 75A2 very good condx, $250 or best offer. Model 26 teletype page printer, good condx, $50 (No table). Cooper, 834 Palma Ave., Maywood, N.J. 07607

FOR SALE: Eico scope model 460 with voltage calibrator model 459 $35. Eico model 368 TV FM Sweep generator and marker $25. A. Gerhard, 326 W. 3rd St., Berwick, Pa. 18603

WANTED: Manual and/or Schematic for DX100-B. J. Wasiewicz, 4230 NW 10th St., Pompano Beach, Fla. 33063

COLLINS 75A4, Exc condx, vernier knob, manual, 2 filters, orig carton, au modifications, mint, hi sensitivity, low noise level. $425. M. Freedman, 15 Kensington Oval, Isle of Sans Souci, Davenport Neck, New Rochelle, N.Y. 10805

COLLINS Mint condition: KWM-2 transceiver; 516 F-2 Pwr. Supply; 312 B5 PTO console; 30L1 Linear-all manuals $1600.00. B. B. Morrow, Box 136, Gold Run, Calif. 95717

SB-200 NEW Tubes bought in March '68, $175. Heath IM-11 $18. J. Shirley, 645 Reynard Ave., Cincinnati, Ohio 45231

SX 42 X Hallicrafters Communications Receiver-540 kc to 108mc. A tremendous bargain at $95. Lt. Col. W. O. Enderle, HQ USA CDC, Ft. Belvoir, Va. 22060

CANADIANS: Hallicrafter SX-100 Communications rcvr $150 Johnson 6N2 100 watt 6 and 2 meter. Transmitter $100 3000V-500ma Power supply $50. D. Wismer, 260 Frederick St., Kitchener, Ont. Canada.

WANTED: Crystals and schematics for QRP TX and RX. Also need ideas for portable antennas. A. Fox, P.O. Box 2202, Huntsville, Tx. 77340. After July 1st. P.O. Box 895, Greenley, Colo. 80631

LEAVING Chicago—sell operating station factory overhauled, HT-32A, SX101A $400 both; Heath Ha10 linear 1,000 W. PEP new tubes $175; all for $525 plus shipping. Ta-33 beam, 55' fixed tower, rotator $150 plus buyer takes down and removes. R. Abramsom, 522 S. Dearborn St., Chicago, Ill. 60605

MOSLEY TA33 Jr. beam only 6 months old, u pay shipping $50—Heath HD-10 keyer good cond, $20 plus postage. A. Schnorrenberg, 325 W. 8th St., Salem, Oh. 44460

COLLINS 516-1 12 volt D.C. Power supply and 351D-2 KWM2 mobile mount $150. D. Klein, 6533 No 52nd St., Milwaukee, Wisc. 53223

WANTED: CB sets. General MC-6. Old model brownings and just plain old CB sets. B. McGwier, P.O. Box 565, Grove Hill, Ala. 36451

WANTED: Old issues of QST, CQ, 73 RTTY; Model 14 Rtty tape equipment wanted. Write for reasonable prices. M. Jabara, 1354 Elm St., Plymouth, Mich. 48170

SALE: Gonset communicator, in good condition $50 or swap. Wanted; Motorola remote control T-1200 or similar. Must be like new, *very clean.* J. Thomsen, 8280 Tennessee Ave., Claredon Hills, Ill. 60514

SELL: TS-406/UP Signal Generator. Battery operated. 1000 to 3500 Mc. 0-60 Db. Attenuator. New condition. $19. G. Richie, RFD 2 Box 149, Salem, Va. 24153

ANTIQUE Hunters: For sale; '35 Pilot Super Wasp super rege SW receiver. All coils, original parts and schematics. A. B Bertucci, 516 Warrington Dr., New Orleans, La. 70122.

WANTED: Johnson pacemaker, mint condition only. F. Clemen Haven Farm, LaTrappe D'Oka, Two mountains, Quebec, Canad

FOR SALE: SB300 with SSB, CW filters and speaker. Just r aligned by Heath service center. Perfect condition. $200. Simon, 94-31 60th Ave., Elmhurst, N.Y. 11373.

AUTO Transformer 0 to 258 VAC. 60 cycle in 2 volt steps. W 55 lbs. 25 to 30 amps. Core 7x6x6. $40. R. Mace, 8600 Skylin Dr., Los Angeles, Cal. 90046.

