January 1965
50¢

CQ

TWENTIETH ANNIVERSARY ISSUE

The Radio Amateur's Journal

When you're as proud of your products as we are, you select dealers you can be proud of, too.

(Here they are:)

ALABAMA
Birmingham — Ack Radio Supply Co
Huntsville — Electronic Wholesalers, Inc.
Mobile — Specialty Distributing Co.

ALASKA
Anchorage — Yukon Radio Supply, Inc.

ARIZONA
Phoenix — Southwest Electronic Devices
Tucson — Elliott Electronics, Inc.

ARKANSAS
De Witt — Moory's Wholesale Radio Co.

CALIFORNIA
Anaheim — Henry Radio, Inc.
Burbank — Electronic City, Inc.
Burlingame — Amrad Electronics
Los Angeles — Henry Radio, Inc.
Radio Product Sales, Inc.
Oakland — Elmar Electronics
Riverside — Mission Ham Supplies
San Diego — Western Radio & TV Supply Co.
San Francisco — Amrad Supply, Inc.
San Jose — Quement Industrial Electronics

COLORADO
Denver — Burstein-Applebee Co. of Colorado

CONNECTICUT
Hartford — Corky's Division, Hatry of Hartford

DISTRICT OF COLUMBIA
Washington — Electronic Wholesalers, Inc.

FLORIDA
Miami — Amateur Radio Center, Inc.
Electronic Wholesalers, Inc.
Orlando — Amateur Electronic Supply
Pensacola — Grice Electronics, Inc.
Tampa — Kinkade Radio Supply, Inc.

GEORGIA
Atlanta — Ack Radio Supply Co.
Southeastern Radio Parts Co.
Specialty Distributing Co., Inc.

HAWAII
Honolulu — Honolulu Electronics

ILLINOIS
Chicago — Amateur Electronic Supply
Newark Electronics Corporation
Peoria — Klaus Radio & Electric Co.

INDIANA
Indianapolis — Graham Electronics Supply, Inc.
South Bend — Radio Distributing Co., Inc.

IOWA
Council Bluffs — World Radio Laboratories, Inc.
Des Moines — Radio Trade Supply Co.

LOUISIANA
New Orleans — Crescent Electronic Supply, Inc.
Radio Parts, Inc.

MARYLAND
Wheaton — Uncle George's Radio Ham Shack Division

MASSACHUSETTS
Boston — DeMambro Radio Supply, Inc.
Reading — Graham Radio, Inc.

MICHIGAN
Ann Arbor — Purchase Radio Supply
Detroit — Radio Supply & Engineering
Kalamazoo — Warren Radio Co.
Muskegon — Electronic Distributors, Inc.

MINNESOTA
Minneapolis — Electronic Center, Inc.
Lew Bonn Co.

MISSOURI
Butler — Henry Radio Co.
Kansas City — Burstein-Applebee Co.
St. Louis — Walter Ashe Radio Co.

NEW HAMPSHIRE
Concord — Evans Radio

NEW JERSEY
Springfield — Federated Purchaser, Inc.

NEW YORK
Albany — Ft. Orange Radio Distributing Co.
Amsterdam — Adirondack Radio Supply
Huntington Station — Rite Electronics, Inc.
Jamaica, L. I. — Harrison Radio Corporation
New York — Harrison Radio Corporation
Harvey Radio, Inc.

NORTH CAROLINA
Asheville — Freck Radio & Supply Co., Inc.
Winston-Salem — Electronics Wholesalers, Inc.

OHIO
Cleveland — Pioneer Electronic Supply Co.
Columbus — Universal Service
Dayton — Custom Electronic, Inc.
Toledo — Selectronic Supplies, Inc.

OKLAHOMA
Tulsa — Radio, Inc.

OREGON
Portland — Portland Radio Supply Co.

PENNSYLVANIA
Philadelphia — Radio Electric Service Co. of Pa., Inc.
Pittsburgh — Cameradio Co.
Wyncote — "Ham" Buerger

SOUTH DAKOTA
Watertown — Burghardt Radio Supply

TENNESSEE
Memphis — W & W Distributing Co.
Nashville — Electra Distributing Co.

TEXAS
Abilene — Howard Radio
Corpus Christi — Electronic Equipment & Engineering Co.
Dallas — Amateur Electronics, Inc.
El Paso — McNicol, Inc.
Houston — Busacker Electronic Equipment Co., Inc.
Electronic Equipment & Engineering Co.
San Antonio — Radio & Television Parts Co.

UTAH
Salt Lake City — Manwill Supply Co.

WASHINGTON
Lynnwood — Cascade Electronic Supply
Seattle — C & G Electronics, Inc.
Spokane — HCJ Electronics
Tacoma — C & G Electronics Co.

