ICD

CQ

November 1964
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The Radio Amateur's Journal

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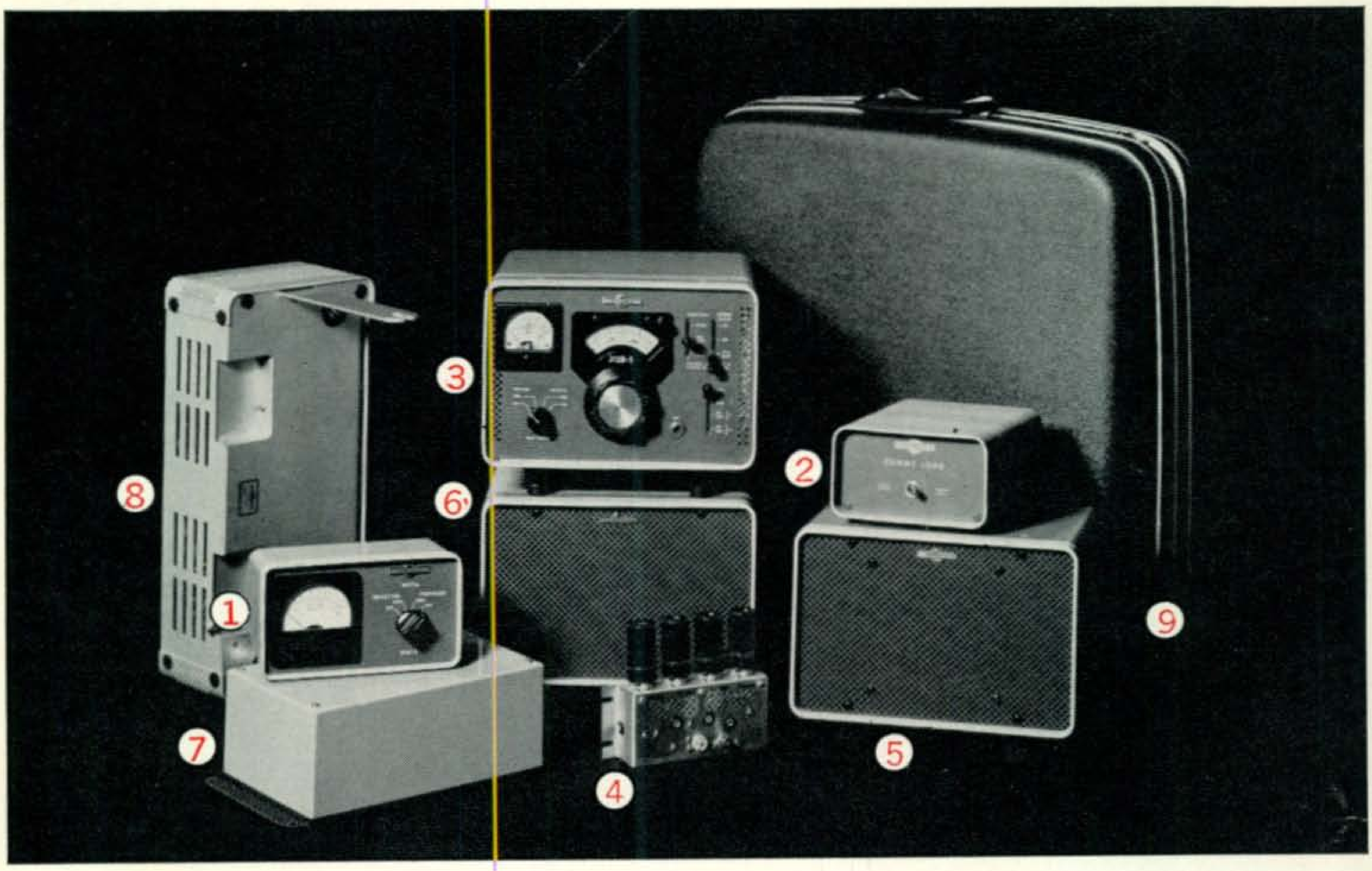

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COLLINS

For further information, check number 2, on page 142

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Official assigned frequencies in the range. Calibrated to .005%. 1600 to 10000 Kc. . . **$3.45** Net

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

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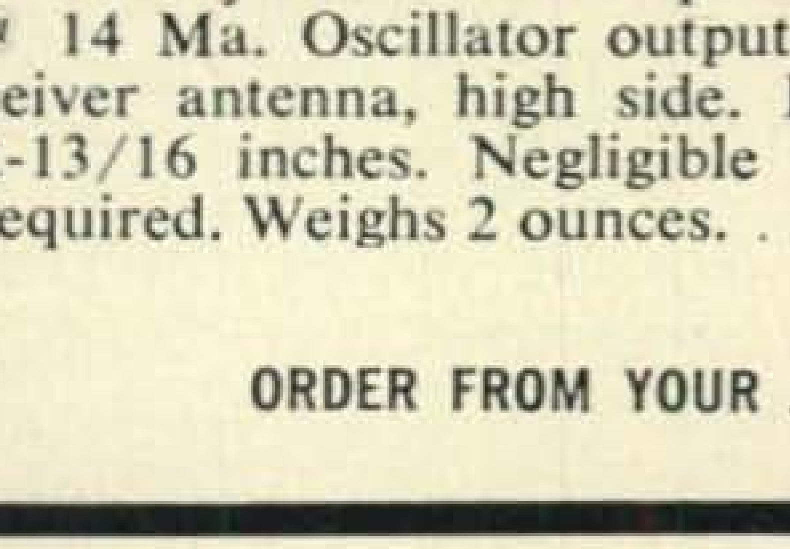

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NOVEMBER 1964 VOL. 20, No. 11

CQ

The Radio Amateur's Journal

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DEPARTMENTS

Offices: 14 Vanderventer Avenue, Port Washington, L. I., N. Y. 11050. Telephone: 516 PO 7-9080.

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


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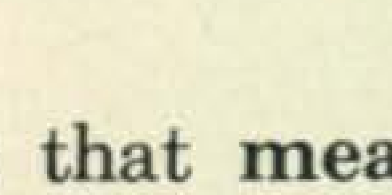
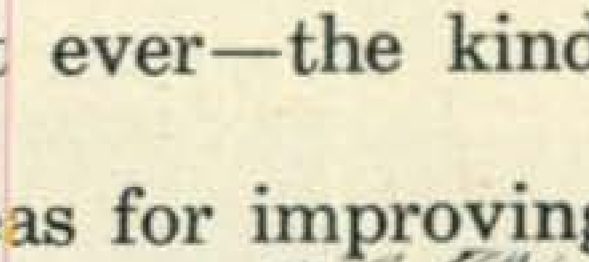
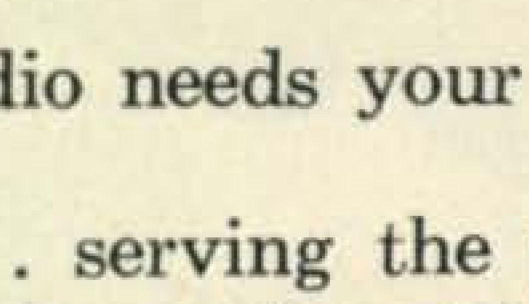
Biggest and best ham contest ever—the kind of contest that **means something!** Amateur radio needs your ideas for improving technique  ... increasing efficiency ... serving the public  ... promoting good will ... fostering international  understanding. Give us your idea and **win a valuable award to boot!**

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HERE'S ALL YOU DO:

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Washington: Electronic Wholesalers

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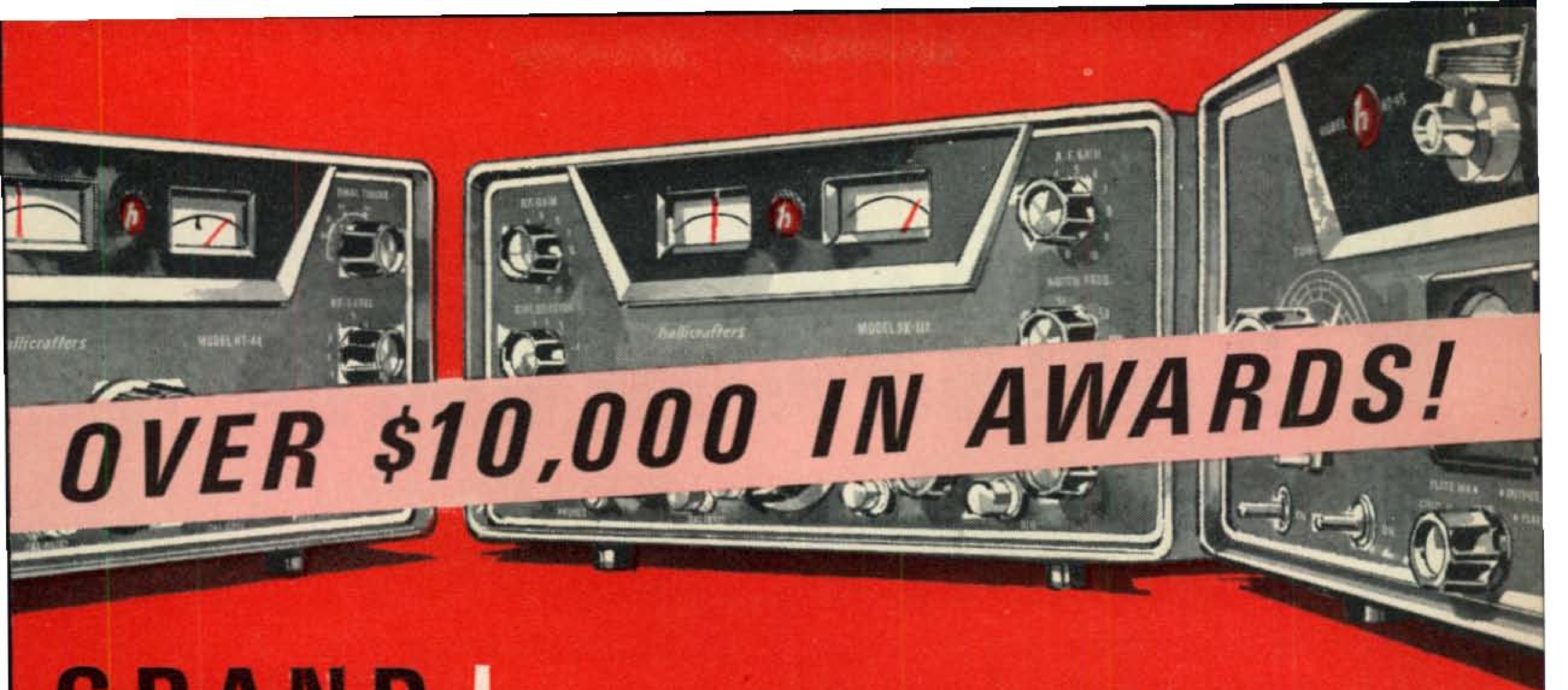
Hopeville: Southeastern Radio



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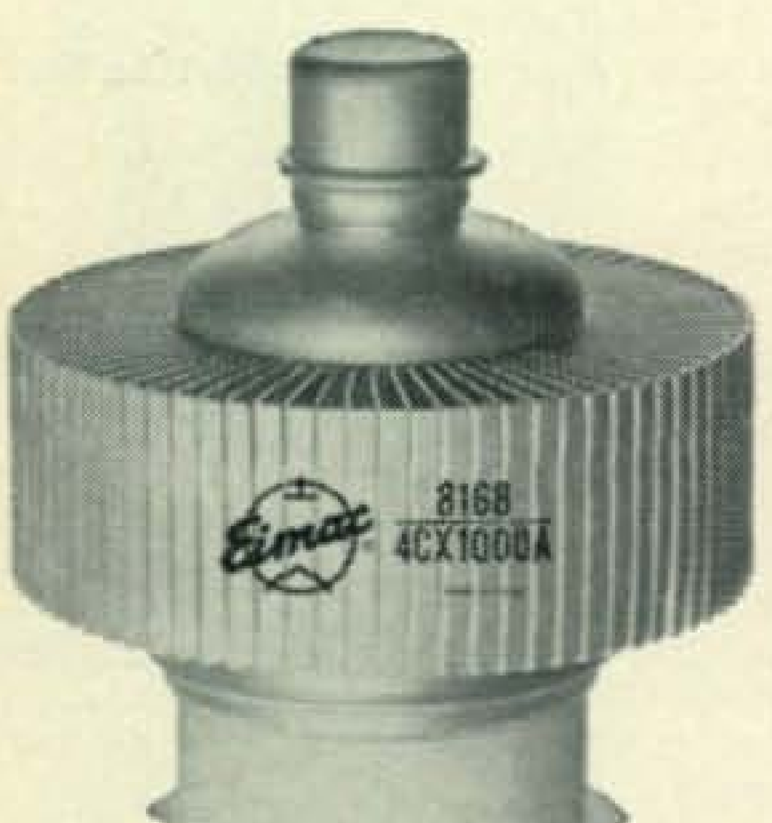
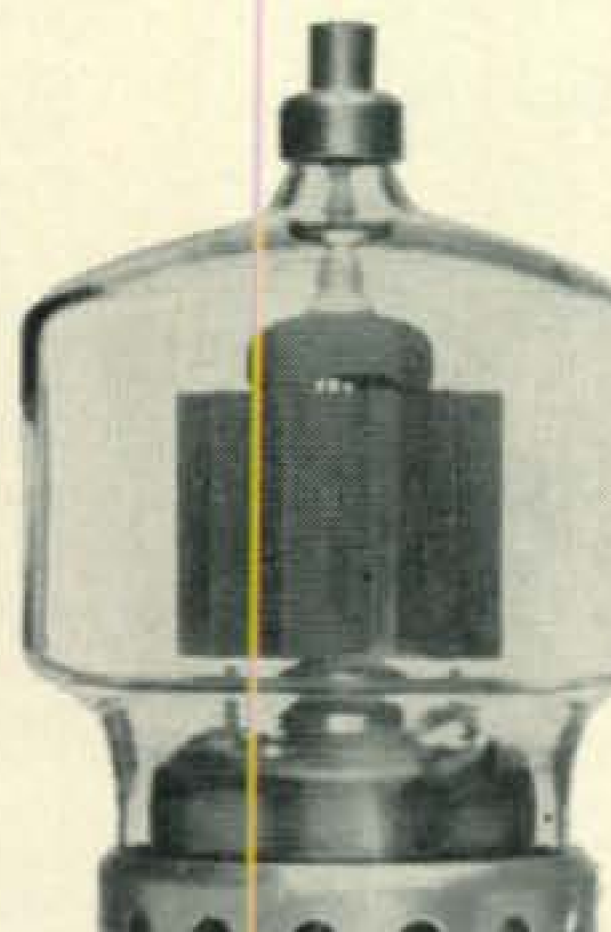


4CX1000A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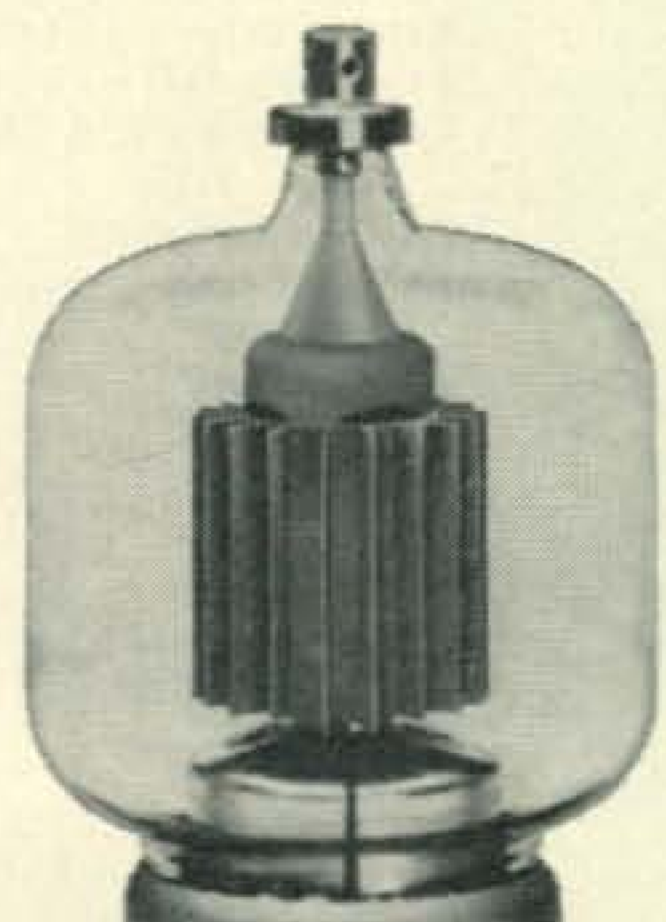
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4CX300A

ZERO BIAS

LATE news from the FCC in Washington tells of another proposed rule-making of interest to many amateurs. The actual Proposed RM was received too late for publication in its entirety in our Announcing column, but the gist of it is that the rules concerning eligibility for the Conditional Class license are apparently due for revamping. Our Washington source indicates that the distance requirement of 75 miles for Conditional License eligibility is proposed to be increased to 175 miles. What this will mean, then, is that only amateur actually residing more than 175 miles from the nearest quarterly examination point will be eligible for a Conditional license. The proposed change will not effect shut-ins, *etc.*, now served by the Conditional license, nor will it be retroactive.

A rather ridiculous filing date for comments of November 16 is given, which nearly precludes comments entirely, but it seems likely that this date will be extended, so we will try to bring you the complete text of the proposed Rule Making next month.

The USA-CA Column

By this time most *CQ* readers have noticed the absence of the USA-CA column in October *CQ*, and will note its absence again this month. An explanation, of course, is in order. It may come as a surprise to some readers that Clif Evans, K6BX is no longer Custodian for the USA-CA Program. After nearly four years in that capacity, problems have suddenly developed in Clif's relationship with *CQ* and since Clif indicated no reasonable reconciliation, we were forced to break off the relationship.

These problems came as rather a surprise to me, for having worked indirectly with Clif for over three years on the USA-CA column, I had developed the picture of Clif as being a dedicated and outspoken professional journalist, familiar with the problems of publishing. But I am rambling; let me get back on the track. It seems that nearly three months ago, I received Clif's September USA-CA column, prepared in its usual professional manner. A cursory look at the text revealed the unveiling of a new award—a USA-CA/CHC Award—and the usual assortment of other local, state and county level awards, along with the regular chit-chat from the certificate hunters. No problem—until I happened across several pages of call letters—yes, just plain letters! Enough, in fact to fill a good two or three full pages in *CQ!* Fine, I said, but just who are they and what reason is there for publishing them in *CQ?* Clif's attached note explained that the list was of all CHC and FHC members with those calls holding USA-CA being underscored. The purpose of the list, he went on, was to guide a few super-hunters in attaining a new super-award—USA-CA/CHC. That is, working X-amount of CHC'ers who hold USA-CA.

A quick analysis of the situation showed that I was being asked (I *thought*) to use two or three *CQ* pages for the benefit of a very, very limited number of readers. But what of the thousands upon thousands of *CQ* readers having no interest in this super-award? Should they be penalized by having to wade through hundreds of call letters instead of getting the opportunity to read another fine technical feature or something else of more general interest, Exercising my prerogative as an Editor, I decided to cut the item from the column until it could be either trimmed down to a reasonable size or used when more space was available.

Another consideration (and some may call it a selfish one) was that this super-award threatened to steal some of the glamour from USA-CA itself, and it would be a great injustice to the hundreds of fellows seeking USA-CA to suddenly find that the award they seek is no longer "top-dog". Selfish? Perhaps some will think so, but how about the fellows that stood to be victimized by K6BX's "planned obsolescence." It's an old story, fellows; just as you've placed a down payment on a 1964 automobile, out come the 1965's. You can't win—or can you? Maybe if someone with strong enough convictions were to put his foot down as best he could, the "planned obsolescence" could be stopped. That's exactly what I did, and in doing so, I set myself up for correspondence containing the most vicious and cutting personal attack that any editor of *CQ*, I am sure, has ever withstood. Yes, it was really a "doozee" with the threats ranging from "ignorant" to "back-stabber" to "incompetent" and topping off the whole pile of humus was a simple "play the game my way, or it may cost you you're

[*Continued on page 124*]

...and for modern, low-profile Mobile Communication Equipment there's the new ultra-low profile, single-ended Amperex 8505

For further information, check number 9, on page 142

LETTERS TO THE EDITOR

Useless Articles?

Editor, *CQ:*

Look, fellas, enough is enough and that's too much already. I mean some of the construction projects that have appeared in *CQ* lately. Take for instance that push-button monstrosity that appeared in this month's issue (September). Now who, may I ask, has the time, patience, skill, materials and test equipment to construct such a piece of equipment? Another thing that irks me is some of the parts in some of these projects, why some of these parts are so special that 99% of us have never heard of them, to say nothing of the astonished looks we get when we ask for them at a parts house. Come on fellas, let's have something that the average ham can construct and use. How about, for instance, some articles on updating some of our present equipment. There is millions of dollars worth of old equipment in use that could certainly be put to better use by changing to newer tubes, or changing circuits to later revised ones, if only we had information on them. Just think of the many old receivers of surplus vintage and pre-war series that could be up-dated and made more useful, and what about the a.m. rigs that are becoming abundant now that could be cleaned up of their TVI, and their other problems, and be made useful once again; maybe even converted to s.s.b. I enjoy *CQ* very much, but as I say some of these projects are getting pretty useless.

Dalphin Emmons, W4APO
P.O. Box 411
Bay Minette, Alabama

Well, it looks like a bit of extra work with the cutting shears caused more than a few fellows to throw up their hands in fright, HI. OH2ZE's article, "A Push-Button Keyer," in September *CQ* was in no way, shape or form intended as a construction article. Instead, it was designed as an "idea" article to show the enthusiastic builder what can be done. What with specially wound toroidal coils and home made aluminum castings for the case, it's far from a routine construction project, but it *does* make good reading and food for thought, doesn't it?—*K2MGA.*

Confused?

Editor, *CQ:*

I'm writing to you at the suggestion of Dick Cowan, WA2LRO, to clear up an error in the Sept. issue of *CQ*. In the USA-CA section, our award was written up incorrectly, and we would appreciate a correction to clear up the confusion.

"Nights at the Round Table" is a group of amateurs on 50 mc. Our President is Don Gillmore, WA2QCQ, and I should be listed as Certificate Custodian.

"Knights of the Round Table" is a 2 meter group, and their President is Roy J. Eise, WA2IGQ, and they are the

◄ For further information, check number 10, on page 110

For further information, check number 11, on page 142

ones responsible for getting Gov. Hughes of New Jersey to sign the Amateur Radio Week Proclamation.

As you can see, the two groups were quite thoroughly mixed up in the articles, and the resulting confusion is a little annoying.

It seems mixed up on paper too, but we have no trouble on the air, as we operate on two different bands. I called Roy Eise, and we will work on it from our respective positions, but anything you can do for us in the magazine will be appreciated.

Thanks for your cooperation.

Phyllis J. McCarthy, WA2PVB
Secretary and Certificate Custodian
Nights at the Round Table
86 Olhson Avenue
Nutley, New Jersey 07110

How To Win Friends . . .

Editor, *CQ:*

In recent months many remarks have appeared in print in various places. Some of these have been distasteful and should be replied to. One such article appeared in the October issue of *73 Magazine* under the title of "City Life (UGH)". Here are my comments on this article.

It's a sorry state of affairs when a so called radio amateur puts r.f. into a master TV antenna system in an apartment house that forbids the placing of any kind of antenna at any location, not to mention the apparent disregard for the safety of group of men dedicated to protection of the life and property of this individual. In addition this amateur has left himself open for a libel suit, intimating that he has in effect "paid off" the superintendent of his apartment house and stating that the superintendent "will take care of the Fire Deparment if they come around."

It's unfortunate what juvenile-minded individuals are allowed to voice themselves in print to the detriment of Amateur Radio. It's inconceivable that the editor who claims to be dedicated to the cause of improving amateur radio would print such illogical activities on the part of an apparently immature amateur.

We are all aware that many hams operate their rigs and install antennas in locations which have rules against it, however, as wrong as this may be, discretion itself has kept these operators on the air for many years. To openly flaunt the rules is indicative of poor judgment which seems rampant on the part of some of our younger generation. What kind of person would erect four dipoles (80, 40, 20, and 10 meters) three beams and a Big Wheel antenna on a building which expressly forbids the same in the lease.

I think that it's time for all amateurs to start thinking. This is an adult hobby and all should approach these siuations in a sensible frame of mind. In this day of population explosion in the radio field we should do all we can to keep up the good will of amateur radio, we should keep on good terms with the public and never do or say anything (particularly on the air) that will antagonize our neighbors and discredit ourselves.

The Fire Prevention rules of the New York City Fire Department (Multiple Dwelling Law, Paragraph 62, Section 2) state that "All radio antennas or other wires over any roof shall, unless otherwise permitted by the Department, be kept ten feet or more above such roof." It seems, however, that breaking of rules is the rule, and not the exception.

Alfred G. Smith, WA2TAG/WB2FNW
President, The Rockaway Amateur Radio Club
Fireman 1st Grade, Ladder 137,
Fire Department of the City of New York
304 Beach 43rd Street
Far Rockaway, New York

Lasers

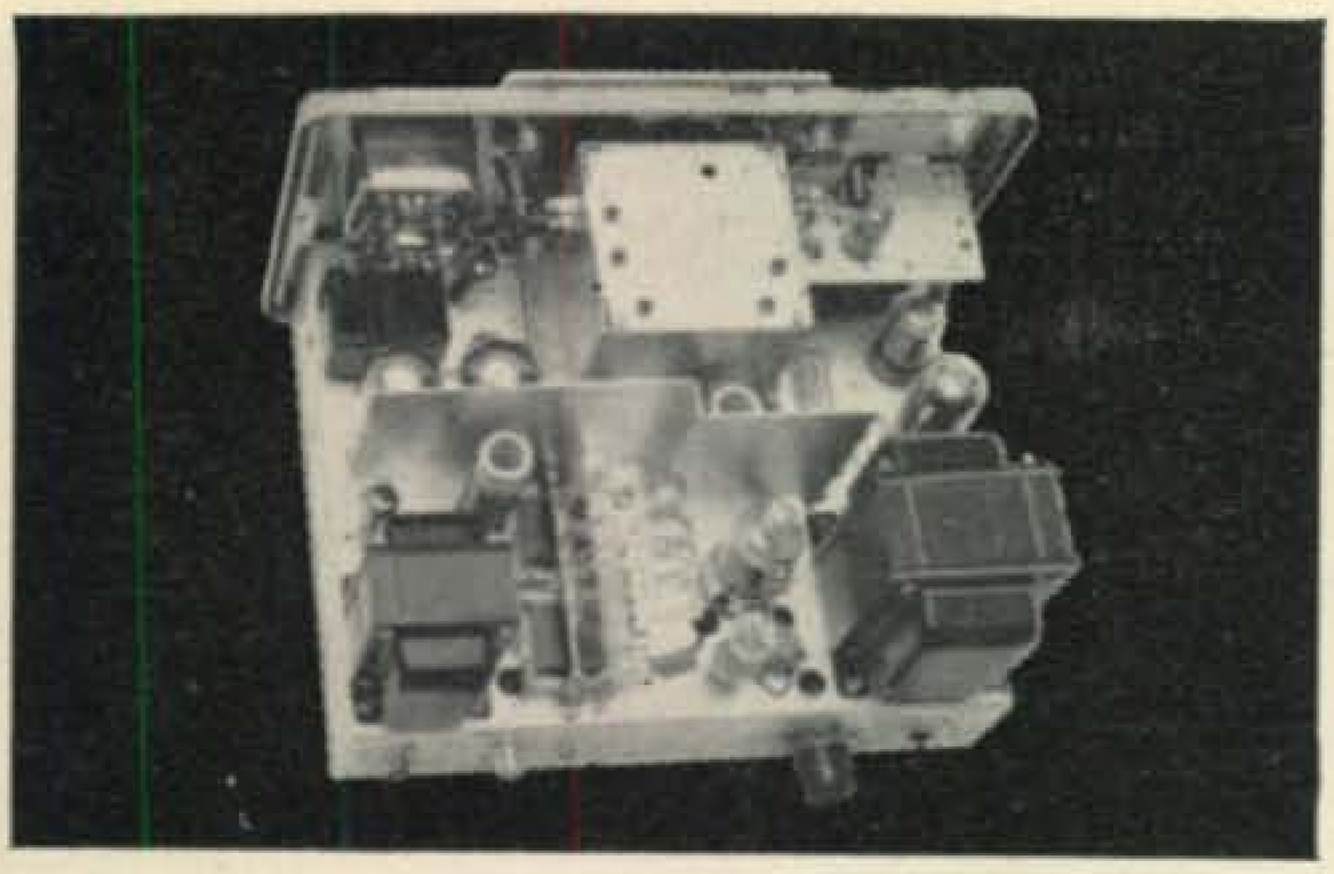
Editor, *CQ:*

Thanks for your article on Lasers by Stanley Leinwoll in Sept. *CQ*. Would like to see some construction articles on the same.

William H. Kunzler, W2AVI
8716-107 Avenue
Ozone Park, 17, New York

Editor, *CQ:*

For the benefit of those who are interested, I think the following information should be made known to the



Some may call it "ancient modulation", some simply call it AM phone—but whatever you call it, AM still represents a major portion of today's amateur activity—and the "Ranger II" is one of today's most popular AM rigs! For AM or CW operation, for 160 through 6 meters—the "Ranger II" offers the "biggest-little" 75 watts you'll find on the air! Rated at 75 watts CW and 65 watts high-level AM, the "Ranger II" delivers communications quality audio with the necessary punch to break through today's QRM! An excellent "first" transmitter for the Novice or the new General, the "Ranger II" will drive any of the popular kilowatt level tubes and will provide a high quality speech driver system for high powered modulators without modification! What else? The "Ranger II" offers attractive styling in a compact cabinet and is available at a reasonable price.

Cat. No. 240-162-1..."Ranger II" Kit ... **Net $249.50**
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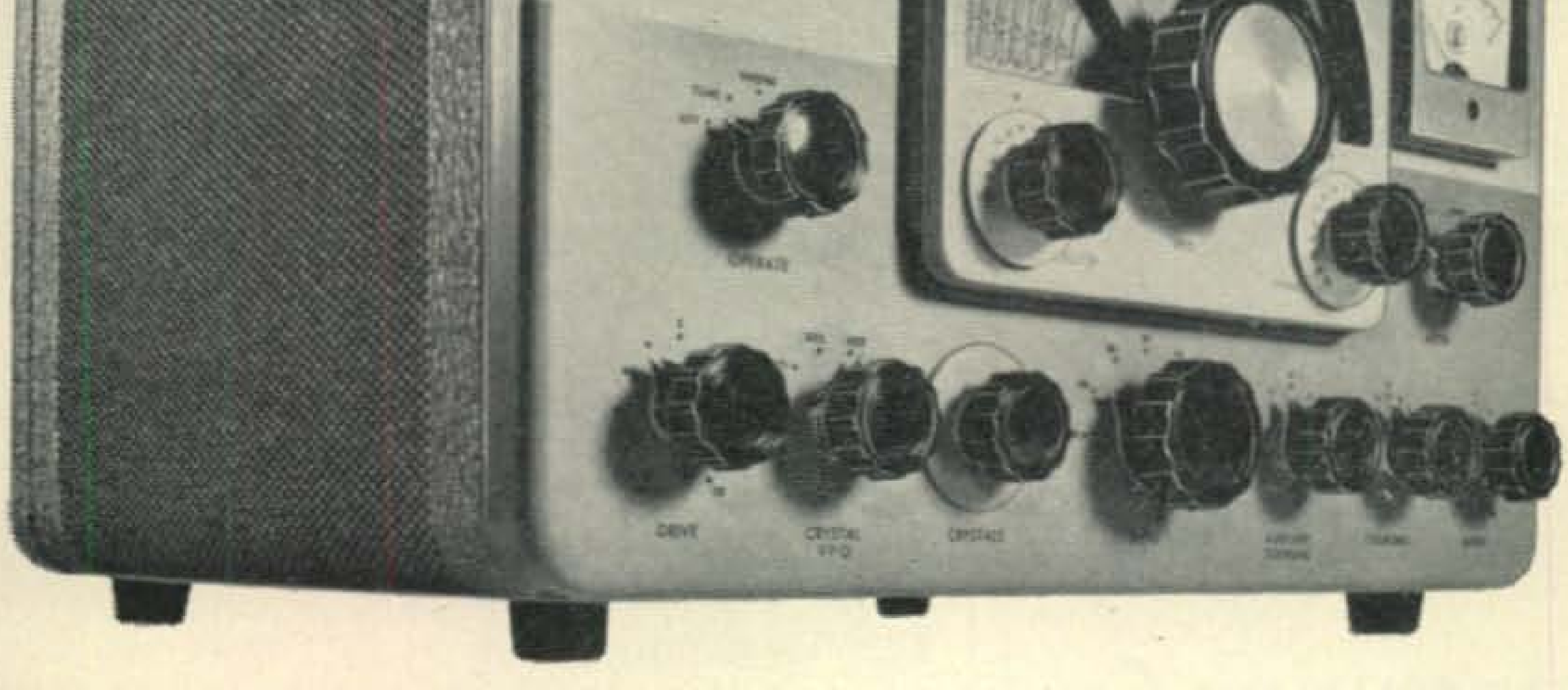
FEATURES

Built-in temperature compensated, extremely stable VFO—separate, calibrated bandspread dial scales for all 7 bands—highly efficient pi-network tank circuit—flexible, timed sequence keying system—self-contained power supplies—effectively TVI suppressed!

EASY TUNING

Basic tuning controls are located on the VFO dial escutcheon—QSY within the phone or CW portion of a band is usually possible by merely changing the VFO frequency setting.

RANGER II



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

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WASECA, MINNESOTA, U.S.A.

For further information, check number 13, on page 142

For further information, check number 14, on page 142

amateur world, since no amateur publication has yet entered the field. Construction information for a gas laser can be found in "The Amateur Scientist" section of the September, 1964 issue of *Scientific American* magazine.

Howard Mark, WA2TNZ
1640 Beach Avenue
New York, New York 10406

An SWL Complains

Editor, *CQ:*

I have a complaint with US hams in general.

As an s.w.l. who has been sending cards to US hams for the purpose of trying to achieve the USA-CA award, I have found that only about fifty per cent of the US hams who *do* QSL to s.w.l.'s fill out the card right, the rest oly put in the call of the s.w.l. station and leave the rest blank. Now I ask you fellow hams, how would you like it if you worked a rare county and when you finally got the card, all it had on it was your call? I would like to stress the fact that a card should have on it the *date, time, frequency* and *mode* at the very minimum.

Now for those hams who will say, "Why should we QSL to s.w.l.'s anyhow?" I say that if a s.w.l. includes return postage the ham should have the courtesy to QSL.

I would also like to stress the fact that the best QSL'ers are certificate hunters and YL International SSB'ers. They know their QSL is valued by s.w.l.'s especially if they are in a rare county.

Richard Markell, WPE6DXC
3258 Woodbine Street
Los Angeles, California 90064

Our Readers Approve

Editor, *CQ:*

Since I wrote you a few years ago and "scorched" you about your attitude toward ARRL, I feel I should write now and compliment you on your attitude.

As an old timer (1912 license 3CC) I feel that such cooperation will be much better for Amateur Radio.

R. L. Jenkins, W9CC
1117 North St. Joseph Street
South Bend, Indiana 46617

Editor, *CQ:*

Stay with the proven soundness of ARRL policies and I'll continue to be a subscriber of your as I have since the beginning. I am an old timer and naturally have been at odds with both your policies ad ARRL's at times but nothing that I can think back on, has been as destructive as the present *73* group.

Alvin U. Haugen, WØPRZ
RFD 1, Aberdeen, South Dakota

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1. Address a postal card (no other form accepted) to yourself.
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3. At the top of the correspondence side (when placed horizontally) write a date (month and year only) when you want the card mailed.
4. When this month arrives, the card will be mailed.

The foundation for Amateur Radio, sponsor of the service, accepts no responsibility, if, for any reason, the card is not mailed. The Foundation does agree, however, to maintain this service as long as volunteers are available. Mail your card today to:

Joan Machinchick, K3KBI
Lake Drive, Cape St. Clair
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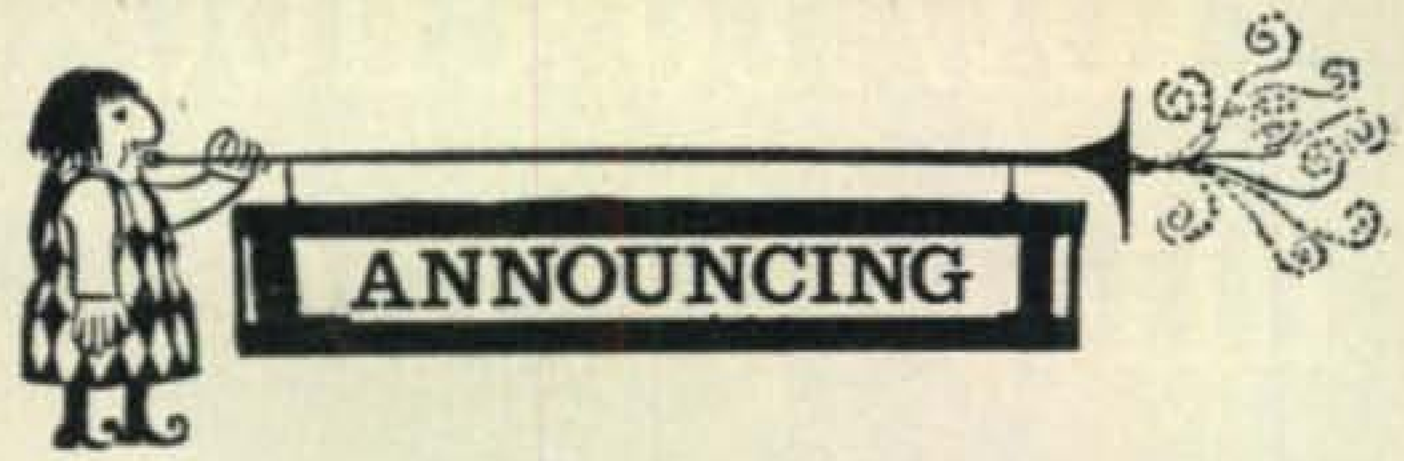


Brownfield, Texas

The Terry County Amateur Radio Club will conduct their annual "Free Swapfest" on November 1st, 1964. Contact E. C. Pool, W5NFO, chairman of the prize committee for further details. His address is 1003 East Buckley Street, Brownfield, Texas.

Russellville, Alabama

W4RLS and K4NMV have available for free distribution to anyone interested, copies of a callbook containing the names, calls and addresses of amateurs belonging to the Church of Christ. There is no charge, but a stamped self-addressed return envelope (No. 8 size) should be included with the request. If you are interested, send your requests to J. Foy Guin, Jr., W4RLS, Box 26, Russellville, Alabama or to Ernest A. Clevenger Jr., K4NMV, 1735 28th Street, Ensley, Birmingham, Alabama.

Washington, D.C.

Gordon E. White, author of "The Command Set Story" in this issue, is looking for information. If any reader has information concerning Army and Navy Command Set work of the 1930's or early forties contact him. In addition he is looking for units to complete a collection of Command sets, among them are the RAV receivers, Type K transmitters and receivers, the R-112, R-113, and T-89, T-90 ARC-5 equipment.

Phoenix, Arizona

The Amateur Radio Council of Arizona will sponsor a display of amateur radio equipment as well as an operating station at the Arizona State Fair. The dates for the Fair are November 5th through the 15th. Drop a line to Bob Dreste, K7VOR, Council Chairman, Amateur Radio Council of Arizona, P.O. Box 3073, Scottsdale, Arizona, for more information.

Correction

R. J. Diehn, W8MJG, was listed as K8MJG in the results of the 5th Annual *CQ* 160 Meter c.w. Contest. Sorry for the goof, Dick.

Cleveland, Ohio

On November 7th, 1964, at 12:00 noon (their time), The Southeast Amateur Radio Club of Cleveland Ohio will be launching a balloon equipped with a radio transmitter. The launch will be made from Edgewater Park in Cleveland.

The purpose of this flight is to establish a new one way, low powered, long distance communications record and further amateur radio interest.

The transmitter will operate on a frequency of 50.050 mc The power input to the transmitter is 90 milliwatts. A c.w. signal will be sent from the transmitter, it will repeat the call letters of the club, K8EMY.

All radio amateurs and swl's are encouraged to participate in listening for their signal. A prize is offered to the most distant point reporting in. To qualify for the prize, you must submit the following information: 1. Date, 2. The exact time the balloon was heard. (Note the time zone), 3. The relative position in which you heard the balloon, 4. The strength of the signal, 5. The length of time you were able to read the signal, and 6. The report of the tone of the c.w. signal. All of the above information should be sent to their chief project engineer, Ralph P. Trefney, W8TGX, 1701 Doering Court, Cleveland 9, Ohio.

How to choose a microphone for SSB

Model 664
$51.00 Amateur Net

Hand us a blank check. Tell us you want the best microphone you can buy for SSB -- with price no object. We'll hand you the Model 664 dynamic cardioid microphone. We'd like to tell you why the 664 is so uniquely suited to SSB operation.

Let's start with the transmitter. Almost every quality SSB transmitter, commercial or home-brew, incorporates an automatic level control circuit. And the general practice in transmitter design is to assume that the microphone response will be flat. On this assumption, the audio input circuits are designed to shape your speech characteristics, in conjunction with the ALC control, so that proper transmitter setup gives you maximum PEP.

Anything less than flat microphone response limits your ability to obtain maximum PEP, and your effective radiated power will be reduced. To satisfy this basic requirement, the 664 is unusually free from peaks or dips in response. It allows maximum PEP while retaining your natural voice characteristics.

Another important SSB feature, found in almost every modern transmitter, is voice operation. The 664 flat response, plus the effective Variable-D® cardioid pattern, reduces the possibility of accidentally opening the VOX circuit when speaker level is high. That's because the 664 rejects sound from the back and sides of the microphone. You can operate with higher receiver volume with complete safety. And noise, reverberation and echoes in the ham shack are reduced by the cardioid pattern to give you better intelligibility on the air.

Despite the performance advantages of the 664, this is not a fragile microphone, far from it. It's rugged, almost indestructible. The dynamic design meets the most rigorous tests for quality and service. And at the heart of 664 dependability is the diaphragm, maae of Acoustalloy®; a unique plastic material available only from Electro-Voice. Acoustalloy is virtually impervious to shock, temperature extremes, humidity and the countless other environmental conditions that gradually destroy less rugged instruments.

But there's more to the list of 664 advantages: High output level, handsome appearance, and the guaranteed backing of a manufacturer of unquestioned integrity and wide experience in electro-acoustics.

While we manufacture microphones ranging from the communications units in the Gemini space program to professional models that have won an Academy Award for their contribution to motion picture sound, no field is closer to our hearts than amateur communications. And the engineers and hams in our organization are particularily responsive to the needs of the amateur fraternity. They insist on good value for every product, in every price range.

But when price is no object, their choice is the 664 for SSB. Outstanding in performance and value for even the most critical amateur radio operator. We urge you to try the 664 in your own shack soon. We guarantee your satisfaction, or your money back.

For further information, check number 15, on page 142

ELECTRO-VOICE, INC.
Dept. 1142G, Buchanan, Michigan

Electro-Voice®
SETTING NEW STANDARDS IN SOUND

NOW

DIRECT CRYSTAL CONTROL TO 160 mc With AOC Plug-In Transistor Oscillators

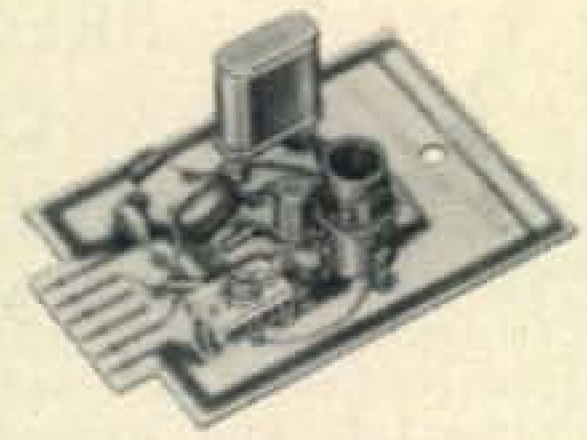
- Portable Signal Standards • Signal Generators For Receiver Alignment • Band Edge Markers
- Frequency Markers For Oscilloscopes • Quick-Change Plug-In Oscillators • Accessory Cases

HIGH FREQUENCY (20 mc – 160 mc)

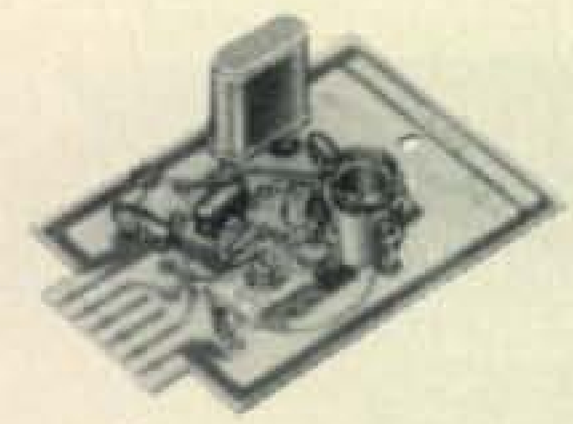
Five transistor oscillators covering 20 mc - 160 mc. Standard 77°F calibration tolerance ±.0025%. The frequency tolerance is ±.0035%. Oscillator output is .2 volts (min) across 51 ohms. Power requirement: 9 vdc @ 10 ma. max.

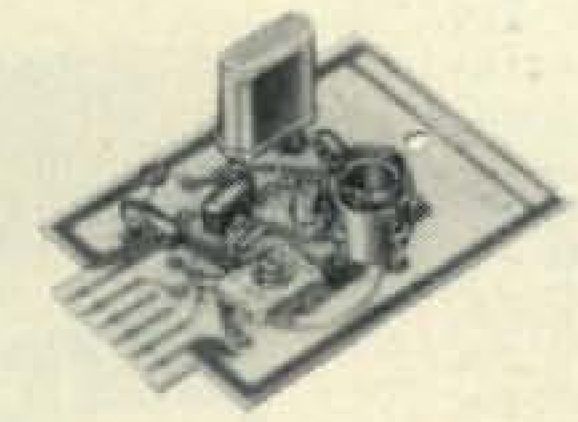
OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40°F to 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-24	20-40 mc	CY-7T	±.0035%	$ 9.10
OT-46	40-60 mc	CY-7T	±.0035%	9.10
OT-61	60-100 mc	CY-7T	±.0035%	15.00
OT-140	100-140 mc	CY-7T	±.0035%	15.00
OT-160	110-160 mc	CY-7T	±.0035%	15.00

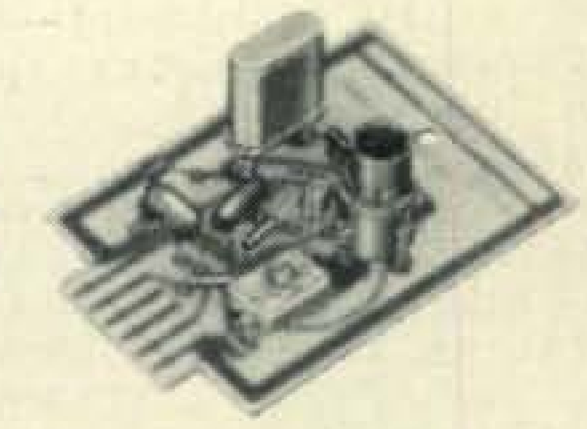
CRYSTAL FREQUENCY	CRYSTAL PRICE
20-60 mc	$ 6.90
60-100 mc	12.00
101-140 mc	15.00
141-160 mc	18.00

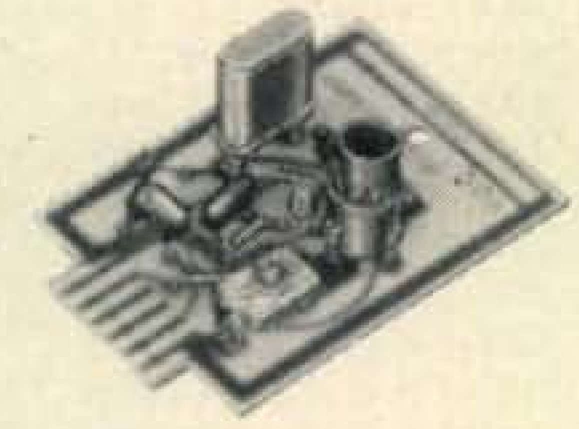


Order direct from International Crystal Mfg. Co.







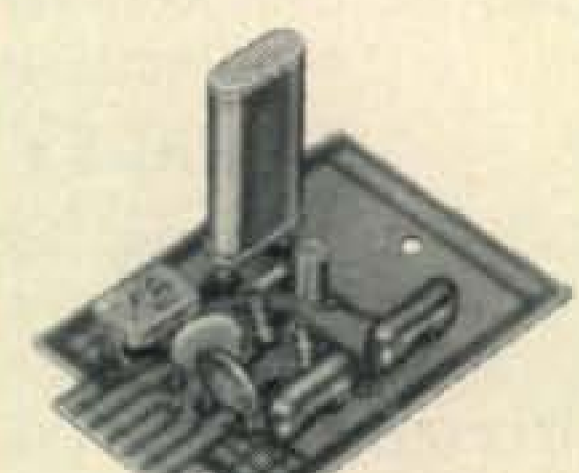


LOW FREQUENCY (70 kc – 20,000 kc)

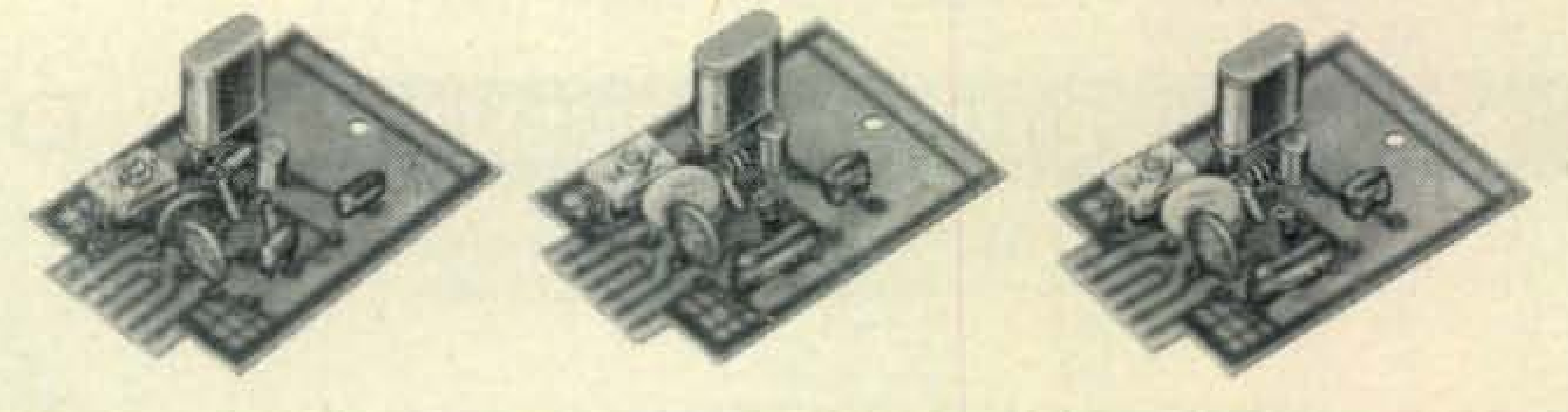
Four transistor oscillators covering 70 kc - 20,000 kc. Trimmer capacitor for zeroing crystal. When oscillator is ordered with crystal the standard will be ± .0025%. Oscillator output is 1 volt (min) across 470 ohms. Power requirement: 9 vdc @ 10 ma. max.

OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40°F TO + 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-1	70-200 kc	CY-13T	±.015%	$7.00
OT-2	200-5,000 kc	CY-6T	200-600kc ±.01% 600-5,000kc ±.0035%	7.00 7.00
OT-3	2,000-12,000 kc	CY-6T	±.0035%	7.00
OT-4	10,000-20,000 kc	CY-6T	±.0035%	7.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
70-99 kc	$22.50
100-200 kc	15.00
200-499 kc	12.50
500-849 kc	22.50
850-999 kc	15.00
1,000-1,499 kc	9.80
1,500-2,999 kc	6.90
3,000-10,999 kc	4.90
11,000-20,000 kc	6.90



INTERNATIONAL CRYSTAL MFG. CO., INC.



18 NORTH LEE OKLAHOMA CITY, OKLA.

AOC OSCILLATOR CASES

Small portable cases for use with the OT series of plug-in oscillators. Prices do not include oscillators. (When oscillator and crystal are ordered with FOT-10 case a 77°F tolerance of ±.001% may be obtained at $2.00 extra per oscillator/crystal unit. When oscillator/crystal units are ordered with FOT-20 case, a single unit can be supplied with temperature calibration over a range of 40°F to 120°F. Correction to ±.0005%. Add $25.00 to the price of FOT-20 and oscillator/crystal unit.)

FOT-20

FOT-10

FOT-20 For high accuracy calibration requirements. Includes battery and output jack, output meter circuit and battery check, as well as thermistor temperature measuring circuit. **$87.50**

FOT-10 Basic case with battery and output jack for general wider tolerance applications. **$14.50**

MT-1 Oscillator board mounting kit. **$4.95**

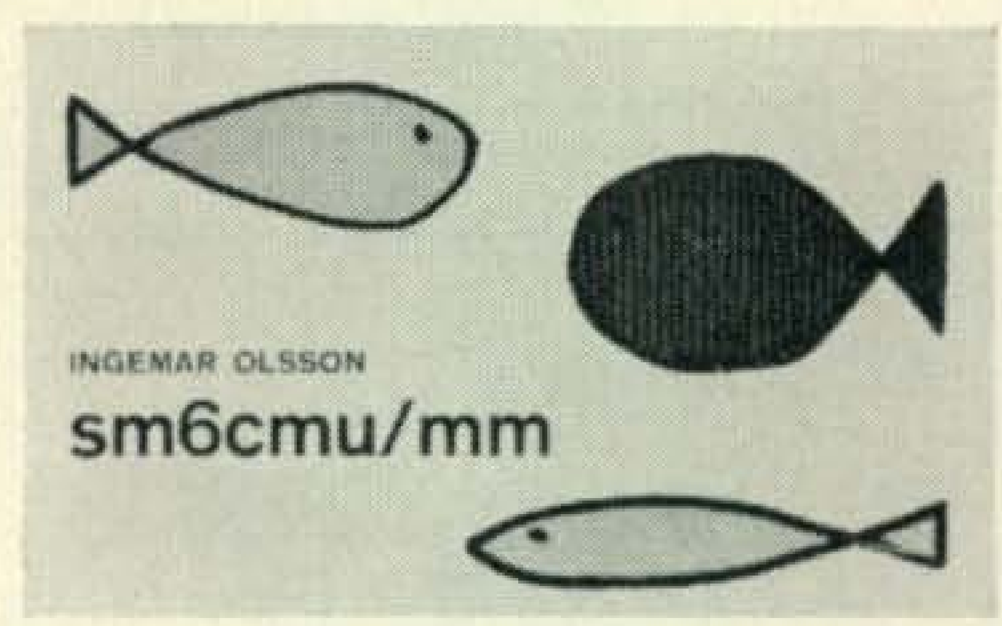
For further information, check number 17, on page 142

For further information, check number 18, on page 142

QSL contest

THIS month we were determined to find room for our QSL contest! Our winner, Kjell "Ken" Ekholm, SM7TE, of Malmo, Sweden will receive one year's free subscription to *CQ*. His card is beautifully colored in orange, black and light green. Our runners-up this month are SM6CMU/MM, 6O1ND and WA2PLO. They will receive a free copy of *CQ*. We also received an interesting card from Frederic Theodor Gaspard, TI9FG, who was operating aboard the schooner, *Bluenose II*. in Cocos Island, but because of technical difficulties we were unable to print it.

Keep your cards coming in—we like making earth shattering decisions.



NEWS

B & W OFFERS AMAZING Model 6100 TRANSMITTER FACTORY DIRECT!

OR THRU YOUR LOCAL DISTRIBUTOR

NOW ONLY

$495.00

NO TRADES

FOB FACTORY

Here's why B & W's Model 6100 has been called the "Most Amazing Transmitter of Our Time"!

- The Barker & Williamson Model 6100 Transmitter has been engineered and built to give the discriminating operator the ultimate in SSB, CW and AM communications.
- The 6100 uses the B & W crystal controlled frequency synthesizer, producing an order of stability which up to this time has been available only in costly military and commercial communication systems.
- The crystal lattice filter method of sideband generation is employed.
  Superior sideband suppression results.
- Solid state rectifiers are used.
- Dual automatic level control (ALC) with adjustable threshold prevents overdrive of output stages.
- Digital Dial System offers a high degree of dial accuracy.

WIRE, WRITE OR PHONE - FACTORY DIRECT - DEPT. T

B&W

BARKER & WILLIAMSON, Inc.

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Complete Radio Communication Systems and Equipment

Beaver Dam Road, Bristol, Pa., • 215 768-5581

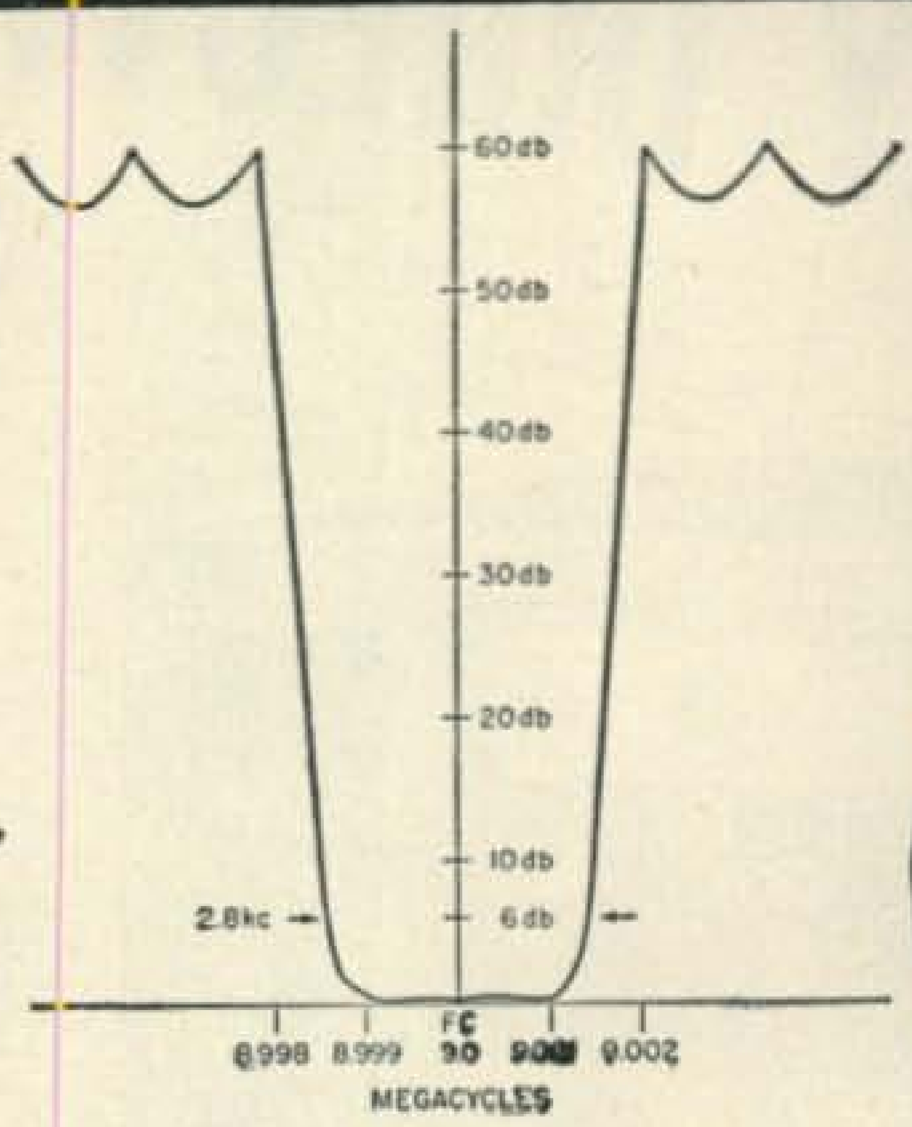
For further information, check number 19, on page 142

Now! for discriminating amateurs who are satisfied with nothing less than *THE VERY BEST*

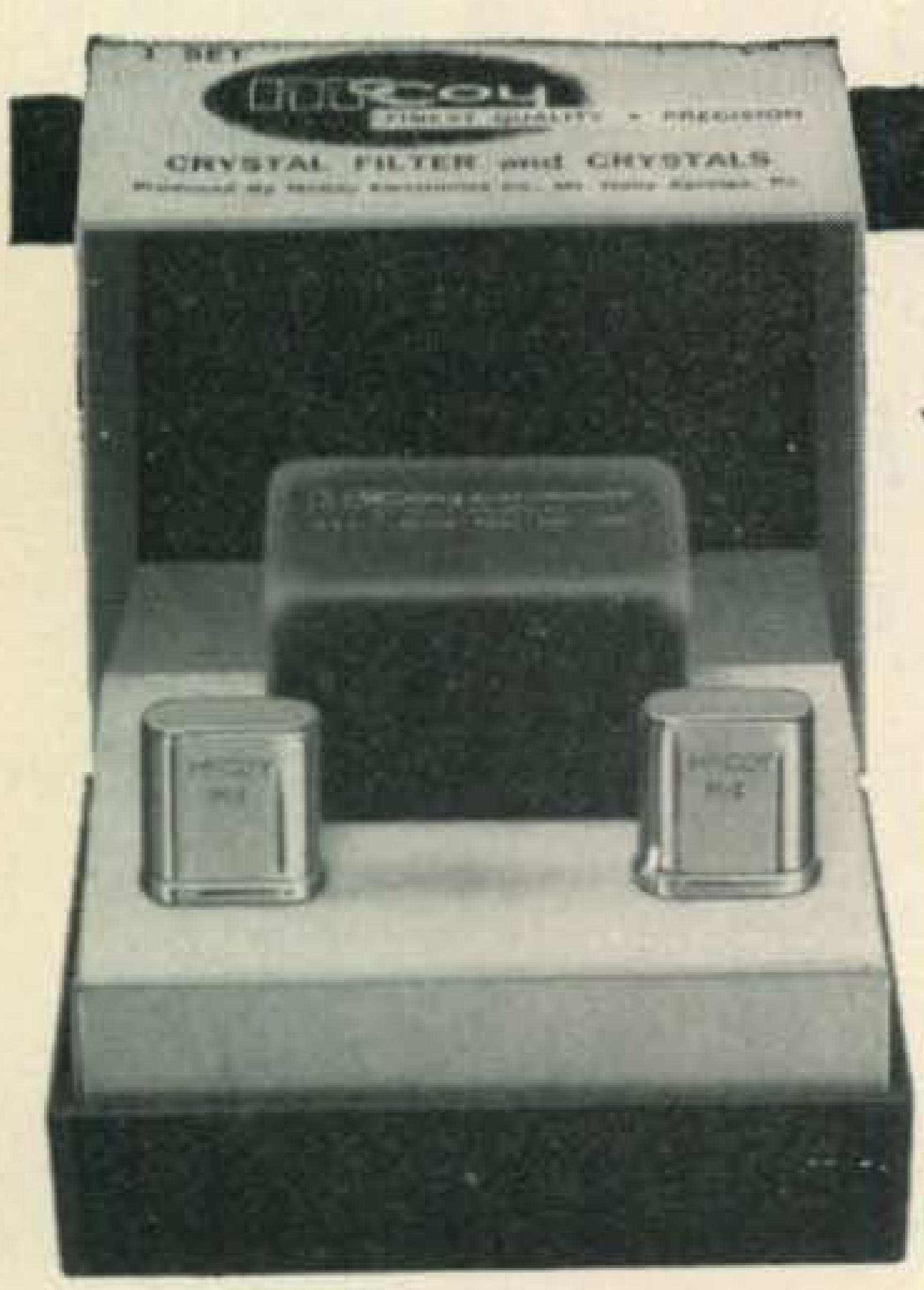
McCoy SINGLE SIDE BAND FILTERS

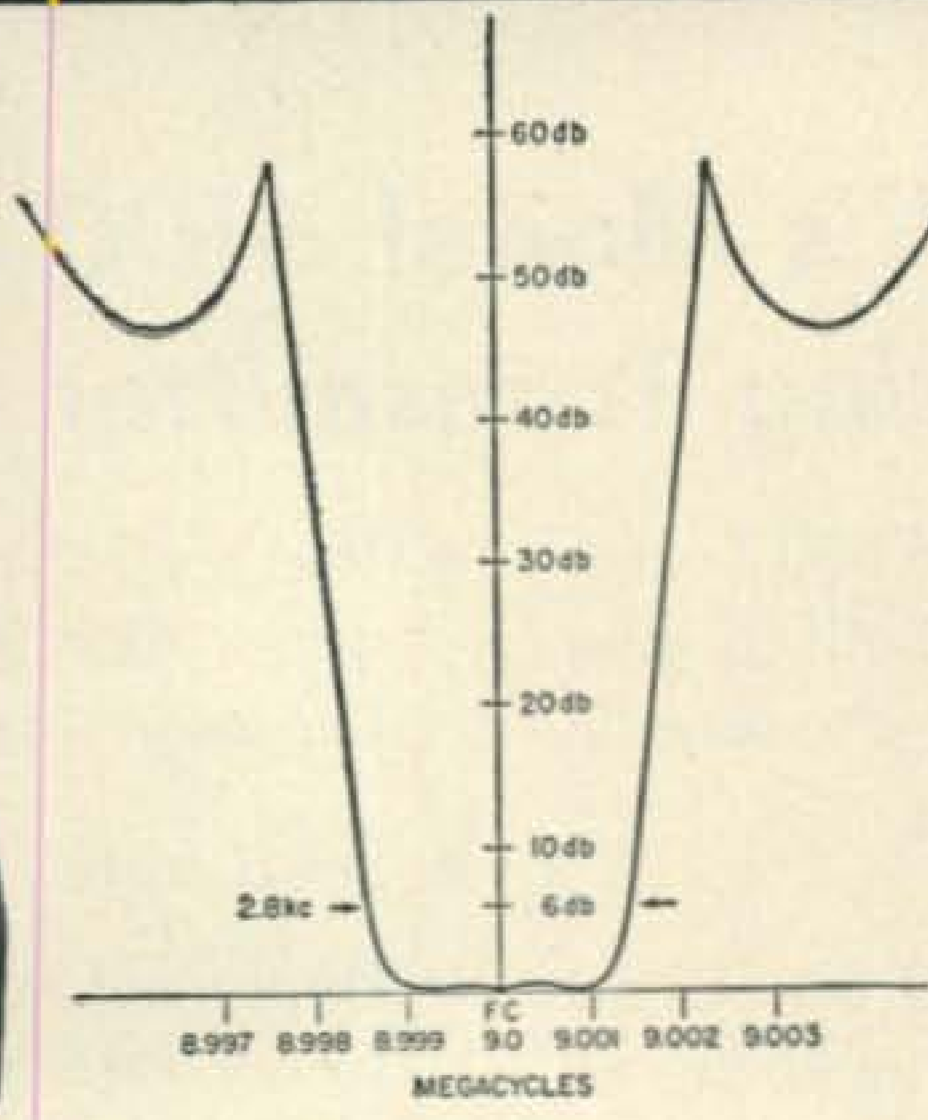
The GOLDEN GUARDIAN (48B1)

TECHNICAL DATA
Impedance: 640 Ohms in and out (unbalanced to ground)
Unwanted Side Band Rejection: Greater than 55db
Passband Ripple: ± .5db
Shape factor: 6 to 20db 1.15 to 1
Shape factor: 6 to 50db 1.44 to 1
Package Size: $2\frac{7}{16}$" x $1\frac{19}{32}$" x 1"
Price: $42.95 Each



The SILVER SENTINEL (32B1)





TECHNICAL DATA
Impedance: 560 Ohms in and out
Unwanted Side Band Rejection: Greater than 40db
Passband Ripple: ± .5db
Shape factor: 6 to 20db 1.21 to 1
Shape factor: 6 to 50db 1.56 to 1
Package Size: $1\frac{3}{4}$" x $1\frac{1}{4}$" x 1"
Price: $32.95 Each

Both the Golden Guardian and the Silver Sentinel contain a precision McCoy filter and two of the famous M-1 McCoy Oscillator crystals. By switching crystals either upper or lower side band operation may be selected. Balanced modulator circuit will be supplied upon request.

Both sets are available through leading distributors. To obtain the name of the distributor nearest you or for additional specific information, write:

McCoy ELECTRONICS CO.
Dept. CQ-11
MT. HOLLY SPRINGS, PA.
Phone: HUnter 6-3411

SUBSIDIARY OF OAK MANUFACTURING CO

For further information, check number 20, on page 142

GONSET **SIDEWINDER**
TRANSCEIVER **Model 900A**

SOLID STATE "SCOOP" FROM GONSET!

FIRST AND ONLY TRANSISTORIZED 2 METER SSB-AM-CW TRANSCEIVER FOR MOBILE, PORTABLE AND FIXED COMMUNICATIONS

The totally new Gonset Model 900A *Sidewinder* is the first and only transistorized SSB-AM-CW transceiver (except mixer, driver, final stages in transmitter) to provide complete coverage of the 2 meter amateur band in 4 segments 1 MC wide. Yet it's so compact it fits quickly under the dash of the newest cars! Transistor design makes possible a primary power requirement in the receiver of less than ½ amp! Separate power supply accessories snap-fasten to back of transceiver, or may be used for remote installation. Here's the trouble free, solid state transceiver with power to spare for any fixed, portable or mobile application!

For complete information, visit your Gonset Distributor, or write Dept.CQ-11.

CHECK THESE HIGH-PERFORMANCE SPECIFICATIONS:

TRANSMITTER: Transistorized (except for mixer, driver, final states) • **Frequency Range:** 144-148 MC • **Power Input:** 20 watts PEP SSB, 6 watts AM, 20 watts CW • **Spurious Suppression:** —50 db • **Carrier Suppression:** —50 db on SSB • **Unwanted Sideband Suppression:** —40 db • Features include VFO low frequency 1st conversion, with crystal controlled high frequency 2nd conversion for stability, filter type side-band generation and broadband circuits for easy operation.

RECEIVER: All-transistorized • **Frequency Stability:** Highly stable; utilizes same VFO as transmitter • **Sensitivity:** ½ mcirovolts or better for 10 db $\frac{S+N}{N}$ • **Selectivity:** 3.5 kc filter for both receiver and transmitter • **Audio Output:** 3.0 watts • **Spurious Suppression:** —50 db or better • **Image Rejection:** —50db (receiver and transmitter utilize double conversion) • Full RF amplifier with three tuned circuits for low noise figure, good selectivity. Separate RF and AF gain controls.

TRANSCEIVER: Both the receiver and transmitter are dual conversion, using 15 MC and 9 MC frequencies with a **hermetically sealed** crystal lattice filter. **Dimensions:** 8⅞" W., 4⅞" H., 7$\frac{3}{16}$" D. • **Wt.:** 10 lbs.-8 oz. POWER SUPPLY: **Dimensions:** (AC or DC) 8⅞" W., 4⅞" H., 5$\frac{15}{16}$" D. • **Wt.:** 13 lbs.-8 oz.

PRICE: TRANSCEIVER: $399.50 Amateur Net; POWER SUPPLY: AC—$67.75 Amateur Net • DC—$79.50 Amateur Net

GONSET, INC.

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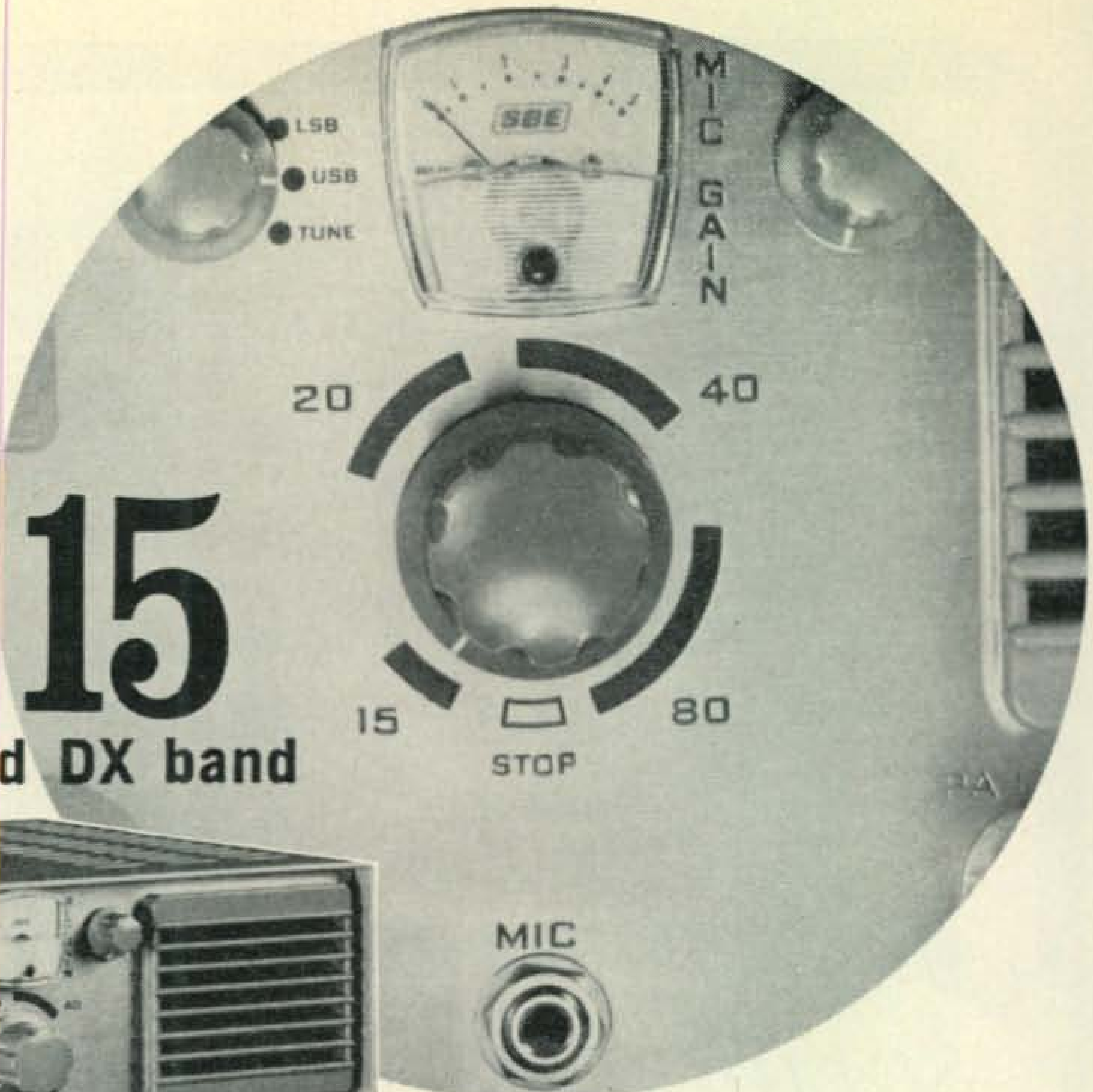
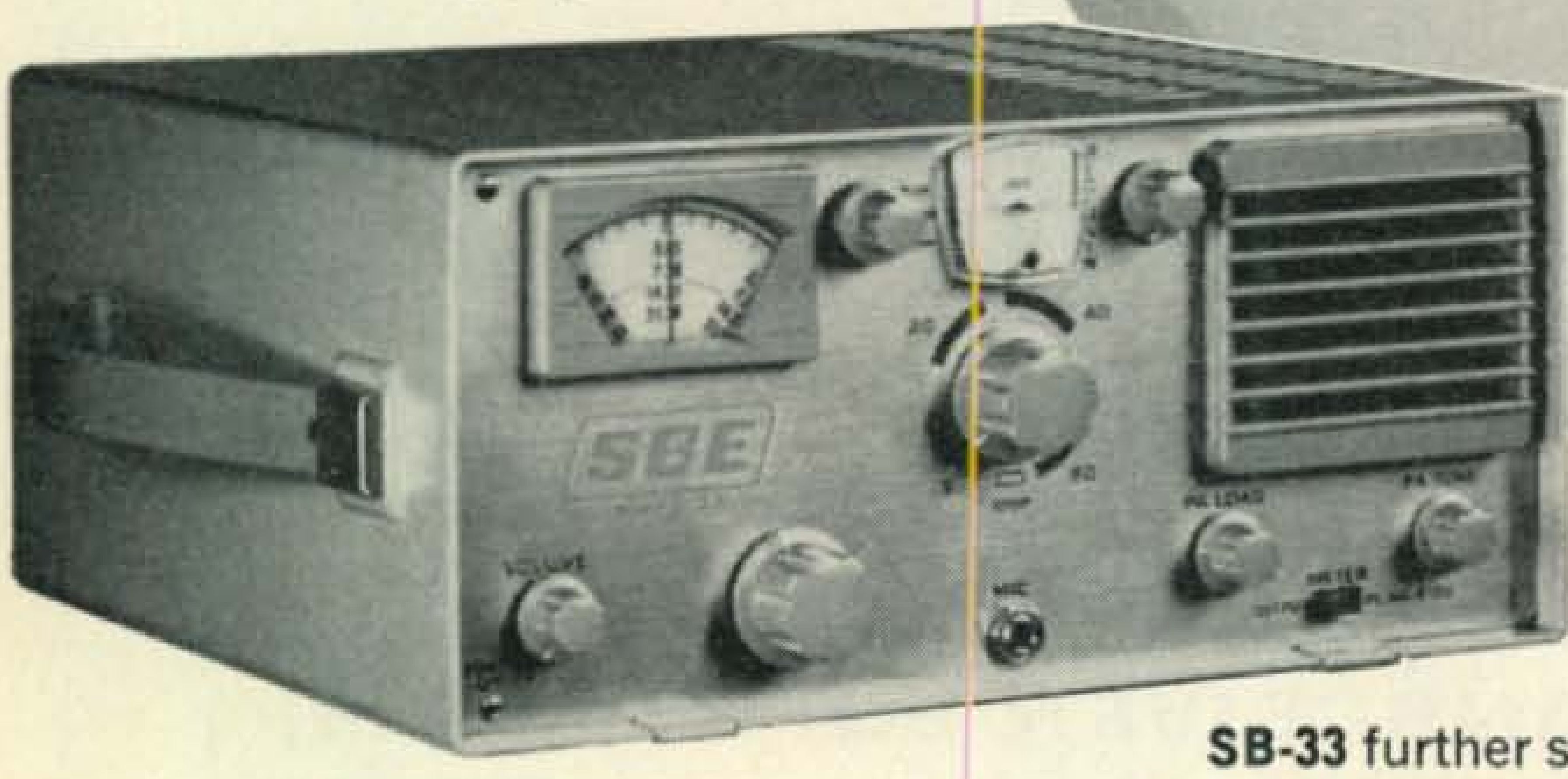
LTV *A Subsidiary of Ling-Temco-Vought, Inc.*
1515 S. MANCHESTER AVENUE, ANAHEIM, CALIFORNIA

For further information, check number 21, on page 142

SB 33 SET FOR 15

lively, year-round DX band





SB-33 further supports its claim to being the **greatest SSB transceiver value available** by offering an exciting **fourth band,** 15 meters. Sun spot minimums not withstanding, 15 meters is frequently open for coast-to-coast and DX operation, proved this well during the recent phone DX contest by providing "pipe line" channels to South and Central America . . . to Europe from the East Coast . . . to JA, HL, VS1, VK and ZL from the West Coast. This band is ideal for SSB transceiver operation; the major activity being in the 21.25-21.45 mc U.S. phone band thereby allowing **all** stations—DX and otherwise—to be "zeroed".

Fixed or mobile, **SB-33** plays this band like a hot smash off the distant fences! The all-solid-state receiver performs in a manner that must be heard to be believed. Reminder: **SB-33** is **all-solid-state throughout** except for the RF driver and the husky, double PL-500's in the amplifier.

For those who want the **big** signal at modest cost, the **SB1-LA Linear Amplifier.** Delivers 1 KW P.E.P. on 80-40-20, 750 watts P.E.P. on 15.

VALUE CHECK LIST

Compare **everybody's** transceiver data and prices.
Read all the small print.

	X	Y	Z	SB-33
Four bands: 80-40-20-15				✓
Built-in AC power supply				✓
Built-in speaker				✓
Panel-switchable sidebands				✓
Price . . complete as above				389.50

SBE

SIDEBAND ENGINEERS

**317 Roebling Rd.
So. San Francisco, Calif.**

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

NAME

NUMBER STREET

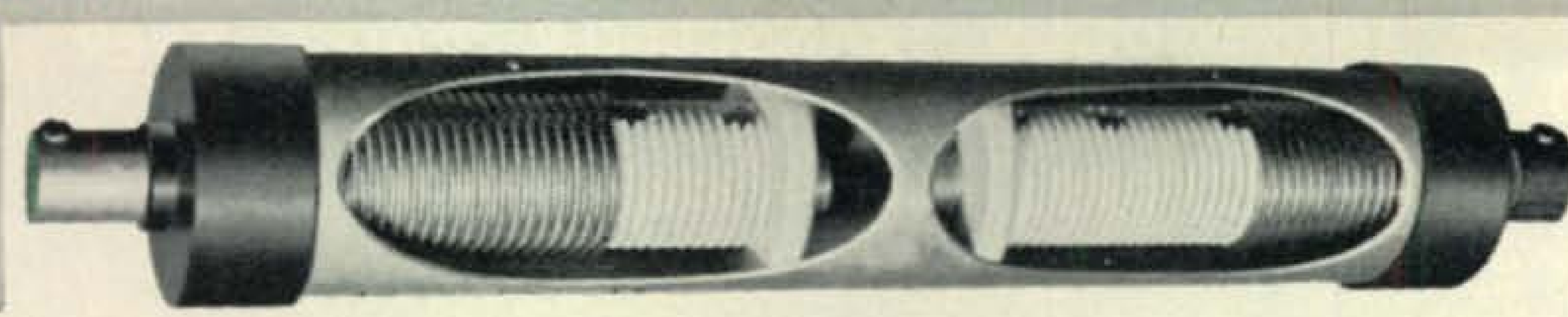
CITY ZONE STATE

RAYTHEON

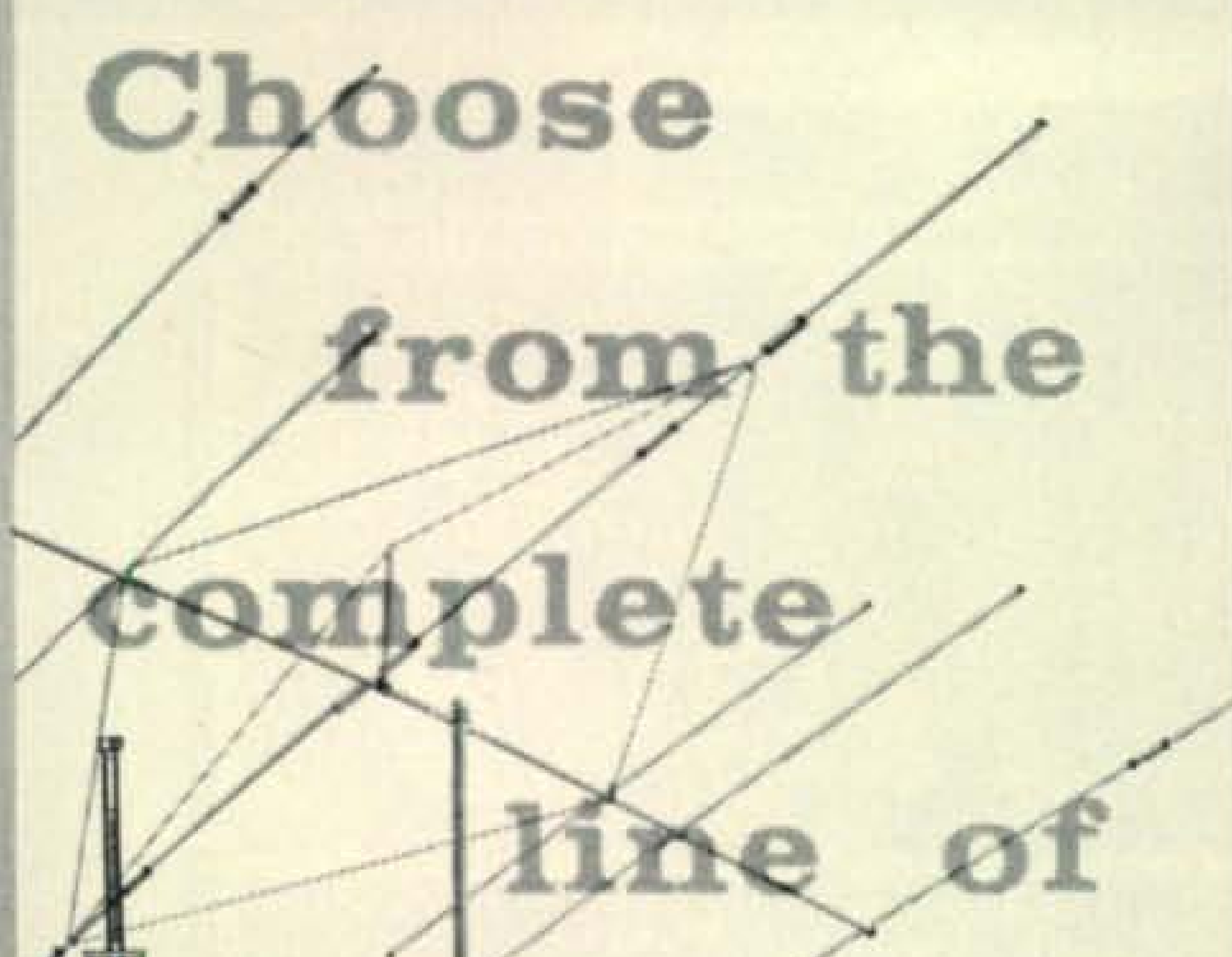
Export sales: Raytheon Company, International Sales & Services, Lexington 73, Massachusetts, U.S.A.

For further information, check number 22, on page 142

HERE'S THE ORIGINAL!



None Better HAS EVER BEEN Made!



Choose from the complete line of multi-band antennas... proved best by every test!

DON'T BE FOOLED BY IMITATION! BE MISLED BY ADVERTISING CLAIMS!

The original all metal encased trap was first produced in 1957 by Mosley for use with the World Famous TA-33. The Mosley trap design has been imitated by many manufacturers of amateur antennas. This is both a compliment and proof of the outstanding engineering built into every Mosley Multi-Band Antenna.

Consider the facts

Mosley MULTI-BAND ANTENNAS have been

1. Used by HAMS all over the world!
2. Specified by the U. S. Government!
3. Produced for Military Installations!
4. Chosen by "Vanguard" and "NASA"!

When your communications need a dependable antenna . . . Get The Finest . . . Get A Mosley!

Mosley Electronics Inc.

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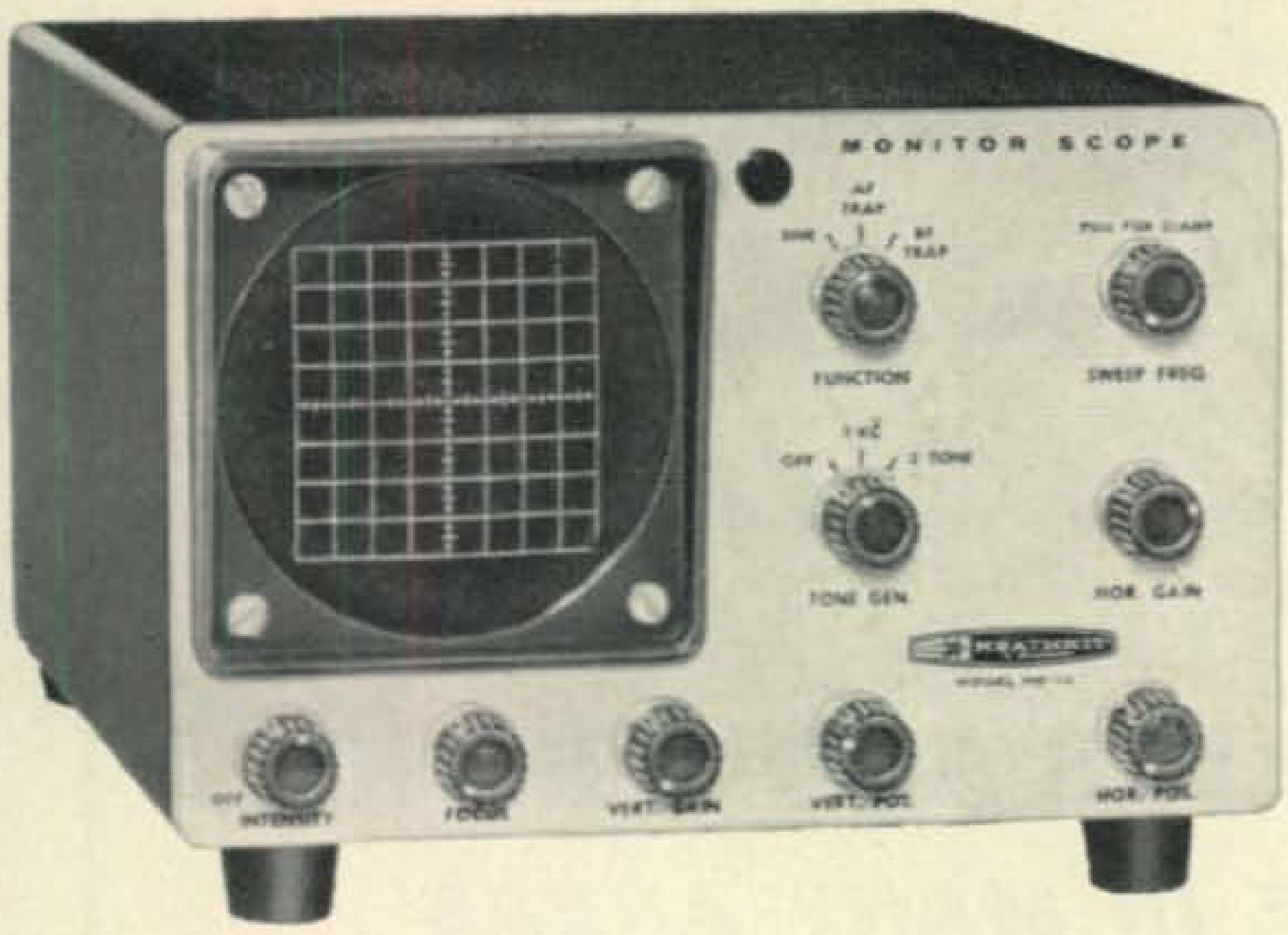
4610 NORTH LINDBERGH BLVD.
BRIDGETON, MISSOURI, 63044

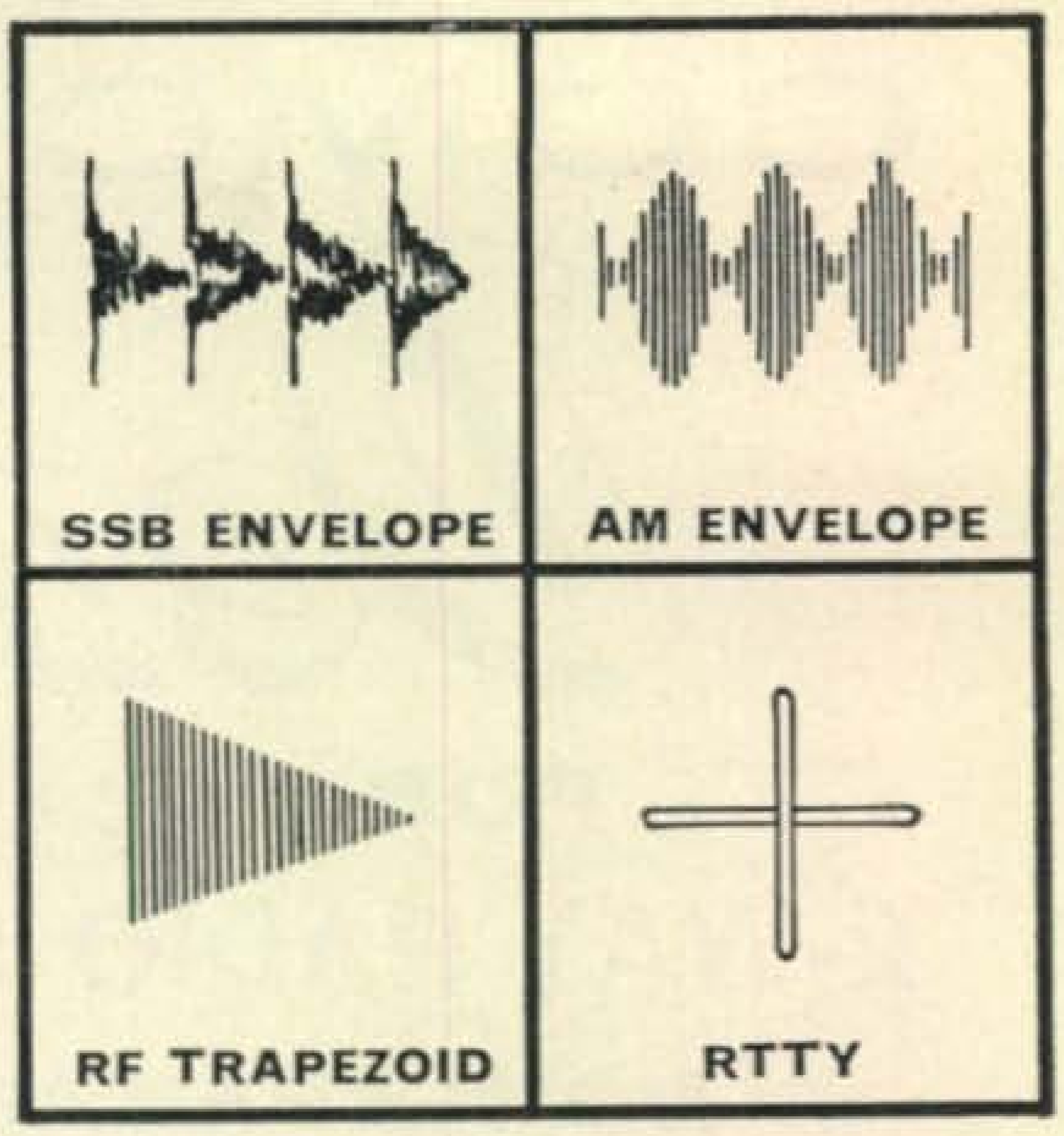
Export Division: 64-14 Woodside Avenue, Woodside 77, New York.

For further information, check number 23, on page 142

For further information, check number 24, on page 142

WATCH IT...WITH THE





NEW HEATHKIT® HAM SIGNAL MONITOR

Specially designed for Amateur Radio use. The Heathkit Monitor Scope provides the perfect answer for monitoring the modulation characteristics of both transmitted and received amateur signals. It shows at a glance the quality of your signal and indicates the presence of distortion due to improper tuning or adjustments assuring that the signal you transmit is of the best quality for finest communications results.

Displays Envelope, AF & RF trapezoid patterns. Automatic switching is featured between transmitted & received envelope patterns and a clamping circuit is employed to pull the spot off-screen during "receive" on trapezoid patterns to prevent burning of phosphor on CR tube face. The RF trapezoid pattern is especially useful in checking for "flattopping" and non-linearity in SSB linear amplifiers.

Independent of frequency. The HO-10 requires no additional tuning when used with transmitters on all amateur bands from 160 through 6 meters. It is designed to handle a wide range of transmitter output power (5 watts to 1 kilowatt) and may be used with all tube-type receivers having an I.F. frequency up to 500 kc.

Built-in two-tone test oscillator. Simplifies transmitter adjustments and testing. A 4-position RF level attenuator provides extra convenience in matching scope to transmitter power.

Simple to connect. Standard coaxial connectors are provided on the rear panel for simple connection to antenna system feed line (50-75 ohm) with phono jacks for all other connections. All inputs and outputs are clearly screened on the panel.

Enjoy it now! Add this convenient accessory to your amateur station facilities now . . . enjoy the pride it brings in knowing that your transmitted signal is of the best quality for outstanding communications at all times!