FOR SALE: Mosley TA40KR-40 TA33 conv $25. Hustler MO Mast & RM-20 M resonator $10 Cush Craft ABW 144 2 m B wheel $7. H. Apler, 10 Scott St., Massapequa Pk, N.Y.

2000 WATT GALAXY Linear and supply. Absolutely mint, owne by first-phone licensed engineer, like new, in original facto cartons. Spare finals. Shipped prepaid $300. W2DAP, 21 Twis ing Dr., Lake Grove, N.Y. 11755

FOR SALE: Viking 2 and Vfo 122 Filter change over OK con tion write, F. Rudolph, P.O. Box 115, Stryker, Oh. 43557.

FOR SALE: QST's '32 thru '65 and CQ's March '49 thru July '6 Make me an offer. J. McCaa, P. O. Box 607, Anniston, A 36201

WANTED: 500 Cycle filter for Collins 75S3B part no. F-455FA-0 For Sale: Two ten mtr crystals for SR-150. E. Talbot, 131 Pe perridge Lane, Battle Creek, Mi. 49015

FOR SALE: 1 Left DX100 Gud shape w manual $65, D104 Mi used very little $12, I-177 Signal Corp tube checker w manu $15. All FOB. H. Lowy, 915 Madison St., Manchester, Te 37355

COMPLETE KIT includes modification for Foot Switch ope tion, extra receiver antenna jack, extra relay contacts, he phone jack SSB/CW switch. $15 pp. Write W. Wilson H. S. L.

WANTED: Pair 7094 tubes, for sale/trade: BC-221; HX-20; HR-2 Transcon 10; Hallicrafters HA-6. A. Kasper, 1742 Petersbu Rd., Burlington, Ky. 41005

SELL: Plate transformer, 2400 volt at 1 amp. (No center ta Can be bridge rectified for 2 kw pep linear $15. Eimac, 4112 tube, like new. $5. B. Nastoff, 320W. 56th Place, Gary, I 46408

SHACK cleanup: For sales or swap, meters, xfmrs, chok tubes, relays, arc-3, tcs, BC-453, Lots more, SASE brings li J. Pehousehek, 1185 Mosswood Ct., Cincinnati, Oh. 45224

FOR SALE: Hallicrafters SX101A receive $150, recondition good condition. E. Wilson, 64 Sheffield Lane, York Woods, O Brook, Ill. 60521

WANTED: Collins F455J21 filter for 75A-4 recr. Please state co and price. B. Hallaway, 6101 France Ave., So. Minneapol Minn. 55410

FOR SALE: Large quantity of CQ and QST Magazines. Publi tions date back to '55. M. Eoawn, 240 First Ave., New Yo N.Y. 10009

POWER PLANT: Portable 31/2 KW everlite alternator, 115/2 AC with 12 v DC winding. Cost $485.10, used 4 hrs, best pick offer over $240. G. Clark, 1741 La Coronilla Dr., Santa B bara, Cal. 93105

SELL UTC Transformer, CG 308 . . . 110/220 Pri 3500-0-350 at 500 Ma $75. S. M. LaDage, 431 Oakland Ave., Maple Sha N.J. 08052

FOR SALE: TWO B&W FC-15A filament chokes for grounded g linear; $8 each or both for $15. Gary L. Swelander, 321 Bur Hall-Utep, El Paso, Tex. 79902.

WANTED: F coil for HRO(480-960KC). A. Brogdon, RD 1, Box 39 State College, Pa. 16801

FOR SALE: Wheatstone oiled 15/32" perif tape. P. Lemon, 3 Tony Pt. Rd., Santa Rosa, Cal. 95401

FOR SALE: Brand new alliance T-45 antenna rotator. Never us Still in factory sealed cartons and in warranty. $19.95. Ke Neighbors, 121 Johnson St., Garner, N.C. 27529

WANTED: Used RCA, NRI etc. Commercial operators lice course. H. Watkins, 2168 Greene St., Augusta, Ga. 30904

WANT: Used HP-14 P.S. Sell: 25' Alu rods $5, MC1530 IC $5, D TVV143 Hi-Fi Preamp $7. J. Schultz, 50 Rossie St., Mystic, Co 06355