WEST VIRGINIA
Charleston — Mountain Electronics

WISCONSIN
Fond du Lac — Harris Radio Corporation
Madison — Satterfield Electronics, Inc.
Milwaukee — Amateur Electronic Supply

COLLINS

Edging, Rounding and Pre-dimensioning Blanks.

Plating to Frequency, with Utmost Precision.

Base-plating is an Important Process.

Baking Crystals in Oven at Elevated Temperature.

Preferred by Amateurs for More Than Thirty Years

Since 1934, amateurs everywhere have been enthusiastic about the performance of PR Crystals . . . their activity, dependability, low drift, and hair-line accuracy. These qualities are built-in by precision workmanship at every stage of manufacture. There are scores of operations from the slicing of the raw quartz crystal to the final rigid inspection. Some of these operations are shown in the photographs at left. PR Crystals are made by highly skilled craftsmen, equipped with the finest precision machinery and electronic devices. Every PR is checked by frequency meters having an accuracy of better than one part in ten million. And EVERY PR CRYSTAL IS UNCONDITIONALLY GUARANTEED.

AMATEUR TYPES

FUNDAMENTAL, PR TYPE Z-2—Frequency Ranges in Kcs.: 1,750 to 2,000 (160M) 3,500 to 4,000 (80M); 7,000 to 7,425 (40M); 8,000 to 8,222 (2-M); 8,334 to 9,000 (6M) ± 500 Cycles. .....$2.95 Net

(All Z-2 Crystals calibrated with a load capacity of 32 mmfd.)

TYPE Z-6A — Frequency Standard, .050" pins, 100 Kc. . . .$6.95 Net

Third Overtone, PR Type Z-9A, 24,000 to 24,-666, 25,000 to 27,000 Kc. ± 3 Kc., 28,000 to 29,700 Kc. ± **5** Kc. . .$3.95 Net

6 Meters, Fifth Overtone, PR Type Z-9A, 50 to 54 Mc., ± 15 Kc. . $4.95 Net

Citizens Band, PR Type Z-9R
Calibrated .005% .....$2.95 Net
Calibrated .002% .....$3.95 Net