Kit HO-10 . . . 11 lbs. $59.95

SPECIFICATIONS—Vertical response: ±3 db from 10 cps to 500 kc. **Sensitivity:** 500 mv per inch deflection. **Input resistance:** 50 k ohm. **Horizontal response:** ±3 db from 3 cps to 30 kc. **Sensitivity:** 800 mv per inch deflection. **Input resistance:** 1 megohm. **Sweep generator: Recurrent type:** 15 to 200 cps (variable). **Tone oscillators:** Approximately 1000 cps and 1700 cps. **Output voltage:** 15 mv (nominal). **GENERAL: Frequency coverage:** 160 through 6 meters (50-75 ohm coaxial input). **Power limits:** 5 watts to 1 kilowatt output. **Front panel controls:** Function Selector, Sweep Frequency, Tone Generator, Horizontal Gain, Horizontal Position, Vertical Position, Vertical Gain, Focus, Intensity/Off. **Rear control:** Xmtr. Atten. Attenuates 0 to 24 db at approximately 6 db per step. **Power supply:** Transformer operated, fused ½ amp. **Power requirements:** 105-125 VAC, 50/60 cps, 35 watts. **Dimensions:** 5¼" H x 7⅜" W x 10½" D.

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FREE CATALOG

Fully describes over 250 different Heathkit products at savings of 50% or more! See the complete line of "mobile" and "fixed station" amateur gear plus many others. Send for your Free copy today!

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In Canada: Daystrom, Ltd., Cooksville, Ont.

☐ Enclosed is $________plus postage. Send model HO-10 Monitor Scope.

☐ Please send Free Heathkit Catalog.

Name______________________________

Please Print

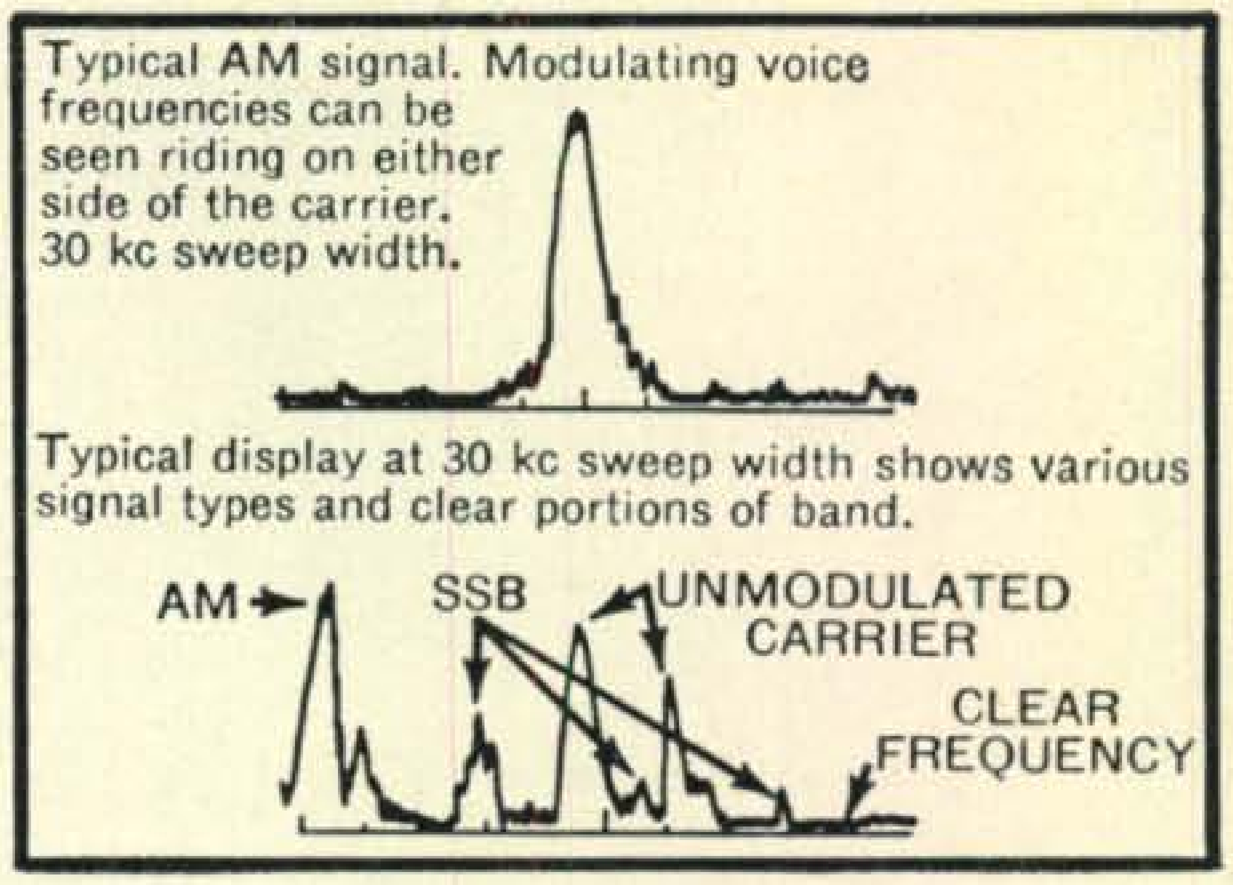
Address____________________________

City______________State__________Zip________

Prices & specifications subject to change without notice. AM-137

For further information, check number 25, on page 142

WATCH IT!... WITH THE



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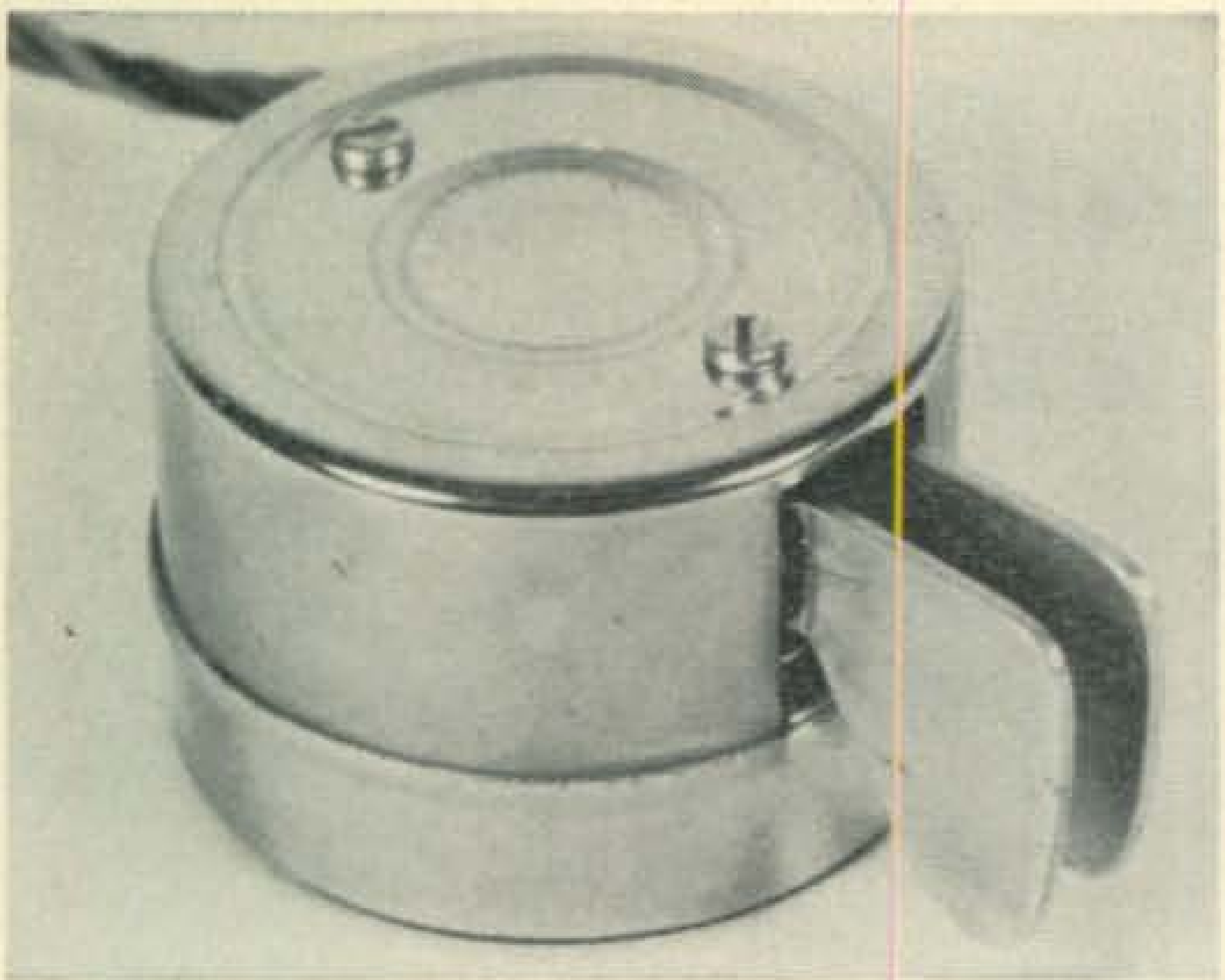


THE TOUCH-KEY

BY ALBERT H. JACKSON,* VE3QQ

This unusual key with its transistorized circuitry is designed to control a conventional electronic keyer. The key itself is unusual in that it has no moving parts. It makes use of two capacity operated relay circuits and . . . well, read the article.

Over the years, a great many types, shapes and sizes of paddle operated Morse keys have been developed and used the world over. To the best of the writer's knowledge, all have involved the use of moving mechanical levers of some description. Even the arrival and widespread use of the electronic key has done little to change the appearance or mechanical operation of the usual side-swiper paddle-key.

The Touch-Key is intended as a control unit for an electronic key, and is a complete departure from the traditional form, in that it has *no moving parts* in the key itself. Two small relays are, however, used in the output circuit; even these might be replaced, in specific instances, by suitable transistors. The use of relays in this particular unit makes it possible to connect directly to almost any type of electronic key.

The Touch-Key, in its present form, is a natural outgrowth from the Can-Key described in a previous article, where use was made of dual, all-metal, grounded levers.[1] In fact, as the photographs will show, the outer appearance is identical to the Can-Key, and the reader is referred to the earlier article for methods of base-weight, cover and lever construction. With the Touch-Key cover removed, the similarity ceases, and transistors replace the mechanics of the Can-Key with features and advantages as follows:

a) The dual *stationary* paddles respond to the slightest touch, and light or heavy fists make no difference to the key's operation.

b) Following the initial set-up of the relays, there are no springs, bearings or contacts to adjust, or get out of adjustment.

c) Mechanical construction and alignment problems are minimized.

d) Both paddles are grounded for d.c.

e) Except for light relay clicking, which can be reduced if desired, operation is quiet.

f) Since mechanical pressure has no effect, the key cannot be actuated accidentally by contact with shifted books, *etc.*, on the operating table. This is a desirable feature in a break-in set-up, where the key controls the transmit-receive function in addition to its regular job.

g) High speed sending is aided, since the required paddle movement is zero.

Operating Principles

The operating principles of the Touch-Key are far from new, though their application to the problems of Morse keying is perhaps unusual. Both dot and dash sections of the unit are identical, and are applications of the well-known capacitive-relay circuit. Each section consists of a Hartley oscillator, operating at a power input of about one milliwatt, and a relay switching circuit, both transistorized. Touching either paddle stops the oscillator on that side, causing it to draw more current and trigger the following transistor and sensitive relay, which operates the electronic key.

This action is fast and reliable with normally moist skin. If your skin tends toward dryness, a little glycerine rubbed between thumb and fingers will increase conductivity to the point where reliable operation is again assured. A one-inch metal cup, containing a saturated piece of plastic sponge, will make the glycerine readily available on the operating table; it will not evaporate, and is an ingredient in a number of hand lotions.

Since the Touch-Key behaves as a pair of true capacitive-relays, it is most sensitive when its frame is grounded to other equipment, as this increases capacity to the body and helps "complete" the triggering circuit. For the same reason, there is a minimum allowable contact area be-

*12 Third Avenue, Box 453, Arnprior, Ontario, Canada.
[1]Jackson, A. H., "The Can-Key." *CQ*, February 1964, page 36.

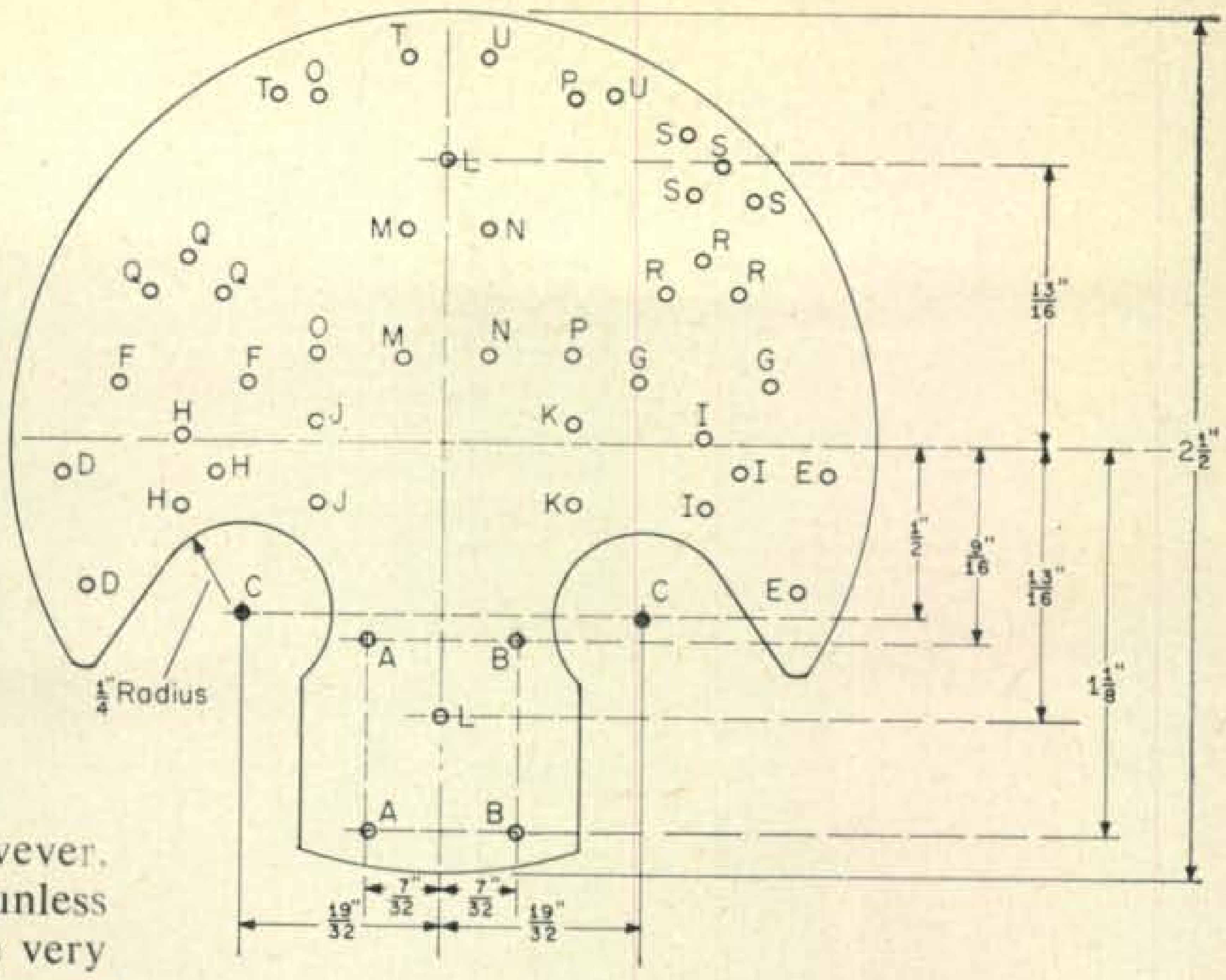


Fig. 1—Parts mounting board, actual size shown, is made from 1/16" bakelite or any other suitable material.

Component Positions.

C_3	JJ	Q_2	III
C_4	KK	Q_3	QQQ
C_5	DD	Q_4	RRR
C_6	EE	R_1	FF
C_7	TT	R_2	GG
C_8	UU	R_3	MM
L_1	C	R_4	NN
L_2	C	Bd Mtg	LL
L_5	OO	Pdl Mtg	AA, BB
L_6	PP	Cable	SSSS
Q_1	HHH		

tween the paddles, thumb and fingers. However, this is easily obtained in normal keying, unless you are one of those who likes to flick the very edges of the paddles. In this case, a slight change of habit is indicated: move a little closer to the key, and increase that all-important paddle contact area!

The oscillator frequencies are set near the high end of the broadcast band, at about 1500 and 1600 kc respectively, which eliminates possible harmonic interference in the amateur bands. The 100 kc separation is necessary to prevent interaction of the oscillators due to stray coupling. Though power input levels are very low, (about 1/600 that of many receiver h.f. oscillators) some broadcast interference may occur if the receivers are in close proximity. If this becomes a problem, a change in frequencies should eliminate it.

Construction

As for the Can-Key, three sandwich-spread canned-meat tins 2⅝" in diameter by 1⅛" deep, or their equivalent, are needed. These will be used to form the outer case for the Touch-Key, and to cast the base-weight as described in the previous article.

Parts Mounting Board

Make the parts mounting board first, to the size and outline shown in fig. 1, using a piece of 1/16" bakelite sheet. While the drawing is actual size, only the critical dimensions are given; remaining hole positions will depend on available parts. As with the Can-Key, a template may be used to make the complete layout if desired, and will simplify some of the procedure. Alternatively, the parts board itself can be used as a pattern to locate holes in the base-weight, cover, and top cover, if this is done before the coil-clearance cut-outs are made.

Paddles and Wiring

Cut the two paddles to the size and shape given in fig. 2. These are then dimpled along the lines indicated, and drilled and tapped to take 4-40 mounting screws. This is accomplished in the same manner as described in detail for the Can-Key, using a drift punch, hammer and a block of hardwood. You will find the process a little easier, if you first use the punch to dimple the wood block in the appropriate positions. For each paddle, begin dimpling at the top edge of the material for the front screw, and at the bottom edge (on the same surface) for the rear screw. Refer to Figs. 2 and 6 for details. Note that right and left paddles should be mirror images of each other; this means starting dimpling from opposite surfaces or opposite ends. Other mounting schemes can, of course, be used if you wish.

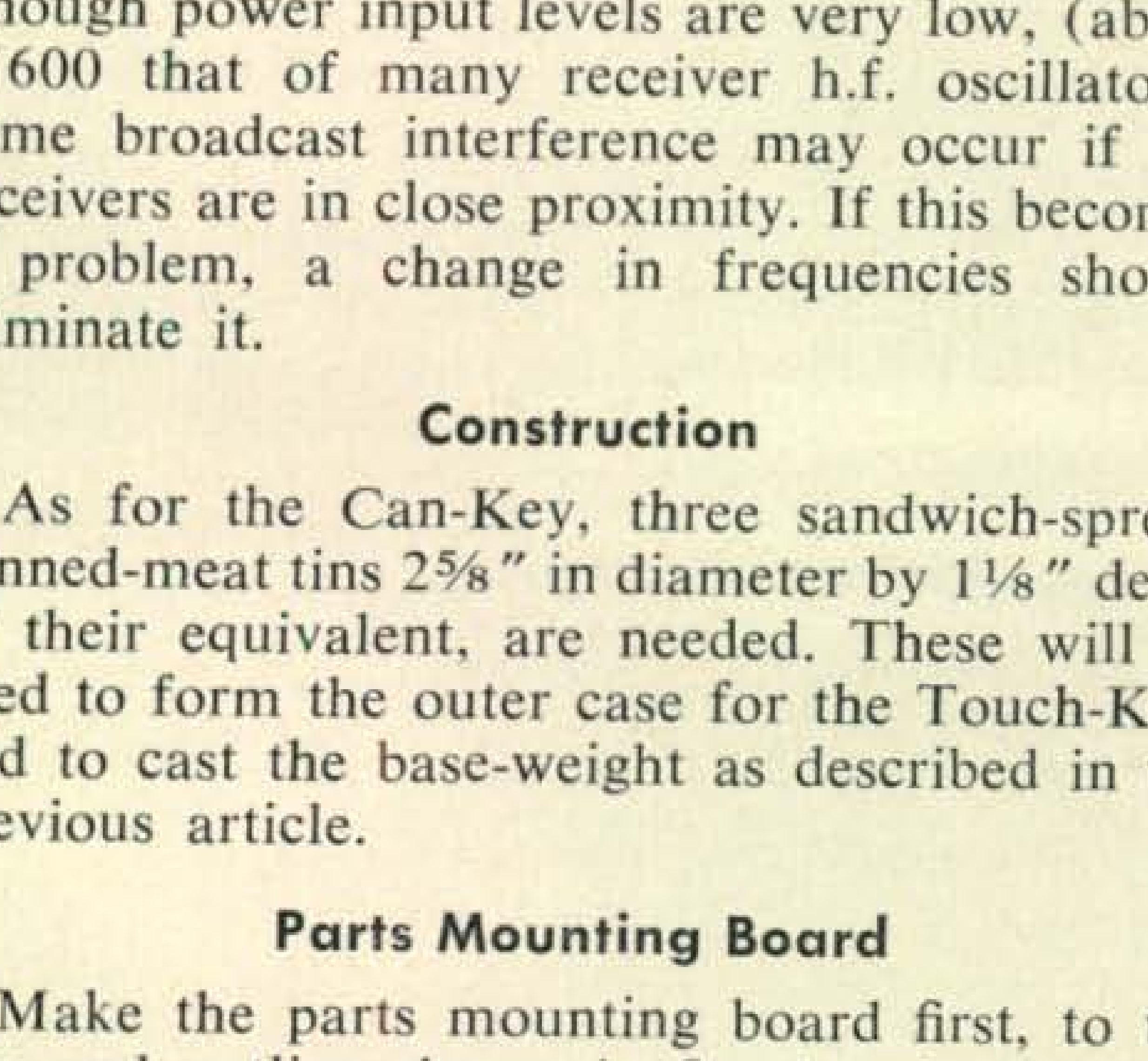
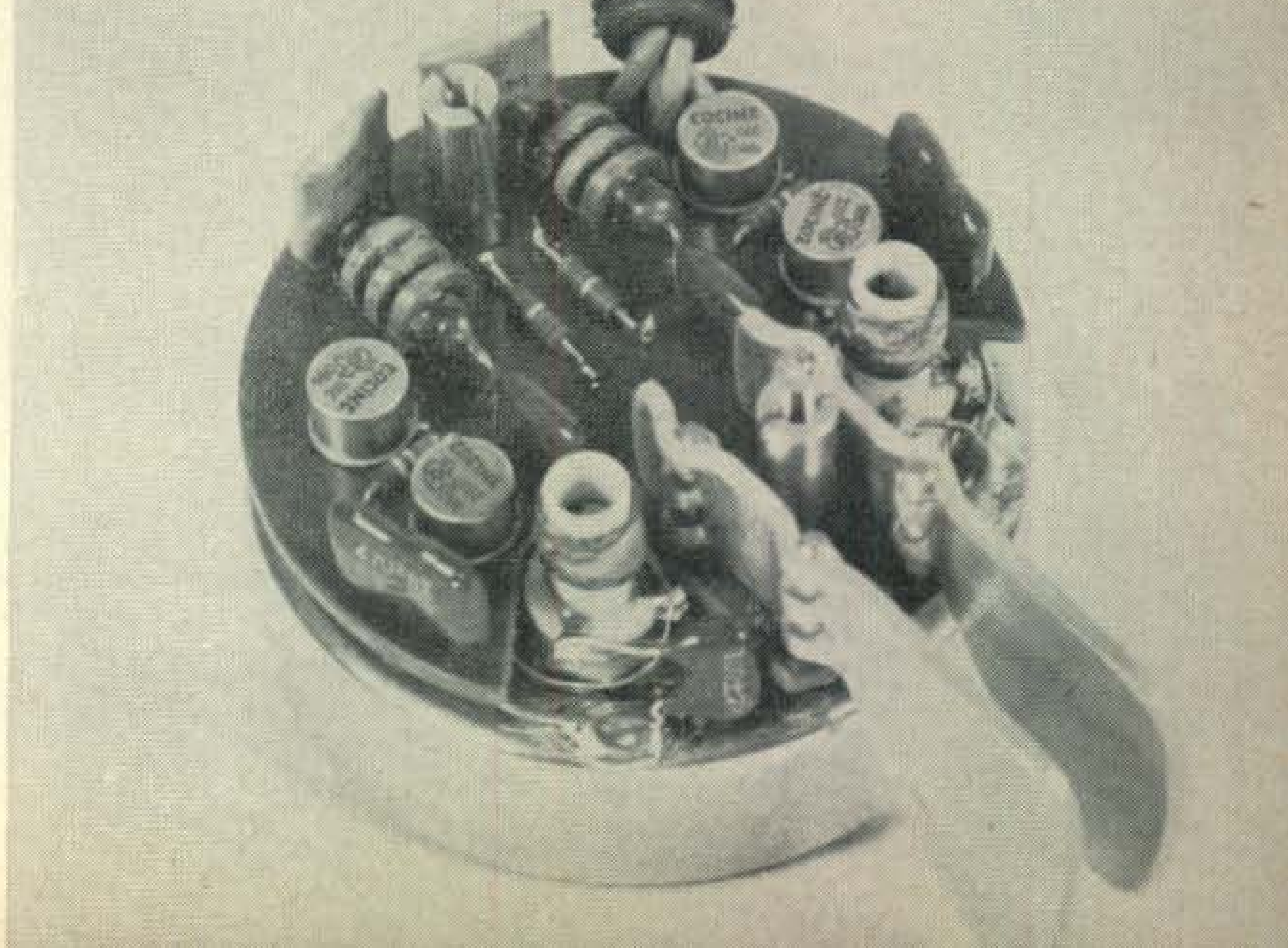


Fig. 2—Paddle dimensions. Two units are fabricated from 12 gauge soft aluminum.

Top view of the Touch Key shows the location of the major components and the paddle mounting.



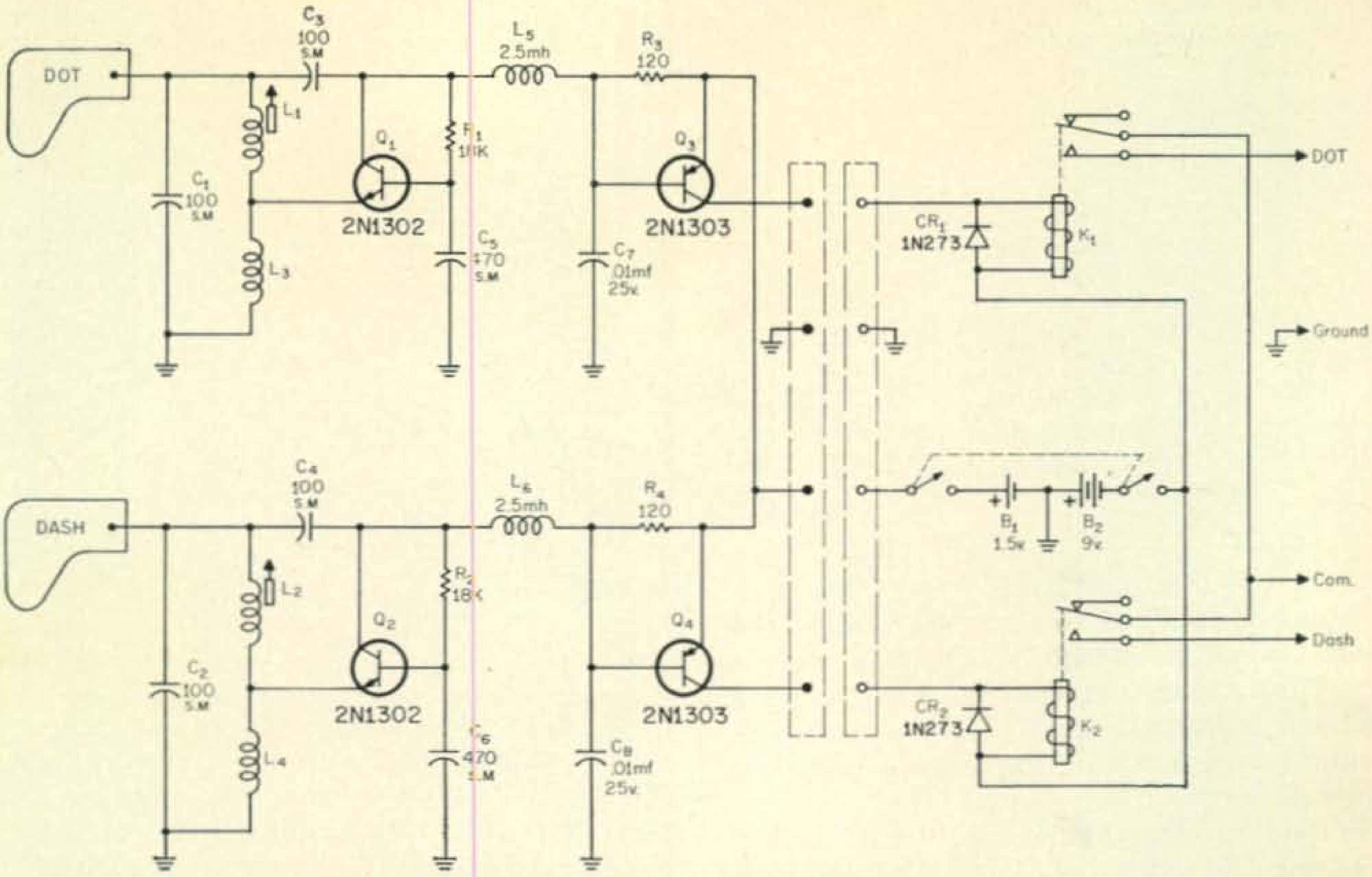


Fig. 3—Circuit diagram of the Touch-Key and relay unit. All capacitors are in mmf unless otherwise noted. All resistors are ¼ watt—10% units.

CR_1, CR_2—1N273
L_1, L_2—R.f. choke, variable, 61-122 μh, Cambridge Thermionic Corp, X2060-7 or equiv.
L_3, L_4—Tickler winding. See text.
L_5, L_6—R.f.c., 2.5 mh, 35 ma subminiature ferrite core.
K_1, K_2—S.p.d.t. relay. Potter Brumfield RS5D, 2500 ohms or equiv.

Mount the paddles on the parts board with suitable screws through holes *AA*, *BB*. Place small soldering lugs with #22 bare wire leads about one inch long under the heads of both rear screws. Bring these leads out toward the front, for attachment to the oscillator coils.

Insert component leads through the proper holes and bend over close to the under surface of the board. Solder into positions indicated by the schematic, fig. 3, using spaghetti tubing if and where needed. Remember to "heat-sink" all semi-conductor leads during this process. Leave all ground leads until after the completed parts board is attached to the base-weight and cover; these wires are then simply brought down to the top of the base-weight cover, cut and soldered to it. Insert the connecting cable leads through

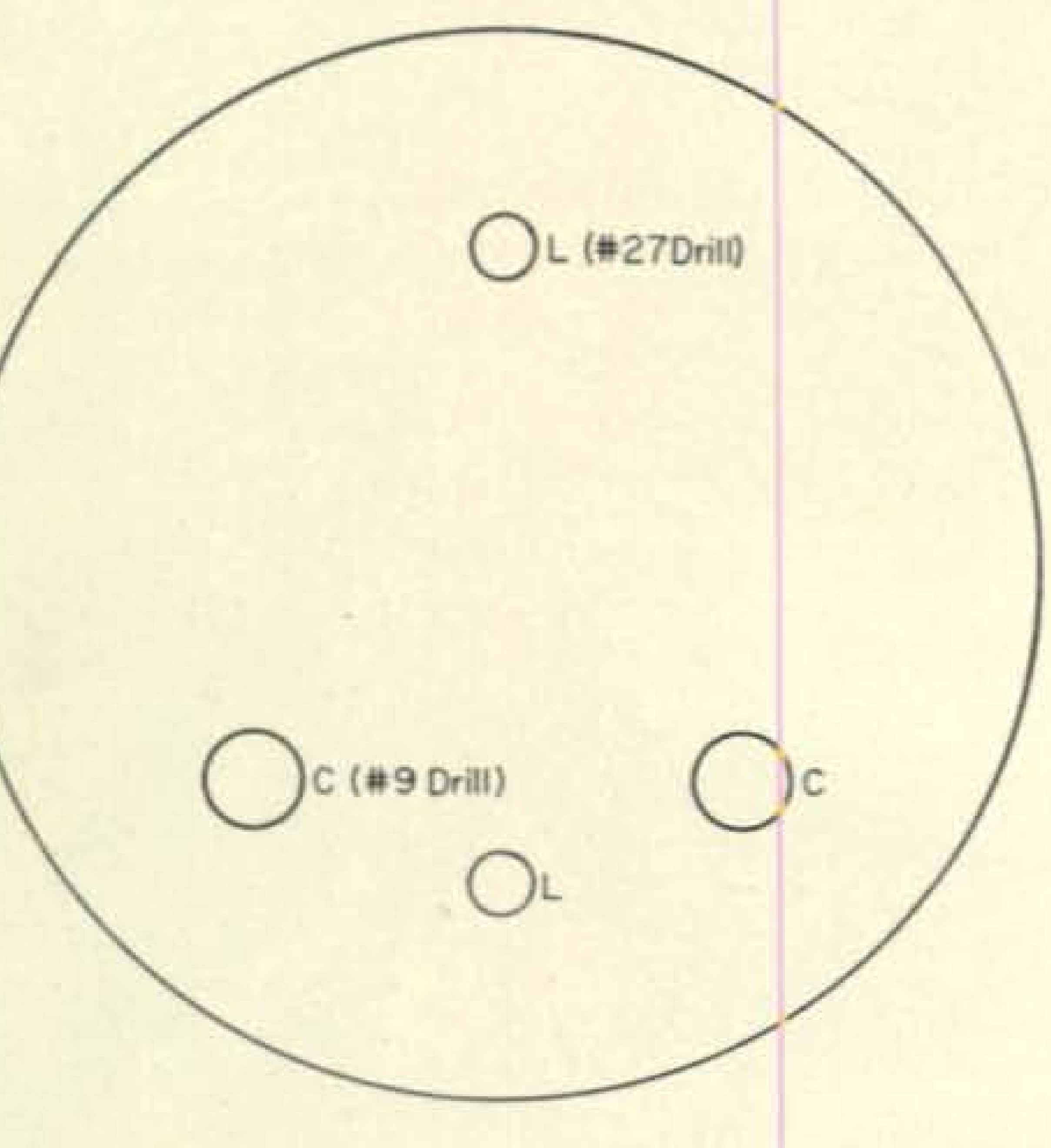


Fig. 4—Base weight dimensions for the Touch-Key.

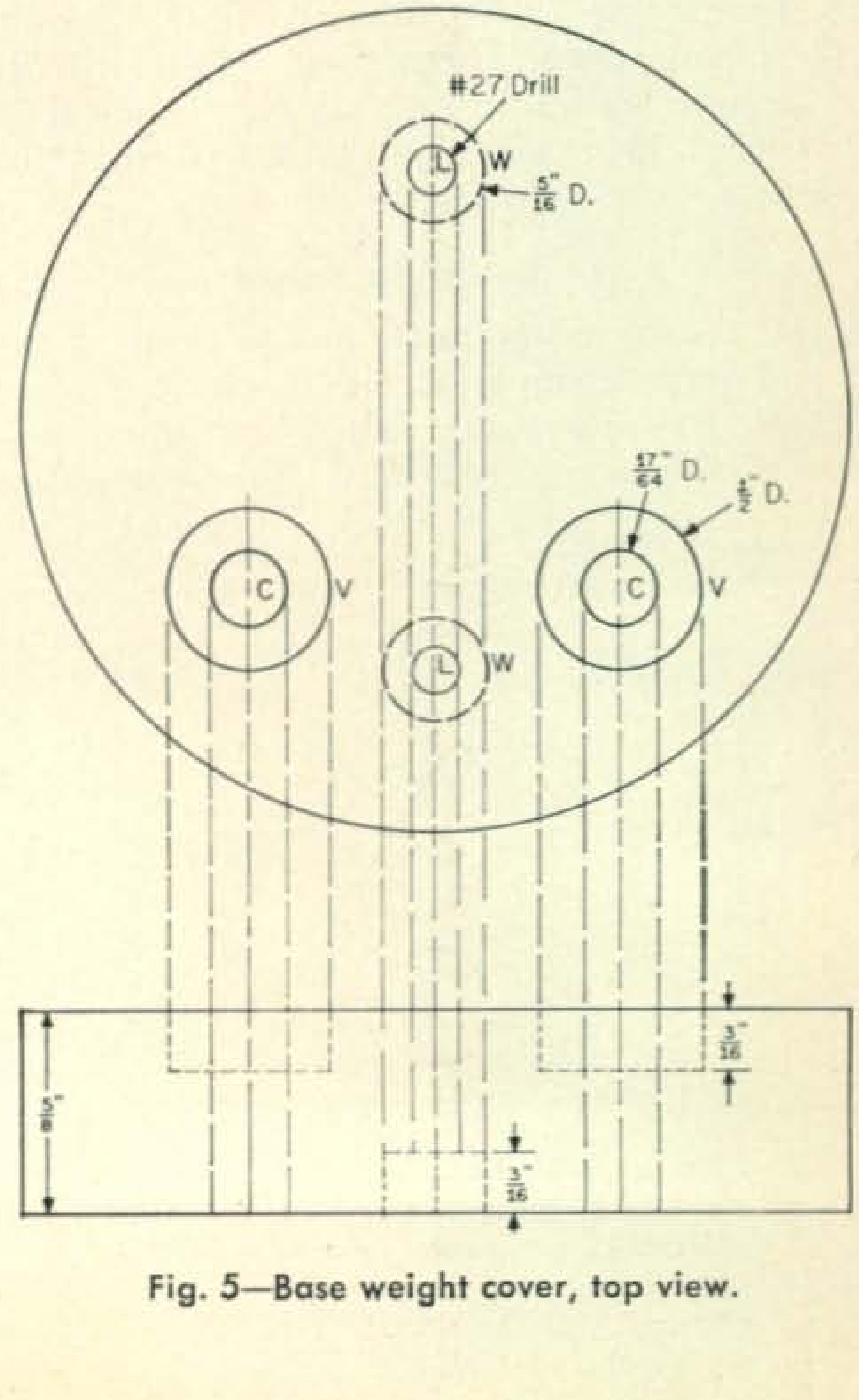


Fig. 5—Base weight cover, top view.

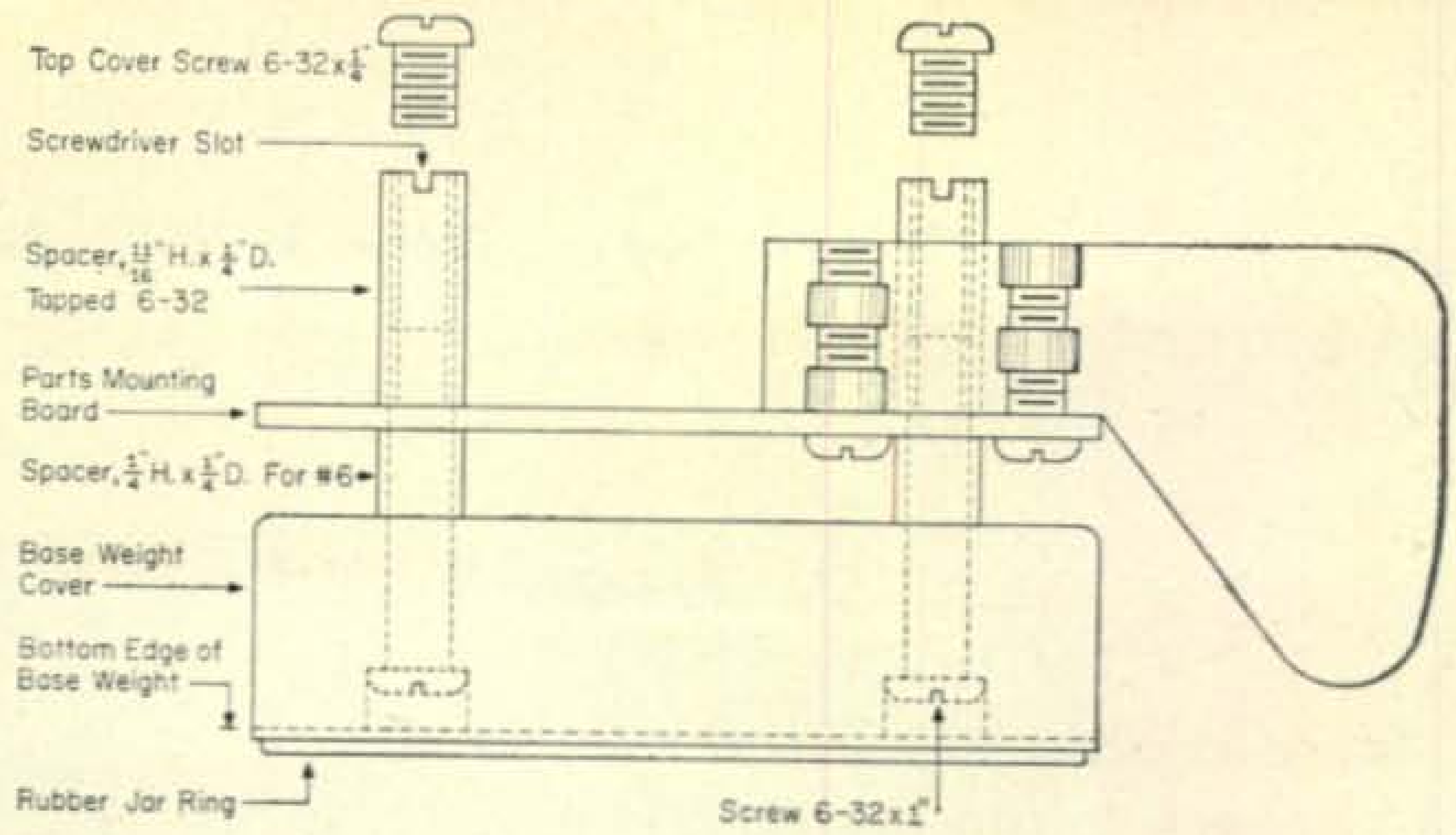


Fig. 6—Mechanical assembly.

a 5/16" o.d. grommet and through holes *SSSS* in the parts board, and attach to the proper circuit positions under the board. Solder the ground lead to the base-weight cover just before mounting the parts board.

Oscillator Coils

The oscillator coils are made by adding 7 turn, jumble-wound, tickler coils of #32 enamel wire against the mounting ends of the coils on two Cambridge Thermionic type X2060-7 slug tuned r.f. chokes. Solder one end of this wire to the outer end terminal lug, wind in the same direction as the choke coil, and bring the other end out through one of the spare slots under the insulating terminal collar; this is the ground lead. Put a little coil-dope over the new coil to hold it in place.

Base-weight

Next, make the base-weight and cover as described for the Can-Key, by melting enough lead into one of the meat-tins to reach a ⅝" depth. When cool, strip the meat-tin from the casting and drill as shown in fig. 4. Cut the second meat-tin to make a cover for the base-weight, leaving a 1/32" lip at the bottom, and drill as indicated in fig. 5.

Assembly

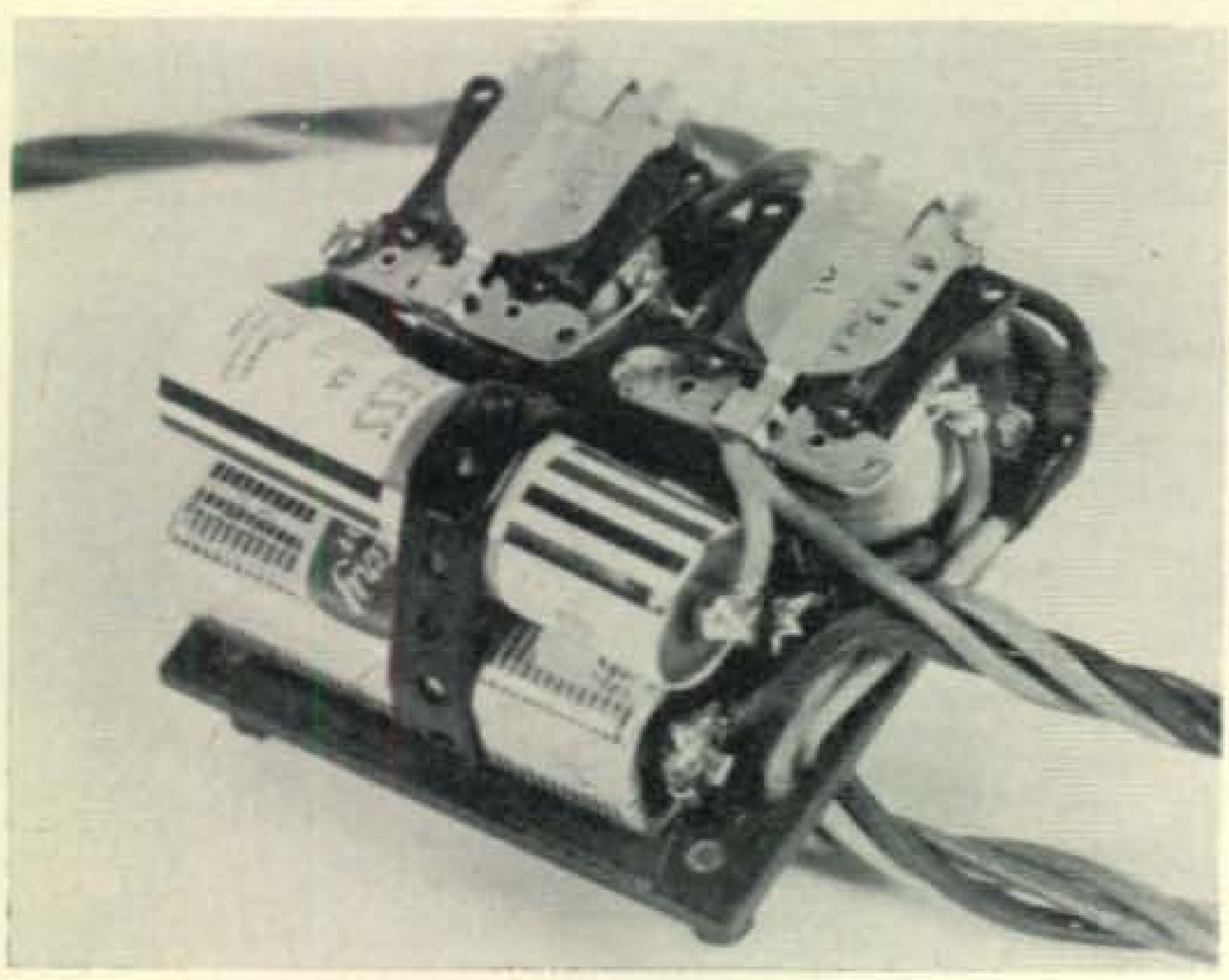
Mount the two oscillator coils upright through the base-weight cover, in holes CC. Assemble the completed parts board, base-weight and cover as detailed in fig. 6, using 6-32 machine screws in holes *LL*. Make sure no "shorts" occur between parts board wiring and the base-weight cover. Solder up the remaining ground connections, and connect the oscillator coils. Capacitors C_1 and C_2 are then added across the coils to ground.

Relay Unit

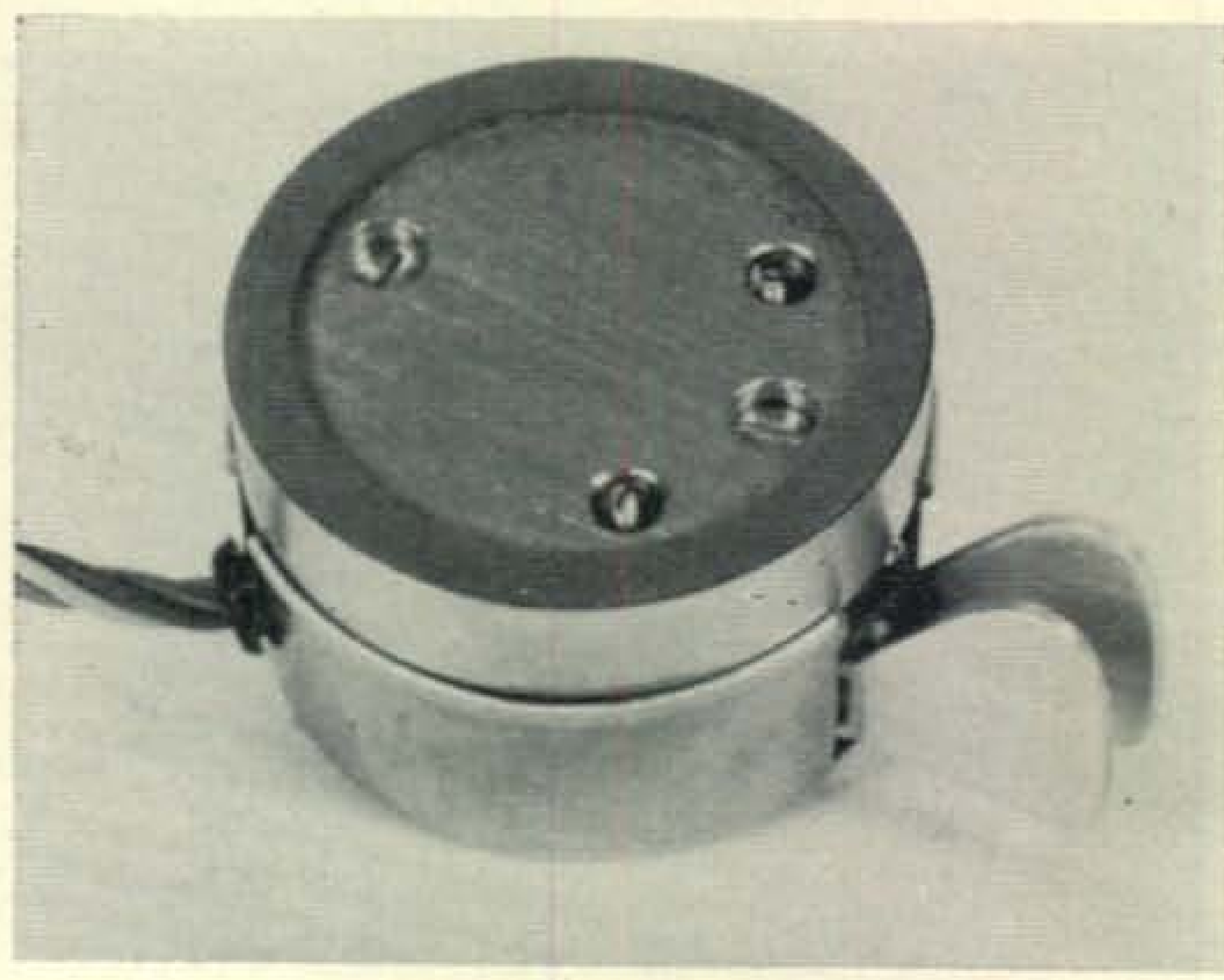
The relay unit can be assembled on a piece of bakelite sheet 2⅜" × 2⅛" × 1/16", as shown in the photograph, or it may be arranged in some other convenient form. In any case, it is intended for installation in an available corner of existing equipment. Miniature batteries are included; for longer life, larger sizes can be used, space permitting. If you already have a battery operated electronic key, perhaps you can arrange a common supply; this would simplify On-Off switching of the batteries, among other things.

Two Potter and Brumfield RS5D 2500 ohm model-control relays are employed as output devices. Their contacts are rated at 115 v. a.c., 2 amps., and for this purpose, the top contacts can be bent closer and the spring tension reduced to provide faster operation at lower coil current. Both relays should be adjusted to close at just under 2 ma.

[*Continued on page 137*]



The battery supply and the two relays are mounted on a bakelite board and located in the most convenient spot.



Bottom view of the Touch-Key showing the non-slip rubber ring in place. The oscillator coil adjustment screws may be seen in this view.

Remote Mobile Installation

BY WILLIAM SHERWOOD,* W6FBY

Here is an approach for those who want to go mobile but can't figure out where to put the rig. (The author's problem car is a Jaguar 3.8 sedan).

THERE are thousands of Hams who would like to go mobile but can't figure out where to put the rig. There are many more who use their cars for business and hesitate to distract their clients or prospects with a driving position that looks like the flight deck of a DC-7.

The transceiver is mounted in the trunk and remotely tuned and operated. You don't have to be surprised; this is the most common method of operating aircraft and police radio. The system that I am describing works very well, and has been producing excellent QSO's on 40 meters for about a year. It tunes the band easily, and is better to operate than if the rig was in the front; the only thing missing is the S meter.

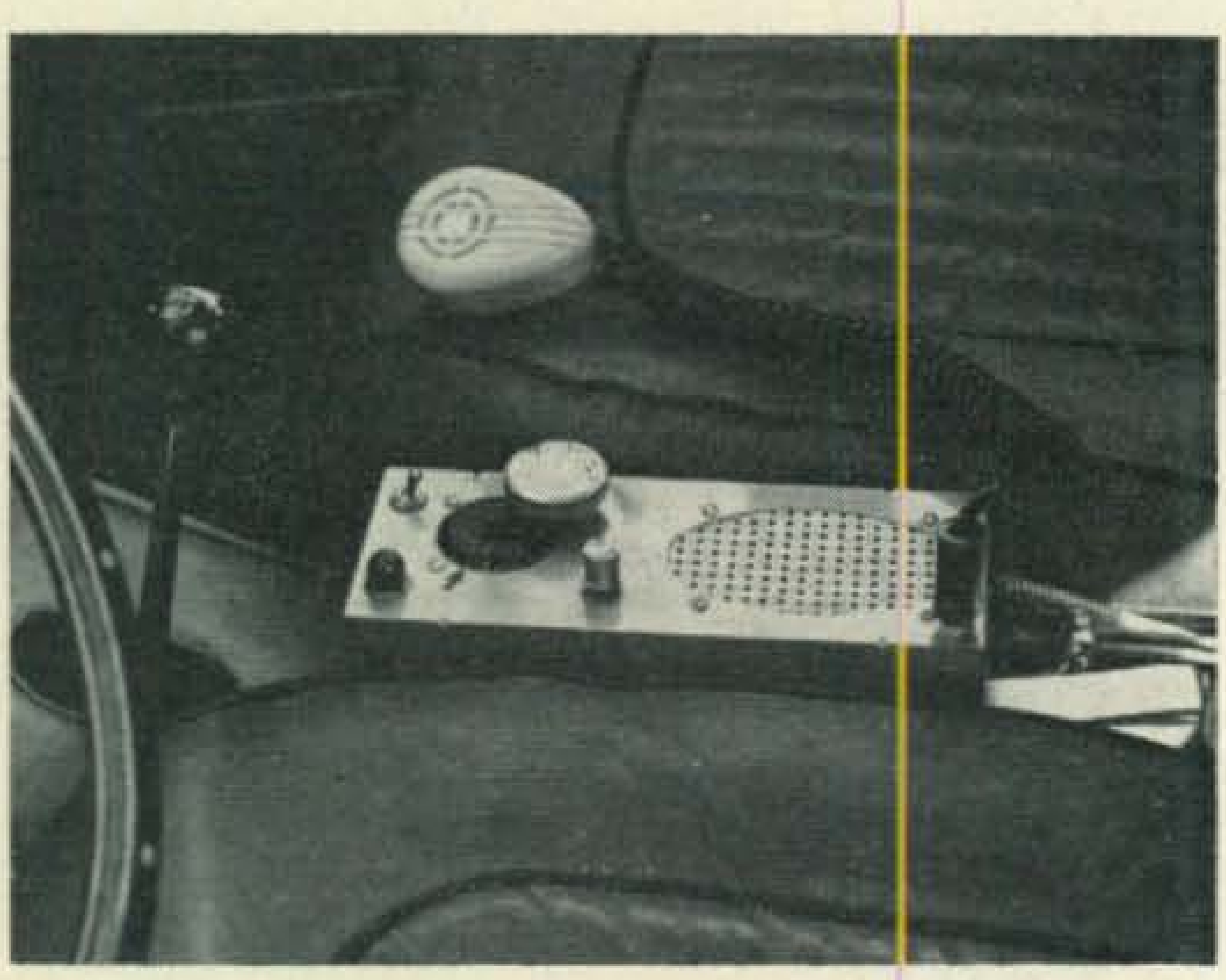
The tuning head that is illustrated was designed to fit between the bucket seats of the author's 3.8 Jaguar. Any size or shape that fits your situation can be used if you keep two important considerations in mind. First, choose a size that lets you use at least a 3" × 5" speaker; any smaller than this will be unsatisfactory for good copy. Second, choose a location that minimizes bends in the tuning cable. The fewer bends, and the more gradual the unavoidable ones are, the less backlash you will experience.

*716 North Rodeo Drive, Beverly Hills, California.

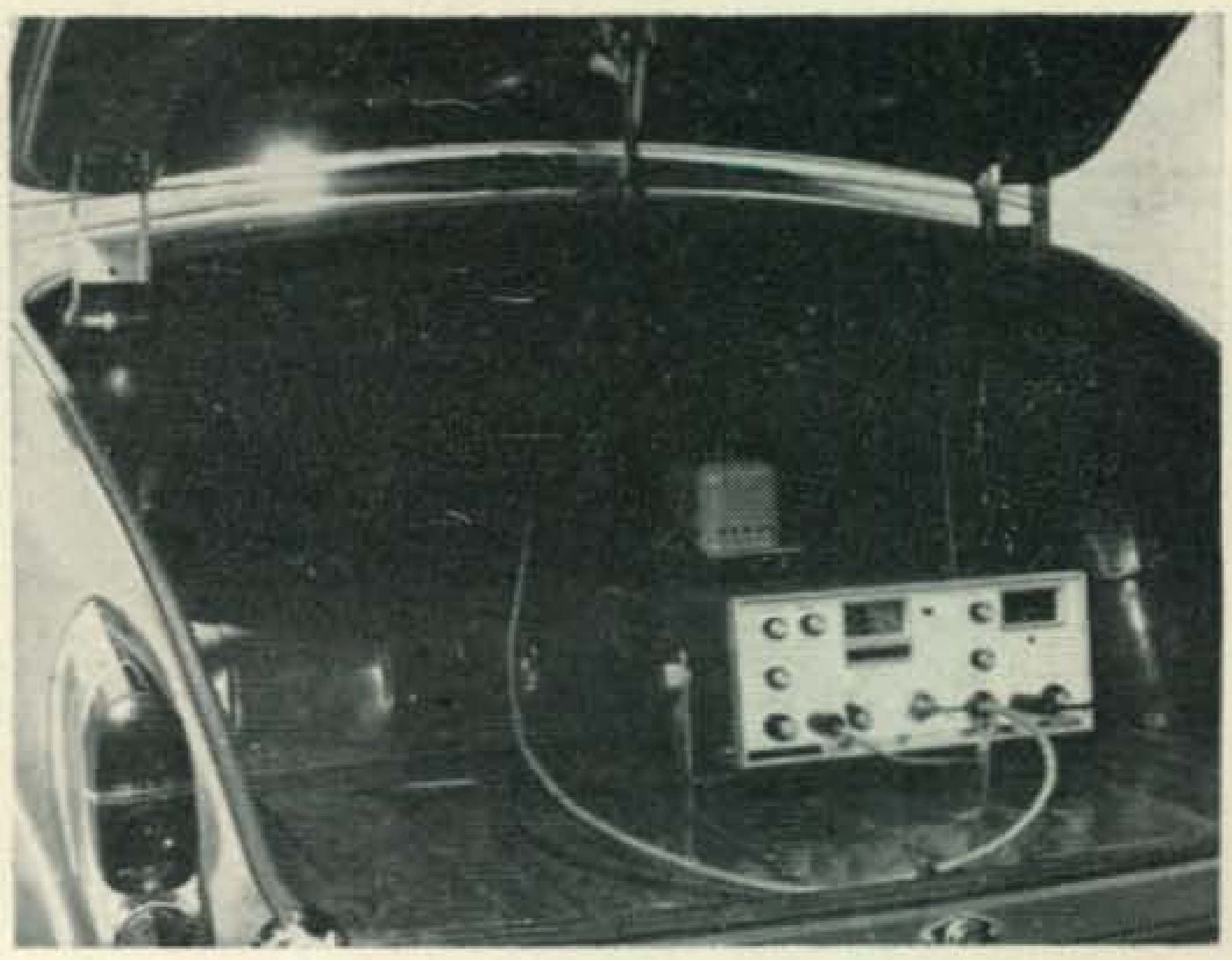
The key component in the tuning head is the BC-450 surplus remote tuning indicator and matching drive cable. When you examine the tuning indicator you will see that it is really three indicators and drive assemblies in one box. If you spoil one you will have two spares. Don't consider removing the gears and remounting them as this will not work. You are going to saw one complete assembly off and mount it in the control head. The easiest way to do this is to strip all the parts out of the section you are going to use, leaving just the gear assembly and drive cable connector. If you look at the inside view of the author's head (tuning, that is) you will see that some careful trimming can be done after the unit is sawed off.

Mounting the gear assembly presents no problem, just be sure to orient it to accommodate the attachment to the drive cable. An octal tube socket is used to connect the tuning head to the control wiring.

A 3" × 5" speaker and an L pad are incorporated in the tuning head. The L pad is the simplest method of controlling the speaker volume. This calls for the volume control on the transceiver to be left about ¾ on. The level of audio is thereafter adjusted in the front seat with the L pad.



The remote control unit nestles snugly on the console between the two bucket seats. All the needed controls are handy.



Interior of the trunk showing the location of the NCX-3. Note the power supply on the back shelf and also the very gradual bends in the flexible cable.

A microphone jack is installed in the lower left corner; it is wired for push to talk.

The last item in the control head is the on-off switch. Most power supplies incorporates a master relay that connects the low voltage to the power supply and the filaments at the same time. This relay is usually controlled by the panel On-Off switch in the transceiver. Rather than open the trunk each time the rig is to be turned on or off, the transceiver is left in the On position. A switch is mounted on the control head and wired to turn the master relay on or off. A bright pilot light is a must, and is wired in parallel with the master relay. The pilot light also doubles as a dial light.

After the control head is finished and installed, mount the transceiver in the trunk .Make sure you will be able to reach the tuning controls with the trunk lid partially open.

Flexible Cable

Plan as straight a route for the tuning cable as is possible going from the tuning head to the tuning dial shaft of the transceiver. In most cars it is possible to run from between the front seats, under the rear floor mat, under the rear seat and through the bulkhead that separates the rear seat from the trunk. Attach the tuning cable to the control head and route the cable until it comes directly opposite the transceiver tuning shaft. Cut through the outer sheath and the inner cable. Remove the cable from the tuning head and withdraw the inner cable from the sheath. Cut four inches from the now empty sheath. Grease the cable well and insert it back into the sheath. Re-connect the cable assembly to the tuning head. The inner cable should now protrude four inches from the sheath.

The inner cable should now be adapted to the tuning shaft of the transceiver. Drill a hole the diameter of the tuning cable in a ½ inch long piece of ¼ inch brass shaft. Insert the tuning cable in the hole and solder. A ¼" to ¼" coupling connects the cable to the tuning shaft. The end of the sheath is clamped or taped to a bracket that is made so as to hold the sheath rigidly about 4 inches from the dial shaft. The bracket should be aligned so as to make the tuning cable line up exactly with the tuning shaft. The photograph shows how this is done. The bracket can be mounted on the panel of the rig or on the floor of the trunk.

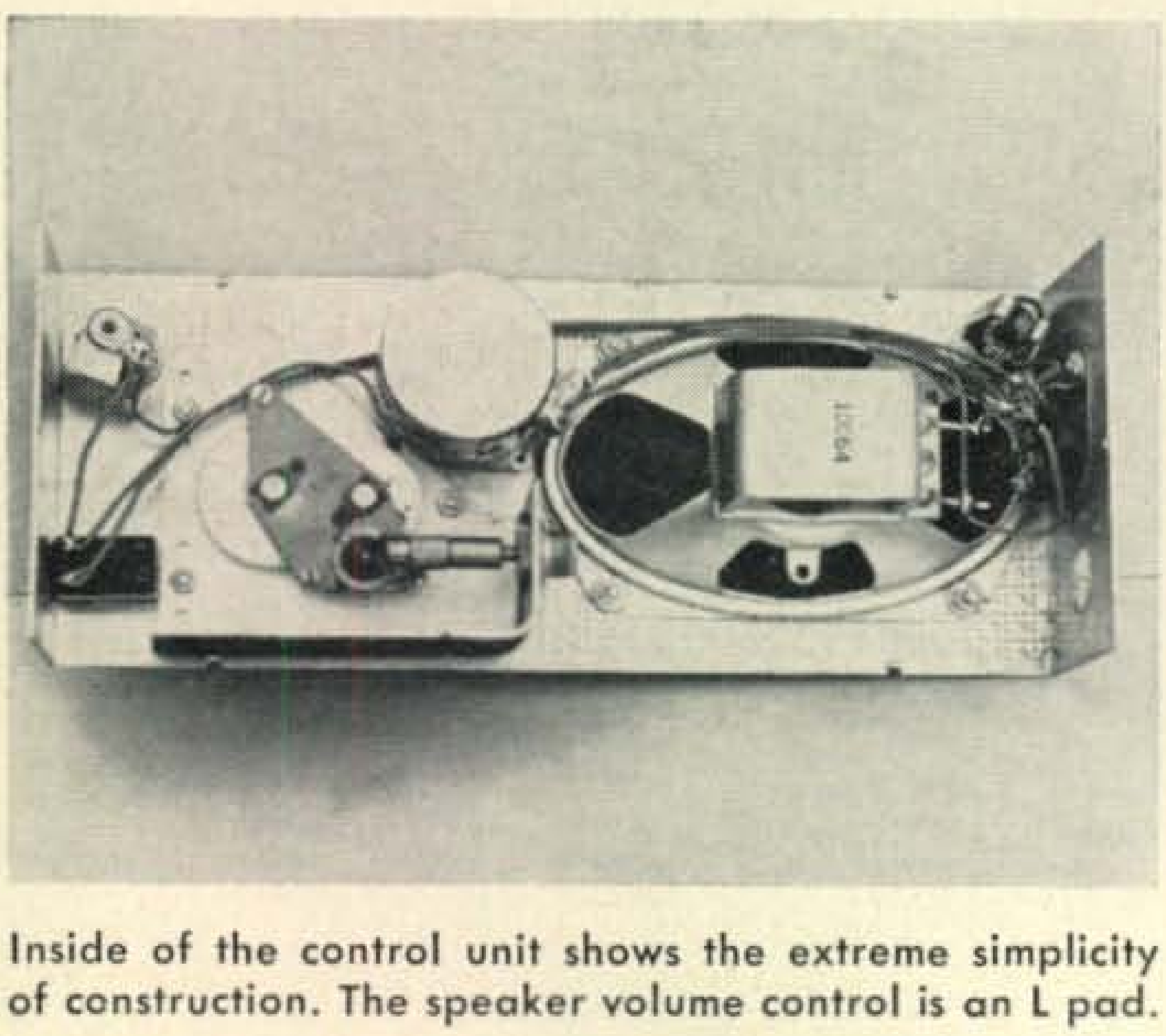
The system will tune more smoothly if the friction of the receiver tuning mechanism is reduced. To do this with the National NCX-3 a friction C washer is slipped off of the planetary drive assembly, being careful not to let the drive come apart. This C washer is flattened slightly and replaced. Different rigs will require different treatments.

The wiring harness can be run any way that is convenient. At the tuning head end it terminates in an octal plug, preferably female. At the transceiver end it terminates in a microphone plug and a speaker plug. Other wiring may attach to barrier strips, but for tuning up and easy removel the two plugs are essential.

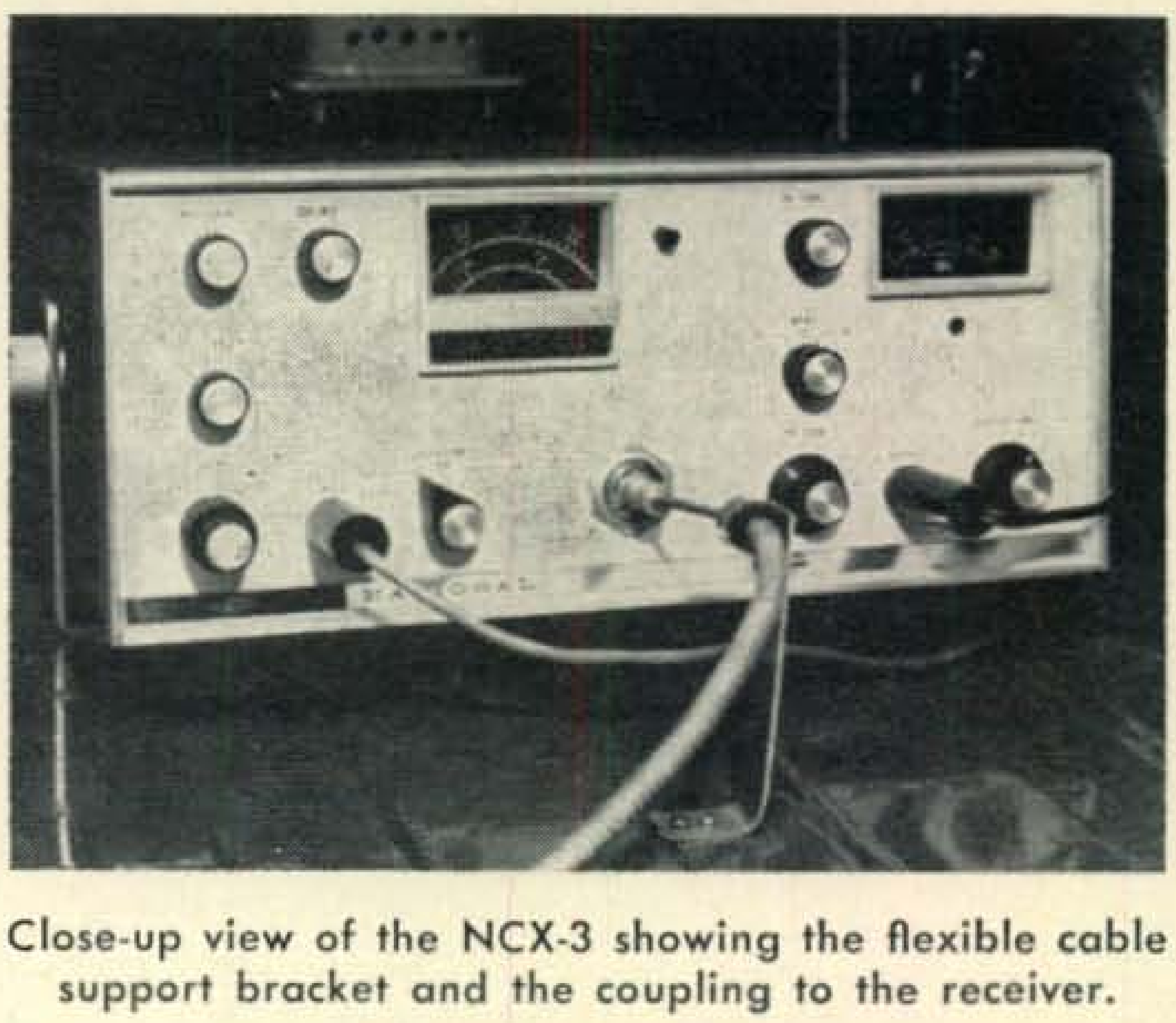
Tuning Up

Tuning the rig up is done with the trunk lid opened slightly so as not to de-tune the antenna. The microphone extension plug is removed from the rig and the microphone that will actually be used in operation is plugged in. Don't use any other mike that's handy or the final gain setting might be wrong. Tune up in the normal way except that peak voice current should be reached only when close talking. This way you will not

[*Continued on page 136*]



Inside of the control unit shows the extreme simplicity of construction. The speaker volume control is an L pad.



Close-up view of the NCX-3 showing the flexible cable support bracket and the coupling to the receiver.

Linear Antenna Arrays

BY RICHARD CLAY*, W9JRO

A simplified approach to the graphical solution of the pattern of a linear array.

IN 1943 an unusual mathematical analysis of linear antenna arrays was published.[1] Although the work has reappeared in several new books on antennas[2] it remains unknown to many persons who might profit by its use. The technique in its most general form covers all possible antennas in which the elements lie in a straight line. For those who might be interested a summary of the complete theory is given in the Appendix.

The following discussion is limited, however, to the case where the elements are equally spaced, causing the currents to have a systematic progression in phase. In this case the analysis becomes a graphical solution which is so beautifully simple that it is almost fun to calculate an antenna pattern.

Let us take as our first example a four element beam with its elements spaced $\lambda/4$ and the currents phased 90° apart as shown in fig. 1. This arrangement gives maximum radiation to the right and zero to the left. This can be understood by noting that the increasing lag in currents from left to right is compensated for by the decreasing distance to an observer at *A*. To observer *A*, the elements appear to be in phase and he senses maximum radiation. To observer *B*, however, the situation is different. Since element 2 is spaced an additional 90° from observer *B*, it appears to have a phase 180° *behind* element 1 and, the two elements appear to cancel each other. The same thing happens with the two remaining elements and theoretically, there is no radiation to the left.

*Box 8391 Madeira Beach, Florida.

[1]Schelkunoff, Sergei A., *A Mathematical Theory of Linear Arrays*, Bell System Technical Journal, 22, 1, 1943, pages 80-107.
[2]Jordan, E. C., *Electromagnetic Waves and Radiating Systems*, Prentice Hall, 1950.
Schelkunoff, S. A. and Friis, H. T., *Antennas, Theory and Practice*, John Wiley and Sons, 1952.

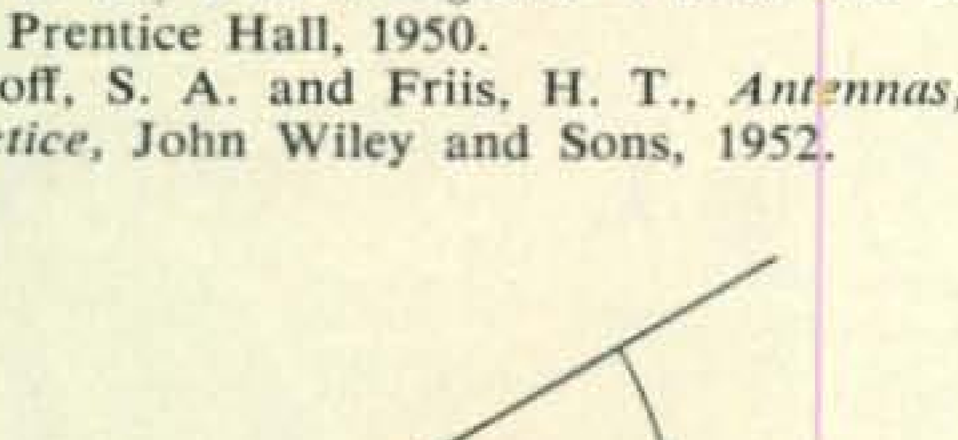


Fig. 1—A four element beam with quarter wave spacing and 90° phase shift in the currents.

It might also be noted that if all of the currents have equal amplitudes they add vectorially to zero when no spacing effect is present so the radiation is also zero in the two directions perpendicular to the line joining the elements. One may expect that the pattern contains a major lobe to the right and two minor lobes on the left.

To calculate this pattern a circle is drawn using a radius such as 5 inches. The circle is then divided into as many parts as there are elements in the array. In this case, points at 0°, 90°, 180°, and 270° are clearly marked. Note that the 90° spacing around the circle has no connection with either the 90° spacing or the 90° phasing in this array but indicates only that there are four elements. Zero degrees is a reference point and should be indicated differently as is shown in fig. 2.

The next step is to plot enough points around the circle which correspond to different values for ϕ so that a smooth curve can be drawn. Selection of points every 20° will usually be adequate. The location of these points is determined from:

$$\theta = S \cos \phi + P$$

where S is the spacing between elements expressed in degrees and P is the progressive phase shift in currents also expressed in degrees. For the four element beam S is 90° and P is −90°. Using a table of cosines such as is found in al-

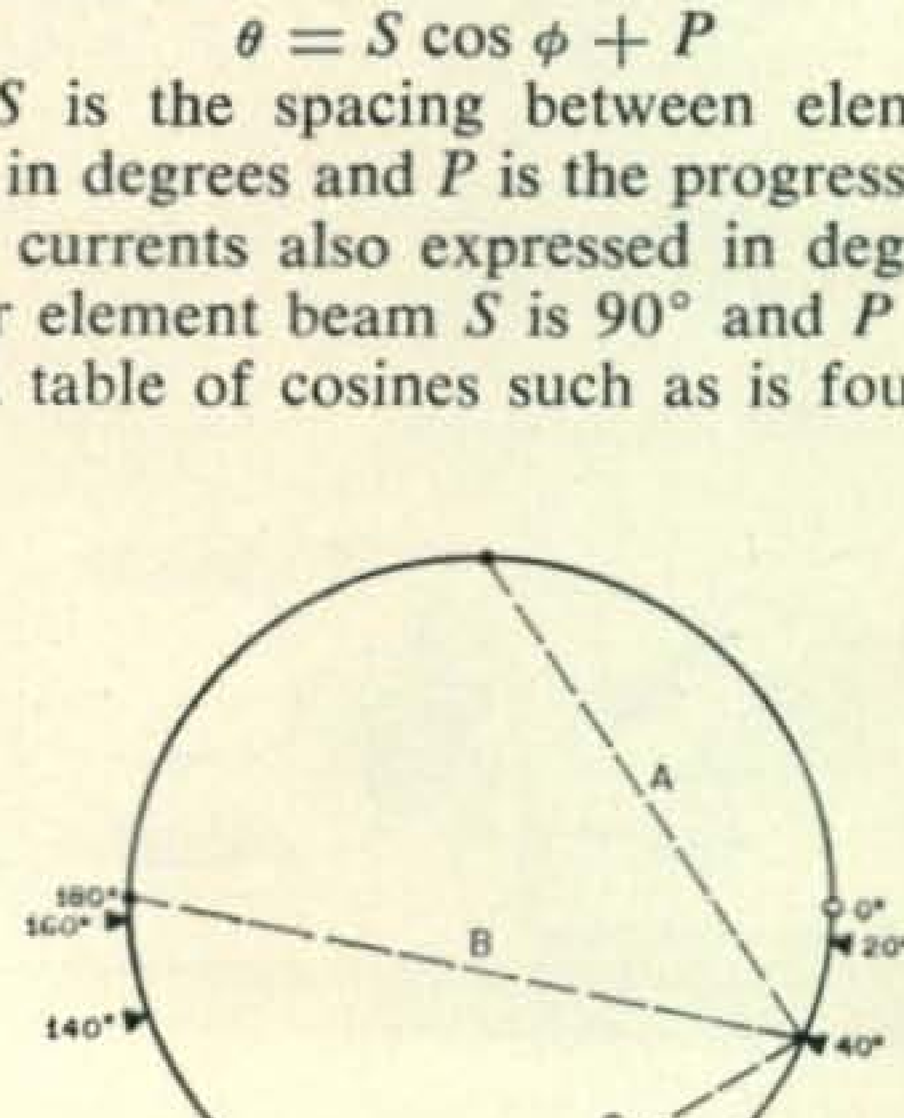


Fig. 2—Circle diagram for a four element array.

ϕ	θ
0°	0°
20°	−5°
40°	−21°
60°	−45°
80°	−74°
100°	−106°
120°	−135°
140°	−159°
160°	−175°
180°	−180°

Table I—The points are plotted around the circle according to the values for θ but they are indicated as the corresponding value for ϕ.

ϕ	A	B	C	E
0°	0.71	1.00	0.71	0.50
20°	0.74	0.99	0.68	0.50
40°	0.82	0.98	0.56	0.45
60°	0.92	0.92	0.39	0.33
80°	0.99	0.80	0.15	0.12
100°	0.99	0.60	0.15	0.09
120°	0.92	0.37	0.39	0.13
140°	0.82	0.18	0.56	0.08
160°	0.74	0.05	0.68	0.02
180°	0.71	0.00	0.71	0.00

Table II—The above measurements were taken directly from fig. 2. The field intensity, E, is the product of three measured lengths, A, B, and C.

most any handbook the values of θ shown in Table I may be calculated. These points are then plotted on the previous circle using the same 0° reference. It should be noted that these points correspond to values for the space angle ϕ and are so indicated, but the actual angle plotted is θ. Thus the point marked 60° actually appears 45° below the reference.

The final step in finding the beam pattern is illustrated in fig. 2 for a space angle of 40°. It is necessary only to measure accurately the three lengths shown. The product of these three numbers is the relative field strength of the beam at an angle of 40° from the line joining the elements. It is convenient to tabulate these measurements as shown in Table II. A graph of the pattern is shown in fig. 3. The pattern has a major lobe to the right and two minor lobes to the left as was predicted.

An approximate comparison between this array and a dipole can be obtained by placing a piece of thin, properly scaled graph paper over the field pattern curve and counting squares to find the area within the curve. A circle of equal area is drawn about the same origin. This circle is the field strength of a dipole which is radiating approximately the same power as the array.

The power gain at any angle can be found by squaring the ratio of the lengths to the two curves. Maximum gain is at 0° and at this angle the ratio of the lengths is 1.71. This is a power gain of 3.08 which may be expressed as 4.9 db. Due to the excessively broad forward lobe this particular four element array does not have optimum forward gain.

Perhaps the method will be further clarified by giving another example where the same four element array is phased for broadside operation. In this mode of operation maximum radiation occurs at right angles to the line joining the elements. This occurs when all the currents are in phase. For this case $S = 90°$ and $P = 0°$. The circle diagrams then assume the form shown in fig. 4. This should be compared with fig. 2 to see the effect of different phasing. Observe that, due to geometrical symmetry, the computation yields identical results on each side of 90° as should be expected. It also simplifies the calculation since only a 90° sector of the entire pattern need be determined.

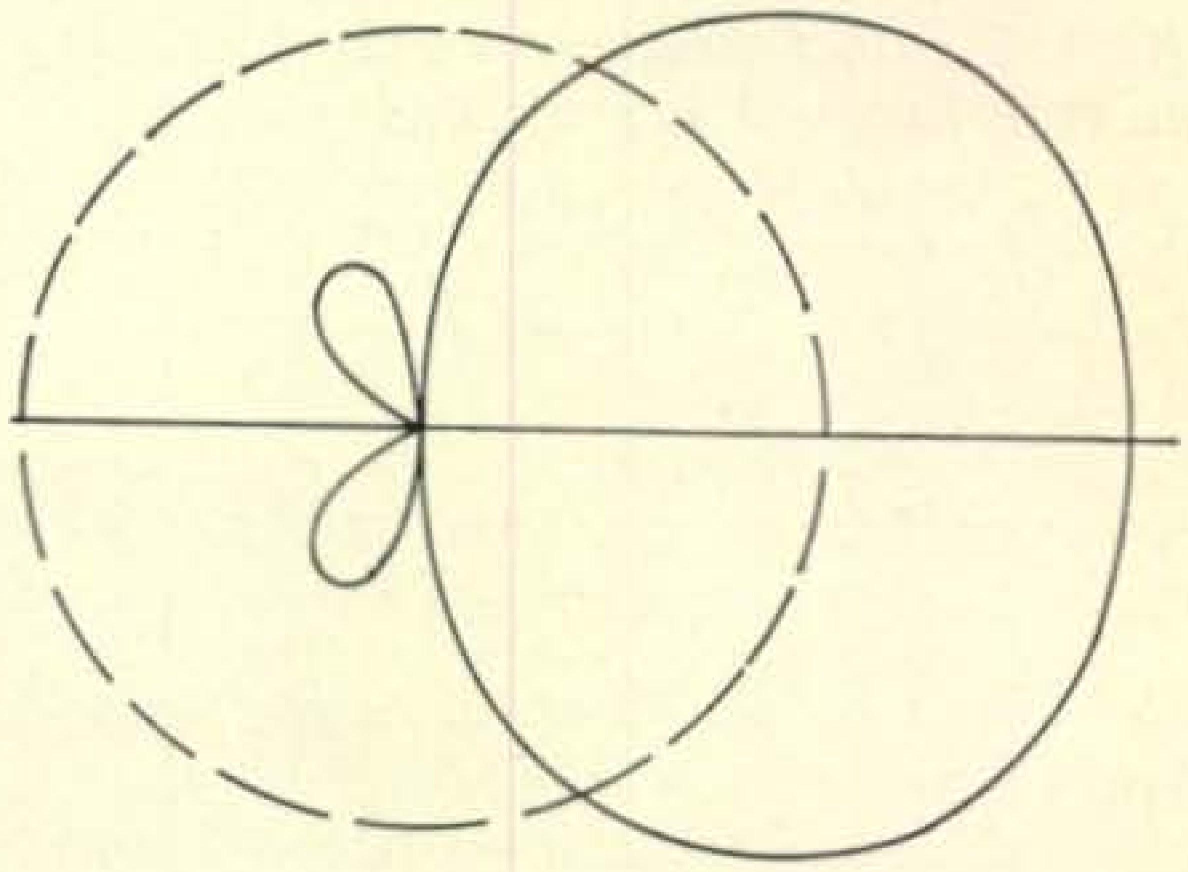


Fig. 3—Radiation pattern for a four element array. The dashed curve shows the field of an equivalent dipole.

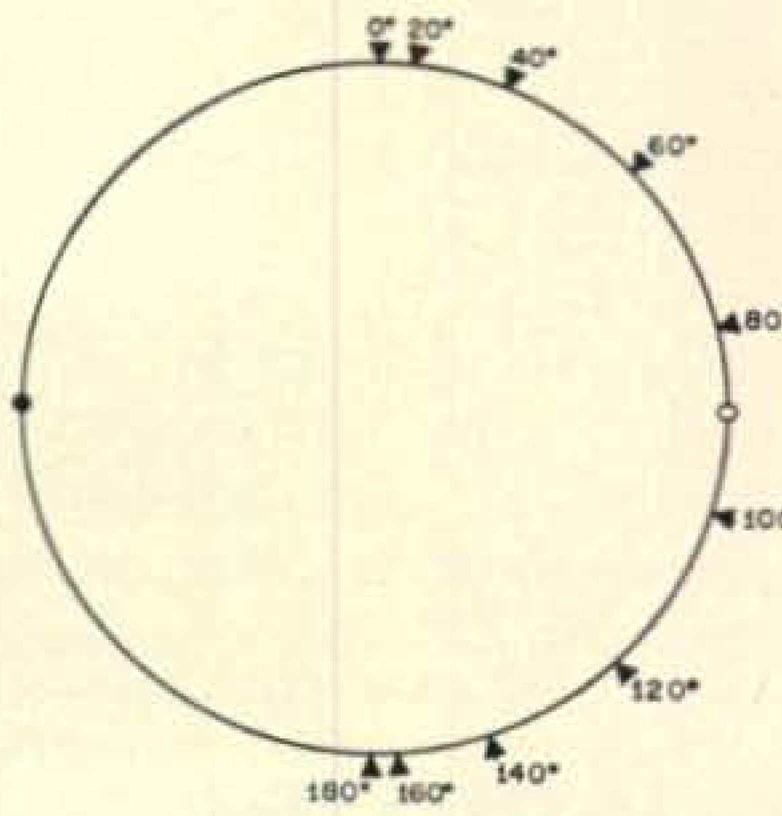


Fig. 4—Circle diagram for the four element array with the currents phased for broadside operation.

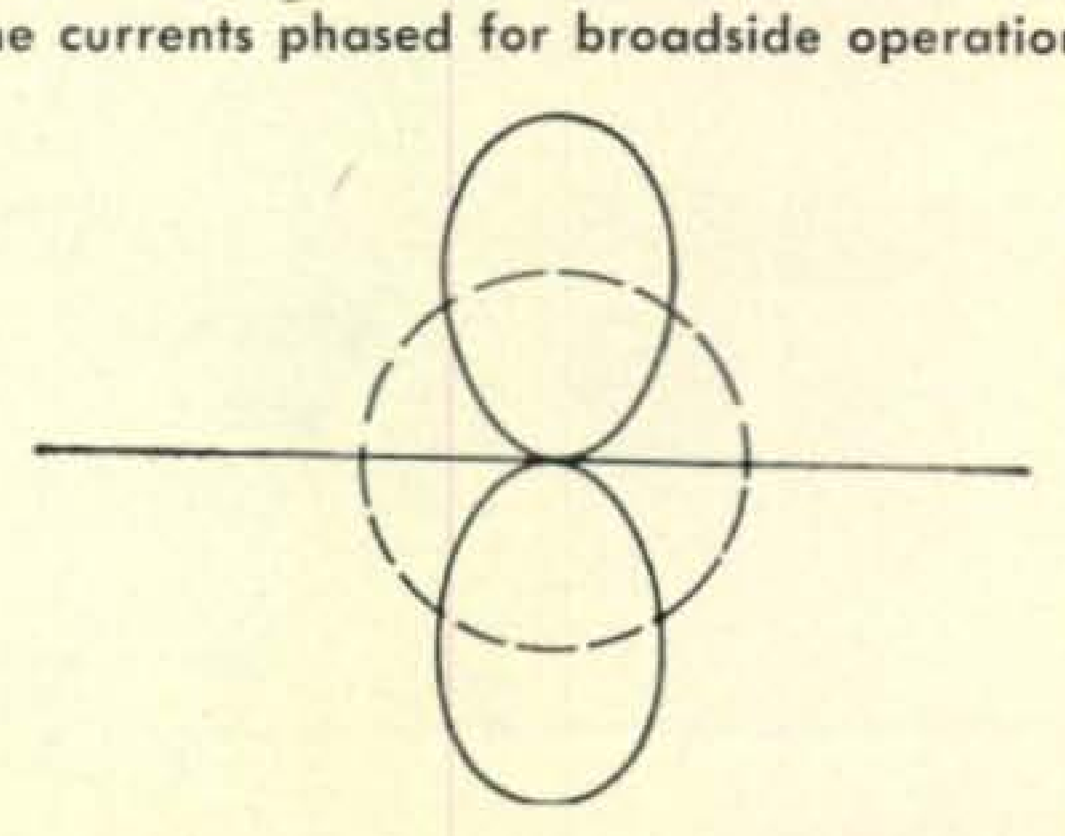


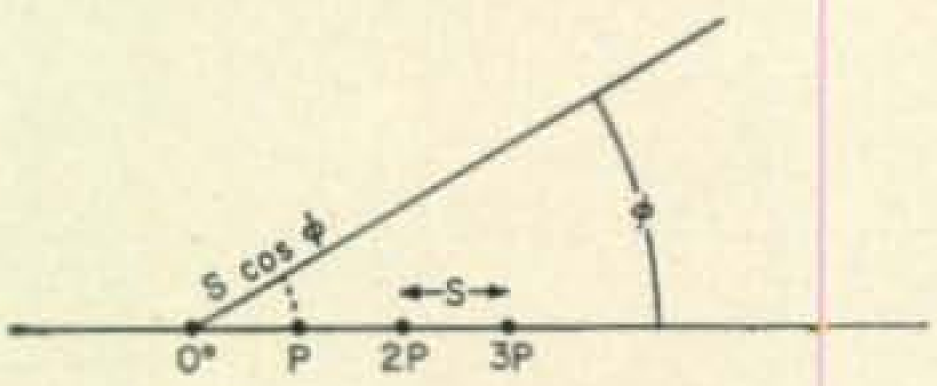
Fig. 5—Radiation pattern for the four element broadside array with the field of an equivalent dipole.

The procedures outlined previously give, for this array, the pattern shown in fig. 5. This is the typical broadside array pattern. Power gain over a dipole is approximately 3.34 which may be expressed as 5.3 db. This is somewhat better than the 4.9 db obtained with the endfire phasing since the lobes are considerably sharper.

Neither of the arrays shown as examples were designed to provide sharp directivity. It may be interesting for the reader to apply the above procedures to a similar array with 180° spacing. The beam will be considerably sharper and the results may be checked with the ARRL Antenna Handbook.

Appendix

In the array pictured below assume that the currents have a progressive phase increase from left to right of P degrees and the spacing between elements is S degrees.



When viewed by an observer at an angle ϕ the apparent spacing is reduced to $S \cos \phi$ and the total phase lead of the second element relative to the first is

$$\theta = S \cos \phi + P$$

A new variable, Z, is defined such that

$$Z = \cos \theta + j \sin \theta$$

In the complex plane this variable is an operator capable of introducing a phase shift of θ without changing the amplitude. Since the field strength is proportional to the sum of the apparent currents including all phasing effects it may be expressed as:

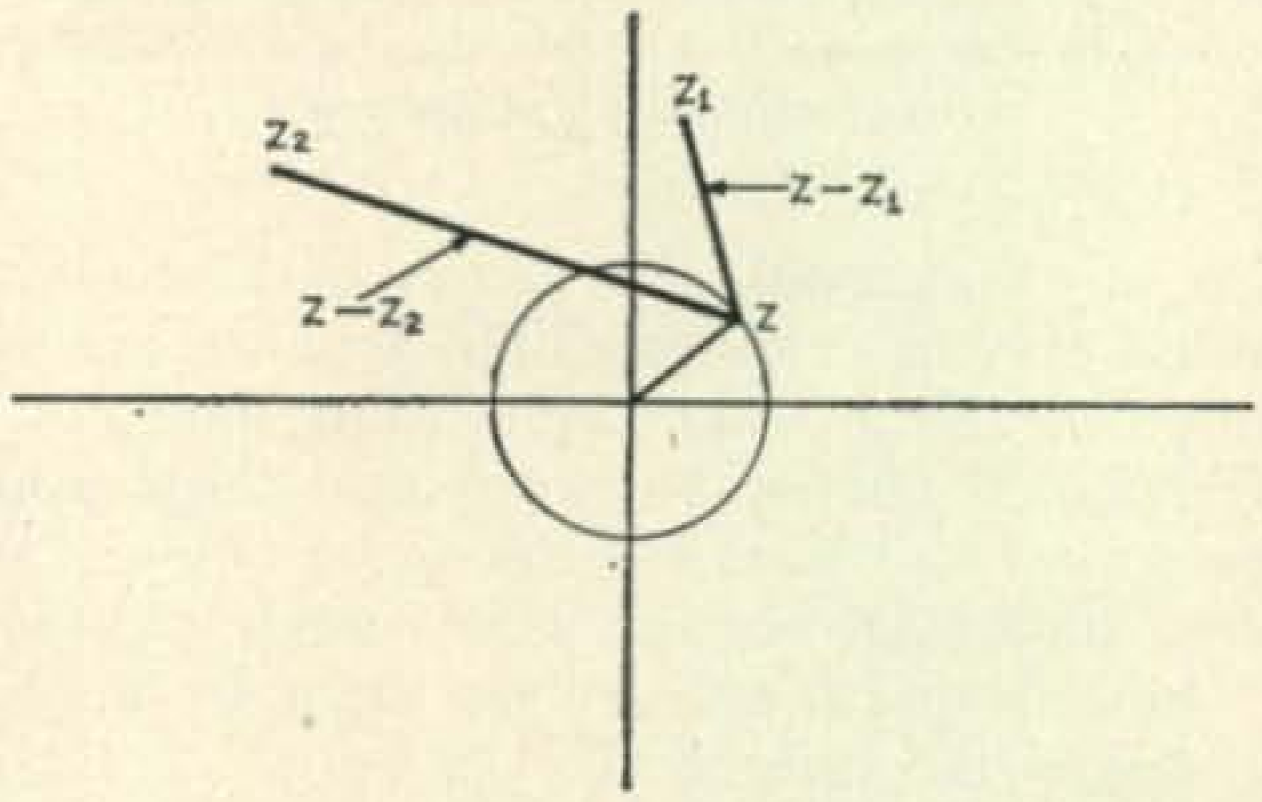
$$E(\phi) = A_0 + A_1 z + A_2 z^2 + - - + A_{n-1} z^{n-1}$$

where the coefficients account for any variations in the amplitudes of the currents and may also be complex to indicate any departure from the progressive phase shift P. Thus the coefficients contain all the anomalies in the currents. Irregularities in spacing can be handled in this analysis by replacing the existing array with an evenly spaced virtual array which has elements in all positions of the original array and zero current in those elements which are not coincident.

By the fundamental theorem of algebra the above expression can be written in the form:

$$E(\phi) = (z - z_1)(z - z_2) - - - (z - z_{n-1})$$

If the roots of the equation can be found by algebraic methods the field strength is found as the product of the $(n-1)$ lengths from the roots to the variable z. This is shown below.