FOR SALE: Health TX-1 apache xmtr, & Hammarlund HQ-1 rcvr all complete with manuals and in excellent condition. Newsome, P.O. Box 542, Wrens, Ga. 30833

FOR SALE: Complete hustler bumper mount antenna 80 15 me coils, resonator and base springs $45. DC Mobile Power S ply for Galaxy 5MX2 $75. Ex. Cond. L. Hodges, 228 Young A Chester, Ill. 62233

GALAXY V mt 2, Galaxy Linear, Remote VFO, VOX, Notch filt Power supplies, spare finals, All mint and in factory cartons. B offer over $600. R. Winslow, 21 Twisting Dr., Lake Grove, N 11755

See page 126 for New Reader Servi

FOR SALE: AR 88 LF Receiver. Frequencies between 75 and 550KC and 1500 KC to 30000 KC. Make firm offer on first card. F. Steiner, 92 Baldwin St., Meriden, Conn. 06450.

PROFESSIONAL Scope OP1 for sale. Also RCA WA44A Audio signal generator. Want model 28ASR or 32ASR. R. Mendelson, 27 Somerset Pl., Murray Hill, N.J. 07971

FOR SALE: Large list of Radio tubes-130 to 1943, vintage. In sealed cartons. E. Edwards, 9609 W. 57th St., La Grange, Ill. 60525

FOR SALE: 80-6 Meter multi-elmac PMR-8 Rcvr AF-68 Xmtr, mobile & Fixed station PWR supply $150. W. Goodrich, 1417 Covedale Ave., Cincinnati, Oh. 45238

WANTED: Used 8mm commercially produced home movies. H. Smith, 467 Park Ave., Birmingham, Mich. 48009

SALE OR Trade: SB-400 $270. HRO-60 with all coils 80 through 6 meters, calibrator and speaker, new condition, $250. Want-NCX-5 or Galaxy 5. J. Shank, 21 Terrace Lane, Elizabethtown, Pa. 17022

SELL: National 200 and AC-75 power supply in good condition. $300 FOB or best offer. SASE for reply. D. Dulle, 1825 W. Main, Jefferson City, Missouri 65101

BACK ISSUES 600 copies. CQ 18 yrs plus 9 copies to 49. QST 23 Yrs plus 100 copies to '28. Best offer. L. R. Sitt, 335 Burwo Lane, San Antonio, Texas 78213

ANTIQUE Collection including tubes, books, magazines other items. Will trade for Drake 2B rcvr. or sell. Samkowsky, 201 Eastern Pky., Brooklyn, N.Y. 11238

BANDIT 2000 B linear with 4 O'Malley 572 tubes, 250. TR-44 Rotator and indicator $25. Excellent condx. Basic 3 elements Quad. used U.S. Fiberglass 3 Bander W/Wire. W. Wiaduck, 4926 Hawthorne Ave., Hillside, Ill. 60162

TRADE: 4CX250B New unopened carton for 7094. Also sell or trade HQ-170AC; Drake L-4 $500 in warranty. Sickness in family. D. Johnson, P.O. Box 162, Wesson, Ms. 39191

FOR SALE: Ameco TX 62 6 and 2 meter transmitter $110. Ameco CN 144 converter 10-14 mc. output $30. Both for $130. W. E. Goff, 5 Adoms St., Plattsburgh, N.Y. 12901.

6M-FM: RCA CMV3E Transceiver, $25 FOB, 60 watt output, easy 6-12 volt conversion, 30-54 mc, partial accessories, w/schematic, R. Beatie, 1904 E. 114th Ave., Tampa, Fla. 33612

FOR SALE: Homebrew SSB rig 150 Watts 80 and 20 meters, VFO control $70 or swap for Electronic keyer and paddle. T. Osborne, 6484 Easy Bay Drive, No. Bend, Ore. 97459

SELL: Immaculate Drake 2-C, Spkr; $205. Ranger I, Clean $90. 20 Mtr Verticle $5. G. F. Kaser, 314 Birch Lane, Paw Paw, Mich. 49079

FOR SALE: 12 Volt system for 6 bx volt VW's. System complete. Motorola 35 amp alternator plus regulator and mounting brackets. New cost $119. Sell for $80. R. Eckton, 1021 Cedar Ave., Redlands, Cal. 92373

FOR SALE: Modulation transformer, 600 watt, UTC CVM-5, $35 fob. W. Dirks, 2305 Mathews St., Fort Collins, Co. 80521