ORDER FROM YOUR JOBBER

PR Crystals

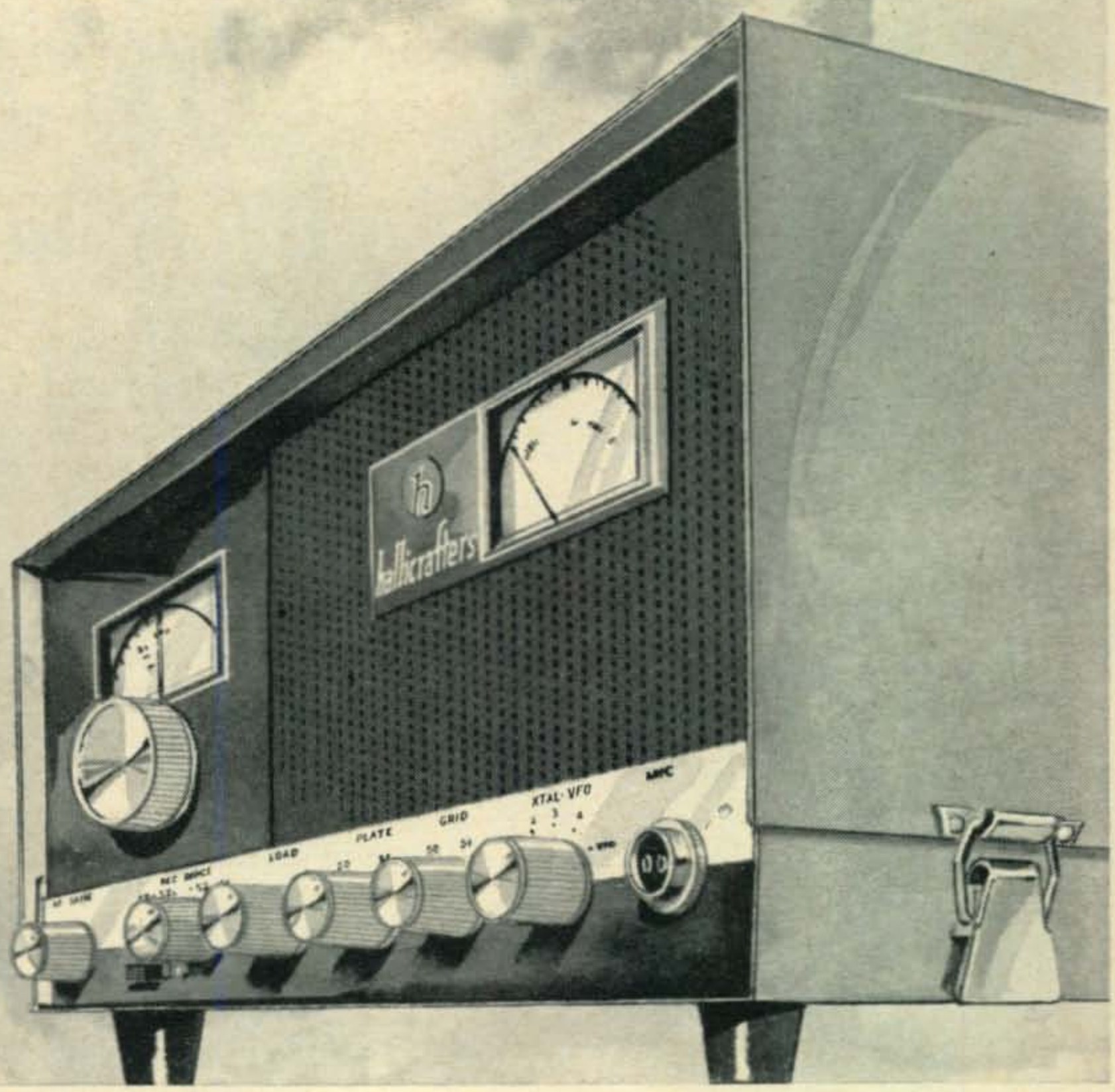
Since 1934

USE PR AND KNOW WHERE YOU ARE

PETERSEN RADIO COMPANY, INC.
2800 West Broadway, Council Bluffs, Iowa

For further information, check number 1, on page 110

Bye Bye Birdie



Efficient filters and selected injection frequencies make the NEW SR-46 and SR-42 VHF transceivers virtually immune to FM and TV interference.

Interference-free reception is only one of many advantages in the new SR-46. Complete six meter band coverage is another. Or full two meter coverage, if you prefer, in the companion SR-42 unit. Both give you double the usual bandspread, through use of dual tuning ranges. A neutralized nuvistor front end boosts sensitivity, and eleven tuned circuits increase selectivity while suppressing interference. Push to talk, of course.

Thorough field testing, before production, by hundreds of operators, assures you of years of trouble-free performance. It all adds up to your top VHF value. See the SR-46, or the SR-42, at your distributor today.

FEATURES

Frequency Coverage: 50 to 52 Mc and 52 to 54 Mc (144 to 146 Mc and 146 to 148 Mc in the SR-42). **Power Input:** 10-12 watts. **Power Supply:** 115 VAC and 12 VDC (vibrator and line cord optional extra). **Transmitter Crystals:** high frequency type; provision for four (one furnished), plus external VFO, switch-selected from front panel. **Tubes:** 10, plus zener diode oscillator control and four diodes (11 tubes, 2 zeners and four diodes in the SR-42). **"S" Meter** automatically switches to RFO. **Cabinet:** "snap-off" type for easy access. **Size:** 5½" high, 12⅛" wide, 8¼" deep. **Shipping Weight:** 17 lbs. **Amateur Net Price:** $189.95.

New **SR·46**

SIX METER VHF TRANSCEIVER
and SR-42 for two meters

"Quality through Craftsmanship"

hallicrafters

Export: Hallicrafters International Div. 5th & Kostner Aves., Chicago, Ill. 60624

For further information, check number 2, on page 110

JANUARY 1965 VOL. 21, No. 1

CQ The Radio Amateur's Journal

TABLE OF CONTENTS

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.

HOOK A TIGER TO YOUR TANK CIRCUIT

With NEW

"Tig-Array"

A familiar signal on the bands is that of Carl Mosley, WØFQY, better known, perhaps, as The Old Man Himself. Those of you who have worked Carl recently have been curious about The Mystery Antenna he has been using . . . . HERE IT IS . . . . THE ALL NEW MP-33 "Tig-Array" modified for operation on 40 meters. Every Mosley antenna is installed on this forty foot tower and extensively "On The Air" tested before the antenna is approved for production. Be sure your antenna is NOT JUST TESTED but MOSLEY QUALITY TESTED!

SPECIFICATION & PERFORMANCE DATA, BELOW, ARE FOR A BASIC MP-33 "TIG-ARRAY" ONLY.

- MAX. ELEMENT - 25 ft.
- BOOM LENGTH - 12 ft.
- WIND LOAD - 96 lbs.
- TURNING RADIUS - 15 ft.
- VSWR - 1.5/1 or better.
- FEED POINT - 50 ohm.
- FWD. GAIN - up to 8 db.
- FRONT to BACK - 20 db.