When the currents have no anomalies the expression for field strength reduces to:

$$E(\phi) = 1 + Z + Z^2 + \ldots + Z^{n-1}$$
$$= \frac{Z^n - 1}{Z - 1}$$

The n roots of $z^n - 1 = 0$ are the vertices of a polygon of n sides inscribed in the unit circle. Since the factor $(z-1)$ appears in the denominator the root at $z = 1$ must be excluded from the n vertices as a root of the expression for $E(\phi)$. The method consists then of:

(1) Dividing the unit circle into as many parts as there are elements in the array,

(2) Excluding the root at the point $z = 1$,

(3) Plotting values of z around the circle at angles given by $\theta = S \cos \phi + P$, and

(4) Finding $E(\phi)$ for any space angle by multiplying the lengths from z to the $(n - 1)$ vertices. ■

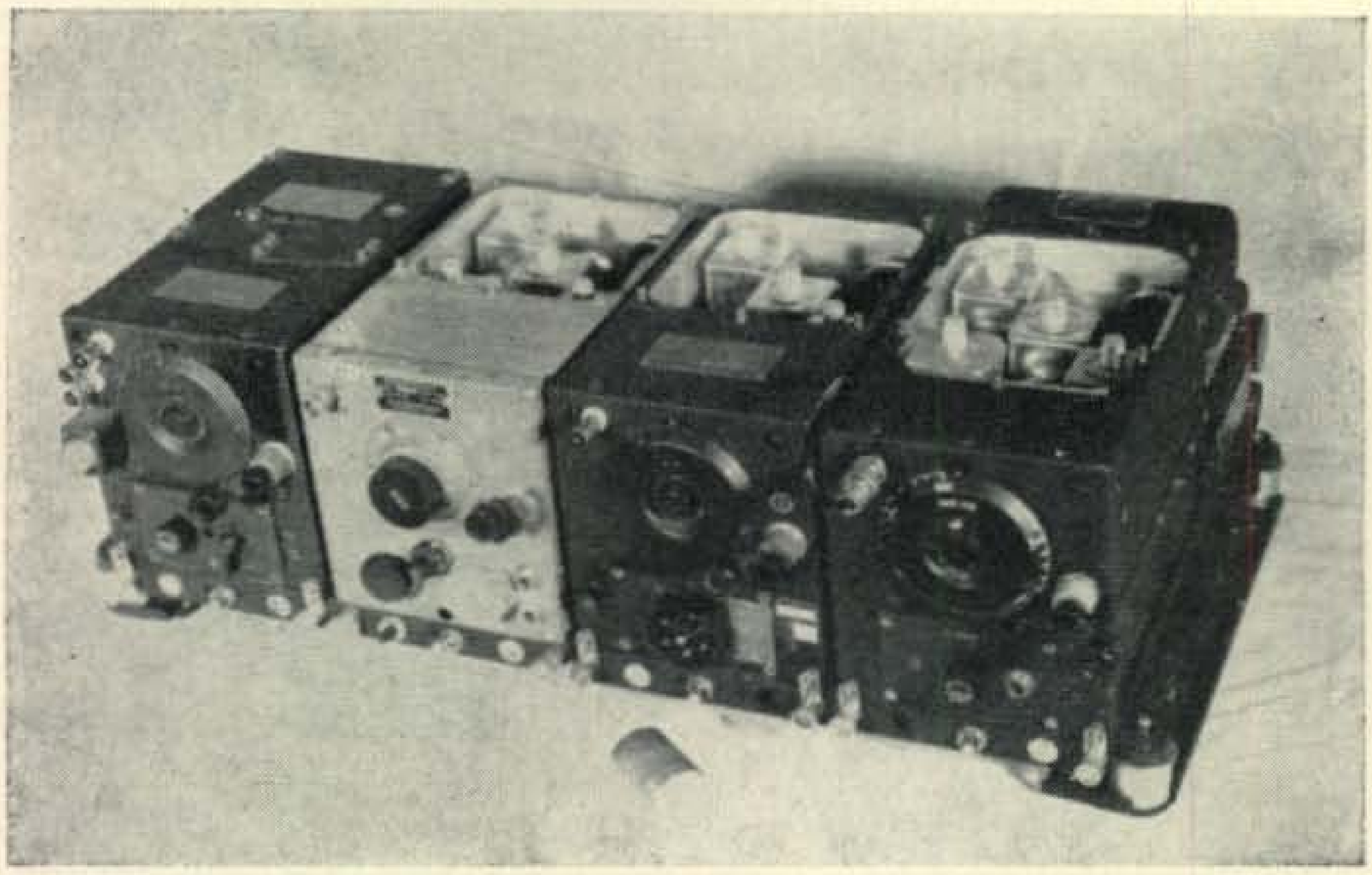
New Amateur Products

Hammarlund HQ-66 General Coverage Receiver

A new general coverage receiver (540kc to 30mc) has been announced by the Hammarlund Manufacturing Co., a Giannini Scientific Co., 53 West 23rd Street, New York 10, New York. The HQ-66 features a ten tube superheterodyne circuit; electrical bandspread tuning with direct dial calibration; and a built in automatic noise limiter to minimize static bursts and ignition interference.

The HQ-66 is continuously tunable from 540kc to 30mc in four bands. It is priced at $159.95. Complete data is available on request from Hammarlund Manufacturing Co.

The



Command Set Story

BY GORDON ELIOT WHITE*

If one could count the number of command sets in use by the amateur or the number and types scavenged for parts, one would begin to realize the impact they have had on amateur radio. It seems only fitting that we should know something about the history of this equipment. Covered below are the three stages of development for the command sets, pre-war, WW II and post war.

When the Type K Command equipment was first conceived, in 1934, very high frequencies were generally unknown and untested for communications. Despite advances in frequencies above 30 megacycles, it was not until the British proved that the u.h.f. region above 100 mc provided excellent voice channels for aerial combat that the U.S. armed forces took an interest in the shorter wavelengths. The result, in 1940, was a rush by this country to get equipment which would operate in the 100-156 mc area.

Both the Army and the Navy had just emerged from a frustrating process of choosing a new combat aircraft radio set for the lower frequencies. The Army Air Corps in particular had made several false starts, and finally had been forced, in June, 1940, to procure the Type K design built to Navy specifications, in order to equip the 50,000 plane force proposed by President Franklin Roosevelt in May of that year.

The Type K equipment had been designed in 1936 and 1937. It was to be manufactured for the Army as SCR-274-N, and for the Navy as RAT, RAT-1, RAV, ATA/ARA, and AN/ARC-5, in larger quantities than any other military radio ever made. At least 1,450,000 receivers and transmitters were eventually produced before the war ended in 1945.

The entire story of the Command Sets, and how tiny Aircraft Radio Corporation, in Boonton, New Jersey, with a handful of engineers, won design competitions against the giants of the U.S. electronics industry, is much too long to be told in a single magazine article; much of it is covered by long-obsolete but still effective security restrictions, or is hidden deep in the trivia of War Department contract files.

Briefly, the Command Sets were the creation of Dr. Frederick H. Drake, chief designer at Aircraft Radio Corporation. He apparently conceived the idea of independent, miniaturized, modular, plug-in transmitters and superheterodyne receivers during the winter of 1934. The Army had been ordered by F.D.R. to fly the Air Mail, a task which it was not equipped to handle. Bad weather, complicated by communications failures, killed 11 pilots in six weeks. The standard combat aircraft radio in

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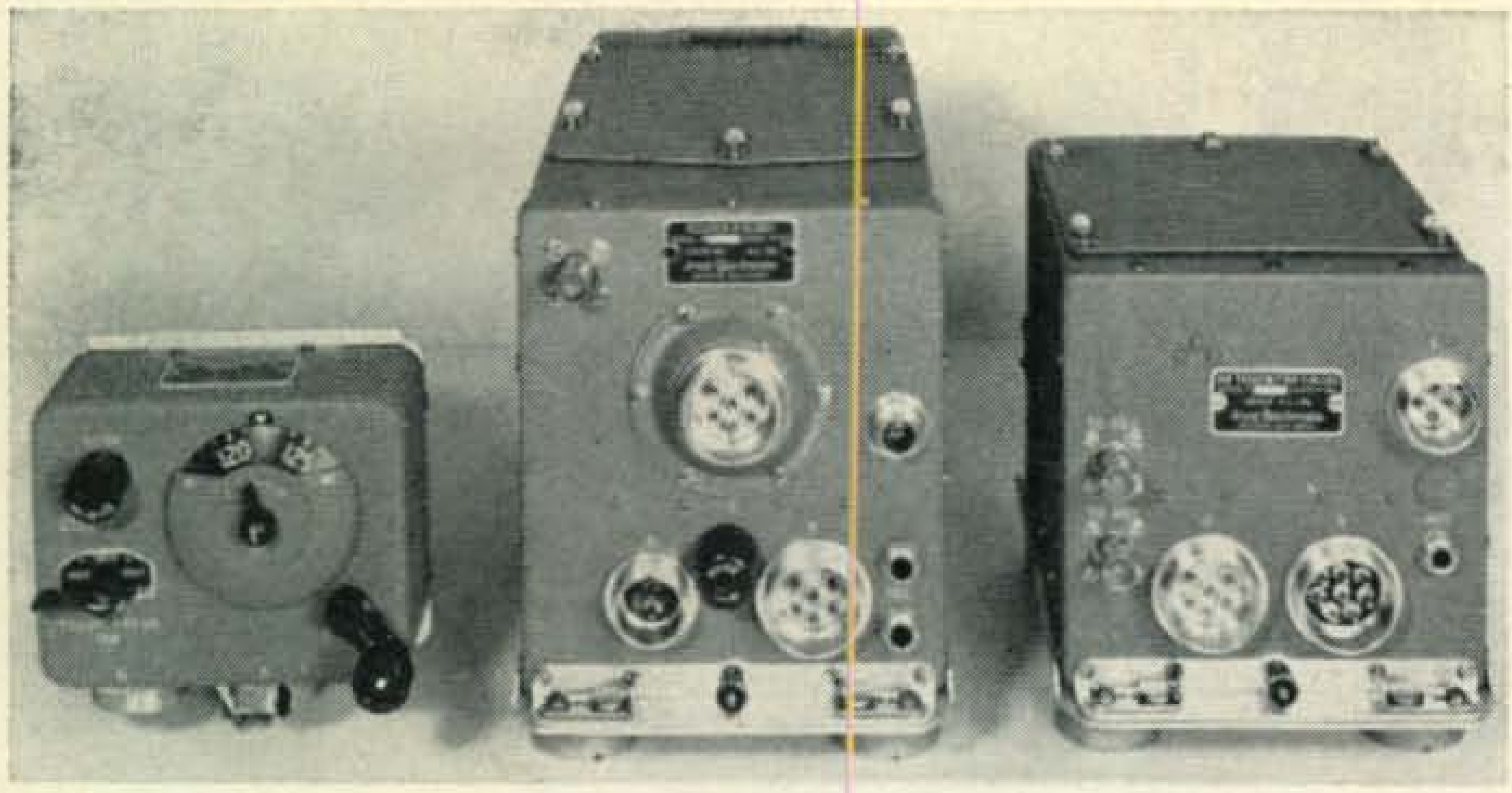


Model XRAV receiving equipment designed for installation aboard a Navy Patrol plane.

the Army Air Corps was the Aircraft Radio Corporation SCR-183. The Navy was using an almost identical A.R.C. set, the GF/RU. Neither was designed for long range communication or navigation. Both were TRF types.

With the advice of a few Navy friends, and a circle of Air Corps cronies that included Carl Spaatz and Hap Arnold (but no federal money) A.R.C. worked out the complete "channel" receiver design in 1935 and 1936. In 1937, Dr. Atherton Noyes was brought from General Radio to design the transmitters.

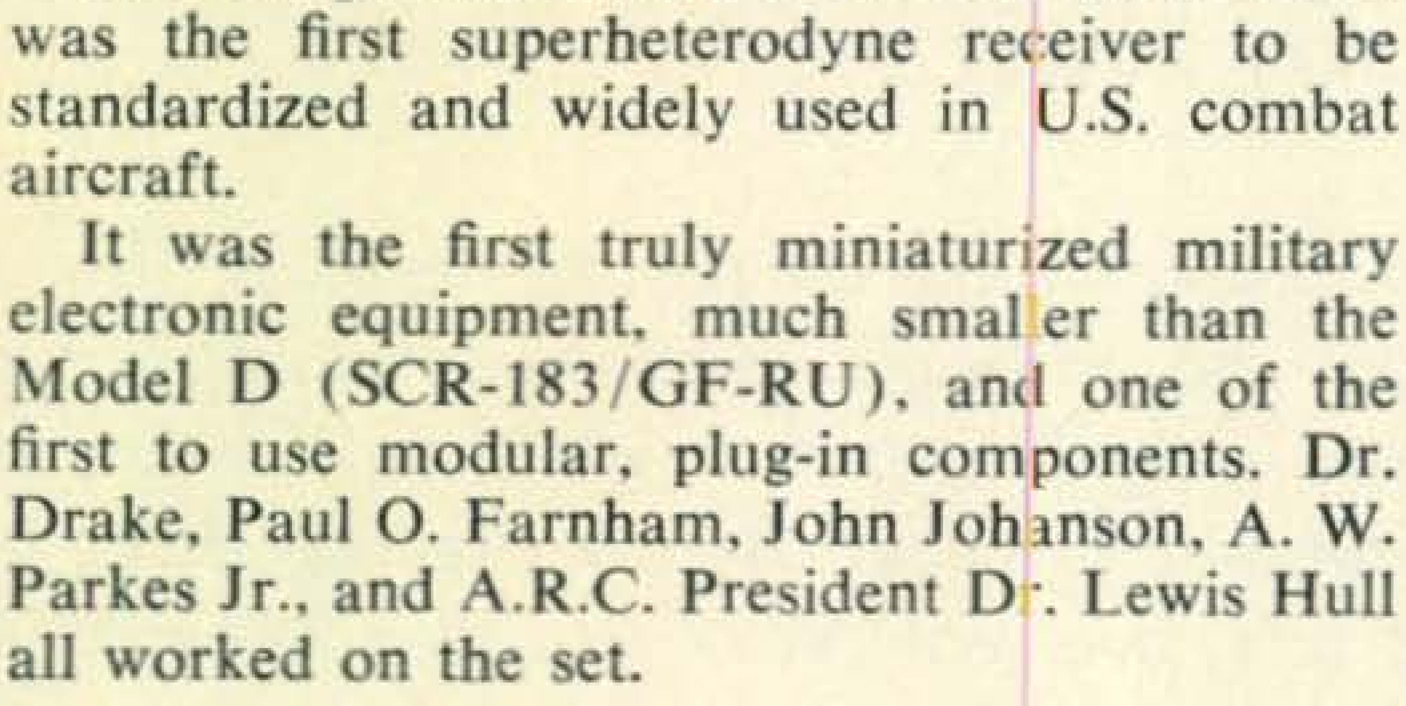
The design established a number of firsts: It was the first superheterodyne receiver to be standardized and widely used in U.S. combat aircraft.

It was the first truly miniaturized military electronic equipment, much smaller than the Model D (SCR-183/GF-RU), and one of the first to use modular, plug-in components. Dr. Drake, Paul O. Farnham, John Johanson, A. W. Parkes Jr., and A.R.C. President Dr. Lewis Hull all worked on the set.

Testing

After 1937, the next five years were spent in testing, improving, and selling the set to the military.

The Navy tested a prototype in 1939, and immediately bought production models starting with RAT (13.5-20 and 20-27 mc receivers) followed by RAV (eight receivers from 190 kc to 27 mc) RAT-1 (24-volt version of the RAT) and ordered the GT/RBD set of receivers and transmitters in June, 1940.



On the left is a post-war v.h.f. Command receiver. Note the smaller tuning capacitor shield and the four 15 mc i.f. transformers. On the right, for comparison, is the familiar R26/ARC-5 (3-6 mc) receiver with three 1415 kc i.f. transformers.

The Army, after suffering a failure in its new crystal-controlled SCR-240 design, tested the type T, but put it aside in 1940 for competitive bidding on command set specifications. Under the urgency of F.D.R.'s 50,000 plane air force, announced in May, 1940, the Air Corps turned to A.R.C. in June, buying the design under the Navy specification, as the SCR-274-N. (The N stood for Navy.)

The British had proved the utility of very high frequencies (known then as ultra high frequency) above 100 mc, in the Battle of Britain, in 1940. The U.S. military then took new notice of the v.h.f. bands, which had been used, until then, only experimentally, although the C.A.A. had been trying v.h.f. for airport control tower use.

Contracts were let early in March, 1941 for v.h.f. experimentation to Western Electric, which had taken over the Army's production of the A.R.C. SCR-274-N, for a v.h.f. component for the command set. The specifications stipulated that the receivers and transmitters fit the SCR-274-N racks, and be compatible with the existing command system, and to use no crystals. Frequencies were to cover the 100-156 mc band.

Western brought in a sub-contractor, Colonial Radio (later Sylvania) for SCR-274-N production, and both companies worked on the v.h.f. design along different, but parallel, lines.

Crystal Control

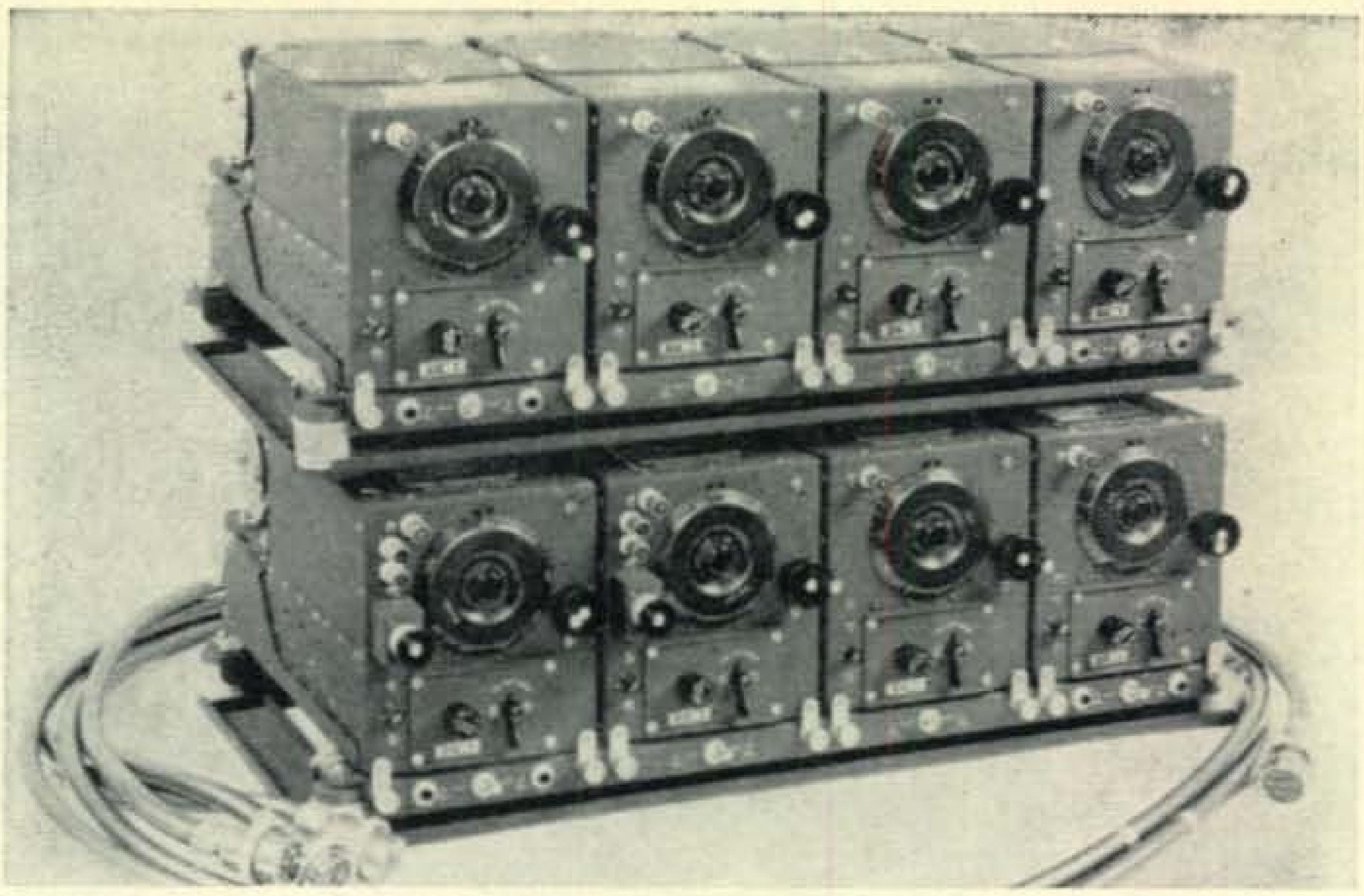
Bendix Radio was given, at British insistence, a contract to copy the Royal Air Force v.h.f. set. Under extreme secrecy the Bendix Company copied and improved the British design, producing it eventually as a 4 channel crystal-controlled transceiver covering 100-156 mc, under nomenclature SCR-522. The first units went into combat planes in mid-1942.

Bendix also was given a contract to design a v.h.f. set for the SCR-274-N equipment, using frequency synthesis to get multiple crystal-controlled channels with only two or three crystals, since crystals were in extremely short supply.

Fairchild was given a v.h.f. design contract, in July '41, for a non-crystal transceiver.

At Aircraft Radio, production of the early SCR-274-N sets, and conversion to the Navy ATA/ARA, absorbed the energies of the handful of design engineers. Stromberg Carlson, in Rochester, N.Y., was also set up for ATA/ARA

View of the post-war command receiver, transmitter and remote control, type ARC/17, airborne equipment.



production. Engineering in 1942-43 was spent on the improved AN/ARC set, a somewhat better Navy version.

Dr. Drake, who had experimented with v.h.f., and with crystal control, was a non-believer in both. The company pressed on with its own design, and no military interest in an A.R.C. v.h.f. design is recorded.

It was Alanson Parkes, A.R.C. field engineer, who saw a demonstration of v.h.f., at Bellevue. Here, the Navy was testing the Western Electric

Transmitters

0.5-0.8 mc — T15/ARC-5.
0.8-1.3 mc — T16/ARC-5.
1.3-2.1 mc — T17/ARC-5.
2.1-3.0 mc — GTATA 52232, T18/ARC 5.
3.0-4.0 mc — Type K (model), GTATA 52208, BC-696, T19/ARC-5.
4.0-5.3 mc — Type K (model), GTATA 52209, BC-457, T20/ARC-5.
5.3-7.0 mc — Type K (model), GTATA 52210, BC-458, T21/ARC-5.
7.0-9.1 mc — Type K (model), GTATA 52211, BC-459, T22/ARC-5.
100-125 mc — BC-699, BC-950, T23/ARC-5, T-126/ARC-5, T89/ARC-5 Type 15 (civilian) T11, T13, (Military) T-336/ARC, T-363/ARC, T-364/ARC.
125-156 mc — T90/ARC-5.
228-258 mc — TV10-A/ARC-60.

Receivers

0.19-0.55 mc — Type K (200-580 kc) (model), RAV 46102, RBD ARA 46129, R23/ARC-5, R23A/ARC-5, R148/ARC-5, BC-453, Type 15 R-11A.
0.52-1.5 mc — Type K (model), RAV 46103, RBD ARA 46145, ARA-2-46181, R24/ARC-5, BC-946, Type 15 R10A, R22.
1.5-3.0 mc — Type K (model), RAV 46104, RBD ARA 46104, R20/ARC-5, R25/ARC-5.
3.0-6.0 mc — Type K (3.5-7) (model), RAV 46105, RBD ARA 46105, R21/ARC-5, R26/ARC-5, BC-454.
6.0-9.1 mc — Type K (model), RAV 46106, RBD ARA 46106, R22/ARC-5, R27/ARC-5, BC-455.
9.1-13.5 mc — Type K (model), RAV 46107.
13.5-20. mc — Type K (model), RAT 46083, RAV 46108, RAT-1/46108.
20.0-27. mc — RAT 46084, RAV 46108, RAT-1/46109.
100.0-125 mc — R112/ARC-5, R28/ARC-5, BC-942, R13 AN/ARN-30 (108-135 mc) AN/ARC 60 R19 (228-258 mc), Type 15 R15 (108-135 mc), R19 (118-148 mc).
125-156 mc — R/113/ARC-5

WE-233-A, an air line set bought for wartime use as AN/ARC-4. Converted to a v.h.f. enthusiast on the spot, Parkes carried the word back to Drake.

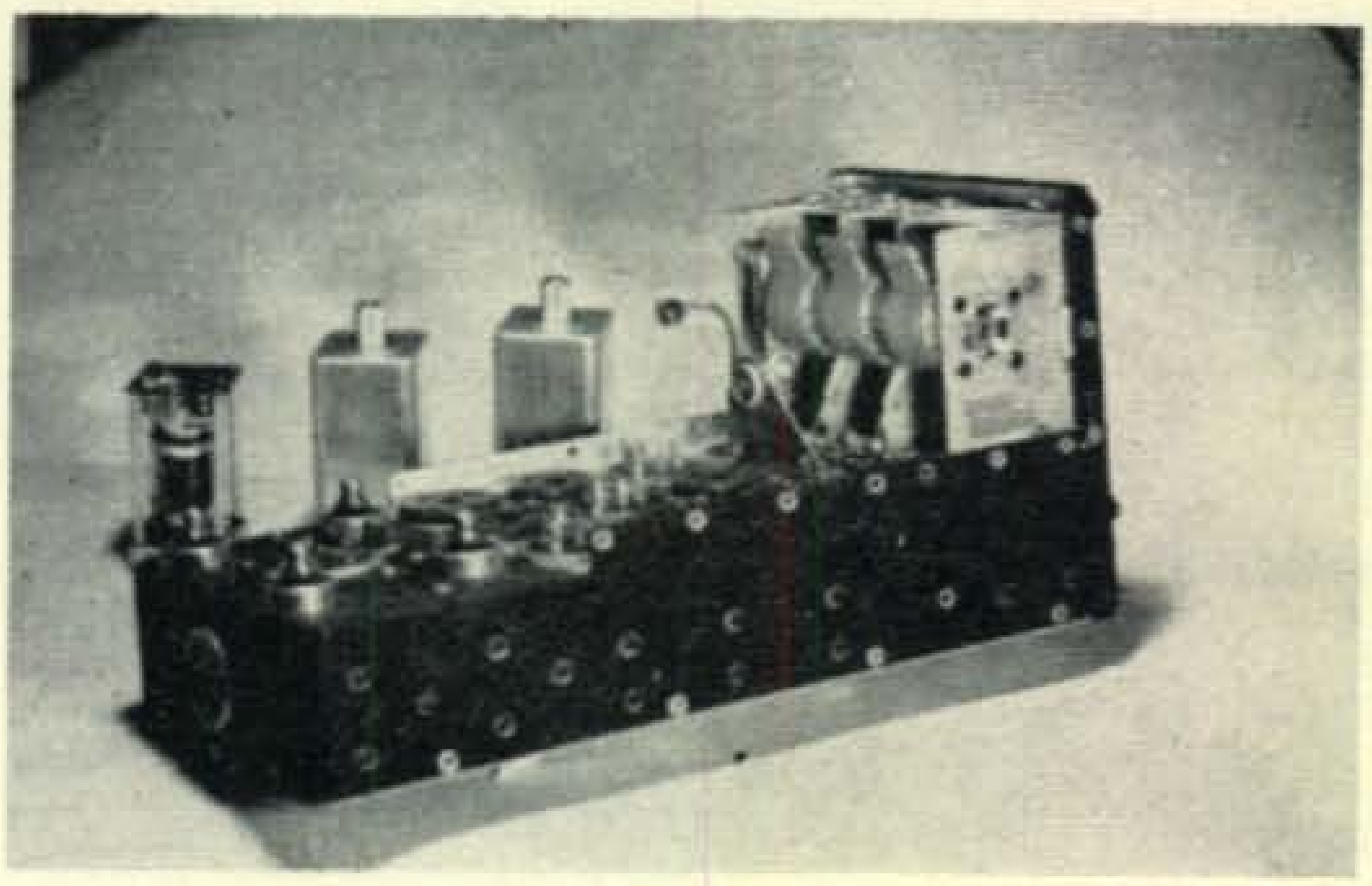
Dubious at first, Drake resisted. Design work was already badly hampered by the demands of production. Finally, after demonstrations, Drake was converted. Characteristically, he made the design nearly a one man effort. Without disrupting the work of the Boonton plant he closed himself in his workroom, and six weeks later emerged with a receiver design for a non-crystal v.h.f. receiver.

The circuit was adapted to fit the ARA receiver chassis, by the addition of a v.h.f. preselector. Two stages of r.f. were followed by a 15 mc i.f. output. Use of four miniature tubes in the preselector allowed room for an additional i.f. stage, all in the same receiver unit that had been used for the lower frequency bands.

Dr. Noyes, brought in to work with the transmitter design. helped Drake put a tuneable v.h.f. transmitter into the ATA transmitter shell, late in 1942.

As with any new design, particularly at very high frequencies, initial mechanical and circuit work needed to be followed up by painstaking test and improvement. Under the press of wartime, Paul Farnham, the detail man at A.R.C., was delayed again and again.

It was late in 1943 before prototypes were far enough along to propose the design to the



Uncovered view of the RAV receiver (circa-1939) which covers 20-27 mc.

Navy, and the tuneable v.h.f. was later pushed into 1944, as crystals became available in larger and larger quantities. By the time the Naval Research Laboratory finished tests, wartime design pressures were easing; the military had decided to use frequencies in the 225-400 mc band, and crystal-controlled sets had become common.

By 1944 the other non-crystal efforts had failed, a reputation that cast a shadow on the A.R.C. work. Fairchild, after three years of work, had abandoned its design. Bendix had dropped its frequency-synthesis plans in 1943. Western Electric had advised the Signal Corps that non-crystal v.h.f. equipment would take three years to build, and had received permission to use crystals in its v.h.f. SCR-274-N. The first prototype of the Western Electric, receivers BC-695 and transmitters BC-699 were rejected.

As finally produced, the Western Electric set (receiver BC-942 and transmitter BC-950) was bought in only token quantities.

Unclassified records show that about 1,000 of the SCR-274-N v.h.f. sets were bought in early 1943, but the contract was taken over by the Navy, which assigned nomenclature R-28 and T-23 ARC-5. Under the Navy type numbers about 22,000 sets were finally bought from Western Electric.

When the Navy tested the Aircraft Radio Corporation tuneable v.h.f. set at Bellevue, in 1944, the lab did not recommend its procurement for Naval aircraft. Under the development contract of 1943, 50 sets were bought, and sent to other military and civilian agencies for test. The Air Force, the C.A.A., and the British supply mission, in Philadelphia, all received samples, along with several of the airlines.

Although it had missed wartime use, the v.h.f. ARC-5 had immediate peacetime applications in the newly-assigned civil v.h.f. frequencies between 108 and 136 mc. The Civil Aeronautics Administration and A.R.C., in 1946, adapted the receiver to the new "Omni" air navigation system and it became the first commercial v.h.f. navigation receiver as part of A.R.C.'s Type 15 system. The Type 15 was also bought by the military as AN/ARN-30.

Although military production of the SCR-274-N and the AN/ARC-5 dropped to a trickle in 1945, and small contracts were signed with the Lewyt Vacuum Cleaner Company and Stromberg Carlson in 1949, 1951 and '52 for a few thousand R-23A low frequency receivers. A.R.C. continued to produce a civilian version of the low frequency receivers in 190-550 kc and 520-1,500 kc bands.

When the Korean war started, these later command sets were widely used in light aircraft and helicopters. The v.h.f. receivers were combined with a light-weight v.h.f. transmitter, and with a u.h.f. "transceiver," or converter system, covering 228-258 mc, under nomenclature AN/ARC-60.

Production of the post WW II command sets continued, at Aircraft Radio Corporation for civilian use, until 1960, when v.h.f. 360 channel crystal controlled equipment became virtually mandatory for U.S. all-weather civilian flying. ■

National's 50th Anniversary

THIS year marks the fiftieth anniversary of not only the A.R.R.L. but also the National Radio Company, Inc. National is perhaps the oldest manufacturer of communications receivers and equipment, starting in 1914 at a small plant in Cambridge, Mass. Initially they were a producer of mechanical products, but after World War I the company began to specialize in electrical components such as tuning capacitors, dials, knobs, and coils for the radio industry, then in its infancy.

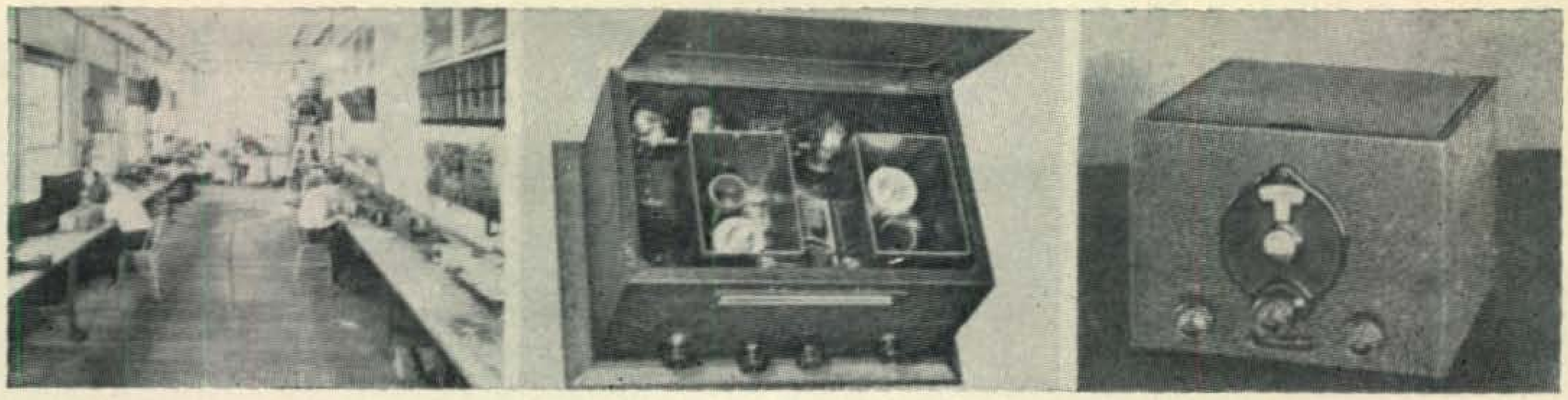
The 1920s and 30s marked the establishment of National as a major factor in the communications field, and in the development of amateur and commercial receivers. The SW-5 "Thrill Box" covered 9 to 2000 meters and was introduced in the early 20s, followed by a less expensive version, the SW-3. Subsequent receivers in an impressive list of models by National include the SW-58, FB-7, FBX-A, the AGS, the NC-100 and 101X. Many of these sets are still in use today, particularly the HRO "Senior," introduced in 1934. The late 1930s saw the introduction of the 60 watt NTX-30 transmitter, the huge "600" transmitter and the NHU v.h.f. receiver.

During World War II, National produced more than seventy-five different models of receivers for our Armed Forces.

The HRO-5 was the first of National's postwar HRO series to be available on the civilian market.

Arriving at the present, we pass through such notables as the NC-240D, the NC-125 and the popular NC-300. The NCX-3 (s.s.b., a.m., and c.w.) marked National's entry into the transceiver field followed by the introduction of the NCL-2000, a high performance desk top 2000 watt p.e.p. linear amplifier. The latest developments from National include the NCX-5 transceiver and the HRO-500 receiver.

Through fifty years the history of the National Company has paralleled the growth of amateur radio itself. Continual growth of a company or a hobby is only a reflection of the interest and support by the people engaged in developing, building and using that product or hobby. In this respect National can well be proud of their efforts along this line. —*K2EEK*



Just a few pictures from National's anniversary photo album. Left to right: a corner of National's engineering laboratory in the early '20s. The SW-5 "Thrill Box"—which covered 9 to 2000 meters. The SW-3, an inexpensive version of the SW-5.

Left, an internal view of the first ham-band receiver with a built-in crystal filter—the FB-X., Nationals first transceiver (1933) the TRW, for 5 meters. Notice the light weight mobile antenna mounted on the bumper of the Buick (center). The first post-war HRO—the HRO-5 (right).

The first HRO, a 1933 engineering prototype (left). A famous war-time compliment to National—the receiver is shown in the center; an identical copy of the HRO manufactured by the Germans for their military communications. The Japanese were not to be out-done during their pretransistor days (right).

Left, a deluxe amateur station of the late 1930's; a NC-101X receiver, CRM oscilliscope, NTE exciter and the "600" transmitter. Center, National's "Dream Receiver", the NC-300, was probably the fastest selling amateur receiver during the mid 50's. The last photo is National's NCX-3, brought out in 1962. The NCX-3 with its accessory a.c. or d.c. power supplies is a complete 200 watt 80, 40, or 20 meter station.

RTTY From A to Z

BY DURWARD J. TUCKER,* W5VU

Part IV

Covered this month is the circuitry for wiring machines in local loops and how the machines are operated by r.f. signals. Two methods are discussed; On-Off and Frequency Shift Keying.

Last month's installment discussed the operation of the keyboard crossbars and the transmitter distributor mechanism. Also covered was the operation of the selector magnet and its associated receiver mechanisms.

It was previously noted that the transmitting mechanism of the machine is not connected to the receiving mechanism of the same machine either electrically or mechanically. The transmitter and receiver circuit of the same machine can be connected together in a simple series circuit that includes a source of d.c. voltage. This is called a local loop and is shown schematically in fig. 24.

Selector Magnet Current

As pointed out earlier, some machines have two selector magnets and these magnets must be powered by a d.c. source. Since there are two coils the operator has the option of connecting them in series or parallel. In the series configuration the coils require a current of 20 ma and in parallel, 60 ma. This does not appear to be correct when looked at from the conventional Ohms Law standpoint.

This has puzzled more than a few beginners who are prone to think of the two coils in terms of their d.c. resistance. Actually, what we are really interested in is the pulling torque and action of the armature and its associated mechanism in each instance, so it works out that the required current for the coils connected in parallel is 60 ma instead of 40 ma as one might think.

The d.c. resistance of each selector magnet coil is relatively low. It is in the neighborhood of 100 ohms, give or take a few ohms, depending upon the machine. Sufficient voltage is used so that several thousand ohms of series resistance is required. See the circuit of fig. 24.

There are several reasons for this. This makes it possible to remove the coils from the circuit, such as with a closed circuit jack, without leaving the battery voltage directly across the keyboard transmitter contacts. It also makes it possible to insert the selector magnet coils into the circuit or remove them without appreciably effecting the current limiting action of the external circuit.

These are very good reasons but there is still one other that is far more important. If there was no series current limiting resistor the required voltage to put 20 to 60 milliamperes through the selector coils would be 3 to 4 volts. The selector magnet coils have both resistance and a varying inductance (as high as 2 henries) with the inductance at its highest value at the moment when the armature is against the pole piece. With a low voltage the time it takes for the current to build up to near 100% is too long and there is a mechanical lag in the operation of the relay. The time becomes much shorter as the voltage and resistance in the circuit is increased and these factors are no longer a problem.

A low voltage source such as 3 or 4 volts may be enough to operate the relay but not fast enough for printing. Let us suppose that the selector coils are connected in parallel which means that the current should be 60 ma. With a voltage of only 3 or 4 volts, the current through

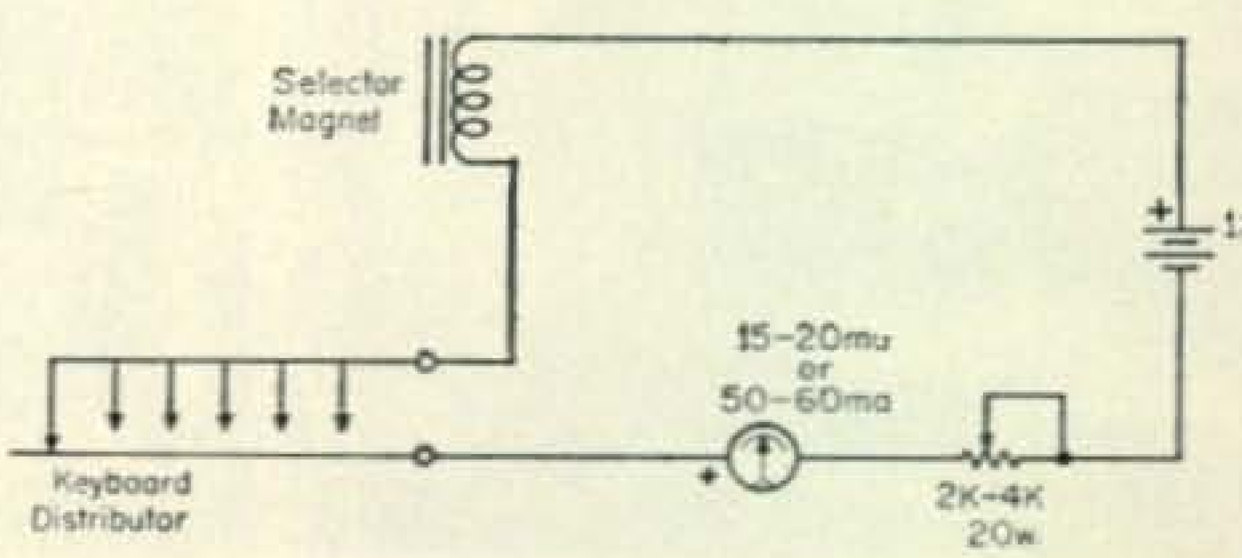


Fig. 24—Circuit above shows how the selector magnet (or magnets) are placed in series with the keyboard contacts, a source of voltage and a series resistance to form what is called a "local loop."

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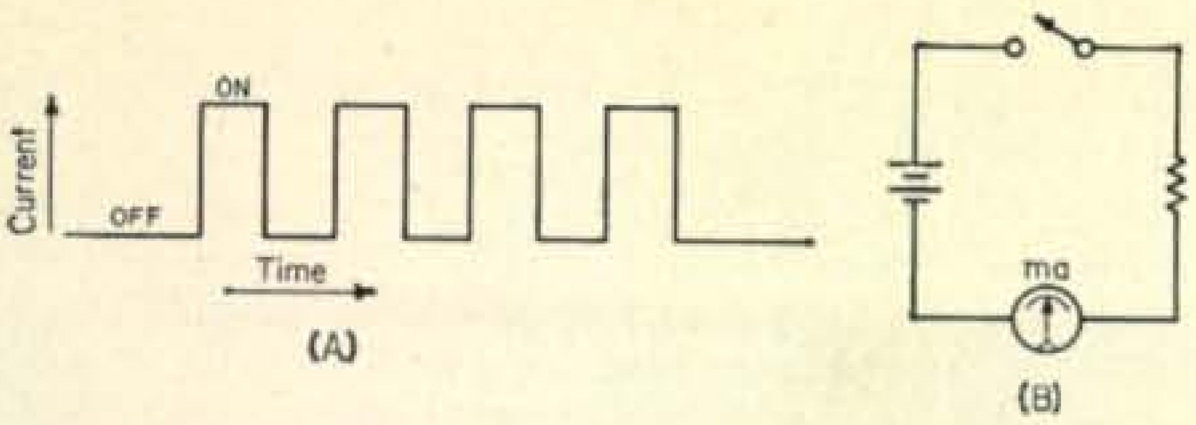


Fig. 25—The square wave in (A) is generated by opening and closing the switch in circuit (B).

the coils will not come up to anywhere near the required 50 to 60 ma during the 22 ms pulse following a 22 ms space when the coil circuit was open. The coil current should reach 90% of its required value in no more than 1 ms after the distributor contact closes. The current through the selector coils should be as near to a square wave as possible. Figure 25(A) shows a perfect square wave produced by opening and closing the switch shown in fig. 25(B), a resistive circuit.

Time and again, throughout this article, whenever the opportunity presented itself, attention has been focused upon the fact that the teletype signal is made from 22 ms pulses, forming a square wave, produced by interrupting a d.c. voltage. In a circuit containing mostly inductance this square wave could not be generated. By placing the inductances in series with large values of resistance and using higher values of voltage the result is almost that shown in fig. 25(A).

Range Finder

An attempt should always be made to have the signal that your machine is required to copy as near a square wave as is possible. I would be amiss if I didn't point out the fact that, although it is most desirable that the signal operating our printer be a square wave, it will settle for less and under certain circumstances considerably much less and still give good copy.

As a matter of fact, the receiving mechanism is designed so that it requires only 20% of the 22 ms pulse or 4.4 ms of each selecting interval in which to perform its function. This is necessary in order to minimize errors in printing. This is particularly important in cases where transmission is over long h.f. paths such as encountered in the amateur bands. It is possible, under such conditions, for the transmitted pulses to be altered in time relationship to each other as well as becoming either lengthened, shortened or otherwise distorted. Only so much of this can be tolerated before the machine begins to print errors. The ideal arrangement would be for the 4.4 ms time, during which the selecting mechanism is performing its function, to fall in the center of the 22 ms interval. Teletype machines are provided with a "range finder" which is adjustable to accomplish this. The end result of this is shown graphically in fig. 26 for the letter Y. This may appear to be an ample amount of safety margin to insure perfect printing and it is—under normal conditions. However, this comfortable margin of safety can soon melt away under adverse receiving conditions. At this point, just about every trick in the book has to be resorted to in order to improve the copy.

Machine Circuits

Earlier it was made pretty plain that all characters, without fail, start with a 22 ms space and yet the pictorial view of the dots and spaces as shown back in fig. 2 indicates a very short pulse before the start of the 22 ms space for all characters. It will be recalled that the transmitter distributor stops at the end of each character and in the stopped position the sixth cam operated switch is left in a closed position. It stays closed until another character is sent, whether that be the next instant or minutes later. When the next character is to be sent, that closed contact must be opened. This happens almost instantly but not quite. Obviously, the next character starts at the end of the last. This is graphically shown in fig. 27 where the letters RST are put end to end.

The synchronous a.c. motor runs continually so long as the machine is in operation or so long as you are at the operating table and on the verge of putting it into operation. If you are not writing on the keyboard or receiving a signal on the receiving mechanism (printing) the machine is silent except for the low drone of the a.c. motor. The silence is broken if the d.c. signal circuit (see fig. 28) is broken. The machine then runs open. As W4JTU once said, "You don't have much difficulty in telling when a machine is running open—it jiggles up and down like it's fixing to take off for the nearest fire exit."

Figure 24 shows the d.c. electrical circuit of a single Teletypewriter showing that the keyboard (actually the transmitter distributor contacts) and selector magnet are series connected with a d.c. power supply of 120 to 200 volts and a current limiting resistor. It is highly recommended that you first hook up your machine in this fashion in order to become thoroughly familiar with its operation. When you press a key the transmitter distributor begins to function. The On-Off operation of the transmitter distributor contacts causes the selector magnet mechanism and printing mechanism to faithfully follow by typing out what is being fed to the keyboard.

The circuit of fig. 24 can be extended to include two teletype machines that are connected together by a two wire line as shown in fig. 28. These may be on the same operating desk or they can be miles apart. It becomes apparent, from an inspection of this circuit, why it is

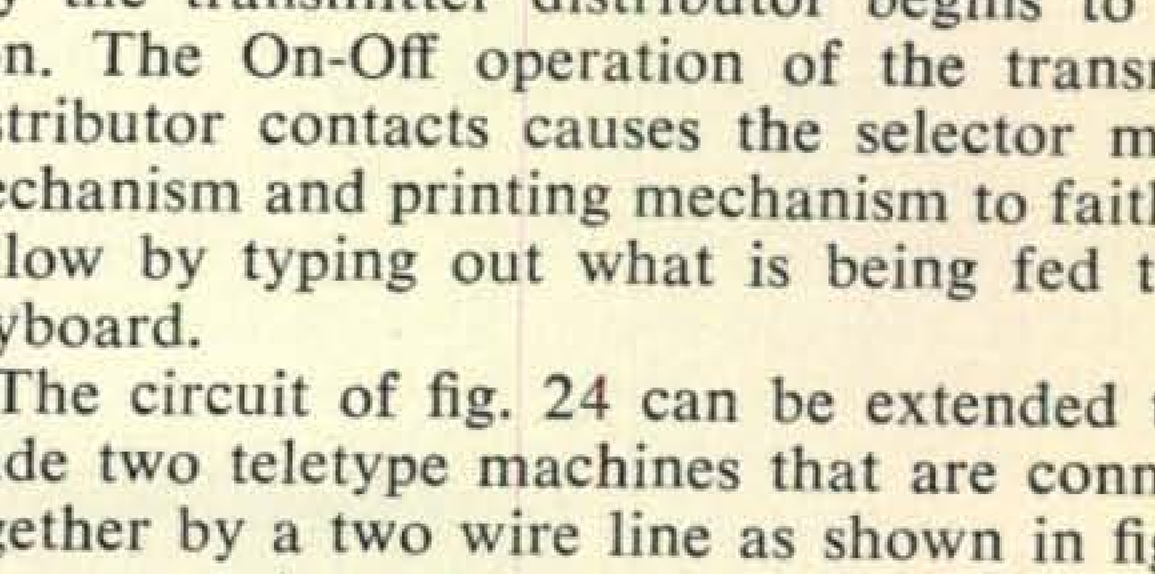


Fig. 26—The receiving mechanism is designed to function on a pulse whose duration may be as little as 4.4 ms out of the 22 ms time allowed. The rangefinder mechanism is used to place the received pulse in the center of the 22 ms interval as explained in the text.

desirable for the keyboards to be in a closed or On (*mark*) position. It can be seen from fig. 28 that the keyboard of machine #1 must be in the *mark* position if you are to send to #1 from the #2 machine and vice-versa.

Machine Connectors

There are three basic circuit connections to be made to a teletype machine requiring three sets of wires. First, there is the a.c. cord to the synchronous motor. This may go directly to a wall socket or it may be wired through another piece of ham shack equipment.

The keyboard and selector magnet should each be terminated in a plug. This makes it possible to unplug the machine so that it can be moved or worked on.

The wiring found in the base of a machine will amaze you when you see it for the first time. One must remember that this wiring was put there because of the external or associated circuits required for the machine's original use. Many of those requirements necessitated extra switches, buttons, jacks, *etc.*, that were mounted on or near the machine or its supporting table. Some hams modify or replace this with wiring and circuits of their own that are every bit as complicated or even more so than the original. I prefer to keep the machine wiring simple and restricted to the three plug-in cords. This way you do not have to take out the present machine wiring or do much to it to get the three lines properly connected.

I hope that by now that you have been convinced of two things: Electrically, the teletype machine could not be much more simple, as shown in figs. 24 and 28; and mechanically, it is not a monster but a marvel—something that will add many pleasant hours to your hamming enjoyment.

Radio Applications

Up to this point, I have deliberately and carefully avoided any reference to the application of the teletype machine to radio use. It is my feeling that the material covered up to this point gives the most trouble to the beginner, especially if he passes on to the radio application before he fully understands the basic functions of the various mechanisms of the teletype machine. If you are still with me at this point, you shouldn't have any trouble from here on in.

The application of the teletype machine to radio does not alter or add anything to that which has been covered up to now so far as the machine itself is concerned. It's an On-Off d.c.

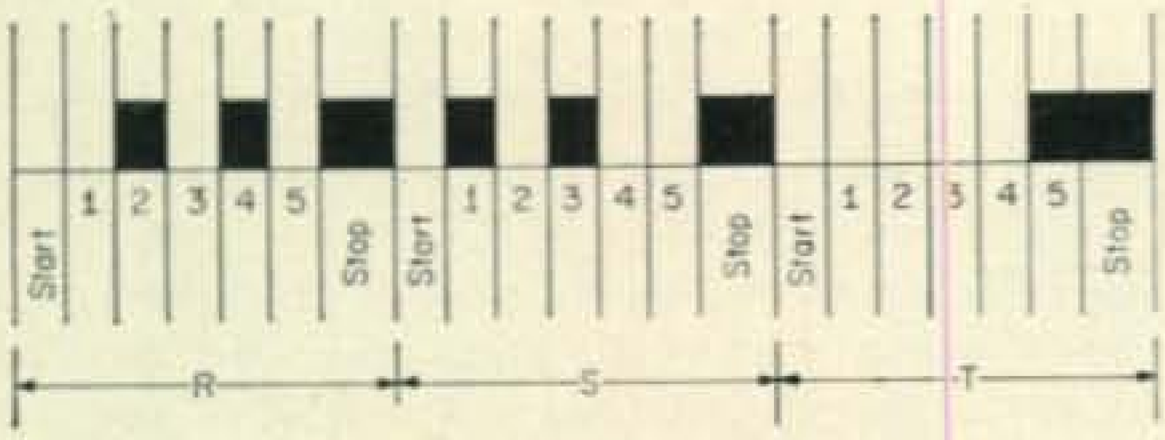


Fig. 27—The letters RST, when placed in sequence, present the pulse series shown above.

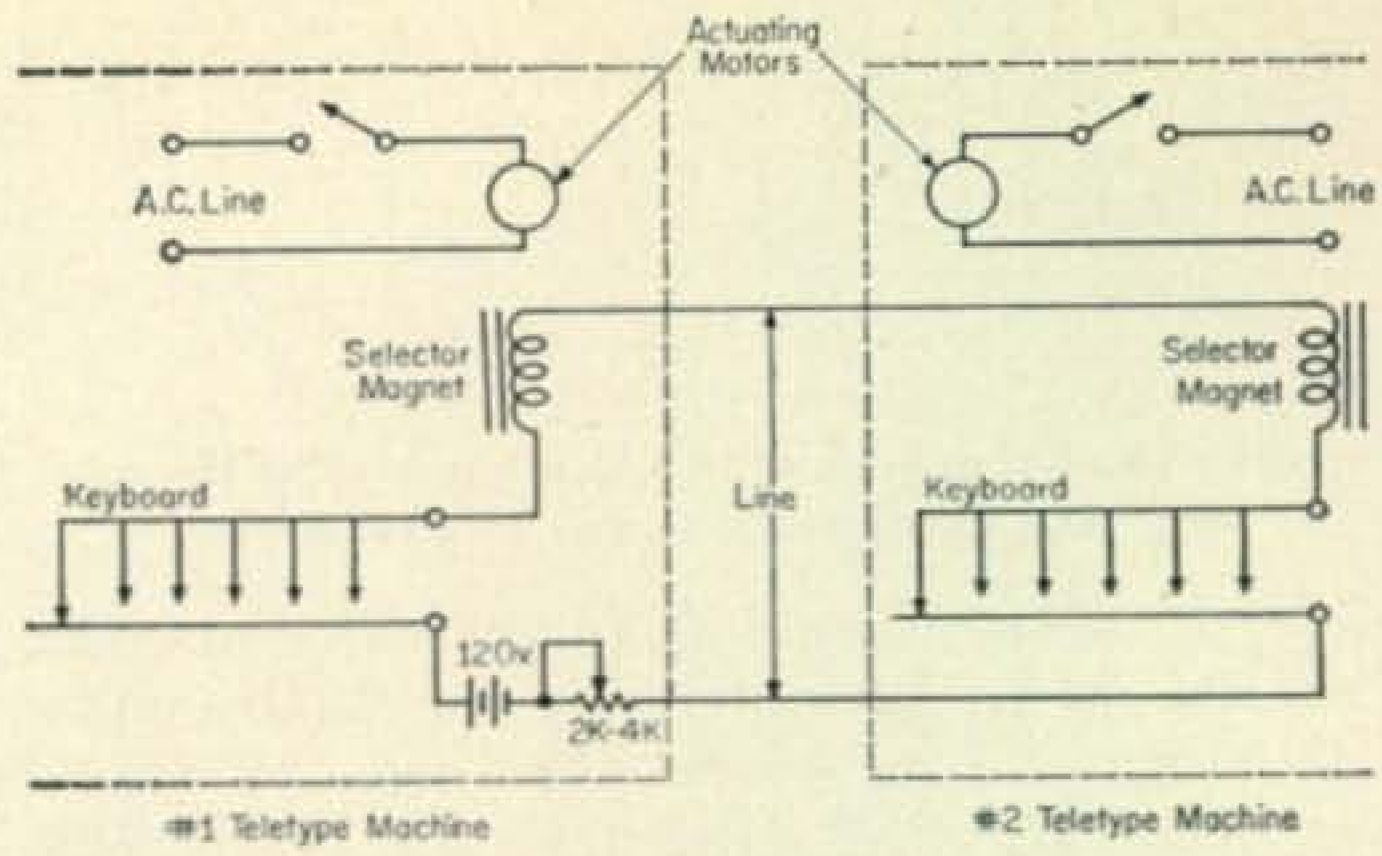


Fig. 28—The circuit of fig. 24 can be extended to include two machines, one of which may be miles away, for direct wire operation.

operated machine and remains so when operated with radio equipment.

On-Off Signals

Any person that knows the morse code is aware of what On-Off signals are. Anyone who has read to this point, knows that a teletypewriter is an On-Off signal operated machine and certainly any ham knows that c.w. telegraphy is an On-Off signal. Furthermore, the reception of c.w. telegraphy is simple and uncomplicated provided your ear can follow the speed of transmission and the signal is reasonably free of the multitudes of interference that can thwart reception. Linkage from the headphones or loudspeaker, through air, to your ears is direct with no devices needed.

This brings us face to face with the first problem we encounter in the application of teletype machines to the reception of On-Off radio signals. The teletypewriter has no "ear" to pick up the signal coming from the loudspeaker even if it is sent in the teletype code instead of the morse code. Neither can the audio output of the receiver be connected directly to the teletype machine selector coil. It will be remembered that it takes a d.c. voltage of 120 to 200 volts and a minimum d.c. current of 20 ma to properly operate the selector magnet and its mechanism.

The reception of either ON-OFF code can be the same up to the output transformer of the receiver. At this point, something more is required for the teletype machine operation. Alas, the mysterious black box enters! Actually, it is not all that bad, so let us review the problem.

We need to take the On-Off a.c. audio signals from the secondary of the receiver output transformer and eventually end up with On-Off d.c. signals that will have a circuit voltage of 120 to 200 volts d.c. and the required current of 20 or 60 milliamperes (operator has option as to which way he connects the selector coils—series or parallel) with which to operate the selector magnet.

It is almost certain that if left at this point, without further aid, most of you would solve this problem in due course. Place the selector magnet in the plate circuit of a power tube (usually two 6AQ5s in parallel), that meets the current and voltage requirements and properly couple from the output of the receiver to the grid of the power tube usually called a keyer tube. The whole circuit will be given in due course.

RTTY actually began in the ham bands as a make-and-break or On-Off keying of the radio transmitter (using the Teletype code, of course) just as had always been done with the Morse code. In the beginning, the c.w. boys were so opposed to the carrier staying on constantly (while transmitting) and using frequency shift keying, as is now done, that the FCC would only allow make-break-make keying. Make-break-make keying of the radio signal is satisfactory *only* so long as you get good copy on the receiving machine. It was soon discovered that On-Off keying for radio teletype was highly vulnerable to signal fading, QRN, QRM, *etc.* Of course c.w. was vulnerable too but RTTY was more so. When you are copying a c.w. signal you can adjust the tuning or the b.f.o. sliightly which may give the received signal an edge over QRM. This isn't necessarily so in copying On-Off RTTY.

The teletype machine may do fairly well with the On part of the signal. It is the Off part of the signal that gives the trouble. A study of the teletype code shows that the Off or spaces of no signals are just as important as the On signal parts. Take, for instance, the teletype code for the letter *Y* as shown in (b) fig. 29. If the "space" signal unit 2 is not received, the character now becomes the letter *Q* as shown in (a). If neither the unit 2 space or unit 4 space is received, the character is neither *Y* nor *Q* but *Letters* as shown in (c).

One thing is sure, the teletype machine is going to "read" every unit of the five unit code as something and that something has to be either *mark* or *space*. *The big problem is getting it to respond to the space units in the face of interference*. How many times have you been copying a c.w. station only to find when he stood by that one or more stations were underneath that were just about as loud? The slight difference in signal strength made it possible for you to copy. If a teletype machine is copying the letter *Y* and another strong signal is present during the *space* time for unit 2 then the machine copies unit 2 as *mark* causing copy error. The teletype machine may not only copy the *mark* signals from the station that you are trying to copy, but it may also copy any other strong pulses (as *marks*) from other stations that are present during intervals of *space* from the desired station. With considerable interference, the machine may act as though nothing but *mark* pulses are being sent or that the carrier is not being interrupted at all. It can be seen from this that On-Off RTTY can not tolerate very much interference of any kind. No small wonder why the RTTY'ers began to clammor to the FCC to get the rules changed to provide for frequency shift keying of the transmitter for RTTY work in the ham hands. This the FCC did, making it effective in February 1953. They called it f.s.k., F-1.

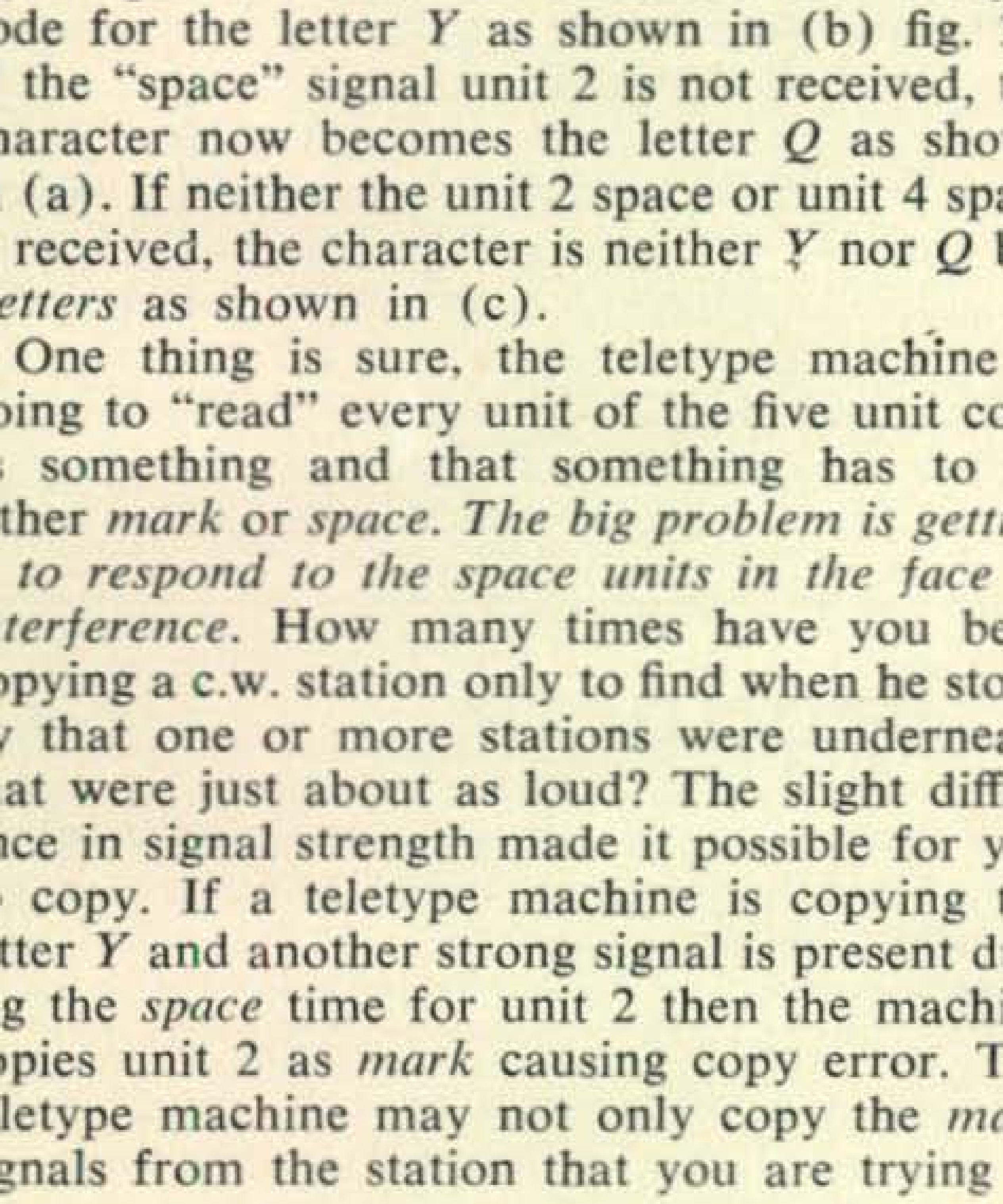


Fig. 29—Teletype code letters Q and Y and the "Letters" character that shifts the machine typing mechanism from FIGS to LTRS. If unit 2 of Y becomes a *mark*, the character now becomes Q. If both units 2 and 4 of Y become a *mark* then the character becomes "Letters."

F.S.K.

The conclusion can now be reached that although the teletype machine operation depends just as much on spaces as it does on pulses of signals, the space is most difficult to transmit satisfactorily by radio with make-break-make signaling. It becomes obvious that some means must be devised whereby the space can be sent by radio by another pulse signal and then converted to a space at the receiver end. With this thought in mind, *frequency shift keying* came into being (f.s.k.). With this system, *energy is sent for each pulse.*

F.s.k. is often referred to as a dual or double On-Off system. If you used two transmitters and keyed one for mark and the other for space, then you would have a true double On-Off system. This is not necessary in actual practice. It is far more practical to use one transmitter and keep its carrier on during the entire transmission. Teletype keying is accomplished by shifting the transmitted r.f. carrier frequency a few hundred cycles from say frequency A to frequency B. The *mark* signal is transmitted on the A frequency and the *space* signal is transmitted on the B frequency. The transmitter frequency is instantly shifted from A to B and back, *etc.*, depending on the code units of the teletype character being transmitted. Frequency shift keying is accomplished at the v.f.o. (or crystal oscillator if such is used) of the transmitter. Vacuum tubes or solid state devices are both used in the frequency shift keying of transmitters. The actual (make-break of a circuit) of the transmitter is done directly by the teletypewriter keyboard transmitter contacts or indirectly through a relay. If a mechanical relay is used, then almost invariably a polar relay is used. Very few electronic relays are used for this purpose, although diode switching is used extensively. This will be covered shortly.

The keyboard transmitter contacts are operated either "dry" (with practically no voltage across the contacts) or "wet" (with normal voltage across the contacts). Both methods, dry or wet, are being used successfully. However, more care and maintenance is required to keep the keyboard transmitter contacts free of oil, carbon, dust or other foreign particles than when an appreciable voltage is at the contacts. A substantial voltage present at the contacts tends to keep them clean by means of the minute arcing that apparently burns much of the foreign material from the contacting surfaces.

A side or indirect benefit from frequency shift keying is that the plate power input does not turn on and off with the keying rate but stays constant since the power stays on so long as the transmitter is being keyed. The advantages of this are obvious—less TVI, less strain on the transmitter and not as susceptible to key-clicks as make-break-make keying.

The maximum frequency shift of 850 cycles for the amateur radio bands is established by F.C.C. rules and regulations for f.s.k. At first this was the only frequency (plus or minus 50 cycles) allowed. This is probably the most used frequency shift; however, many other shifts are now being used. At least considerable experimenting with other shifts goes on among the RTTY'ers. The other shifts are usually multiples of 170 cycles such as 680 cycles, 510 cycles, even down to 170 cycles. The main reason for the use of multiples of 170 cycles is convenience as well as giving some semblance of standardization. Commercial RTTY circuits using f.s.k. have shown that the smaller frequency shifts have an improved signal-to-noise ratio.

The "rest" or carrier frequency ("A" as earlier explained) before keying starts is considered the *mark* frequency such as 14,100.000 kc. It is customary to shift down in frequency for *space*. In this case a shift of 850 cycles down to point "B" would give a *space* frequency of 14,099.150 kc. Occasionally, an operator may frequency shift key his transmitter in such a way that the frequency shifts up for *space* instead of down. This is considered as sending "upside down". Under these conditions, at the receiving machine, the *mark* becomes *space* and *space* becomes *mark* and the machine, as can well be imagined, prints nothing but gibberish. Obviously, the greatest objection to sending "upside down" is the confusion it creates. The receiving operator may not be able to determine at first if he is trying to copy a poor signal or that the signal is just upside down.

All receiving setups have a "turn over" switch somewhere in the RTTY lineup for this very purpose. When in doubt, you flip the switch. Just the same, it is somewhat of a nuisance if many of the fellows slip into the sloppy operating habit of sending upside down.

Remember that the carrier is on at the key-down (*mark*) point "A" and also at the key-up (*space*) point "B". The question may arise as to why the rest frequency is not the key-up point B (space) if we are not actually keying the transmitter. It will be remembered in the discussion of teletype machines and the teletype code that there is a 31 ms rest pulse (*mark*) at the end of each character. The machine "rests" at this point until the next character is keyed. If the machine were to rest on space while we were thinking about what we were going to say next it would "run open" and make so much noise that we couldn't think. With c.w. telegraphy we are used to considering the key-down condition as existing only while we are sending since nothing is being sent when the key is up (carrier off). With f.s.k. we are sending a space signal that is just as strong as the mark signal. Since there is twice as much power in the f.s.k. system (double On-Off) its transmitted intelligence is considered to have a 3 db power gain over an On-Off system.

Next month, Part V will cover actual transmitter f.s.k. circuits and two tone signals.

[*To be continued*]

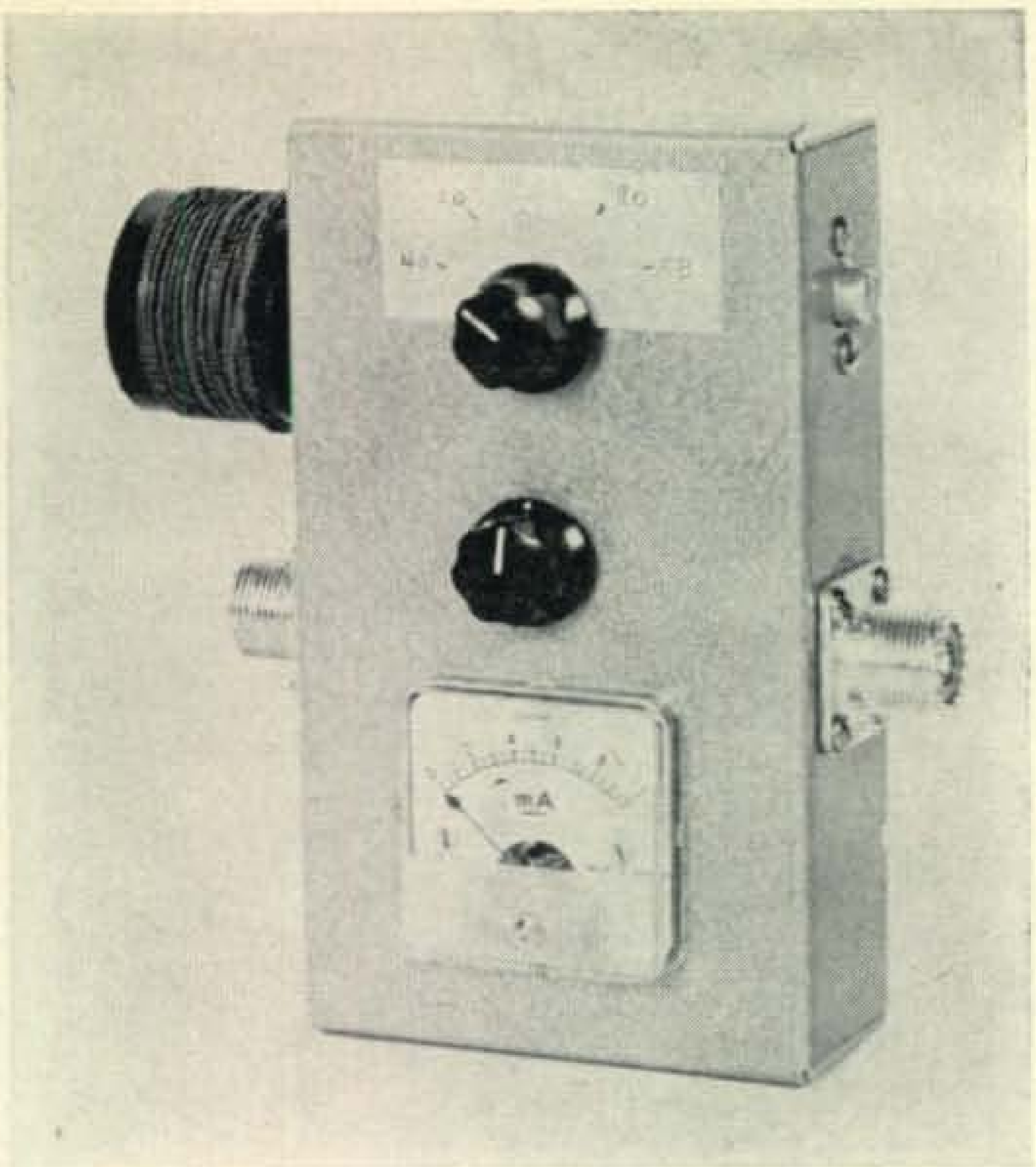
New Amateur Products

The Electro-Voice W9IOP Q Dial

A NEW companion to the Electro-Voice W9IOP DX computer is the W9IOP Q Dial. Similar in appearance and size (except it's blue instead of red), it offers the following:

1. Most commonly used 10-Code signals. 2. ARRL phonetic alphabet. 3. Universal time conversion chart. (EDST, CDST, MDST, PDST, EST, CST, MST, PST, GMT). 4. Continental Morse code chart. 5. Most commonly used Q signals. 6. 3.5 to 144 mc Table of Amateur Allocations, including frequency limits and modes. 7. QSL Bureaus for U.S.: territories and posessions and Canada. 8. CB districts and prefixes. 9. Amateur prefixes. 10. State capitals and what time zone they're in. 11. Most commonly used c.w. abbreviations. 12. Logging space for all states and U.S. possessions. 13. Description of National Bureau of Standards Radio Services and their technical services. 14. Standard RST reporting system.

The only thing that it appears to lack is the ability to turn on and operate the rig. It is available from your local dealer at $1.00 each or by writing to Electro-Voice, Buchanan, Michigan.



The Transmitter Tune-Up Box

Front view of the triple function transmitter tune-up box. The plug-in coil for the field strength meter function is visible on the left. The tuning capacitor is roughly calibrated by bands.

BY WELLS CHAPIN,* W2DUD

Three very handy aids to transmitter tune-up are combined in one package; a field strength meter, a power meter and an oscilloscope take-off point that is properly attenuated. The unit, as designed, can handle transmitters up to 1 kw.

THE box shown in the photos houses three essential units for transmitter tune-up; a power indicating device, a voltage divider for a scope test point, and a field strength meter. Through careful design and utilization of components the actual parts count is thirteen plus the cabinet at a total cost of approximately $7.65.

The unit is very essential for proper tune-up and adjustment of any type of transmitter up to and including a power of 1 kw. It is very simple to build and use. No modification to any part of the transmitter is necessary when using the unit for an indicator while adjusting the transmitter.

To use the unit for power output indication and scope display you merely remove the coax feed from the antenna to the transmitter, attach it to either coax connector on the tune-up box and attach the other connector on the tune-up box to the antenna terminal on the transmitter. Output for your oscilloscope is picked up at the same time by using the phono type receptacle on the side of the unit.

After adjusting your transmitter you remove the tune-up box, put the antenna back on the transmitter, insert proper coil for band desired into octal socket on side of tune-up box and this converts the unit to a field strength meter and enables you to walk around and check your field strength.

Where It Can Be Used

This type of output indicating device is a necessity in linear amplifier adjustment in present day s.s.b. transmitters. The old method of plate current dip and then loading to maximum current just does not work and should not be used on linear amplifiers. Tuning class "C" amplifiers by the method of plate current dip and then resonating the antenna for maximum current does not *necessarily* mean maximum output.

The unit is particularly useful in low power citizens band transmitters that do not generally have this type of output indicating device and do rely on the old dip method of tuning. The unit can also be used effectively on older transmitters of any type. The oscilloscope test point is especially useful in visually checking the results of your work and a must for checking the performance of a linear amplifier.

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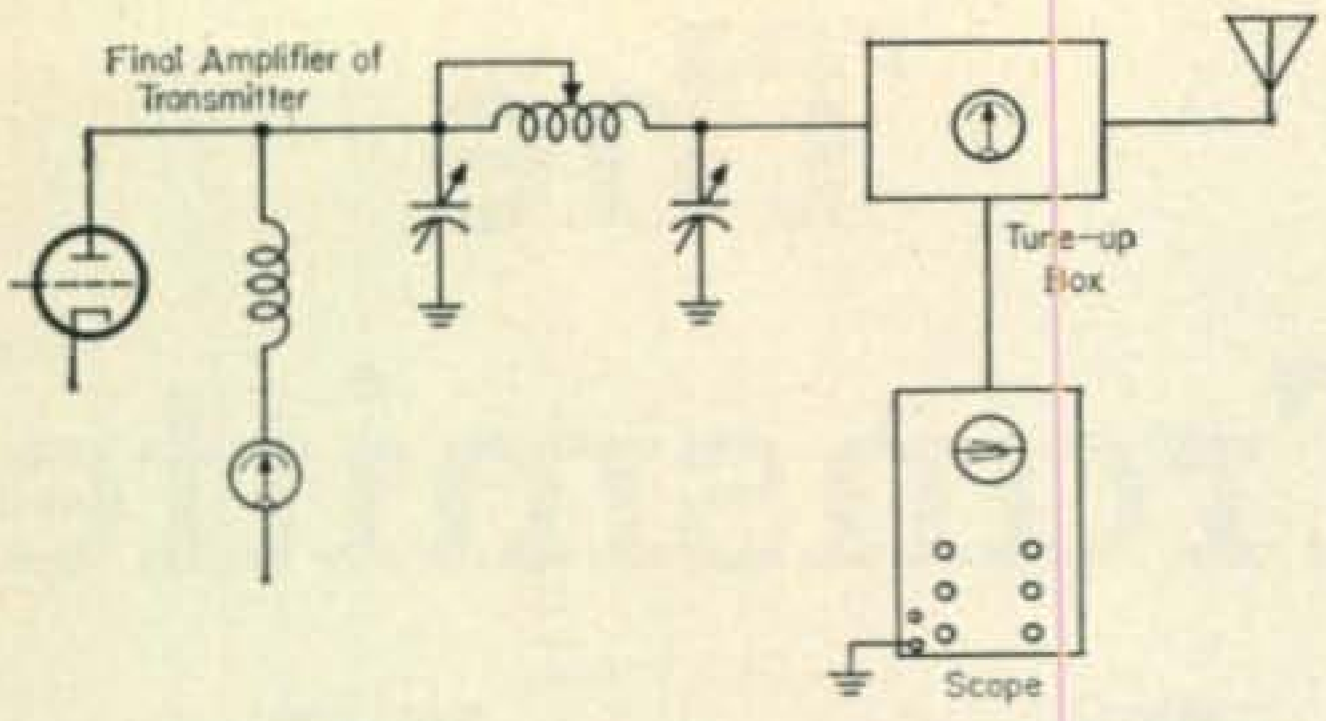


Fig. 1—Typical set-up for use of the transmitter tune-up box as an attenuator for scope observations.

In mobile work, at best, the efficiency of your antenna system is rather low, so anything you can do to get the last ounce of power is desireable. This you can do with the tune-up box. Figure 1 shows the box hooked up to a transmitter and oscilloscope.

Basic Design

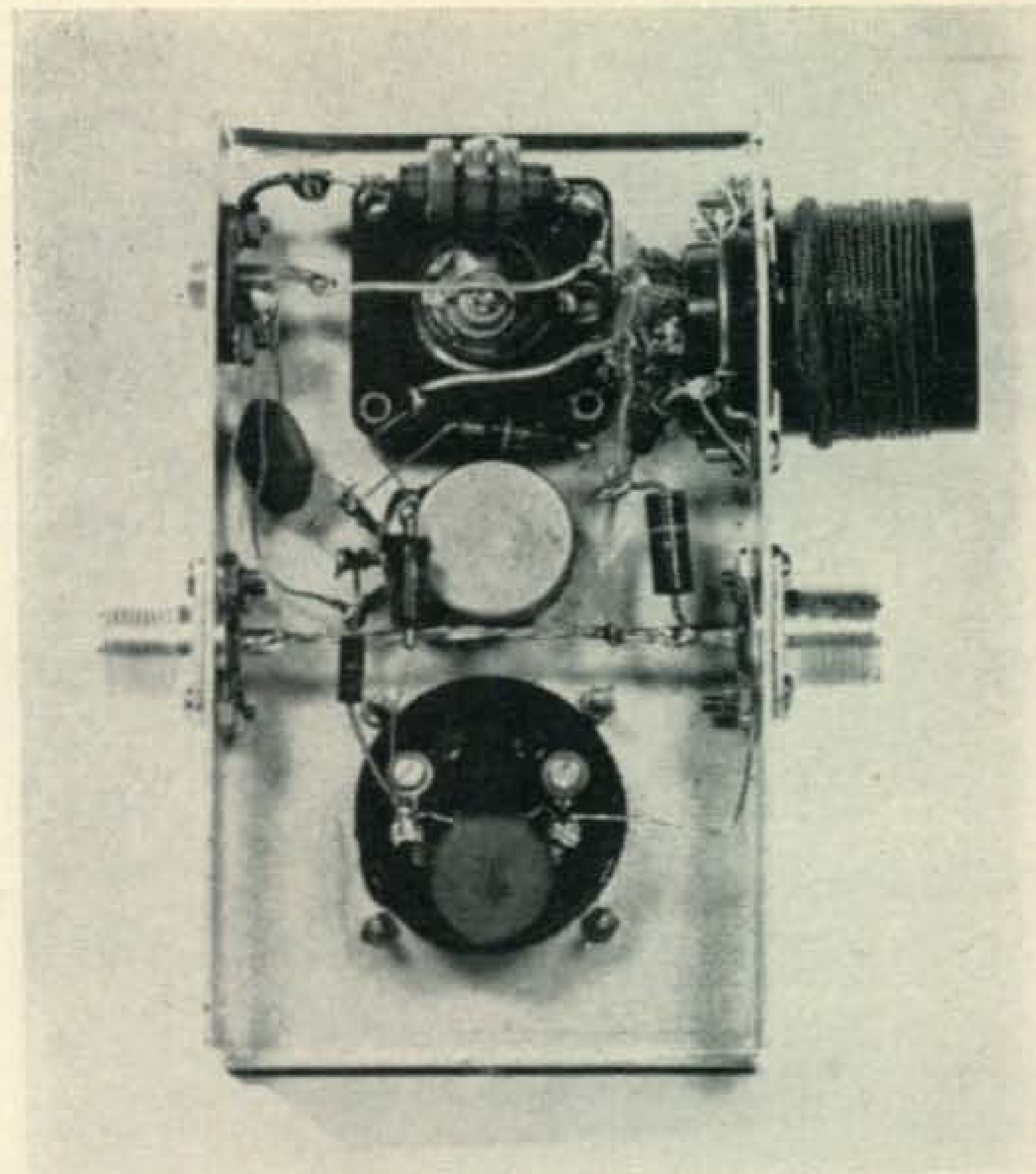
The basic design was dictated by the fact that it was desired to get three tune-up units into one box and at the same time make as many parts and functions as possible serve a dual function. A standing wave function could be added quite easily, if desired, with a few parts and a switch. The unit was built to handle a maximum r.f. power of 1 kw, as this is adequate for all citizens band, amateur and most mobile and stationary transmitters. The circuit is simple and straightforward and is shown in fig. 2.

Operation

Scope Take-Off—For the scope take-off function, attenuation of the signal is necessary to prevent damaging the scope input circuits. A divider is formed by capacitor C_3 and the r.f.c. The signal across the r.f.c. only is fed to the scope. Capacitor C_3 then acts as an excitation control and can be used to set the amplitude of the scope display. The plug-in coil should not be inserted when in use for this function.

Power Meter—The power meter function makes use of the voltage divider R_3, R_4. The r.f. voltage developed across R_3 is rectified by the diode CR_2 and the d.c. voltage is developed across R_2 and filtered by C_2. Resistor R_1 is a multiplier and it converts the meter to a 0 to ½ volt range. The function of R_2 is to adjust the meter range for different power levels.

Field Strength Meter—For this function coil L_1-L_2 must be inserted in the socket and, of course, the tune-up box is completely disconnected from the transmitter. Winding L_1 is tuned by C_3 and the r.f. energy is coupled to L_2. The output of L_2 is fed to CR_1 and the rectified signal voltage is read by the meter. Capacitor C_1 acts as a filter.



Interior view of the transmitter tune-up box shows the simplicity of wiring and placing of parts. Point to point wiring is used.

Construction

The basic layout and parts placement is shown in the photos. The unit was built over a week-end so I resorted to the junk box for parts. As shown, the large square unit is an old broadcast type Japanese variable which works very well but maybe hard to obtain. However, it probably would be best to substitute a conventional 120 mmf variable in its place.

The box size is 3″ × 5½″ × 1½″ and is the smallest that will accommodate the 1 kw power and in addition is easily held in the hand or set on the desk.

The layout of parts, while not critical, cannot be altered too much or you get into "long lead" trouble. A good addition would be to use numbered knobs so that the unit can be accurately calibrated. The plug-in coil socket is a standard

[*Continued on page 136*]

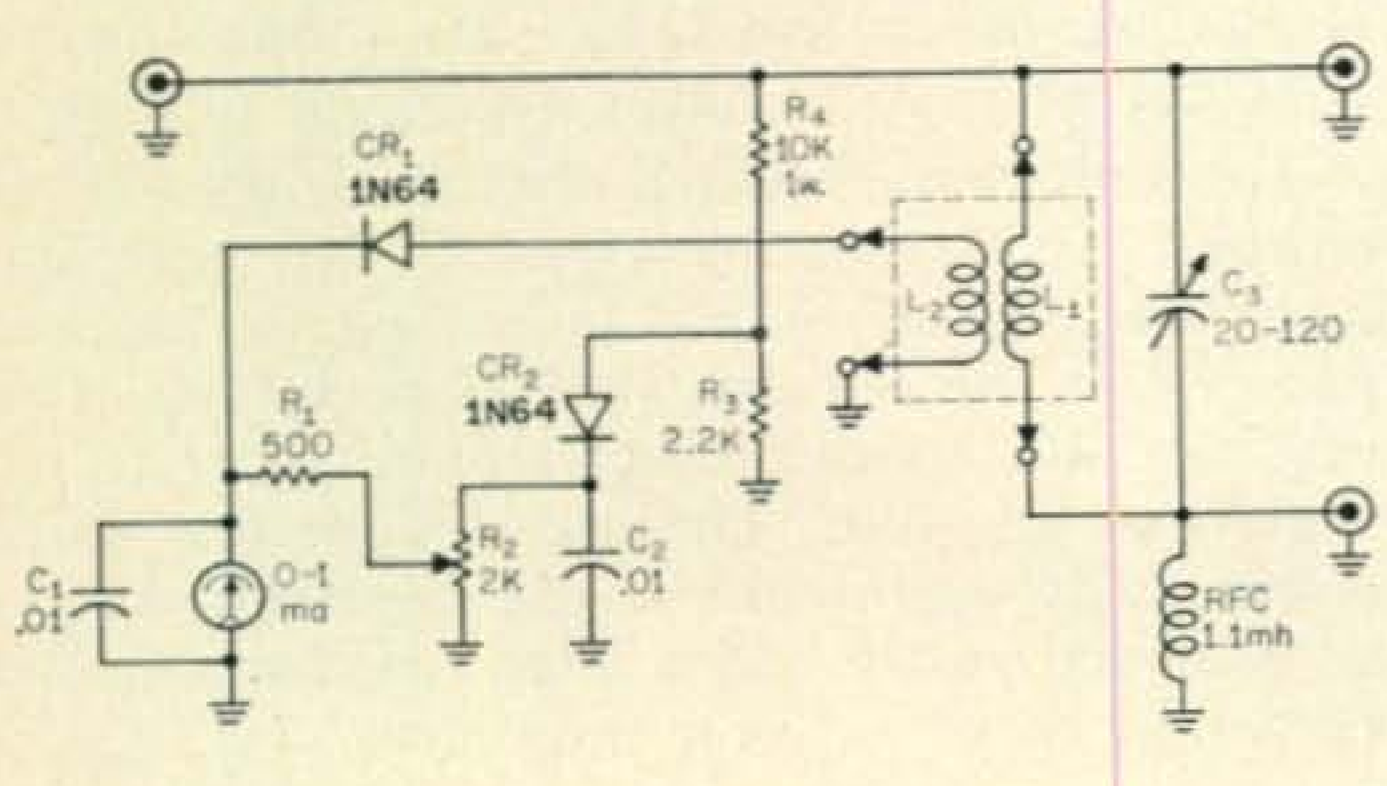


Fig. 2—Circuit of the tune-up box. All resistors are ½ watt unless otherwise noted; the potentiometer is wirewound. All capacitors are in mf except the variable which is in mmf.

L_1—3.5 mc 36t #26 e. closewound on octal tube base.
7.0 mc 18t #26 e. spaced length of tube base.
14 mc 10t #26 e. spaced length of tube base.
21 mc 7t #26 e. spaced ½ inch on tube base.
28 mc 5t #26 e. spaced ½ inch on tube base.
L_2—6t #26 e. scramble wound on bottom of L_1.

A Quick-A-Just For The Speed Key

BY JERRY CAMPBELL,* K6ZPE

This modification of the speed key permits rapid changes of speed by a simple flip of the thumb. While the idea is not new, it seems to have disappeared in recent years.

EVER since I graduated from the hand key and started using the mechanical speed key I have been looking for an easy way to adjust the speed. Until recently several alligator clips wrapped with solder were kept at the side of the key and used to give added weight for slower speed. This method works fine until you want to QRS and find your clips are gone. An alternative is to tap the side of the paddle or keep a hand key near by.

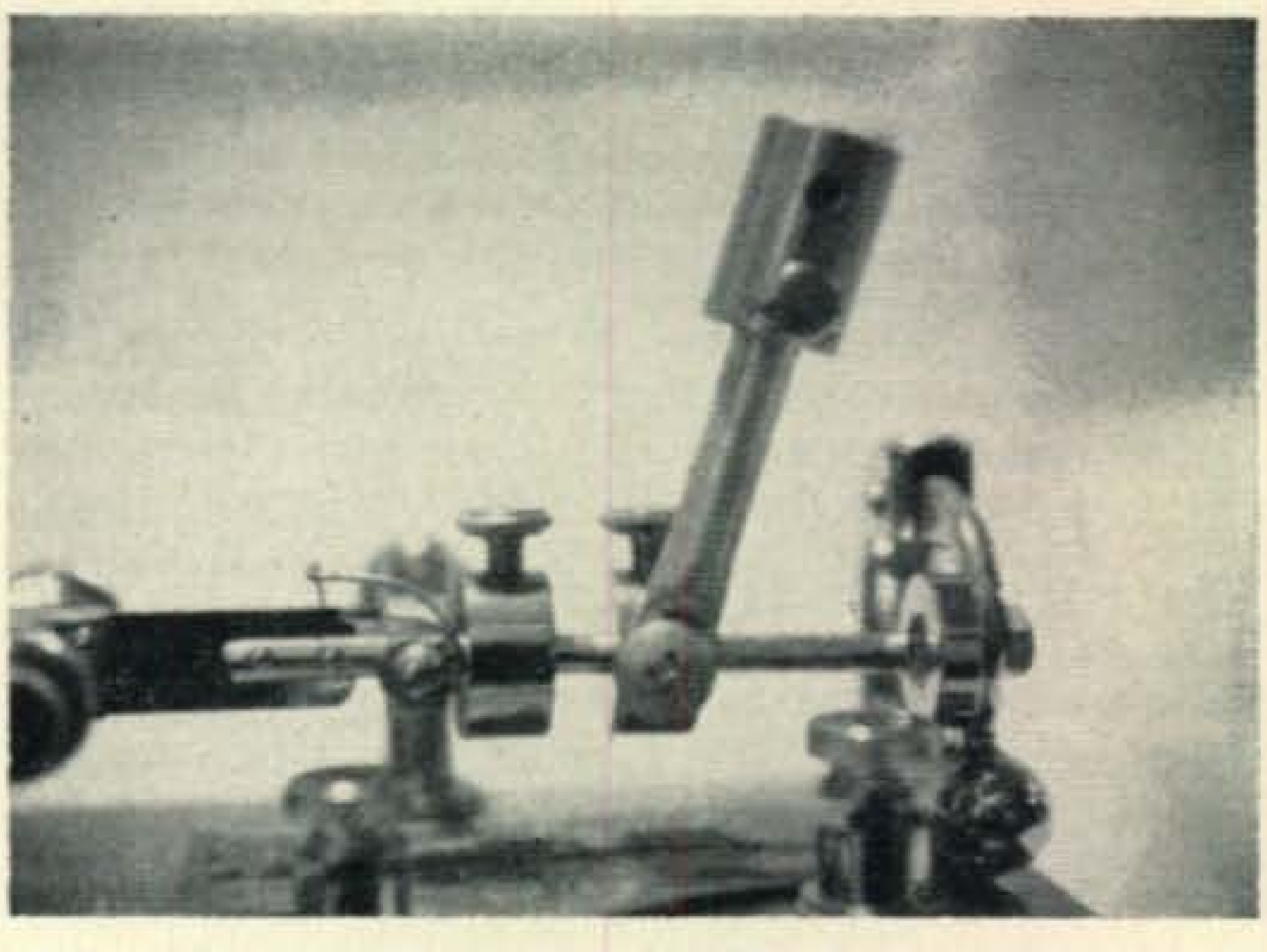
None of these methods met with my satisfaction, but on field day two years ago I found the answer. One of the fellows brought along his speed key with a quick adjustment installed. Unfortunately, he did not remember where he purchased it but recalled he ordered it from somewhere in the east. After several inquiries and a search through old amateur publications, I gave up and decided to construct one for myself. The following information is for the c.w. man using a mechanical speed key, so you electronic keyer boys and phone men may now turn to the editorial.

Construction

First cut a ¼ inch shaft of aluminum or brass to a 2½ inch length and flatten ½ inch on one end. Filing or grinding would also accomplish the same result. Using a #18 bit (0.169"), drill a hole through the flattened portion of this rod. This will clear an 8-32 screw. Install a ¼ inch shaft coupler on the other end. This is used for additional weight. Next remove one of the existing weights, and 90 degrees around from the nut used for tightening, drill a #29 (0.136") hole through to the center and tap it for an 8-32 screw. The length of this screw is approximately 5/16 inch. It should tighten against the shaft of the vibrating arm and at the same time apply enough pressure to the ¼ inch rod to hold it in any position. A split ring lock washer will aid in this adjustment and should be placed between the head of the screw and the flattened portion of the rod. Final adjustments for pressure can be made by carefully filing the end of the screw to give the correct length.

Return the modified weight to the vibrating shaft and then attach the ¼ inch rod making the above adjustments for correct pressure. Slide the unmodified weight forward for fast speed, then adjust the modified weight along the shaft for the desired speed range. With the weights in the position shown in the photograph, I can vary the speed from 15 to 30 wpm merely at a flick of the thumb or forefinger. By proper adjustments, speeds of 8 or 10 to 20 or 25 w.p.m. can be attained. For you old timers who want a faster range of speed, just remove the extra weight.

Now my alligator clips are back on the end of my test leads and my hand key is on the shelf. Hope you enjoy your modification, and I will see you on c.w. sometime. ■



Side view of the speed key shows the ¼" rod and shaft coupler attached to the rear adjustable weight.

*33862 Lincoln Drive, Yucapia, California.

Ultra Modulation For The A.M. Transmitter

BY KEN "JUDGE" GLANZER*, K7GCO

Ultra Modulation will give your a.m. signal real authority, raise your stations-called, stations-worked percentage and help maintain DX contacts under conditions of heavy QRM. The circuits, principles of operation and adjustments are covered in the article below.

THIS article is the result of three years experimentation with low power rigs of the 32V-3 class and a high power version using a pair of 813's running 800 watts input of r.f. The techniques described here will apply to your modulator system even if the Ultra Modulation attachment is not used.

Modulation Problems

One hundred per cent modulation is the peak percentage and usually refers to the negative swing. Since every word or syllable you speak does not necessarily reach 100%; the average percentage is much lower, about 30 to 50%. To get extra punch, you must raise either the average or the peak percentage.

The average and the peak percentage may be raised without splatter by using the "Ultra" attachment. It should be noted that exceeding 100% modulation in the positive direction does not create splatter as does exceeding 100% modulation in the negative direction. The reason for this is when 100% modulation is exceeded in the negative direction, the final tube is cut off for the length of time that the 100% level is exceeded and is cut off as many times per second as the frequency of the audio tone. For example, with a 1000 cycle tone, the carrier will be interrupted 1000 times a second.

When the final tube is cut off there is no carrier being generated and the waveform is no longer continuous. Under conditions of over modulation then, the output is effectively a train of pulses. It can be shown that a pulse can be broken down into an infinite number of harmonics (sinusoidal) of varying amplitudes. It is these harmonics that form the splatter.

In addition, the modulation transformer is unloaded during the time 100% modulation is exceeded. This frequently results in a blown modulation transformer since maximum voltage is developed across the secondary at this time. One additional advantage of the Ultra attachment is that the modulation transformer is loaded through out the entire swing even if 100% is exceeded in the negative direction.

*202 S. 124th, Seattle 68, Washington.

Figure 1A shows a typical a.m. waveform representing 100% modulation of the carrier with an audio tone. Figure 1B shows the waveform if the carrier is modulated 200% with an audio tone. The zero line, *Y*, representing 100%, or cutoff, actually comes from the scope since the final amplifier is blocked by a negative voltage on the plate. The pattern should actually look as shown in fig. 1C if no splatter is to be developed.