MINT SB-10 with MK-1 Kit, all manuals $70; Deluxe joy stick indoor antenna system $17.50. W. McDonald, Dadeville, Alabama 36853

SWAP OR Sell: Bolex B8 movie camera & Case, $35. Olympus autoscope projector, $90. 1177 tube tester $20. Need curta computer, CIE slide rule, Gonset Super 12. O. McMahon Jr., 113 Woodcrest Circle. New Iberia, La. 70560

WANTED: 6 Meter SSB Transmitter. J. Wentz, Box 102, W. Liberty, Ohio 43357

HAVE FEW Elements for bird thruling 43 or line sections, and suitable meters, $15 each. C. Spitz, 1420 S. Randolph St., Arlington, Va. 22204

SALE: 80-10 M Xmitter SSB 180W P-P. Geloso VFO in cab w/ps and fan $185 FOB. L. Kulhay, 19 Topstone Dr., Danbury, Conn. 06810

FOR SALE: Collins 32V-2 needs work $40. C. St. John, R. 4 Allegan, Mich. 49010

SB 34 $335 Demo, BTI $700 new. KWM2 $700, 32SI $425, Want 51S1. 32S1 $425. Adcom 500 power supply for KWM2 $100. F. Baker, Box 546, McComb, Ohio 45858

GLOBE CHAMP 300 $65. Globe 6 & 2 Local. E. Moist Jr., 1527 Poplar, Royal Oak, Mich. 48073

HEATH DX-60, UFO. Used to work over 200 counties and 12 countries. Grid meter needs work. $50 prepaid. C. Smith Jr., 421 W. Hancock, Apt. 133, Athens, Ga. 30601

CQ'S WANTED: Nov. '63; Feb, May, July, Sept, Oct, Nov, '65; Jan thru Nov '66's. May, June, July, Nov '67. D. Cook, 3917A Kingsbridge Road, Chattanooga, Tn. 37416

FOR SALE: Swan 350 with AC & DC power supplies, also Base & Mobile antennas. All in new condition for $350. R. Dorough, P.O. Box 61, Terrell, Tx. 75160

GALAXY 300 Transceiver, with VOX and Psa 300, mint condition; In original boxes, with manuals and cables; $250. Garey C. Coggins, 7235 Hunters Branch Dr. NE, Atlanta, Ga. 30328

TOWER: Brand new 50′ Rohn tower with hardware and accessories. Never erected only $110. Also, Hygain 3 element triband beam $50 and 10-40 meter vertical $10. R. Stern, 4138 Willow Grove, Dallas, Tx. 75220

EICO 753 for sale; Also 752 DC supply. Sell either or both. Best offer. R. Guard, CMR Box 7542, Patrick, AFB, Fla. 32925

FOR SALE: Exc SP600 JX17 in plexiglass case and very late serial number 30L'-would like late serial number 75A4 and CE 200V. C. Kaufman, 231 Jasmine St., Denver, Colorado 80222

FOR SALE: 12AVQ and 11EL 220 beam. Local deal only. P. Wiegert, 625 Van Duzer St., Staten Island, N.Y. 10304

WANTED: Manual or Schematic for DZ-2 direction finder. F. Chapman, 1367 Villa Rd., Birmingham, Mich. 48008

TRADE FOR 4CX1000 and/or chimney. Write for list or state needs. J. Amery, 7541 La Avenida Dr., Dallas, Tx. 75240

FREE GOODIE list. M. Gauthier, 10425 San Jose Ave., South Gate, Cal. 90280

CapACITOR DISCHARGE Ignition?? Inside story. Masters thesis $5. Michael Gauthier, 10425 San Jose Ave., South Gate, Cal. 90280

FOR SALE: Sherwood tuner S-3000 $30 and Scott and Fisher Stereo Adapters $20 each. A. Bott, 340 S 24th St., Quincy, Ill. 62301

TRADE: Husky variac 110/220v-10 amps, for BC-221 or 1-177 B tube tester. S. Zuchora, 2748 Meade St., Detroit, Mich. 48212

FOR SALE: Heath Ho-10 $40; HO13, $45; Both for $80 with rack adapter. E. White Jr., Box 582, Waynesboro, Va. 22980