The Ultra attachment allows the peak percentage to be raised and the average percentage is also increased; but they are still widely separated. If a low level speech clipper or compressor is used, in addition to the Ultra attachment, brother, then you have something. Twelve db of clipping or compression is equivalent to a certain amount of extended positive peak modulation without clipping or compression insofar as audio punch is concerned. The clipping or compression would be cheaper and much simpler for that amount of extra punch for the first step. However, if you want to go all out and really bore a hole in the QRM, then a modulation peak percentage of 150 to 200% and some low level clipping or compression will do the trick.

Basic Circuit and Operation

The Ultra circuit, when added to an a.m. transmitter, will permit more than 100% modulation on the positive peaks (no splatter from this) but prevent more than 100% modulation on the negative half cycle. The basic circuit is shown in fig. 2.

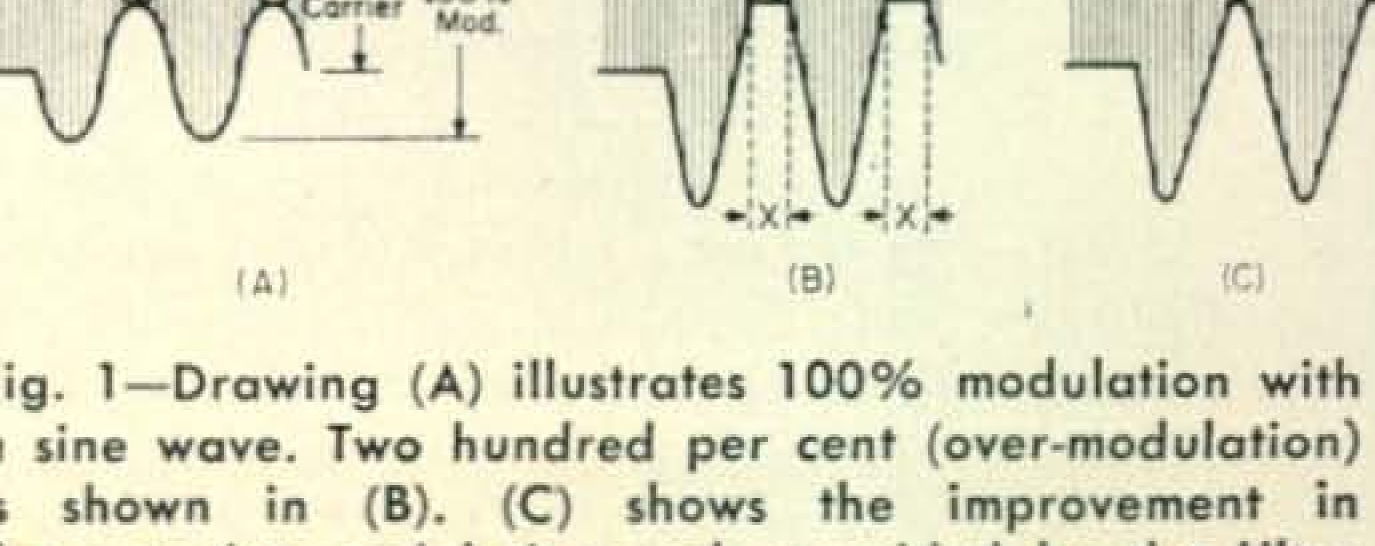


Fig. 1—Drawing (A) illustrates 100% modulation with a sine wave. Two hundred per cent (over-modulation) is shown in (B). (C) shows the improvement in the negative modulating cycle provided by the Ultra modulator circuit.

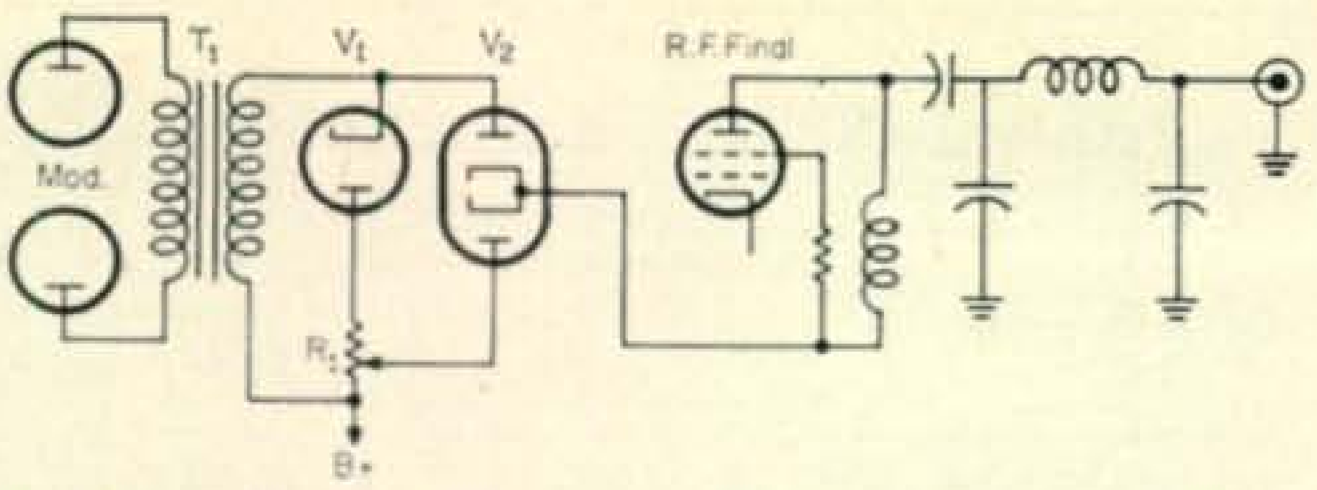


Fig. 2—Basic circuit of the Ultra modulator. The operation is described in the text.

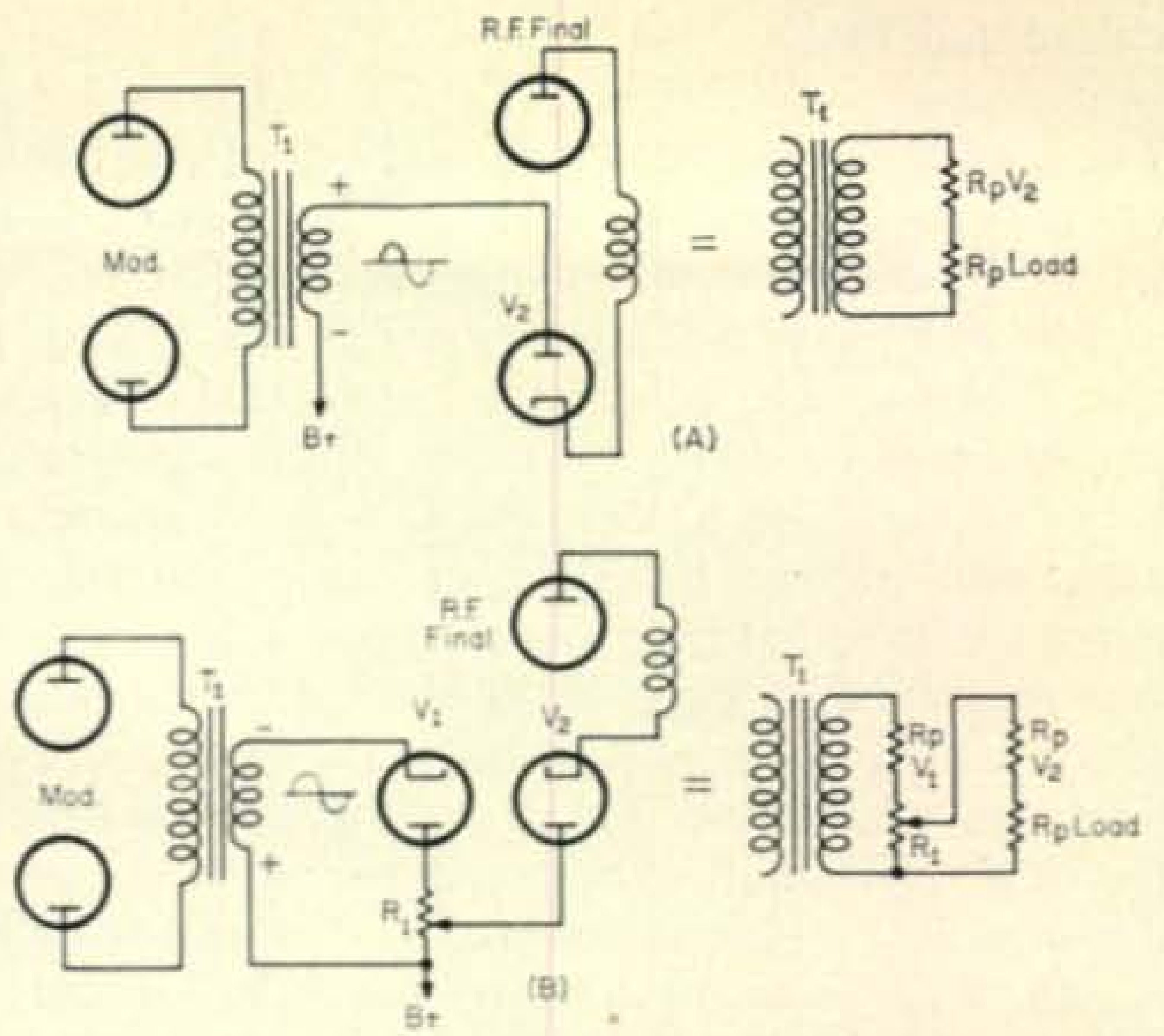


Fig. 3—(A) shows the portion of the Ultra modulator active during the positive cycle of the audio signal and the equivalent circuit. (B) shows the active portion of the circuit during the negative half of the audio cycle and its equivalent circuit.

On the positive modulation swing, as shown in fig. 3A, V_1 does not conduct and so V_1 and R_1 are not part of the circuit for the moment. However, one half of V_2 does conduct and the equivalent circuit is as shown. In effect, all added circuits are removed and only V_2 is in series with the high voltage line and its low resistance is negligible compared to R_p.

On the negative swing, the load resistance, R_1, plus the resistance of V_1 (40 ohms or so), is automatically connected across the secondary of the modulation transformer by the action of diode V_1. See figure 3(B). To adjust the amplitude of the negative swing the slider on R_1 is set so that the negative swing just reaches 100% with voice peaks. The adjustment sets the limiting action only on the negative swing and must be set properly because 100% modulation can still be exceeded in the negative direction with the Ultra attachment as 100% is a function of the audio power output, r.f. power input, and the slider setting on R_1.

Low Power Circuits

The first circuit described is for low power a.m. rigs such as the Collins—32V-3, Viking II, DX-100 and B&W 5100. The Ultra attachment can be connected to the 32V-3 without serious internal wiring changes as shown in fig. 4.

The modulation transformers in the 32V-3 and DX-100 have secondaries with 500 ohm taps. This winding can be fed to T_1 as shown in fig. 4 which is a 500 ohm to push-pull Class B grids. The 811's are ideal as modulators since zero bias can be used with plate voltages up to 1400 volts. The modulation transformer that is ideal for T_2 is the one used in the ARC-13 (pair of 811's modulating an 813).

The value of R_1 should equal the plate resistance of the stage being modulated and may be

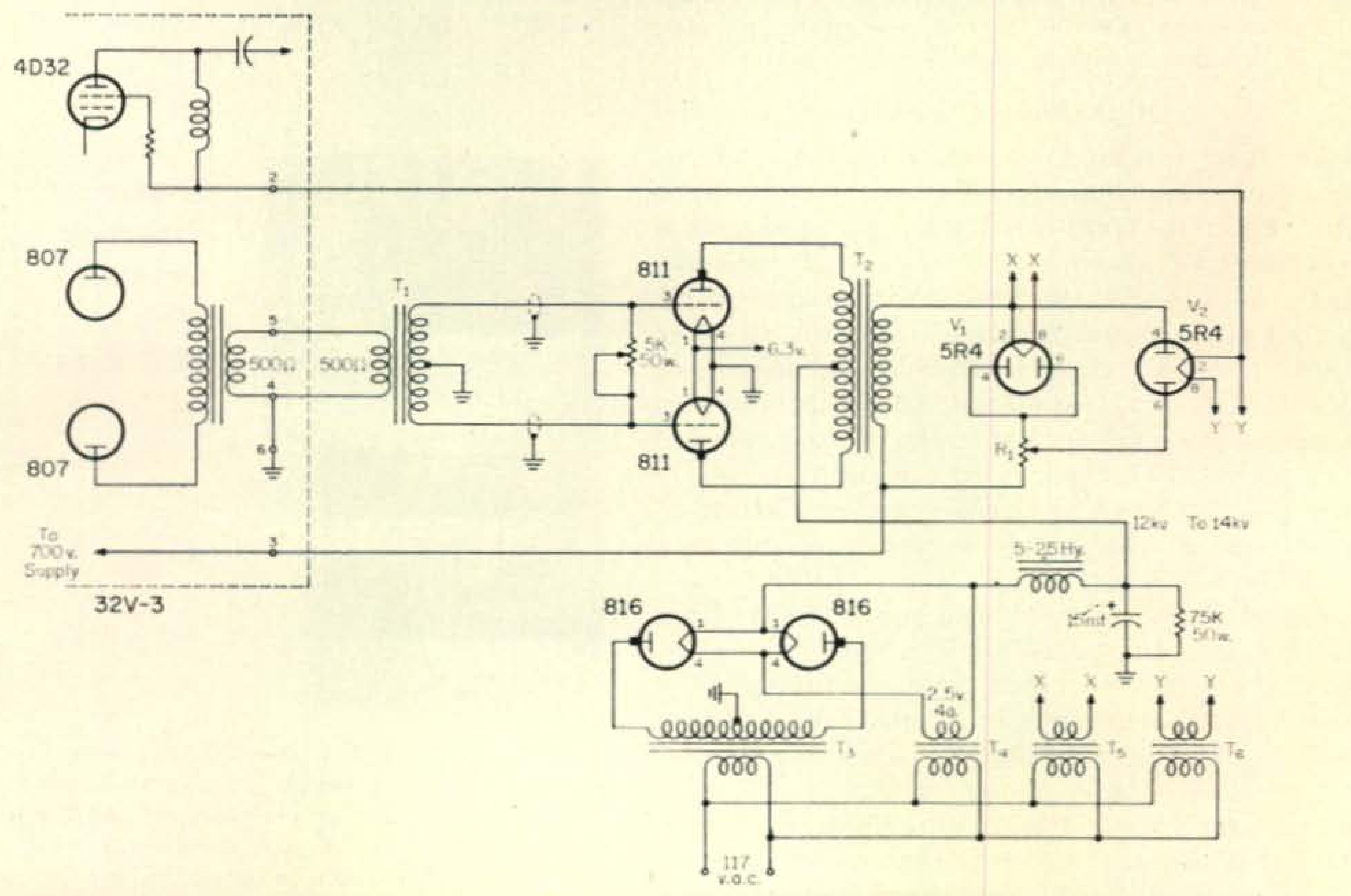


Fig. 4—A practical circuit of the Ultra modulator as used with the Collins 32V-3. Transformers T_1 and T_2 are described in the text; T_3 provides 2.4 to 3 kv at 300 ma and T_5 and T_6 provide 5 v, at 2 amps with 2.5 kv breakdown.

calculated thus:

$$R_1 = E_p / I_p + I_s$$

The power rating of R_1 should equal one third of the modulator power. A suggested value would be 3K, 100 watts.

The modulation transformers in the Viking II and Ranger have center tapped secondaries and can be used to drive the grids of the modulator tubes direct. The 32V-3 and DX-100 require an additional driver transformer, as explained, to drive the external modulator tubes. The situation was remedied by purchasing the Viking II modulation transformer and installing it in the 32V-3. The cost was about $15 from the E.F. Johnson Co. This eliminates the need for an additional driver transformer and works very well for driving the 811A's or modulating the 32V-3 directly. The circuit is shown in fig. 5. The grids of the 811A's should be loaded with a 5000 ohm 50 watt adjustable resistor.

Be sure to cool the 4D32 with a fan to prolong its life. When using a 32V-3 it may be necessary to use the 600 volt tap if the s.w.r. in the installation is high. If at all possible, keep the s.w.r. below 1.5 to 1 at all times to prevent arcing when modulating.

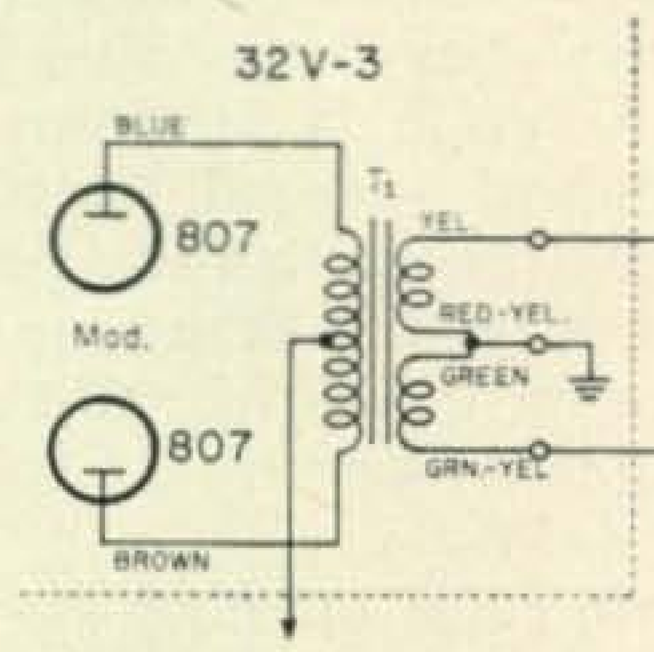


Fig. 5—Removal of the original modulation transformer and substitution with the Viking type of transformer, T_1, as shown above, simplifies the package.

High Power Circuit

The best modulator tubes I have found for high power audio are 833A's. Any plate voltage from 2000 to 4000 volts may be used and a maximum of about −110 volts is needed for bias. They drive easily and are relatively simple to find since many broadcast stations still use them. The only disadvantage is the expensive socket. However, two 60 amp fuse clips make an inexpensive socket for each tube. Two, four, and even six 304TL's were tried but didn't compare to a pair of 833A's. Table I shows a chart of typical plate voltages, bias, power output *etc.*, for 833A's.

Figure 6 shows a suggested high power version that has proven successful. The bias supply for the 833A's or any other final modulator tube must be well regulated and adjustable. Unregulated bias for the modulators is a serious blunder and the bias supply shown is simple and does the job very well. Use two regulator tubes in parallel if the grid currents exceeds 60 ma.

The grids of the 833A's should be swamped with a 5 to 10K fifty watt resistor to improve regulation, particularly if the grids are driven into the conduction region.

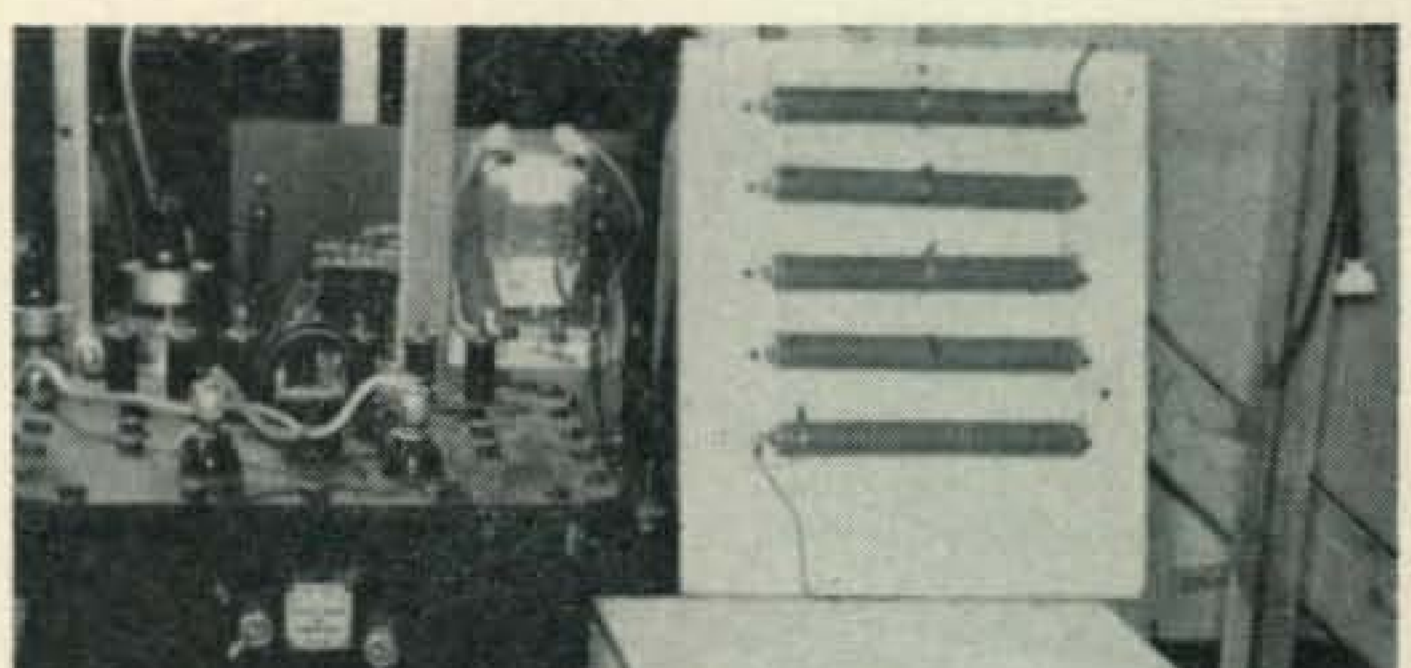
Table I—833A Characteristics

	Natural Cooling		*Forced Air Cooling*	
Plate voltage	3000	3300	4000	4000
D.C. Grid voltage	−70	−80	−100	−100
Peak A.F. Voltage (g to g)	400	440	480	510
Zero Sig. d.c. I_p	100	100	100	100
Eff. Load R. (p to p)	9500	10500	12000	11000
Max. Sig. Drive Pwr.	20	30	29	38
Max. Sig. I_p	750	780	800	900
Max. Sig. Pwr. Out.	1650	1900	2400	2700

When working with high power circuits it is very necessary to have the impedances matched in the final stages. The tube manuals quote plate to plate impedances but they never seem to check out for some reason. The only sure way is to have a modulation transformer with different turns ratios. How to find the right turns ratio is described later.

Testing Setup

Initial tests should be made with a 1000 cycle audio tone and an r.f. dummy load as it is illegal to transmit an audio tone on the air. Figure 8 shows a suggested test set up for adjusting the system. The scope can be connected to the r.f. final in a conventional manner. It has been found necessary to ground one of the scope pick-up leads in order to get a clean pattern. Figure 9 shows a safer way to develop a voltage for the scope. Figure 9 also shows an alternate way of using an r.f. ammeter to measure power output with and without modulation.



The 833A modulators, seen above, were found to be about best. The power transformer shown is *much* larger than need but one shouldn't look a gift horse in the mouth. The 5K one kw dummy load, shown to the right, is invaluable for checking out the modulator. A scope can be connected 25 to 50 ohms above ground for waveform observations. The modulation transformer is enclosed in acoustical box to muffle chatter which was causing feedback.

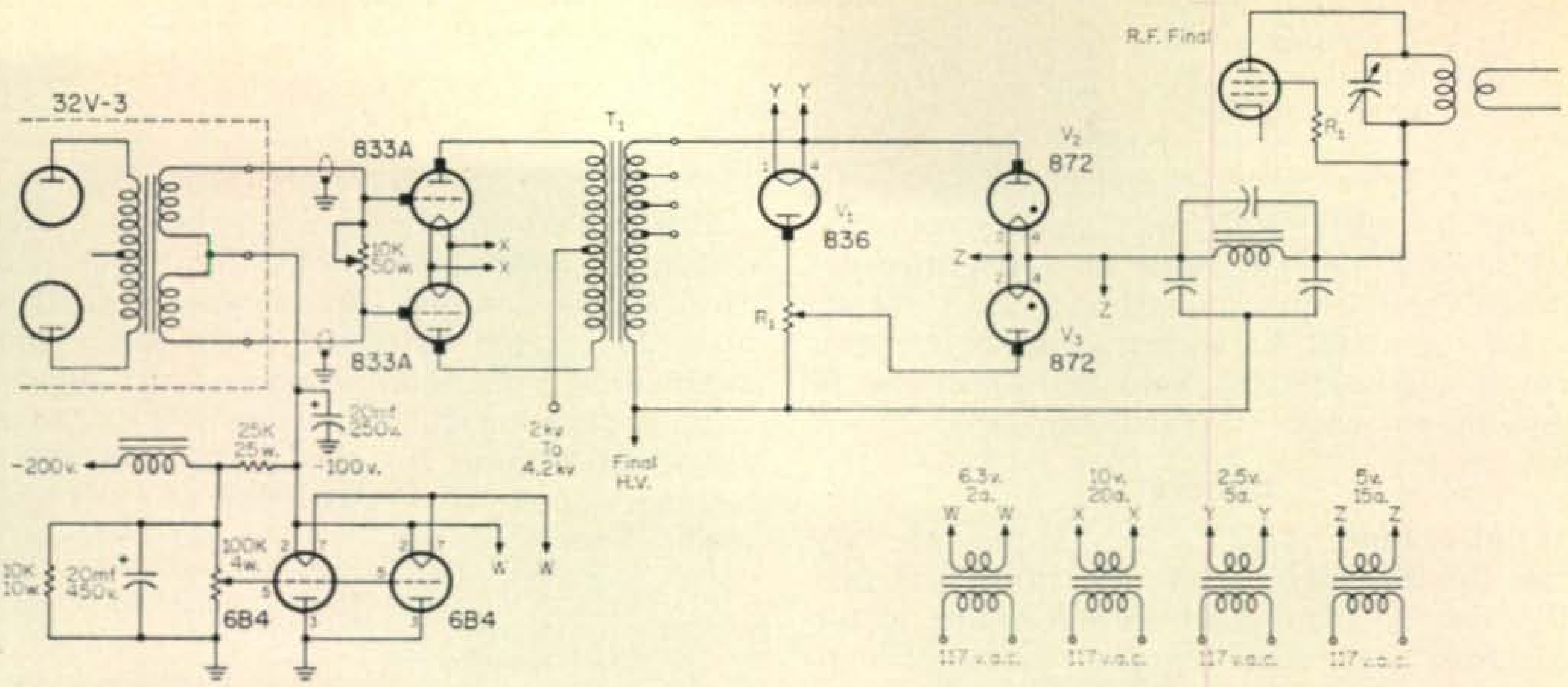


Fig. 6—High power version of the Ultra modulator uses a pair of 833A's driven by the 32V-3 modulator. A Multi-match transformer is used for T_1 and the value of R_1 is computed in the same manner as in the low power circuit. The filter in the feed to the r.f. final should be designed to cut off at 4,000 cycles. An alternate driver is shown in fig. 7.

Turns Ratio Calculation

An r.f. ammeter in the antenna circuit is the fastest and simplest way of finding the optimum turns ratio of the modulation transformer. The optimum turns ratio is important and it will give maximum audio power output and this is an important factor with high power audio. A close estimate of the optimum turns ratio can be calculated from the formula $N_p/N_s = \sqrt{R_p/R_s}$ where R_p equals the plate to plate load of modulator tubes and R_s equals R_p, the load of the r.f. final. When calculating the R_p of the final be sure to include the screen current value if a screen resistor is used.

Adjustment Procedure

After the scope has been properly connected to the final r.f. and the calculated turns ratio is set on the modulation transformer increase the audio generator output gradually. Note the wave form and modulation percentage on the scope. The slider tap on R_1 should be set to the end nearest the plate of V_1. As 100% modulation in the negative direction is observed, cut the high voltage and move the slider down a bit and repeat the test. The modulation percentage in the negative direction will be less now so increase the audio drive. Continue this procedure until the waveform starts to distort and about 80% modulation in the negative direction is obtained. This will give about 100% modulation in the negative direction with voice frequencies.

This procedure should be used for various turns ratios which are higher and lower than the calculated one. The r.f. ammeter and modulator plate current reading should be observed and recorded for all the tests. Maximum plate current to the modulator *is not* an indication of maximum power output. Maximum r.f. ammeter increase under modulation *is* an indication of maximum audio power output on the carrier. Use the turns ratio that provides the greatest increase in r.f. current under modulation.

Without the Ultra attachment the r.f. current will increase 22.5 percent for 100% modulation with sine wave modulation. With voice modulation, increase will be about 10 to 15% increase due to the lower average power of the voice waveform. Some typical r.f. ammeter current values for the 32V-3 without the Ultra attachment are 1.5 with no modulation to 1.6 with voice modulation and 1.83 with sine wave modulation. With the Ultra attachment the values were 1.5 with no modulation to 2.1 with voice and 2.5 with sine wave. With a kw rig, typical current values with the Ultra attachment are

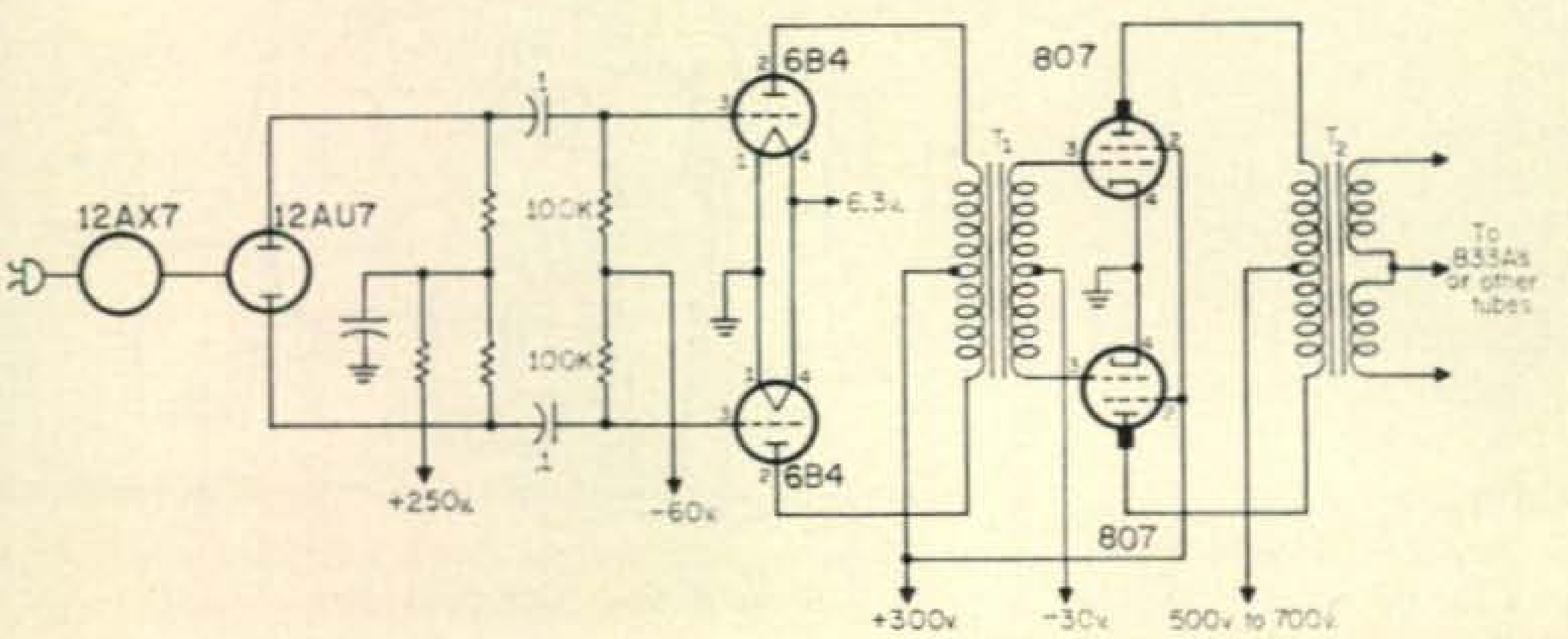


Fig. 7—Circuit of an alternate driver for the high powered modulator shown in fig. 6.

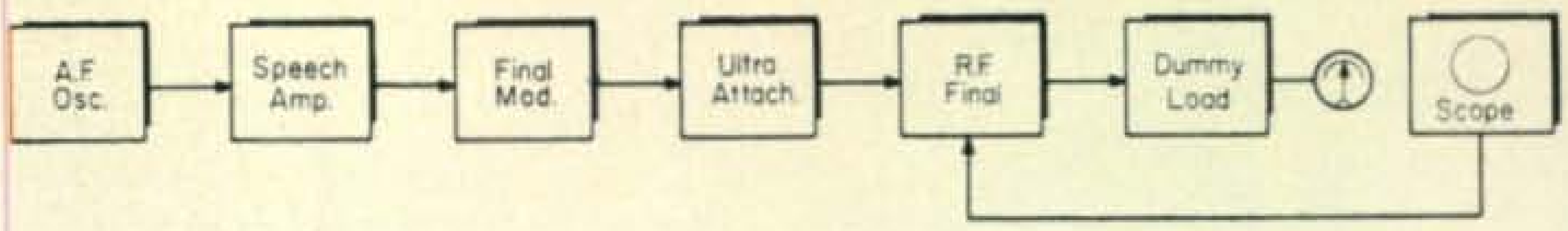


Fig. 8—Suggested test setup for adjusting the Ultra modulator attachment.

3.8 to 5.2 amperes with voice and 5.7 with sine wave modulation. The value for 100% modulation with a sine wave but without the Ultra attachment is about 4.5 amperes. So you can see, there is a considerable amount of increase in power output under modulation.

General

If link output is used it will be found necessary to use the least number of turns in the link that still gives full loading to prevent arcing in the final. Also, it is mandatory to use a variable capacitor in series with the link as shown in fig. 9. It is also necessary to have a low s.w.r. on the feedline to prevent arcing. Standing waves will also cause the r.f. ammeter readings to be either above or below the value which would result from a 1:1 s.w.r. With 1:1 s.w.r. the formula:

$$I = \sqrt{R/P}$$

will give the expected value of current.

It will be necessary to increase the grid drive about 20% and to cool the final tubes with a fan. No splatter suppressor choke is *generally* needed as the negative swing is *not* clipped but attenuated through the entire negative swing. However, it is a good idea to use one set for a 4000 c.p.s. cut off.

The Ultra attachment does in itself create amplitude distortion. The positive swing is larger than the negative swing. If this occurs in a low level audio stage due to incorrect bias for example, all the following stages amplify the harmonics and much distortion will result. However, when the unbalancing is done in the final and in the load with the Ultra attachment the final only reproduces it and as high as 2 to 1 or 200% modulation can be used without noticeable splatter. It takes 300 watts of audio to modulate a 150 watt carrier 200%. This is four times the normal audio needed. 675 watts or 9 times the normal audio would be needed to modulate 300%.

Although a pair of 813's are used in my final amplifier they are overloaded quite a bit. But with a fan they hold up for as much as a years time. Bigger tubes are strongly suggested.

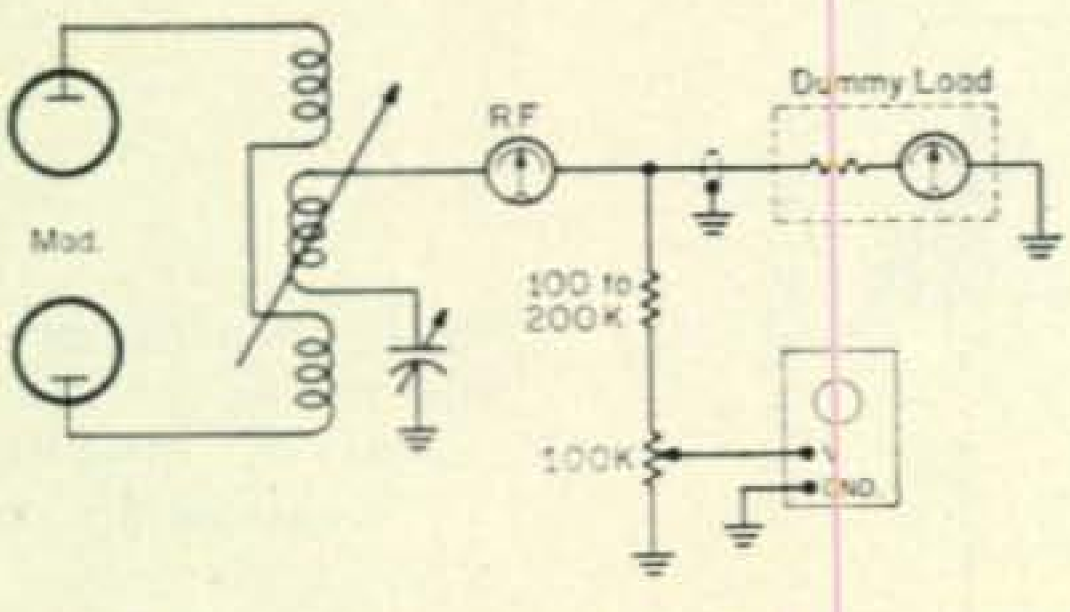


Fig. 9—An alternate test setup for link or pi-net circuit. The signal is fed directly to the vertical plates of the scope and the 100K pot is adjusted for the proper level.

If working properly there is a plate and screen current increase under modulation. This is because of the non-symmetrical waveform. If the plate and screen currents do not jump under modulation something is improperly adjusted. Typical plate current values are 200 to 280 ma under modulation for the 32V-3 and 400 to 500 ma with 2000 volts on a pair of 813's under modulation.

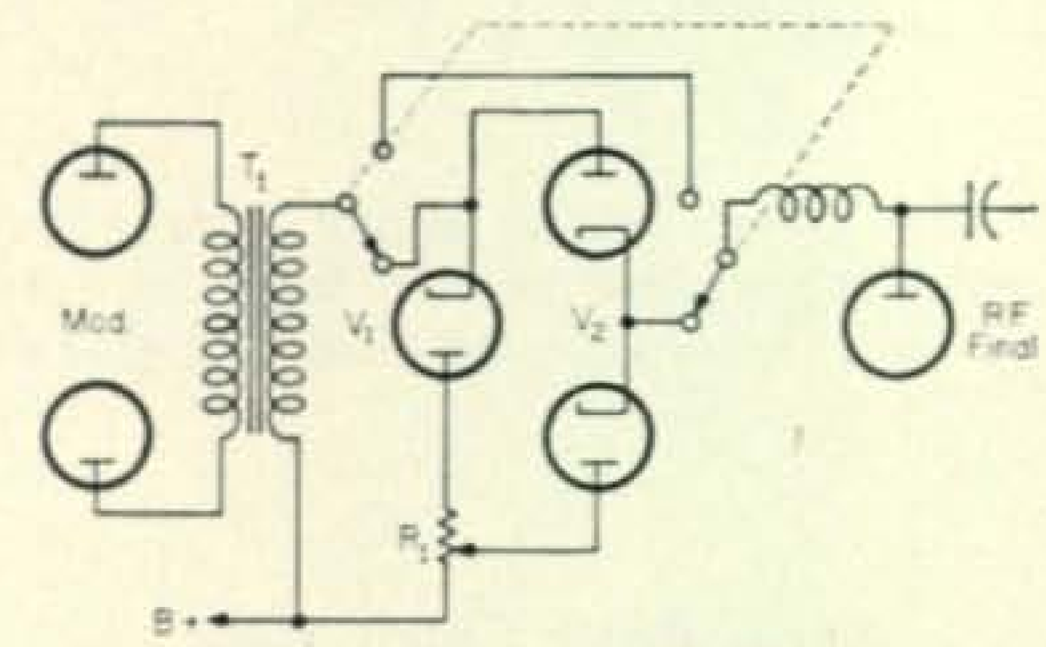


Fig. 10—A simple switch-out circuit permits bypassing of the Ultra attachment for local contacts or when no QRM is present.

It is suggested that for local contacts or when no QRM is present that the Ultra attachment be switched out to save the tubes and power. Figure 10 shows a suggested switching arrangement to disable the Ultra circuit. It can also be used to show the difference between the two audio levels. Be sure to turn the gain down when it is not in the circuit. ■

"CQ field day, CQ field day . . . ."

Don Johnson, W6QIE, trained the sisters for their amateur license examinations. Shown above at a code practice session are, from l. to r., Sister M. Maurice, Sister M. Regina, Sister M. Ramona and Sister M. Blandia

Sister Hams

BY LELAND R. REEDER,* WB6EYZ

For the first time, a religious order has made the amateur radio service a part of its missionary work. The nuns, stationed at Puno, Peru, high in the Andes Mountains, will maintain contact via amateur radio with the home station at the College of Our Lady of Mercy in Burlingame, California.

THE amateur radio service has been used to great advantage by numerous organized groups carrying on exploration, missionary or charitable activities, such as Admiral Byrd's trips to the South Pole and the more recent use of the service by the hospital ship *S. S. Hope*. But to our knowledge the following is the first time a religious order has made the amateur radio service a part of its initial planning for missionary work.

Of course, Roman Catholic nuns who are also amateur radio operators are not new to our hobby; well known in ham communications are W1HUH, Sister Emiliana, who has been on the air since 1933; W6VFE, Sister Charlotte (ex-W7MUT, licensed in 1948), and others.

This story of "Sister Hams" begins in 1961 with an appeal by Pope John XXIII for volunteers to work in Latin America. Plans were initiated by the Sisters of Mercy in the California-Arizona comunity to implement his wishes. Several offers of Missions in Peru were made to the community and in January 1963 two nuns, including Sister M. Hilary, who was to lead the first group, went to Peru to study the needs of the people and to visit the Missions. As a result of their findings, the Altiplano region on the west shore of Lake Titicaca was selected.

Lake Titicaca is the largest body of water in South America and the highest large lake in the world, being 12,645 feet above sea level. It is 110 miles long, about 30 miles wide and is surrounded by two ranges of the Andes Mountains. Steamboats sail the lake and carry visitors to the islands on which are ruins of the Inca civilization. To reach the lake from Mollendo on the Pacific coast, one rides one of the highest steam railroads in the world. It climbs to 14,000 feet around many high peaks and over a divide before dropping down to Puno on the lake shore.

The Altiplano region is like a world apart. It is always cool and frequently very cold. The air is rare, the ground mostly barren and things grow slowly and small, including the people. For the most part the people are pure Aymara Indians who have kept the language, customs and culture of their ancestors. Superstition is a powerful force in the lives of these people. They not only believe that the mountain peaks are the home of the gods, but attribute the occurrence of anything they do not understand to the work of some god.

Station at Puno

The work of the Sisters will include teaching religion in the schools, preparing native catechists, Cursillo activities and dispensary work. The radio station they set up at Puno will be used for direct contact with the home station at the College of Our Lady of Mercy in Burlingame, Calif., and to keep in touch with the world in general. Later the station may be used as the center of a radio school to develop native technicians who could man a local net to carry essential information on religion, nutrition and sanitation to more remote areas.

The nuns chosen to begin the missionary work are Sister M. Hilary, Superior, formerly of Our Lady of Angels School in Burlingame; Sister M. Blandia, from St. Peter's Academy of San Francisco; Sister M. Maurice, from St. John's Hospital of Oxnard, and Sister M. Ramona of St.

*109 Skyview Way, San Francisco, California.

Gabriel's School of San Francisco. They are now in Peru and, by the time this is in print, they probably will have completed the necessary conditioning to prepare them for the rigors of living at the high altitude of Lake Titicaca.

Chief operator of the radio station high in the Andes will be Sister M. Ramona who has a technical background as a college instructor in physics and mathematics. Sister M. Blandia is the linguist of the group and will handle the language problems. Sister M. Maurice is a registered nurse and will handle any medical problems should the station be called on for emergency or disaster traffic. The radio station at Mercy College in Burlingame will be operated by Sister M. Regina. She was the first to receive a call, WN6JJH, and has been the leader in setting up the radio program for the missionary expedition.

W6QIE Is Instructor

Preparing these nuns to become competent amateur radio operators and to familiarize them with the intricacies of setting up and operating two inter-continental stations 5000 miles apart became the novel experience of Chief Radioman Don Johnson, W6QIE. Don, who operates the master control station at the Treasure Island Naval Facility during on-duty hours, volunteered to assist the nuns in preparing for their FCC test.

Many hams and Navy radiomen can attest to the teaching ability of Chief Johnson, who is also director of the west coast section of Navy MARS with the call NØASH. In the past 15 years over 1800 civilians have received help from Don in working toward their radio tickets. He carries on this work in his off-duty hours in two buildings at the rear of his home in South San Francisco. The larger of the two houses his ham station plus space for classes of twenty or more students. Classes are held two evenings a week and are free to all interested persons. The Northern Peninsula Electronics Club, W6PMK, also holds meetings here. The second building is a shop where students and hams can work on gear.

W6QIE contacted the Peruvian Consul in San Francisco before the nuns left for South America to determine what had to be done to secure a license for the station in Peru. His opinion was that all that was needed was for the Sisters to demonstrate their ability to set up and operate the equipment, and that their FCC tickets would undoubtedly fill the bill.

"S"-Line Gear

Equipment to be installed at both the Mission station in Peru and the home station in Burlingame will be of the finest. Transmitters and receivers will be from the Collins "S" line. Beam antennas will be Mosley Tri-Banders turned by CDR Ham-R Rotators and installed on thirty foot crank-up towers. A diesel driven ten-KW portable electric generator will furnish power for the ham station and hospital at the Andes location.

[*Continued on page 134*]

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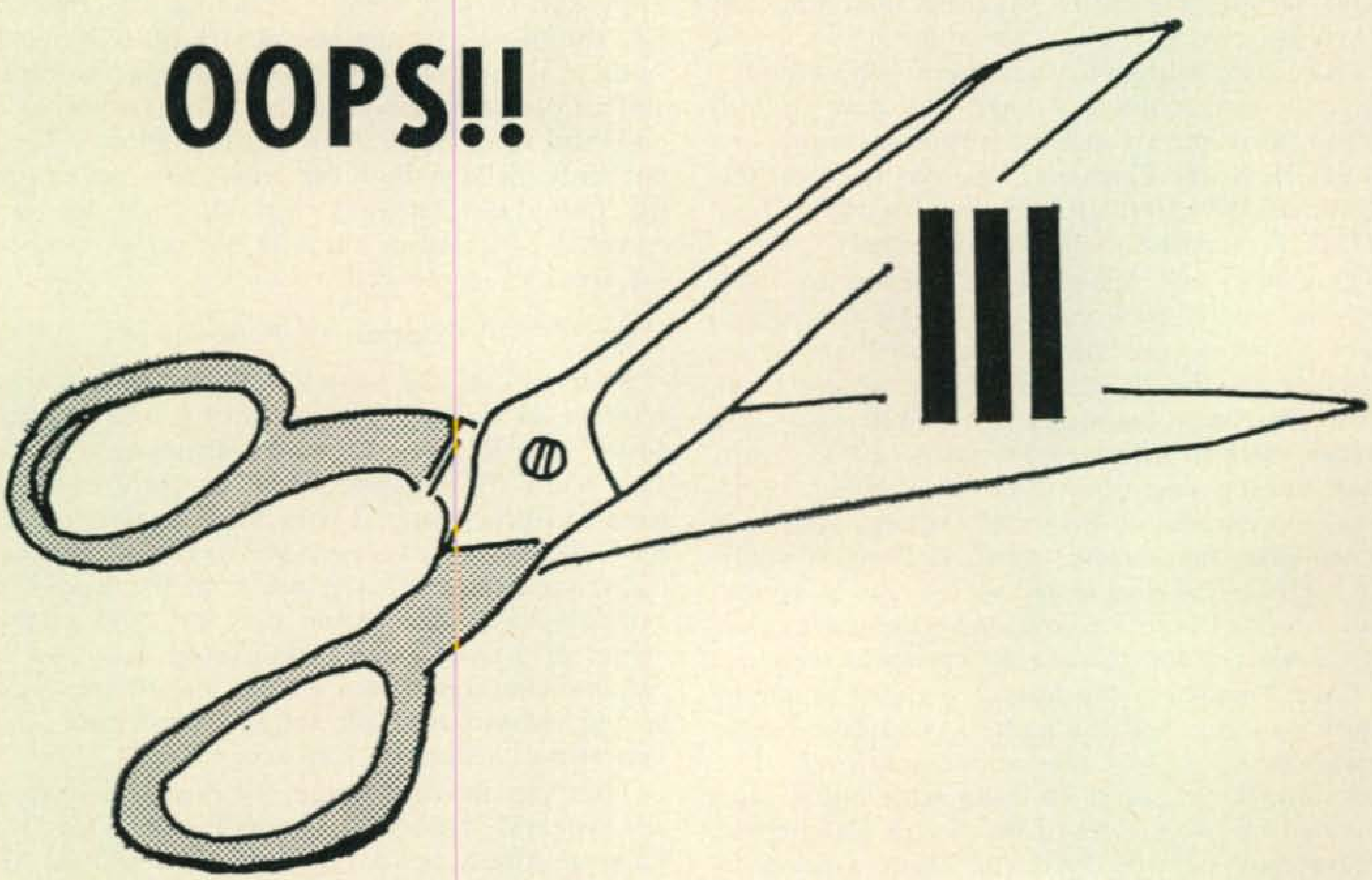
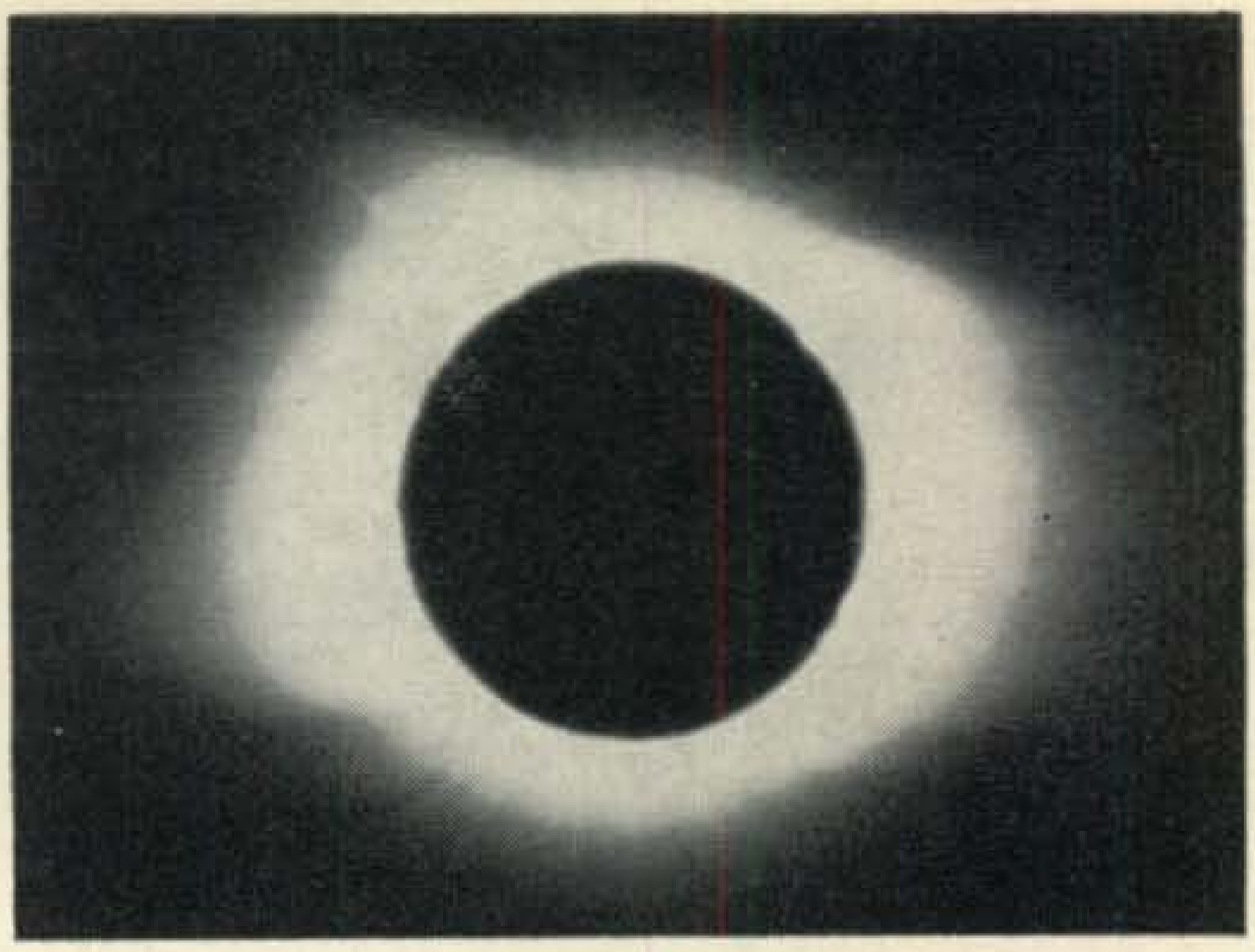


Due to a printer's error, the III was left out of the OSCAR III story last month. You paid for it and we felt you should have it. So if you feel as strongly about it as we do, please cut it out and paste in. HI!

Propagation and the Solar Eclipse



The solar corona can be seen clearly as a halo encircling the sun in this photograph taken at the exact moment of totality during the solar eclipse of July 20, 1963. During the period of the eclipse, the solar radiation responsible for formation of the ionosphere decreased considerably. (Photo by the High Altitude Observatory, Boulder, Colorado)

BY PERRY I. KLEIN,* K3JTE

THE eclipse of July 20, 1963, which was seen in totality along a narrow arc extending from southern Alaska, across Canada, and through the central part of Maine, offered a rare opportunity for radio amateurs over large areas of the United States and Canada to observe unusual ionospheric effects. The following report by K3JTE summarizes typical effects observed on the medium wave broadcast band the lower portion of the high frequency spectrum. Following K3JTE's report are excerpts from some of the nearly 100 other reports received from readers of CQ's Propagation Column. — *W3ASK*

THE purpose of this experiment was to observe the effects of the solar eclipse on *D* layer ionospheric absorption at medium frequencies, noting whether nighttime propagation conditions would prevail during the eclipse. Since the projection of the moon's shadow onto the earth is a localized effect, the shadow moving as a function of time, it was expected that propagation effects would also be localized and changing as a function of time. Clear-channel broadcast stations at various distances to the north, northeast, west, and south were selected to observe localized effects. Since at a given longitude the eclipse occurred simultaneously over a wide range of latitudes, it was expected that stations to the north and south would be affected simultaneously whereas stations to the west would be affected earlier in time. In addition, since the eclipse was total toward the north, it was expected that stations to the north would show greater effects than stations to the south where the eclipse was only partial.

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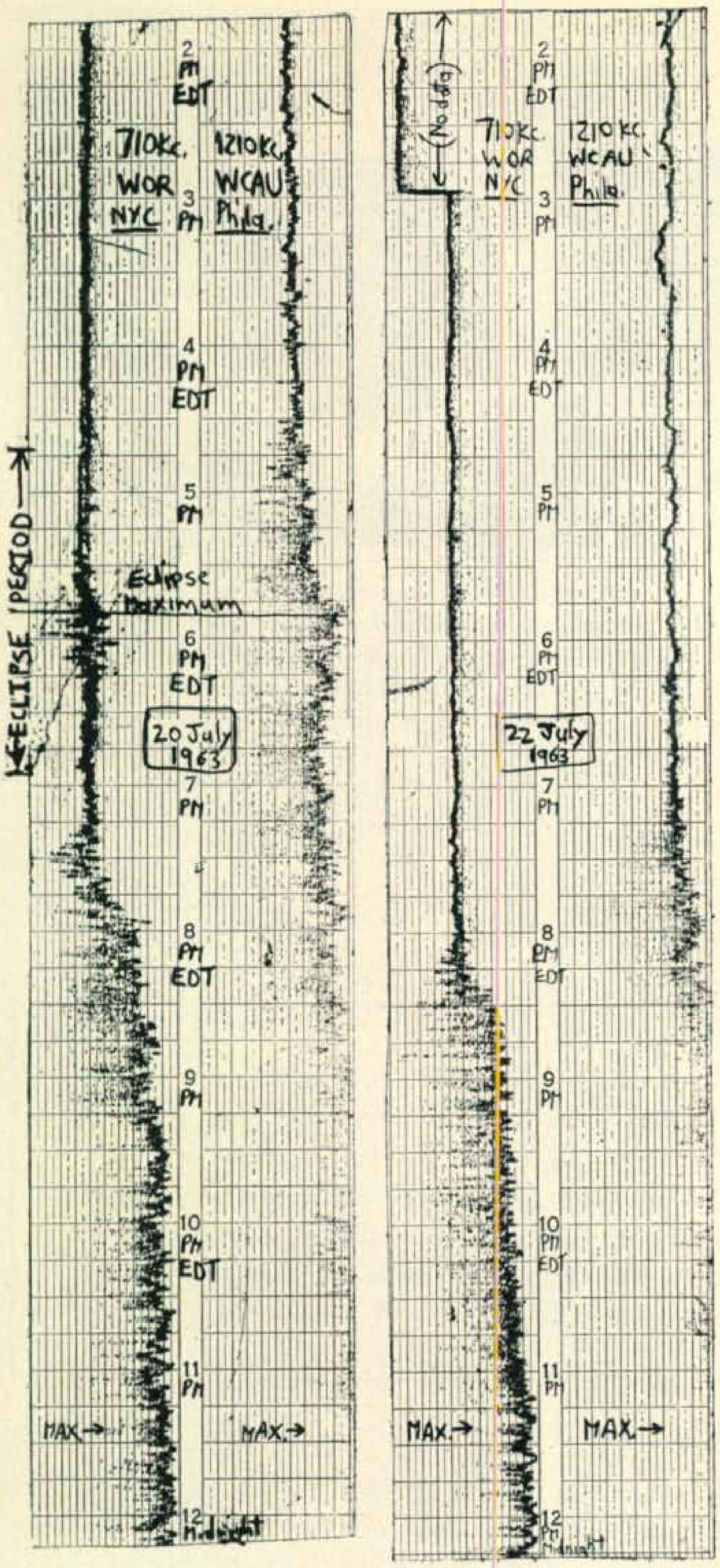
Data concerning the eclipse are listed in Table I. Table II lists data concerning the broadcast stations monitored during the experiment.

Instrumentation

Two RACAL type RA-17C receivers monitored New York City (WOR, 710 kc) and Philadelphia (WCAU, 1210 kc), and the a.v.c. voltages were sampled every two seconds and recorded as a function of time on a two-channel Rustrak strip-chart recorder. Two Stromberg-Carlson model RBS-1 receivers monitored the Ottawa CHU beacon on 3330 kc and 7335 kc, and these a.v.c. voltages were recorded as a function of time on a two-channel Sanborn strip-chart recorder. In addition, a Collins model R-390A receiver was used to check all the monitored stations, and the signal level meter readings of each station were recorded every fifteen minutes.

Results

Figure 1 shows the effects noted on WOR, New York (left channel) and WCAU, Philadelphia (right channel). Figure 1A is the chart



←Fig. 1—Chart A (left) was recorded during the eclipse and Chart B (right) was made during a normal control period two days after the eclipse.

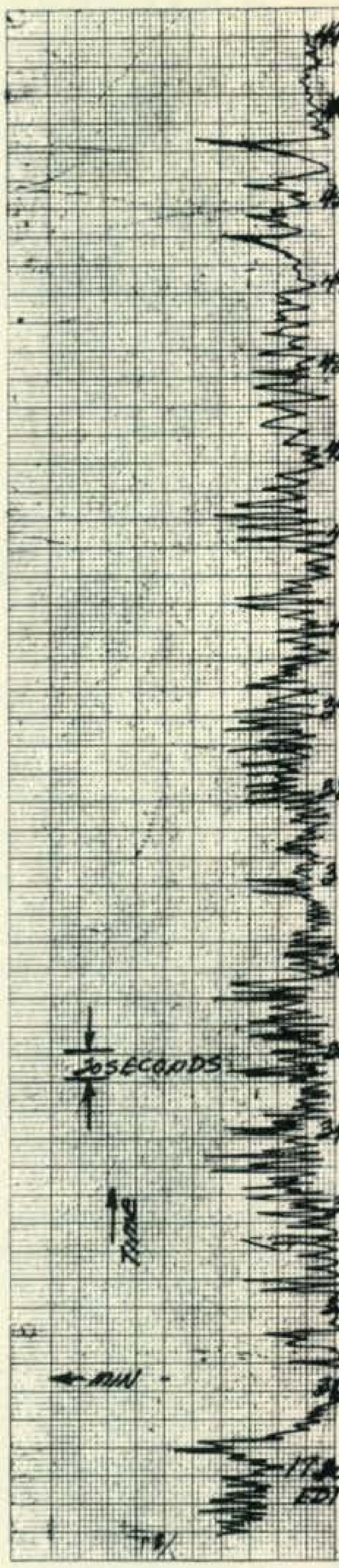


Fig. 3—Strip chart recording of CHU, Ottawa, Canada on 7335 kc, July 20, 1963 during the eclipse period.

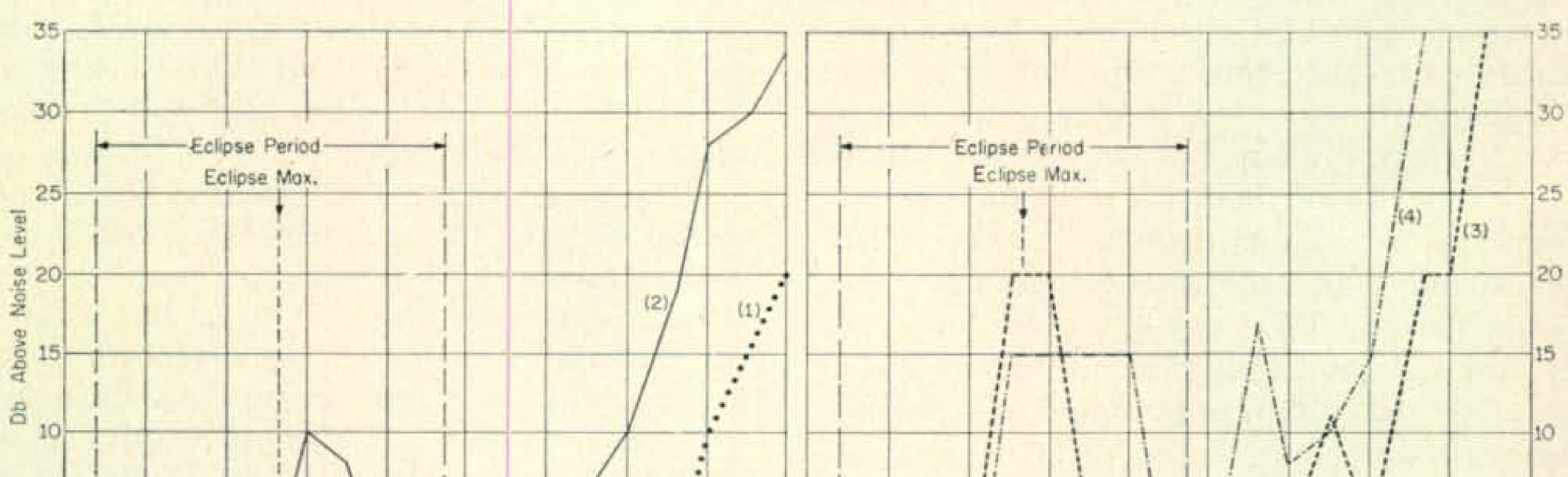


Fig. 2—The graphs represent data copied (Table III) for four stations which showed interesting signal level variations during the eclipse. Curve 1—KYW, Cleveland, Ohio, 1100 kc (300 miles); Curve 2—WRVA, Richmond, Va., 1140 kc (105 miles); Curve 3—WWVA, Wheeling, W. Va., 1170 kc (260 miles); Curve 4—WQXR, New York City, N.Y., 1560 kc (200 miles). Each curve shows signal/noise versus time.

Date	July 20, 1963
Time	4:42 PM, EDT to 6:52 PM EDT
Max. Coverage	82% of the solar face
Time of max. coverage	5:51 PM EDT
Speed of lunar shadow	1700 miles/hour
Totality region	Canada and Maine

Table I—Solar Eclipse data for Bethesda, Maryland receiving site.

made during the eclipse period, and fig. 1B is a chart made during a normal "control" period two days after the eclipse. The New York City station showed conditions similar to sunset at the time of eclipse maximum, for 30 minutes, after which daytime conditions returned. Evidently ionosphere recovery was not complete, since actual sunset conditions returned 45 minutes earlier than normal. Under sunset conditions sky waves and ground wave interfered, resulting in selective fading. The Philadelphia station showed increased fading effects similar to sunset as the eclipse began. Maximum signal level occurred at the time of eclipse maximum. Return to daytime conditions did not occur. Instead, nighttime conditions continued, suggesting a very slow recombination of the *D* layer.

Table III contains signal level data taken on sixteen stations recorded approximately every fifteen minutes. Figure 2 shows graphs of these data for four stations which displayed interesting signal level variations during the eclipse. WCAU, Philadelphia, (fig. 1A) and WWVA, Wheeling, (fig. 2) were the first stations to show increases in signal level during the period of the eclipse. WQXR, New York City began increasing in signal level a few minutes later (fig. 2). Around the time of eclipse maximum, these stations all reached maximum signal levels. KYW, Cleveland (fig. 2), WRVA, Richmond (fig. 2) and WOR, New York (fig. 1A) also reached maximum signal levels around the time of maximum eclipse. Minor signal level increases were noted on CBF and CBM in Montreal, and WBZ, Boston, around the time of eclipse maximum. WGN, Chicago, WLW, Cincinnati, WBT, Charlotte, and CBL, Toronto had very weak signal levels and did not show appreciable effects during the eclipse period.

On h.f., CHU Ottawa was monitored on 3330 kc, 7335 kc, and 14670 kc. The 3330 kc signal increased slightly during the eclipse period, reaching a maximum around the time of maximum eclipse. The 7335 kc signal level dropped for several periods during the eclipse, and there were periods in which the fading rate was nearly constant at approximately one fade per five seconds (fig. 3). The 14670 kc signal level was not measurable, and no significant effects were observed at this frequency.

Conclusions

Increased signal strength and fading rate of several stations during the eclipse indicate that sky-wave propagation was involved. This would have been expected from a decrease in ionosphere *D*-layer absorption due to less solar radiation activating this layer of the ionosphere. Nighttime propagation effects occurred for stations located within three hundred miles of the receiving location to the northeast, west, and south. These effects could also be observed for stations to the north at distances of nearly five hundred miles. This possibly indicates that the phenomena was localized, and most apparent in the region of total eclipse toward the north. After the eclipse period the *D*-layer was reactivated only partially, as indicated by the early occurrence of sunset conditions later in the evening.

Although Wheeling, West Virginia, to the west was the first location for which significant eclipse effects were observed, there was no additional evidence to indicate that propagation phenomena moved from west to east as the position of the eclipse changed.

Unusual fading observed on CHU, Ottawa at 7335 kc during the eclipse period indicates that the ionosphere *F*-layer was affected, changing the propagation path length as a function of eclipse position. No data were obtained to determine whether a change in maximum usable frequency (m.u.f.) took place during the eclipse.

The Bureau of Standards has reported that the sunspot count on the day of the eclipse was

Station	*Location*	*Distance*	*Direction*	*Freq. kc*	*Pwr.*
CBF	Montreal, Que.	480 mi.	NE 20°	690	50 kw
WLW	Cincinnati, O.	400 mi.	W	700	50 kw
WOR	N. Y. C., N.Y.	200 mi.	ENE 53°	710	50 kw
WGN	Chicago, Ill.	590 mi.	WNW 293°	720	50 kw
CBL	Toronto, Ont.	290 mi.	NW	740	50 kw
CBM	Montreal, Que.	480 mi.	NE 20°	940	50 kw
WBZ	Boston, Mass.	390 mi.	ENE 52°	1030	50 kw
KYW	Cleveland, O.	300 mi.	NW 307°	1100	50 kw
WBT	Charlotte, N.C.	335 mi.	SW	1110	50 kw
WRVA	Richmond, Vir.	105 mi.	S	1140	50 kw
WWVA	Wheeling, W. Va.	260 mi.	WNW	1170	50 kw
WCAU	Phila., Pa.	120 mi.	ENE 53°	1210	50 kw
WQXR	N. Y. C., N.Y.	200 mi.	ENE 53°	1560	50 kw
CHU	Ottawa, Ont.	420 mi.	NNE	3330	3 kw
CHU	Ottawa, Ont.	420 mi.	NNE	7335	3 kw
CHU	Ottawa, Ont.	420 mi.	NNE	14670	5 kw

Table II—Broadcast stations monitored.

zero and conditions were geomagnetically quiet. This indicates that radio propagation conditions were better than normal on the day of the experiment. Thus it is highly improbable that sunspots or magnetic conditions caused the results observed.

In summary, the solar eclipse produced local nighttime propagation conditions for the duration of the eclipse, resulting in the occurrence of an additional 'sunset' and 'sunrise' on the day of the eclipse.

Excerpts

From William C. Ellsworth, W3FED. "Observations of signal strength over a 510 mile path between Washington, D.C. and Midland, Michigan were made on 3.510 mc using A1 mode by W8BIE (Colonel R. J. Anderson) and W3FED. Communication was established at 4:00 p.m. EDT and continued at 15 minute intervals until 6:30 p.m. EDT. The exchanged signal reports were S3 at 3:00 p.m., and increased to S7 at 5:45 pm. the nearest observation to the time of totality. By 6:30 p.m., the signal had decreased to S3. The static level likewise increased and decreased. The maximum signal level logged at 5:45 p.m. was about the same level usually logged on regular schedules between W3FED and W8BIE at 10:00 p.m. The participants have been scheduling each other regular since 1922 and are old experienced band condition observers."

From Jim Janke, K9WIE. "In Waupaca, Wisconsin, my QTH, we had about a 79% eclipse. During the peak of the partial eclipse Europe was booming in very loud on 20 meters. The skip was very long, the east coast was very weak along with all other W/K signals. By 5:45 p.m. (1 hour after the eclipse) Europe was down where it was before the eclipse, 559 or so."

From Doc Smith, KL7DWB. "Here in Ketchiken, Alaska we were south of the total eclipse and this was a twilight effect not anything comparable to nighttime darkness, and lasted for only a few minutes. I monitored various amateur bands for a two hour period before, during and after the eclipse, and to sum it up briefly, nothing happened. I had expected night time frequencies to open up and daytime ones to close down, but there was little difference in band conditions. Twenty was open with several good signals throughout the eclipse; there were two stations readable on 75, which improved slightly, but no others could be heard. Noise level remained high throughout the entire period."

From John Hill, W5CBN. "I listened to the 6 meter band in Houston, Texas. At 4:00 p.m., forty minutes before the eclipse maximum, signals were skipping in from W 6, 7, and 8 with S 3-4 signals. At 4:30 p.m. the skip was from W 4, 7, and 8, and all signals had rapid QSB. At 4:35 p.m. all that I could hear were W 7's, and the QSB became even more rapid. At 4:40 p.m., when the eclipse was maximum, I heard W 4 and W 7, with slow roll on all signals. At 4:50 p.m. the QSB began to clear up and reception was possible from W 4, 7, and 8 with S 2-3 signals. At 5:00 p.m. signals picked up in strength, and QSB continued to decrease. Skip mainly from W 4 and 8. At 5:10 p.m. signal strength increasing, hardly any fading. At 5:20 p.m. signals up to S 5-7, skip mainly from W 3, 4, and 8, with no fading." ■

Time EDT	CBF Montreal 690 kc	WLW Cinc. 700 kc	WOR N. Y. C. 710 kc	WGN Chicago 720 kc	CBL Toronto 740 kc	CBM Montreal 940 kc	WBZ Boston 1030 kc	KYW Cleveland 1100 kc	WBT Charlotte 1110 kc	WRVA Richmond 1140 kc	WWVA Wheeling, W. Va. 1170 kc	WCAU Philadelphia 1210 kc	WQXR N. Y. C. 1560 kc	CHU Ottawa 3330 kc	CHU Ottawa 7335 kc	CHU Ottawa 14670 kc
1:15 p.m.	0	N	0+	N	—	0	0	0	0	0+	0, I	0+	—	—	—	—
1:45	0I	0	0+	N	—	0	0	0	0	0+	0, I	0+	0	0	0+	0
4:25	0I	N	0+	0	—	0	0	0	0	0+	0, I	0+	0	0+	0+	N
4:50	0	0	0+	N	—	0	0	0	0	0+	0, I	0+	0	0	15db	N
5:05	0	N	0+	N	—	0	0	0	0	0+	0, I	0+	0	—	—	—
5:20	0+, I	0	0+	0	—	0	0	0	0	0+	3db	0+	0+	0+	25db	N
5:35	0+	0	0+	0	—	0	0+	0	0	0+	7db	0+	2db	0+	25db	N
5:45	0+	0	0+	N	0+	0+	0+	1db	0	0+	20db	2db	15db	0++	18db	N
6:00	0+	N	0+	N	—	0+	0	3db	1db	10db	20db	3db	15db	0+	28db	0
6:15	0+	0	0+	N	0	0	0	0	0	8db	2db	10db	15db	0+	15db	N
6:30	0	N	0+	N	0	0	0	0	0	0+	0+	0+	15db	0+	20db	0+
6:45	0+	0	0+	N	0	0	0	0	0	0+	0+	5db	0+	0+	2db	N
7:00	0+	0	0+	N	0	0	0	0	0+, I	3db	1db	8db	0+	0+	5db	N
7:15	1db, I	0	0+	0	0	0	0	0	0	3db	1db	10db	17db	0+	0+	N
7:30	1db, I	0	0+	N	0	0	0	0	0	6db	4db	0+	8db	0+	10db	0
7:45	0+, I	0	0+	0	0	0	0+	0+, I	6db	6db	11db	10db	10db	1db	10db	0
8:00	0+, I	0	15db	0	0	0	0	0+, I	5db, I	10db	4db	10db	15db	4db	30db	0
8:20	0+, I	0	12db	0	0	0+	15db	3db, I	20db	19db	20db	26db	36db	0+	30db	0
8:30	0+, I	0	3db	0	0	2db	20db	10db	24db	28db	20db	30db	35db	0+	30db	0
8:45	0+, I	0	20db	0	8db	0+, I	9db	15db	31db	30db	40db	28db	39db	15db	15db	0
9:00	0+, I	0+	20db	0+	5db	5db	27db	20db	38db	34db	45db	30db	42db	17db	40db	0
9:30	2db	3db	37db	0	25db	25db	30db	30db	42db	45db	50db	30db	35db	3db	38db	N
Ident.:	U	C	C	U	C	C	C	C	U	C	C	C	C	C	C	C

Table III—Signal level data. A dash indicates no data taken; zero indicates that the carrier was heard at approximately noise level; N indicates no carrier heard; I represents an interfering station heard. The data were taken July 20, 1963 on an R390A receiver set for fast a.g.c. and with a 15 mc dipole. The time listing is EDT P.M. The identification line c or u, indicates confirmed or unconfirmed.

$ $ An Economy Power Supply $ $

BY ALLAN H. MATTHEWS,* W3BEF/2

If you can get one of the older TV chassis that used a power transformer, you can build a power supply for a medium sized transmitter for under three dollars. This supply can provide 600 to 700 v.d.c. at 200 to 250 ma, suitable for two 6146 tubes in the final.

When reading through the various radio magazines, one is likely to come across transmitters calling for power supplies to deliver 600 to 700 volts. Described below, is a power supply that can provide this voltage at about 200 to 250 ma and is about as low cost as you can make it.

The circuit, shown in fig. 1, is nothing new; it is the basic bridge rectifier. However, in most forms it requires two or three filament windings (5 volts each) and at least three heat producing, power consuming tubes.

When I needed 600 volts at 200 ma to power a pair of 6146's I turned to the old reliable junk TV. The transformer salvaged provided 300 volts r.m.s. each side of the center tap and the current rating was unknown, but recognized to be 200 ma or over. The filter chokes and capacitors were salvaged from the same TV set.

*R.D. #1, Waverly, New York.

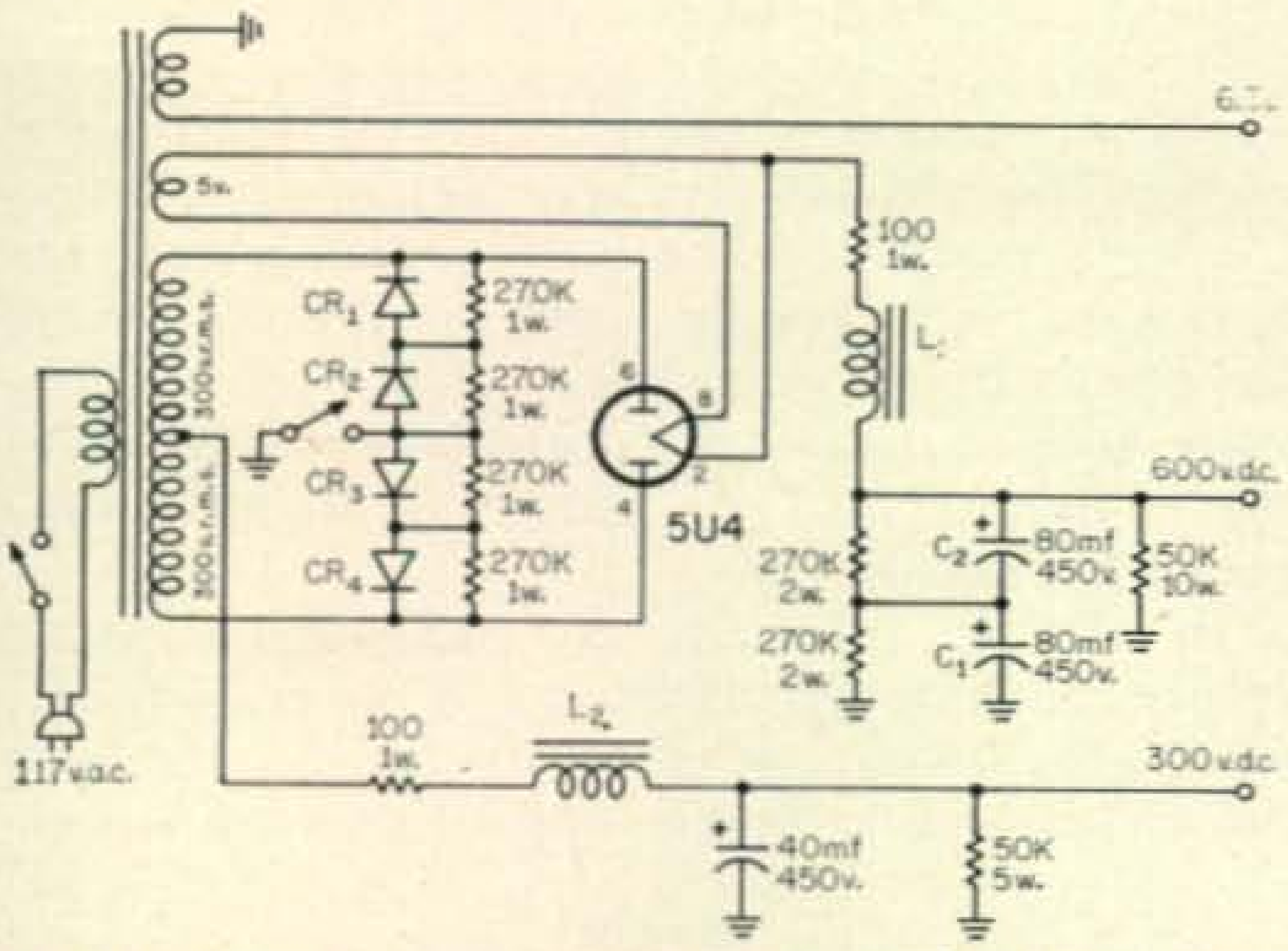


Fig. 1—Circuit of a simple bridge rectifier type power supply suitable for medium power transmitters. The values of the chokes are not known since they were scrounged from the same TV set. The diodes are silicons rated at 600 p.i.v. at 750 ma. All capacitors are in mf.

The silicon diodes shown in fig. 1 cost 36¢ each at Barry's. The only other expenses were the chassis, the bleeder resistors, and the shunt resistors across the diodes and I included some series resistors to limit the surge current.

The advantages of the power supply are several. First, it is inexpensive. The total cost will probably run under $3.00 if you have the old TV chassis. The 5 volt filament winding is on the power transformer and so a 5U4 is used for two of the four legs of the bridge circuit. Also the 5U4 is usually found in the TV set.

The supply can be made very compact and besides supplying 600 to 700 volts d.c. it also provides a voltage of about half of that for a screen supply or the exciter stages of the transmitter.

Precautions

Care must be taken to use enough series diodes in each leg. The total p.i.v. rating of each leg must be at least 1.5 times the r.m.s. voltage of the entire high voltage secondary. Be sure to shunt each diode with an equalizing resistor of 200K to 270K. Also, cover the cases of any filter capacitors if they are hot with respect to the chassis. The only one like that in fig. 1 is C_2.

The final results with the power supply built was 880 volts no-load with 600 volts at a 240 ma load. While the transformer ran a mite warm it was no warmer than it probably ran in the TV set. ■

A Simple 3 Band 2 Element Beam

BY ED MACKENZIE*, W8NGO

This low cost beam for 20, 15 and 10 meters can produce excellent results due to its method of construction. Each beam built is custom tuned according to the simple instructions and thus provides peak performance. The array, built of TV masts, bamboo and soft drawn copper wire is light and thus presents no special support problems.

FREQUENTLY, the greatest single factor that prevents many amateurs from owning a beam is cost. There is the cost of the antenna itself as well as the cost of a tower support system and rotator. If the antenna is homebrewed a considerable savings can be made and if the homebrewed antenna is light in weight, savings can also be made in the supporting structure and the rotator.

Material Strengths

Aside from direct compression, materials have their greatest strength in tension. A guyed tower or mast can be much lighter and smaller than one which is self-supporting.

The use of antenna members which are either in tension or compression, with a minimum of bending moments, can result in a much lighter structure.

Most antennas constructed of aluminum, or other tubing, require considerable strength of the element material in order not to droop, bend, sag, or break. In addition the boom may become quite heavy in order to support the elements and its own weight. All of this adds up to expense and, in many instances, rules out the beam completely. Also, the use of such materials as wire, bamboo, wood, and string, puts construction of beam antenna arrays within the reach of everyone. The little arrays to be described here make use of these structural principles.

Construction

Rather than presenting this array as a project to be built exactly as outlined, it is presented as a guide and idea source. Thus, each builder will suit his own needs and utilize the materials available. The excellent performance will be obtained by the correct adjustment and this will take into account most mechanical variations that would otherwise change the beam characteristics.

*430 University Place, Grosse Point 30, Michigan.

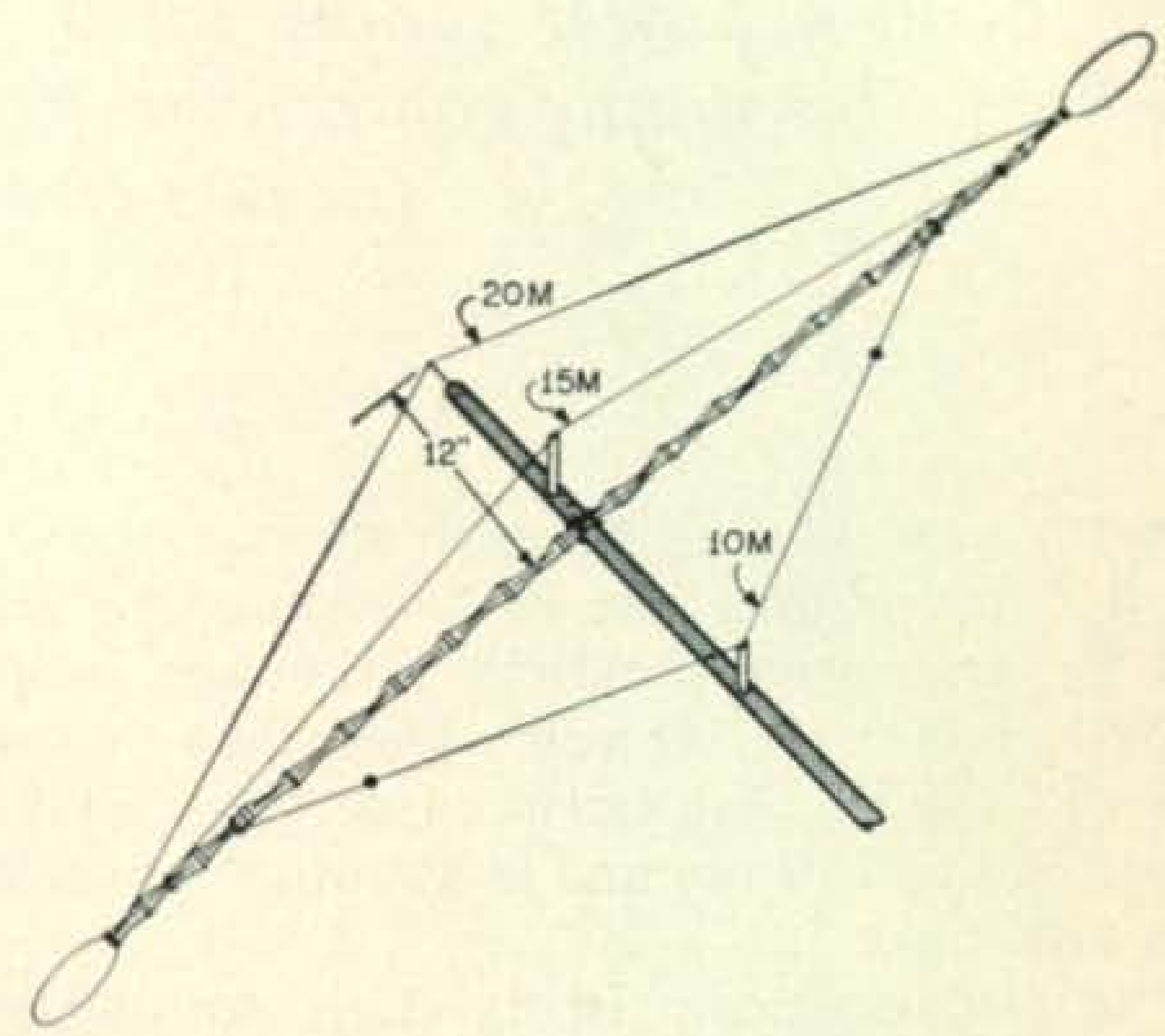


Fig. 1—The sketch above does not show the electrical details but only the positioning of the dipoles for each band. The 15 meter dipole acts as the umbrella guy while the 20 and 10 meter dipoles, when properly adjusted, hold the relatively light bamboo poles straight. The umbrella guy is supported off the boom by a 12" to 15" upright.

Figure 1 shows how a relatively light piece of bamboo can act as a spreader or strut while the wires perform as both the antenna elements and guys. The booms used (several antennas have been built) ranged from 1¼" TV masting with wooden dowel reinforcements to 1⅞" tubing with 1¼" × 1¼" aluminum angle to support the bamboo.

In all the antennas, the hardware used to secure the boom to the mast and the cross-members to the boom was of the TV type available at most radio parts suppliers and hardware stores.

Boom

An overall boom length of 9 foot, measured between the centers of the 20 meter elements, is about optimum. The bamboo spreaders or cross-members are one foot in from each end.

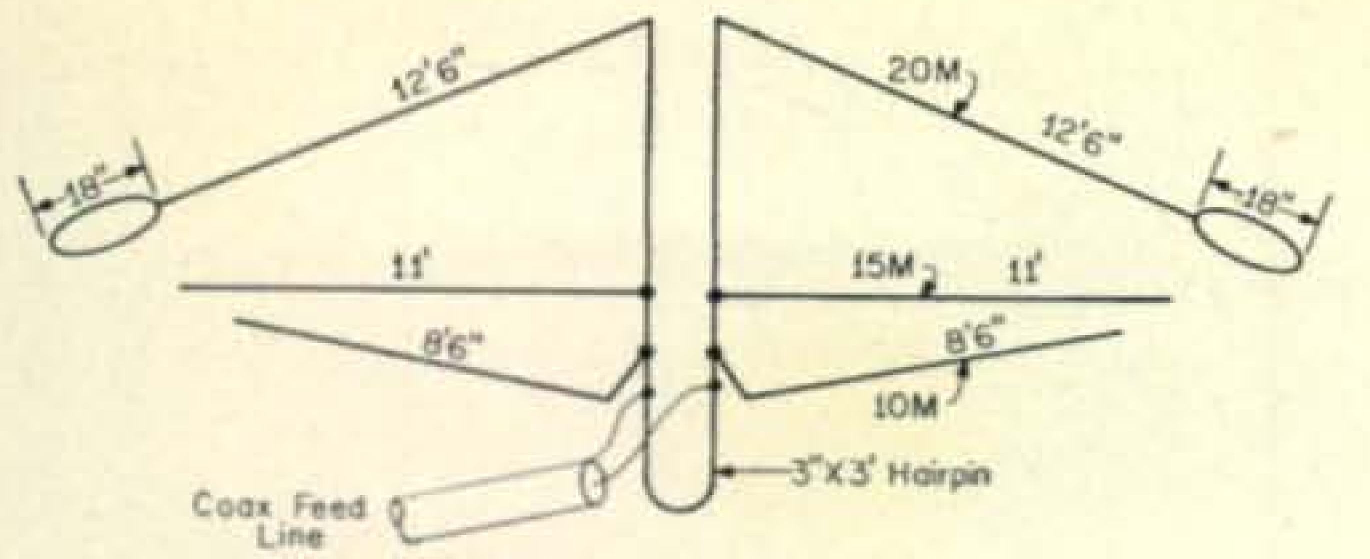


Fig. 2—Electrical connections for the driven elements. The lengths and dimensions shown are approximately the finished sizes after tuning. However, for peak performance the starting sizes given in the text should be used and the tuning procedure outlined will bring them to the exact size for your array.

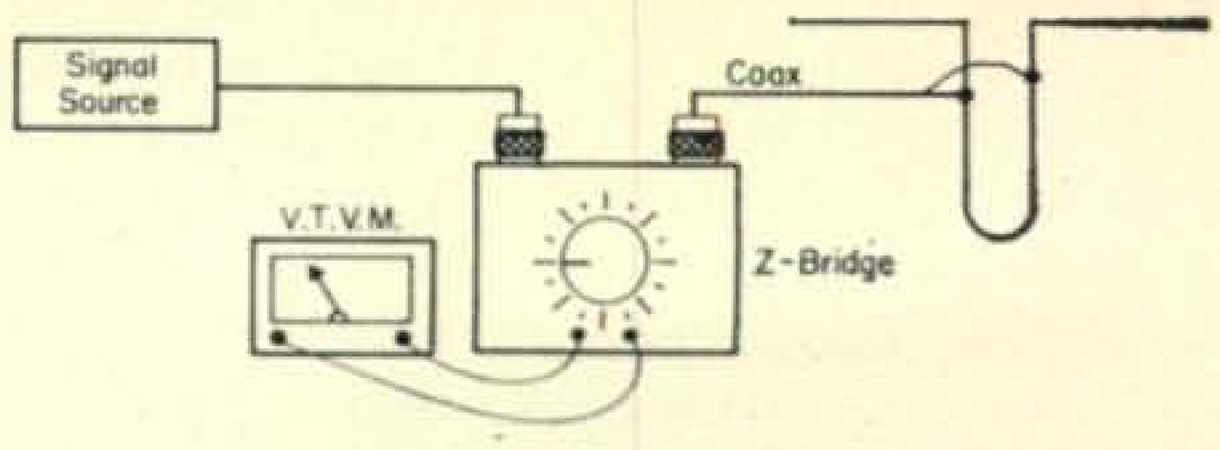


Fig. 3—Set up for tuning the driven elements. The signal source may be a signal generator or grid dip meter. The Z-bridge can be of the inexpensive type made by most kit manufacturers. The text gives the details of the tuning procedure.

The boom, may be as short as 7 feet. This would allow a 5′ length of TV mast plus two one foot extensions. However, the larger boom is more desirable.

Element Lengths

The wire element lengths are not critical, the main problem being one of attaining maximum wingspread on 20 meters. Two 12′ lengths of bamboo were assembled for each crossarm, and located one foot in from the end of the boom. The 20 meter element was then made of two lengths of #12 or #14 soft drawn copper wire approximately 12½′ long, positioned as shown in fig. 1. "Eggbeaters," made of aluminum clothesline are fastened to the end of each wire to provide an additional 18″ of length on each end. The eggbeaters are fastened to the copper wire with aluminum ¼-20 screws and nuts. After the electrical connections are tight, some varnish or liquid rubber, liberally applied, will help to prevent corrosion.

The hairpin, shown in fig. 2, measures 3″ by 3′ and is also made from #12 or #14 wire as are all other elements. The 3″ spacing is maintained by plastic spacers mounted on 3/16″ × 4″ bolts which are secured to the boom.

The 20 meter reflector is made in exactly the same manner except that the hairpin terminates in a three or four turn coil which is grid dipped to 13,520 kc and later adjusted for the best front to back ratio.

Matching

After the 20 meter wires are strung it is necessary to match the array to the transmission line before proceeding any further. When matching, it is desirable to support the array as far off the ground as possible.

The only two instruments needed to tune the array are the simple impedance bridge and a signal source (a grid dip oscillator or signal generator).[1] These are set up as shown in fig. 3. Be sure that the length of coax between the bridge and the hairpin is not a ¼ wavelength or a multiple and is as short as possible. Connect two alligator clips to the antenna end of the coax and clip them on the hairpin near the open end.

Now, adjust the Z bridge dial to 52 ohms (or 72 ohms if you are using 72 ohm coax) and set the signal source to the desired frequency in the 20 meter band. Note the meter reading and adjust the coax connection points up or down the hairpin until a null or minimum reading shows on the bridge indicator. Remove the clips and solder the coax in place permanently. Be sure to remove any enamel from the hairpin if you hope to accomplish this.

The 15 Meter Elements

The 15 meter elements may be strung now as shown in figs. 1, 2 and 4. This element will require some "cut and dry" techniques as it cannot be tuned by moving the coax along the hairpin as in the case of the 20 meter element.

To begin, cut two lengths of wire, each 11 feet long for the driven element. Connect the alligator clips to one end of each wire and tape down the other ends about ten feet out on each side of the bamboo. Cut a length 23′6″ and string the reflector as shown in fig. 4. Set the bridge up again at 52 ohms (or 72) and set the signal source somewhere in the 15 meter band preferably at the frequency which you intend to operate. Position the wire elements as shown in fig. 1 and bring the alligator clips down to the hairpin; connect them about 5″ to 6″ from the open end.

Move the alligator clips up and down the hairpin looking for a dip; a null is not likely. By varying the frequency of the signal source after a dip is found a complete null will then be located but not at the frequency you want. If the frequency at which the null is found is lower than the desired frequency, you must shorten the wires and if higher in frequency lengthen the wires. Since the initial length is made longer than needed, the wires will have to be shortened.

Reset the signal source to the desired frequency and correct the wire lengths by folding the free ends over a few inches at a time. Also move the alligator clips along the hairpin until a combination of both methods produces a null at the desired frequency.

The 10 Meter Elements

If 10 meter operation is desired, the same procedure is followed as for 15. First cut your re-

[1] Geiser, D. T., "The Instrument Deluxe," *CQ*, October 1962, p. 47, Exercises 10, 11 and 12.

flector to a length resonant below the band, about 17'6". String it up as shown in fig. 1. In order to have all the elements attached to the bamboo at one point, extend the 10 meter wire elements with nylon cords (which act as insulators).

Make up the driven element using two 8½' wire lengths. Clip to the hairpin at about 6" to 8" from the open end. Now follow the same tuning procedure as for 15 meters but with the signal source somewhere in the 10 meter band.

Once the matching points and lengths are determined for 10 meters the wires can be soldered to the hairpin, all ends pulled taut and secured to the bamboo.

Reflector Tuning

The final tuning of the reflectors should be done with the array and the tower at the height it will be used. The over-all performance may or may not be materially affected by doing so, but if the beam is reasonably accessible, it may be worth while.

Absolute measurement of gain over a band of frequencies is most difficult and too many variable factors can be introduced. The front-to-back ratio, however, is relatively independent of power input, receiving antenna variations, and receiver variations, etc.

The front-to-back ratio can be checked using a stable, remote, signal source a mile or so distant and results read off the receiver S meter as the array is rotated. Conversely a "friend" can be pressed into service to make the S meter readings while the antenna is used for transmitting.

For example, a chart can be made over the 14 mc band as follows:

Frequency	*F/B Ratio*
14,000	20
14,100	15
14,200	10
14,300	5
14,350	2

In this instance it is apparent that the reflector is reflecting best at the low end and should be shortened to improve things the phone end. After removing a turn from the coil, another run might look like this:

Frequency	*F/B Ratio*
14,000	15
14,100	20
14,200	20
14,300	15
14,350	12

This would be about the optimum one could hope to obtain. The driven elements will be affected very little by slight "touching up" of the reflector, if it has been correctly adjusted to begin with.

Additional Elements

Using the same principles of construction, a longer boom could be constructed and directors added for each band. In spite of the over-all light construction, this would require a heavier and stronger boom with additional technical

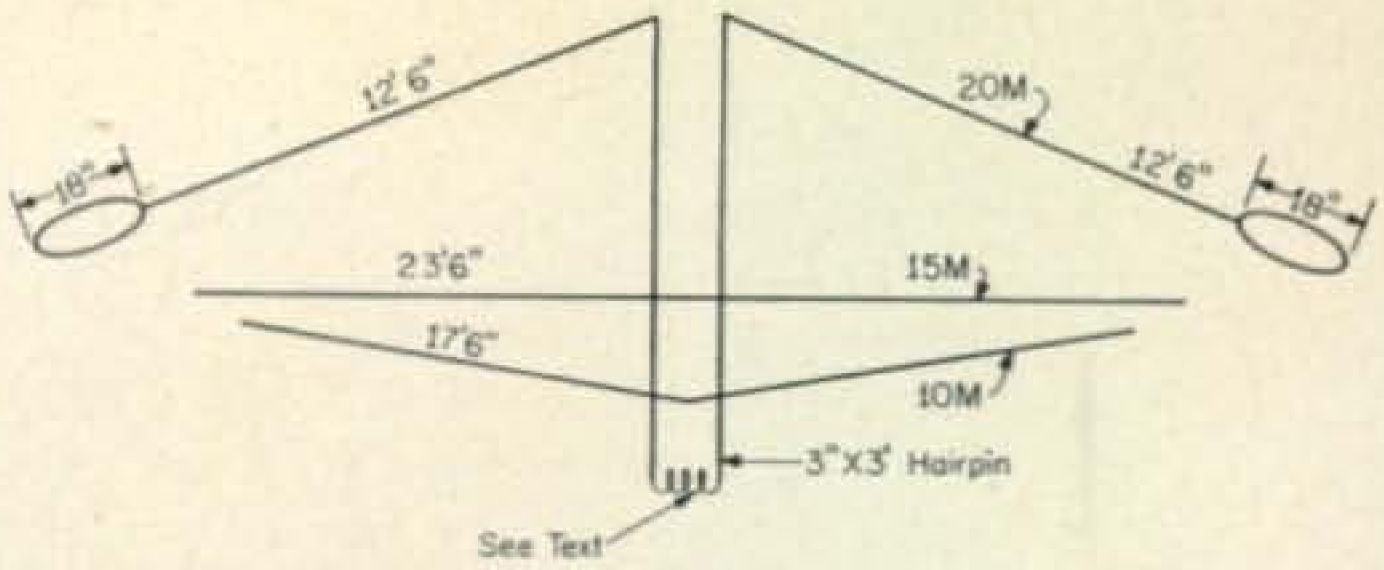


Fig. 4—Electrical details of the reflector assembly. The overall length for 20 meters 33', for 15 meters 23'6" and 17'6" for 10 meters. Final pruning for best front-to-back ratio is done with the antenna in place, if possible, as explained in the text.

problems in matching and tuning. Anyone making a parasitic antenna for the first time would do well to stick to the simple 2 element version for a start.

This type of construction has some definite advantages over coil or trap loading of the elements. Very little compromise is made in spacing by placing the center sections of the lowest frequency elements farthest apart on the boom. The hairpin in the driven element, and the small coil in the 14 mc reflector are the only portions not involved in useful effective radiating. The overall efficiency is not appreciably affected.

Results

No remarkable results can be expected with a small array such as described here other than the well known qualities of any 2 or 3 element parasitic array. The beam width between the half power points will be 50 to 60 degrees. The apparent front to back ratio will be about 15 db. So far as the vertical angle of maximum radiation is concerned, height above ground and the nature of the ground itself are the determining factors.

Comparison of antenna performance by signal reports, perhaps with another station only a few miles away, is not necessarily valid, but comparison with your own results with the old dipole or vertical are. Try it and see if such a simple rotatable array does not open up a whole new world of signals, both DX and domestic. ■

Flash...

As we go to press, we have just received word that a new standard manual of antennas will shortly be added to the famous CQ Technical Series. Written by Ken "Judge" Glanzer, K7GCO, this new reference handbook will be the most unique and comprehensive guide to amateur antenna systems ever published—bar none! Look for more information in later issues of CQ.

Are You An OLD TIMER?

BY JOHN P. STOWE,* K3TLC

THE term "Old Timer" is a relative one. Ask a hundred people, and you will likely come up with a hundred different definitions. The fiftieth anniversary of the ARRL has brought to my mind a few things a person should be able to remember if he is to call himself "OT."

Do You Remember

Battery acid on the rugs and curtains . . . Oatmeal box coil forms . . . When 5 meters was u.h.f. . . . R9 magazine . . . Coherers for receiving . . . BH rectifiers . . . Knife switches . . . Variometers and vario-couplers . . . The 160 meter zepp antenna . . . A pair of 45's on a breadboard . . . Copper tubing tank coils . . . Loop modulation . . . The SW-3 receiver . . . Graduating from a BT mike to a double button job . . . Adjusting the old cat whisker . . . The loose coupler . . . Those new screen grid tubes . . . Plug-in coils . . . Rotary spark gaps.

"Appliance operators" who bought condensers instead of making them with window glass and tinfoil . . . The first band-switching receiver . . . The side-swiper key . . . W3ENX on 40 with his drummer-boy swing . . . Using tube bases for plug-in coil forms . . . "That's the dope on that" . . . Everybody, but everybody was rock bound . . . Hashafisti Scratchi . . . The All Star receiver kit . . . When FCC was FRC . . . TOM articles in Cue Street . . . Scanning-disc television . . . Telephones without dials . . . No TVI—no TV . . . Horn speakers . . . Early Gil cartoons in Cue Street . . . That old tape puller in Phila FCC (It was still there last time we were) . . . The WD-11, 01-A, 27-A, etc . . . Magnetic speakers . . . Those new metal tubes . . . Bayonet tube sockets.

*P.O. Box 192, King of Prussia, Pennsylvania.

When the cathode ray tube (Crookes tube) was a laboratory phenomenon with no practical use . . . Ditto the solenoid . . . The thrill of hearing somebody calling you for the first time . . . When there was no s.s.b. . . . When there was no fone . . . When the Call Book was saddle stitched . . . The pine breadboard with bakelite panel . . . The three (or more) wire antenna . . . The first issue of CQ?

Believe me, OT, if you can remember more than half of these items, you're an O'er T than I am, OT." ■

A photo of the author (Chief OT) at the keyboard of the mill, pursuing his profession of technical writer. You will notice the blank sheet of paper trying to stare him down.

A 40 and 80 Meter C. W. Transmitter—Receiver

BY ED MARRINER,* W6BLZ

A complete c.w. transmitter-receiver built on and from an ARC-5 receiver makes a compact vacation package. It uses a keyer circuit that eliminates the need for a T/R switch and provides full break in operation.

HERE is a c.w. transmitter-receiver combination that gives excellent performance on 40 and 80 meters. Many of the parts are obtained from a BC-453 surplus receiver (200-500 kc) and even the chassis is used. No doubt this construction job will take time but if you start now it may be ready for your next vacation.

Circuit Operation

Receiver—The antenna is fed to the 6BZ6 r.f. amplifier through the pi-network, this network acting as the r.f. amp tuned circuit as well as the final output tank. The output of the r.f. amp is fed to a 6J6 broadband crystal converter. This output, in turn, is fed to the input of the 6K8 converter where the 7 or 3.5 mc signals are selected by the tunable oscillator and converted to 85 kc.

The i.f. amplifier design of the original BC-453 has been modified considerably. Only one i.f. amplifier is used, a 6AC7. To retain good selectivity, however, all three i.f. transformers are used. The first two i.f. transformers are placed "back to back" and coupled through a 5 turn gimmick and then fed to the 6AC7.

The output of the 6AC7 is fed to ½ of a 12AT7, the product detector. The output of the b.f.o. (at 85 kc) is fed to the cathode of the product detector. The audio output of the detector is fed to the second half of the 12AT7 from where it is fed to ½ of a 6CX8 pentode amplifier driving a 4" speaker.

Transmitter—This section begins with a 6AG7 in a Colpitts circuit. The oscillator coil, tuned to 3.5 mc portion of the band, is housed in a small aluminum shield can. The output, fed to another 6AG7 is either amplified or doubled and then passed on to the 6146 stage. The last stage is operated Class A and thus free of harmonic distortion (I hope).

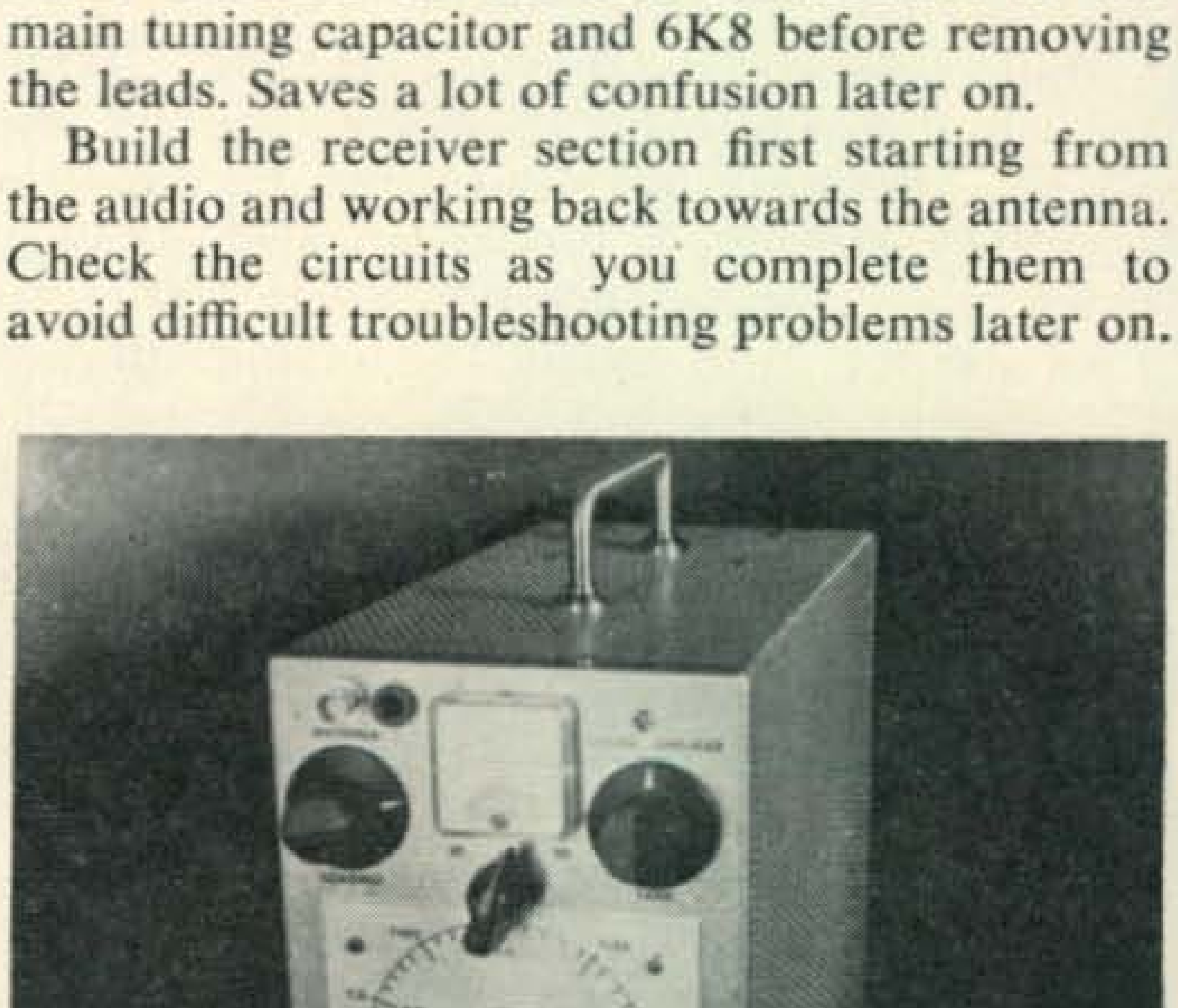
The clean sounding signal is achieved by blocked grid keying of the 6AG7 only. The v.f.o. operates continuously during the keying time. As the key is pressed, a relay is closed switching the voltages from receiver to transmitter. This relay can be set to hold in for a long or short period of time, which ever suits the operator. This relay also allows the v.f.o. to be energized.

There is no antenna relay because the final tank circuit is used for the tuned circuit of the receiver input tube which, during transmit, has the voltage removed. The keyed signal is monitored at a comfortable level by leaving just the screen voltage applied to the 6K8 mixer tube.

Receiver Construction

Strip all the components off the BC-453 chassis saving all the parts. It is advisable to make sketches of the coil connections to the main tuning capacitor and 6K8 before removing the leads. Saves a lot of confusion later on.

Build the receiver section first starting from the audio and working back towards the antenna. Check the circuits as you complete them to avoid difficult troubleshooting problems later on.



Front view of the 80-40 meter c.w. transmitter-receiver vacation package shows the control layout. The controls are from left to right on the bottom, V.F.O., AUDIO GAIN, RECEIVER TUNING .The b.f.o. can be adjusted through the hole in the panel to the right of the AUDIO GAIN control. The transmitter controls across the top are LOADING, BANDSWITCH and TANK TUNING.

*528 Colima Street, La Jolla, California.

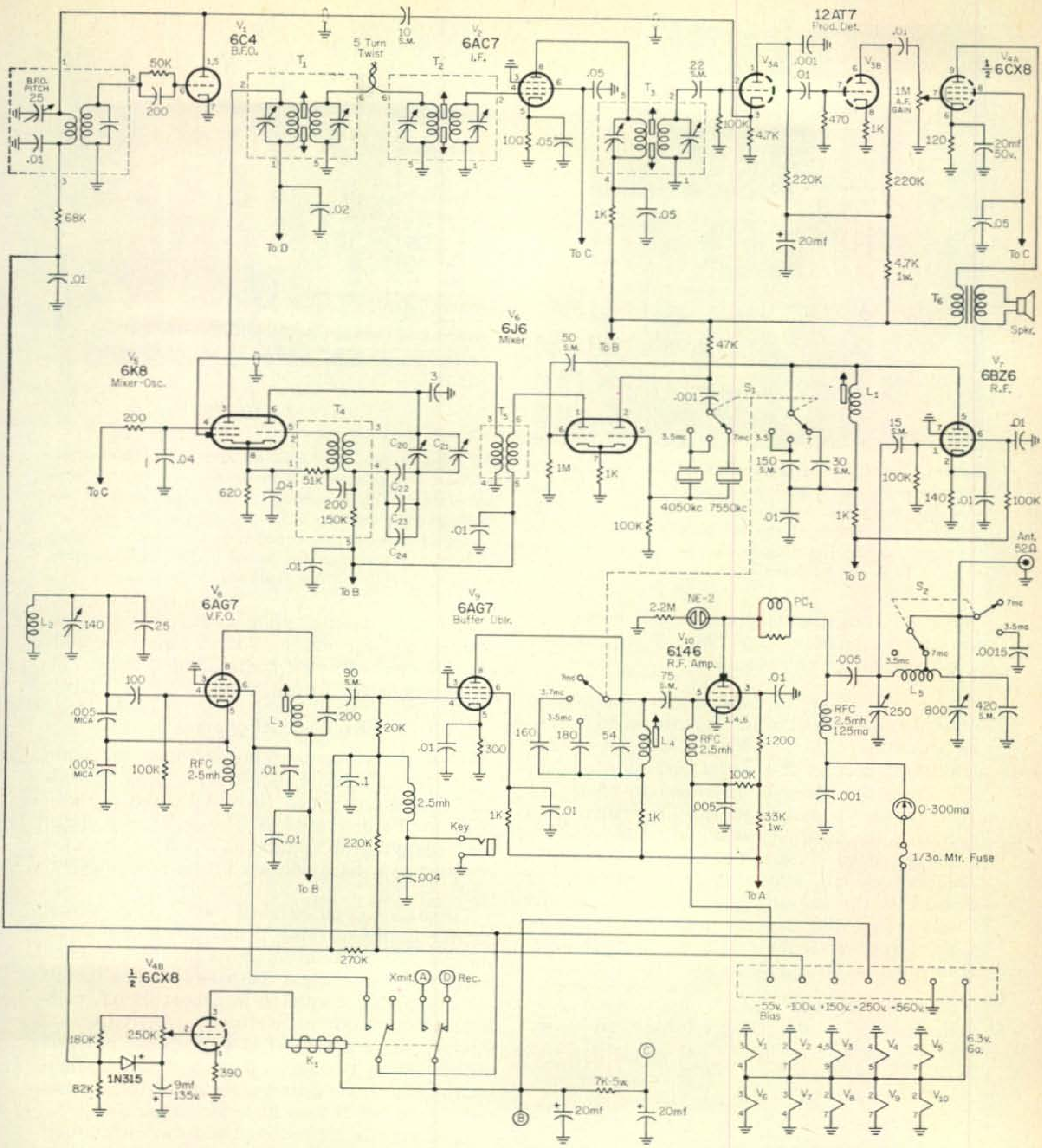
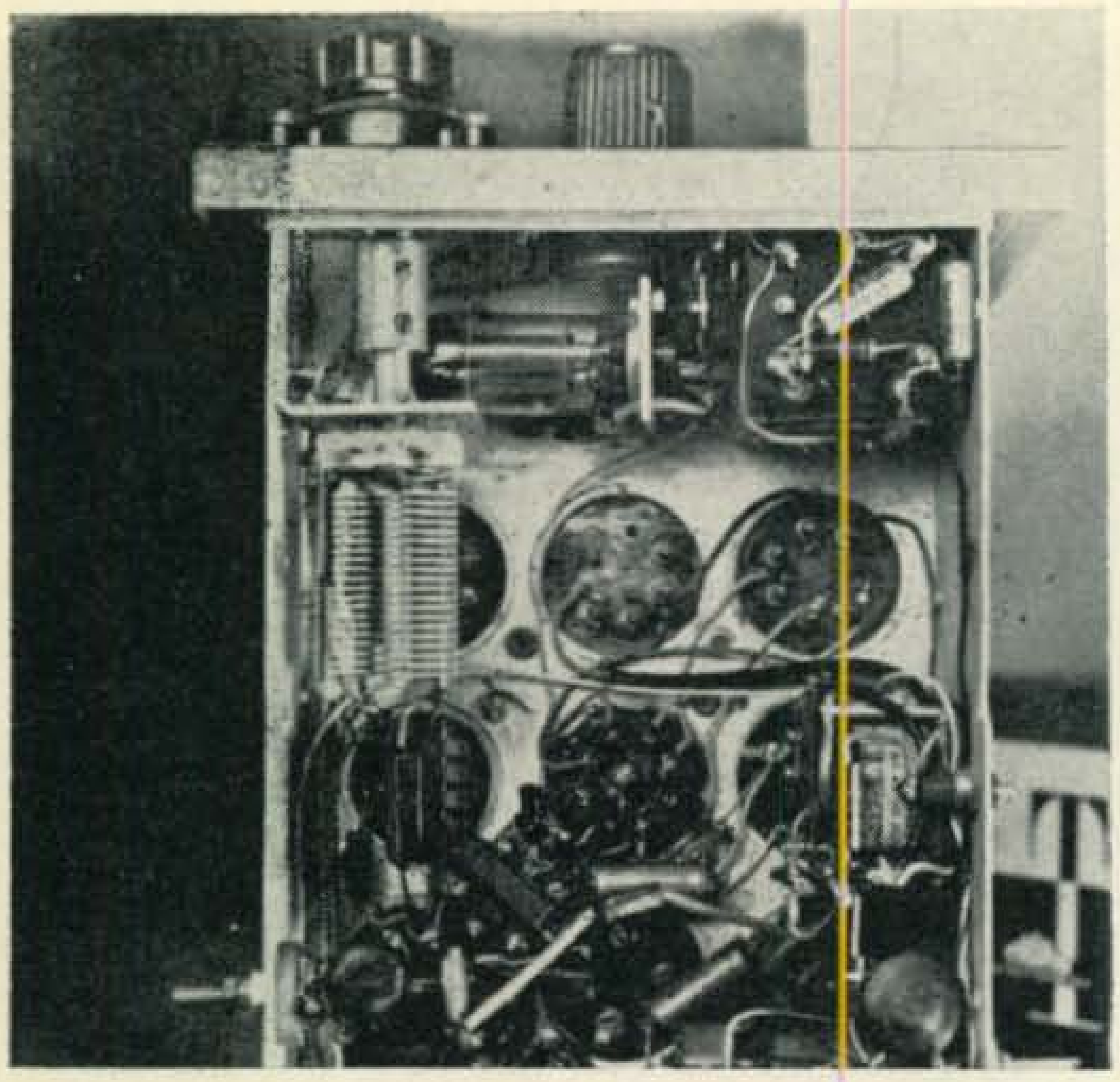


Fig. 1—Circuit of the 80 and 40 meter transmitter and receiver built around a BC-453. All resistors are ½ watt unless otherwise noted. All 0.01 capacitors are disc ceramics. Capacitors marked SM are silver micas. Capacitor values greater than one are in mmf and those less than one are in mf unless otherwise noted.

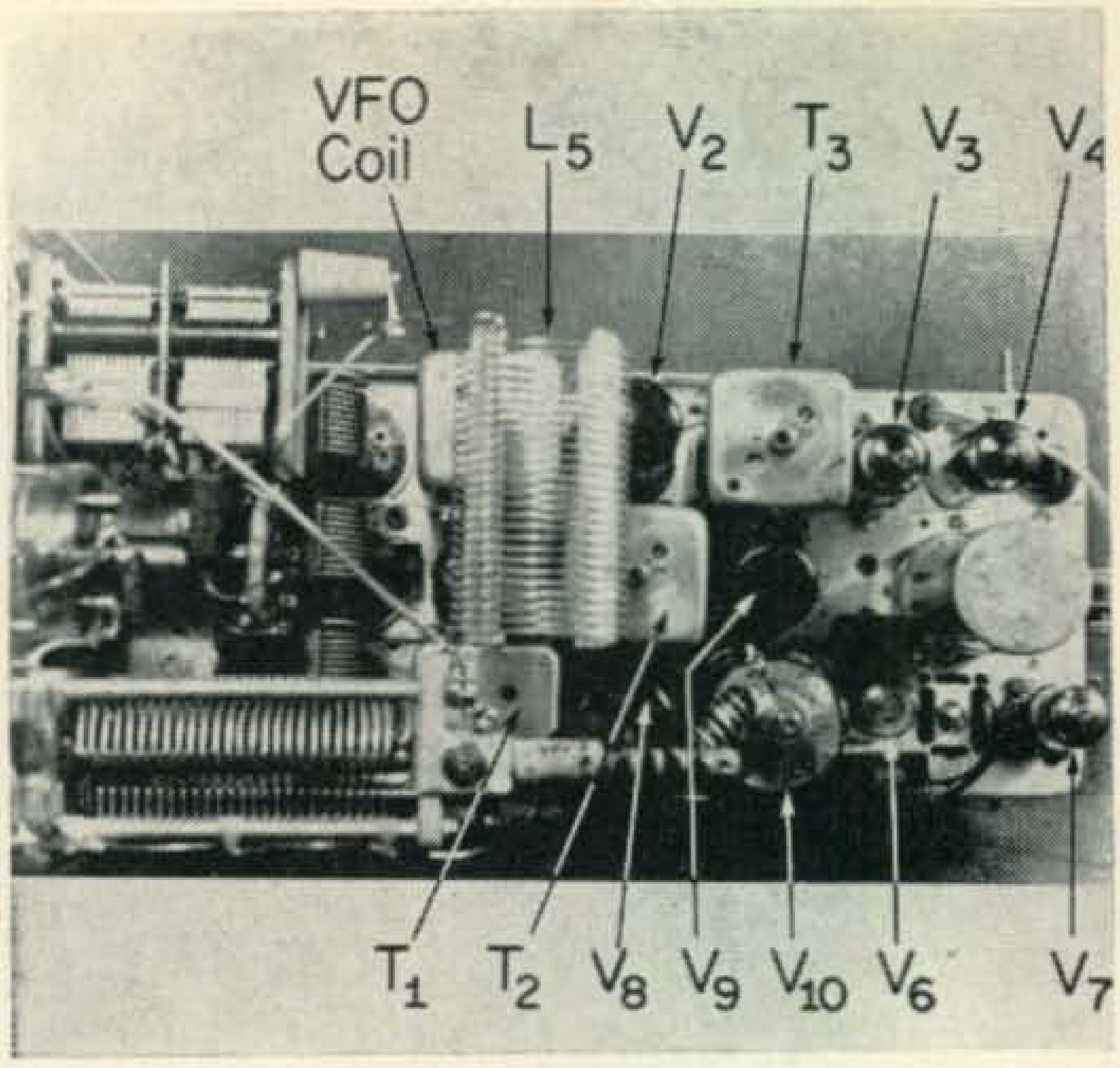
K_1—D.p.d.t. relay, 10K coil.
L_1—30t #30 e. ⅜" long on 11/16" dia. slug tuned form.
L_2—30t #26 e. close wound, ⅝" dia.
L_3—32t #26 e. close wound on 11/16" dia. slug tuned form.
L_4—24t #26 e. close wound on a National XR-50 form.
L_5—37t of #1210 Air Dux (10 t.p.i., 1½" dia.) tapped 11t from plate end.
PC_1—5t #18 tuned on a 50 ohm ½ watt carbon resistor.
T_1, T_2, T_3—Original ARC-5 i.f. transformers.
T_4—Original ARC-5 oscillator coil.
T_5—Original ARC-5 R.F. coil.
T_6—8000/3.2 ohm output transformer.

The layout for construction can be seen from the photographs.

After the audio section has been built and tested, the i.f. and product detector should be constructed. The i.f. coil terminals are numbered in a clockwise direction. Remove the shield can and inspect the coil leads to help familiarize yourself with the circuit. At the same time re-



Bottom view of the front section of the 80-40 meter unit shows the v.f.o. tuning capacitor on the left. The 6C4 for the b.f.o. is mounted on a bracket and is parallel with the panel and the b.f.o. transformer is in the right corner. The plug-in coils have been removed to show the wiring more clearly.



The full top view of the 80-40 meter c.w. transmitter-receiver. The pi-network can be seen to the left with the plate tuning capacitor in the lower part of the photo and the loading in the top section. The tank coil is located between the capacitors. The receiver tuning capacitor can be seen just below it. The tube locations are marked.

move the fibre spacer between the coils so that the slug can be pulled out. This will increase the selectivity of the transformers.

The i.f. section is difficult to test for two reasons. First, the product detector will produce no audio output unless the 85 kc b.f.o. is also fed into it. Second, if a signal generator is available, it is not likely to go down to 85 kc. In order to check and align the i.f. system it is necessary to construct the 85 kc b.f.o. and 6K8 converter stage as well. The b.f.o. coil and 6C4 oscillator are mounted in the front compartment to increase the working space in the rear of the chassis. This also isolates the 85 kc oscillator from the converter input. The b.f.o. transformer is tuned through a hole in the front panel.

The 6J6 Pierce oscillator stage requires an active type of crystal. If an FT-243 type is used the 47K plate resistor may have to be reduced to 27K to increase the activity.

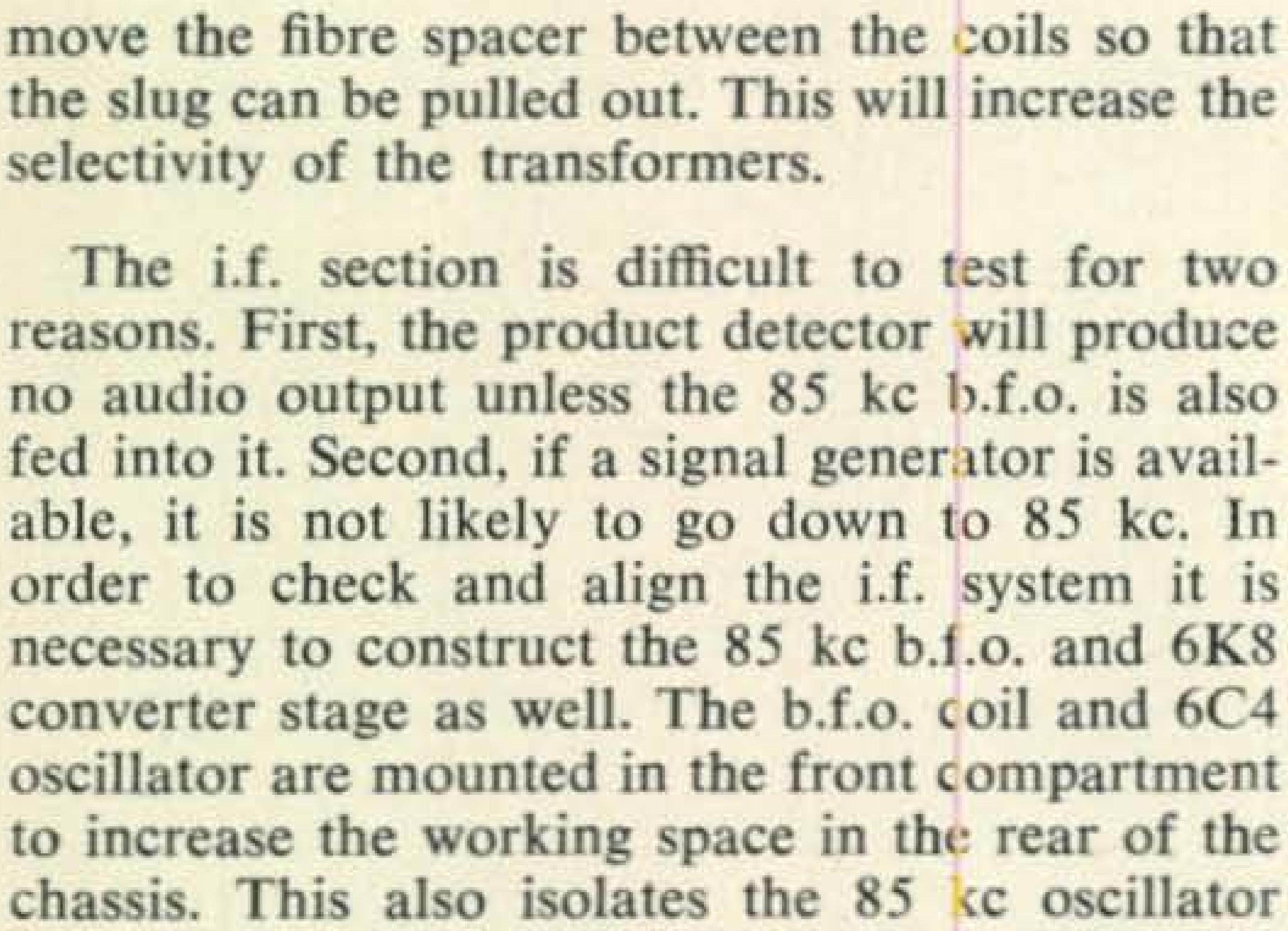


Fig. 2—Circuit of a power supply that can be used for fixed operation of the portable T/R. The diodes are 400 p.i.v. units (International Rectifier SD-94 or equiv.).

The r.f. amplifier plate coil is designed to resonate at 7 mc with a 30 mmf capacitor. With an additional 150 mmf it should hit 3.5 mc. The specifications for L_1 are given in the coil table.

Receiver Alignment

If you have been careful and used the same parts for the b.f.o. it should tune to 85 kc with the 25 mmf tuning capacitor in the half capacity position. To determine if it is oscillating check for negative grid voltage at pin 6 of the 6C4 or listen to a harmonic on a low frequency receiver.

The 6K8 can be checked out next. If the oscillator is not working a number of broadcast stations will be received across the dial. A quick check is sure to reveal the trouble. Once the 40 meter signals are coming in, adjust the i.f. coils for maximum output. Naturally, a signal generator would be a help, if you have one, but it is not absolutely necessary. Run through the alignment by ear several times, preferably on a weak signal, and you'll soon have the hang of it.

If no signals are received and the 6K8 circuit checks out, the 6J6 mixer oscillator circuit may be at fault. Here again, check the oscillator grid for a negative voltage (pin #5). If it is not oscillating try lowering the value of the plate load to 27K as previously noted.

While in the 7 mc position, tune to the center of the band and peak L_1 for maximum output. Now switch to the 3.5 mc band and check to see if the L_1 setting is also peaked at the center of the band. If not try smaller or larger capacitors than the 150 mmf across L_1 in this position.

Transmitter

The 6146 output and 6AG7 buffer doubler should be wired along with the keyer stage.

[*Continued on page 130*]

Hamming in the USSR

BY LARRY TEIEN,* KØLJO

THE Soviet Union has some of the world's most skilled amateur radio operators and builders. Credit for this goes partly to the Soviet government, which sets high licensing standards and offers surplus equipment, technical knowledge, and attractive rewards as incentives. Possibly no other government does as much for its hams.

Despite these encouragements, almost no mass-produced equipment designed especially for Soviet amateurs is available. Government owns all industry, and production of consumer items plays a minor role in the country's economy.

Advancement of amateur radio in the USSR has depended on the universally admired ham trait—ability to modify and "home brew" their own gear.

An increasing number of technical and cultural exchanges between the United States and the Union of Soviet Socialist Republics has fanned the curiosity of each side about life in the other country. The following look at how our hobby is conducted in their government-controlled society may help us appreciate our own strengths and concentrate on our shortcomings.

Background

Radio is not new to the USSR. The Soviet Union's annual international contest, "CQM", is held around May 7 to celebrate "Radio Day." This is the date in 1895 when Alexander Papov demonstrated "the first radio in the world," according to the Russians.

Some years later Lenin encouraged the development of radio for use by the government for news and propaganda.

Soviet amateur stations appeared in 1924. That year, the first DX QSO crackled 2,000 miles from Fyodor Lbov's 10 watt c.w. rig. The first national contest, in 1927, had 300 entrants.

Today the Soviet Union's amateurs number over 15,000—second only to the United States' 300,000. About 10 per cent of Soviet hams are women. Add to this the SWL's, designers, experimenters, and radio sportsmen, and there are over 100,000 Russians whose hobby is radio.

Assistance

Learning radio code, theory, and regulations

Leningrad engineer Alexander Drozdovski, UA1ADG, and his daughter Marina listen to the Soviet third cosmic rocket. USSR hams have had no space project like America's "Project Oscar" satellites.

takes a variety of forms. Adults use books, records or tapes, the help of fellow amateurs, and free or tuition courses. These may be taken at radio clubs, factories, offices, schools, or by mail.

Soviet youngsters can join "electronics circles" which are courses at elementary school or the club houses of the "Young Pioneers" (youngest members of the communist party, aged 9 to 14).

There they learn code and electronics fundamentals, and build and test simple receivers and other equipment. Members with an aptitude for electronics are counseled to continue toward electronics engineering degrees in school. Repairmen, electronics specialists, and technicians are in short supply, so these jobs are filled from the ranks of promising hobbyists.

Much help comes from the Voluntary Society for Assisting the Army, Navy, and Air Force (abbreviated DOSAAF in English). Headed by a lieutenant general in the Red Army, it offers electronics courses (it claims over 1,000,000 have completed them), as well as training in rifle, parachute-jumping, or motorcycling.

DOSAAF publishes electronics books and magazines, sponsors code-copying contests, sets up exhibits, gives prizes for the best electronics-construction projects, and organizes ham radio contests of all kinds.

Also, DOSAFF or Ministry of Communications radio center offices anywhere in the Soviet Union answer technical questions in person or

*2071 Ronald Ave., White Bear Lake, Minn.

Attention W9HCR, Elmer Zinders of Madison, Wis., and K6ENL, Aleta Cash, an XYL from Fair Oaks, Calif! Here's how the other end of the circuit looked when you worked the radio station of the Moscow Electrotechnical College, UA3KAH. Left to right are Eugene Yekzhanov, Leo Petunin, Velyor Kustov, and Eugene Zivert.

by phone. The Central Radio Club in Moscow provides help, as well. The club once had a select membership, including RAEM, Earnest Krenkel. Now as headquarters of the Soviet Federation of Radiosport, it has no members.

Instead, the organization plans and runs contests, gives awards, conducts the nation's QSL bureau, and teaches ham operating. It has a multi-operator station with several transmitters and the calls UA3KAA, UA3KAB, and UA3KAF.

All QSL cards for the USSR are handled by the Central Radio Club at P.O. Box 88, Moscow, USSR. QSL cards are provided free by the government, although some hams design their own.

Licensing

In order to become a licensed amateur, Russians usually follow this procedure:

1. Complete a basic DOSAFF electronics course.

2. Join a club and take a s.w.l. test which licenses them to listen on the ham bands. The test covers theory, wave propagation, Q-signals, ham-operating procedures and jargon, log keeping, amateur frequencies, international radio prefixes, safety rules, and first aid. They must be able to send and receive International and Russian code at 10 words (of five characters each) per minute. They must be able to build and repair simple receivers.

They are awarded a station call, such as UA3 2791, and can start listening on the ham bands at their club station. SWL cards are furnished by the government.

3. After at least six months of experience, an SWL who is age 14 or over can ask the SWL commission, composed of the most active SWL's to recommend them to the operator's qualification commission, composed of the club's best hams chosen in an annual election.

4. The third-class test consists of a more difficult exam and 12 w.p.m. code test. The schematic of a 10 watt rig must be drawn, and they must explain how it would be integrated, how frequency stability would be achieved, what kind of antenna would be used, and how it would be tuned. The third-class certificate permits them to operate 10 watts on 3.5-3.65 mc and 7-7.1 mc c.w., and 28-29.7 mc phone.

Six months after passing the test, an official of the Ministry of Communications calls to approve the transmitter and grant the actual license. Licenses are renewed only when the operator moves to another class.

5. The second-class license is more difficult. When passed, Russian hams are permitted to run a maximum 40 watts. They can operate c.w. on 3.5-3.65 mc, 7-7.1 mc, 14-14.35 mc, 21-21.45 mc, 28-29.7 mc, 144-146 mc, and 420-435 mc. They can use phone on the 10 meter frequencies. One hundred and sixty meters is not open to Soviet hams, nor is 6 meters which is taken by TV.

6. The difficult first-class exam is similar to the extra class in the U.S. They must be able to send and receive code at 18 w.p.m., design transmitter and receiver circuits, and build and troubleshoot advanced transmitters and receivers. They can run 200 watts c.w. or phone on all bands available to second-class operators. (The closest thing the Soviets have to citizens band allows operating with a maximum 5 watts on 144 and 420 mc. The applicant must be at least age 12. There is no code test.)

Construction

Soviet hams have solved their equipment problems by blending surplus World War II gear obtainable from the government with devices they can home brew. Very little foreign electronic equipment is available—mostly East German tape recorders. Even when foreign goods are offered, Russians prefer Russian products.

Soviet amateurs are completely familiar with printed circuits, transistors, and silicon diodes. Tubes are more popular and cost a little less than semi-conductors.

There is very little miniaturization, so Russian equipment is larger and heavier than Western gear. Also, the Soviets traditionally like bigness for its own sake.

In addition to ham equipment, amateurs produce many amplifiers, f.m. and a.m. receivers, phonographs, tape recorders, TV sets, stereo units, and the popular pocket radios.

The heaviest concentration is on gadgets for use in industry, medical science, and agriculture. Top inventions are exhibited in Moscow. They bring no patent rights, but payments sometimes reach $600.

In outer-space work, Soviet hams have conducted no experiments like the American Project Oscar satellites, but they eagerly listened to signals from their country's Sputniks.

Equipment

Most hams in the USSR have their own rig.

UA3CH, R. S. Gaukhman of Moscow, is known as one of the Soviet Union's most ardent radio experimenters.

However, multi-operator club stations are widespread. The gear is installed wherever space can be found in the apartment or house—there is no favorite location. Consideration for other family members must be taken into account. In Russian cities all rooms in the typical two- or three-room apartment are occupied by relatives.

Receivers

Most Soviet hams have a factory-built war-surplus receiver. Almost all are general-coverage superheterodyne models. Preamplifiers and some Q-multipliers are used. V.h.f. reception is obtained through converters.

Speakers and headphones are both in use. Phone patches are not, however, because third-party messages may not be forwarded for the general public except in emergencies.

Transmitters

Most Russians have a home-brew transmitter. Linear amplifiers are widely found, and also are home-brew.

On two meters, a triode vacuum tube for the oscillator is permitted, unlike the U.S. where crystal-control is required. On s.s.b., multi-quartz filters and phasing exciters are equally popular.

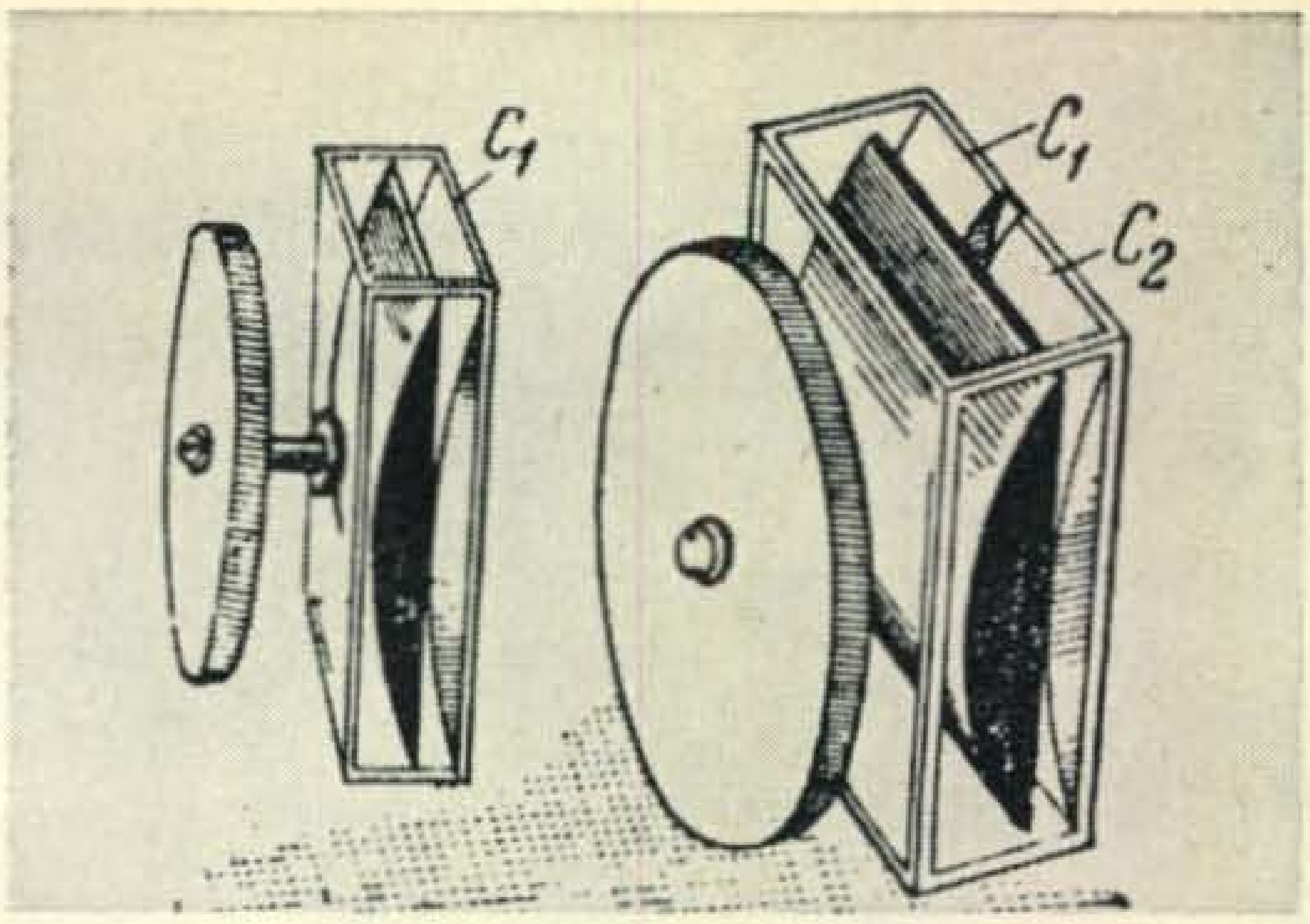
Crystal and dynamic microphones are the most popular types. Push-to-talk on a.m., and vox on s.s.b., are used. C.w. break-in with fast switching is widely employed. In order of preference are electronic keyers first, then straight keys and "bugs", with keying by tape quite rare.

Antennas

Soviet amateurs prefer multi-band antennas, with transmitting and receiving being done on the same antenna by means of an electronic/mechanical changeover relay.

The most common form of antenna is the long wire "V", followed equally by the dipole and vertical, the cubical quad third, and the beam fourth. Few if any rhombics are found.

Antennas are mounted on the roofs of buildings or strung between trees. In the Baltic region the great forests enable some hams to use tall poles. However, wood or metal towers are scarce. Motor rotators are 100 per cent home brew.



Four pages of text, graphs, and dimension drawings in "Radio" magazine told Soviet hams in extreme detail how to build this small variable capacitor.

Russian amateurs like 52 or 75 ohm feed lines of coaxial cable or air-insulated types. Some use 200 or 300 ohm feed line. Stub matching is the favorite.

Ballast resistors and ordinary light bulbs are most commonly used as dummy antennas for adjusting a transmitter.

TVI is a headache familiar to Russian hams. They solve TVI with filters in the feed line and transmitter, and amplifiers for the TV antennas. Co-channel interference is reduced by filters, a feedline-matching system, and TV antennas with narrow bandwidth and maximum sensitivity to groundwave signals.

Power Supplies

In most parts of the USSR, "house power" is 127 volts or 220 volts, 50 cycles. Other voltages range at least from 110 to 240 volts.

Full-wave rectification is widely employed. Soviet regulations prohibit signals below T-7, with fines or closure for offenders. Solid-state diodes are more prevalent than vacuum tubes.

Soviet hams generally are city dwellers. Operation by the 40 per cent of the population which lives in rural areas is handicapped because only one-third of the farms have electricity. Portable generators are not available for hams.

How They Build

Amateur construction in the USSR is thorough and lengthy—the kind that brings pride of accomplishment to the builder. Construction takes place both at clubs and at home. Club workshops are fully stocked with tools and test equipment, such as a grid dip meter, frequency meter, oscilloscope, v.t.v.m., ammeter, tube tester, signal generator, s.w.r. meter, capacitor and resistor checkers, and soldering irons.

Since there are no amateur radio stores in the USSR, the government-owned electronics stores are where the amateurs can buy parts and a few kits. Magazines tell *what* is available.

Winner of many national and European "fox hunts" (hidden transmitter hunts on foot) is Alexander Akimov, UA3AG.

Usually there is one parts store in each town, and several in big cities. There is no self service. Instead, the prospective buyer stands in one line to determine the price, another line to pay the cashier and obtain a receipt, then back to the first line again to pick up the merchandise. Prices are figured on the store's wooden abacus. All goods are unwrapped, and the buyer must bring his own packaging.

When the parts stores run out of stock, the builder must order by mail or make his own parts out of purchased supplies. Construction articles in Soviet magazines usually tell how to make tube sockets, variable capacitors, coils, switches, and transformers. Coil-winding data is normally included.

The government operates a parts mail-order office in Moscow, but the service is not fast. A few surplus items and simple kits can also be obtained, such as a two-band receiver, power supply, and a low-power transceiver.

Reading

Radio is the only national amateur radio publication in the USSR. It is a 64 page monthly, costing 30 kopecks (about 7¢ U.S.), published by the Soviet Ministry of Communications and by DOSAFF.

It contains no ads, but has half a dozen construction articles; something on electronics equipment for space exploration; new Soviet receivers, tape recorders, or a TV set; electronics in automation, cybernetics, or radio astronomy; DX activities around the world for hams and SWL's; a SSB column; and short excerpts from foreign magazines including those in non-communist nations. (*CQ* has been among these.)

Radio carries few photographs of equipment, but many excellent sketches.

In addition to *Radio*, small booklets on all phases of electronics, which the Soviet government mass-produces and sells for about 50 kopecks apiece (10 to 15¢ U.S.), are some of the favorite reading material in the USSR. News stands are sold out fast.

Written for beginners, they are especially popular in rural areas where regular electronics courses may not be available.

Also, some radio clubs produce newsletters. One of the best is published monthly by the club station UB5KAB in Donetsk, Ukraine. Chief operator Leo Yailenko edits the contributions of 16 top-flight hams from all over the country on news of home and abroad.

Operating

Soviet hams like to operate c.w. best, followed by s.s.b. and a.m. V.h.f. has quite a few fans, along with some Control Level Carrier (CLC). Amateur TV broadcasting is rare, and there is no radio teletype (RTTY)

Soviet amateurs must keep a log-book record of all contacts. Russians can obtain a USSR call book, containing more than 10,000 "U" calls and QTH's, to aid their record work.

A number of experienced operators are designated as "public controllers." They can break in on offenders and correct them, or report them to communications authorities. Penalties for important infractions range from fines to revocation of license.

Regarding languages, Russian hams QSO each other in International Code, Q-signals, English abbreviations, and Russian words to fill in the rest.

With over 100 nationalities and national groups living in the USSR, many languages are used on the air. In school, children study in the native languages of their region. Russian is also studied if it is not the native language. Most students must learn English or German as well. Some Soviet hams have studied English in after-work courses in order to improve their technique in this "international amateur language."

Radio is considered a sport by the Soviet government, and so is made competitive through contests. However, some hams prefer combining radio and athletics in a game called "fox hunting."

It is the Soviet version of the transmitter hunt, conducted on foot instead of in cars as in some countries. Portable receivers with direction-finding antennas are carried by participants on foot to find a hidden transmitter.

Another version is called "Radio Network Operating," in which 25-pound radio packs are used. This race against time tests hiking, setting up the portable station at three points, and handling messages.

The Soviet government awards attractive prizes and medals for code copying, fox hunts, national contests, and the nation's only international contest—"CQM". Some Russian hams hardly miss a contest, especially UA1DZ in Leningrad, UC2AA in Minsk, and UB5WF in Lvov. ■

Two 2 meter dipoles are shown set for bi-directional operation. This will provide from 2 to 3 db gain in both directions. Note how the feed cable for the lower antenna is brought up from the bottom to try to reduce minor lobes. The lad with the happy expression is Tom, the author's son.

A 2 Meter Ground Plane With Gain

BY A. A. HALLIGAN,* WA6ITS

The antenna system described below is flexible in design and configurations can be set up for various gains or patterns. By stacking and positioning the ground plane antennas, cardioid or bi-directional patterns can be obtained and gains of almost 9 db can be approached.

THE increase in local operating nets on the v.h.f. bands, particularly 2 meters, together with the increasing use of vertical polarization in this band, has created a need for a more efficient antenna system. This antenna system must be simple to construct and adjust, have a low angle of radiation, and be physically adaptable for mounting in a number of different situations. In addition, the antenna system should have a moderate amount of gain where required and a radiation pattern that will completely cover the desired area. This means that the radiation pattern must be adjustable.

The antenna system described herein will meet all of the above requirements and in addition may readily be tailored to the needs of the individual amateur. Design variations are available that will make allowances for gain, directivity, and limited finances. Further, the design is such that construction may be on a progressive basis thus allowing the amateur to evaluate his requirements more fully. If it is found that one of the more simpler configurations of this antenna system provides satisfactory coverage, it will be unnecessary to continue construction beyond this point.

All materials used in the construction of the antenna system are readily available from a number of different sources. These sources include hardware stores, mail order houses, radio and TV supply houses, surplus stores, automobile supply stores, *etc*. Further, the size and weight of any individual component is such that it may readily be carried on public transportation or in the amateur's car even if it is one of the pregnant roller skate variety.

The antenna system design allows considerable latitude in mounting arrangements. Mounting may be on existing towers, rooftops, or on the ground. Various methods of guying the antenna mast are possible when this is considered to be necessary.

The electrical design of the antenna system is such that regardless of the selected configuration, the nominal impedance is in the vicinity of 50 ohms and provides a good match to RG-8/U coaxial cable. The basic radiating element is a

*472 Valencia Drive, South San Francisco, California.

ground plane antenna with drooping radials. This antenna was selected because it is extremely simple to construct and is easily adjustable for a proper impedance match simply by bending the radials up or down with respect to the vertical radiator. Figure 1 shows the approximate relationship between the antenna impedance and the position of the radials in degrees below the horizontal.

Stacking

The complete antenna may be constructed on a progressive basis. A single ground plane is first constructed and adjusted to achieve a good impedance match to the transmission line. This antenna may be used as a single non-directional radiator by mounting it on top of a mast or it may be used as a directive antenna with an approximate gain of 2 to 3 db by mounting it approximately one-quarter wavelength below the top of the mast. When operated in this manner, the radiation pattern will be essentially a cardioid.

The next step is to construct a second antenna identical to the first. The second antenna is adjusted in the same manner as the first antenna to have a nominal impedance of 50 ohms. This is again accomplished by adjusting the "droop" of the ground radials. These two antennas are now stacked vertically on the mast 9/10 wavelength apart. The desired radiation pattern may be selected by proper placement of the individual antennas on the mast. The radiation pattern selected will also determine the antenna gain. In general, if both antennas are placed on the same side of the mast, the radiation pattern will be essentially a cardioid and the maximum gain will be about 4 to 6 db. If the antennas are placed on opposite sides of the mast, the radiation pattern will be essentially bi-directional and the antenna gain will be about 2 to 3 db.

Matching and Phasing

To obtain the correct impedance and phasing of the two antennas, a stacking harness is used. Two choices of stacking harnesses are shown in fig. 2 that give identical results.

Optimum performance of this antenna system dictates that the antenna arrays have low

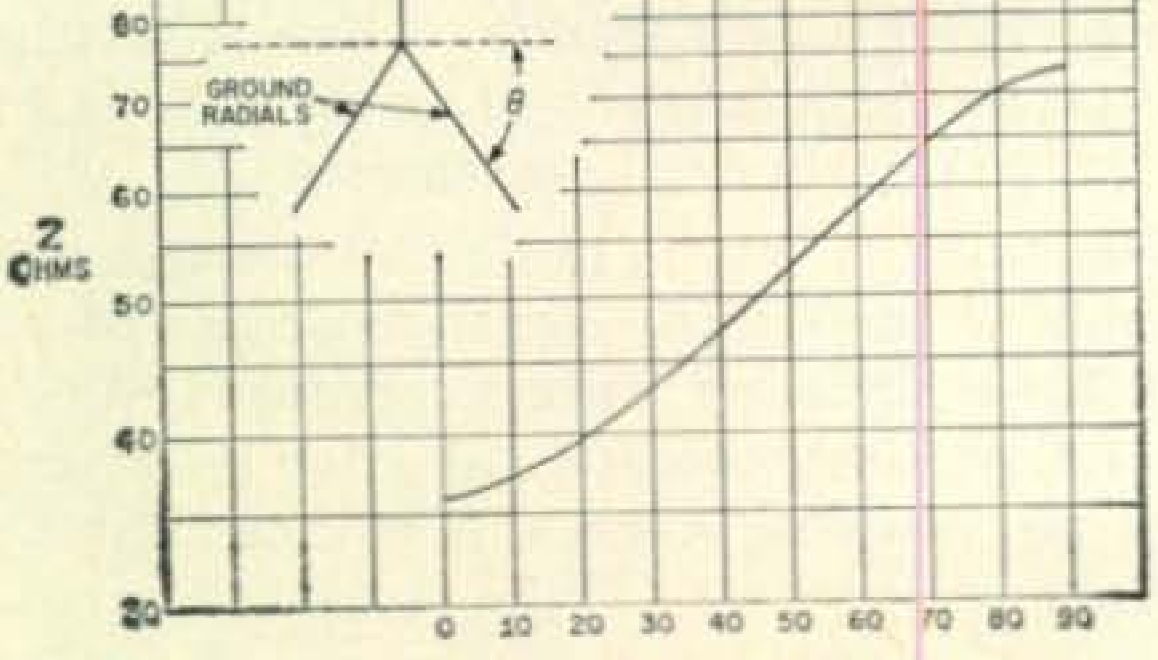


Fig. 1—The above chart shows the approximate impedance of the ground plane antenna for various angles of the radials.

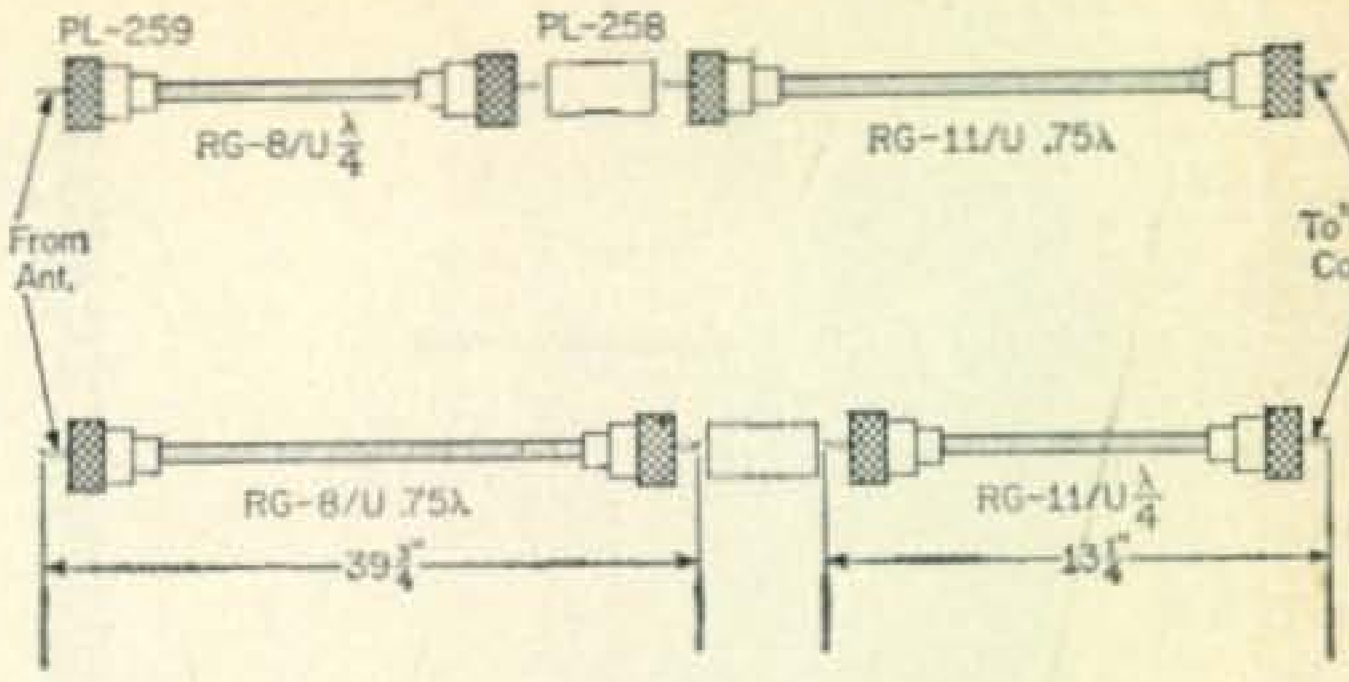


Fig. 2—Two types of stacking harnesses that may be used to connect and properly phase two of the 2 meter ground planes. Two of either type cables are required.

s.w.r. and be operated in phase both physically and electrically. A combination of stacking harness and physical mounting of the antennas accomplishes both of these requirements. The antennas are stacked vertically 9/10 wavelength apart to achieve optimum addition of the radiation from each individual antenna. The antennas are fed in phase by the stacking harness which maintains the electrical separation at an even number of full wavelengths. In addition to providing the proper electrical characteristics the stacking harness also provides the necessary impedance matching. This is accomplished by the use of a Q section transformer.

Physically, it is not possible to limit the electrical separation to one wavelength because the electrical connection to the antennas is made via solid dielectric coaxial cable that has a velocity factor of 0.66. This means that the physical length of the connecting cable will be 66% of the electrical length. If the antennas are physically separated by approximately one wavelength, it therefore follows that the electrical separation must be greater than one wavelength because of the velocity factor of the connecting cable. In order to achieve the proper phase relationship, an electrical separation of two wavelengths is used.

In order to feed two antennas in parallel from a single 50 ohm transmission line, it is necessary that each antenna present an impedance of 100 ohms at the point of parallel connection. Since the ground plane antennas have been adjusted for 50 ohms impedance, it is necessary to raise the value of this impedance. This is done by the Q section transformer which is part of the stacking harness. The impedance of the Q section transformer is calculated from the following formula:

$$Z_0 = \sqrt{Z_r Z_s}$$

where: Z_o = "Q" section impedance

Z_r = Required impedance

Z_s = Source impedance

In this case, the source impedance is 50 ohms (ground plane antenna), and the required impedance is 100 ohms. Therefore, the product

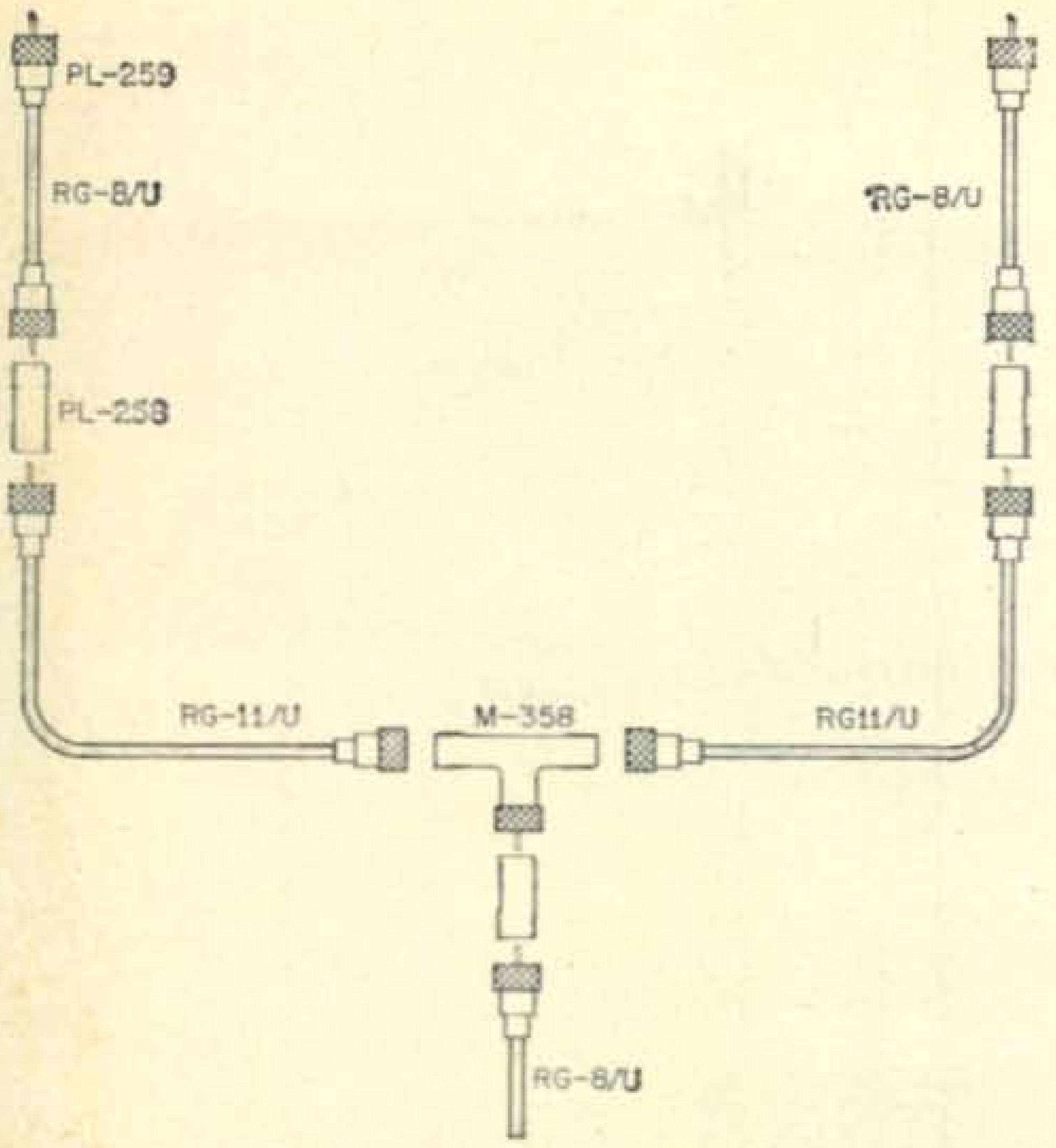


Fig. 3—Interconnection of the stacking harness showing the location of the tee and the feedline.

of $Z_r Z_s$ is approximately 5000. The square root of 5000 is approximately 70. Z_o therefore equals approximately 70 ohms which is the required impedance of the Q section transformer. The Q section transformer is readily constructed using an odd number of quarter wavelengths of coaxial cable having a characteristic impedance of approximately 70 ohms such as RG-11/U, RG 13/U, *etc*. In order to obatin the proper phase relationship between the individual antennas, it is necessary that there be one wavelength between each antenna and the common feed point. This is accomplished in the make-up of the stacking harness. Two choices are available. One choice would be to use one quarter wavelength of 50 ohm cable and three quarter wavelengths of 70 ohm cable. The other choice would use three quarter wavelengths of 50 ohm cable and one quarter wavelength of 70 ohm cable. See fig. 2.

Coaxial cable plugs (PL259) are used on each cable end and the cables are joined using coaxial unions (PL258). A coaxial tee (M358) is used at the common feed point. Details of this arrangement are shown in fig. 3.

Radiation Patterns and Gain

The radiation pattern of a single ground plane antenna mounted at the top of a mast is nondirectional and the gain is unity. If this single antenna is mounted approximately one quarter wavelength below the top of the mast and approximately a quarter wavelength away from the mast, the mast will then act as a reflector. This reflector will restrict the radiation in one direction and reenforce it in the opposite direction. A gain of up to 3 db is possible in the reenforced direction. By keeping the spacing between the mast and the antenna at one quarter wavelength, minimum effect on the antenna impedance is obtained. If two antennas are mounted on the mast with the top antenna approximately one quarter wavelength below the top and the lower antenna approximately one wavelength below the top antenna, various combinations of radiation pattern and gain are possible. It is assumed that the antennas are alwaye fed in phase and that impedances are properly matched.

If both antennas are mounted on the same side of the mast, a cardioid radiation pattern will be obtained with a maximum gain of 4 to 6 db. If the antennas are mounted on opposite sides of the mast, a bi-directional radiation pattern may be obtained with a maximum gain of 2 to 3 db obtainable in the two directions.

When 4 antennas are fed in phase and are all mounted on the same side of the mast, a gain of 9 db may be obtained in one direction. If these same 4 antennas are distributed around the mast at 90 degrees from each other, a 6 db non directional gain may be realized. If the 4 antennas are mounted 2 on each side of the mast, a bi-directional pattern may be obtained with a gain up to 7.4 db in the two directions.

It can be seen from the above that other variations are possible both in radiation pattern and gain simply by controlling the physical placement of the individual antennas around the mast. To feed 4 antennas, it is only necessary to stack two groups of two antennas using the stacking harness described and then constructing a third stacking harness to stack the two groups. This is shown in fig. 4. In all cases, for optimum performance, the vertical spacing between antennas must be maintained.

Construction

The antenna mast used may be standard aluminum TV mast. Aluminum is preferred be-

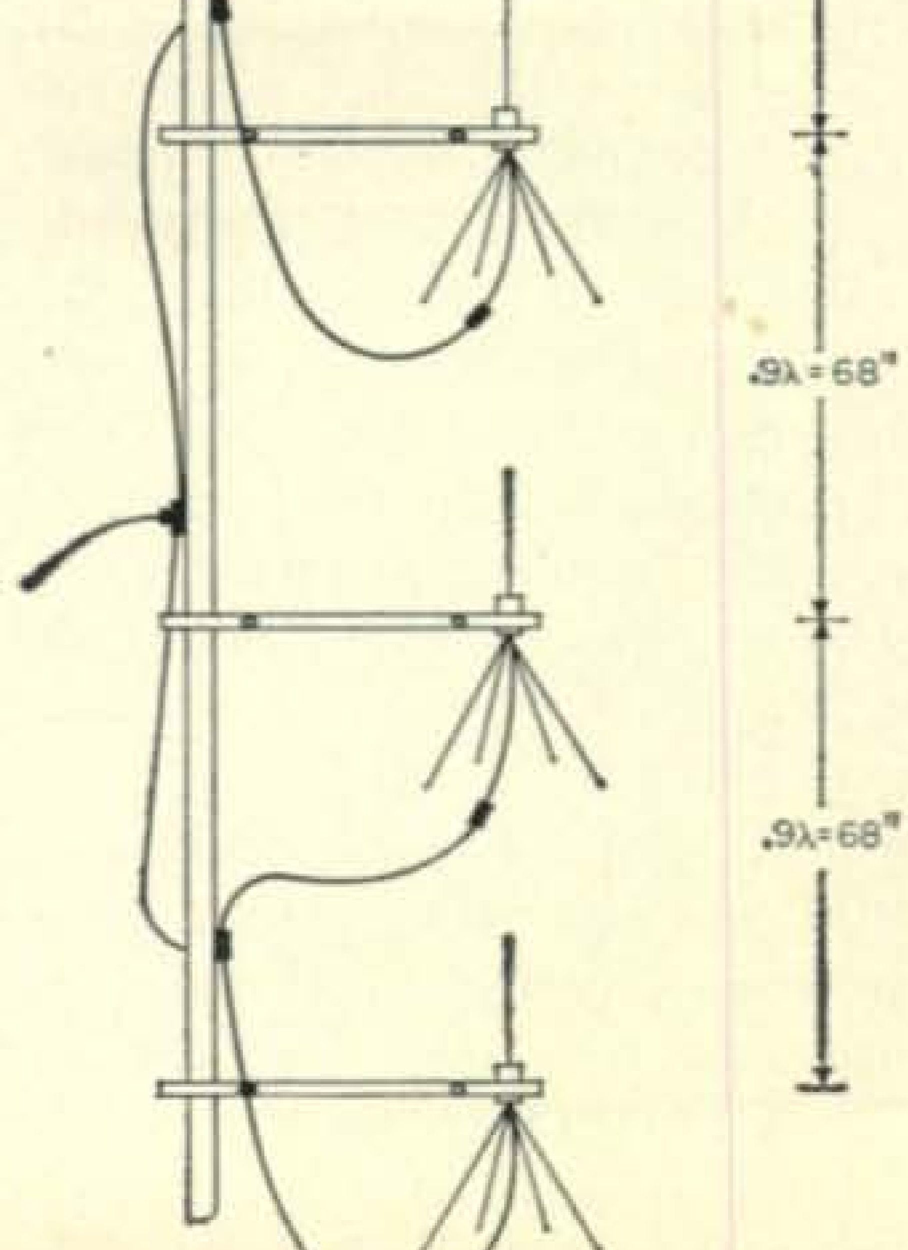


Fig. 4—Four antennas stacked vertically will produce a cardioid pattern with a gain of approximately 9 db. Note that two stacking harnesses are used.

cause of its light weight. This mast is obtainable in 5 foot or 10 foot sections. The sections come with a swaged diameter at one end to allow it to telescope into the next section. Guy rings can be placed between sections.

The antenna elements are constructed from ¼" copper tubing. The ground radials (146 mc) are 22¾" and the radiator is 18¼". The ground radials are soldered to a copper plate 1½" square. The center of this plate is drilled to accept an SO239 coaxial connector. The radiator element is soldered to the center conductor of this connector. Figure 5 shows construction details.

The insulator shown is a 2 inch length of polystyrene rod 2 inches in diameter with a hole drilled through its center so that it will slip over the radiator element. (The poly rod used was obtained on the surplus market. It is possible to substitute a number of various plastics for this application. The main purpose of the insulator is to provide protection of the SO239 from exposure to the weather and also to serve as a convenient method of mounting the individual antennas. Any substitute used should accomplish these functions. The SO239 connector and the copper plate with the radials are fastened to the insulator with self-tapping screws. The mounting holes in the SO239 connector may have to be enlarged to accommodate the screws used. It should be noted that a number of different types of screws may be used in this application. The insulator may be drilled by using the SO239 connector as a template to guide the drill. By drilling the holes smaller than the screws to be used, many types of screws will cut their own threads in polystyrene or plastic. These types include machine screws and wood screws in addition to self-tapping varieties.

The antennas are fastened to the mast using a piece of hardwood for each antenna. This piece of hardwood should be about 1 inch by 3 inches by 24 inches. Holes are drilled in each end of the hardwood to accommodate the mast and the antenna insulator. The holes should be located to space the antenna radiator element 19 inches away from the mast. The holes should be slightly smaller than the diameters of the mast and the insulator. After the holes are drilled, the piece of hardwood is sawed (ripped) down the center. Two holes (¼") should be drilled through the edges of the board to accommodate the carriage bolts. See fig. 5. It may be necessary to trim the mast and insulator holes with a knife to obtain a good fit thus assuring maximum rigidity when the units are assembled. It is also desirable to coat the wood, after assembly, with a marine paint or varnish for protection from the weather.

In constructing and testing this antenna, it was found that the placement of the coaxial cable feeding each antenna was critical from the standpoint of minor lobe radiation. The top antenna in a stack does not present any problem when the cable is brought away from the antenna inside of and below the ground radials. The

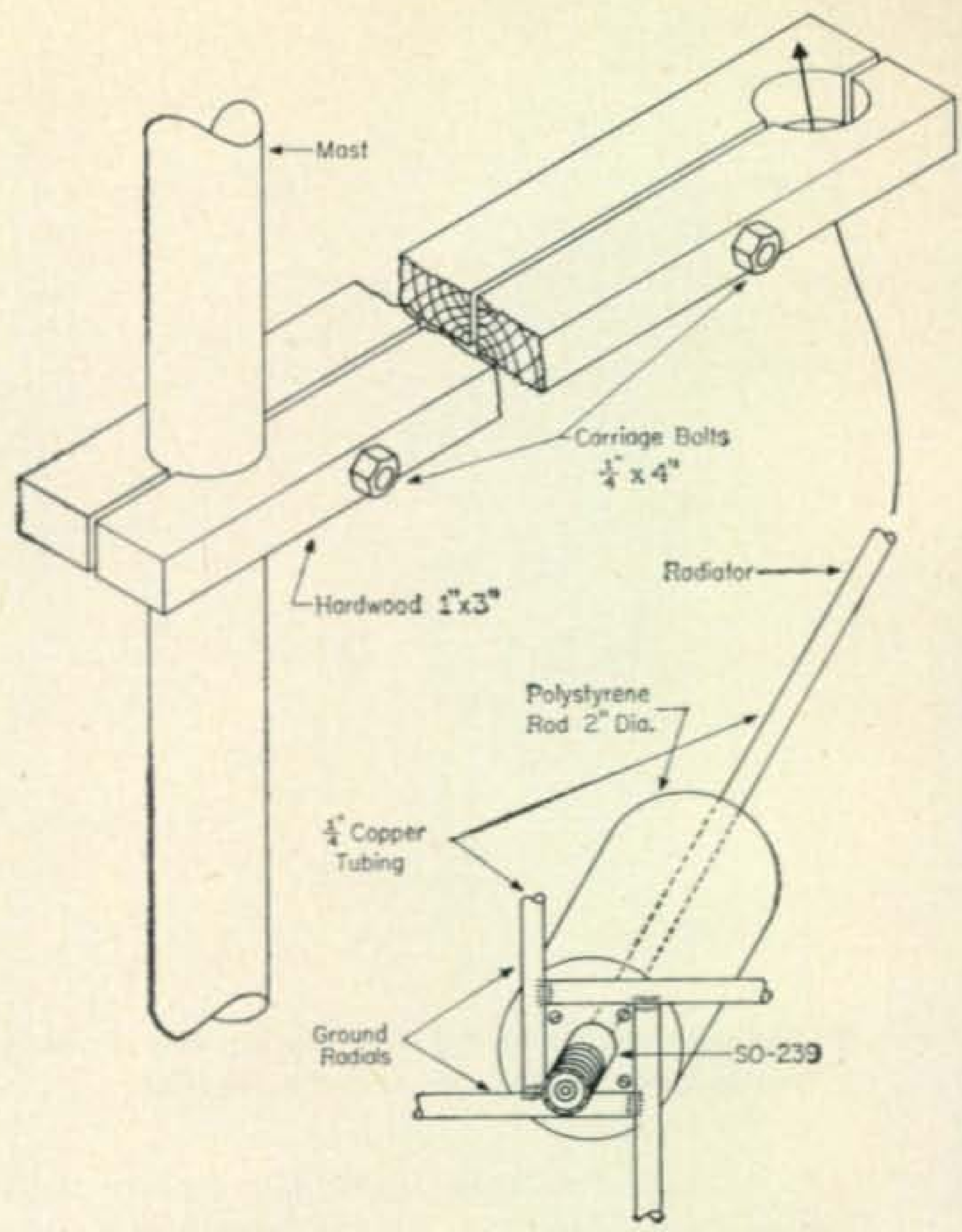


Fig. 5—Antenna construction and mounting details. The SO239 connector is mounted on the copper plate and self-tapping screws secure both the connector and copper plate to the polystyrene rod. The antennas are secured to the mast by the 1" × 3" hardwood clamp shown above. The clamp is drawn together by the ¼" × 4" carriage bolts.

bottom antenna in a stack is a bit more critical. Minor lobe radiation may be minimized by running the feed cable down the mast as far as length will permit and then up under and through the ground radials.

It is possible to obtain greater reduction of minor lobe radiation by using one of the newer coaxial cable equivalents of RG-11/U and RG-8/U that use expanded polyethylene foam for a dielectric material. These cables have a velocity factor of about 0.80 which brings their physical length closer to their electrical length when used as *Q* sections. An increase in the physical length of these sections will allow the placement of the feeder cables to make minor lobe radiation negligible thus resulting in additional gain and more uniform radiation patterns.

During tests of this antenna system, a simple piece of test equipment was developed together with a procedure for measuring antenna gain that should be within the capabilities of most amateurs both from a technical and financial standpoint. It is planned to make this the subject of a future article.

Afterthoughts

Electrical tests in connection with the adjustment of the ground radials can be made in a number of ways. These include measurements of forward power and reverse power with the transmitter connected to the antenna or impedance measurements using an r.f. impedance bridge.

[*Continued on page 130*]

Concluding Thoughts and Suggestions on a Forthcoming Frequency Conference

BY WILLIAM I. ORR*, W6SAI

THE first part of this article discussed the position of amateur radio in regard to the International Telecommunication Union and drew an important distinction between the *Amateur Radio Service* and *Public Service*, two terms that are often confused in the minds of both the radio amateur and the interested public. Finally, the defense of vital frequencies by the radio astronomy group at the last Space Communications Conference of the ITU was noted, with reference to the successful defense of a special interest by a small, well organized non-governmental group operating within the framework of the conference.

The Defense of Amateur Radio

Active steps must be taken, and will be taken to protect amateur radio. The first step is to insure that our house is in order and that amateur radio in the United States is of such value to the public that it will warrant full and enthusiastic support of our own government. *In other words, our defense begins at home—in our own bands and in the structure of amateur radio!* Radio amateurs must live up to the *service* connotation which is the philosophy of the Amateur Radio Service.

First and foremost, radio amateurs must conduct themselves as befitting a formal communications service as recognized and defined by the ITU. So acting, the amateur radio service retains the use of a large portion of the h.f. spectrum at the present time. In fact, amateur radio is the third biggest user of h.f. spectrum space—which is occupied by more amateur stations than the total of broadcasting and fixed services stations combined! There exist nearly 400,000 amateur stations in the world, with about 265,000 of them in the United States. The amateur radio service has a proud record of past history and accomplishments as a service, blazing a trail into v.h.f. and h.f. communications. Project OSCAR and recent trans-oceanic v.h.f. communications are but two examples of the service aspect. Amateur radio must remain strong in this concept and mere numbers of "communicators" or "appliance operators" will not save the day when the yardstick of performance is the ITU-defined philosophy.

While individuals may only be interested in "ham radio" as a communications hobby, the amateur fraternity as a whole must observe and adhere to the formal amateur radio connotation, as this is the only facet of amateur radio recognized by the ITU. Moreover, this formal image must be properly presented to the general public in terms of public self-interest.

The overall trend in the United States during the past decade has been away from the proper service aspect, with undue emphasis placed upon the pleasant hobby of communications. This trend is hazardous, and present indications are that such a fact has been recognized and that the trend, indeed, is slowly being reversed as more and more amateurs take cognizance of the situation.

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Of necessity, we must face our responsibilities to ourselves (and to overseas radio amateurs) and take necessary actions, forthwith, to strengthen and enhance the amateur radio service. The radio amateur must, in his own self-interest, occupy the position of a public-spirited citizen, presenting the picture of wholesomely active, youth and intelligence and successful business and professional people in all walks of life.

The Amateur Radio Pedestal

United States amateurs compose two-thirds of the world's amateur population. What we do, therefore, creates the principal impression of amateur radio throughout the world. With our kilowatt power limit and our fine equipment, the voice of the U.S. radio amateur is predominant on the DX bands. This predominance has its dangers, as the picture of a communications hobby dominated by Americans is not a particularly wise one to project to other countries.

Like it or not we (meaning the United States) have but one vote at any conference debating the fate of the h.f. amateur bands. We must, therefore, ask other countries to join the United States in the battle for the preservation of amateur radio, as one vote won't do the job! Moreover, we must make sure we have the support and the respect of our own government for this important undertaking. Facing this sombre challenge, it seems obvious to me that United States radio amateurs bear a heavy responsibility to place our own service on as high a pedestal as possible so that other countries (as well as our own), observing our conduct, deportment and goals, will say: "That's worth my vote!" *In this regard, it is painfully obvious that no country will vote for an American communications hobby, but many countries will support an amateur radio service worthy of the name, and that is a valuable communications asset!*

The following proposals, then, are my thoughts on how best this difficult undertaking may best be accomplished and represent some of the steps that may possibly be considered to improve the status of amateur radio, at home and abroad.

Our problem is two-fold: amateur radio must be strengthened here at home, and support must be given to those societies in other countries to accomplish the same program in their own individual way. Intensive efforts at self-improvement coupled with an effective public relations program point the way to an improvement of the overall amateur radio service. Looking at home first, it would seem that our task is to increase the evidence supporting amateur radio's real and actual service to the public, in line with ITU philosophy.

In particular, the public impression of the radio amateur must be upgraded from that of "the nut down the street that interferes with 'Gunsmoke' ", or of a group of eccentrics, self-consumed with certificates and contests, playing with a communication toy—. This image must be upgraded to that of a group of dedicated citizens: an impressive gathering of intelligent and successful enthusiasts engaged in a comprehensive program of self-improvement and education.

Distasteful as this may seem to hams, unless this impression is soberly conveyed, we could end up with a half-million radio amateurs, but with a public (including Congress and the FCC) unconvinced that we should be licensed at all! This upgrading process demands a thorough public relations program: *how many non-amateurs ever read* QST *and* CQ? We must reach far beyond our own organizations—to the public at large—to attain this goal.

The Voice of Amateur Radio at Home is the ARRL

Backed by a record of 50 years of successful defense of amateur radio, the American Radio Relay League remains the proper body to serve as the force of a new, determined effort to create the recognition of amateur radio as indispensible to public welfare. There is no substitute for the experience of time and participation in international and domestic affairs, and the ARRL has been "on the job" since the inception of amateur radio. It is the sober duty of all radio amateurs in the United States to support the ARRL and make it a stronger, more effective representative of all radio amateurs. The fact that only about one-half of present licensed amateurs are ARRL members weakens the effectivenss of the League. Increased membership and the intelligent chioce of top-grade amateurs as Directors will keep the League strong and healthy.

At the same time, radio amateurs must beware of divisive efforts aimed at weakening the League and splitting amateur radio. Spurious "Institutes" and "Societies" purporting to represent the radio amateur, and who offer easy solutions to difficult problems should be carefully examined. Doors now cordially opened to representatives of amateur radio may be slammed shut if irresponsible parties appear on the scene, frothing pious platitudes as they do long-term damage to the prestige and status of amateur radio.

There is no doubt that a "loyal opposition" is required in amateur radio and is healthy for the ARRL. Radio amateurs are indeed fortunate that *CQ* adopts this position, offering constructive criticism when needed, and trustworthy support on matters worthy of consideration. Prejudiced obstructionism within the ranks of amateur radio, if unchecked, may prove to be the "Trojan Horse" for us all!

A Self-improvement Program

Various undertakings should be considered by the ARRL as a portion of an overall radio amateur self-improvement program:

Creation of an ARRL Scholarship. To emphasize the worthiness of amateur radio among educators and to simultaneously support worthy radio amateurs, an ARRL scholarship to a technical college or university should be created and granted on a competitive or honorary basis to one or more young radio amateurs each year. There is no reason why this effort cannot be expanded to include scholarships sponsored by large radio clubs in major cities. Surely friends of amateur radio—and radio amateurs themselves—would join hands in providing funds to make such a worthy program a reality! Thus amateur radio would directly aid those young amateurs, the leaders, scientists, engineers and professionals of tomorrow who, perhaps because of lack of funds or opportunities, cannot achieve the education they deserve.

Creation of Service Awards and Recognitions. Certificates and awards currently available for DX achievements and contests are but a form of competitive recognition of the "sport" of amateur radio. Such awards create interest, but should not be allowed to degenerate into "paper-hunting" activities that are ego-satisfying only to the recipient and the giver. Another form of recognition would be *merit awards* for those radio amateurs that render outstanding public service, are leaders in the field of self-training, or render outstanding technical investigations. Merit awards brought to public attention through civic meetings, local newspaper's in the radio amateur's community, broadcasting and TV media, and such organs of wide communication would immeasurably contribute to the stature of the radio amateur in the eyes of his fellow citizens. Awards for technical ability (as opposed to awards for operating feats of survival in an extended contest) could go a long way toward upgrading the impression of amateur radio in the public mind.

Creation of a Public Service Department in the ARRL. Few citizens other than amateurs read *QST* or *CQ*. A Public Service Department for amateur radio can accomplish much if responsibly run. Regular press releases covering radio amateur activities could be undertaken. Mailings should include the press, radio and TV stations, the FCC, and other influential bodies. Much happens in the world of amateur radio that is newsworthy, but that is never known outside amateur circles because of the lack of suitable public relations machinery. Those who hear the "bad" side of amateur radio must be given the opportunity to hear the "good" side as well. Above all, amateur radio must speak with a clear, truthful voice, avoiding slander, unfounded rumors and equivocal statements if it is to survive.

In the Public Service field, it would seem to me that material in *CQ* and *QST* devoted to gossip, contests and individual activities may well be placed in an auxiliary news-sheet, permitting more magazine space to be used for worthy public service news, technical material, and overseas articles of interest. Appointment of overseas radio amateurs as news correspondents for *QST* would do much to infuse an international aspect into that publication, sorely missing today. *QST* must have "a nose for news" of amateur radio, and be an opinion maker and news vehicle, rather than a passive mirror of the events of yesterday.

Replenishment of the Reservoir of Technicians Within Amateur Radio. Amateur radio, in the past, has been the traditional reservoir of trained technicians and engineers for the electronics industry. *This reservoir has gradually and steadily decreased in the past years until the electronics industry can no longer depend upon amateur radio as a source of potential technicians and engineers.* Although the electronics industry is in a chronic shortage of trained technicians and engineers, by and large, applicants for these jobs are not coming from the ranks of the radio amateur. Amateur radio remains one of the best possible vehicles of introduction to the field of electronics, and the intellectually curious and scientific-minded youngster could seek no better interest or avocation. For this reason, the amateur radio service must be regarded as a valuable national resource, and must be encouraged in proper growth and expansion. Amateur radio must serve as a vehicle for education and a natural pathway into the advanced sciences. Proper guidance and incentive will make such a task easier, and will prevent this natural body of interested amateurs from deteriorating into a shapeless mass of communicators of questionable value. *Means must be provided for serious amateurs to better themselves, and recognition must be given to those amateurs who have exerted the necessary discipline to advance themselves in the field of electronics.* Some form of training program for interested radio amateurs must be worked out, whereby they can advance from amateur radio into the intellectual and technological facilities of this nation.

Creation of a Documentary Film on Amateur Radio. A documentary film on amateur radio will tell the story of this valuable service to the world in the most effective manner to mass audiences in countless countries. It can be presented to millions in cinema audiences and on television and to relatively small but influential groups in Congress and national and international regulatory agencies. Translated into various languages, the story of the amateur radio service could reach vast potential friendly audiences overseas in an effective and forceful manner. Such a film would capitalize upon the vast international reservoir of public approval for improved people-to-people communication and exchange of ideas. In addition, it would build upon mankind's increased recognition of the need to improve contact and understanding among peoples of the world. In identifying ourselves with the self-interest of these citizens who directly influence our future, we have an invaluable basis upon which to build the survival and future growth of amateur radio.

These, in fact, are some of the pressing reasons for constructive support for the concept of incentive licensing, as this proposal falls directly in line with achieving a high "image" level. *As long as the U.S. licensing standards fall below the standards of the majority of other ITU administrations* (as they do now) *the picture of amateur radio in this country adhering to the ITU connotation is unconvincing!*

Amateur Radio in the Peace Corps

It would seem to me that the Peace Corps is an ideal vehicle for *amateur radio to help itself by helping others.* Many emergent countries in this world are leaping from the age of smoke signals to the age of microwave communications without pausing to pass through the telephone and telegraph age. They sorely need trained engineers who can assist with this burden of communications. Where but in the ranks of amateur radio can such a body of trained individuals be found in a minimum of time? U.S. citizens workng through the Peace Corps are assisting many nations in other phases of their development, why should amateur radio not assist as it may in this worthy undertaking? Surely radio amateurs must exist in this country who have the necessary combinations of adventurous spirit and will help others who, *if given the chance* could make their contribution to a better world through activities in the Peace Corps.

Rapid communications may be set up by means of radio amateur activities and training classes in theory, code and communications techniques could aid in modernizing facilities of many countries in all parts of the world.

The February, 1964 issue of *QST* magazine (page 10) heralded the formation of S.P.A.R.C.S. (Society for the Promotion of Amateur Radio Communication Services) formed to "promote amateur radio in areas of the world where there is now little ham activity". The organization would "provide educational material and equipment to encourage would-be foreign hams". It was noted that "several ARRL officials are on the Board of Directors of SPARCS and *QST* will carry more about the society as its program develops". Alas, as of this date (late September) nothing about future SPARCS efforts has appeared in *QST*. It is hoped that this organization can and will fulfill some of the opportunity that lies before it and that its activities will be reported via *QST*.

The Voice of Amateur Radio in the World is the IARU

The International Amateur Radio Union is an association of national amateur radio societies united for the common purpose of coordinating and fostering international two-way communication. Born in 1925 as a brainchild of the late H. P. Maxim, the IARU has grown until it now numbers 60 member societies. A quarterly bulletin, *The IARU Calendar* is published by the Headquarters Society (the ARRL) and is sent to all member societies. As outlined earlier in this article, the IARU is the spokesman of amateur radio before the ITU and, in this role, should be strengthened and supported by all member societies. Various suggestions are made herewith to achieve this aim.

The IARU should be expanded into an active, operational body. The IARU could well be expanded into a supra-society that represents world-wide amateur radio. Aside from a gathering of representatives at the ITU deliberations, the IARU today represents (through the pages of *QST*) a picture of little more than a collection of QSL bureaus. The IARU societies in Europe, however, are banded together for mutual protection of amateur frequency allocations in Region 1, and a similar operation is in process for Region 2 (the Americas). Such an action should be planned for Region 3 (Australasia) to pave the way for united action in all regions.

Consideration might be given to creating an IARU headquarters *outside the U.S.A.*, staffed with sufficient full-time or part-time employees to form a working organization. The staff, preferably, should not be a majority of U.S. amateurs so that the charge of "U.S. domination" is not raised. Among its duties, the IARU headquarters could perhaps supervise and make order out of the chaos of international contests, awards and recognitions. Perhaps the DXCC award should be an IARU award (as is the present WAC). By whatever formal means, the IARU should be expanded from a casual "union" of societies into an international body charged with representation of the Amateur Radio Service before international regulatory agencies. The umbrella of the IARU should be a permanent protective canopy, financed by the various national radio amateur societies. The IARU should conduct a worldwide information and public relations program designed to acquaint peoples with amateur radio. An IARU scholarship should be created, and the IARU should encourage formation of national amateur radio societies in the newly emerging countries. Equipment should be provided to assist these societies to maintain a club station, and to assist worthy amateurs to get on the air. The IARU should provide information and assistance for such groups to inaugurate self-training programs in communications with the intent of forming a backbone of communications experts well versed in amateur radio. The self-education aspect of the amateur radio service is a great, persuasive force that may emphasize the tremendous natural resource inherent in the radio amateur—a resource that is vital to countries deficient in communication experts! *Amateur radio is the short, direct route to the creation of self-trained communication and electronic experts for emergent nations.* It should be the task and duty of the IARU and the national societies to make this asset available to these countries.

In addition, the IARU can coordinate and supervise a world-wide monitoring program to discover, log and report to the ITU those radio intruders in the amateur bands. This program (already in existence in several countries) can help to protect radio amateur allocations since intruders, if not recognized by a formal complaint seem to gain "squatter's rights," as they can then attest that their continued operation causes no interference, as no complaints have been filed! A formal IARU monitoring program, therefore, would give unity of purpose to all radio amateurs to log and identify such invasions of our bands.

* * * * *

These, then, are some possible actions brought forth to provoke discussion of the future of amateur radio. We must move ahead and continue to provide the traditional "forward look" that has been the fountain-head of amateur radio in the past. Amateur radio must be the broad, training ground for the youth of tomorrow in the exploding electronics world. Amateur radio must provide the technicians and experts for the world of tomorrow. Amateur radio must aid those *today* who look to this avocation for learning.

It is my belief that only by creating and maintaining a communication service, faithful to the ITU concept of amateur radio and properly presenting this picture to the world, may we survive in this intensely competitive world.

Over the foreseeable future, human communications must struggle along in an imperfect world, bolstered by hopeful but imperfect ideas; created, modified and bargained over by an imperfect society of fallible men. Amateur radio will play its fateful part in this panorama. May the next Telecommunications Conference aid man's attempt at communication with himself and hasten the day of more efficient usage of one of nature's most awesome gifts: the radio frequency spectrum! ■

Other articles along the same line by W6SAI can be found in the July issue of CQ, page 49; September, page 38; and October, page 47, all this year. They are all recommended as worthwhile reading.

Stabilized Regenerative Detector

BY WARDELL SMITH,* W2BRQ

The regenerative circuit has been used mainly as a Q multiplier. This stabilized circuit permits its use as a first or second detector to hop up those marginal receivers.

FROM 1918 until the late 1920's the regenerative receiver was the main stay of both commercial and amateur reception until it was replaced by the superheterodyne. A great many attempts have been made to incorporate regeneration into the superheterodyne receiver, the purpose being to increase the selectivity and sensitivity of the receiver. Regeneration has thus been added to the mixer circuits, to the i.f. strips, in the form of regenerative second detectors, and as Q multipliers. The most popular was and is the Q multiplier. The difficulty with any form of regeneration circuit, however, is stability.

The Q multiplier is usually added as a parallel regenerative circuit placed at the front or beginning of the i.f. strip, usually in the first i.f. stage and then usually in the grid circuit of that stage because this is the first point in the receiver in which tuning is fixed and where the signal is weakest. When the Q multiplier circuit is adjusted for maximum selectivity and sensitivity, that is, just before it breaks into oscillation, the best results are obtained. As the strength of the received signal increases, the effective regeneration decreases and hence the selectivity decreases also. This means that even while the tuning is fixed, the feed back is not, so that different degrees of signal level require different settings of feedback in the Q multiplier.

If regeneration is added to the mixer, where the signal is still weaker than the grid of the i.f., another difficulty is encountered. The performance of the mixer stage is altered by its tuning and by the change in strength of the injection voltage from the local oscillator as the receiver is tuned through the band.

If regeneration is employed in the second detector circuit, the great changes in signal strength completely defeat the regenerative action. It was at first thought that the beat frequency oscillator could be eliminated for c.w. reception and an oscillating second detector employed, but for the reason just stated, this proved to be impractical.

The circuit (fig. 1) to be described can be employed in any of the aforementioned positions, first detector, i.f. or second detector, and when once adjusted, will require no further tinkering. It is simple, straightforward, and has seen a great many hours of service in all of its described forms. It will improve any receiver and maintain a constant performance over a signal input variation of 25 to 30 db.