FOR SALE: HW-12 $75, with HP-13 $125; Drake 2B, HT-44, PS150-AC P/S $400. All perfect cond. J. Clark, 786th Radron, Box 29, Minot AFS, No. Dak. 58701

MAGAZINES QST, CQ, 73, Misc magazines. B. Hayward, 3408 Monterey, St. Joseph, Mo. 64507

WANTED: 2 or 3 ele tri-band beam, in gud condx, and/or cheap tower but in fair condition. T. Nail, 96 Fairhaven Dr., Buffalo, N.Y. 14225

WANTED: Johnson Ranger II, F/W preferred, mint condition. State price. M. Ricker, 7119 Main St., Pwendale, Mich. 48754

FOR SALE: SX 101A $150. Eico 753 $140. T-150A $50. R. Nowicki, 524 Broughton Ave., Bloomfield, N.J. 07003

FOR SALE: 6 meter RF amp and 2 meter converter. Dec '65 QST $45. Heath HG10 VFO never used $25. H. Douglas, P.O. Box 164, Luther, Mich. 49656

FOR SALE: T-Bolt Amp. Clean $225. 2 meter gonset 500 watts Clean $215. DX60 Clean $45. Ha5 VFO Clean $45. 10-4-14avq v.g. want 3kv generator. C. Logsdon, 2115 26th Ave., San Francisco, Cal. 94116

WANT BIRD #43 wattmeter with VHF plugs, also recent FM Gear, freq counter, R. Beatie, 1904 E. 114th Ave., Tampa, Fla. 33612

CALIFORNIA Sale-HyGain DB-24A 20/40 meter beam. New, unused. Will not ship, you pick up. Make offer. A. Emerald, 8956 Swallow Ave., Fountain Valley, Cal. 92708

WANTED: Need 51S-1 instruction book. Also manuals for collins 51J4 and TS-382D/4RR Audio Generator. Has anyone put mechanical filters in A51J3? F. Gilmore, 560 S. Warren Ave., Springfield, Mo. 65806

6M-FM:RCA CMV3E Mobile Rig, 60 Watt output, easy 6-12 volt conversion, 30-54 mc, partial accessories, w/schematic $25, FOB. R. Beatie, 1904 114 Ave., Tampa, Fla. 33612

FOR SALE: Swan 350 with AC DC Power supplies and base mobile antennas plus extras. R. Dorough, Box 61, Terrell, Texas 75160

FOR SALE: Carter 6 v.d.c./115 v.a.c. rotary converter. 80 watts continuous. Used 20 hrs. $20. H. Smith, 467 Park Ave., Birmingham, Mich. 48009

FOR SALE: SP600 JX17 General coverage 540 Kc. to 54 Mcs. in plexiglass case, excellent condition. C. Kaufman, 231 S. Jasmine St., Denver, Colo. 80222

READER SERVICE

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Advertiser's Index

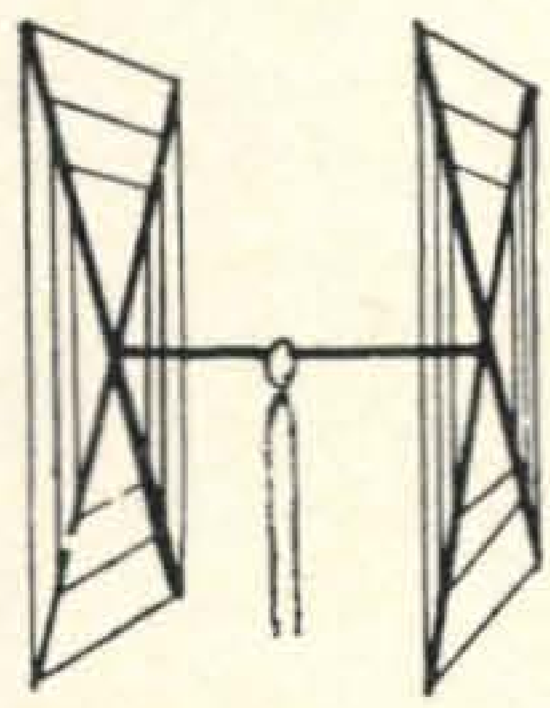
See page 126 for New Reader Service

GOTHAM ANTENNAS ARE MUCH BETTER
OF COURSE, YOU PAY MUCH LESS

How did Gotham drastically cut antenna prices? Mass purchases, mass production, product specialization, and 15 years of antenna manufacturing experience. The result: The kind of antennas you want, at the right price!