Q Multiplier

Application of this circuit as a stabilized Q multiplier is as follows: One glance will show

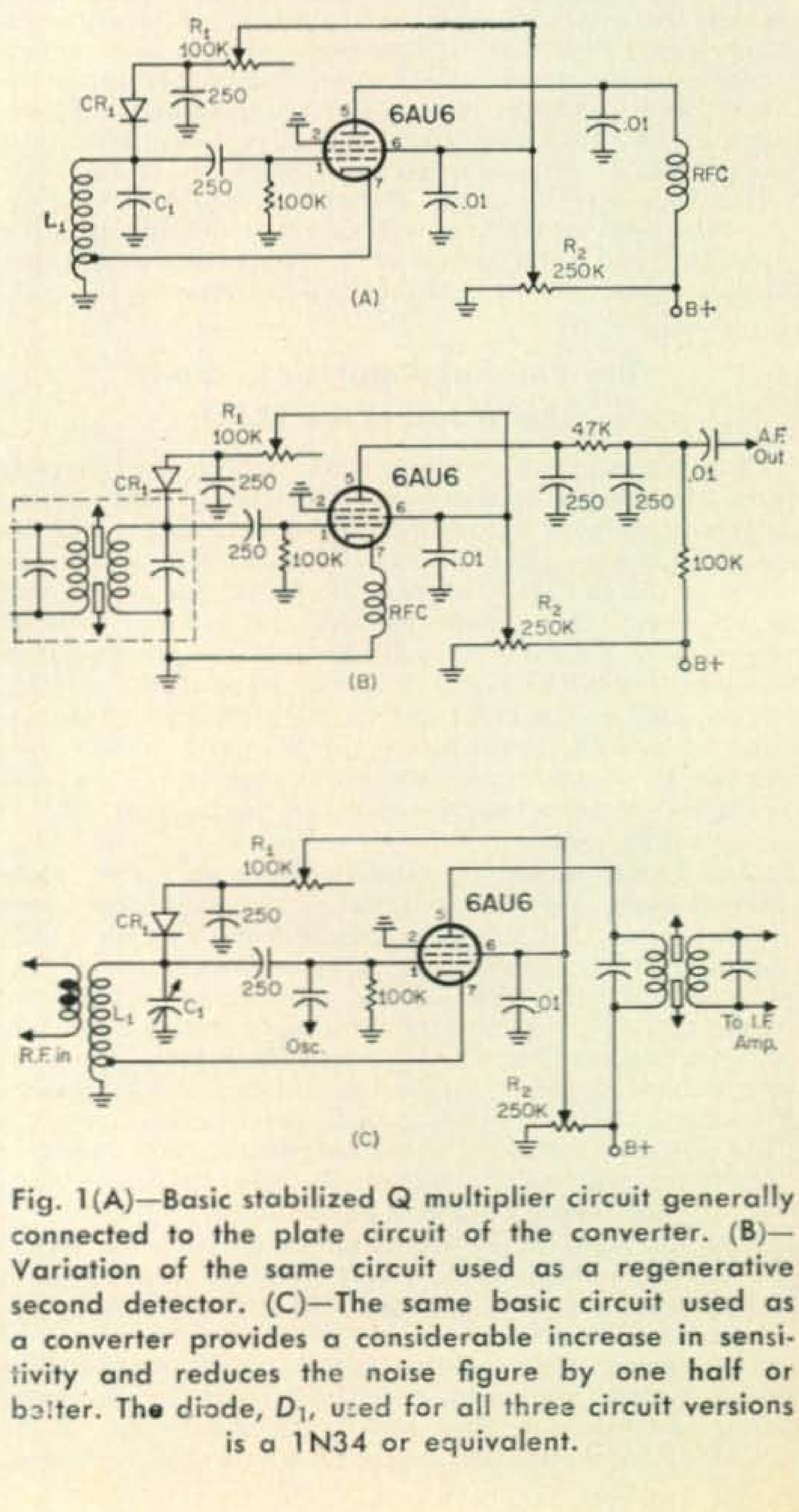

Fig. 1(A)—Basic stabilized Q multiplier circuit generally connected to the plate circuit of the converter. (B)—Variation of the same circuit used as a regenerative second detector. (C)—The same basic circuit used as a converter provides a considerable increase in sensitivity and reduces the noise figure by one half or better. The diode, D_1, used for all three circuit versions is a 1N34 or equivalent.

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that the circuit is the familiar Hartly oscillator. Components L_1 and C_1 are tuned to the frequency of the first i.f. stage and coupled in the conventional manner for a Q multiplier. Regeneration is adjusted by the control R_2. When the arm of the pot is brought to ground, the circuit is non-regenerative and completely inactive. As the arm is brought towards B plus, the circuit becomes regenerative and then oscillatory. This is old hat. Everybody knows about it.

But now, we will stabilize the circuit so that its performance will be constant. Control R_1, 100,000 ohms, is added along with diode D_1. As can be seen, the diode is connected to the hot end of L_1 back to the screen grid of the pentode through a 100,000 ohm pot, R_1, and bypassed to ground by a small capacitor of 250 mmf. The diode is polarized so that a voltage appearing across the 250 mmf will produce a negative voltage on the screen grid. With the maximum value of R_1, R_2 is advanced until oscillations occur. It is then advanced further, about another 10%. At this point an a.c. voltage is being developed across L_1 which is producing a negative bucking voltage on the screen grid. If this negative voltage is increased by decreasing the value of R_1, a point will be reached where oscillations cease. In other words, the regeneration can now be controlled by adjusting R_2. Obviously, the voltage developed by the diode D_1 and applied to the screen through potentiometer R_1 will now control the feedback. As the voltage developed across L_1 by its own oscillations is the source of energy supplying the diode, the circuit will go into and out of oscillations at a superaudible rate, maintaining itself on the threshhold something like superregeneration but in reverse. While superregeneration goes way beyond the point of oscillations, this circuit merely goes up to the point of oscillations and then out. It is obvious that the relatively small signal received from the air can now have no effect upon the stability of the circuit, so that one adjustment and only one is required.

Second Detector

To employ this circuit as a second detector, some slight variations will be in order. As most i.f. transformers do not have a tap for the cathode, it will be necessary to place a choke between the cathode and the ground as shown in fig. 1B. The value of this choke will depend upon the i.f. frequency and a little experimentation will provide the exact value. It should have an inductance of approximately 50% of that of the i.f. transformer as it has no shunting capacity to tune it. If it is desired to use the circuit as a second detector in an oscillating condition for c.w. reception, and eliminate the b.f.o., it is only necessary to adjust R_1 to just beyond the point of oscillation with no signal or a weak signal present. Incidentally, this will make a very good receiver with only one i.f. stage!

Mixer Operation

If it is desired to use the circuit as a mixer, all that is necessary to do is to employ L_1 and C_1 at the signal frequency, that is, the band on which you wish to operate, preceded or not by an r.f. stage or stages. Also, remove the plate resistor and place the primary of the first i.f. transformer of the receiver in the plate circuit. This is shown in fig. 1C. Adjust as explained in case 1. You will increase the sensitivity of the receiver ten fold and reduce its noise figure by one half or better.

Any pentode can be used, but the voltages and parameters will depend on the individual mechanical arrangement such as the length of leads, the physical size of the bypass capacitors, the *LC* ratio of the tank circuit and its *Q* and type of tube. The values given in the diagram are representative and for a 6AU6. This circuit has been used for a great many years by the author and many receivers have been converted to use it. ■

New Amateur Products

Hammarlund HQ-88 Receiver

A NEW addition to the Hammarlund line is the HQ-88 receiver. The HQ-88 covers all popular ham bands — 10 through 160 meters — including MARS, Citizens Band, WWV, and Marine band. It offers 262 kc 2nd i.f. with selectivity of 2.2 kc for s.s.b., 5 kc for a.m. and a 3:1 selectivity curve shape factor to 60 db down. The sensitivity is 0.75 microvolt for a 10 db a.m. signal-to-noise ratio and better than 0.40 microvolt for s.s.b. and c.w. The thermal drift is rated at no more than fifty cycles after a short warmup. The dimensions are 15" W. × 7¾" H. × 10½" D., and it weighs about 17 pounds. Speaker is optional. The price for the HQ-88 is $299.00. For more information, circle B on page 142.

50 Mc Propagation Effects

Summary Report On A Five-Year DX Study

BY MORGAN MONROE*, K7ALE & DOROTHY MONROE*, K7ALF

The following is the second report based on 6 meter observations made almost continuously during the past five years. An interim report was published in CQ in 1962.[1] The observations cover daily, seasonal and sunspot trends in DX propagation on 6 meters. It is one of the most comprehensive studies ever undertaken by amateurs using regular amateur equipment.

A FIVE-YEAR investigation of propagation effects in the 50-54 mc frequency range was completed by the authors at the end of 1963.

This summary report covers results of study conducted between November 1, 1958 and January 1, 1964; it extends and expands the interim report previously published in *CQ*.[1] Data acquired since January 1, 1962 are in many respects the most significant of the entire study.

Our investigation was accomplished under average amateur operating conditions in an effort to gain accurate, long-term information concerning v.h.f. propagation effects about which little was known with certainty in the past. Considerations that shaped the course of investigation were:

1. Desire to learn, *under amateur operating conditions,* how the 50 mc band was affected by declining solar activity following the all-time record sunspot maximum of 1958, including percentage relationship determinations of "open" band time to total and monitored time.

2. An effort to accurately observe and record the number, duration and path directions of 50 mc band openings via both F_2 and "short skip" types of propagation from a fixed location during the declining years of sunspot cycle 19.

3. Desire to determine the distribution of 50 mc DX opportunities by geographical source, season, number, time of day, and duration, using only low-powered transmitters and types of receiving and antenna equipment readily available to any v.h.f. operator.

4. An attempt to determine the possible relationship between declining solar activity and sporadic-*E* (E_s) propagation effects in the 50-54 mc frequency range.

5. The hope that our work perhaps would encourage other v.h.f. operators to undertake similar research in their respective regions.

The Study Site

The first five months of investigation took place from an urban location in Phoenix, Arizona. After May 1, 1959 the study was continued from a location near Tucson, Arizona, at latitude 32° 20′ 34″ N, longitude 110° 59′ 21″ W. This station, at an elevation above mean sea level of 2,485 feet (757.42 meters), is 100 air-line miles (160.9 kilometers) southeast of the initial study site and 70 miles (112.7 kilometers) north of the Mexican border.

Nearby mountains ranging in elevation to 9,432 feet (2874.87 meters) are northeast, east, and southeast of the study site. The nearest peak, eight miles (12.9 kilometers) to the northeast, has an elevation of 7,950 feet (2423.16 meters). Another peak 13 miles (20.9 kilometers) to the northeast is 9,185 feet (2799.58 meters) above sea level and 6,700 feet (2042.16 meters) above the study site.

As planned originally, the investigation was to continue through the year 1964. That projection was based on assumption that the lowest point of sunspot cycle 19 probably would occur in the spring or summer of 1965. Before the end of 1963, however, there was indication that the low point of the cycle probably would be recorded earlier.

The Swiss Federal Observatory at Zurich, international center for sunspot observation and data compilation, reported appearance on August 28, 1963 of the first cycle 20 sunspot. At least two additional cycle 20 spots were observed later in 1963. As the low point of a cycle is

*7522 Ellison Drive, Tucson, Arizona.

[1]Monroe, M., Monroe, D., "50 Mc Propagation Effects," *CQ*, June 1962, p. 37.

Table A—Comparative Summary—Nov. 1, 1958-Jan. 1, 1964

	1958 2 mos	1959 11 mos	1960 12 mos	1961 12 mos	1962 12 mos	1963 12 mos	Total Or Avg.
Yearly mean sunspot number	184.8	159.0	112.3	53.9	37.5	27.9	—
No. monitored days	61	335	366	365	365	365	1,857
No. days band opened	45	99	126	101	113	109	593
No. band openings	70	121	169	140	152	156	808
Total minutes band opened	6,167	14,797	16,326	21,316	25,594	26,494	110,694
Avg. duration of openings (mins.)	88.1	122.3	96.6	152.3	168.4	169.8	137.0
% open to monitored time	11.23	4.90	4.96	6.49	7.79	8.07	6.62
% open to total time	7.02	3.07	3.08	4.06	4.87	4.79	4.12
% open to monitored days	73.77	29.55	34.43	27.67	30.96	29.84	31.93
Avg. no. openings per open day	1.51	1.22	1.34	1.39	1.35	1.43	1.36
No. states heard/worked	19	42	30	46	44	40	50
No. foreign prefixes heard/worked	18	11	15	7	10	6	40

known to occur approximately one year after appearance of the next cycle's initial spots, the Zurich report indicated that the cycle 19 low probably would occur in 1964 instead of 1965. In view of this possibility our study was terminated at the end of 1963, thereby assuring that findings would reflect only data acquired during the downcurve of cycle 19.

Study of Decline

Our work, therefore, covers a 61-month period of declining solar activity beginning below the 1958 maximum of cycle 19 and ending before the possible 1964 low. Results are not associated with propagation conditions existing during either the highest or lowest periods of the cycle, but with *effects prevailing during intervening years of steady decline.*

The investigation was based on daily 15-hour monitoring periods between the GMT hours of 1400 and 0500 (7 A.M. to 10 P.M. MST). The study covered a total of 27,855 monitored hours between November 1, 1958 and January 1, 1964. No observations were recorded in the month of April, 1959 for a reason discussed elsewhere.

In the total of 1,857 monitored days the six meter band opened during 593 days. A total of 808 band openings was observed and recorded.

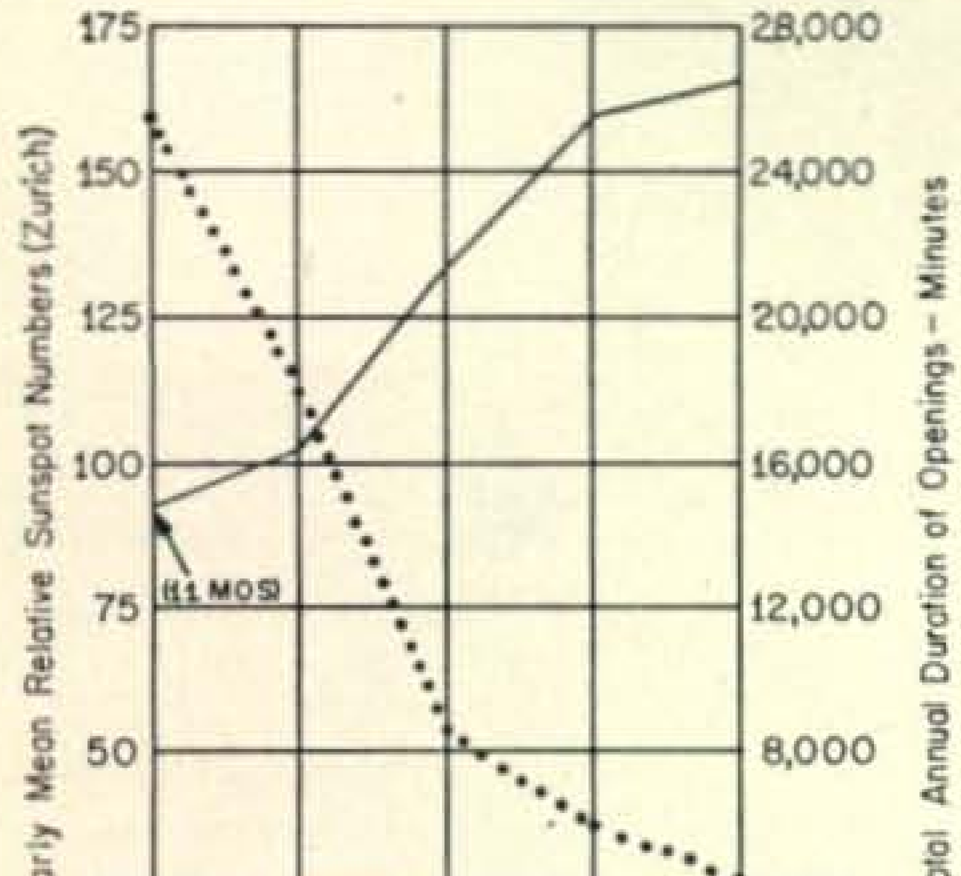


Fig. 1—Relationship between annual duration of 50 mc band openings, in minutes, and yearly mean relative sunspot numbers as determined by the Swiss Federal Observatory at Zurich. Solid line indicates annual duration of openings (read on scale at right); dotted line indicates yearly sunspot numbers (read on scale at left).

The aggregate duration of the 808 openings was 110,694 minutes (1,844.9 hours). Therefore the average number of openings per day of opening was 1.36 and the average duration of openings was 137 minutes (Tables A, G, H, I and J).

Our records show that the six meter band opened to areas outside of Arizona at some time within daily monitoring periods during 56 of the 61 study months and 593 of the 1,857 monitored days. This represents available 50 mc DX during 91.8 per cent of the total study months and 31.9 per cent of the total study days (Tables B and C).

The investigation also indicated that the band opened between south-central Arizona and regions *outside the continental United States* during 38 of the 61 months. This represents available *foreign* DX opportunities in 62.3 per cent of the total study months (Tables B and D).

Inverse Relationship

The study demonstrated clearly that in the declining years of cycle 19, F_2 propagation effects diminished as anticipated but there persisted a marked *inverse* relationship between sunspot activity and available DX communication time in the 50-54 mc frequency range via E_s propagation. As sunspot numbers and F_2 supported DX declined steadily, 50 mc E_s-supported DX time *increased steadily* (fig. 1).

This finding is of particular interest because very little is known about E_s propagation or what causes it. The well defined inverse relationship between sunspot numbers and 50 mc E_s effects during five declining years of cycle 19 appears to be the most significant single determination of the study. It should be noted that the E_s trend continued upward throughout the investigation (fig. 1).

June is the highest 50 mc DX activity month at the study site. As all six meter DX in June is via E_s propagation at the location of the study, the month, therefore, offers a reliable index of the E_s trend from the summer of 1959 through the summer of 1963. The continuous E_s rise is shown in Tables E, G, H, I and J.

Significantly, the E_s-supported DX peak observed during the decline of cycle 19 was recorded in June, 1963, *more than five years after the March, 1958 sunspot peak.*

	1958	1959	1960	1961	1962	1963
Jan.	—	UF	UF	UF	US	US
Feb.	—	UF	UF	NO	NO	US
Mch.	—	UF	UF	UF	NO	US
Apr.	—	—	UF	US	UF	NO
May	—	US	UF	UF	UF	UF
Jun.	—	UF	US	UF	UF	UF
Jul.	—	UF	UF	UF	UF	UF
Aug.	—	UF	US	UF	US	US
Sep.	—	US	UF	US	UF	NO
Oct.	—	UF	UF	UF	UF	US
Nov.	UF	UF	UF	US	UF	US
Dec.	UF	US	UF	US	UF	US

Table B—Monthly DX availability by source. *US* indicates months with DX openings within the continental United States; *UF* indicates months in which both U. S. and foreign openings were recorded; *NO* indicates no openings.

Experienced 50 mc DX operators generally agree that the 1963 summer E_s season exceeded in DX possibilities anything observed previously in a comparable period of time. At the study site 99 band openings were recorded in the 91 day period May 16-August 15 (Table F). Reports from others indicated that conditions were even better in some areas of the United States.

Another revealing indication of the magnitude of E_s-supported DX activity during the 1963 peak is apparent in the 1.57 average number of openings per open day recorded during the 1963 summer E_s season (Table F). This average exceeded the 1.51 figure (Table A) recorded for the last two months of 1958, a period in which the frequent availability of three propagation forms—F_2, E_s and tropospheric—made new DX records possible for many six meter operators.

Challenging Question

Thus during the declining years of cycle 19 there was abundant evidence of a marked inverse relationship between the sunspot peak and the 50 mc E_s propagation peak. The persistence of that relationship throughout more than five years could not very well be attributed to coincidence. Whether such relationship is associated with all sunspot cycles or only with cycle 19 poses a challenging question that warrants additional investigation by v.h.f. operators. Long-term study of this kind conducted at various latitudes could lead to greater knowledge of the E_s propagation phenomenon and what causes it.

E_s propagation effects are known to vary considerably with latitude. Simultaneous, coordinated v.h.f. studies, for example, by operators in north-central Canada, the south-central United States and southern South America probably would contribute desirable knowledge of both the E_s phenomenon and its latitude variations.

The geographical distribution of DX recorded during the investigation extended from Southern Rhodesia westward to Australia and from Alaska to Southern Argentina. The most productive paths were those between 90 and 100 degrees (true), and between 60 and 70 degrees. After these in order of productivity were 330-340, 50-60 and 70-80 degrees (fig. 2).

These bearings, all centered on the study site a few miles northwest of Tucson, encompass most of the U. S. eastern seaboard, the midwestern, plains, southern and southwestern states, California, and the Pacific Northwest. More continental U. S. band openings were recorded between the study site and Texas than for any other state (Table C). This appeared to result from the fact that Texas is worked via both E_s and tropospheric forms of propagation. Evidence of atmospheric ducts was observed a number of times between south-central Arizona and southern Texas, particularly the Gulf Coast.

California, Oregon, Nebraska and Washington, in that order, were next in line among U. S. states heard/worked most frequently (Table C). Canada topped all out-of-the-U. S. regions, with Mexico, Argentina, Hawaii and Puerto Rico following in that order (Table D). Hawaii became a state in 1959; its fourth position as a non-continental DX source resulted from contacts both before and after statehood.

A large area of the world southwest of the study site contains virtually no six meter activity. This 90 degree quadrant of the Pacific Ocean between 140 and 230 degrees, as measured from the station location, extends approximately from the west coast of South America to New Zealand (fig. 2).

Pacific Phenomenon

Despite lack of 50 mc activity in this region, it is the apparent surface area underlying ionized layers which in spring and fall months often reflect six meter signals from several areas of the United States. Under such conditions, which at times continued for several hours, we worked six meter phone stations in the midwest, Texas and California via backscatter with the beam at 200 degrees. In no case could any of these stations be heard with the beam directly on them.

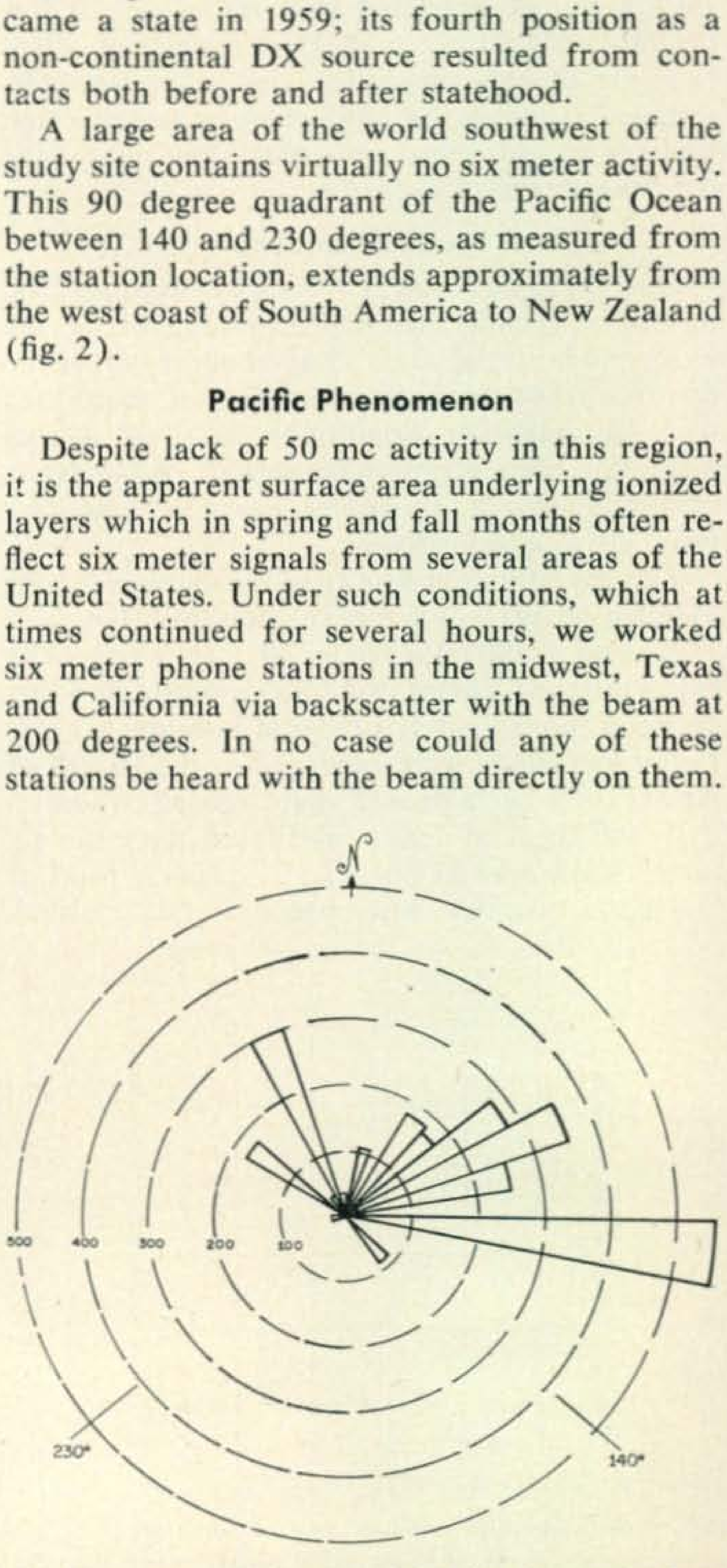


Fig. 2—Number of times states and/or foreign prefixes heard/worked by path direction. Directional segments are indicated in "true" 10 degree bearing increments centered on the study site near Tucson, Arizona.

	1958	*1959*	*1960*	*1961*	*1962*	*1963*	*Total Times H/W*
Alabama	0	1	0	4	10	9	24
Alaska	*	4	0	0	0	0	4
Arkansas	3	7	4	7	13	14	48
California	2	24	36	35	32	46	175
Colorado	0	7	12	20	14	18	71
Connecticut	11	0	0	1	3	0	15
Delaware	0	0	0	8	1	0	9
Florida	0	11	3	9	13	17	53
Georgia	0	1	1	3	7	9	21
Hawaii	*	6	1	0	0	0	7
Idaho	0	4	6	7	6	6	29
Illinois	2	2	0	0	3	3	10
Indiana	0	2	0	4	4	1	11
Iowa	0	9	3	10	23	20	65
Kansas	3	9	4	17	28	27	88
Kentucky	0	1	0	4	3	4	12
Louisiana	3	12	13	20	26	20	94
Maine	26	1	0	1	1	0	29
Maryland	0	0	0	4	0	0	4
Massachusetts	25	4	0	7	2	0	38
Michigan	0	1	1	3	2	3	10
Minnesota	0	8	4	12	6	11	41
Mississippi	0	4	0	2	5	5	16
Missouri	3	10	3	20	29	25	90
Montana	0	10	12	9	11	9	51
Nebraska	0	15	21	31	34	35	136
Nevada	0	7	7	8	3	6	31
New Hampshire	15	1	0	2	0	0	18
New Jersey	6	1	0	11	3	2	23
New Mexico	0	0	0	1	5	7	13
New York	7	0	0	6	4	3	20
North Carolina	2	2	1	3	2	6	16
North Dakota	0	7	5	7	3	1	23
Ohio	0	4	1	9	7	10	31
Oklahoma	3	18	15	26	33	31	126
Oregon	0	21	34	25	35	30	145
Pennsylvania	4	2	2	7	8	3	26
Rhode Island	15	0	0	1	3	0	19
South Carolina	0	2	0	2	1	4	9
South Dakota	0	7	8	17	16	16	64
Tennessee	0	4	4	4	9	7	28
Texas	12	42	74	72	85	85	370
Utah	0	3	1	2	3	6	15
Vermont	8	0	0	1	0	1	10
Virginia	1	3	2	8	2	4	20
Washington	0	21	30	22	31	29	133
West Virginia	0	3	1	5	2	2	13
Wisconsin	0	5	2	3	5	8	23
Wyoming	0	8	12	16	10	7	53

Table C—States heard/worked. Figures indicate number of times heard/worked. For those entries marked with an asterisk see the foreign prefix table.

Solid 50 mc backscatter contacts are unusual with low power. Those recorded at 200 degrees in spring and fall months appeared to be possible because signal levels invariably were higher and steadier in both directions than would be expected in "normal" backscatter communication. This suggests that seasonal ionized layers occurring over the Pacific along a bearing line projected from the study site toward the western Antarctic probably contain very high electron densities.

The 90 degree "Pacific gap" eliminates 25 per cent of the total possible DX-producing beam bearings at the study site (fig. 2). This condition together with the nearby mountain ranges makes the site far from ideal for DX operation.

Study findings indicate that more six meter band openings occurred between 0100 and 0400 GMT than in any other three hour period of the monitored day (fig. 3). These are evening hours throughout the United States.

Differs With Theory

Percentage breakdowns of openings by beginning times (to the nearest hour) indicate that more than 50 per cent of all recorded openings occurred after 5 PM local time and 41.83 per cent of the total occurred *after* 6 PM local time. In connection with this finding it should be noted that the totals include all of the frequent *morning* F_2 openings of late 1958 and early 1959.

Most of the openings recorded after the spring of 1959 were via E_s propagation. In view of this, the 41.83 per cent during five evening hours, as compared with 23.76 per cent in the five hour period centered on local noon, disagrees sharply with generally accepted propagation theory. As postulated in recent years, theory states that E_s propagation may occur at any time but that essentially it is a daylight phenomenon peaking *at or near midday.*

Our records indicate that there is considerably

	1958	1959	1960	1961	1962	1963	Total Times H/W
*CE3	0	0	1	0	0	0	1
CO2	0	0	0	1	5	0	6
*CT1	3	0	0	0	0	0	3
CX8	0	0	1	0	0	0	1
*EI2	4	0	0	0	0	0	4
FG7	0	0	0	0	0	1	1
HC1	0	3	2	0	1	0	6
JA1	1	0	0	0	0	0	1
JA3	1	0	0	0	0	0	1
JA4	1	1	0	0	0	0	2
JA5	3	0	0	0	0	0	3
JA6	1	0	0	0	0	0	1
JA7	1	0	0	0	0	0	1
JA8	2	0	0	0	0	0	2
KH6	8	4(See Table C after statehood					12
KL7	10	(See Table C after statehood)					10
*KM6	1	0	0	0	0	0	1
KP4	1	4	0	5	2	2	14
LU1	0	0	3	0	0	0	3
LU2	0	0	2	0	0	0	2
LU3	0	3	6	1	0	0	10
LU4	0	2	7	0	0	0	9
LU5	0	0	3	0	0	0	3
LU7	0	0	1	0	0	0	1
LU8	0	1	0	0	0	0	1
LU9	0	0	2	0	0	0	2
*PY6	0	0	0	0	1	0	1
VE1	33	5	0	0	0	0	38
VE2	4	0	0	0	0	0	4
VE3	1	0	0	1	1	0	3
VE4	0	1	0	1	0	0	2
VE5	0	0	0	0	2	0	2
VE6	0	0	2	5	4	5	16
VE7	0	2	1	0	4	2	9
*VK3	0	0	1	0	0	0	1
*VK5	0	0	1	0	0	0	1
VO2	7	0	0	0	0	0	7
VP7	0	0	0	0	1	4	5
XE1	0	6	8	11	16	4	45
*ZE2	1	0	0	0	0	0	1

Table D—Foreign prefixes heard/worked. Figures indicate number of times heard/worked. Those prefixes marked with an asterisk were heard but not worked.

more 50 mc E_s DX available in evening hours and much less at or near midday than theory suggests (fig. 3). Whether this condition was uniquely associated with the declining years of cycle 19 or is identified with all sunspot cycles is unknown. Again, only additional investigation can determine the answer. Here is another fruitful field of research for v.h.f. operators.

The accompanying tables and charts contain statistical results of our work. They do not, however, indicate the kinds of operating equipment with which these data were obtained, or the criteria that controlled investigation.

Equipment Used

The antenna in use throughout the study is a rotatable commercially manufactured 18-foot boom, eight-element Yagi type beam mounted 50 feet (15.24 meters) above ground in a suburban residential area. Transmission line, replaced twice during the study to avoid deterioration effects, is standard RG-8/U. Standing wave ratios never exceeded 1.4:1 and were in the range from unity to 1.2:1 most of the time. Computed net antenna gain after line-loss deduction was 10.6 db at resonance.

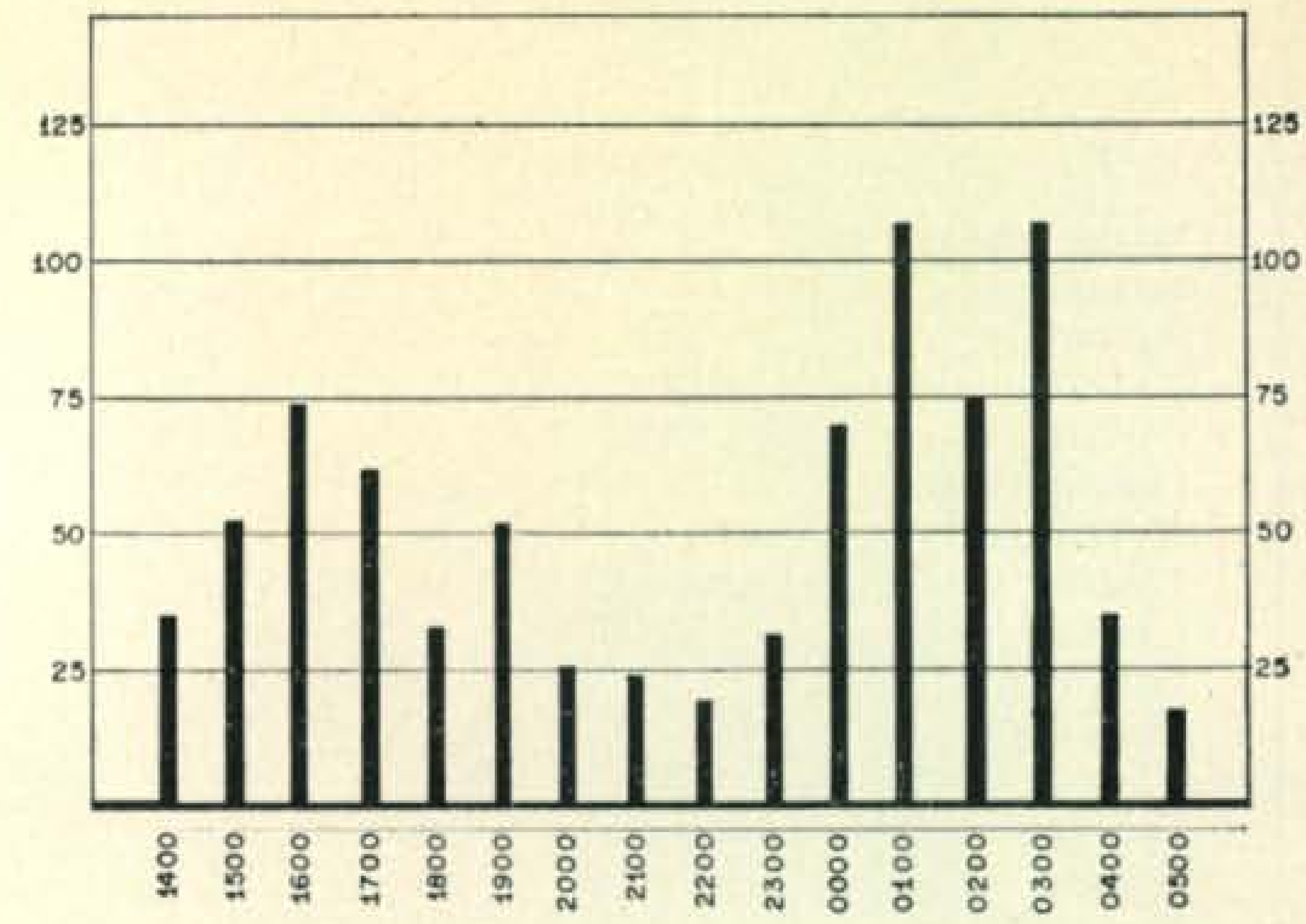


Fig. 3—Beginning time in GMT, to nearest hour, of the 808 openings recorded during the study.

An unmodified Communicator III transceiver with an output of approximately seven watts was used for transmitting and receiving during the first five months of the study. At times of heavy QRM the i.f. output of the Communicator was fed into a conventional communications receiver (HQ-150) for greater selectivity.

In the period May 1, 1959 through December 31, 1963 an unmodified G-50 transceiver with an output of 25-27 watts was used exclusively for transmitting and receiving. Accessory equipment in use throughout the study included a variable a.c. line voltage transformer, which controlled voltage to all station equipment, and a standing wave ratio indicator of the reflectometer type. No special or laboratory equipment was used at any time.

The reason for employing such commonly available over-the-counter equipment was to assure that operating facilities simulated as closely as possible those in use at many amateur v.h.f. stations. Thus study results are representative of what can be done with "garden variety" equipment from a not-too-good location.

Study Criteria

For purposes of standardization, a band opening was considered to be any interval of five or more minutes in which identified six meter DX

	1959	1960	1961	1962	1963
Mean sunspot numer	168.7	110.2	77.4	42.0	35.9
No. monitored days	30	30	30	30	30
No. days band opened	19	21	26	26	27
No. band openings	23	30	38	41	51
Tot. mins. band opened	4,385	2,855	8,530	7,602	10,850
% open to monitored days	63.33	70.00	86.88	86.67	90.00

Table E—Comparative summary for the month of June.

	1959	*1960*	*1961*	*1962*	*1963*
No. monitored days.	91	91	91	91	91
No. days band opened.	51	62	66	63	63
No. band openings.	63	89	94	93	99
Total minutes band opened.	10,157	9,556	18,785	16,870	20,345
Avg. duration of open. (mins.).	161.2	107.4	199.8	181.4	205.5
% open to monitored time.	12.40	11.67	22.94	20.60	24.84
% open to total time.	7.75	7.29	14.34	12.87	15.53
% open to monitored days.	56.04	68.13	72.53	69.23	69.23
Avg. no. openings per open day.	1.24	1.44	1.42	1.48	1.57
No. states heard/worked.	36	28	46	43	39
No. foreign pref. heard/worked.	3	2	6	7	6

Table F—Comparative Summer E_s Seasons, May 16 to Aug. 15.

signals were received at the study site via any form of propagation other than so-called "groundwave" or meteor scatter. DX was defined as any identified six meter signal originating *outside* the 113,909-square-mile area of Arizona. This area is considerably larger than the combined areas of New York and the five New England states.

Band-opening durations were determined by total elapsed time from reception of first to last identified DX signals. Timing was by synchronous electric clocks calibrated daily with WWV or WWVH. Antenna rotational accuracy was checked weekly and calibrated electrically when necessary with established transit lines at the station site.

No data were recorded during the month of April, 1959. This was due to moving the station from Phoenix to the Tucson area where, during April, only a temporary antenna was in use while the tower and beam were being installed at the new location. To avoid possibly misleading data caused by temporary lack of antenna standardization no study records were made that month although several 50 mc openings were observed.

Throughout the investigation no attempt was made to record either the strength or quality of received DX signals. Although carrier levels and signal quality varied widely, both by and within openings, there is no objective method of measuring them against reliable standards under amateur operating conditions and within the limits of the study criteria. The error factor introduced by S-meter readings, for example, is of such magnitude that "S-timate" records are virtually worthless where objective information is sought.

	1958	*1959*	*1960*	*1961*	*1962*	*1963*	*Tot.*
Jan.	—	13	6	8	3	2	32
Feb.	—	12	4	0	0	8	24
Mch.	—	3	3	3	0	2	11
Apr.	—	—	10	3	5	0	18
May	—	4	16	9	23	21	73
Jun.	—	19	21	26	26	27	119
Jul.	—	18	21	26	23	23	111
Aug.	—	14	14	7	2	8	45
Sep.	—	1	1	2	4	0	8
Oct.	—	3	6	6	8	2	25
Nov.	29	7	9	5	4	9	63
Dec.	16	5	15	6	15	7	64
Totals	45	99	126	101	113	109	593

Table G—Number of days per month the six meter band opened.

DX Highlights

Among DX highlights of the investigation were some we may never duplicate. These included solid F_2-supported schedules in 1958-59 with Labrador and Alaska, using seven watts output at *both* ends of the circuits; working and confirming Alaska and Hawaii as "countries" before statehood and states thereafter, and catching seven call areas in Japan and eight in Argentina. Other rewarding DX experiences were making initial Arizona six meter contacts possible for VP7CX in December, 1962, and FG7-XT in June, 1963. First Arizona 50 mc contacts also were made for operators in Japan, Argentina, Uruguay, Hawaii, Puerto Rico, Cuba. Canada and Mexico. Some of these were, of course, also firsts for us.

The FG7XT contact, with excellent signals in both directions despite intense Texas and Florida QRM, was the longest double-hop E_s QSO recorded during the study—3,300 miles (5310.8 kilometers). A day later the shortest E_s-propagated signal of the investigation was recorded from a distance of 257 miles (413.6 kilometers). It came bouncing in from northwestern New Mexico as the skip shortened while working midwestern and eastern states.

The most discouraging DX experience was hearing ZE2JE's fine signal buried by Phoenix local ragchewers in November, 1958. Only one Arizona station got back to him in the melee before he dropped out at the end of a brief F_2 opening into Southern Rhodesia, a distance of more than 9,500 miles (15288.8 kilometers).

EI2W and CT1CO were heard a number of times in the fall and winter of 1958-59, but could not be worked through heavy QRM from the

[*Continued on page 128*]

	1958	*1959*	*1960*	*1961*	*1962*	*1963*	*Tot.*
Jan.	—	14	7	11	3	2	37
Feb.	—	15	4	0	0	8	27
Mch.	—	5	3	3	0	2	13
Apr.	—	—	18	5	5	0	28
May	—	4	26	9	35	35	109
Jun.	—	23	30	38	41	51	183
Jul.	—	20	28	42	33	29	152
Aug.	—	20	18	7	2	8	55
Sep.	—	1	1	3	4	0	9
Oct.	—	4	8	9	9	2	32
Nov.	52	10	11	5	4	11	93
Dec.	18	5	15	8	16	8	70
Totals	70	121	169	140	152	156	808

Table H—Number of band openings per month.

AMATEUR RADIO CLUB IDEAS

JULIAN N. JABLIN*, W2QPQ

Most VHF clubs quickly reach the point where the "old-business-new-business" routine fails to excite the members. Then the program committee really has to buckle down to work, or the results will be seen in a rapidly-dwindling attendance at meetings.

To make things easier for the program committee, we have listed some ideas and resource information which we have found useful for the Amateur UHF Club and which we have picked up from the various club bulletins. These are weekly or monthly meeting suggestions and do not include such major projects as Field Day participation, rig-building programs and public service activities, which have been covered extensively in various amateur radio publications.

Speakers

Good speakers on VHF amateur radio are not easy to find, but speakers who can present related subjects that hams might find interesting are usually available. Your local utility and telephone companies, radio and TV stations, police or fire department communications sections and government agencies frequently have people engaged in electronics work who can speak on subjects allied to amateur radio.

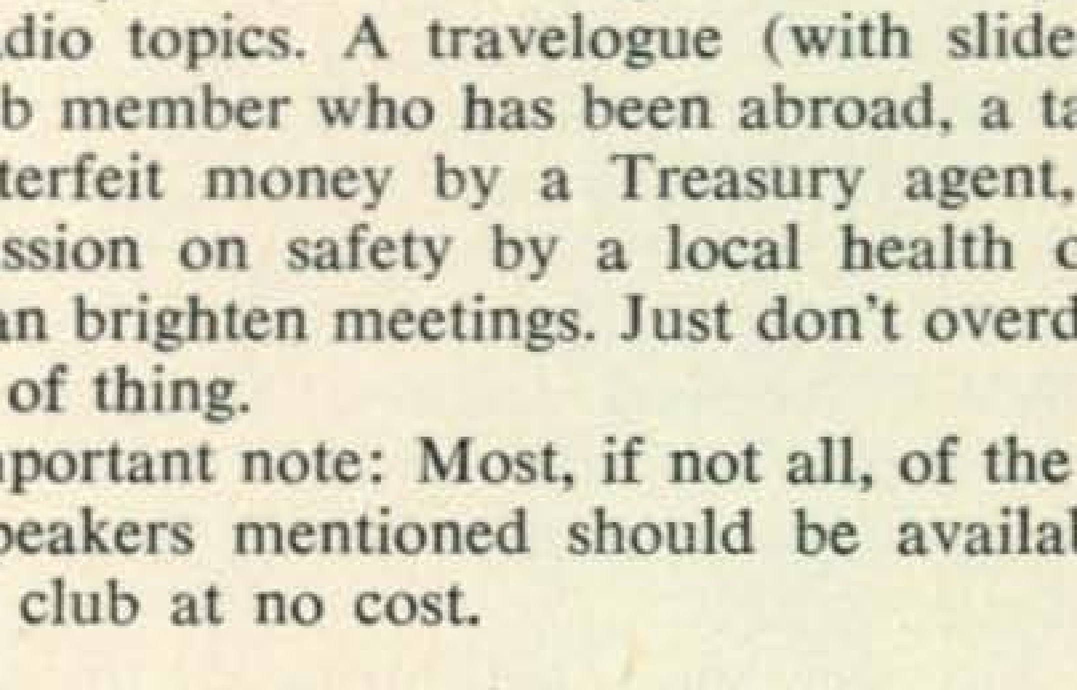
Local electronics manufacturers are another source, and you may wind up with a fascinating lecture on a device or project which will make national headlines long after you first heard about it at a club meeting. If there is a firm in your locality which makes ham gear, you might ask for an engineer to speak on the problems of designing equipment for hams; suggest that he bring along examples of the company's products, since a little free advertising is always welcome to these companies. Incidentally, we have had better luck with the smaller manufacturers.

What about the members themselves? In many cases, club members in the electronics field are doing work which will provide material for a talk.

*Secretary, Amateur UHF Club of Jamaica, 147-17 Charter Road, Jamaica 35, New York

Finally, it is not necessary to limit all speakers to radio topics. A travelogue (with slides) by a club member who has been abroad, a talk on counterfeit money by a Treasury agent, or a discussion on safety by a local health official all can brighten meetings. Just don't overdo this kind of thing.

Important note: Most, if not all, of the kinds of speakers mentioned should be available to your club at no cost.



Courses and Clinics

A series of lectures on related radio topics can extend over half a year and can be given by your own members. Set a theme — transmitters, receivers, antenna systems, construction — and break it down into component subjects. Assign lectures to members one or two meetings ahead of time for a short presentation and a question period. If you have members who know a subject, fine. If not, let them do a little research. I learned a lot about antennas when I was asked to prepare a talk on beams. This sort of program is especially good because it gives continuity to the meetings.

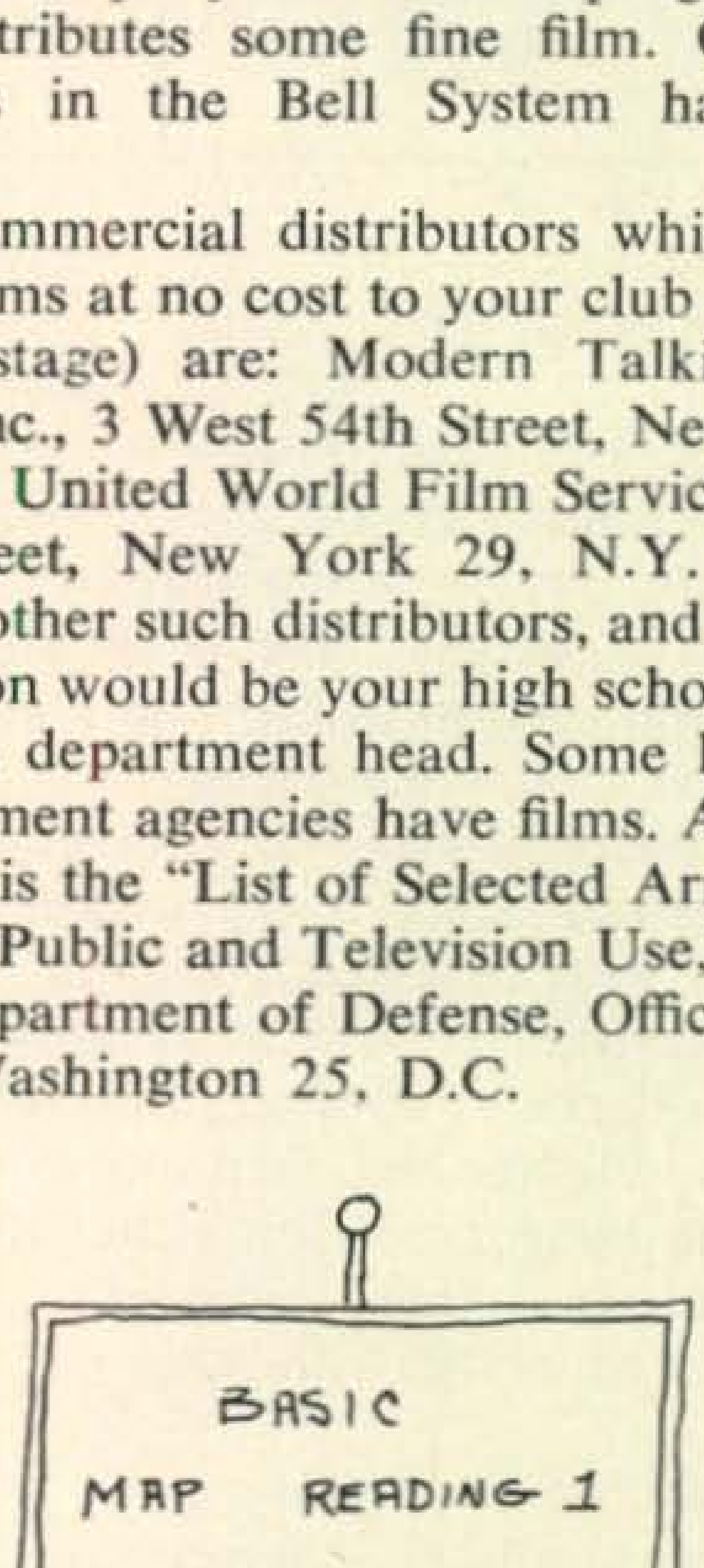
On the other hand, club members always have problems with their gear, and one reason that hams belong to a club is to be able to talk these over. Set up a "trouble" committee of "experts" who can answer questions. Put aside a definite period for these questions, to be answered by members of the panel. This is a useful kind of program which holds everyone's interest; it becomes great fun when the members of the panel disagree on what to do about a specific problem.

Films

Our club has had one movie night a year for as long as we can remember, and this is a most popular meeting. One secret is to keep the program short; one film of about 30 minutes running time, preceded by a 10 minute short subject is sufficient. If the film is to be followed by a discussion, just one film should be enough.

However, even at the rate of two or three films annually, it eventually becomes a problem to find pictures related to amateur radio. The first source to consult is the A.R.R.L., whose training aids list, which also includes slide films, tapes and quizzes, is very helpful to ARRL-affiliated organizations. In New York City, our telephone company maintains a program bureau which distributes some fine film. Other local companies in the Bell System have similar services.

Two commercial distributors which lend industrial films at no cost to your club (except for return postage) are: Modern Talking Picture Service, Inc., 3 West 54th Street, New York 22, N.Y., and United World Film Service, 105 East 106th Street, New York 29, N.Y. There are probably other such distributors, and a source of information would be your high school principal or science department head. Some local offices of government agencies have films. A very good catalogue is the "List of Selected Armed Forces Films for Public and Television Use," published by the Department of Defense, Office of Public Affairs, Washington 25, D.C.



Some of the larger electronics firms have films for loan. We have borrowed films from Hallicrafters; General Electric (contact your regional GE distributor) has some; the Film Board of Canada has good films, as does the British Information Service. Write to the nearest Canadian or British Consul for details. Also try other governments and airlines, most of which have travel films and may have a stray movie on communications, radar and the like.

All of these films requires a 16mm sound projector. If you have no access to one, try your high school, YMCA or a local camera store. Rentals should be nominal.

Intra-Club Contests

We have had a lot of fun with contests among our own members, run rather informally with modest prizes. Code speed contests are common and require little equipment, but how about a QLF Contest? (QLF, for you newcomers, is an old "Q" signal for "Send with your *left* foot for a change.") Yep, the key is tapped with the left foot, and it takes some practice.

We once ran an "oscillator efficiency" contest; the problem was to build a 420 mc oscillator which developed the most output in relation to the power input. This was before the days of crystal control and multiplier chains, and one requirement was that the oscillator actually be in the 420 mc band as measured with leecher wires! Later we ran a contest for 420 mc antennas; the weird assortment of square-corners, long-long Yagis, bed-springs, colinear stacked arrays and plane reflectors gathered in our YMCA gym was a sight to behold. A reference dipole was excited and the antenna under test was hooked to a simple field-strength meter. A new possibility for such contests now opens up on 1215 mcs.

Try a trouble-shooting contest to liven things up at a meeting, and to test your member's radio skill. Disable a simple receiver or other gear by removing one lead where it won't be missed. Provide a signal generator and VTVM and the fun begins. Or *don't* provide the test gear; let the members know what they are going to do and let them bring their own equipment, makeshift as it may be. Set a time limit and see if anyone finds the trouble.

Other contests of a technical nature include frequency spotting, in which members try to find the exact frequency of an unmarked crystal by using a BC-211 or other frequency meter and beating the signals in a receiver; circuit analysis (guess what the circuit is supposed to do); Ohm's Law calculations involving complex combinations of current and voltages; "simplest solution" contests to find the best way to meet control and other problems.

When you get down to it, club programming can be as broad in scope as this hobby of ours, which covers a great deal of territory. We haven't even gone into the "best DX of the month" prizes, club-sponsored QSL programs, auctions, rig-building activities, picnics, mobile installation judging for neatness and efficiency, message-handling tests and many more. Actually, most club program committees need only to be pointed in the proper direction and given a gentle push—the traditional ham ingenuity provides the rest. As long as club officers remember that activity at meetings builds interest, and that interest holds membership, the radio club will grow. ■

A TRANSISTORIZED A.F. SHIFT KEYER

BY ROBERT P. BRICKEY,* W7QAG

For RTTY work on v.h.f. an audio frequency shift keyer is almost a must. This unit is transistorized and not at all critical to construct. Due to the low impedances involved it is very insensitive to hum and almost any layout works well.

With the increasing availability of teletype equipment at a price the average amateur can afford, there has been a considerable rise in interest in RTTY operation. Much of the RTTY activity takes place on v.h.f. where audio-frequency shift keying is used. Therefore, one of the first problems confronting the prospective RTTY'er is the construction of a suitable audio-frequency shift keyer.

The shifter to be described offers many advantages over other types of tone shifters. These advantages include: 1—parts layout not critical. 2—freedom from the capacitive loading effects of the keying circuit. 3—the use of inexpensive easily obtainable components. 4—provision for balancing the *mark* and *space* output levels. 5—small physical size. 6—very low power consumption. 7—excellent output wave form. 8—exceptional frequency stability.

Block Diagram

Figure 1 shows a block diagram of the audio-frequency shift keyer as well as the associated equipment. The keyboard output cord from the teletype machine connects to contacts in the keyboard which are closed when a *mark* signal is to be transmitted and open on a space signal. As the contacts in the keyboard make and break, they change the conduction of the keyer transistor, which in turn effects the frequency of the oscillator. The keyer serves to isolate the oscillator from the keyboard circuitry. This prevents instability due to stray lead capacitance and eliminates frequency changes caused by wave correction filters in the machine.

The oscillator is a modified colpitts circuit using a resonated 88 millihenry toroid in the frequency determining circuit. A toroidal inductance was used since it has a large amount of inductance compared to its resistance, resulting in a very high Q. The high Q of the inductance increases the selectivity of the resonant circuit and therefore improves the stability of the oscillator. These toroids have been advertised in the Ham Shop section of *CQ* for sometime now at $1.00 each or five for $4.00.

Another factor contributing to the stability of the circuit is that since no tubes are used there is very little heat produced. This almost totally eliminates warm up drift. The stability was measured using a Berkeley counter, and the frequency was found to change less than one cycle per second in a one hour period on either the *mark* or *space* frequency. There was also very little change in frequency with changes of supply voltage.

The oscillator is followed by a common emitter buffer amplifier. The primary function of this stage is to provide isolation between the oscillator and the load, thereby reducing the effects of transmitter loading on the oscillator frequency. The collector load of this amplifier contains a potentiometer which can be used to adjust the audio-frequency shift keyer output to an amount which will provide 100% modulation of the transmitter. It is not usually advisable to connect a miniature potentiometer in series with the collector current as was done in this circuit, however if a standard size potentiometer is used

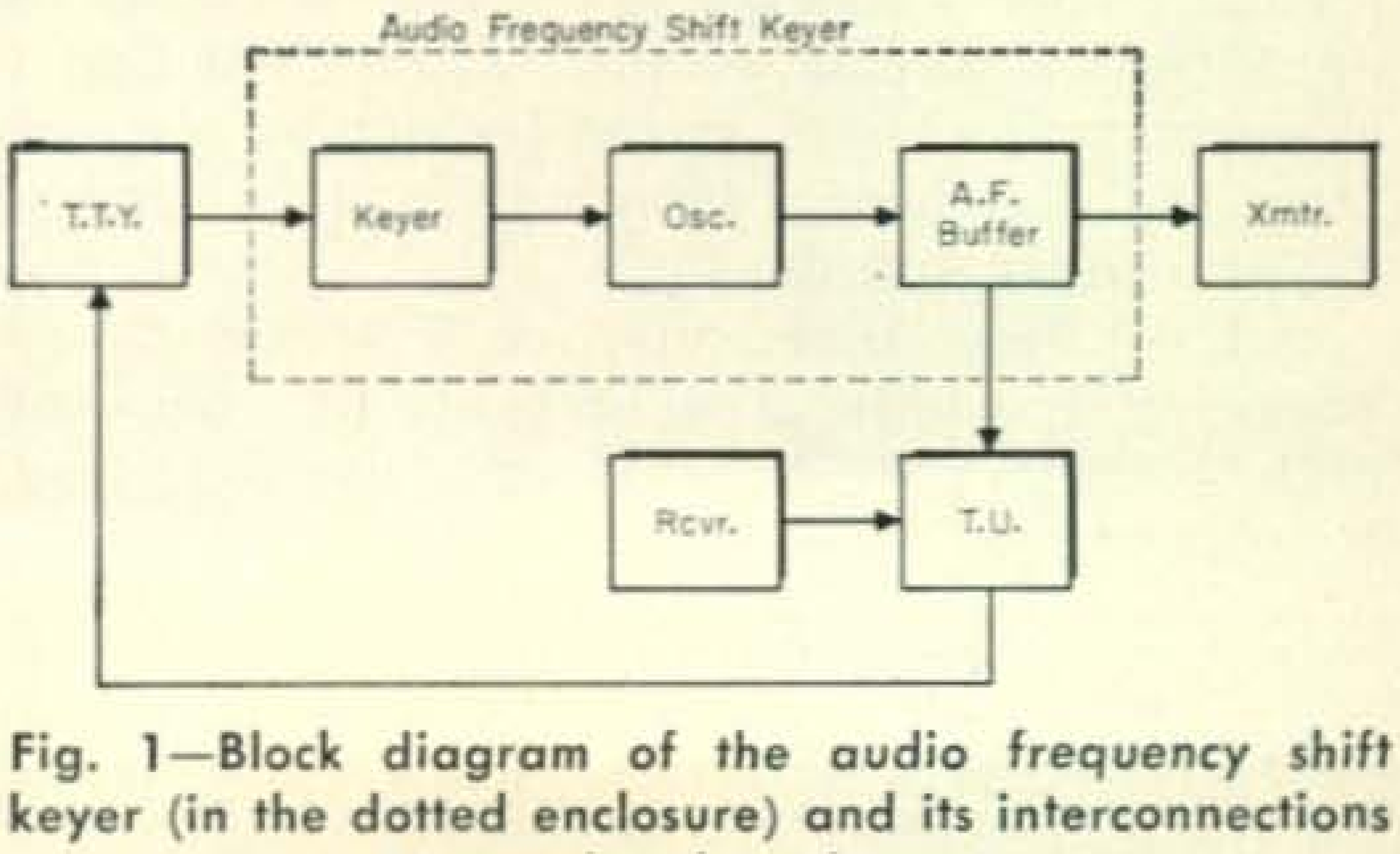


Fig. 1—Block diagram of the audio frequency shift keyer (in the dotted enclosure) and its interconnections to associated equipment.

*Instructor, Utah Trade Technical Institute, 349 North 250 East, Orem, Utah.

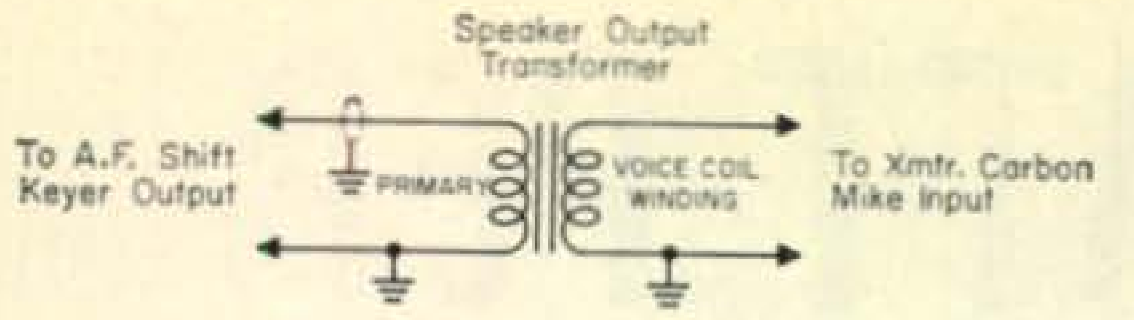


Fig. 2—Circuit showing how a speaker output transformer may be used to match the a.f. shift keyer output impedance to a carbon mike input.

no trouble should be experienced as the collector current is very small. By properly adjusting this control it is unnecessary to change the transmitter audio level when going from teletype to phone modulation.

Since the output impedance of this amplifier is relatively high, if it is desired to operate into a carbon microphone input, a matching transformer should be used. Although the input and output impedances of an ordinary vacuum tube audio-output transformer are not ideal for this purpose, such a transformer will provide an inexpensive yet acceptable match. The transformer should be connected as shown in fig. 2.

If the output from the audio-frequency shift keyer is fed into the terminal unit, as well as into the transmitter, it will be possible to print locally what is being sent. Obtaining local copy in this fashion eliminates the need for switching the selector-magnet current. It also solves the problem of having the keyboard key both a local loop and the audio-frequency shift keyer. The connection to the TU should preferably be made after the first audio stage in the limiter in order to isolate the receiver from the shifter. If this scheme is used to obtain local copy, it will be necessary to disable the audio-frequency shift keyer during received periods. This can easily be done with the relay connected to the transmit receive control system in the transmitter which will disconnect the battery power from the keyer while receiving. Doing this will also greatly increase battery life as there will only be a load on the battery while actually transmitting. Of course the voltage rating of the relay used must match the available control voltage from the transmitter.

This scheme of providing local copy has provided excellent results and is highly recommended. It makes possible one switch transmit-receive operation without a lot of complicated switching. Since the printer is copying the same tones that are being transmitted, it provides a continuous check on the performance of the audio-frequency shift keyer while transmitting.

Circuit Operation

When a *mark* signal is to be transmitted, the keyboard contacts are closed making the base of Q_1 negative with respect to the emitter. The resulting base current causes the collector to emitter resistance to be greatly reduced. Since the collector of Q_1 is connected in series with C_1, when the resistance of the transistor decreases it causes C_1 to be connected across the toroid. This lowers the oscillator frequency to mark, 2125 c.p.s.

The keyboard contacts are open when a *space* signal is transmitted and this causes the base of Q_1 to go positive. The resulting base current cuts off the transistor and removes C_1 from the circuit. This causes the oscillator to shift to the space frequency, 2975 c.p.s.

When the keyer transistor is conducting it still has some resistance which lowers the oscillator circuit Q, and therefore slightly reduces the output. By properly adjusting the mark space level balance adjustment an equivalent loss can be produced when transmitting a space tone in order to make the oscillator output the same under both conditions. If desired the balance control may be adjusted to compensate for different frequency response characteristics of the transmitter audio system at the two frequencies. This will assure full modulation of the transmitter on both *mark* and *space*.

The oscillator is a common base modified Colpitts circuit. The frequency of the mark and space tone is determined by the capacitance of C_1 and C_2. The values given on the circuit diagram for C_1 and C_2 are the approximate values necessary to establish resonance on the proper tone frequencies. Due to small differences in the actual values of the capacitors used, the inductance of the toroid, and other loading effects it

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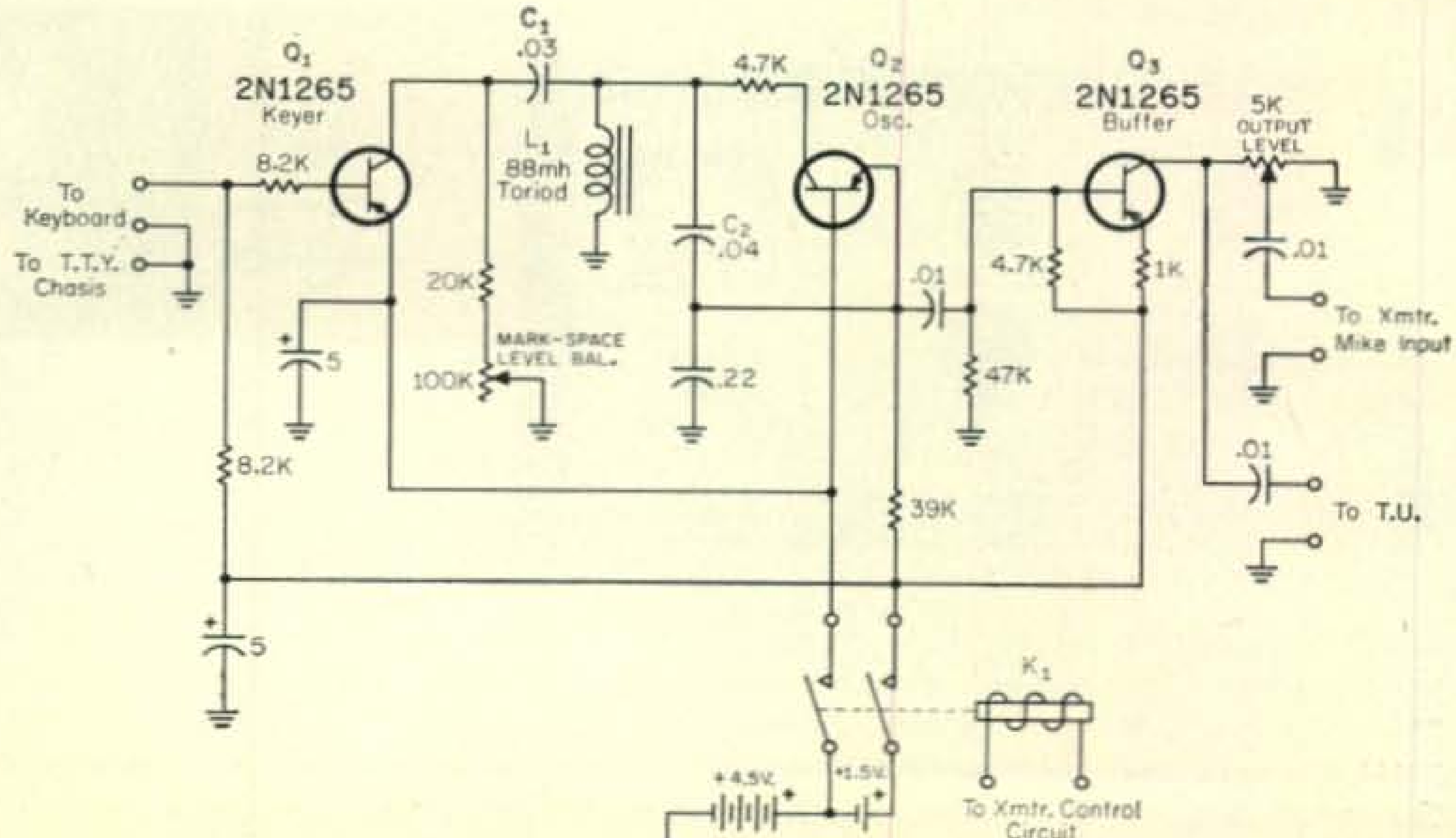


Fig. 3—Circuit diagram of the audio frequency shift keyer. All resistors are half watt; all capacitors are in mf. Battery B_1 is composed of four flashlight cells in series tapped at 4.5 volts. Relay K_1 is described in the text.

A 1600 WATT PEP LINEAR

BY RICHARD A. YEOMANS*, W2DMK

The simple compact linear described below is built around four 6JE6 TV type horizontal output tubes. Its simplicity, compactness and low cost will appeal to many amateurs.

With the new television horizontal deflection tubes hitting the market at a fast rate these days we decided to build a linear amplifier around one of them. Looking for a real husky that could be run as a grounded grid amplifier we dug into the most recent RCA receiving tube manual. The majority of the tubes described had their cathode and suppressor grid tied together within the tube envelope. This arrangement will of course not do for grounded grid operation. Finally we did run across a valve that had both a separate cathode and suppressor grid pin connection and also had a fairly good plate dissipation rating. The little lad chosen was the 6JE6 with a 9 pin novar base. It is almost identical, electrically, with the ever so popular 6DQ5. This tube had made its way into the ranks of hamdom some time ago. Many commercial a.m. and s.s.b. transmitters and transceivers use this tube to acquire a high r.f. output with a single tube.

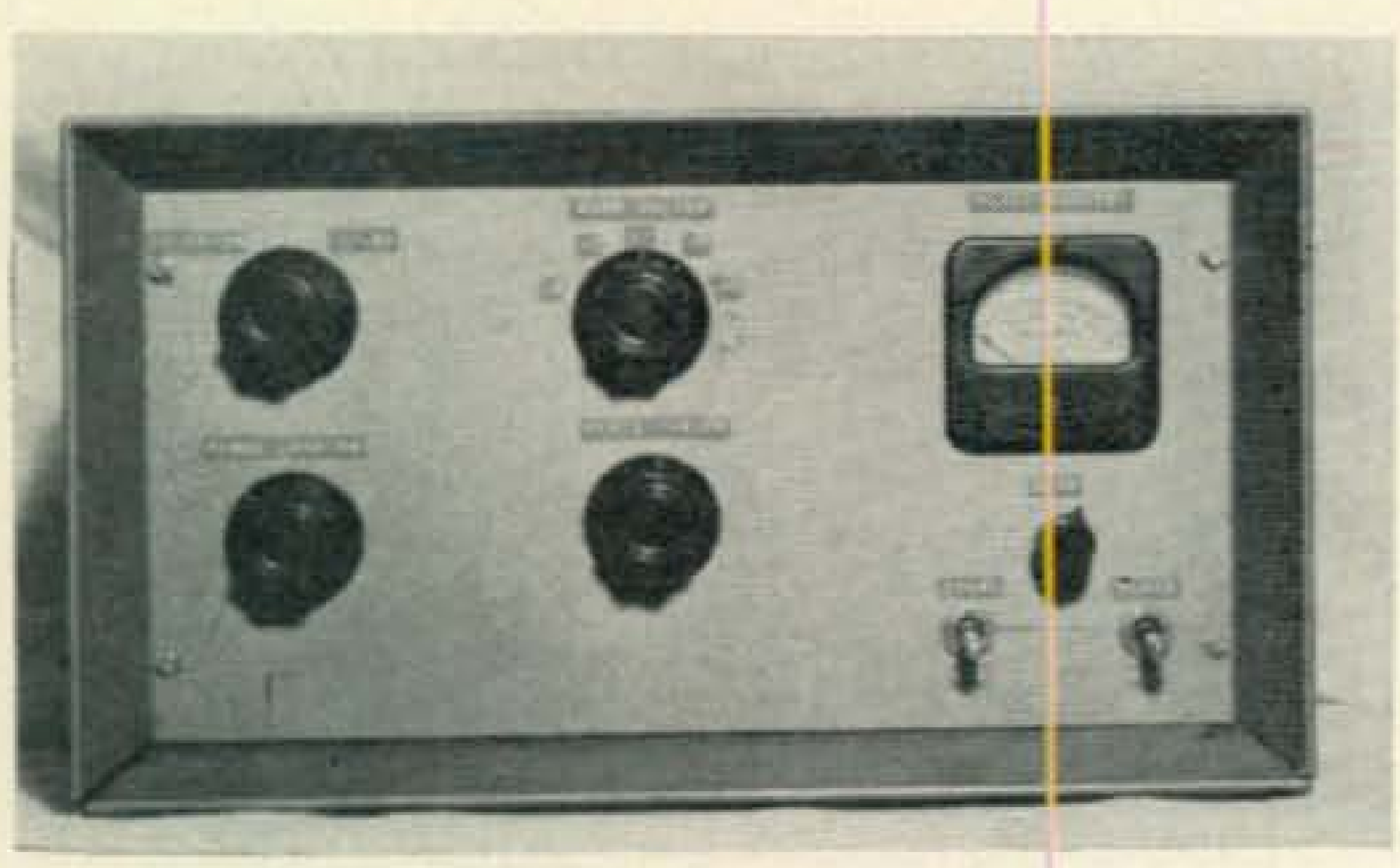
A few years back we built an experimental amplifier using a single 6DQ5 operating in Class C. We found to our amazement that just one of these tubes with same plate voltage as two 6146 had a higher output as indicated by an accurate watt meter. (No discoloration of tube plate was observed, either.)

Reading the 6JE6 specs closely it was noticed that the interelectrode capacity was a bit high. If more than four of these tubes were to be used in grounded grid, the L/C ratio of the final tank circuit would become a problem on the 10 meter band.

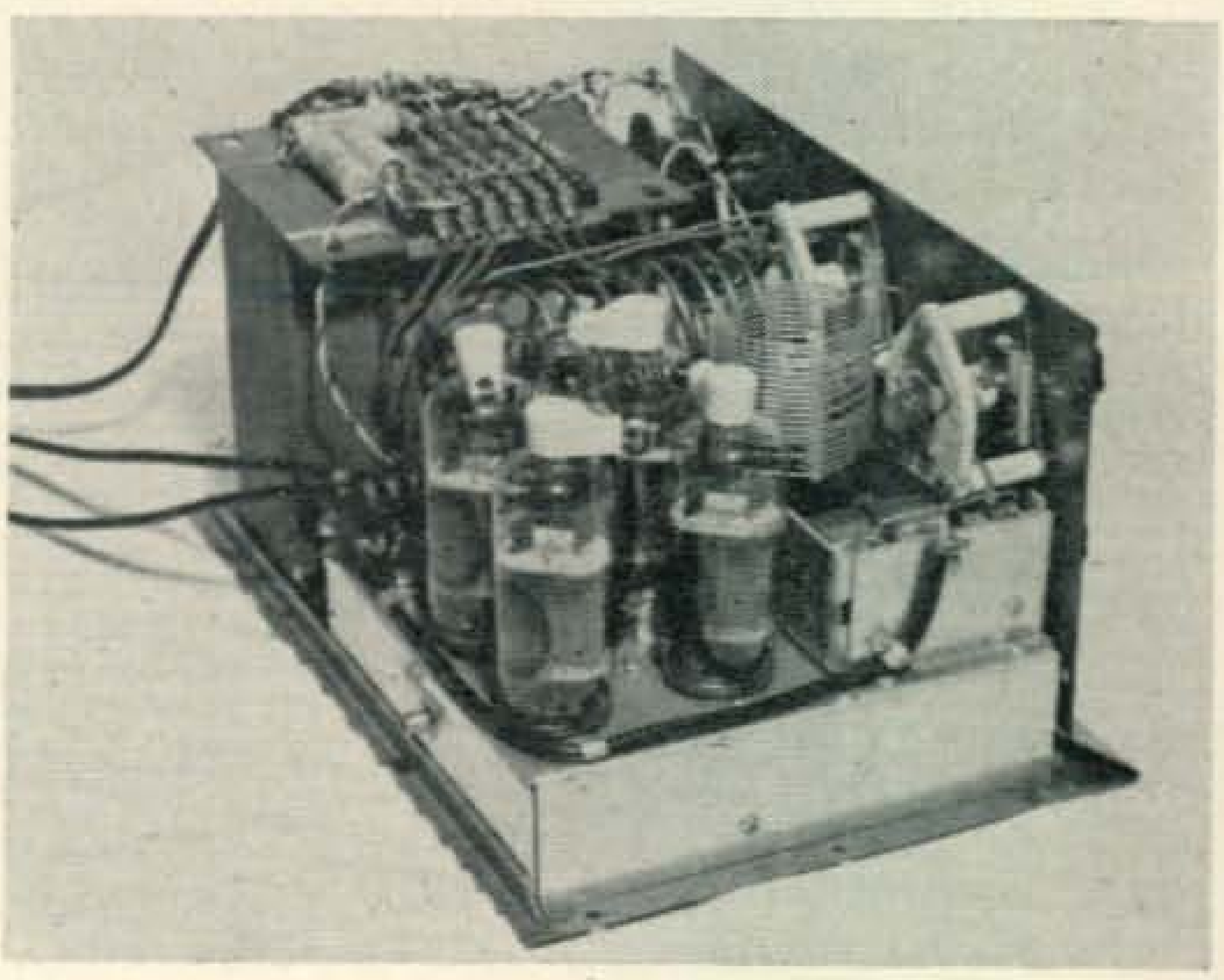
Between your junk box and the few bucks you hold out each payday you will have an inexpensive table top kilowatt (less than a hundred dollars) and the wife will hardly know the difference. Well, almost anyway.

This amplifier, excluding power supply, would be useful for higher power mobile operation. The necessary power could be derived from a pair of solid state power supplies connected in parallel. By using just two of the 6JE6 tubes with 800 to 1000 volts on the plates, with sufficient excitation, one could run close to 1 kw p.e.p.

*1243 Front Street, Binghamton, N. Y.



Front view of the all band linear amplifier shows the simple control groupings. Top row, left to right; CAPACITOR SWITCH, S_1; BAND SWITCH, S_2; Bottom row l. to r.; FINAL LOADING and PLATE TUNING. Grouped beneath the the meter are the BIAS CONTROL, FILAMENT switch and PLATE switch. The cabinet measures 7″ × 9″ × 13″.



Rear view shows the linear in the foreground with the power supply in the rear. The loading capacitor is on the edge of the chassis with S_1 *above it. The diodes* forming the bridge rectifier are atop the power transformer.

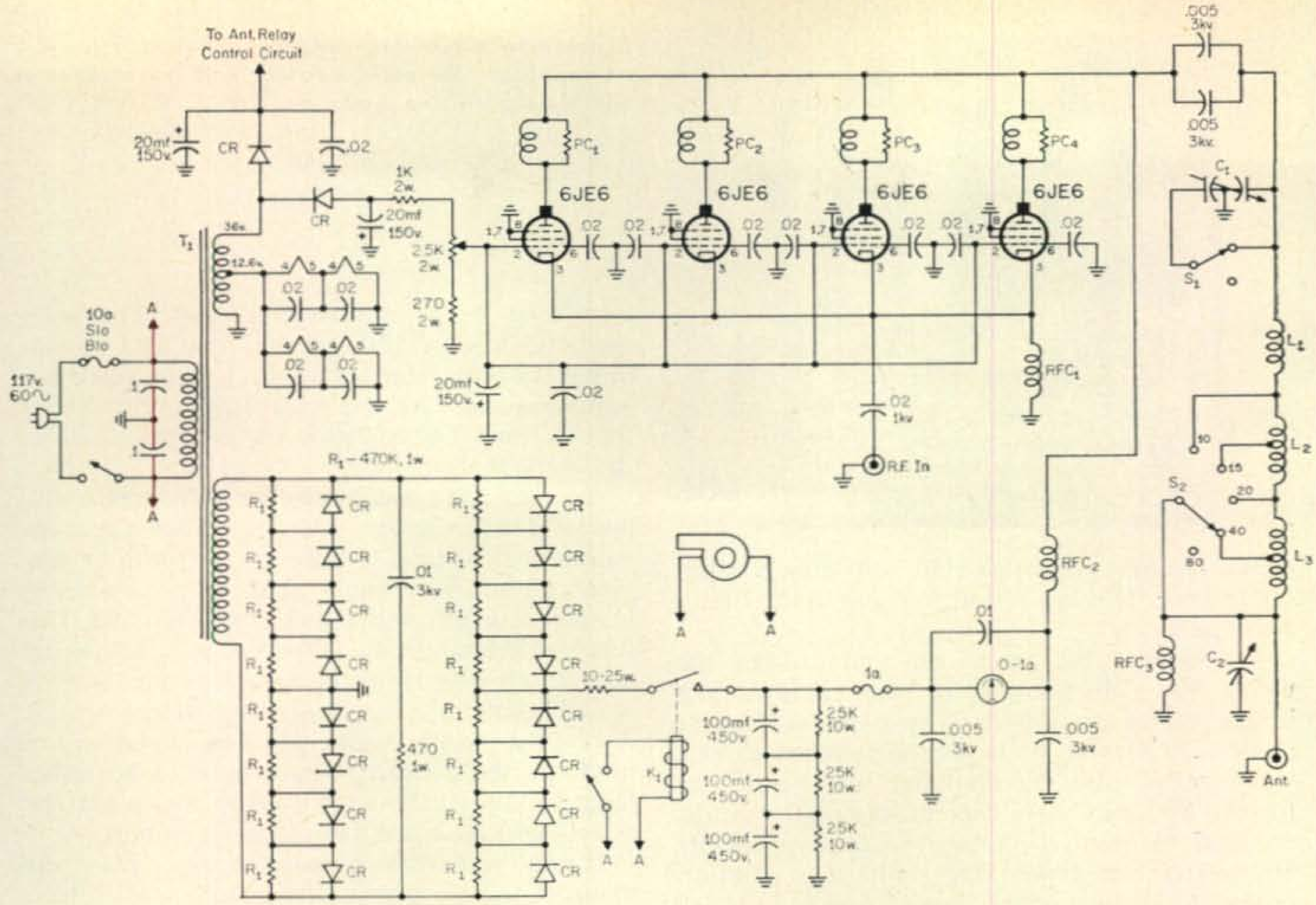


Fig. 1—Circuit of the linear amplifier using four 6JE6, TV horizontal output tubes. All capacitors less than one are in mf, greater than one in mmf unless otherwise noted. Capacitors without voltage ratings are 600 volts. Transformer T_1 specifications are given in the text.

CR—750 ma 400 p.i.v. replacement type silicons.
C_1—150-150 mmf double spaced variable.
C_2—3 gang broadcast variable, 365 mmf per section, paralleled.
L_1—2½ t., ¼" brass flat stock, wound 1" diameter, 2¼" long.
L_2—8 t., ⅛" copper tubing, 2" diameter, 3½" long, tapped 3 t. from plate end of coil.
L_3—21 t., #16 wire, 2" diameter, 2" long, tapped 8 turns from the plate end.
K_1—S.p.s.t. relay 117 v.a.c., 2 kv insulation.
PC_1, PC_2, PC_3, PC_4—4 t., #18 E. wound over 47 ohm 2 w resistor.
RFC_1, RFC_2—220 t., # 24 E. close wound on 4" long, ⅝" diameter steatite rod.
RFC_3—2.5 mhy at 125 ma.

input from the family chariot. For higher power the alternator system would be more practical for a power source.

The Amplifier Circuit

There is nothing unorthodox about this grounded grid amplifier; the unit is straightforward.

It should be observed, as shown in schematic, that both screen grid pin connections are grounded (pins 1 and 7). This also applies to the bypass capacitors on the control grids. Each pin (2 and 6) of each socket should be bypassed to ground through a 0.02 mf 600 volt disk capacitor with short leads to reduce any inductance caused by lead length. All leads should be kept as short as possible to prevent unnecessary trouble.

The chokes RFC_1 and RFC_2 were home-brewed but a commercial type with an adequate current rating may be used, of course. They may be wound either by hand or connected to an electric drill, controlled with a Variac to bring the speed down to about 5 to 10 r.p.m.

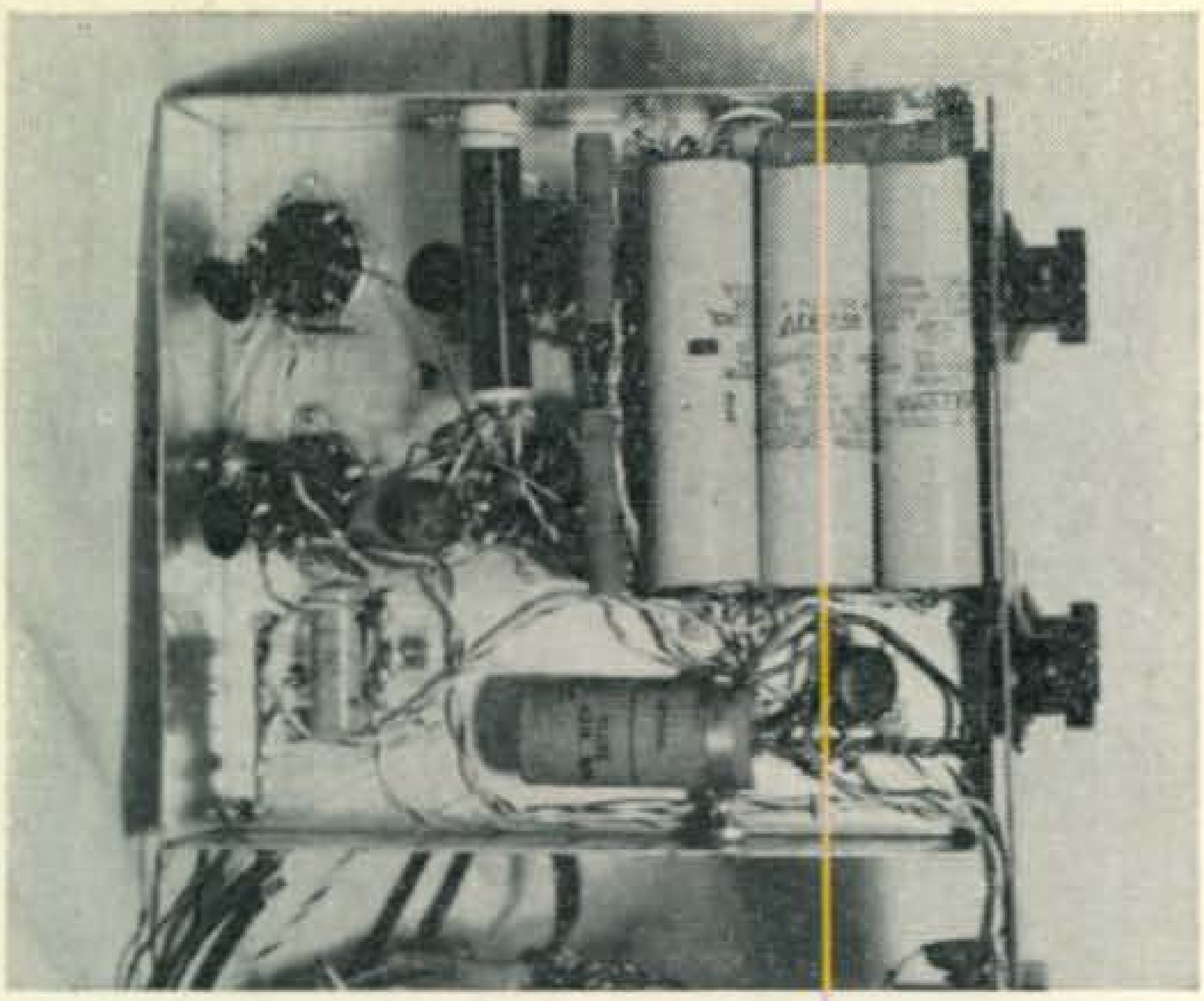
It would be a nice feature to meter both grid current and plate current by a flip of a switch. In this case it was not found necessary, though. Trying to keep the unit simple we left this feature out. With on the air tests we checked the grid current with an external milliameter and found the ratio of grid to plate current proper.

The plate tuning capacitor is a dual unit of equal capacity, 150 mf each. On 10 through 20 meters, only one section is put into operation. When operating 40 or 75 meters the remaining section is switched in parallel. This switch should be of ceramic r.f. type with fairly husky contacts.

There was no need for a more efficient cathode circuit as our exciter was capable of 150 watts p.e.p. output. We found that this was more than enough drive on all bands. If one has an exciter below 100 watts p.e.p., it may be to your advantage to incorporate a more efficient input circuit using an L network.

Power Supply

The power transformer used in this linear amplifier is 5 × 5½ × 6¼ inches overall. The transformer was rated at 450 volts each side of



Bottom view of the linear amplifier shows the three 100 mf capacitors, the cathode choke and the handful of additional parts. The chassis measures 7″ × 7½″ × 2″.

center tap at 1 amp with a 36 volt, 6 amp winding to boot. This is a lot of power in such a small package.

We ignored the center tap and utilized the whole 900 volt winding by using a full wave bridge of silicon diodes. The plate voltage at static load was at 1150 volts d.c. When carrier was inserted and the amplifier was loaded up to read 800 mils plate current, the plate voltage dropped to exactly 1000 volts. This represents 800 watts d.c. input. The voltage regulation proved to be surprisingly good.

True, when a full wave bridge is utilized, the current rating of the transformer drops off by half. The transformer being surplus in origin has a safety factor that all military type equipment must have. Besides it was designed for constant duty operation. In s.s.b. service power supply capabilities of good design may be exceeded almost by twice its original rating as the duty cycle is slight.

The three 100 mf, 450 volt, electrolytic capacitors further improve the dynamic voltage regulation. Each capacitor in series is shunted by a 25K ohm 10 watt wire-wound resistor to act as both a voltage equalizer across the capacitors and as a bleeder. It was not found necessary to use a filter choke as the ripple content was low.

The 36 volt winding fortunately was wound on the outside of the transformer. This winding, as seen in the schematic diagram, serves 3 functions, filament, bias and control voltage. First though, we had to tap down to the 12.6 volt point and bring out a lead to supply the necessary filament requirements. The four 6JE6 filaments connected in parallel would require 10 amps of current and the winding was found to be rated at 6 amps. We then connected the filaments in series parallel. This brought the current demands down to 5 amps leaving 1 amp to spare. The full 36 volt winding is used for a bias supply and a d.c. control voltage source. One diode is connected for a negative 36 volts d.c. bias voltage for the final amplifier grids. The second diode is for energizing the antenna relay.

In our case the antenna relay had to be operated at a low voltage as in the KWM-2 exciter, the extra contact supplied on the transmit relay was designed for switching an external relay to chassis ground; therefore, the common 110 volt type relay could not be employed. The relay used did have a 110 volt a.c. coil but on d.c. this relay only required about 1/3 the rated a.c. voltage to activate the relay armature at a fast pull in time. The selection of this relay is up to the individual.

Another relay was put to use between the output of the bridge rectifier and filter capacitor bank via final load. As we know, the tube filaments should be brought up to proper operating temperature before plate voltage is applied. This relay, operated from 117 volts a.c., has better than 1100 volts at this point; we decided a relay would stand-up somewhat better than a switch. A ceramic switch (wafer type) of course can be used but the contacts would have to be rather large for the current involved at this point and a well insulated shaft would be required.

It may be hard to acquire an exact plate and filament transformer as that used here. I have no idea what piece of surplus gear this unit was originally associated with or even who manufactured it. There are many similar in ratings on the market though. Fair Radio, Lima, Ohio and Barry Electronics, N.Y.C., are good starting points.

The filament transformer does not have to be part of the plate transformer. A 6.3 volt, 10 amps filament transformer of moderate size could be mounted beneath the 80-40 meter tank coil. Still another small transformer would have to be incorporated to furnish the bias voltage. A 26.5 volt, 1 amp filament transformer could be mounted underneath the chassis. They are rather small in size, which helps. The antenna relay could still be operated from this supply as described previously.

Operation

Like all tubes, the heat they generate is their own worst enemy. A small fan or blower should be mounted near the four tubes to help dissipate the heat generated. Not shown in photographs, we employed a muffin fan that is mounted on the back plate of the cabinet. At the top sides of cabinet two louvers were cut, two inches high by six inches long, to vent hot air out of the closed cabinet.

When operating c.w. the power input should be held to 600 watts with the power supply shown. For s.s.b. the static current at 1100 volts should be adjusted to indicate between 50 to 60 ma on the plate meter for normal operation or about 2/3 maximum plate dissipation. ■

Acknowledgment

I would like to thank Don Abbott, WA2MZQ, for the photographic assistance in this article.

DX

BY URB LE JEUNE,* W2DEC

THE annual New England DXCC dinner meeting will be held October 17th, 1964, starting at 6:00 P.M., at the Motel 128, Dedham, Massachusetts, located at the junction of Routes 1 and 128. Members, guests, and interested hams are invited. Tickets, including dinner $5.00. For reservations, send check to: Leo Wilber, W1MV, 74 Bedford St., Bridgewater, Mass.

These fellows sure put on a shindig and if you are in the area, I would suggest attending.

The following letter was sent to Harry A. Tummonds, by Senator Goldwater and it is quoted from the "V. H. F. Association":

"Now that S-920 (Reciprocal Operating Privilege Bill) has been signed into law, I think it would be very fitting and proper if you gave recognition to the man really responsible for achieving the miracle in one of your coming issues. He is William Seward, an assistant of mine who has been on my staff for a number of years and is one of the most competent young men I have ever encountered.

"I turned this matter over to him two years ago, and he, working with officials of the State Department, the FCC, and the Bureau of the Budget, plus members of the ARRL—particularly Herbert Hoover, Jr. (W6ZH)—brought the bill into its acceptable form and guided its way carefully through the maze that is the lot of all legislation.

"Amateur radio owes him an undying debt of thanks. It would also be proper to mention the good work of Senator John Pastore of Rhode Island and Congressman Oren Harris of Arkansas whose Committee in the House speedily passed the bill, allowing it to go before the whole body for its quick approval. I mention these names to you because I know that Amateur Radio desires to recognize those who help it.

"With best 73's. /s/

Barry,

Barry Goldwater, (K3UIG/K7UGA)"

On behalf of all hams, particularly DXers, I would like to thank each and every person who helped the bill along its way to successful passage.

DXpedition to Rockall

There has been a great deal of speculation recently on the possibility of a DXpedition to Rockall, which according to the ARRL DXCC criteria would form a separate country as it is separated offshore from its governing area by more than 225 miles of open water. Rockall lies approximately 57° N. and 14° W. and is 180 miles from St. Kilda and 290 miles from the nearest point of the Scottish mainland. Its peak lies 70 feet above high water mark but the only flat space on the rock is 20 feet long and varies in width between 6 and 10 feet.

During periods of extreme calm, which occur only at infrequent intervals throughout the year, the swell at the base of the rock is some 3 to 4 feet; normally the swell is some 10 feet. The area has the unfortunate habit of developing Force 4 winds very quickly and without a great deal of prior warning, which means that a method of leaving Rockall must be always at hand; that is apart from a swift slide down one of the vertical rock faces. The writer has seen a picture taken by RAF Coastal Command during rough weather which shows seas 170 feet high breaking over Rockall!

The last landing was made in 1955 by helicopter by a party from HMS *Vidal*, and which, amongst other tasks, cemented an iron ring into the flat ledge mentioned above. DXpedition operators would no doubt make good use of this, holding on with one hand and operating a transceiver with the other. Anybody who makes a successful trip to Rockall will really have given the DX chasers good value for money.

Thanks to G2BVN for the above.

Long Island DX Association's First Annual DXCC Contest

"All the DX you can work in a year" is the object of the First Annual DXCC Contest being sponsored by the Long Island DX Association in order to stimulate DX activity throughout the world.

The Contest will begin at 0000 GMT, January 1, 1965, and end at 0000 GMT, December 31, 1965. Contestants will be required to work as many different countries over 100 as possible in order to be eligible for the special prizes which will be offered by the LIDXA. Any mode and any band may be used but *just one confirmation* from each country will count. The contest will be based on ARRL DXCC rules and the ARRL Countries' List will be followed.

The prizes to be awarded to the winners include the Long Island DX Association Trophy, going to the top scorer in the world; six unique and individual certificates to be awarded to the top scorers in each country from which entries are submitted as well as winners in each of the U.S.A., Canadian and Australian districts.

At the close of the contest, participants will be required to submit just their *lists of confirmed countries worked* to: LIDXA CONTEST, PO Box 599, Lynbrook, New York, with postmarks no later than February 15, 1966. Potential winners will be notified and will be requested to submit all their contest QSLs to the Contest Committee whose members are: Joe Helmann, W2MES; Dorothy Strauber, K2MGE; Win Tames, WA2QNW; and Marv Fricklas, W2FGD. A complete list of winners will be published as soon as the Committee has completed the tabulation of the entries. For any additional information, contact the LIDXA Contest Committee via P.O. Box 599, Lynbrook, N. Y.

*Box 35, Hazlet, New Jersey 07730.

The following certificates were issued during the period from August 4th, 1964 to September 4th, 1964

CW-PHONE WAZ

2029	SP8HR	Zbigniew M. Rybka
2030	W2GKZ	David T. Ferrier
2031	DJ1PN	Rainer Kanzler
2032	W4DLG	Rudolph B. Spivey
2033	VP7NS	Don R. Thompson
2034	W2KIR	Alex Ekblad
2035	UH8BO	Eugene M. Zwontsov
2036	OK3OM	Julo Cejka
2037	W4PAA	Jack T. Burney
2038	SM5BGM	Bo I. Forsslund
2039	W4TFL/1	R. E. Beatty
2040	EA1BC	Alberto Mairlet Chaudoir
2041	W5EZE	Max Busick
2042	K5AAD	Donald Busick
2043	LA1H	Harstadgruppen Av Nrrl
2044	K6POC	Joan Saueressig
2045	W3DJZ/BOC	Arden B. Hopple
2046	K5DGI	Wes Attaway
2047	W5BOS	Lanny R. Phillips
2048	W3KBC	Charles Dunkerton
2049	DJ2ZX	Klaus Schatton
2050	DL3AR	Alois Stirba
2051	W2BMK	A. Hesse

ALL-PHONE WAZ

258	W4PAA	Jack T. Burney
259	VE6SF	Ray J. Nadeu
260	W6MBD	Harry M. Leonard
261	G2BOZ	John Bazley
262	W3DJZ/BOC	Arden B. Hopple
263	W4MS	Edward J. Collins
264	ZS6VX	Dennis Helyar

TWO-WAY SSB WAZ

254	SM5HK	Walter Karswall
255	W6REH	J. G. Davis
256	VE7HJ	W. G. Stunden
257	UB5UN	Serge G. Bunimovich
258	W4PAA	Jack T. Burney
259	W4MS	Edward J. Collins
260	DL1KB	Hans Pazem

CW WPX

569	I1SF	Serafino Franchi
570	YO2BQ	Bartl Iosif
571	ZL1ARY	Ray W. Chandler
572	UB5CG	Anatoly F. Zhurba
573	W5EZE	Max Busick
574	DL7DE	Wilhelm F. Siebert

PHONE WPX

112	TG9SC	Cesar A. Siu

SSB WPX

193	VQ2WR	George W. Ripley
194	YB5BIG	Raul Eiris
195	OA4KY	John W. Krakenberger
196	EP2AU	Foy Edwin Privette
197	HK4EB	Gustavo Orozco C.
198	W5ZKZ	A. M. Sprague

MIXED WPX

98	I1SF	Serafino Franchi
99	W3FDH	Robert G. Adams, Jr.
100	HK4EB	Gustavo Orozco C.
101	W5EZE	Max Busick

100 TWO-WAY SSB

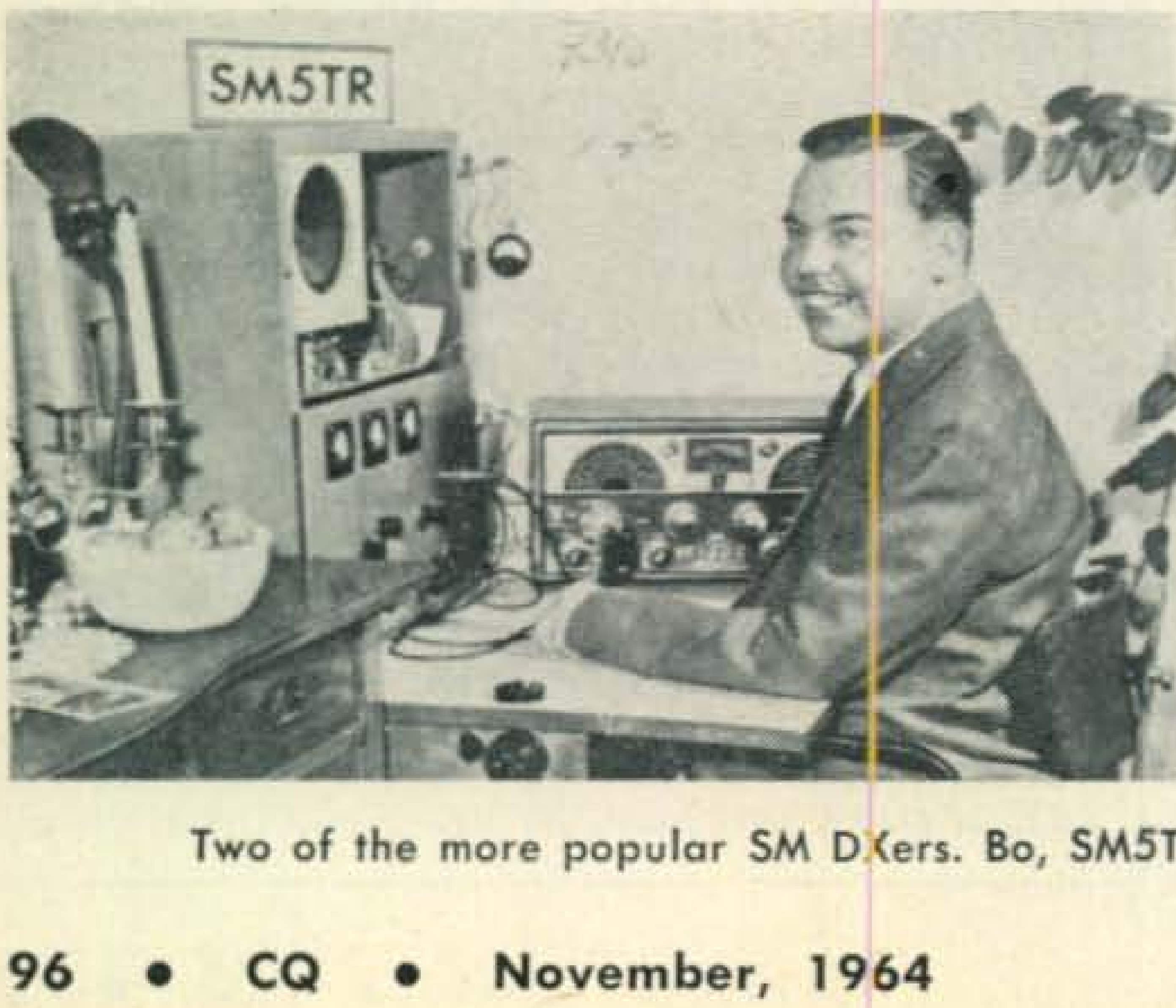
461	UA1MU	Victor Topler
462	G3KXT	R. I. Richardson
463	G2BOZ	J. E. Bazley
464	W4HKJ	William E. Ethier
465	XE2WH	William E. Hughes, Jr.

HS Thailand

The following from Frank, W4LCY/HS1P, should help clear up the HS situation: "We have been rather busy trying to get ham radio started in Thailand. In August of 1963 a bunch of us boys got together and formed the Radio Amateur Socety of Thailand which, I might add, is the first time in Thailand's history to have such an organization. The idea being that as an organization perhaps we could do more in the way of getting ham radio started than has been done in the past by individuals. From what everybody in-on-the-know tells us, we should make it. At the present, the outlook is highly optimistic.

"At this very moment we are waiting to have our charter registered. An organization cannot function in Thailand without first being registered by the police as Thailand is still under martial law. We submitted the Charter about two weeks before Thanksgiving Day, after having rewritten it to the satisfaction of the 'legal eagles', and it has taken its sweet time getting up to the Chief of CID where it is now. The charter first had to be passed by the Dept. of Education and then they forwarded it to the Dept. of Police. Yesterday all of the charter members had to appear before the Director of CID of the Dept. of Police with our passports, ID cards and extra copies of mug shots. The Thai boys had to fill out a four page questionnaire while we Americans just had to put our John Henry on them. So we are now in the process of being investigated by the CID. The standard joke among us is that we'll get the word in a few days that we have 26 hours in which to get out of the country . . . hi . . .

"The reason for all of this 'delaying action' is that the officials of Thailand are rather particular about allowing organizations to form because of the obvious threat. Thailand is surrounded by countries with Communist leanings and that is the prime reason for no ham ac-



Two of the more popular SM DXers. Bo, SM5TR, on the left and Gunnar, SM5AJR, on the right.

Group picture outside the tent which housed SV-SV. 1st row: Paul Wright, G3SEM; Christian Mottini, s.w.l., France; Rene Mazone, s.w.l., France; Allix Bertrand, s.w.l., France; Thieny de Sauliens, s.w.l., France; David, (son of DL2DM). 2nd row: Francis Bachtiger, HE9FPG; Ian Kerr, VE2BMK; Patrick Vandermeersch, ON5ET; Randy Starr, KØVRM. 3rd row: Louis Avramidis, SV1AR; Len Jarrett, VE3EWE; Spyros Spanapoulos, SV1AV; Akis Lianos, SV1AD; Maurice Gaveriaux, F3GN; Larry Becker, SVØWW (WA8JLE); Edwin 'Yogi' Bauer, SVØWW (K3WPO); William 'Bill' Moore, SVØWW (WA4PAX); Spyros (Doc) Tsaltas, SV1AT; George Karanassos, s.w.l., Greece; Kyriakos Kambouropoulos, SV1AS; Evangelos Moustakas, SV1AN.

tivity to date. They're really afraid of subversive activity on the ham bands. You can't really blame them, but we hope to change their minds for them by dispelling a lot of mistaken notions. So, we're waiting, as this investigation is supposed to be the last step in the registration process. If and when we become a legal organization, we start the paperwork toward the Prime Minister who is really the only one who can say yes or no about allowing ham radio and removing the ban at the ITU. Time will tell. . . .

"We have about 35 members in RAST (mostly Americans) as the only means we have had to tell people about RAST is by word of mouth. We couldn't advertise it in the papers because we are not legal and it would have been an excellent excuse for the police to swoop down on us. We have a few Thai but most of them tend to shy away because of possible repercussions. You can't blame them. As soon as we get the word from the authorities, we will conduct a campaign for members. There have been a lot of people inquiring about RAST.

"The following are the officers:

Mr. Sangiem Powtongsook, HS1PJ†	President Emeritus
Mr. Robert E. Leo, HS1L (K7KOK)†	President
Lt. Col. Kamchai Chotikul, HS1WR†	Vice President
Mr. Frank A. Phillips, HS1P (W4LCY)†	Secretary
Lt. Kitti Chamnanwanakit (no call)	Thai Secretary
Maj. James T. Bell, HS1J (W4IPH)	Treasurer
Mr. Jonas Eddy, HS1SD†	Chairman, TVI Committee
Capt. Kenneth M. Irish, HS1I (K8SXH)†	QSL & Activities Mgr.
Lt. Jamnong Sowanna, HS1JN	Education Officer

†Charter Members

"Mr. Sangiem (they use their first names only here), was our first president but since then he has become Director of the new Nat'l Telecommunication Organization of Thailand and, with the added work load, cannot make the meetings and the footwork necessary that will be coming up in order to push the paperwork thru, so he dropped back and the group made Bob Leo the president. Mr. Sangiem is a good man to have in RAST because with his new job he'll be the one who puts his signature on all of the tickets issued in Thailand from now on. He's been hamming since 1928 and is the first and oldest active ham in Thailand. He's been with the Radio Engineering Division of the GPO for the past 26 years. Bob Leo is an old DXer. He was one of the group in the Gatti-Hallicrafter Expedition to East Africa in 1948 (I believe it was then) and he is ex-W6PBV. He's used some exotic DX calls in his time with about two or three MP4 calls in addition to the ones he used in Africa. Jonas Eddy is ex-XU6Q, C6RSM and used to be QSL Manager for XU6 in the good ol' days. So, as you can see, we have a pretty good crew.

"So, the above info should clear up a lot of wondering on the HS bit. At present we have asked the boys to curtail operations on the bands so as not to cause anything to go 'wrong' which might hamper the registration of RAST. In addition to the poor conditions, that is the reason many of the boys back home haven't heard us on of late. We used to be quite active in spite of the ban."

Here and There

Sir Gus/DXpedition of the Month—When attending the Pacific Northwest DX Convention in Vancouver, Canada Stu Meyer, W2GHK, founder and director of the "DXpedition of the Month" announced that Gus Browning, W4BPD, will soon dxpedite to many areas of the world on behalf of DXpedition of the Month. In making this announcement Stu emphasized that "Sir Gus" would not only try to give the old timers and Honor Roll members a chance at a new one or two, but also try hard at helping out those lower down on the totem pole. Further details will follow. *(Tnx W2GHK)*

VR5 Tonga-FU8 New Hebrides-FK8 New Caledonia—G3NIR will visit these places beginning with VR5 November 3-6, FU8 November 9-13, FK8 November 18. It is expected one of the WA2WUV-Virgil Dxpedition rigs will be used and further information will be forthcoming from him in ample time. *(Tnx WGDXC)*

CR6 Angola—CR6GO, Antonio, Box 86, Malange 14012 kc CW 22-2300 GMT recently daily. *(Tnx WGDXC)*

FB8W Crozet Island—Despite rumors to the contrary, Marcel, FB8WW, is active almost daily. He can usually be found on 14050 kc. Where he is listening is anyone's guess. He is especially active between 0400 and 0800 GMT also around 1200 GMT. *(Tnx VERON)*

FC Corsica—F9UC/FC (QSL DL9PF) has been active on s.s.b. 14100-20 kc, 21-2200 GMT, daily. *(Tnx WGDXC)*

FH8 Comoro Islands—Andre, FH8CD, is active daily starting at 1500 GMT. He QRTs between 1700 and 1800 GMT. He prefers 14250 or 14300 kc. *(Tnx VERON)*

FO8 French Oceania—Leon, FO8BJ, is active on 14133 kc on s.s.b. on weekends. Club station FO8AA is almost constantly active on 14036 kc c.w. *(Tnx VERON)*

IS1 Sardinia—This moderately rare one will be well represented on s.s.b. with future planned expeditions by IS1VAZ. There are about 3 active permanent residents IS1MM, IS1ZUI, and IS1CXF who favor 20 meter cw operation while the DXpeditions favor s.s.b. operations. *(Tnx NEDXA)*

JT1 Mongolia—JT1KAA should now be active on 14255/296/324 kc s.s.b. JT1CA is now back home operating UA3CA. Vlad did a really great job putting JT1 on the s.s.b. map.

KB6 Canton Island—A new station recently joined KB6EPN and that is KB6EPQ. He is active on 14260 s.s.b. beginning around 0230 with fairly good signals. KB6EPN favors operation around 14310 at the same times and he does look for the weak ones. *(Tnx NEDXA)*

LA/P Jan Mayen—LA2J/P is a new one presently active occasionally on the low end of 14 mc c.w. around 1300 or 0100 GMT. *(Tnx WGDXC)*

OY Faeroes Islands—OY2GHK (W2GHK) has permission to operate but no date set as yet. *(Tnx WGDXC)*

PYØ St. Peter and Paul Rocks—PY2PE and PY2PA as

The operating position of SV1SV which was operated during the 11th International Boy Scout Jamboree in Greece. *(Tnx SV1AT)*

well as several other prominent PYs are planning a DXpedition to this spot. It is situated between Fernando De Nanoranha and the Brazilian Coast. It should count as a new country. The trip is tentatively scheduled for the end of October or the beginning of November.

TU2 Ivory Coast—TU2AE operates daily on s.s.b. He usually starts about 1700 GMT on either 15 or 20 meters. *(Tnx K1TOL)*

VK4 Willis Island—VK4TE and a new staff are now on location in Willis Island. They have shown next to no interest in ham radio although VK2AGH and several other VK hams are trying to get them to work some of the DX gang. *(Tnx VERON)*

VK9 Christmas Island—VK9XI is on most weekends 14105 s.s.b. listening 14250-60 from 1300 GMT. QSL via Hammarlund, GPO 7388, NYC. *(Tnx WGDXC)*

VK9 Nauru Island—VK9WP is reported enroute for a two year tour of duty. *(Tnx WGDXC)*

VKØ Macquarie Island —VKØPK is now active on 17020 kc c.w. commencing at 0730 GMT daily. *(Tnx VERON)*

VP1 British Honduras—VP1TA is active on 14049 kc almost daily. VP1JF is the only other c.w. operator there at present. Lee, VP1TA, is reorganizing the old radio club.

VQ8R Rodriguez Island—VQ8AM, Frank DuMont DXpedition set for early November will use the s.s.b. rig furnished to Harvey, VQ8BFC which is now in the hands of Leny, 5Z4GT, who will ship it to VQ8AM, France in Mauritius, so says G8KS who wishes it known that he is not the QSL Manager for France, who will handle his own QSL chores. *(Tnx WGDXC)*

VR2 Fiji Islands—Active on s.s.b. are VR2BJ (14250-0185 GMT) VR2AP (14325-0730 GMT) and VR2ES (14295-0745 GMT).

VR4 Solomon Islands—VR4EE has been active almost every weekend around 14255 s.s.b. starting at 1300 GMT. He puts in a fairly good signal, but transceiver operation increases delay in making contact. It is remarkable how he can copy a pack of S5 signals with relative ease. *(Tnx NEDXA)*

VS4 Sarawak (Malaysia)—VS4RS, Ron is active each Sunday from 1100 GMT until his 1300 GMT sked with the "LW" net and usually can be found between 14 and 14050 sometimes answering CQ's. Ray, VS4RD is also available at times on 7 and 14 mc c.w.

VS5 Brunet—VS5MH is active mostly during weekends again on 14100-20 kc s.s.b. listening there or 14245-60 kc. *(Tnx VERON)*

YA Afghanistan—YA4A, Dick is reported active daily on c.w. 14110 kc 17-1800 GMT listening for s.s.b. answers on that frequency and 14250 kc. Dick should have his s.s.b. gear on about the time you read this.

YK Syria—YK1AA, Rasheed DSB with rotary-dipole Fridays 0300-1100 and 1300-1600 GMT most other days of week. *(Tnx WGDXA)*

ZD3 Gambia—ZD3A should now be on s.s.b. with the rig sent by W4RLS. Foy skeds ZD3A every Sunday at 1900 GMT. After the s.s.b. operation begins, W4ZRZ will handle all QSLs.

The ever present CR9AH. John built all the equipment except the receiver.

ZD8 Ascension Island—KP4BPW, Father Tom Farly, presently Army Chaplain at Fort Brooke, San Juan, will QSY to Ascension Island and promises to activate a ZD8 call. *(Tnx KP4 Dxer)*

ZL Chatham Island—Ted, ZL2AWJ, expects to be QRV from there soon, probably during November. *(Tnx VERON)*

7G1 Rep. of Guinea—7G1L (W3ZBG) has been active on 14 mc s.s.b. around 14245-260 usually at 2200 GMT or thereabouts. Lou is operating transceive and will answer on frequency of station he picks. So, you may call him on any frequency within a 10 kc range and watch your own frequency for any possible reply from him. 7G1IX and 7G1EZ also operate on the low end of twenty between 1800 and 2200 GMT daily. *(Tnx KP4 DXer and WGDXC)*

7Q7 Nyassaland/Malawi—Peter Dodd, ex-ZD6PBd, is now active as 7Q7BPD around 14125 s.s.b. between 1700 and 2000 GMT. New QSL cards will be printed. At DXpedition of the Month, logs are now hand for the Independence Day Celebration which took place using the call signs ZD6I and 7Q7I. *(Tnx W2GHK)*

9L1 Sierra Leone—9L1OT is currently active on 20 c.w. with a T7 note.

SP Call Book—The Central Radio Club of Poland has available a Call Book of all licensed SP hams. It is available for 8 IRC direct from the CRC, Box 770, Warsaw, Poland.

9M2 Western Malaysia—The following is from Jim, 9M2DQ. After having been 7½ years on Langkawi Island, I have moved back to the mainland of Malaya, (Western Malaysia) and my new address is J. C. Pershouse, 9M2DQ, Baling Estate, Kuala Ketil, Kedah, Malaya:

[*Continued on page 132*]

George, OH9QU, at the operating position of his completely home brew station. *(Tnx W2OKM)*

Propagation

BY GEORGE JACOBS,* W3ASK

THE c.w. section of the 1964 *CQ* World Wide DX Contest will take place November 28-29. Special DX Propagation Charts for use during the contest periods appeared in last months column. Be sure to check these Charts for a prediction of band openings and other propagation data which should be useful during the c.w. section of the contest.

During the month of November, 20 meters is expected to continue to be the best band for world-wide DX openings from dawn through the early evening hours, while nighttime DX propagation conditions are expected to be optimum on 40 meters. Some fairly good DX openings are also predicted for 15 meters during the hours of daylight, and for 80 meters during the hours of darkness.

For a day-to-day forecast of general propagation conditions expected during the month of November, including the contest dates of November 28-29, see the "Last Minute Forecast" appearing at the beginning of this column.

This month's column contains a Short-Skip Propagation Chart for use in the continental United States for distances between 50 and 2300 miles. Special propagation charts centered on the states of Hawaii and Alaska are also included. Excellent short-skip propagation conditions are predicted for November and December during the *daylight* hours on 20 meters for distances between 1300 and 2300 miles; on 40 meters for distances between 250 and 750 miles, and on 80 meters for distances up to approximately 300 miles. During the *nighttime* hours, excellent short-skip propagation conditions are expected on 40 and 80 meters for distances ranging between approximately 1000 and 2300 miles, and on 160 meters for distances up to about 2000 miles.

Sunspot Cycle

The sunspot cycle continues to decline slowly towards a minimum. The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot number of 9 for August, 1964. This results in a 12-month running smoothed sunspot number of 17 centered on February, 1964. The sunspot cycle is derived from the monthly smoothed sunspot numbers.

During last year's c.w. section of the contest period, smoothed sunspot activity was measured at a level of 23. A smoothed sunspot number of 10 is predicted for this year's c.w. contest period. This is expected to be the lowest level of sunspot activity recorded during any November since November, 1953.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for November

	Forecast Rating and Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **6, 15, 26**	A	A-B	B-C	C
Normal: **3-5, 7-8, 11-12, 14, 16, 20, 22-25, 27-28**	A-B	B-C	C-D	D-E
Below Normal: **2, 9-10, 13, 17, 19, 21, 29-30**	C	C-D	D	E
Disturbed **1, 18**	D	D-E	E	E

How To Use These Charts

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

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

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

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

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

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

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

6—These Propagation Charts are valid through December 31, 1964. These Charts are prepared from basic propagation data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

VHF Openings

Some v.h.f. meteor-type ionospheric openings are likely to occur during the *leonids* meteor shower which should take place between November 14 and 18. Some auroral-type v.h.f. ionospheric openings may also occur during the month when ionospheric conditions are below normal or disturbed. Check the "Last Minute Forecast" at the beginning of this column for the days that are likely to be in these categories.

73, George, W3ASK

CQ Short-Skip Propagation Chart

November & December, 1964

Band Openings Given in Local Standard Time

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

Band (Meters)	*50-250 Miles*	*250-750 Miles*	*750-1300 Miles*	*1300-2300 Miles*
10	*Nil*	*Nil*	09-21 (0-1)	09-21 (1-0)
15	*Nil*	09-21 (0-1)	09-11 (1) 11-14 (1-2) 14-21 (1)	09-10 (1) 10-11 (1-3) 11-14 (2-4) 14-15 (1-2) 15-17 (1) 17-21 (1-0)
20	*Nil*	09-11 (0-1) 11-16 (0-2) 16-21 (0-1)	09-11 (1-4) 11-16 (2-4) 16-18 (1-2) 18-21 (1) 21-09 (0-1)	07-08 (1) 08-09 (1-3) 09-16 (4) 16-17 (2) 17-18 (2-1) 18-19 (1)
40	07-09 (0-1) 09-12 (2-4) 12-14 (3-4) 14-16 (2-4) 16-18 (1-2) 18-20 (0-1)	07-09 (1-3) 09-14 (4-2) 14-16 (4) 16-18 (2-4) 18-20 (1-2) 20-00 (0-2) 00-07 (0-1)	07-09 (3) 09-14 (2-1) 14-16 (4-2) 16-18 (4) 18-00 (2-3) 00-03 (1-2) 03-07 (1-3)	07-08 (3-2) 08-09 (3-1) 09-14 (1-0) 14-16 (2-1) 16-17 (4-2) 17-18 (4-3) 18-20 (3-4) 20-00 (3) 00-03 (2-3) 03-07 (3)
80	08-16 (4) 16-18 (2-4) 18-20 (1-3) 20-22 (1) 22-06 (1-2) 06-08 (2-3)	08-09 (4-2) 09-16 (4-1) 16-18 (4-2) 18-20 (3-4) 20-22 (1-2) 22-06 (2-3) 06-07 (3-4) 07-08 (3)	08-09 (2-1) 09-16 (1-0) 16-18 (2) 18-20 (4) 20-02 (2-4) 02-06 (3-4) 06-07 (4-2) 07-08 (3-1)	08-09 (1-0) 09-16 (0) 16-18 (2-0) 18-20 (4-3) 20-04 (4) 04-06 (4-2) 06-07 (2-1) 07-08 (1)
160	09-17 (1-0) 17-19 (3-2) 19-07 (4) 07-09 (3-2) 09-11 (1-0)	17-19 (2-1) 19-05 (4) 05-07 (4-3) 07-09 (2-1)	17-19 (1-0) 19-21 (4-2) 21-04 (4) 04-05 (4-2) 05-07 (3-1) 07-09 (1-0)	19-21 (2-1) 21-00 (4-2) 00-04 (4-3) 04-05 (2) 05-07 (1-0)

Hawaii To:

*Openings Given in Hawaiian Standard Time**

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

Alaska To:

Openings Given in GMT§

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Eastern USA	20-22 (1)	19-21 (1) 21-22 (2) 22-00 (1)	07-09 (1) 12-14 (1)	*Nil*
Central USA	20-22 (1)	17-21 (1) 21-23 (2) 23-01 (1)	06-15 (1)	*Nil*
Western USA	19-21 (1) 21-23 (2) 23-00 (1)	18-20 (1) 20-23 (3) 23-00 (2) 00-01 (1)	01-02 (1) 02-03 (3) 03-15 (2) 15-17 (3) 17-18 (1)	11-15 (1) 15-16 (2) 16-17 (1)

*Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST and 10 hours *behind* GMT.

†Indicates possible 10 meter openings.

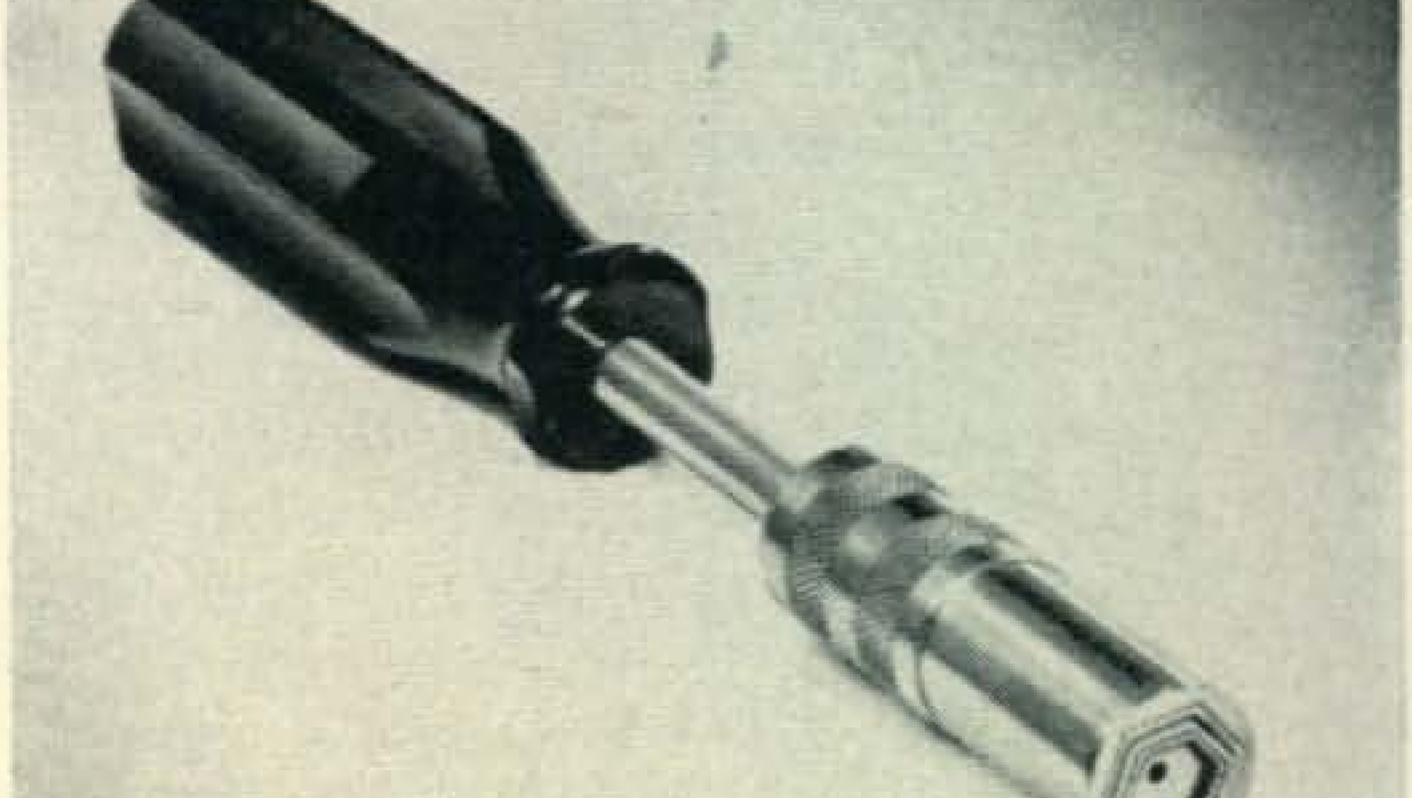
‡Indicates possible 160 meter openings.

§GMT or Z Time is 5 hours *ahead* of EST; 6 hours *ahead* of CST; 7 hours *ahead* of MST; 8 hours *ahead* of PST and 9 hours *ahead* of Alaskan Standard Time in the zone between Skagway and 141 degrees west longitude, etc.

New Amateur Products

Sock-O-Matic Wrench

The new Sock-O-Matic socket wrench will do the work of 4 individual wrenches—this one tool can be used on 7 different size hexagonal screws or nuts. The four hexagon inserts used in this tool were selected to fit the greatest number of hex head type screws and nuts without sacrificing efficiency of operation. The insert sizes are ¼", 5/16", ⅜", and 7/16". This gives the tool a range of commercial hex head screws from #6 to ¼" and hex nuts from #2 to #6, with #10 to ¼" thread sizes. To use the Sock-O-Matic wrench, the unit is pressed over the nut or screw and the knurled barrel is turned until the socket locks. The Sock-O-Matic wrench is available from the Silverbrook Manufacturing Co., Inc., Springfield, Mass. at the cost of $6.95. Circle A on page 142 for further information.



Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Oct. 31-Nov. 1		RSGB 7 mc DX Phone
Oct. 31-Nov. 1		New Hampshire Party
November	4-5	YLRL Phone Party
November	14-15	ARRL SS Phone
November	21-22	ARRL SS C.W.
November	21-22	RSGB 7 mc DX C.W.
November	**28-29**	***CQ* WW DX C.W.**
December	5-6	RSGB 21/28 Phone
December	5-6	OK DX C.W.
December	5-6	New England Party
December	12-13	Virginia QSO Party

RSGB 7 mc DX

Phone—Oct. 31-Nov. 1 **C.W.**—Nov. 21-22
Starts: 1200 GMT Saturday. Ends: 1800 GMT Sunday in each instance.

It's the world working the British Isles on 7 mc in this one. (G, GB, GC, GD, GI, GM and GW) And it's going to be mighty rough going during the C.W. week-end when the ARRL SS is also on.

The scoring does not follow the conventional lines as in other contests, therefore it is strongly recommended that you review the rules as they appeared in last month's CALENDAR.

The closing date for posting entries is December 14th and they go to: R.S.G.B. Contest Committee, 28 Little Russell Street, London, W.C.1, England.

New Hampshire Party

Contest period is divided into three periods.
From 0000 to 0400 GMT Sunday, Nov. 1
From 1200 to 1600 GMT Sunday, Nov. 1
From 0000 to 0400 GMT Monday, Nov. 2

The fifteenth New Hampshire QSO Party offers an opportunity to gain credits for the WNH (Worked New Hampshire) and GSA (Granite State Award) as well as certificates for contest activity.

Rules and operating frequencies appeared in last month's CALENDAR.

Mailing deadline is November 25th and your logs go to: Nashua Mike and Key Club, P.O. Box 94, Nashua, New Hampshire.

YLRL Party

Phone—Starts 1700 GMT Wednesday, Nov. 4.
Ends: 2300 GMT Thursday, Nov. 5.

The c.w. section has already taken place. Louisa Sando gave the details in her YL column last month.

*14 Sherwood Road, Stamford, Conn. 06905.

Your logs go to: Martha A. Edwards, W6QYL, 44303 North Date Avenue, Lancaster, Calif.

ARRL SS

Phone—Nov. 14-15 **C.W.**—Nov. 21-22
Starts: 2400 GMT Saturday. Ends: 2400 GMT Sunday in each instance.

Rules remain the same as in last year's contest. The message exchange will be two digits indicating the year first licensed, followed by the month and day of birth. The October issue of *QST* should give the rules in detail.

It's significant to note that altho this activity still occupies two week-ends its basically a one week-end contest for each mode. A very welcome improvement. Now, if the powers that be would apply this positive thinking to the February/March DX competition, and cut down the quarterly CD parties to once a year, it would greatly relieve the pressure on an already overcrowded calendar.

Your SS logs as well as requests for this improvement go to: The ARRL, 225 Main Street, Newington, Conn. 06111.

CQ WW DX

C.W.—Starts: 0000 GMT Saturday, November 28
Ends: 2400 GMT Sunday, November 29

The Phone section should be over by the time you read this and if you haven's gotten the message by this time it's too late to try and educate you about the greatest contest in the world.

However you can still check the September issue for the rules in detail and George Jacobs' Propagation column for the best operating times.

Mailing deadline for your Phone logs is December 1, 1964 and January 15, 1965 for the c.w. entries. Please indicate on the envelope if the enclosure is a Phone or c.w. entry.

Our new mailing address: *CQ* WW DX Contest, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050.

RSGB 21/28 mc Phone

Starts: 0700 GMT Saturday, December 5
Ends: 1900 GMT Sunday, December 6

Once again it's the world working the British Isles, but this time it's on 21/28 mc Phone. Rules are similar to those for the 7 mc contest.

1. The usual five figure serial Number, RS

report plus a progressive 3 digit number starting with 001.

2. For overseas stations, each contact will count 5 points. Only one contact per band permitted with the same station and crossband operation is not allowed.

3. An additional bonus of 50 points may be claimed for the first contact with each British Isle country/prefix on each band. (*ie:* G2, G3, GB2, GC3, GM6 and etc.) A possible 37 on each band.

4. An additional bonus of 50 points can be claimed for every ten stations worked in each of the 37 country/numeral prefixes, irrespective of the band.

5. Your final score therefore will be the sum of QSO points and bonus points, no multiplier involved.

6. Log sheets should be columned and show in this order: Date/time in GMT, station worked, serial number sent and received, band, bonus points and QSO points.

7. Each entry should also include a summary sheet with name and address in BLOCK LETTERS and other pertinent information.

8. Certificates will be awarded to the leading stations, single operator and multi-operator, in each country and call areas in the following: U, VE, VK, W/K, ZL and ZS. And don't forget the usual signed declaration that all rules and regulations have been observed.

9. There is also a SWL section. Rules are the same as listed above, except that bonus points listed under Rule #3 is 20 points. CQ and test calls do not count. The logged station must actually be working someone, and the call and report of the station being worked must also be listed.

10. Logs go to: R.S.G.B. Contest Committee, 28 Little Russell Street, London, W.C.1, England. Postmark deadline is December 21st.

OK DX C.W.

Starts: 0000 GMT Sunday, December 6
Ends: 2400 GMT Sunday, December 6

This is a world wide type contest so don't confine your operation to working Czech stations only.

1. Use all bands, 1.8 thru 28 mc, on c.w. only of course.

2. There are three categories: A. Single Operator, All Band. B. Single Operator, One Band. C. Multi-operator, All Band.

3. The number exchange will be five figures. RST report plus 2 figures indicating the number of years the operator has been active in amateur radio. (*ie:* active since 1934, 57930) Multi-operator and club stations will use date station was licensed. (*ie:* licensed in 1955, 57809)

4. Each completed contact counts 1 point, but *3 points* if its with a Czech station. The same station can be worked only once per band and contacts with stations in the same country have no value.

5. The multiplier is determined by the number of prefixes worked on each band. (WPX Award List)

6. Final score therefore will be the total contact points multiplied by the sum of the prefixes from each band.

7. Use a separate log sheet for each band and show in this order: Date/time in GMT, station worked, number sent, received, contact points and prefix. (First QSO only)

8. Include a separate summary sheet showing the scoring and other pertinent information and your name and address in BLOCK LETTERS. Also include and sign the following declaration: "I hearby state that my station was operated in accordance with the rules of the contest as well as all regulations established for amateur radio in my country, and that my report is correct and true to the best of my belief."

9. Certificates will be awarded to the highest scoring operator in each country and in each category.

10. Contest contacts may be applied for the "100 OK" (worked 100 Czech stations) and the "S6S" (worked all continents) awards, providing a written application is submitted with your log.

11. Logs go to: Central Radio Club, Post Box 69, Prague 1, Czechoslovakia. Mailing deadline is January 15, 1965.

Virginia Party

Starts: 1800 GMT Saturday, December 12
Ends: 0200 GMT Monday, December 14

The Virginia QSO Party sponsored by the Roanoke Valley Amateur Radio Club will have the same rules as last year and will be given in detail in next month's CALENDAR.

Editors Note

It was my pleasure to once again meet many of the top DX contest men at the recent ARRL Convention in New York City. The *CQ* Booth with the Contest Trophies on display and Angelo (of Apollo Engraving) busily engraving call letter tie clasps and lapel plaques, was quite the center of activity.

Many of the fellows were of the opinion that it was next to impossible for a W/K station to win a Trophy, especially in the most popular category, single operator, all band. There is no question of the many advantages enjoyed by many foreign stations, especially those in a few choice locations.

To fill this void and give the boys over here something to shoot for, the Potomac Valley Radio Club and the North Jersey Radio Association are donating Trophies to the highest scoring USA station in the Single Operator, All Band category, phone and C.W. respectively.

K2HLB, Dr. Harold J. Megibow is donating a Trophy to fill the spot vacated by the PVRC as listed in the September issue.

And don't forget the 7 mc Trophy donated by the Israel Amateur Radio Club for the highest C.W. score on that band.

Lots of luck fellows, hope George Jacobs was good to us and gave us a couple of good weekends. 73 for now, Frank, W1WY

SPACE COMMUNICATIONS

BY GEORGE JACOBS,* W3ASK

Late August and early September witnessed several major milestones in space exploration. During this period, the United States launched successfully an Orbiting Geophysical Observatory (OGO-A), an Ionospheric Research Satellite (TOTSI), a SYNCOM Communication Satellite and a NIMBUS Weather Satellite. Each of these satellites contained advanced communication or telemetry equipment, and provided additional "sounds from outer space" for space-listeners to tune in on the 136 mc space band.

OGO-A

The first in a new series of large American satellites, the half-ton Orbiting Geophysical Observatory (OGO-A), was launched from Cape Kennedy on September 4.

OGO is truly an orbiting research center. The huge satellite contains equipment for conducting *twenty* different scientific experiments as it orbits high in space. This is a far greater number of experiments than has ever been attempted previously with an American satellite.

OGO-A's orbit is elliptical in shape, ranging from 175 to almost 93,000 miles above the Earth's surface. In this orbit, the satellite is able to measure and observe scientific phenomena in the Earth's atmosphere, the ionosphere, the regions in space under the influence of the Earth's magnetic field, and in interplanetary space beyond the Earth's magnetic field. OGO-A is inclined 31 degrees to the equator, and takes approximately 63 hours to complete an orbit.

The main purpose of the OGO satellite is to learn more about the influence of the Sun on the Earth and its atmosphere. Much of the data produced by the OGO experiments are expected to be useful in radio propagation, astronomy, and in the evaluation of the hazards involved in manned exploration of space. The satellite is expected to have a one-year operational life-time. Five more satellites in the OGO series are planned for the future.

OGO-A Frequencies

The communication system aboard the OGO-A satellite is the most advanced ever incorporated in a scientific satellite. It is capable of handling 254 different ground-originated commands and consists of a data handling system which stores up and transmits data to ground stations upon command at a volume equivalent to the number of words in three thick novels—all in a minute's time!

A four-watt wideband transmitter aboard OGO-A is used for command telemetry on 400.25 mc. Another four-watt transmitter is available should the main one become inoperative. A 100-milliwatt c.w. beacon transmitter operates continuously on 136.20 mc. Upon ground command, the power of this transmitter can be raised to 10 watts to permit accurate tracking when the satellite is at maximum range. A standby beacon transmitter is also available should trouble develop. A 500-milliwatt telemetry transmitter also operates upon ground command on a frequency of 400.85 mc. The satellite also contains two command receivers, one v.h.f. and one u.h.f. omnidirectional antenna, and a u.h.f. directional antenna with a gain of 12 db. Solar cells provide about 500 watts of power to the 28-volt nickel-cadmium batteries for driving the communication and other electrical equipment aboard the OGO-A satellite.

TOPSI

On August 25, NASA launched successfully EXPLORER 20, a satellite designed to explore the region of ionized gas above the Earth's surface called the *ionosphere*. The ionosphere is of scientific importance since it reflects high frequency radio waves over great distances.

EXPLORER 20, nicknamed TOPSI, is another important step in NASA's Ionosphere Program which began in 1958 with sounding rockets. The purpose of this program is to explore the ionosphere and probe its mysteries in an effort to better understand what may cause it, and how it behaves. Prior to TOPSI, three satellites have been used to explore the ionosphere—EXPLORER 8, ARIEL 1 and ALOUETTE 1. TOPSI, containing equipment of advanced design, is expected to contribute considerably more new data about the ionosphere, which will have both scientific and practical applications. From TOPSI's data scientists hope to get a fuller understanding of the ionosphere and communication engineers (and radio amateurs) will be able to use this information for determining optimum frequencies to use on high frequency radio circuits, and in the prediction of radio storms.

In order to explore the ionized region for as long as possible, TOPSI is in a near circular orbit, varying between 500 and 600 miles above the Earth's surface. The satellite is inclined 80 degrees to the equator, and completes an orbit in 104 minutes.

TOPSI is equipped with six radar sets for pulsing the ionosphere, a two-way communications system, a tracking beacon and a solar power system. Its primary job will be to take radio "soundings" of the upper atmosphere. This technique is similar to that used by a world-wide network of ground ionospheric sounding stations which has been in operation for more than thirty years. There ground stations explore the bottom of the ionosphere, while TOPSI will be used to explore the topside region.

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

TOPSI's Frequencies

While in orbit, TOPSI makes a sounding on each of six frequencies in sequence, every one-tenth of a second. The frequencies are 1500, 2000, 2850, 3720, 5470 and 7220 *kilocycles*. The transmitters used for soundings range in power from 8 to 45 watts. When the pulses strike the ionosphere they either will be reflected back to the radar aboard TOPSI, or penetrate through the ionosphere. The highest frequency pulse reflected back to the satellite is an indication of the intensity of ionization in the region. Travelling in a polar orbit, TOPSI is able to chart the level of intensity in the ionosphere on a world-wide basis.

In addition to the six radar sets, TOPSI contains a two-watt a.m.-f.m. telemetry transmitter which is used to relay TOPSI's findings back to ground stations upon command. This transmitter operates on 136.35 mc. A c.w. beacon transmitter, with a power of 75 milliwatts, is used for tracking purposes on 136.68 mc. The power of this transmitter can be raised to 250 milliwatts upon ground command, in order to transmit special telemetry data.

When the degree of ionozation is such that some of the pulses transmitted from TOPSI penetrate the topside of the ionosphere, it may be possible to hear them on the ground receivers. Since two of the frequencies used by the satellite fall in the amateur bands (3720 and 7220 kc), the pulses may be heard by radio amateurs and space- listeners without difficulty under certain conditions.

NIMBUS

NIMBUS-A, the largest experimental weather satellite ever built by the United States, was placed into orbit from NASA's Pacific Missile Range on August 28. The satellite, an 830-pound orbiting weather station, is expected to perform more tasks in space than any weather satellite launched previously. Weather Bureau officials have estimated that NIMBUS-A will do the work of thousands of ground-based weather stations. As a follow-on to the highly successful TIROS weather satellite program, which scored eight successes in eight attempts, NIMBUS is the next step in NASA's meteorological program to develop an operational weather satellite system on a world-wide basis.

Launched in a near perfect polar orbit, and varying in altitude between 250 and 560 miles above the Earth's surface, cameras aboard the satellite are photographing cloud formations continuously, both night and day. Advanced design television cameras aboard the spacecraft operate during the daylight hours for 50 minutes out of each 103-minute-orbit. When the satellite is over the dark side of the globe, the television cameras are shut-off automatically, and highly sensitive infrared equipment is turned-on to view the Earth's cloud cover. NIMBUS is the first weather satellite to obtain cloud cover and other meteorological information in darkness.

NIMBUS' Frequencies

Most of the data obtained by NIMBUS is stored on tape and released to ground stations on command. However, a special experimental Automatic Picture Transmission (APT) service is being provided by the satellite. This service provides real-time pictures, which are sent immediately from the satellite to relatively simple ground stations scattered around the globe. The camera used for this public service photographs an area of one-million square miles. The pictures are sent to the ground by a 5-watt transmitter operating on 136.95 mc. This same transmitter also sends the start and synchronizing signals to alert ground stations using the APT service that NIMBUS is approaching. Approximately 62 stations, including 12 in foreign countries and 4 built by private users, are receiving APT information from the NIMBUS-A satellite.

A typical ground station for the APT service consists of a manually tracked 13 db gain antenna (a helix about 12-feet long would do the trick), a radio amateur type v.h.f. receiver for 136.95 mc, and a standard facsimile machine. The 800-line APT pictures and 0.25 scanning time per line are comparable with standard 240 r.p.m. facsimile equipment.

A continuous 500-milliwatt c.w. beacon transmitter, which is also used for 2-channel telemetry upon ground command, operates on 136.498 mc.

SYNCOM 3

SYNCOM 3, the third in a series of experimental high-altitude communication satellites, was launched successfully from Cape Kennedy on August 19.

After several intricate space maneuvers carried out over a period of a month, SYNCOM 3 became the first spacecraft to achieve a completely synchronous orbit. This means that the satellite appears to be standing still in the sky. Hovering at an altitude of 22,300 miles, SYNCOM 3 is located over the mid-Pacific, at the intersection of the equator and the 180 degree meridian, or the International Date Line. From this position, it appears to remain completely stationary with respect to the Earth. One of the many advantages of a synchronous satellite is that it eliminates the need for complex tracking antennas at ground-based stations using the satellite for communications.

In its mid-Pacific synchronous orbit, SYNCOM 3 has linked the United States with the Far East and Southeast Asia. The satellite is being used for experimental two-way telephone, teleprinter and facsimile transmissions. Modifications were made to the satellite several weeks before launch to enable it to be used for the limited relay of live television broadcasts between Japan and the United States during the October Olympics held in Tokyo. Since SYNCOM 3 was not originally designed for television, the quality of the pictures were not expected to be as high as those received over the Atlantic via the TELSTAR and RELAY satellites. By the time this appears in

[*Continued on page 132*]

THE VHF COLUMN

BY BOB BROWN, K2ZSQ

and ALLEN KATZ, K2UYH*

SOMEWHERE between the *CQ* offices at Port Washington, Long Island, and K2UYH's QTH in Verona, New Jersey, lies a manila envelope marked "Special Delivery" which contains the bulk of the V.H.F. COLUMN's correspondence for this month. Mr. Postman really goofed this time! Soooo we are running on about quarter power—6 db down. Look for a bigger column next month from the overflow, and please excuse us this month if we get a little personal with our extra space.

A Month for Moving

We Browns are now settled in our "connubial nest" (as K2UYH terms it) on the west side of Beacon Hill in Port Washington, L.I. The hill is a favorite contest site for the Long Island gang as we learned dramatically last night when K2UMM/2 literally blew the receiver off its moorings. Turned out the operator was K2MGA, esteemed editor of *CQ*, busy racking up sections in the ARRL's September affair. In truth, though, the location does seem to be a good one—far better elevationwise, at least, than we had been accustomed to in New Jersey. Right now we're in the process of running down an intermittent noise level problem at 50 mc. After due investigation, it appears to be a combination of local ITV and a faulty power transformer on a nearby telephone pole. At the moment we are awaiting a return landline from the power company re the hash.

Once these problems are remedied (soon, I hope), K2ZSQ should be found on most evenings in the first 100 kc of six. Present equipment consists of a homebrew d.s.b.-a.m. 60 watter, ARC-5 v.f.o., Clegg Interceptor and a 4 element Yagi, compliments of K2UYH. We are hoping to get an 11 element job up in the spring with luck. Cross your fingers.

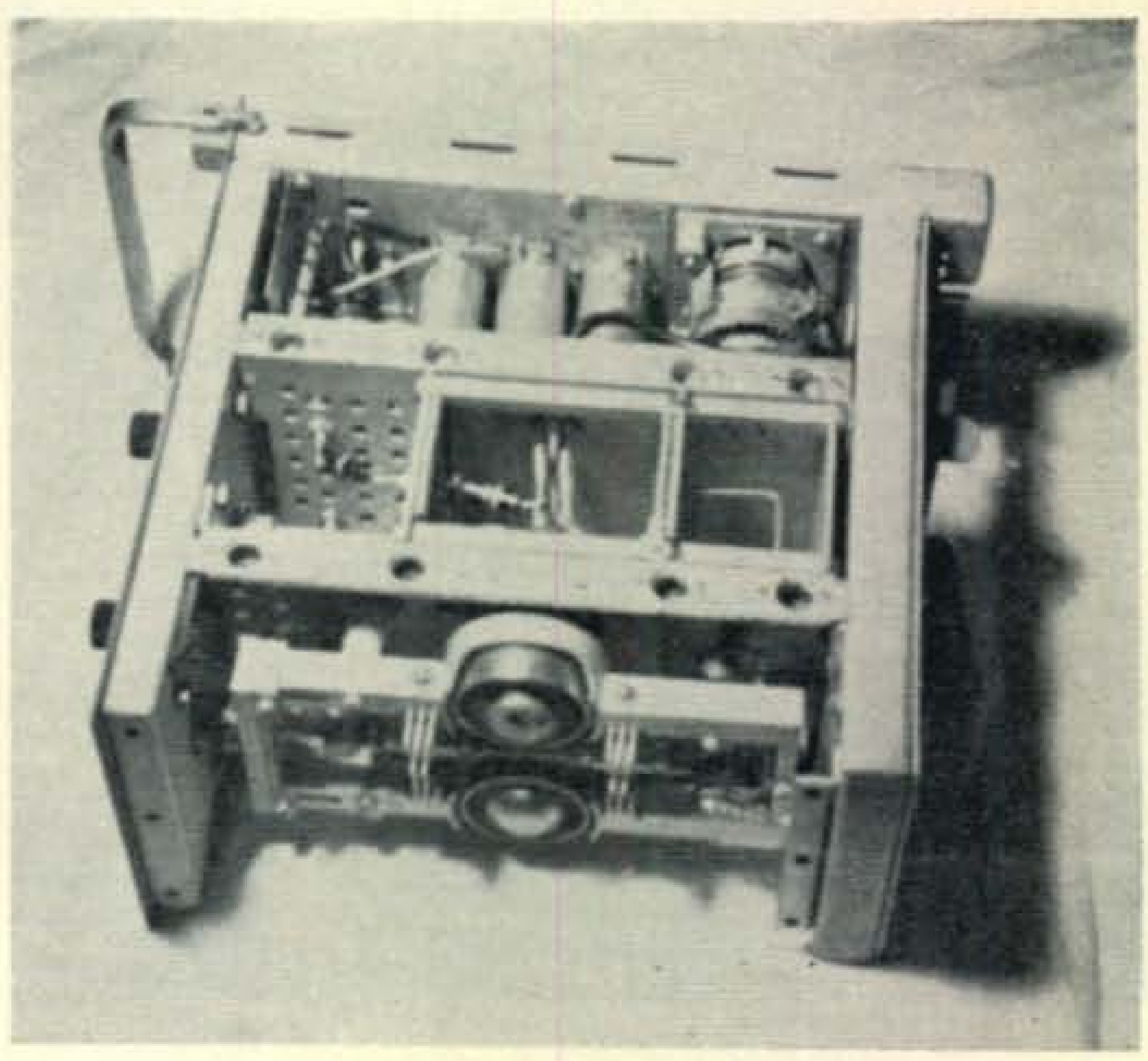
While we're on the subject of six meters contestwise, we must mention one station who certainly deserves credit for an outstanding job in the September QSO Party. Running a full kw into stacked eleven element Yagis, WB2MRK in NYC was indeed a station to be envied. With no exaggeration we can say that a great number of stations who usually score well in these contests were observed tail-ending WB2MRK to get those rare sections! Perhaps this is the beginning of a trend back to high power. If so, it is about time. In a Channel 2 TV area such as ours high power has always been the exception rather than the rule. But more and more 200-watt-plus signals are popping up on the band lately. Another indication is the frequency of stations who chose to use the 1.25 power multiplier in *CQ*'s Summer V.H.F. Contest. Here again, high power seems to be the vogue.

*c/o *CQ*, 14 Vanderventer Avenue, Port Washington, Long Island, N.Y. 11050.

K2UYH has also taken to the hills, a 1300 footer in particular, near Stockhom, New Jersey. Although all the gear is not in place yet, a 13 element cross yagi for two meters is up 65 feet. Ninety-six elements of a 192 element collinear array should be going aloft soon too.

Things are kept interesting on 2 meters by Ray, VE3BPR (approx. 144.1 mc—v.f.o.), who is on almost every night at 2200 hours EST skedding W2AMJ, W2NCF, and the rest of the two meter s.s.b. group with strong enough signals to make it up this way. A nonconformist K2 (whose call has slipped our mind for the moment) on a.m. (ancient modulation) from Syracuse, New York, is also heard often in the scramble. How he gets away with operating among the s.s.b. boys is beyond me. Stable v.f.o., I guess—a feat darned hard to achieve on two meters unless you heterodyne up there. W4JFU (144.800) also on almost daily at 12 noon from Ononack, Virginia, can most frequently be heard working WA2FSQ—one of the outstanding Technician stations in the country. Fred provides a shining example of what can be accomplished above 145 mc on two meters.

Still going strong after many months, W8KAY and K2IEJ (144.30 mc) QSO on c.w. at 2300 hours EST over a near 500 mile path. We have never heard them miss. Even more fantastic is the fact that signal reports exchanged are usually S7 or 8. At this QTH, even with the 500 cycle



Ham's eye view of the K1WHS/K1WHT 220 mc r.f. unit. Inside this mighty 10 × 10 × 6" case are push-pull 4X150A's in the final, operating straight through with a 4X150A driver/tripler and 6CL6's multiplying. Nifty?

filter, W8KAY is seldom above an S3. Either we have a Scottish "S" meter or our converter is not working properly. (I suggest it is the converter since our "S" meter has been calibrated with an attenuator.) Later in the evening W8-KAY usually turns his beam south to work W4NHW in Kentucky. We have heard W4NHW a few times on bursts. Maine, one of the previously hard-to-get states on two meters, is now well represented by K1UGO (144.020 mc), who runs 180 watts to a Clegg Zeus. I'll bet many a two meter station has Carl to thank for his first Maine contact. K1UGQ can usually be found on early Sunday morning along with W3ARW, W2HF, W3IBH, W3LML, and several other early birds.

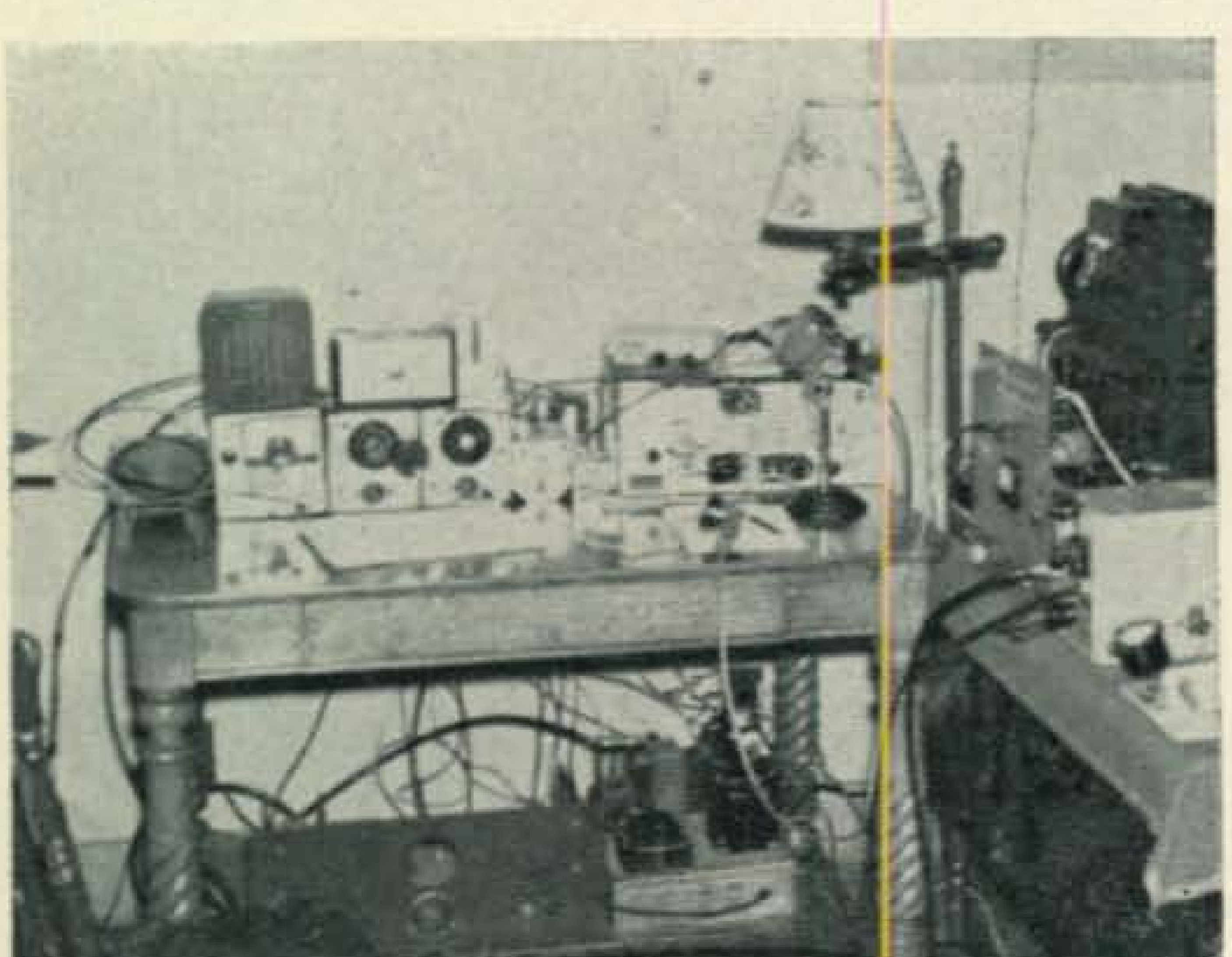
W3ARW has quite an interesting station. It is located atop a 2100 foot mountain and is remote controlled by Charlie from his home in Scranton on 144 and 220 mc. However, he does have to go up to the mountaintop to operate on 432 mc.

Sorry but we can't be too informative about the bands above two meters owing to the fact that all our antennas are not up. Tuning around 220 mc with a 5 element beam only a few feet off the ground produced the usual TV hash, and we haven't even done 432 mc this much justice. As far as ATV is concerned, we have learned of a few more pockets of activity and hope to have a beacon going on 440 mc by the time this column appears in print.

What A Day!

When we at long last realized that the Summer V.H.F. Contest was scheduled for the same weekend as the ARRL National Convention in New York, it was but a few days before blastoff. Real planning, huh? Well, we promise it won't happen again (we hope). We, ourselves, were torn with indecision. It is pretty hard to be partisan when you are a member of both parties. Our love of v.h.f. contests won out, however, and we were off with the pack.

On-the-air talks with the fellows indicated that they were in pretty much accord with the rules. It looks like the single band scoring, small power multiplier, and hours multiplier are here to stay, although the multi-operator division will probably be reinstated next summer. We will have more on the up-and-coming v.h.f. contests after a few top level conferences with the brass. But we thought we would let you know we are looking out for your interests. Results of this affair will appear next month.



"Wild and wooly" is the way they describe Maine, and wild and wooly is the way K1VUE refers to his v.h.f. emporium. In spite of appearances, K1VUE emits a wicked 50 mc signal from Wilton, Maine, regularly on both a.m. and d.s.b.

This foursome always seems to be doing something unusual. This time they're posing for the VHF camera at Dennis Hill State Park in Norfolk, Connecticut. Left to right: K1SJG, WN1AOQ, K1NCA and K1NKV. In a single weekend's time from this QTH K1NCA/1 snagged 53 counties on both 50 and 144 mc!

How High Is High?

Over twenty years ago the now famous Dale Carnegie, author of *How To Win Friends and Influence People* and founder of the Dale Carnegie Institute, made a seemingly insignificant blunder in one of his Sunday afternoon radio broadcasts. In an on-the-air reference to Louisa May Alcott, he mentioned that her birthplace was Concord, New Hampshire. Much time has passed since this lecture and few people even remember what it was about. But, there are at least three patriotic residents of Concord, Massachusetts, who will never forget Mr. Carnegie for this error. You see, Miss Alcott was the famous resident not of Concord, New Hampshire, but of Concord, Massachusetts. Many of the vehement letters and phone calls he received as a result of that broadcast were spoken and literary epics.

Few could compare, however, to those received by this lowly editor as a result of a similar item in our August column. We mentioned on page 70, and I quote, ". . . to scale Slide Mountain, New York state's highest pinnacle, for operation in the Spring CQ V.H.F. Contest. . . ." We have been informed by countless New York state residents that Slide Mountain although the highest in the Catskills does not even approach Mount Marcy, New York's highest summit at 5344'. Our sincere apologies for this goof. Although undeserving, we beg these readers for forgiveness. If Dale Carnegie could learn a lesson from his experience, so too have we learned ours.

From The Mailbag

Cal Jones, WA3AMT, on his 432 mc M.B. Project: "This letter is to announce our interest in planning moon bounce skeds for next summer. We have our project well underway with W3FAF building the transmitter, K3OBD building the receiver, and WA3AMT building the antenna.

"We intend to work near the center of the 420-450 mc band with 500 watts on c.w., eight 22 element turnstile-yagis, and a parametric preamplifier. We will be pleased

You have all been waiting for it—Here it is: the famous K7VQI ham TV shack in Tucson, Arizona. Quite a conglomeration!

to answer technical questions and look forward to hearing comments from others interested in u.h.f. communications." *(Good luck with your plans, Cal. We hope things work out the way you expect, though we have always been a bit skeptical about group projects. We have just seen too many of them fall through. Another thing we are wondering about, is the advisability of using yagis on 432 mc—Particularly long and crossed ones! When you get your array working, it should be quite interesting to see how much the Faraday rotation affects your 432 moon bounce propagation. The effect drops off with frequency and by the time one reaches 432, it should be quite small.)*

Dave Bray, K2LMG, on M.B. with Arecibo: "For the tests I used circular polarization. I received KP4BPZ best on right-hand circular polarization with a good degree of cancellation on left-hand circular polarization." *(Do you know what Gordon was using for a feed antenna?)* "The signals were very heavy with QSB. Peak signs were about S6 from him and he went down into the noise. The fading was so rapid that it made copy very hard to read. I made a recording of the signals for the entire time—about 2 hours.

"Receiver here is a 7077 grounded grid to 417A grounded grid to 6CY5 grounded cathode to 6FS5 mixer to 75A3 receiver. Transmitter is a Heathkit Seneca to a Johnson 6N2 Thunderbolt.

"My antenna consists of 4 Telrex model 2M-814 beams. I originally had two of these antennas so I ordered two more and four extra sets of elements for the vertical antennas. These are well made antennas but have one feature which tends to be a disadvantage. The antennas are matched by a hairpin and there is no means provided to adjust the match. An antenna with a T-match would allow adjustment if the lines were not exactly correct. The antenna booms were re-drilled for the vertical elements as the manufacturer did with the horizontal elements to produce cross-yagis." *(Further information on cross-yagi construction can be found in the U.H.F. ROUNDUP column for February, 1964.)* "Antenna gain is about 20 db with about 1.5 db of line loss. The Arecibo antenna gain was about 43 db on two meters and he ran, from what I've heard, 350 watts.

"As for W6DNG, that is a fantastic feat. Having finally heard a good strong moonbounce signal and seen how bad the fading is makes me realize even more how difficult a task moonbounce is with amateur-size antennas. More power to them for their tremendous effort and the patience to get a suitable antenna built and many hours of attempted QSO's. Anyone can do it with the Arecibo antenna on the other end, but W6DNG and OH1NL have shown that if you really have the desire it can be done with amateur equipment." *(Besides moonbounce, Dave is very interested in two meter communication via a passive satellite and is readying his gear to be used with the Echo satellite to be launched sometime this fall. Expect to hear more from him then.)*

Gary Pass, K5WWQ, on APX-6 Experiments: "In the early summer of 1964, Alan, WA5DJU, and I set forth to do something for which we would probably later be laughed at; however, I think we have accomplished a few things.

"We obtained a couple APX-6's in virtually mint condition, and converted them with basic data from *QST*, the only information source available." *(Try June 1962 issue of* The VHF Amateur.) "We added a few things of our own, but still rigged for a.m. and with the original i.f. strip with its 18 mc bandwidth. After we found one another, we tried some 500 foot tests with good results. So we decided to test a path from my QTH to Alan's—2.75 miles. The results were not too good. I could barely copy Alan and he could not copy me. My antenna was out of the "can" variety from the *CQ V.H.F. Handbook* at 25 feet fed through 40 feet of RG-8/U polyfoam. Alan used a corner reflector at about 35 feet through 50 feet of the same coax.

"We next tried mobile, using basically the same setup except for a ground plane antenna. Don't laugh. I drove over to Alan's house, parked under his antenna and called "CQ 1220." Sounds ridiculous but at least I got a reply—hi. So down the road I went toward my house, hoping to discover why we couldn't work fixed. My house is in a "hole," so to speak, but I didn't think it would make much difference—even on 1220 mc. It did." *(We know, sob. It even makes a difference on two meters.)* "On the other side of my house, on reasonably high ground, good Q5 copy was established both ways. I kept going in this direction until Alan could not copy me—A distance of 5.5 miles. The next weekend we took off in another direction toward the hill on which the local TV station is located. After about three miles, communication was lost in the valleys and foothills, etc., until half way up the mountain. Then a smattering was heard of WA5DJU calling me with a tired voice. At the top signals were very strong. Charles, WA5HLQ, who came along to see what could happen, was beginning to become interested in 1220 mc. Being human, success makes one drive further, and that we did . . . to the next highest hill—a Nike Zeus radar sight. We established a solid Q5 contact here, although the hill we had been on was in the way. The distance was about 11 miles.

"Since the time of these tests, WA5EUD and WA5BLQ have both obtained APX-6's. Paul (EUD) is on the air now. I have obtained a vertical collinear antenna with 5.5 db gain over the ground plane and have started tests with Alan on double-conversion f.m. At the same time we are on the verge of ATV with the transponders. Alan has a flying spot scanner built and working—a little. I have a receiver; however, all I see at the moment is modulation bars. I feel certain, though, we will have television setup going very soon.

"We are looking for other contacts out of the city. On occasion other local TACAN stations have been heard—Some as far away as 500 miles. We have called CQ a number of times, but to no avail. Band openings via ducting seem to occur quite regularly and we are hoping for some DX." *(FB on your 1220 activities! It is just this type of operation which will eventually make the bands above 432 mc popular. Keep up the excellent work.)*

Al, K7VQI, on ATV in Arizona: "Despite being 2500 feet up, we are still in a hollow here with 9000 foot mountains all around. But we have some interesting Ham-TV. activities. Three of our ATV boys recently visited Sid, K7GBE, in Phoenix for a demonstration of a three-station TV net there. Then Sid returned the visit and brought considerable Ham-TV gear with him. We set up a temporary station at K7KYQ's shack with WA7BBM and K7HIN participating with Sid. K7VQI acted as anchor-station and the boys tried out various transmitters, converters, etc. and compared them with Sid's. This gave them a chance to find out if their gear was weak. We had two-way QSO's from here to K7KYQ, K7GBE/7 and WA7BBM/7." *(Some field day! Did you receive any ATV QRM?)*

New VHF Century Club Members

Six Meters		Six Meters		Two Meters	
WB2GQZ	273	KØJSY	280	HG5KBP	184
WA8IJW	274	WØDYK	281	WB2GQZ	185
WA9HRN	275	WA4PSU	282	K1SUB	186
K5YCP	276	WB2JGO	283	WB2FXB	187
WB6BZX	277	K2EFN	284	SP5ADZ	188
WA9EJE	278			WB2BAI	189
K3EAV	279			HG5KDQ	190
				K9RNQ	191

Ben Hall, W9OVL, on 220 in Chicago: "On August 2 at 0908 CST we worked W9OKM in Plainfield, Ill. Hank was operating from a new club portable trailer with provisions for operation on the 6, 2 and 1¼ meter bands. Earlier in the month we worked Bill, K9WSZ, who now has 240 watts on 220 mc, both phone and c.w. We also contacted W9RPF on July 17 at 2005 hours in Naperville, Ill. John runs 200 watts and was putting in a 59 signal. Not many openings during July, here's hoping conditions improve." *(We're with you Ben! Maybe even a little aurora during the fall. Wouldn't that be nice? Look for W9OVL Monday, Wednesday and Friday nights between 2000 and 2100* CST. *What frequency?)*

Bob Muggie, WØHGF, on his 432 Converter: "Since I've recently moved and gotten myself an XYL, I have been mainly building. I have enclosed the schematic of a transistorized 432 converter I have built. I am now working on a completely transistorized all band u.h.f.-v.h.f. receiver. I will have more on this project in the future, possibly an article. The converter uses a new transistor by Amperex available for work up to 500 mc, the 2N3399. The specs say the noise figure is less than 5 db at 400 mcs and the gain is 11 db at 800 mcs. Preliminary results in the lab indicate a sensitivity of 0.4 microvolts for a 10 db signal-to-noise ratio with the 2N3399's in a circuit similar to that published by Philco in their *Supplement 15* for the 2N2398/T2028 series (now made by Sprague). The 2N3399's are quite a bit better and plug right in with no changes, and I'm sure everyone will appreciate the single-lot price of $2.55 each." *(Thanks for the information; the 2N3399 sure sounds hot. I wonder how they react to overload and their sensitivity to large doses of r.f.? I guess we will just have to try them.)*

Bob Russe, K3DJC, on Varactor Triplers: "I was glad to see information on varactors in your column. I can confirm W4GJO's information on operating varactors as linear frequency multipliers." *(We agree they work, but why? If you take a 144 mc carrier and modulate it with a 400 kc sine wave, you will have two frequencies. The carriers at 144.000 mc and the sidebands at 143.600 and 144.400. Multiplying by three as a linear varacter should do, we came up with carrier on 432.00 mc and sidebands on 430.800 and 433.200 mc. Now the frequency of modulation appears to be 1200 kc, eh?)* "I was lucky and picked up a M/A 4062B at Syracuse last year. I used it in a circuit recommended by Microwave Associates and after a small amount of fiddling got it working (completely noncritical in tuning). It was checked at Bendix and found to be running at about 60% efficiency. At this time I was working from the Keystone V.H.F. Club station (W3HZU) using a 4CX250B amp and keeping skeds with W3SST in Rockville, Md. (75 miles).

John and I made nightly checks on 432 and under fair conditions he was able to copy my varactor barefoot, using only a Gonset II Communicator to drive it. In every instance John was able to copy my carrier. I also raised Ernie, W3UJG, on a 'CQ.' With my interest burning, I rigged up a folded dipole antenna and again, only using the Gonset for drive, I was able to work Fred, W3MMV of York, over a 15 mile none-line-of-sight path from my home QTH. My signal on 432 was as solid as Fred's received on 144 mc. In fact, because of the very rapid flutter of 432 mc, Fred's a.v.c. smoothed it out and produced a very solid signal. This was done with an estimated power output of 3½ watts max.

"I have since acquired a varactor for 1296 mc and plan to mount it at the antenna along with the receiver front end. I also have enlisted in the U.S.A.F. which has limited my building. After I complete my schooling at Chanute, I expect to get back in the swing again."

"I am looking for information on front-ends using the RCA 8058. I am using one now ahead of the *Handbook's* Nuvistor converter. The converter was a farce without the 8058, although W3UJG claims the 6CW4 works out quite well in grounded grid." *(Ernie speaks the truth, if you've got the time and equipment to play with it. Anyone have any information on 8058 front ends?)*

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2. Write anything you wish to tell yourself on the card.
3. At the top of the correspondence side (when placed horizontally) write a date (month and year only) when you want the card mailed.
4. When this month arrives, the card will be mailed.

The foundation for Amateur Radio, sponsor of the service, accepts no responsibility, if, for any reason, the card is not mailed. The Foundation does agree, however, to maintain this service as long as volunteers are available. Mail your card today to:

Joan Machinchick, K3KBI
Lake Drive, Cape St. Clair
R. F. D., Annapolis, Md. 21401

Century Club Time

We'll have to forego our regular DX section in view of the lost-mail situation this month; it will return in December with full reports (we hope). Meantime, let us hasten to remind you that we are still processing the *CQ* V.H.F. Century Club awards, a free incentive program quite popular on the very highs. Our awards are issued to those holding the required number of QSL cards confirming contacts all made on a single v.h.f. band within any one 365-day period. On 50 mc, 150 cards are necessary; on 144 mc, 100 cards; on 220 mc, 50 cards; on 432 mc, 25 cards. Full details, explaination and picture of certificate appeared in our March 1964 column (page 82). Applications and rule sheets are still available from us in case you don't have the issue handy.

Wrap-Up

It has been many moons since ye editors have prodded you about doing reporting for this column. A complete program has been set up to aid us in our coverage each month—a program in which you are invited to participate. Drop a line to the address at the head of the column and we'll ship you a batch of reporting forms. Be an official v.h.f. booster! We need letters, circuits and news for this column each month. Can we count on you?

73, Bob, K2ZSQ, Allen, K2UYH

We would like to ask you to refrain from reading this issue while eating your Thanksgiving dinner. Giblet gravy stains are so hard to get out of the paper. Enjoy your dinner and have a happy Thanksgiving from all the gang at CQ.

NOVICE

WALTER G. BURDINE,* W8ZCV

PEOPLE all over the world often think the same way. The other day a local ham was talking about the different contacts he had made and brought up the subject of class consciousness prevalent amongst the hams today. He said there is only 8 words of code speed between the Technician and the General. The next day Ev Taylor, K7YSE, (ex-W8NAF) sent me a letter telling me that Bill Young, W7RVY uses the expression, "The only difference between the Tech/Novice type of ham and the General is 8 w.p.m." I have said many times that the class of ticket that we have is no indication of the individual's hamming ability. *Who* are *you* trying to impress by your class consciousness? I'm just trying to enjoy my ticket!

I ran into a group of fellows here in Ohio that have been mountain-topping in a state that I had thought of as being near flat. They are hunting station sites and fire tower locations in some of the rare counties to help the county hunters. They seem to be enjoying themselves and helping others to learn the geography of the states. I've worked 11 counties, but none of the four or five groups mountain-topping. I'll do better next time. A big hand for these wonderful fellows. They are adding new thrills to our hobby.

And by the way, *CQ's* USA-CA Program is teaching more geography to the amateur than any other award ever has. We are all learning how many counties each state has and the general location of our state counties. Those mountain-toppers are adding more and more to our education as they go to the highest spots in each county to help us garner the new ones. I guess we should put on a campaign to get some amateurs in those counties that have none or few amateurs located within their boundries. Some of the radio clubs near these counties could contact the high schools and some of the local clubs such as the Lions, Rotary, etc., to root out some likely prospects for getting ham tickets. The Boy Scouts have many prospective hams. Let me hear from you about this idea. The possibilities of our hobby are unlimited.

How Does it Work?

The analysis of the circuit and component parts of so complex a device as a radio transmitter is not an easy task, but the development of the subject material can be made plain so that the beginner as well as the advanced amateur can develop and widen their knowledge of the subject.

This month let's take a real close look at one of the fundamental parts of the ham transmitter: The oscillator.

The basis of any transmitter is an oscillator. An oscillator is a device that transforms d.c. power (from the power supply) into a.c. power. In a transmitter, this a.c. power is at very high frequencies called radio frequencies (r.f.).

Many types of oscillators are available, each with its own advantages, but the type of greatest interest to the Novice is the *crystal* oscillator. The advantages of the crystal oscillator are that it will produce a fairly strong r.f. signal that is extremely stable, that is, its frequency will not change by more than a few cycles.

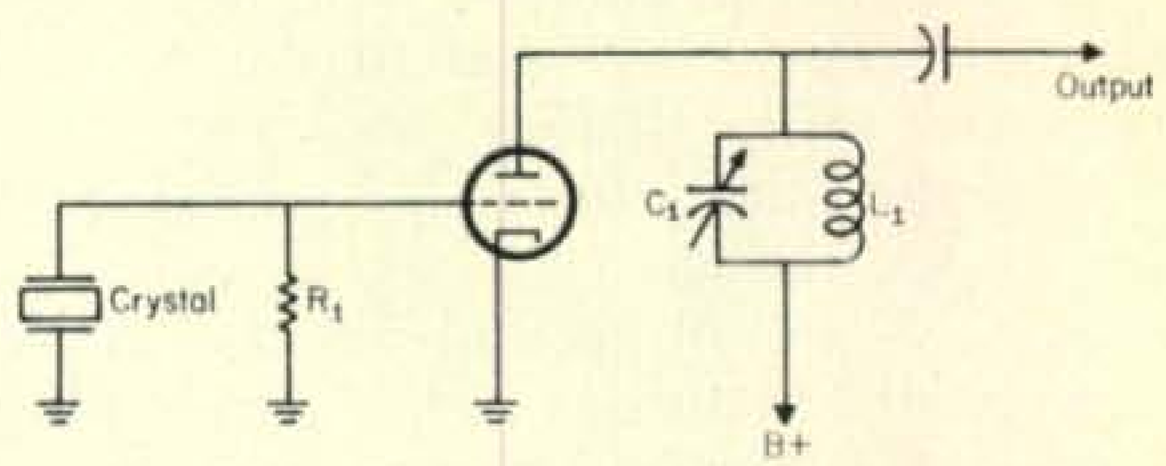


Fig. 1—Crystal oscillator which can be used as a complete transmitter.

What causes a circuit to oscillate? In the crystal oscillator shown in fig. 1, the actual oscillations begin in the tuned circuit L_1-C_1. Taken separately, this circuit, fig. 2A, can be viewed as an oscillator. If C_1 is charged by a battery and then connected to L_1, it will begin to discharge (from $-$ to $+$) through L_1.

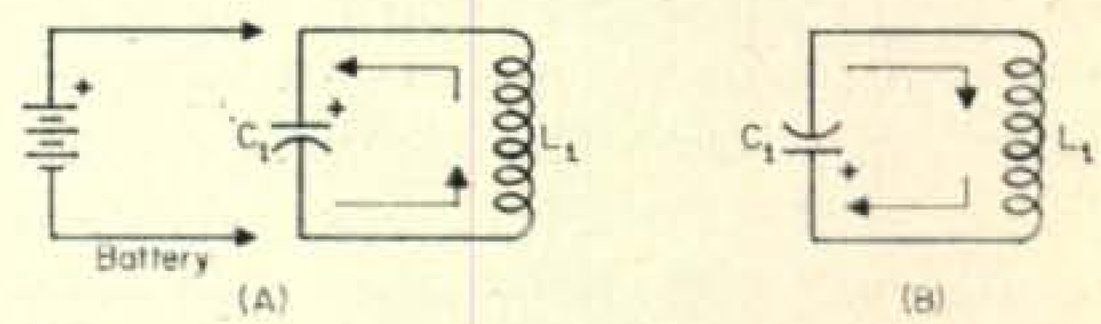


Fig. 2—(A) Initial discharge of capacitor at the start of an oscillation. (B) Second half of the oscillatory cycle.

Current flowing through a coil sets up a magnetic field about that coil. The collapse of this magnetic field (when current stops flowing) generates another current in the coil, which continues to flow in the same direction as before. Thus, when the capacitor is completely discharged, current from the capacitor stops flowing and the magnetic field around L_1 starts to collapse. This collapse generates more current which then begins to charge C_1 in a direction opposite that of before. The cycle then repeats.

This charging and discharging process will continue until all the energy is expended. This action is called the "flywheel" action.

The problem now is to keep the oscillation going with some form of sufficient energy as to be useful, and maintain some stable frequency. Referring back to fig. 1, we see the tuned circuit connected to the plate of a tube. A con-

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

tinuous d.c. voltage is applied to the coil and capacitor (tank circuit). A consideration at this point might be "if a continuous voltage is applied, how does the capacitor charge and discharge to form this magnetic field?" The answer to this question is that when power is first applied, a certain amount of time is needed until the voltage reaches its maximum. It is this difference in potential that causes a difference in the charging rate of the capacitor and hence, for a very small amount of time, enough of a changing magnetic field is generated to cause an oscillation. This is called "ringing."

This small oscillation is fed directly to the plate of the tube. Since the plate and grid are both conductors and since the vacuum in the tube is an insulator, we see that the grid and plate form a capacitor. One property of a capacitor is that it will "conduct" an a.c. signal, but block d.c. thus the gridplate capacity will "conduct" the a.c. signal from the tuned circuit L_1—C_1 to the grid circuit.

If we then attach a crystal to the grid, the small amount of oscillatory energy (the a.c. signal) from the tuned circuit will set the crystal vibrating or oscillating.

The crystal is usually a thin flat quartz plate whose physical dimensions permit it to vibrate at the desired frequency. Once the crystal is started vibrating, it will remain vibrating until the energy applied is used up. During the time it is vibrating an a.c. signal is developed across the crystal.

This a.c. signal appears on the grid of the tube and as with any properly operated triode, amplification takes place. That is, the small signal from the crystal is impressed upon the grid and is in turn amplified, to appear at the plate. This "higher powered" signal can be taken from the plate circuit in several ways, but that is a good subject for another discussion later.

The brief explanation above makes no attempt to tell the entire story of how an oscillator works, but will at least give you some insight as to "how it works."

Letters

As I am running short of space this month I will only have room for a couple of letters but please keep them coming and I need some pictures badly. Thank you.

This one tells its own story: "Dear Walt, 11 years after my Novice ticket expired I finally got my general—with college and military services taking up the slack in between tickets. I am smack in the middle of the 40 meter Novice band and I think that is where the most fun is.

"However, I note two points that Novices could improve on: *First*—listen instead of endless CQs. The QRP boys like myself can't afford the luxury of long CQs and I think by listening a while it's much easier to make those long haul QSOs. *Second*—some lids continue to give 599X reports while repeating every word two or three times. If the QSO is solid once is enough—no repeats needed!

"I continue to believe that your column makes the Novices of today better Generals of tomorrow. 73, Chuck Entwistle, WA4TFH."

There sure is a story about the first QSO I had with this young lady that I'll have to tell you some day. We hams around here have unanimously elected her our Queen of the day. She is Leilia Wilson, WN8KSW, 341 East Locust Street, Wilmington, Ohio. She has just passed her test for Technician license.

"Dear Walt, I get a lot of valuable info out of your column. Although I'm an electronics technician, there are still several things I don't know, Hi.

"I'm the only Novice on Midway Island and would like for you to pass this info on to your readers.

"I operate two or three hours almost every night, usually from 0800 to 1100 GMT I can usually be heard on 7183 kc, sometimes on 7168 and 7160 when the foreign broadcast stations permit. I plan to get on 80 meters and have on several occasions, but the QRM is real bad.

"The rig is a T-60, Drake 2A and a choice of dipole or vertical antenna.

"I have worked ten states and six countries since I went on the air on June the 20th. All my QSOs are DX. I've had one local QSO and the others have been at least 1100 miles. I operated for two months as WN6KOG/KM6 and have just received my call as a WM6. As far as I can determine, I am the only WM6 in existence at the present. Thanks and 73, Jim."

Jim's address is: Jim Howard, ATC, AV. A&W BARON PAC MIDET, Navy #3080 FPO, San Francisco, California. His call is WM6DH and I'm sure he will be watching for you. Good luck, Jim and look for me this fall and winter.

Help Wanted

Only one person is in need this month so we should be able to help him easily. He is Carl Rennagel, 8641 East Nada Street, Downey, California. Phone TO 9-2851. Help him out with his code, fellows.

Thank you for past favors and please write and send some pictures. I have used up my space for this month but I do want to wish you the best of DX in the coming winter months and don't forget the OSCAR program, I'll see you on two. 73, Walt, W8ZCV

HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV

DURING the last two years we have seen gigantic strides made in the miniaturization of electronic-radio equipment and the end is not yet in sight. Now we are hearing a great deal about *micro-miniaturization*. Where will it all end? No one yet knows; but we are inclined to think that from the radio amateur's viewpoint that the appearance of an all-band transceiver (having a power output of 150 watts PEP) housed in a cabinet the size of a cigar box is more than a few years off!

There will always be a practical size for ham equipment beyond which nothing would be gained by making it any smaller.

The reason of course that there is so much work being done on integrated circuits using solid state techniques is the need for such equipment in our space programs. Reducing the load that a rocket must lift and carry is very important—but when is it so important that a ham transceiver be reduced in weight from 15 to 9 pounds?

Perhaps a few "long-hair" hams will argue that when weight is reduced you are achieving greater reliability or efficiency—but this is not necessarily so.

Some of the micro-modules I have seen would be impossible to repair—they would have to be replaced. Imagine a four stage af amplifier *smaller* than a dime! This sort of thing is being done today—but not for the ham market.

Of course, future ham equipment will contain more and more transistors, diodes, voltage tuned capacitors and so on; but before the all transistor transceiver hits the market with a power output of 100 watts some little time will have passed. To even guess the months or years that will have gone by before we see one would be "sticking our necks out"—for the radio-electronics art is changing so fast that anything could happen—even overnight.

The Possible Future Designs of Ham Equipment

If you would ask the average ham one runs into, what he would like in a receiver, transmitter or transceiver of the future, he would swallow hard, his eyes would take on a sinister gleam and he would reply, "well, I haven't really thought about it—really." With a little encouragement, he would smile and then say: "I'd sure like something I could afford, I can tell you that." Then he would lapse into silence again.

We asked many of the hams who have written into us to write us again and tell us what they would like to see produced in the future. Here are some of the answers we received.

"I want a transceiver that covers the ham spectrum from 2 meters to 160 meters. It should be transistorized and contain d.c. and a.c. power supplies. It should be as small as the state-of-the art will allow. It should contain a frequency synthesizer and I should be able to tune the receiver alone. Automatic push-button tuning would be great too. Certainly I want stability, selectivity and sensitivity second to none. Price? Well, let us say $500.00."

A dreamer? Perhaps.

Another ham said he wanted a two or three band set for around $300.00. It should be a transceiver and the manufacturer should provide additional band modification kits at a fair price. I think this is a good idea.

One ham who answered our query told us that he would like to see a transceiver available that would compare with a well known set in the thousand plus dollar class but at half the price—he said: "If this ever happens they will sell like pop-corn." I agree, but quality and excellent engineering costs money.

Some hams virtually asked for the moon. One chap even took out the time to compare all transceivers available today—and he did a good job. I suggested that he re-do his long, long letter into an article and submit it to *CQ*'s editor for publication. The gist of his survey? All transceivers available today seemed to be priced within the reach of the average American ham, but none contained all the features most hams would like to have at the money they would be willing to spend. He pointed out a number of very weak areas in design.

A few readers even suggested that a "Ham Consumers Testing Union" or a similar testing organization be set up. These readers maintained that the tests made by employees of a magazine had to be partial because advertising is involved.

One ham took out the time to price each component of his transceiver (on a wholesale basis), figured in assembly, testing, engineering and other costs, then wondered how the manufacturer made money!

But the one letter that "tickled" me most was the one in which a ham suggested that some enterprising manufacturer take only the best features of all available equipment and incorporate them into the "most ideal transceiver." His suggested cost was around $400.00.

What is there still left to do in coming up with the *ideal* ham transceiver? In my opinion, quite a bit. Most of the sets on the market today are worth the money asked for them and a ham should not wait around for the "ideal" set—if he does, he will lose out on a lot of good communication.

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

What Better Way?

EACH one of us is indebted, in one way or another, to one or more amateurs for kindness done and favors given over the past year. Maybe it was the fellow who ran a phone patch for you, possibly the fellow with whom you keep a sked, or maybe it's the op down the street who helped you put up the antenna.

WHAT better way to say "thanks" and wish your friends a Happy Holiday Season than by giving them a gift for each and every month of the coming year?

YES, a gift subscription to CQ *costs but $5 and will be a reminder of your thoughtfulness for each of the next 12 months.*

AN active ham, be he Novice, VHF'er, DX hound, traffic handler (in fact, if he is interested in any of the 1001 phases of Ham radio) will find CQ, *or one of our books, to be an invaluable aid in keeping abreast of our dynamic hobby.*

CHECK the Subscription envelope and rates on the opposite page. A handsome gift card, signed with your name and call will be sent with each gift book or subscription.

Here are some of the features I personally would like to see incorporated in forthcoming transceivers: first, 2 to 80 meter coverage; selectivity control; off-set frequency tuning (this means *anywhere* in a band with the receiver as well as the transmitter portion of the set); effective s.s.b.-c.w.-a.m. noise limiter; smaller power supplies and if possible, the a.c. supply incorporated within the set; an easily read dial (without interpolation); the maximum use of transistors (why? because their reliability has been proven); full c.w. and phone band coverage and last but not least, a fair ham price. I predict that we will have such an animal before too long. In fact, one manufacturer I know could modify his present set and still be competitive, and come close to what I would like.

Questions

Reciprocal Licensing—Since the reciprocal ham operations law (PL 88-313) became operative we have received a large number of letters from hams in the U.S. and overseas asking us about the procedure that must be followed to be allowed to operate in the U.S. and certain countries. From the information we have gathered, letters to the embassies of the U.S. and the countries involved, telling the First or Second Secretaries that you would like to operate in the U.S. or a specific overseas country under the provisions of the law will start the wheels in motion (if they are not already turning) to allow you to operate. I have had reports that the U.S. Department of State is very much "on the ball" in handling requests from overseas hams. Remember, it takes a little time before agreements are reached. As time goes on the wait will be shorter. Another thing, you may be surprised when you advise a particular communications administration in an overseas country that you would like to operate your ham rig there and find that they will immediately grant you the privilege as they have a right to do, with or without agreement with the U.S. But the fact that the U.S. is open for reciprocal agreements makes them more receptive and more accommodative. Do let those who control radio amateur operations in the overseas country in which you are located know that you would like to operate and request that they contact U.S. Embassy officials relative to PL 88-313.

If you plan a DX-pedition do not count on a "quick" U.S. agreement with a nation which does not now have radio hams or does not permit ham radio operation.

As more information is made available on reciprocal operations we will carry it. Watch *CQ* for future announcements.

DX-100 Fuse Popping—"I have had very good luck with my DX-100 except recently it has been popping fuses. All tubes check okay and the voltages seem normal. What else can I look for?"

In the DX-100 check for possible flash-over between rectifier tube terminals and ground, and resultant carbonization. Next, check screen by-pass capacitors. Check for a shorted filter capacitor, and also look for a shorted high voltage choke. The choke may not short out when cold, so check it as soon as a fuse pops. The last thing to look for is a shorted power transformer. We hope you find your trouble.

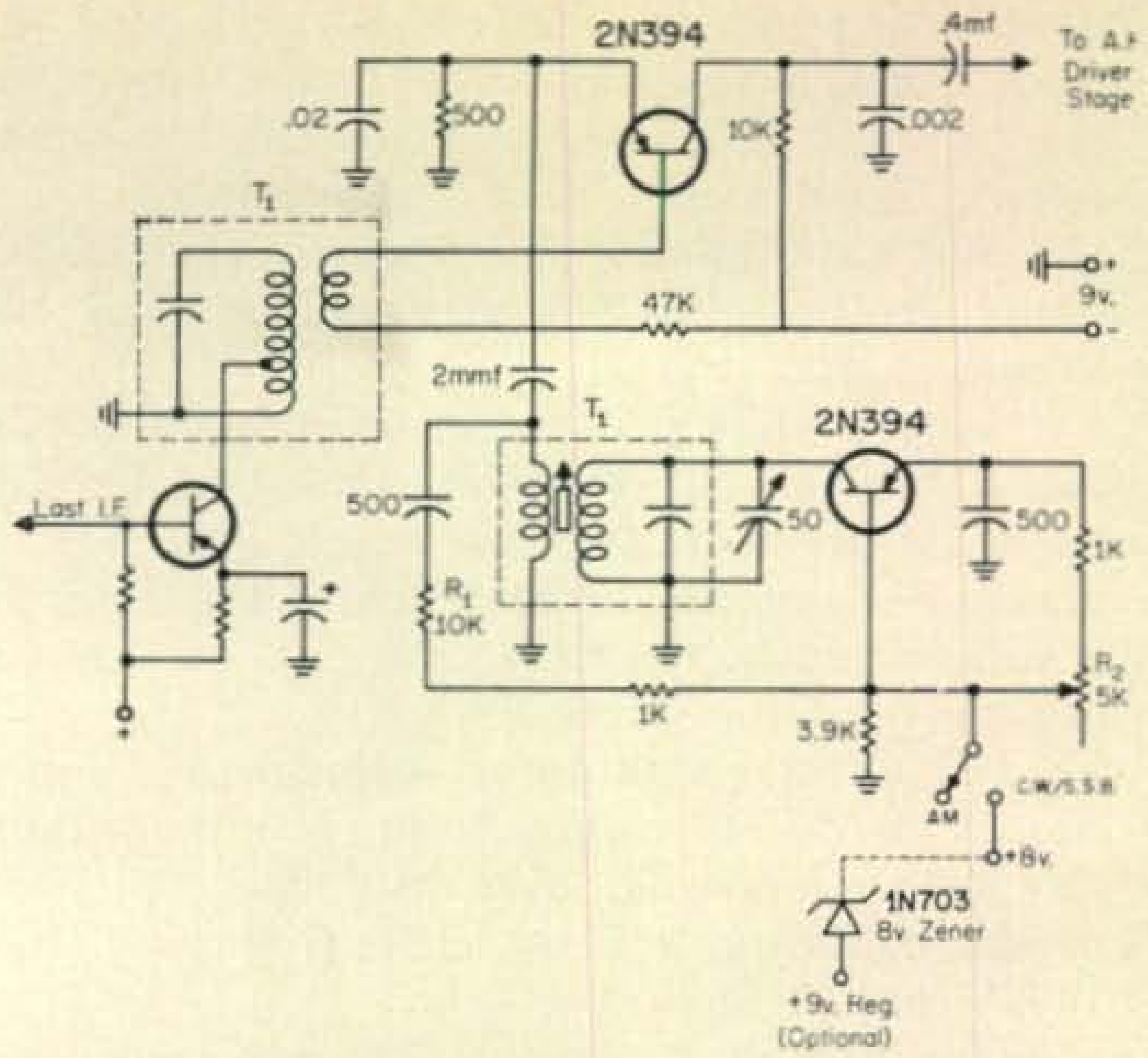


Fig. 1—Transistorized product detector. All resistors are ½ watt and all capacitors are in mf unless otherwise noted. R_1 can be adjusted up or down in value for proper operation. R_2 should be set for good oscillation, then replaced with a fixed value. T_1 is a transistor to diode type i.f. trans. 455 kc.

Transistorized Product Detector—"I know there are a number of schemes for using transistors for the detection of s.s.b. signals and I have tried a few without too much success. Can you publish a circuit that you have tried that really works? I do not want to use over three transistors. Any chance?"

Sure. See fig. 1. This is a circuit similar to one attributed to Earnshaw (*WRA* Jan. 1960). This circuit works equally well on c.w., s.s.b. and a.m. Furthermore, by switching out the b.f.o., the detector is usable for a.m. Parts values are not overly critical. There are more complicated and effective approaches, but this simple circuit worked very well on the first try.

HE-15A to 10 Meters & Hum—"I converted my HE-15A Lafayette CB transceiver to 10 meters. The job was quite simple. All I did was change crystals and replace the 10 mmf capacitor across T_3 (the final output coil) with a 25 mmf variable. Reports around town have been very good until recently when I was told that I had hum on my carrier. What do I look for?"

First check the two solid state rectifiers in the power supply. I suggest that you series new ones (if replacement is indicated) with resistors having a power rating of 1 watt and between 47 and 100 ohms. Next check the two 100 mf capacitors in the filter circuit. You should also check the two 40 mf capacitors bridging the 5000 ohm 5 watt resistor. I would also suggest that you parallel the two rectifiers with .001 mf capacitors—this will help guard against transients along with the series resistors. I hope you have checked the transmitter tubes (including the 6V6 and 12AX7 associated with the modulator). Good luck.