QUADS

Worked 42 countries in two weeks with my Gotham Quad and only 75 watts... W3



CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16′ square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10′ long x 1¼″ O.D.; 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064″ diameter.

X Frameworks: Each framework consists of two 12′ sections of 1″ OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞″ tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished); 52 ohm coaxial cable

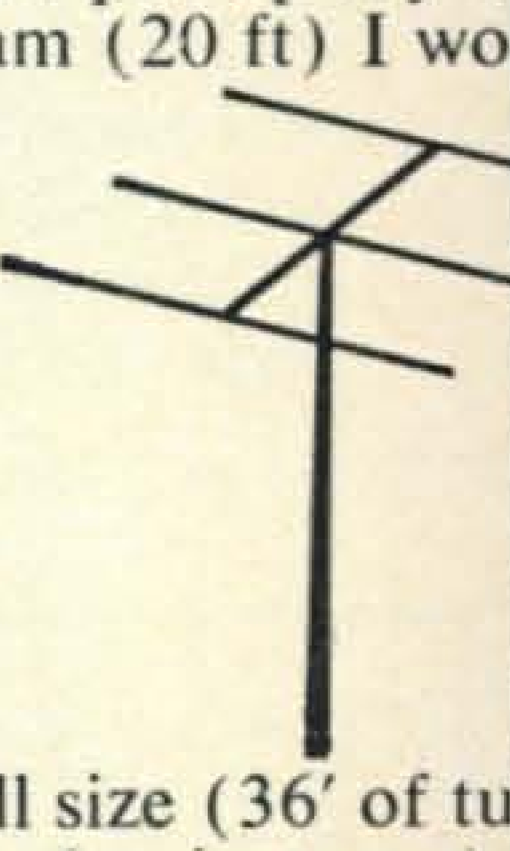
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$35.00
10-15 CUBICAL QUAD	30.00
15-20 CUBICAL QUAD	32.00
TWENTY METER CUBICAL QUAD	25.00
FIFTEEN METER CUBICAL QUAD	24.00
TEN METER CUBICAL QUAD	23.00

(all use single coax feedline)

BEAMS

The first morning I put up my 3 ment Gotham beam (20 ft) I wo YO4CT, ON5LW, SP9-ADQ, and 4U1ITU. THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36′ of tu for *each* 20 meter element, for instance); solutely complete including a boom and all h ware; uses a single 52 or 72 ohm coaxial f line; the SWR is 1:1; easily handles 5 KW; and 1″ alumnium alloy tubing is employed maximum strength and low wind loading beams are adjustable to any frequency in band.

2 EL 20	$16	4 EL 10	$
3 EL 20	22*	7 EL 10	
4 EL 20	32*	4 EL 6	
2 EL 15	12	8 EL 6	
3 EL 15	16	12 EL 2	
4 EL 15	25*	*20′ boom	
5 EL 15	28*		

ALL-BAND VERTICALS

"All band vertical!" asked one ske "Twenty meters is murder these days. Let's you make a contact on twenty meter phone low power!" So K4KXR switched to twe using a V80 antenna and 35 watts AM. He a small portion of the stations he work VE3FAZ, T12FGS, W5KYJ, W1WOZ, ODH, WA3DJT, WB2FCB, W2YHH, V FOB, WA8CZE, K1SYB, K2RDJ, K1M K8HGY, K3UTL, W8QJC, WA2LVE, Y MAM, WA8ATS, K2PGS, W2QJP, W4J K2PSK, WA8CGA, WB2KWY, W2IWJ, V KT, Moral: It's the antenna that counts!

FLASH! Switched to 15 c.w. and worked K IKN, KZ5OWN, HC1LC, PY5ASN, FG7 XE2I, KP4AQL, SM5BGK, G2AOB, Y CLK, OZ4H, and over a thousand other static

V40 vertical for 40, 20, 15, 10, 6 meters	$14
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$18

HOW TO ORDER: SEND CHECK OR MONEY ORDER. WE SHIP IMMEDIATELY UPON RECEIPT OF ORDER BY RAILWAY EXPRESS, SHIPPING CHARGES COLLECT.

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See page 126 for New Reader Service

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