HX-500 Ventilation—"The 6146s in my HX-500 really get hot. I'd like to install a small fan. Where should it go?"

I suggest that you mount it directly behind the 6146s on "L" stand-off brackets. Be sure there are holes for the *exhaust* air. I do not advocate blowing air directly against the tubes for it will end up on the v.f.o. assembly—this would not be good for stability.

SX-117 Crystal Calibrator Adjustment—"I purchased an SX-117 from a buddy of mine without any instruction book. How do I adjust the 100kc crystal calibrator exactly to frequency by using WWV on 10 mc?"

Set all receiver controls for a.m. reception. Set band selector to WWV and adjust tuning to the WWV signal. When there is *no* modulation from WWV turn the crystal calibrator switch *on* and carefully adjust the crystal calibrator, adjust so that it will allow zero beating with WWV. If you try to adjust when there is modulation on WWV you'll more than likely get the "wrong" beat and of course the frequency will be off. C_{301} the calibrator adjust, is located directly in front of the 6EA8 on a small chassis. It is a ceramic trimmer (round) capacitor near the corner of the calibrator chassis. You have a fine receiver.

Apache Drive on s.s.b.—"I do not seem to get enough drive from the SB-10 driving my Apache. I have changed tubes. What do I look for?"

Check the length of your coax cable from the SB-10 to the TX-10, and of course check the alignment of the various coils associated with the output stage of the SB-10. One other ham complaining of the same trouble was using a 7′ piece of coax, when he cut it to 2′ it worked fine.

Scope Kit—"What scope kit available on the market today would you recommend for between $50 and $75?"

In the $50 ($49.95) range I'd take the Heath 10-21. In the $75 range I'd take the RCA Model WO-33A. Both are small and worth every penny asked for them. EICO is also offering a fine scope, Model 430, that also should be considered.

Selsyn Driven v.f.o.—"In which issue of *CQ* did an article appear on a selsyn driven v.f.o.? If I remember correctly it was around 1948 or 1949."

You are correct. *CQ* March 1948.

Wide Range v.h.f. Converter—"Can you suggest a circuit or where I can obtain information on constructing a wide range v.h.f. converter? The frequency range should be between about 40 and 220 mc."

See if you can obtain a November 1949 *CQ*. See the article on converting a surplus Mallory Inducto-tuner—this is the best information I can suggest.

Using 304TL's—"In what magazines did information appear on using 304TL tubes?"

See the August 1950 issue of *CQ* and the September 1950 issue of *Radio & Television News (Electronics World)*.

BC-348 to 10 Meters—"Where can I obtain information for modifying the tuning range of the BC-348 receiver for 10 meters?"

QST, January 1952.

Coil Data for the BC-454—"Where can I find coil modification data for the BC-454 for the ham bands to and including 6 meters?"

See the January 1960 *QST*.

Motor Generator—"I am a radio operator on a rich man's yacht equipped only with equipment for producing 110 to 120 v. d.c. I need around 385 watts for my ham rig (110v.a.c.). What can you suggest?"

Try Barry Electronics, 512 Broadway N. Y. N.Y. 10012. They sell a motor generator for $55.00 which converts 115v. d.c. to 115v. a.c., 60 cps at nearly 500 watts.

Vertical Trouble—"I recently purchased an all-band vertical. This antenna has gotten some good reports from many hams, but for some unknown reason it will not load up for me. I mounted it on a 2″ diameter pipe stuck into the ground. The pipe is about 10 feet high. The ground around the area is quite rocky and of course the bottom of the vertical is insulated from the pipe mount. I feet it with 52 ohms as recommended by the manufacturer. What gives?"

If you have the antenna I think you have, by using that 10 foot pipe to mount it on you have "created" an unbalanced vertical dipole. Put the antenna on the ground as recommended by its maker and I'll bet it will load beautifully. Use radials if you cannot get a good ground.

Use the Handbook

The ham who does not own an *ARRL Radio Handbook* or the *Radio Handbook* (Ed. & Engineers), is missing a lot of good technical information. We note that many of the questions sent into us can be answered by reference to a good handbook. We do not mind answering the questions but you could save yourself some waiting and time by trying the handbook first before writing to HAM CLINIC. As we have said before, we do not always have the answers to all questions and we tell you so. Being human we err just like anyone else and even with over 30 years experience in telecommunications we seem to learn something new everyday.

Thirty

This issue of *CQ* will be in circulation before the elections are held—some of America's 300,000 hams will vote for K7UGA and some will not, but this is the freedom of choice we Americans have and we all should exercise it. Needless to say, K7UGA has certainly given ham radio a well needed "publicity shot in the arm." He along with Ray Meyers and others got us our reciprocal operations privileges which will have great international impact and contribute to better understanding of the U.S. and its way of life.

A happy Thanksgiving to all of our very fine readers. 72, 73 and 75 Chuck & Elfriede.

RTTY

BYRON H. KRETZMAN,* W2JTP

RTTY Operating Frequencies

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

80 meters	3620 kc
40 meters	7040 kc
40 meters (narrow shift)	7140 kc
20 meters	14,090 kc
15 meters	21,090 kc
6 meters	52.60 mc
2 meters	146.70 mc

RTTY THE HARD WAY . . . No. 34, with the RTTY Column in the August '64 issue of *CQ* (page 83) was drawn in jest by W8DTY. We didn't anticipate the response we got, but we might have known—the RTTYer is a most unusual breed of the ham family! In other words, mobile amateur radioteletype is *not* beyond the realm of possibility.

The pictures with this column show the mobile set-up of W3DTN of Glen Burnie, Maryland. The machine is a Model 15 page printer with all solid-state electronics built inside the cover to provide a completely self-contained RTTY unit. The terminal unit (TU) is a combination WØACY/homebrew device, with oscillators and modulator for the transmitters in the car.

The radio gear includes a Drake TR-3 on the lower bands, a Motorola -80D f.m. set for 30 watts output on 52.60 mc and a Motorola -140D f.m. set for 60 watts output on 146.70. (The third Motorola set pictured is on the local radio club channel.) In case you are wondering about what powers all this gear, Gary has a 50-ampere Leece-Neville alternator to keep up the battery on his '63 Dodge Dart.

W5IFH of Pasadena, Texas, also sent us a photo of his mobile RTTY set-up, but unfortunately it didn't come out well enough to print. Ken jury-rigged a Model 12 in the back seat of the car, running the a.c. governed motor from a *Heathkit* MP-10 inverter. The machine is connected to a transistorized a.f.s.k. oscillator, modified from the one in the *New RTTY Handbook* (Cowan Publishing Corp., $3.95). The transmitter is a Sixer and the antenna a halo. Ken is looking for a Model 14 strip printer with a d.c. governed motor so he can operate it from the Heath inverter using a quad of silicon diodes.

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

So there you have it. We would be further interested in receiving stories and pictures about other mobile and/or portable RTTY installations. Who *else* is set up like W3DTN and W5IFH?

On the Bauds

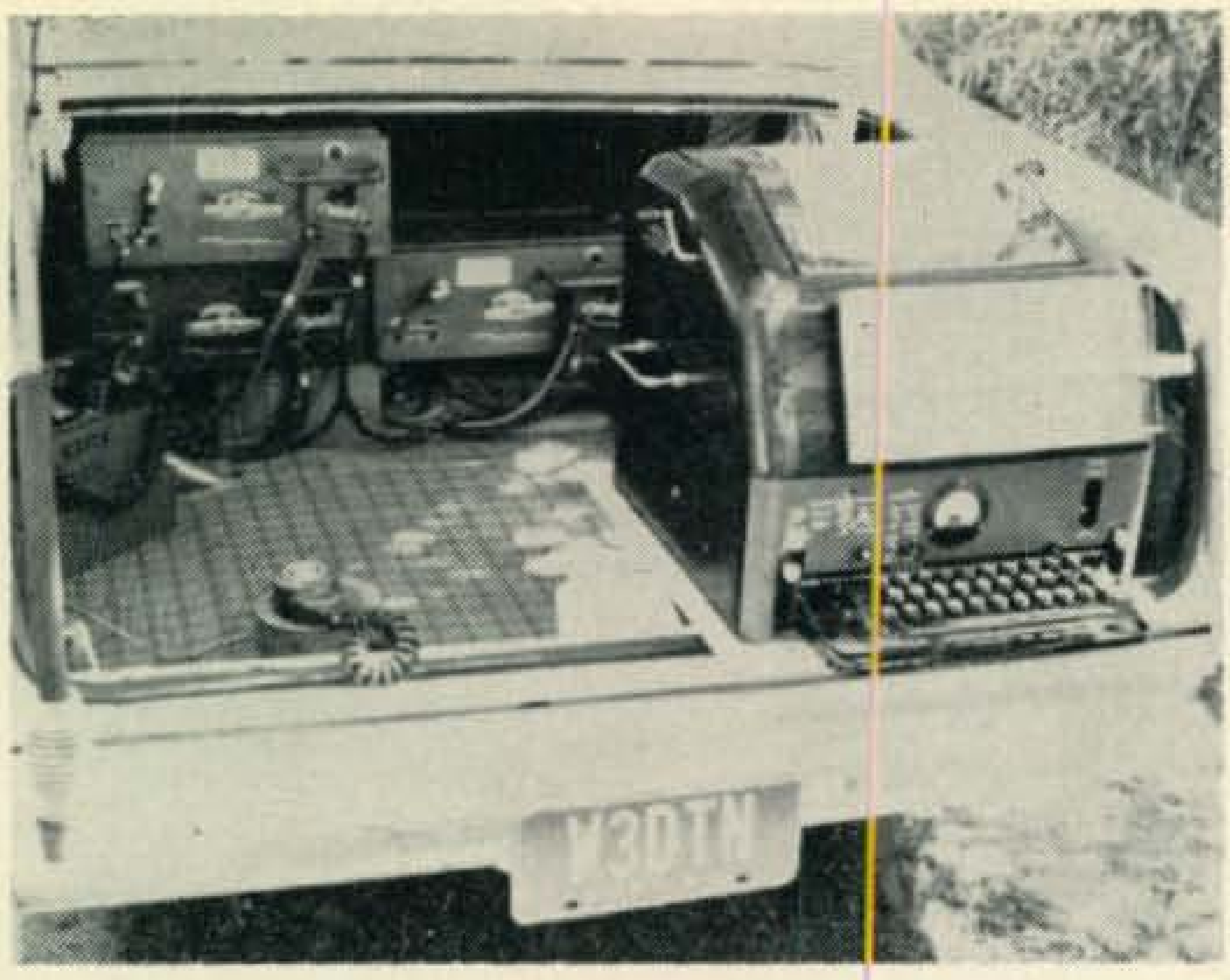
K1LGO works 80 from Nashua, N.H. K1FJV of Norwalk, Conn., is on 2-meter a.f.s.k. with a.m. W1BGW of Boston, Mass., works narrow shift on 7140 Sunday mornings. K1BOX of Southboro, Mass., is looking for a DXD distortion measuring set.

WA2AZR at McGuire AFB, N.J., has a TT-4 and a rebuilt CV-89/CV-57 TU. Al is looking for modules for his MITE Model 104 compact printer. W2IPB of New Hyde Park, N.Y., got a TT-7 and is looking for dope to get it going. W2NQW of Port Jervis, N.Y., works 80. W2-NGW of New York City works 2-meters with a.f.s.k. and a.m. W2MZB, ARRL Official Observer of Islip, L.I., uses his Model 15 to copy intruders. W3CRO of Springfield, Pa., uses his tower as a vertical radiator on 80 with excellent results. Dick also works 10-meter f.s.k. when conditions get tough on 80.

WA4NKZ of Ashland, Va., acquired a Model 15 to go with his 75S-3C and is looking for commercial stations to copy. *(See the September '64* RTTY *Column, Bob!)* K4KCX of Springfield, Va., is looking for printed circuit boards for the transistor tone standard in the *New RTTY Handbook. (Try Quality Circuits, Inc., 180 N. Commerce Ave., Largo, Florida, via W4WKY.)* K4ZNW of Tuskegee, Ala., works 20 meter DX. K4ACZ of Roanoke and W4CQI of Warrenton, Va., both run tape on 80 as does W4BLK of Oxford, N.C. W5IQH of Franklin, La., is looking for local help with RTTY. W5NQK is /4.

WA6LBK at Moffett Field, Calif., has Models 19, 15, and 14 to go with a KWS-1 and a 75A-4. K6SZQ of Norwalk, Calif., is on 2-meters. W6AEE of Arcadia, Calif., printed the schematic of the TT-63A regenerative repeater in August '64 *RTTY*, the monthly bulletin of the RTTY Society of Southern California, Inc., ($3 per

W3DTN operating his mobile Model 15.



Inside the trunk of W3DTN mobile RTTY. Note the three Motorola f.m. sets; one for 52.60, one for 146.70, and the third on the local radio club channel.

year). W7VKO of Phoenix, Ariz., has a TT-63 and is working for WAS. Harvey Simpson, Box 294, Tillamook, Oregon, will clean and adjust polar relays for $1 each, plus postage.

W8FWG of Laurium, Mich., works 20 with an NCL-2000 driven by an HT-37, Models 15 and FRXD, a Drake 2B receiver, and a K6IBE TU-D. K9WHA and XYL K9DVD of Markle, Ind., work 80 with Marauder and Mohawk rigs plus a linear, and Model 12 and 14 machines. W9AOV of Cuba, Ill., works 7140 kc. WØEGA of Sioux City, Iowa, is building a W2JAV narrow shift transistor TU.

SVØWL says that he simplified the c.w. sign-off (*QST*, Mar. '64) of W4AWY by using only a normally-closed push-button switch mounted near the OFF-ON switch on the TD. XE2R wants to obtain a transistor tuning fork standard. K1OEZ/KP4 is looking for toroids and polar relays. *(Try W6VPC.)* I1AHN uses English on 20. VE2HY and VE3CM are on 7140 with narrow shift; usually Sunday mornings.

On the Boards

We still keep getting orders for the wide-shift transistor TU and a.f.s.k. oscillator printed circuit boards of W2JAV. Again, we regret to report that these boards have long since been gone, and we know of no other source. Our suggestion is to build these transistor devices on the perforated board available from Lafayette, Syosett, N.Y. (Write them for a catalog. They also have printed circuit board etching kits.)

Boards are still available for the W2JAV narrow shift TU described in the September '63 RTTY Column. These can be had for $2.50 each, postpaid. Send check or money order (no cash) made out to me, and send it to the QTH at the head of this column. A printed circuit connector for this board will be included only as long as our supply holds out.

Comments on W1AW

Why doesn't W1AW send official ARRL bulletins on RTTY? We asked this question last month; we have asked it many times in the past, in print, in person, and on the air. We have never gotten a satisfactory answer. The main excuse is, "lack of manpower." Ok, but we insist that *no* increase in operating personnel at W1AW would be necessary. How? *By planning ahead.* Much to-do is being made about the rebuilding of W1AW, but apparently there is nothing being done to plan and/or install the equipment that would make this supreme service of W1AW possible.

To clarify the "how," it *must* be known to the ARRL Communications Department and to the Executive Committee that an operator can sit at the keyboard of a teleprinter machine and *simultaneously* prepare Official Bulletins in the form of 5-unit Teletype code perforated tape and in the form of Wheatstone perforated tape for Morse; and, at the same time monitor on the page printer of the very same machine the bulletin being prepared, all printed out, in capital letters.

Last month we said that the advantages of bulletin transmission on RTTY are very obvious (to us). It is so obvious that we didn't mention the most obvious; *60 words-per-minute transmission.* Why are they missing such a good bet? Ask *your* Director.

73, Byron, W2JTP

Antenna Trial Postponed

THE Antenna Trial of Mace Warner, WØJRQ, was scheduled for 8:00 A.M. Sept. 16, 1964. Due to the death of Andrew H. Bahlay, KØOOA, from a cerebral hemorrhage at 1:00 A.M. on that day. Mace's attorneys asked the court for a continuation of the trial and it is now set for January 26, 1965. KØOOA was Engineer in Charge of the FCC at Denver and was to be a key witness in this trial. The new date will bring the case into its third year at a cost of $3,000.00, about half of which has been paid by amateur contributions.—*W5RZJ*

YL

LOUISA B. SANDO,* W5RZJ

Congratulations to these newly elected officers of YLRL, who will assume their offices on January 1, 1965: President, Martha Edwards, W6QYL; Vice President, Kayla Bloom, WØHJL. Fran Bailey, K7MRX, has been re-elected to a third term as secretary, while Barbie Houston, K5YIB, has been re-elected to a second term as treasurer.

Serving as District Chairmen for 1965 will be the following:

W1OYM, Faith Wedge
WA2GPT, Beatrice Dietz
W3SLS, Betty Jane Aylor
WA4FEY, Ruth Heitfield
W5PFF, Audrey Beyer
WA6AOE, Maxine Hanberry
W7—tie vote; to be announced
K8ITF, Marge Farinet
K9TRP, Diane Price
WAØBBP, Maxine Winterhalder
K5MHI/KH6, Ruth Jones
KL7CUY, Kay McNulty
VE3EUV, Dorree Butler

Other YLRL positions remain the same: Editor of *YL Harmonics*, Edie McCracken, K1EKO; Publicity Chairman, Marte Wessel, KØEPE; Supplies Custodian, Ginny Bush, KØGZO; Librarian, Harryette Barker, W6QGX; Continuous Membership Chairman, Ruth Seigelman, W2OWL.

All members of YLRL are grateful to these YLs for carrying the ball for the Young Ladies Radio League. Having successfully completed its first 25 years of existence, we look forward to YLRL's next 25 years of continued friendships and good will among all YL operators everywhere.

Martha, W6QYL, ex-OD5CH, has served

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

Right—Martha Edwards, W6QYL, president of YLRL for 1965. Left—Kayla Bloom, WØHJL, vice president of YLRL for 1965.

YL NETS

Day	Time (EST)	Freq. (mc)	Name	NCS or Mgr.
Daily	1300	14.230 a.m. 14.340 ssb	CHC/FHC World-wide Service Net	CHC YL Chap. 4
Mon.	0830	3.900	Buckeye Belles Phone	K8MZT
	0900	3.920	U.P. Mich. YL	Rotates
	0900	7.225	Floridora	K4JZX
	1100	7.235	Loaded Clothes Line	WØESD
	1300	50.4	IMPS	K9YIC
	1400	3.870	LARK	Rotates
	1400	14.331	YL Int. SSBers	K4ICA
	1430	3.737	Buckeye Belles c.w.	K8TFG
	1800	3.890	Oregon YLs	W7HHH
	2300	3.900	Midnight YL Roundup	W4HLF
	2300	3.900	YL Round-up	W4HLF
1st & 3rd T.	0800	50.25	Puget Sound YL	Rotates
Tues.	0830	3.900	Blue Ridge	K4CZP
	0830	3.940	Jayhawker	KØHEU
	0900	51.3	Buckeye Belles	Rotates
	0900	3.933	Floridora YL SSB	Rotates
	0930	Tune Band, 2-Meter Net		K8NOK & K8TVX
	1000	50.33	Floridora YL Southern	K4ACF
	1300	7.179	Buckeye Belles c.w.	WN8DZL
	1300	50.4	IMPS	K9YIC
	1300	14.331	YL Int SSBers	K4RHL
	2130	50.5	Colorado YLs	WAØBBR KØWZN
	2130	3.825	GAYLARK	Rotates
	......	3.915	LARK (after North Central phone net)	Rotates
Wed.	0830	3.900	Yankee Lassie, WRONE	K1LCI
	0930	50.25	Hawk Roost	K9MZV
	0900	3.900	YL Welcome	K8LHF Alt. W8ATB
	1100	7.100	Loaded Clothes-line c.w.	KØEVG
	1300	50.0	IMPS	K9YIC
	1300	50.65	WRONE	W1HOY
	1400	14.288	YL Open House	K6KCI & WA4FJF
	2100	50.7	Chix on Six Akron	Rotates
	2100	50.3	Suncoast YL	K4EAC
	2100	50.7	Chix on Six Cleveland	Rotates
	2200	146.1	L.A. YLRC	K6BUS
Thurs.	0900	7.270	Friendly Forty	W3UUG
	0900	3.860	Georgia Peach	K4MXL, Alt. K4ZNK
	0900	3.880	TYLRUN	K5IOJ
	1130	7.235	TYLRUN	K5IOJ
	1300	14.240	Tangle Net	KØEPE
	1300	14.277	Floridora Int'l Upper SB DX	KP4CL
	1300	50.4	IMPS	K9YIC
	1300	14.331	YL Int. SSBers	K4ICA
	1430	7.185	Floridora Novice	WA4FJF
	1900	50.64	Buckeye Belles Columbus	W8LGY-K8CEN
	2300	28.8	10-Mtr. Chirps-W6	Rotates
Fri.	0830	3.600	WRONE c.w.	K1IJV
	1200	3.880	Northwest YL (Minow)	K7RAM
	1230	7.250	40 Mtr. Round-table-W6	Rotates
	1300	50.4	IMPS	K9YIC
	Late eve...	14.331	YL Int. SSBers	ZL2ZO & ZL2WS
Sat.	0930	3.910	Hawks Roost	K9ILK
	1300	3.845	BAYLARC Mermaid	WA6LIZ
	1300	14.331	YL Int. SSBers	K4ICA
Sun.	0900	7.225	Floridora Business Girls	K4UIZ
	1700	3.940	Jayhawker	W9JUV

These ZS YLs attended the first s.s.b. convention held in South Africa, at Lydenburg, on May 23-24, 1964. L. to r., Corrie, MYL of ZS6OS; ZS6's BIF, Eileen; APG, Doreen; GH, Diana; BAW, Sue, and BDB, Dot. Earlier this year Diana was honored by SAWRC who presented her with an engraved silver jug and scroll for 12 years meritorious service to the YL club. In addition, the S.A. Radio League presented Diana with the Jack Twine Merit Award for her contributions to amateur radio and her work for the SARL branch in Johannesburg.

YLRL during 1964 as vice president and activities manager and as such it has been her job to check the hundreds of logs in the various YLRL contests. Martha is going to have an even busier year ahead for in June '64 she was installed as president of the Los Angeles YLRC as well, and little Paul Charles, now over a year old, has reached that lively stage! (For additional details see write-up Nov. '63 *CQ*, p. 106.)

Kayla, WØHJL, is ex-KH6CKO and as such served as KH6 D/C for YLRL and as both president and secretary of the KH6 YL Club. She has held her license since 1957, is a member of Colorado YLs and YL Int. SSB'ers. Her OM is Bernie, WØHJN, and they have three jr. ops. Membership chairman for the Denver Radio Club, Kayla also is a contributing editor to the club bulletin, *Round Table*.

For write-up on YLRL secretary, Fran, K7MRX, see *CQ*, Nov. '62, p. 86.

Treasurer Barbie, K5YIB, has been well known in ham radio since she became W3OQF in 1948, and later as KØLYV. She has held a number of YLRL offices: Editor in 1949, publicity chairman in 1954, 3rd D/C in 1957, custodian of WAC/YL for 6 years, treasurer in 1964. Barbie is a member of TYLRUN, holds Advanced class license, A-1 op, and many contest and other certificates. Her OM Dick is K5YIC (ex-W4GPW, W3MAX, KØLYX), and they have two boys.

DX Membership

There is a change in the International Membership Chairman for YLRL. Betty, K5MJW, who has been handling DX membership correspondence for some time, will be DX herself, with QTH in Europe. We hear she is in a tizzy, and who wouldn't be! Taking over the job of DX membership is Ginny Powell, K1LCI.

1968 YLRL Convention

That's right—you can start getting ready for the next one! An invitation from the Colorado YLs to hold the next convention at Denver has been accepted by YLRL officers. Chairman will be KØEPE, Marte, and working with her as co-chairman will be KØBTV, Kay. Other committee members selected to date include, WAØEXX, Elizabeth, publicity; WØHJL, Kayla, prizes, and KØRGU, Tillie, registration.

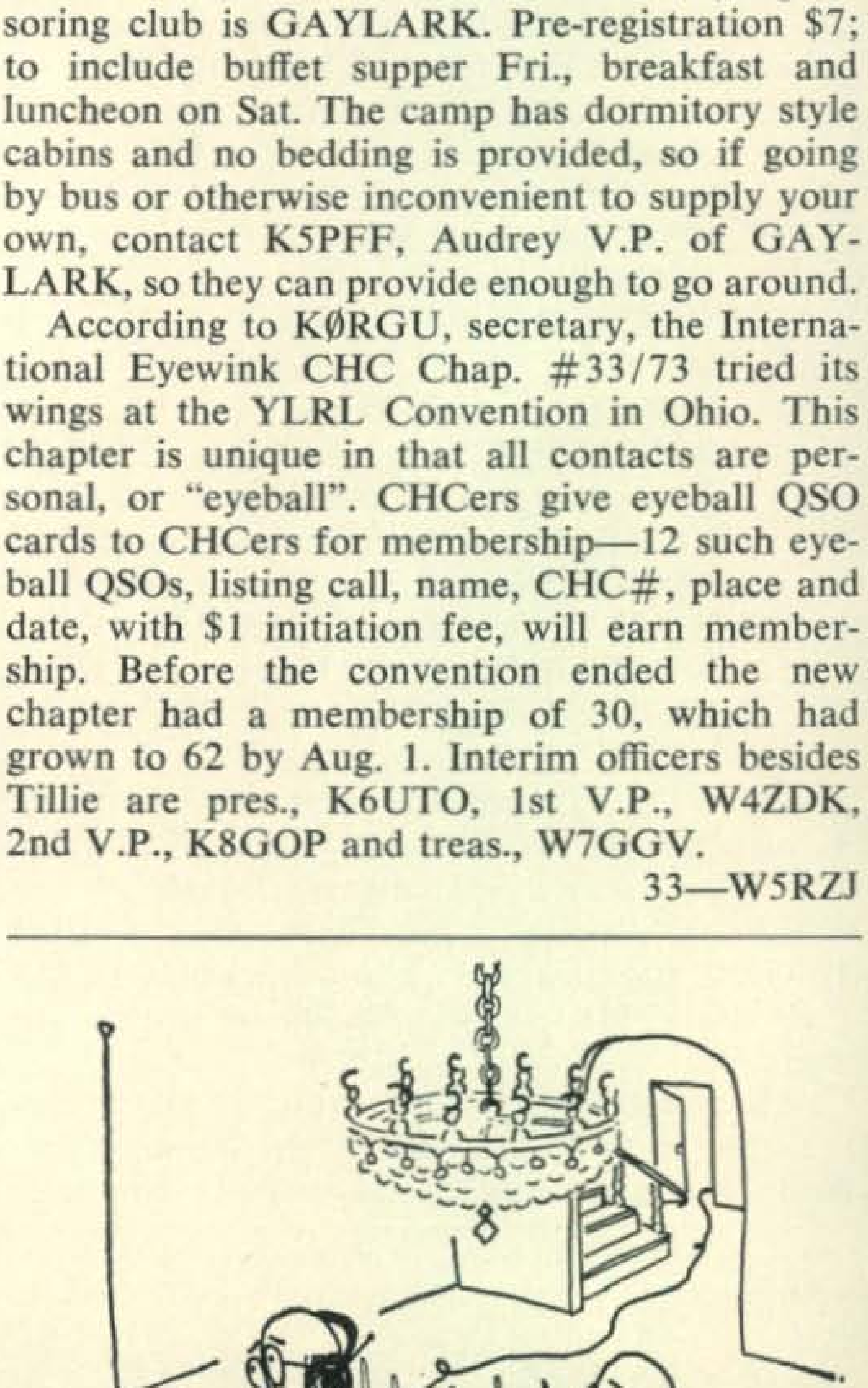
Colorado, with its majestic snow-capped Rockies, fabulous mountain passes, tall forests, streams and lakes is a summertime paradise. It may seem awfully early, but get out your maps and literature and start planning for a super convention-vacation trip in 1968!

Here and There

The TYLRUN annual birthday party will be held Nov. 6-7 at Camp Manisen, near Friendswood, Tex. (on the outskirts of Houston). Sponsoring club is GAYLARK. Pre-registration $7; to include buffet supper Fri., breakfast and luncheon on Sat. The camp has dormitory style cabins and no bedding is provided, so if going by bus or otherwise inconvenient to supply your own, contact K5PFF, Audrey V.P. of GAYLARK, so they can provide enough to go around.

According to KØRGU, secretary, the International Eyewink CHC Chap. #33/73 tried its wings at the YLRL Convention in Ohio. This chapter is unique in that all contacts are personal, or "eyeball". CHCers give eyeball QSO cards to CHCers for membership—12 such eyeball QSOs, listing call, name, CHC#, place and date, with $1 initiation fee, will earn membership. Before the convention ended the new chapter had a membership of 30, which had grown to 62 by Aug. 1. Interim officers besides Tillie are pres., K6UTO, 1st V.P., W4ZDK, 2nd V.P., K8GOP and treas., W7GGV.

33—W5RZJ



"It's only fair, I had it for the YLRL Phone Party."

by hams...
for hams...
Harvey is reliability

HARVEY
VALUES OF THE MONTH

TRANSISTOR IGNITION BY AUTOMOTIVE ELECTRONICS —

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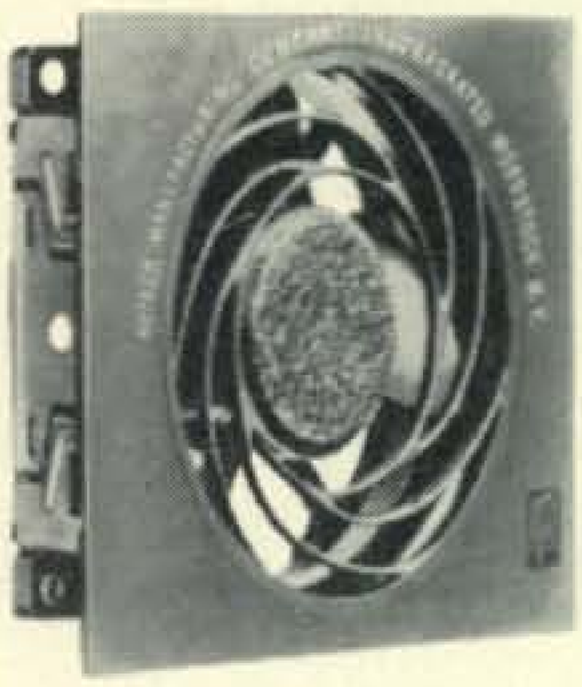

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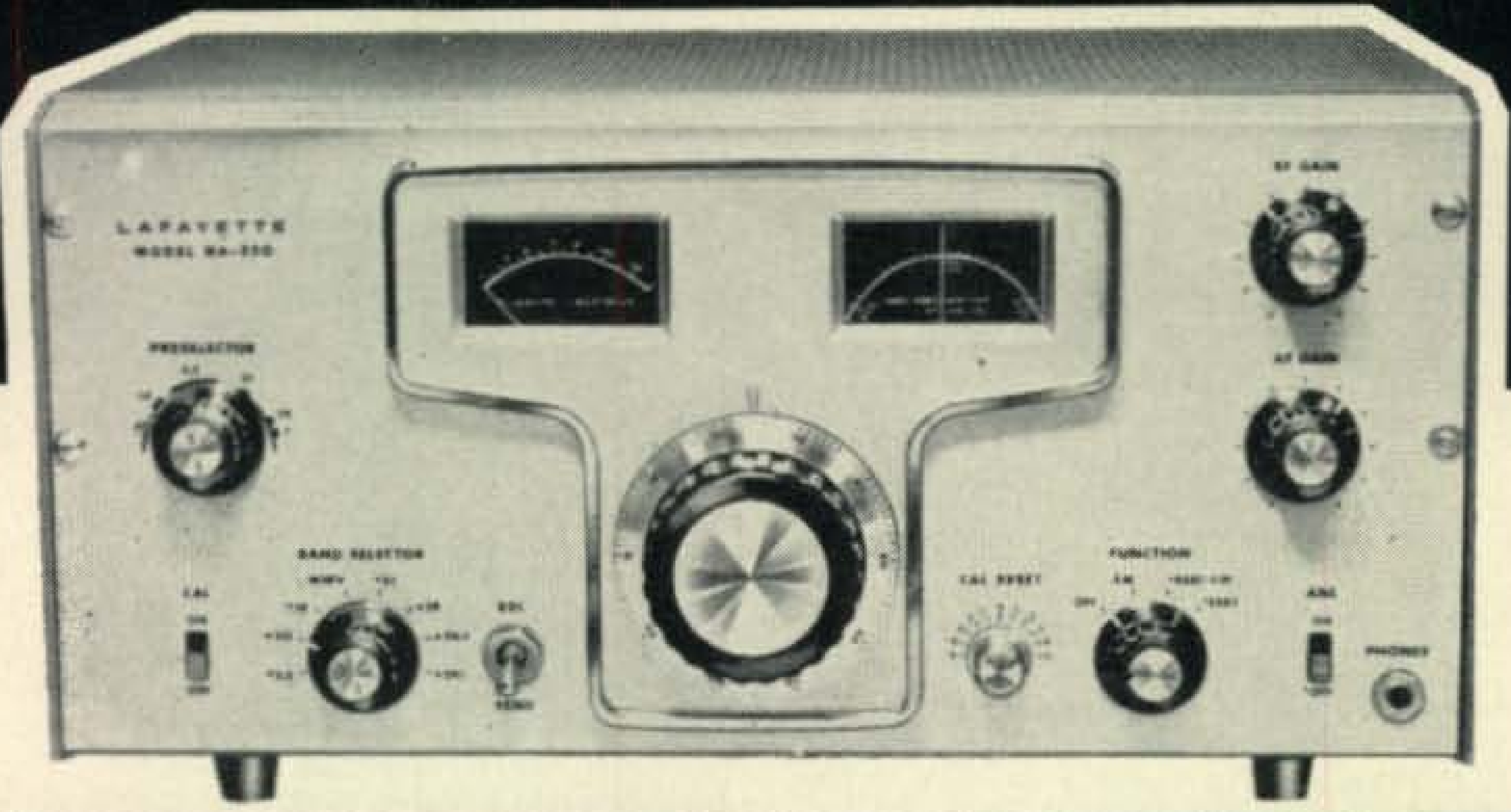

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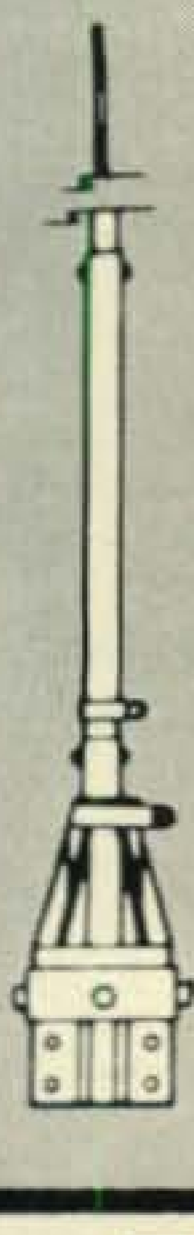

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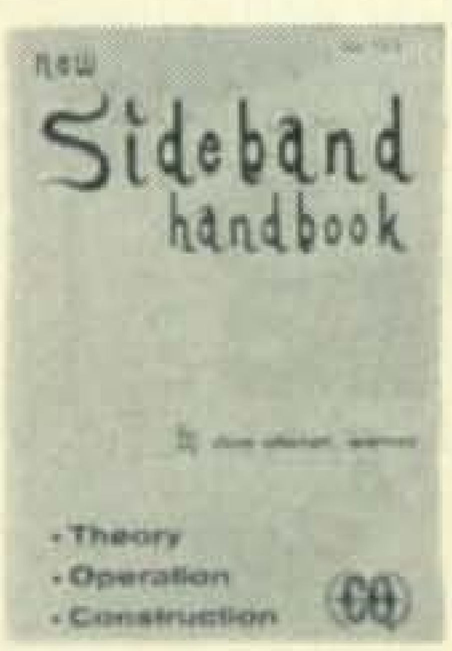

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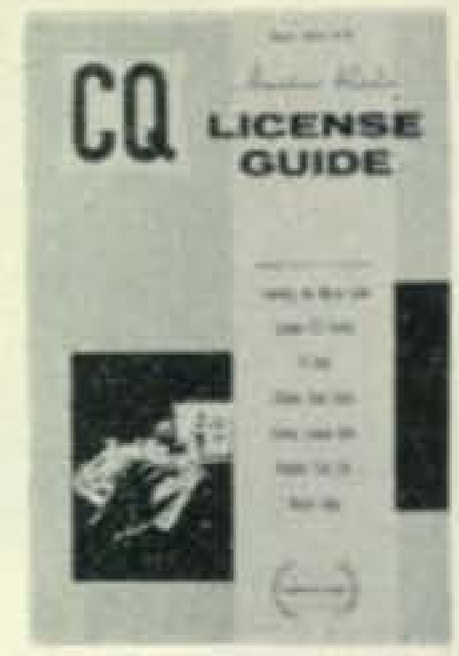

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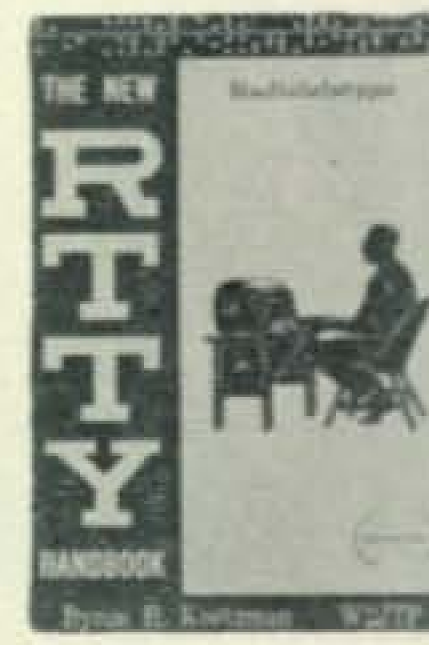

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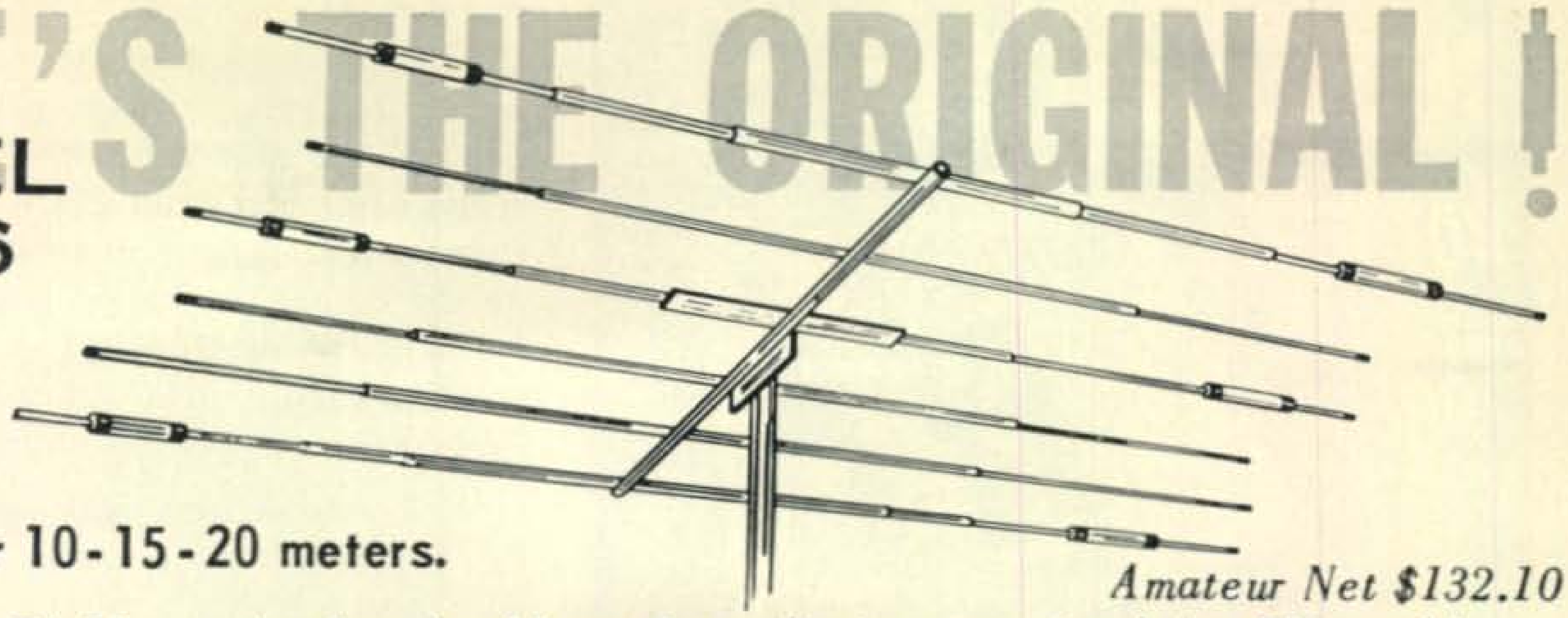

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For further information, check number 45, on page 142

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For further information, check number 46, on page 142

Zero Bias *[from page 7]*

job." Being a thick-headed Scotchman, I decided to play the game *my* way just to see what would happen. Lo and behold, a few days after my reply, came a registered letter to my boss, S. R. Cowan, telling the half-truth. After being called on the carpet to explain why, as Clif had said, I was utterly destroying *CQ*, a brief show of the correspondence involved brought the question, "Where did we get this character?"

Well, it took a little bit of convincing to establish the fact that Clif may be a character, but he is also a brilliant propagandist who for years used his talents for the US Navy and is now using them for K6BX. Clif's talent is responsible for the phenomenal growth of USA-CA in the past 3½ years, this we wouldn't even try to deny, but somewhere along the line even a brilliant propagandist must be slowed down, lest he destroy all he has created.

The upshot of this whole lurid affair was that Clif refused to write the USA-CA column until this and other matters were cleared up, or in other words, until I agreed to do things his way. I didn't agree and Clif didn't write, it's as simple as that.

What does this mean for the USA-CA Program? Not a thing—except that instead of the certificates being signed by K6BX, they will be signed by a new USA-CA Custodian, which we will probably announce next month. All clubs and local organizations having award news should simply send it directly to *CQ* instead of to K6BX, unless small scale, low-intensity coverage is all that is desired.

Tragic, isn't it, how a few power-hungry individuals can louse up a wonderful hobby? Well, enough of this angry-young-man business for one month. To take your mind off the miserable end of ham radio for a while, why not start on page 26 for one of the most jam-packed issues in *CQ*'s history. Happy Thanksgiving, fellows!

73, Dick, K2MGA

AF Shift Keyer *[from page 91]*

will be necessary to select these two capacitors to provide the desired output frequencies. This may be most easily accomplished by paralleling small valued capacitors across larger ones until the correct frequencies are reached. Capacitor C_2 which determines the *space* frequency should be adjusted first since its value will also effect the *mark* frequency. After this value has been determined, C_1 should be adjusted to provide the *mark* frequency. When adjusting the shifter frequency, the most reliable frequency standard locally available should be used, in order to assure compliance with regulations as well as compatibility with stations using very selective filters

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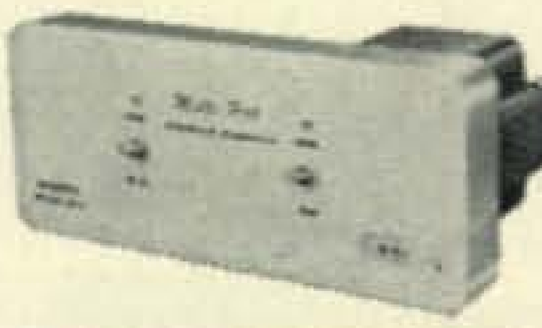

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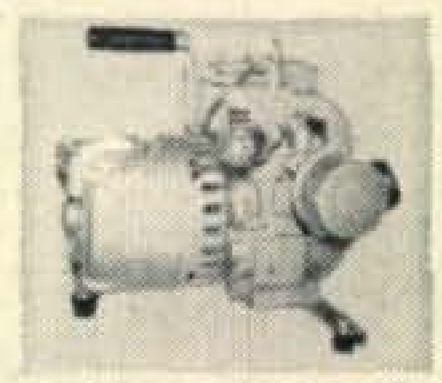

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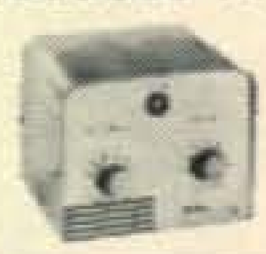

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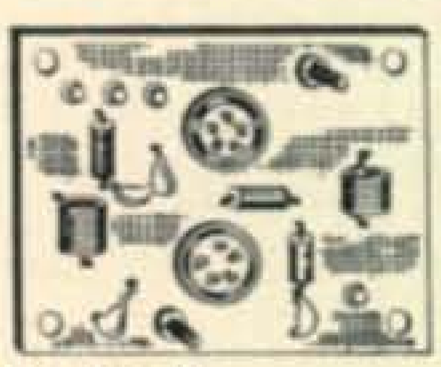
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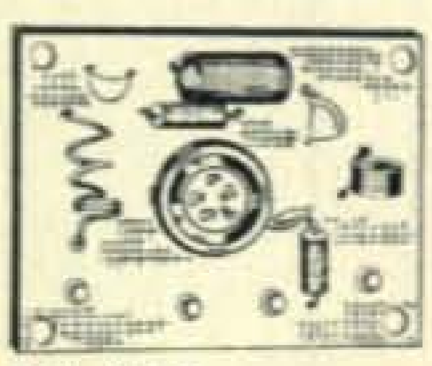
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For further information, check number 65, on page 142

in their terminal units. Once these frequencies are set up there should be no need for further adjustment as the oscillator is inherently very stable.

Summary

A detailed step by step construction procedure for this unit was purposely not included as it was thought that most constructors would have their own idea about the physical layout. For instance some of the local fellows have included this shifter on the same chassis as their terminal unit. So far there have been over one dozen of these units built in the Utah Valley area, and no two of them have been constructed alike.

Due to the relatively low impedance of most of the circuit areas it is almost impossible to make a layout that would not function properly. After the construction has been completed and the *mark* and *space* frequencies properly adjusted, it is a good idea to check the output waveform on a scope. If everything is working properly the output should be an almost perfect sine wave. If a sine wave is not obtained it will probably be due to improper bias on the buffer transistor. If transistors other than the ones specified are used it may be necessary to adjust slightly the value of the base biasing resistors in the buffer stage. It is essential to have a sine wave output in order to transmit a narrow signal. If the wave shape is anything other than a sine wave it will contain overtone frequencies which, after modulation, will produce side bands far removed from the carrier. This not only is a potential source of interference to adjacent frequency stations, but also reduces the usable power in the *desired* side bands. For the same reasons it is also important that the transmitter audio system pass the output signal from the shifter without distortion. If the transmitter employs negative clipping this should not be used while transmitting teletype as most clipper circuits distort the incoming wave shape.

If you are about ready to get started with RTTY, why not give this transistorized shifter a try. It's really not as complicated as it all sounds. The whole thing can easily be constructed in a few hours and with reasonable care it's almost impossible to go wrong. ■

50 Mc Prop. Effects [*from page 87*]

	1958	1959	1960	1961	1962	1963
Jan.	—	76.0	134.0	68.6	53.3	98.5
Feb.	—	56.3	30.0	0	0	131.0
Mch.	—	51.4	29.0	115.0	0	40.0
Apr.	—	—	59.1	40.0	158.0	0
May	—	77.7	101.1	447.2	206.7	159.2
Jun.	—	190.7	95.2	224.5	185.4	212.7
Jul.	—	199.9	131.6	130.8	193.2	189.1
Aug.	—	103.9	53.0	132.1	27.5	170.0
Sep.	—	132.0	195.0	70.2	38.0	0
Oct.	—	38.7	56.8	51.1	49.9	17.5
Nov.	101.2	52.0	55.9	14.0	175.0	78.6
Dec.	50.2	212.0	182.0	45.0	129.7	125.0

Table I—Average duration of band openings, in minutes, by months.

For further information, check number 69, on page 142

For further information, check number 70, on page 142

For further information, check number 72, on page 142

For further information, check number 73, on page 142

eastern United States. Despite much tuning for it, Canada's elusive VE8 prefix was not heard during the study; every other Canadian prefix was worked (Table D).

More Study Needed

Our investigation was not intended to "prove" anything. It answered some puzzling questions and posed others that require more study by others. In reviewing results, two major findings point up the need for additional amateur investigation of v.h.f. propagation and its effects. These two are the inverse relationship between sunspot numbers and E_s propagation activity, and the recorded discrepancy between propagation theory and operational results in the matter of daily periods during which E_s-supported communication peaks in the 50-54 mc frequency range.

As was pointed out in our interim report of 1962, there is international need for cooperative, long-term study of v.h.f. propagation effects under average amateur operating conditions. To be of maximum value, such study must include standardization of data and interchange of accurate propagation effects findings as they become available.

We hope our work may serve to encourage

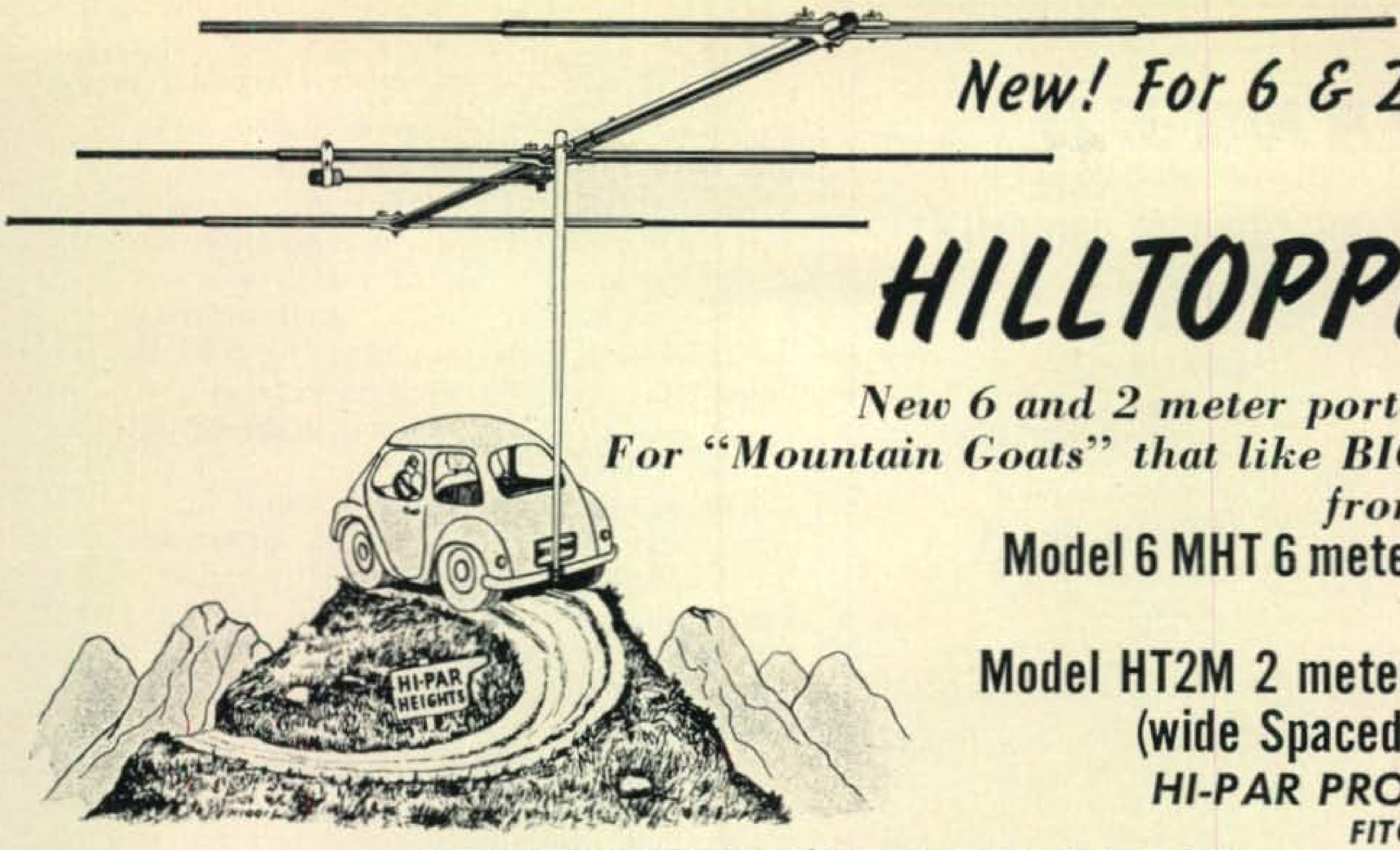
	1958	*1959*	*1960*	*1961*	*1962*	*1963*
Jan.	—	41.94	19.36	25.80	9.70	6.45
Feb.	—	42.86	13.79	0	0	28.57
Mch.	—	9.68	9.68	9.68	0	6.45
Apr.	—	—	33.33	10.00	16.66	0
May	—	12.90	51.61	29.03	74.19	67.70
Jun.	—	63.33	70.00	86.88	86.67	90.00
Jul.	—	58.06	67.74	83.90	74.19	74.19
Aug.	—	45.16	45.16	22.22	6.45	25.81
Sep.	—	3.33	3.33	6.66	13.33	0
Oct.	—	9.68	19.35	19.35	25.81	6.45
Nov.	96.66	23.33	30.00	16.66	13.33	30.00
Dec.	53.33	16.13	48.39	19.35	48.39	22.58

Table J—Percentage of open to monitored days.

v.h.f. operators elsewhere to undertake similar research in their respective areas. If a representative number of operators entered into comparative study of this kind—*effort requiring no special equipment or skills*—they could make significant contributions to presently limited knowledge of v.h.f. propagation and its effects. Results would benefit amateurs of all nations and perhaps would aid in finding solutions for some stubborn scientific problems.

In addition to the scientific value of such activity, those participating would increase their DX scores. The 50 states and 40 foreign prefixes recorded in our six meter logs in 61 months resulted directly from desire to gain greater knowledge of 50 mc propagation effects.

Many v.h.f. amateurs contributed—some unknowingly—to our work. Space limitation does not permit acknowledgement of our appreciation to all of them. Among those most helpful were Garth E. Ghering, W7AGG; Herbert E. Skibitzke, K7CDT; Charles E. Strobel, KØWHX, formerly VO2HA; Maj. Frank L. Paus, DL4PA, formerly KL7CRB; Miguel A. Czysch, LU3-



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T.V. CAMERA

Adaptor included. Use on T.V. set, or ham T.V. only. $395.00 complete.

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CB CRYSTALS! HAM CRYSTALS!

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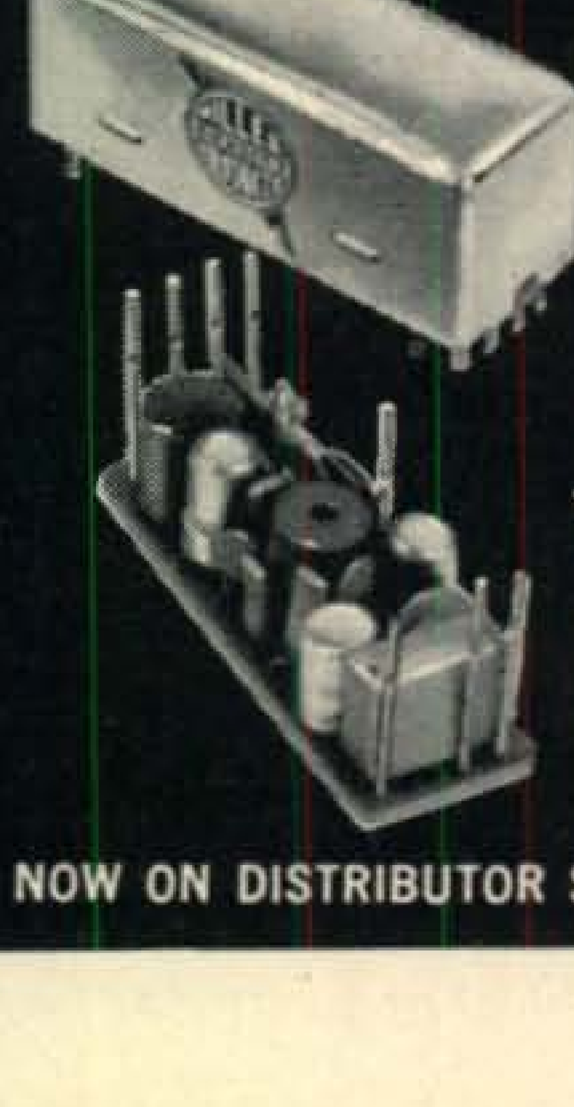

Model 8902 pre-tuned 455 KC IF strip provides excellent gain (55 db) and selectivity (6 db bandwith: 8 KC), No alignment is required. Included among the 21 components on the PC board are a mechanical filter, 2 transistor amplifiers and a diode detector capable of driving earphones. Overall dimensions: ½" x ½" x 1½".

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For further information, check number 57, on page 142

DCA; Harold Lund, VP7CX; David H. Brill Jr., XE1OE; Arnold S. Trossman, W2DTJ, and George Jacobs, W3ASK. ■

2M Gnd Plane [*from page 76*]

Relative gain of the stacked antenna system may be measured on a comparative basis by using one antenna of the array as a reference antenna while receiving a signal and observing the receiver S meter reading. The complete antenna may then be used to receive the same signal and a relative reading again be obtained on the receiver S meter.

The attached photographs show the coaxial connectors exposed. It is recommended that these connectors be protected by taping in the final installation. It is also recommended that the ends of the copper tubing elements be closed by pinching and soldering or by means of plastic plugs and cement such as "Q dope." It should also be noted that the ground radials may be attached to the copper plate by small screws rather than soldering if equipment is not available that will furnish the large amount of heat required for this operation. A soldering torch is required for this operation.

The insulator used should be made weatherproof around the radiator element and also around the copper plate. This again may be accomplished by using cement such as "Q dope."

The individual antenna elements when attached to the mast should be positioned such that no single ground radial is any closer to the mast than any other element. The placement of guy wires should be such that no interference is caused to the radiation pattern or antenna impedance.

It is also possible to mount 4 antennas by using 2 masts with 2 antennas on each mast. The 2 masts are then physically separated by approximately 9/10 wavelength in the horizontal plane. ■

80 & 40M XCVR [*from page 68*]

Again, the parts locations are shown in the various photographs. After completing the construction these stages can be tested by using a 3.5 mc signal from a crystal oscillator or v.f.o. Feed the signal source into the grid of the 6AG7 through the 90 mmf and tune the plate circuits of each stage. Note the output as indicated by the NE-2. Be sure to have a 50 ohm dummy load on the output during the tuning.

The bias on the 6146 is adjusted for Class A operation. However, the 6146 can be driven into Class C by reducing the 6AG7 cathode resistor for increased drive. Operating Class A produces less TVI and the signal sounds much better.

After constructing the v.f.o., the tank circuit should be grid dipped to 3.5 mc. Some prefer to put the grid at 1.75 mc and double to 3.5 in the plate as a means of getting improved stability.

The keyer circuit switches all the necessary voltages to the transmitter as soon as the key is pressed. How long the relay is held in is determined by the setting of the 250K delay pot in the grid of the keyer tu be. If after adjusting

For further information, check number 64, on page 142

this control the relay does not hold in long enough, increase the value of the 9 mf capacitor by two or three mfs.

Power Supply

The power supply used will, of course, depend upon the applications, fixed station or mobile, etc.

The power supply shown in fig. 2 is ideal for fixed station work. The power transformer may be of the general replacement type. If the transformer does not have a 125 volt winding, then a Stancor PS-8415 can be added. ■

SPACE [*from page 104*]

print, the Japan-USA live television transmissions should already have taken place.

Earlier SYNCOMS 1 and 2 were launched on February 14 and July 26, 1963, respectively. SYNCOM 1 achieved a successful orbit, but all communication equipment aboard the spacecraft failed. SYNCOM 2 achieved a successful near-synchronous orbit and has worked flawlessly since. The satellite, first located over the south-Atlantic, linked the United States with South America, Europe and Africa. It is now located over the mid-Pacific, and is being used for experimental communication transmissions between Asia and the United States.

SYNCOM 3 Frequencies

A 2-watt continuous carrier transmitter operates as a beacon on 136.980 mc. A second 2-watt transmitter aboard SYNCOM 3 is used for command telemetry on 136.470 mc.

OSCAR 3

The first part of a special article on OSCAR 3 ("OSCAR 3—An Active Communication Satellite For Radio Amateurs") appeared in last month's issue of *CQ*. It was originally planned to publish the second part of this article in this month's issue, in preparation for what was hoped to be a December launching of the satellite. The need for extensive ground-testing to assure reliability of the satellite's communication equipment, and the additional time required to find a suitable U.S. space mission on which OSCAR 3 can ride as a hitch-hiker, have resulted in a launch delay. Latest information from Project OSCAR Headquarters indicates a *late winter* launch the satellite, at the earliest.

In order that late information about the satellite is available as close to launch time as possible, Part II of the Oscar 3 article will appear in either December's or January's *CQ*, depending upon information received from Project OSCAR Headquarters concerning the probable launch period.

73, George, W3ASK

DX [*from page 98*]

"After much trouble have up the old faithful 3 el wide spaced 20 meter beam again and it is working fine. Using a locally built welded tower which is 60 feet high and cost less than US $70 to make but a lot of trouble to put up. Have a separate 50 foot aluminum home-made tower with a home-made 15 meter 3 el.

For further information, check number 71, on page 142

For further information, check number 62, on page 142

For further information, check number 63, on page 142

beam on top. The bottom guy wires on this tower are ¼ wave radials attached to the tower for 40 meters. Above this is a gamma/omega match to load the top part of the tower (plus 15 meter beam) as a 40 meter vertical. I have a s.w.r. on 40 meter of 1:1 but the gamma match seems far too long and reports not too good compared with a 40 meter dipole 45 feet high. Any recommendations or comments from vertical enthusiasts would be appreciated.

"Since the bands have improved again lately I would like to work my W friends. With the kind help of my Chinese XYL, Kim See, we QSL 100% at the end of each month to the Malaysian Outgoing QSL Bureau for any stations contacted which we have newly worked, or newly worked on s.s.b. Note *all* stations, whether they ask specifically for a QSL or not. The Malaysian QSL Bureau is run very efficiently by 9M2DW and works fine. It may be a bit slow by sea mail to USA but the cards get there. Whether or not the W stations receive them depends on whether they keep self-addrssed envelopes at their respective W QSL Bureau.

"In addition note we do QSL direct airmail to those who send sufficient IRCs. American stamps cannot be used here."

QTHs and QSL Managers

G2BVN was recently reported in error to be the QSL Manager for VP3YG. Des handles his own cards and does so very promptly, I might add.

CN8GB	via W2CTN.
CO2JB	Box 6996, Habana, Cuba.
EL2AE	Box 98, Monrovia, Liberia.
F5CH	Henri Castro, 91 Rue Jordaens, Lille (Nord), France.
F08AA	Box 374, Papeete, Tahiti.
F08BJ	Box 867, Papeete, Tahiti.
GB3RAF	via G2BVN.
HL9KA	Lt. Gen. T. Conway, D/CG EUSA APO 301, San Francisco, Calif.
HL9KR	T/SGT. Quinn, Det #5, 6146th AFAG, APO 18, San Francisco, Calif.
HL9TD	SFC. Chichester, Hq. Co. 1st Bn 31st Inf. APO 24, San Francisco, Calif.
HL9TE	CWO McGee, Co. "A" 27th Maint. Bn. 1st Cov. APO 24, San Francisco.
HL9TS	Weiss, HHB 4th Bn. 76th Arty, APO 51, San Francisco.
HL9TU	Capt. Skelton, Hq. & Hq. Co. 1st Cav. Div. APO 24, San Francisco.
HZ3TYQ	via Aramco, Box 1721, Dharan, Saudi Arabia.
IS1VEA	via IS1FIC.
KZ5KY	via DZ5MQ, Box 1061, Cristobal, Canal Zone.
ON4QY	via K6ICS.
TJ1AC	F. Bucher, c/o Electricity Corp. Victoria, West Cameroon.
TU2AE	Gilbert Laine, Posts & Telecoms. Abidjan, Ivory Coast.
VE8ML	via VE3BZO.
VP2KT	via W2CTN.
VP7NG	Box 5755, Nassau, Bahama Islands.
YS1RRD	Box 517, San Salvador, El Salvador.
ZD3A	via W4ZRZ.
ZD3P	via G2BVN.
5Z4IV	via W2CTN.

73, Urb, W2DEC

Sister Hams [*from page 56*]

The three nuns now in Peru will be followed by other groups who will receive similar training in radio before going to South America. We wish them all success in their venture and welcome them to the ranks of amateur radio. W6QIE is to be congratulated for his fine work in training the Sisters.

Now you DX hounds can point your beams southward and start listening for a new OA-5 call. Who knows, you might just get a nice QSL from the "Sister Hams" at Lake Titicaca. ■

For further information, check number 53, on page 142

Tune-up Box [*from page 48*]

octal. This enables you to salvage old tubes, remove the bases and use them for coil forms. If you want to add an s.w.r. bridge, the extra pins available on the octal socket can be utilized for switching and shorting.

The input and output r.f. connectors are standard SO-239 types. The scope output connector is a standard phono. Different connectors were used for the scope and r.f. outputs so that it is impossible to put high power r.f. into the scope.

Calibration And Use

To use the unit as a power output indicator remove the plug-in coil and insert the tune-up box into the antenna lead at the transmitter. Hook either SO-239 output connector to the transmitter, the other connects to the antenna. Be sure the coil is removed and then proceed to turn R_2 ¼ turn on and keep adjusting up or down so that you get the meter deflection you desire. After a little use, the R_2 dial, which may be roughly calibrated in power, will give you a good indication of the effect of one adjustment as compared to another.

You will find that in a linear amplifier, maximum plate current at resonance does not always mean maximum power. Always tune for maximum output on your meter. After you have completed your transmitter adjustment remove the meter from the antenna and reconnect the antenna to the transmitter.

Put proper coil (the band you desire) into the tune-up box and tune C_3 for maximum indication as you walk around the shack. If, when using the tune-up unit as a field strength meter, you do not have enough pickup to swing the meter, just add a small antenna at either SO-239 connector. After a little use the shunt R_2 across the meter can be calibrated and the meter can be read in watts.

To use the scope, connect a short length of coax (no more than five feet) to the phono plug on the side of the unit.

This instrument has been a really valuable addition to my ham shack equipment and has been indispensible in my mobile transmitter work. Its real handy to have a single unit when you are working on your mobile rig in the driveway of the house. ■

Remote Mobile Inst. [*from page 33*]

have to worry about mike gain settings when you are in the front and the rig is in the back.

Once tuned up the transceiver remains set, and children or parking lot attendants can't get their hands on the controls.

Many years ago while operating a trunk mounted mobile on 2 meters, I noticed that the trunk lid seriously affected the transmitter tuning because of its proximity to the antenna. I used to climb into the trunk and pull the lid down and tune up with a flashlight and a tuning wand. At seven o'clock one morning after a tuning session I stepped out of the trunk just as the milkman pulled up. He was startled and I was embarrassed . . . so I just nodded, got in my car and drove away. It wasn't until later that I realized he thought that I slept in the trunk.

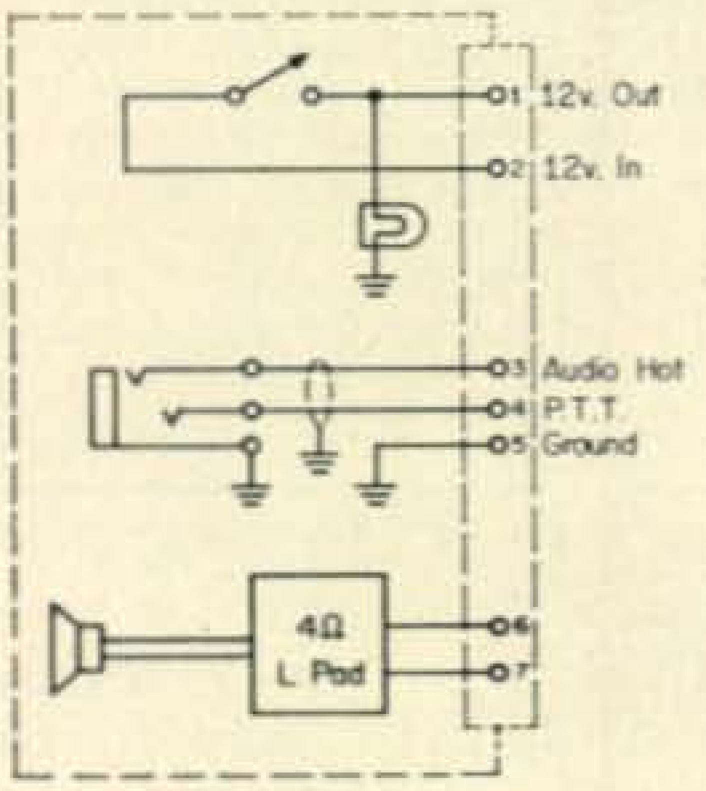

Fig. 1—Circuit of the control wiring for the remote control head. The mike lines, 3, 4, and 5, should be a 2 conductor shielded line. The battery cable should be fused for 20 amps. Number 8 wire should be used for 12 volt systems and #4 for 6 volt cars.

Well, you don't have to climb in the trunk unless you are on 2 meters. You will however, have to squat and squint somewhat to tune this one. Good luck, I hope you have as much fun with yours as I'm having with mine. ■

The Touch-Key [*from page 31*]

To reduce clicking, insert a 9/16" × 9/16" piece of soft, thin plastic sheet between each armature and its pole-piece; tiny drops of cement at the front two corners will anchor the plastic to the bakelite contact support assembly, while allowing it to remain flexible. Check the contacts for reliable performance, and readjust spacing if necessary. If further noise reduction is desired, mount the completed unit on a piece of sponge rubber kneeling-pad.

A 1N273 diode is reverse connected across each coil, to reduce the inductive "kick-back" voltage to a safe level for the transistors. Voltage and current measurements should be of the following order:

	9 v. batt	*1½ v. batt*
Key open	0.2 ma ±	1.6 ma
Key closed (one side)	4 ma	10 ma
Battery lower limit	6.5 volts	1 volt

These figures were obtained at room temperature, with both dot and dash sections of the key in operation. Actual oscillator current (key OPEN) for one side only, is about 0.7 ma.; at 1½ volts, this gives a power *input* of approximately one milliwatt.

Alignment

Plug the Touch-Key into the relay unit. With the top cover in place, turn the key over and adjust one coil slug to bring its oscillator to about 1600 kc. This can be heard as a "hiss", on an adjacent broadcast receiver previously set to this frequency. Adjust the second slug to about 1500 kc in the same manner.

Attach the relay unit to your electronic key, and give it a try. No trouble should be experienced in getting the key to operate, but if problems do arise, a check against the schematic, and the voltage and current figures given above, should reveal the source of the difficulty. ■

Ham Shop

Rates for the Ham Shop of 5¢ per word for advertising which in our opinion, is non-commercial in nature. A charge of 25¢ per word is made to all commercial advertisers or organizations. Since we do not bill for Ham Shop advertising, full remittance **must** accompany all orders.

Closing date is the 15th of the 2nd month preceding date of publication. Your copy should be typewritten, double spaced on one side of the page only.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein. We reserve the right to reject advertising which we feel is not of an amateur radio nature.

CREATIVE QSL CARDS free, new catalog and samples. Personal attention given. Wilkins Creative Printing. P.O. Box 787-2, Atascadero, California.

QSL's Samples free. Little Print Shop, Box 9363, Austin, Texas.

QSL's . . . $1.90 . . . Dime . . . Filmcrafters . . . Martins Ferry, Ohio

RUBBER STAMPS for QSL Cards. Kits available. Free sample impressions. E & R Stamp Co., 50 Gerald Rd., Rantoul, Illinois.

QSLs At last! Something new in QSL cards! All orginal designs. Send 25¢ for samples. Yarsco Box 307, Yorktown Heights 2, N.Y.

Q-STAMPS Now $1.50! Postage stamp size photographs for QSL's! 50 large or 100 small, $1.50 per gummed-backed, perforated sheet. Free Samples. Q-Stamps, Box 149, Dept. 4A, Gary, Indiana. 46401.

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QSL's—Brownie, W3CJI—3111 Lehigh, Allentown, Pa. Catalog with samples, 25¢.

QSL's, CB, WPE samples 10¢. Nicholas & Son Printery, P.O. Box 11184, Phoenix, Arizona. 85017.

PICTURE of yourself, home, equipment, etc., on QSL cards, made from your photograph. 250—$7.50 or 500—$10.00 postpaid. Samples free. Write to Picture Cards, 129 Copeland, LaCrosse, Wis.

QSLs SWLs XYL-OMs (Sample assortment approximately 9¾¢) covering designing, planning, printing, arranging, mailing, eye-catching comic, sedate, fantabulous. DX-attracting. Protopay, snazzy, unparagoned cards. (Wow!) Rogers, KØAAB, 961 Arcade St., St. Paul 6, Minn.

QSLs free samples. Fast service. Bolles, 7701 Tisdale, Austin, Texas.

RUSPRINT QSLs—SWLs 100 2-color glossy $3 postpaid. QSO file cards $1 per 100. Rusprint Box 7507, Kansas City, MO. 64416.

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CALL CARDS Badges, decals, goodies, illustrated literature with samples 25¢. Errol Engraving Att: K1VRO, Westfield, Mass.

QSLs Samples, dime. Print Shop, Corwith, Iowa.

QSL CARDS $2.50 per 100 in three colors. Samples and catalog free. Garth, Box 51C, Jutland, New Jersey.

QSL CARDS. As low as $2.50 per 100. Samples free. Radio Press, Box 24C, Pittstown, New Jersey.

C.B.—WPE—QSL's. Christmas Designs. Catalogue-samples 10¢. Longbrook Press, Box 393-Q, Quakertown, N.J.

PLASTIC CALL SIGNS. Baisden Specialties, Box 6174, Savannah, Georgia.

PRINTED CIRCUIT BOARDS Hams, Experimenters. Many different projects. Catalog 10¢. P/M Electronics, Box 6288 Seattle, Washington 98188.

HAMS Convert any television to sensitive, big-screen oscilloscope. Simple changes. No electronics experience necessary. Illustrated plans, $2.00. Relcoa, Box 10563, Houston, Texas.

COLLINS 32S-1, 75S-3 516F-2 with cables and manuals like new in original boxes. $975.00. Also, Heath 2KW PEP xmtr with spare 4-400 and matching Heathkit 3200 volt power supply. $395. Will finance. Gene Cramer W8APQ, P.O. Box 612, Benton Harbor, Mich.

WANTED Commercial, Military, All types, ARC, ARN, ARM, GRC, PRC, URR, URM, TS, 618S-1-T, 17L, 51R-V-X, APN, Others. RITCO, P.O. Box 156, Annandale, Va.

WASHINGTON Amateur Radio News. Free copy. Foundation for Amateur Radio, 2509 32nd St., S.E., Washington, D.C. 20020.

WRITE for free lists of finest reconditioned amateur equipment. Guaranteed. On approval. Time payments. Buy the best for less. Henry Radio Company, Butler, Missouri.

TOP PRICES paid for AN/GRC-3 thru 9, GRC-26, 27 to GRC you name it. AN/URM, UPM, USM, SG-1, 2, 12, 13, any and all mil test sets. GR, HP, Meas. Corp, Boonton, ARC, Tektronix, all commercial sets, AN/ARC-27, 33, 34, 44, 52, 58, 65, etc. R-390, 389, 388, SP-600, BC-610, T-368, We pay shipping. Call, Write, Visit our store. Tech. Systems Corp. 42 W. 15th St., New York 11, N.Y. Call Ed. Charol, CH 2-1949.

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REMOTE CONTROL unit, 9 tubes, AN/ARW-26, brand new, complete, $5.00 postpaid (cost Navy $125.00) MDC, 923 W. Schiller, Phila., 40, Pa.

FOR SALE Complete instructions including 28 page booklet and 22" × 36" schematic for converting the ART-13 transmitter to a.m. and s.s.b. Satisfaction guaranteed. $2.50. Sam Appleton, 501 No. Maxwell St., Tulia, Texas.

ATTENTION RTTY'ers. Typewriter ribbon re-inking device—$3.00 postpaid! WØAJL—Walter E. Nettles, 201 So. Eudora St., Denver, Colorado, 80222.

12 DB GAIN forward. 100 db front to back ratio. Our rhombic antenna is superior to any other antenna on the market. We challenge you to find an antenna on the market with as much forward gain. We do not guarantee good performace, just the best. Specifications: 2000 watts p.e.p. 600 ohms impedance, swr 1.3 to 1, low Q, easy to match. Complete with high tensil strength copper wire, insulators, and termination resistor. This is the same antenna used by telephone companies for overseas communication. Sold on a fifteen day money back guarantee. Exact frequency must be specified. Order now! 20 Meters $44.95, 15 Meters $37.95, 10 Meters $39.95. The Hilliard Laboratories, Box 2614, Macon, Georgia.

JOYSTICK See July **"CQ"** p75. Watch future ads in **"CQ."**

COLLINS 75A owners. Tuning Knob, 6 to 1 reduction, $7.00 postpaid. **W4VOF,** 1517 Rose Street, Key West, Fla.

JOYSTICK Pending internal merchandising arrangements please order direct to Partridge Electronics Ltd., 7 Sowell St., Broadstairs, Kent, England.

JOYSTICK, Cave dwellers, Cliff dwellers. Your prayers are answered. Send only $18.15 to Partridge Electronics Broadstairs England for complete DX antenna system by return mail. Just stand it in the shack, connect to TX (or RX) and fire away all bands 160 thru 10, CB Mars frequencies. Money back guarantee.

ELECTRONIC TUBES—Top brands sold at substantial savings! (Minimum Order $15.00). Authorized GE Distributor. Send for free Buyers' Guide for all your tube requirements. Top Cash pad for your excess inventory (New only—Commercial Quantities). Metropolitan Supply Corp., 443 Park Avenue South, New York, NY. 10016, 212 MU 6-2834.

Wanted: Back issues of QST, 1925-Nov, 1924-Feb., 1923-April, May, Oct, Nov. Must be complete and in good condition. Send description & prices. K2EEK c/o CQ.

PERSONAL PROPERTY plaques for portable rigs with name and address deep cut engraved and black enamel filled on 1" x 3" solid brass, bronze, silver or gold finished plate, $1.50 each or 2 with same engraving for $2.50. Station call plates on same material 1" x 4" with ½" letters $2.50 each. 1½" x 7" with 1" letters $3.50 each. Custom engraving for custom built rigs, submit sketch for quote. Aladdin Engravers, Box 186, Short Beach, Conn. 16407.

FOR SALE—Gonset Communicator III 6 meter complete with mike and book. Like new. Local sale only. $165.00. K2EEK, 75-15 177 St., Flushing 66, N.Y.

NEED MONEY for college this fall. Must sell entire rig. SR-150 with ac power supply, HA-1 keyer with key, Knight swr bridge. AR-22 Rotor, Bud low pass, TA-33 Jr., B&W antenna switch. All in excellent condition. (Make offer.) WA8ASV, 1211 Milbourne, Flint, Mich.

IF WA2NHH and K9KIC will send a post card to the CQ offices we will send a free copy of the SSB Handbook by return mail.

WANTED 1945 issues of CQ magazine for CQ collection. Issues must be complete, including covers. Contact the CQ editorial offices concerning price and condition.

TOROIDS uncased 88 mh 60¢ each or 5/$2.50. Fasold, WA6VVR, Box 34, Dixon, California.

COLLINS 51J4 or 51J3 wanted. State condition, price. Phone collect P to P. Mike Ercolino W2BDS 201–775–7252.

BUY, SELL, TRADE Ham, CB Directory. 12 issues $1.00. Philupi, 1225 Hillside, North Bergen, New Jersey.

For further information, check number 43, on page 142

For further information, check number 44, on page 142

For further information, check number 52, on page 142

SELL: As new Johnson Thunderbolt. No modifications, ship in original packing, $325. Write. W7GYO, 1214 Beach Street, Maysville, Washington.

WANTED: Hallicrafters S-20 (not S-20R), S-21, S-22. Howard Hoagland Junior, 639 North Sierra Bonita Ave., Los Angeles, Cal, 90036.

STOP paying high prices for QSL's. Add your call & handle to our low cost QSL's and you're in business. 250 for $1.50 or $1.00 for 150 cards. Haral Assoc., 1133 Broadway, New York, N.Y.

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QSLs? WPE's? CB's? Finest samples 25¢. Deluxe 35¢. Religious 25¢. (refunded) Sackers, W8DED, Holland, Michigan.

SELL SX101 Mk 3, speaker, instruction book $200.00. Ship in original carton. Andrasko 223 E. 96th St., N.Y.C.

WANTED Tubes, parts, components, new and used Amateur, Industrial, Commercial. Mid-West Electronic Supply, 54 Mia Ave., Dayton 27, Ohio.

SOLID STATE RECTIFIERS eliminate heat, increase voltage. Buy direct. No surplus, fresh stock. Vacuum tube substitutes, plug directly into tube sockets. Use in transmitters, receivers, transceivers, amplifiers and power supplies. Send self addressed stamped envelope for details. The Noel Company, Box 1058, Minnetonka, Minnesota 55345.

SELL—Poly PC-6 AC/DC Latest, Four Crystals, B & W 423 Filter, Telrex 3 Element Beam Mint, Hy-Gain HH-6B Halo, HMB Mast, Mobile Mount, all new $250.00. Al Taylor, WB2KTA, 3092 Ave. X, Brooklyn, New York.

HEATH APACHE mint condition and SB10 with cables also National NC109 receiver, general coverage with product detector and notch filter. Best offer K8TIY Walt Wright, Route 4, Coldwater, Michigan.

GOOD 75A1 for sale. Priced to sell fast at $165.00, FOB K1NNC, 100 S. Main, Unionville, Conn.

KWM-2 WANTED—Pay cash for right deal, or trade Ampex mod. 970 Tape or Nikon F 35mm Camera plus cash. Will consider other Collins gear. D. O'Neil, 3948 Neptune St., Lompoc, California.

DRAKE 2-B perfect condition. Late Model. Used about two hours. In original carton. $210.00. WA5FPD, 803 Pleasant Drive, Baytown, Texas.

COLLINS 75S-3 $460.00. Gonset GSB-100 $200.00, both 2 years old. Mint condition. WA4JAY, 207 Palm Ave., Auburndale, Florida.

WANTED—Used Allied T-150 Transmitter. Write W4HKM, Jacksonville 8, Florida.

FOR SALE HT-32 xmtr. $325.00. Like new SX 101 mark 111 receiver $200.00, will ship COD. Ken Formby, WA4NNL, Bamberg, S. C.

FOR SALE Heathkit 5-inch oscilloscope; Heathkit audio generator; Solar Exam'eter; will trade for a good general coverage or ham receiver. Write Keith Birdwell, Rural Route 1, Havana, Kansas.

POLY-COMM 6 & 2 meter Transceiver. Never used since factory alignment. Book and all accessories. Mint condition. Will pay ½ shipping charges. $275.00. B. A. Densmore, KØPUE, 808 5th Ave., Camanche, Iowa.

WANTED KE-93 (Pierson-Holt) Mobile Rcvr. Must be excellent, with schematic. D. R. Kelly, W7NXJ, P.O. Box N1016, US NAVSTA KWEST, FLORIDA.

CENTRAL 100-V in mint condx. First certified check for $350.00 gets it F.O.B. W2WRI, 23 New Street, Katonah, N. Y. 10536.

FREE catalog: Wholesale electronic parts and equipment. Hundreds of bargains. Western Components, Box 2581, El Cajon, California.

SELL SX-110 and Globe Chief 90 with SM-90 modulator and manuals for all three $120. Might sell separately. WA8HCS, 403 Lincoln, Chesaning, Michigan.

COLLINS 51J4 or 51J3 Wanted. State condition and price. Phone collect person-to-person. Mike Ercolino, W2BDS. Telephone: 201-775-7252.

FOR SALE New miniature coax relays, silver plated cavity, gold plated contacts, manufactured 1963. Minimum lead length 6 inches, most one foot. Leads RG-58 and RG-188/U (teflon). 150 watts RF to 470 MC. VSWR less than 1.25/1 Coil 9-15 VDC. Several hundred available $2.25 P.P. Also tubes for antique radios. Typical types 01A, 10, 12, 201A, and 227. Tubes unused in original boxes $1.25 P.P. each. Over 35 types available. Also 1.5 volt octals, and many loctals. Send SASE for list. Fred Clinger, WA8KJJ, 640 Grove Ave., Galion, Ohio 44833.

FOR SALE: Swan 240 and 110 volt power supply, $350. K3MHK, 338 Grandview Ave., Chambersburg, Pa., Phone 264-4547.

COLLINS 75S-1 (value $320); 32S-1 (value $449); 30 L-1 (value $375)—widow of "Hal" W4DWC will appreciate reasonable offer for above equipment. Also, best offer for RCA Oscilloscope WO33A; Heath Kit Q Multiplier Q7-1; Master Timer; Triplet Microampers, Silvervomax Model 900, Thermagalvanometer, Vibroplex key . . . Write, or call Mrs. Alberta L. White, 116 So. 14 Ave., East, Duluth, Minn. (218-724-1170).

APACHE—$210.00 SX-100 $260.00 TA-33 Jr. AR-22 Rotator $60.00 all in excellent condition. Deliver within 50 miles N.Y.C., P. Narins, 315½, Eddy Street, Ithaca, New York.

SELL—NC 183D clean, with Heath Q Multiplier and Knight Crystal Calibrator. $165.00. Ranger F/W with P.T.T. excellent $160 00. Both for $300.00. WB2AWL, 99 Brookwood Road, Clifton, New Jersey.

3-D QSL CARDS that have glittering Space-Age look with 3rd dimension standout, like putting your name in lights! Samples 25¢ (refundable) including CB and Ham personalized Christmas greetings. 3-D QSL Co., Monson 4, Mass.

QSLs $2.00 per 100 postpaid. New style glossy 2-colors. Free sample. Hobby Print Shop, Umatilla, Fla. 32784.

ELIMINATE Mobile Vibrator Noise. Revolutionary device outmodes noise-creating vibrator. Completely transistorized unit plugs directly into vibrator socket. No moving parts. Same size as vibrator. 12 Volts. Not a kit. Comes completely wired ready to use. **For negative ground only.** State make and model of transceiver. $11.95 PPD.-$5.00 deposit on all C.O.D. orders. Tel-Trol Systems, 2180 Bronx Park East, Bronx, N. Y.

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WØGFQ offers you hundreds of reconditioned equipment bargains. Write for Free Blue Book List. Galaxy 300 $229; Swan 140 $129; AF-67 $59; HT-37 $299; SX-101 $179; Valiant $199; Viking 500 $389; NC-125 $79; SP-600 $309, and many more. Ask for our new 1965 Catalogue. Write Leo, Box 919, Council Bluffs, Iowa.

QSLs. Large selection including photos, rainbows, cuts, etc. Fast Service. Samples, dime. Ray, K7HLR, Box 1176, Twin Falls, Idaho.

NCX-3 TRANSCEIVER used 5 months then factory-overhauled and modified with NCX-A and NCX-D power supplies. Also 20-meter Hustler mobile antenna, lavalier mike, cables and instruction books. Selling lot only. Will ship collect in original cartons on receipt of $400 cash or equivalent. Wm. A. Martin, 56 Riverlawn Drive, Fair Haven, N. J. 07702.

TO SELL for college expense TX-1; SB-10; Drake 2-B; each excellent. Make offer. Frank Nigh, K9CDF, Box 102, Palestine, Illinois.

SX-140 RECEIVER. New. $114. Trades considered. Also have other equipment. Belvidere, Box 1103, New Britain, Conn.

WANTED: DeForest receivers, transmitters, audion with screw base, "H" tube, Oscillion, Fleming valve, Boonton 160-A "Q" meter, W9EWK, 610 Monroe Ave., River Forest, Illinois 60305.

TRANSISTORIZED oscillator, telegraph key, and miniature speaker $2.25 with this advertisement only. Free catalog. Western Components, Box 2581, El Cajon, California.

MUST SELL—Invader Hi Power conversion kit, factory wired and tested with tubes. Box never opened. Selling because of hospital bill. Best Cash Offer. K4LWU, 601 North Adams St., Henderson, Kentucky.

FOR SALE SB-400 & SB-300 fabulous brand new Heathkits wired by a professional. Rec. has all opt. fltrs. must sell. $625.00 takes all. Write: F. Klein, RFD #1, Nashua, N. H.

RF COAXIAL CABLE. Extremely low loss air dielectric cable .5 Db at 144, .6 Db at 220, .9 Db at 440, Mc: per 100 feet. For additional information contact John Link, 542 Jupiter Rd., Indian River City, Florida AM72372.

WANTED—Modulation Transformer—500 watt type, Pri 3800 Ohm Ct; Sec 4500 to 7900 ohm Imp., 7000 V Test. Advise particulars. E. Hanson, 3127 S. 2800 E., Salt Lake City, Utah.

COLLINS 32V2, 120 watt 2 meter adaptor, 2 meter converter, 2 New 4-400A's, $325. Robert DuBois, RD #1, West Branch, N. Y.

NC-270 For Sale. Receiver is in excellent condition. $160.00 FOB Anderson. Roger Loftus, Rt. #1 Box 3120, Anderson, Calif.

POLAR RELAYS M.D.I. Serves 300-150 ohm coils, as shown in July issue of **CQ,** adjusted zero bias, as new, $4.50 each, two $8.00, three for $10.50, postpaid in U.S. Ken Spaulding, KIZXH, 15 Minivale Rd., Springdale, Conn.

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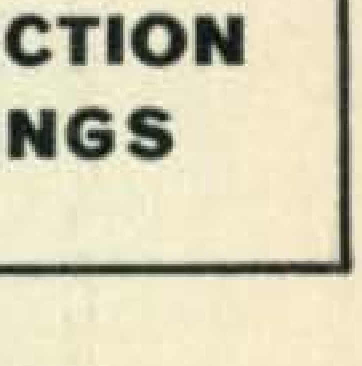

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Announcing an extraordinary achievement in amateur radio

THE NATIONAL HRO-500 RECEIVER

e National HRO-500 is the result of thirty years of mprovement of the breed". From the first HRO *nior* of 1933 to the present, the HRO series has en almost legendary. The HRO-500 continues this oud tradition, and incorporates important techno- gical advances resulting from National's leadership the field of solid state physics, frequency standard- tion, and frequency synthesis.

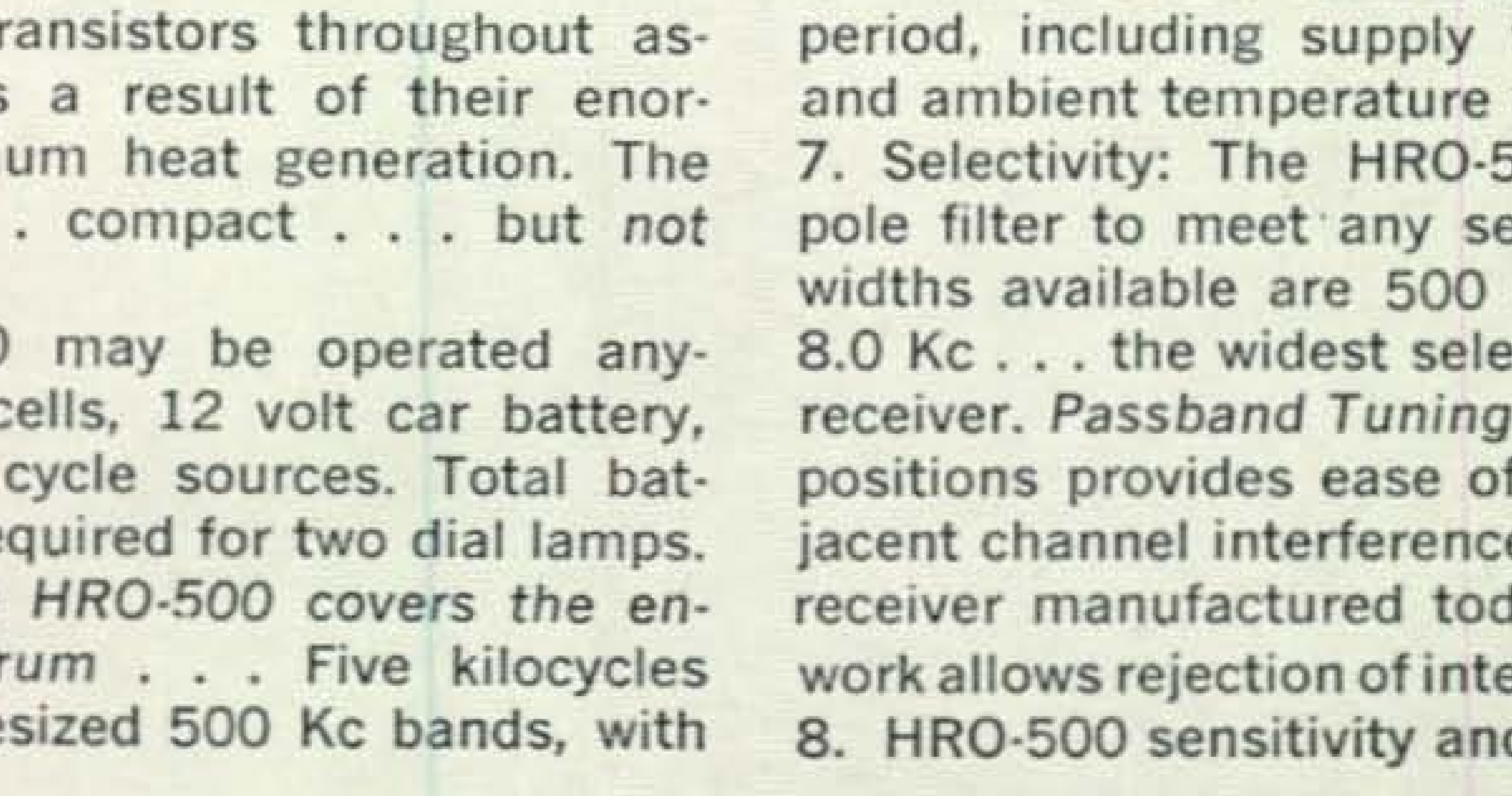
any criterion, the HRO-500 is extraordinary.

Design Concept: The HRO-500 is totally solid state. equency is determined by a phase-locked crystal nthesizer* feeding a VFO-controlled tunable IF. nilar circuit techniques are found only in advanced itary communications equipment.

Reliability: The use of transistors throughout as- res amazing reliability as a result of their enor- usly long life and minimum heat generation. The O-500 is hand-wired . . . compact . . . but *not* niaturized.

Versatility: The HRO-500 may be operated any- ere . . . from flashlight cells, 12 volt car battery, from 115V/230V 50/60 cycle sources. Total bat- y drain is less than that required for two dial lamps.

Frequency Coverage: *The HRO-500 covers the en- e VLF through HF spectrum* . . . Five kilocycles ough 30 Mc. in 60 synthesized 500 Kc bands, with ual stability and dial uracy throughout its ing range. No need confine operation to n bands only . . . the O-500 provides total erage of MARS, com- rcial, foreign broad- t, marine, VLF com- nications, test and perimental frequen- s. All required heter- ne frequencies are generated by the frequency synthesizer.



5. Dial Calibration and accuracy *over the entire tuning range* is one kilocycle, employing a linear VFO and National's famous PW epicyclic dial mechanism. 1 Kc divisions are $\frac{1}{4}''$ apart, allowing easy interpolation to 200 cycles or better. VFO tuning rate is identical on all bands.

6. Stability: The HRO-500 employs a 500 Kc reference crystal standard, output of which is synthesized and phase-locked to produce crystal-stable high frequency oscillator signals. The VFO is electronically regulated. The use of transistors throughout practically eliminates internal heat generation. Long term stability from turn-on is better than 100 cycles over any ten-minute period, including supply voltage variation of $\pm 10\%$ and ambient temperature variations of 30° C.

7. Selectivity: The HRO-500 employs a *tunable* six-pole filter to meet any selectivity requirement. Bandwidths available are 500 cycles, 2.5 Kc, 5.0 Kc, and 8.0 Kc . . . the widest selectivity range of any amateur receiver. *Passband Tuning* in the 500 cycle and 2.5 Kc positions provides ease of sideband selection and adjacent channel interference rejection found in no other receiver manufactured today. A *Rejection Tuning* network allows rejection of interfering heterodynes by 60 db.

8. HRO-500 sensitivity and noise figure is substantially superior to the previous standard of comparison, all earlier HRO models! Amateur net price will be approximately $1000.00, with delivery this fall. If your requirements demand the finest amateur receiver obtainable at *any* price, the National HRO-500 is your only choice.

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