"Tig-Array", a direct descendant of the World Famous TA-33 Trap-Master and features top three band performance on 10, 15 and 20 meters, rugged Trap-Master construction and power rated to 750 watts AM and CW, 2000 watts P.E.P. on SSB (input to final amplifier).

"Tig-Array" utilizes the All Metal Enclosed Trap pioneered and developed by Mosley for the most dependable multi-band operation. Here is the perfect antenna for the radio amateur operating medium power.

MODEL MP-33

JUST $24.72

"TIG-ARRAY" BOOSTS POWER RATING OF TA-33Jr ANTENNAS

If you own one of the famous TA-33 Juniors . . HERE IS GOOD NEWS . . a version of "Tig-Array's" radiating element is available as a modification kit to . . BOOST THE POWER RATING TO EQUAL THAT OF NEW "TIG-ARRAY" yet will not effect the function of your TA-33Jr.

MODEL MPK-3

"TIG-ARRAY" IS EASILY MODIFIED FOR 40 METERS

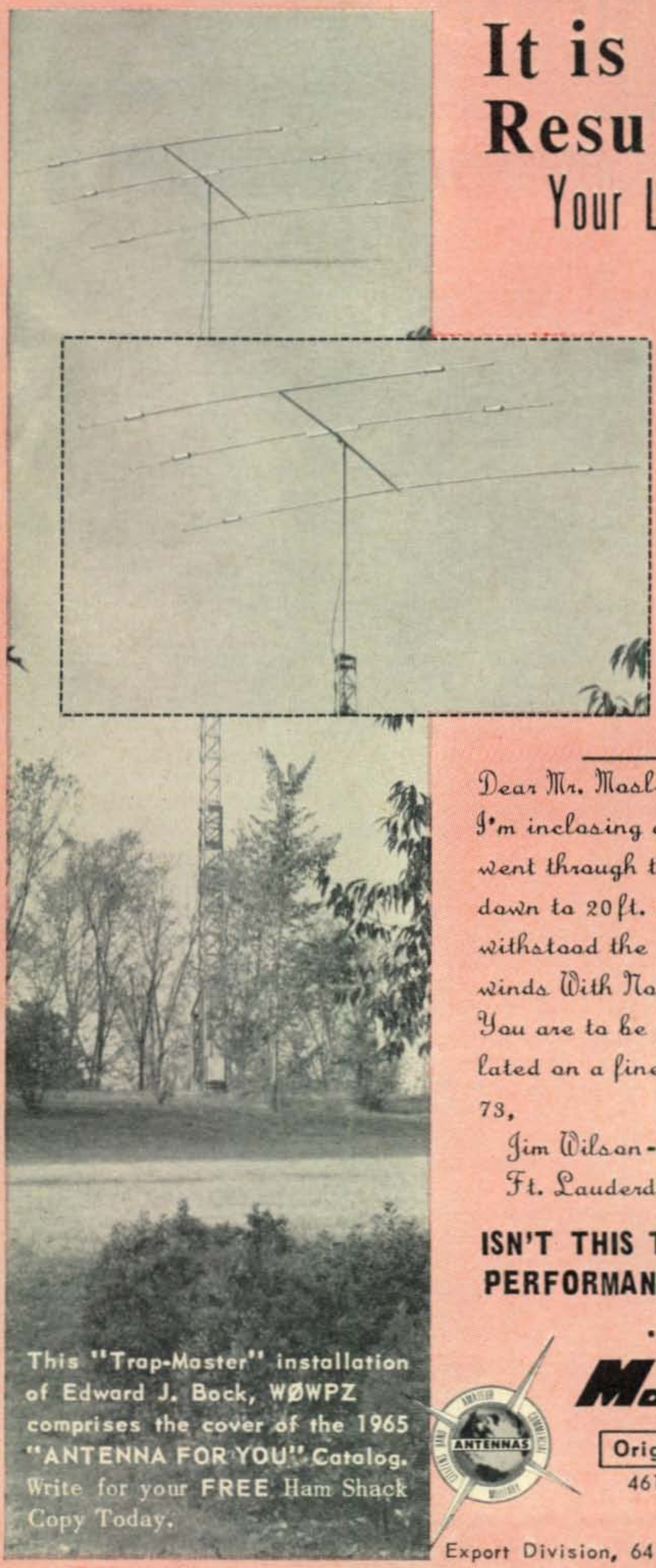
"Tig-Array" is easily modified for operation on 40 without effecting the operation of MP-33 on 10, 15 or 20. When installed, MOSLEY TA-40KR will enable "Tig-Array's" radiating element to operate as a rotatable dipole. Power rated to 1000 watts AM or CW and 2000 watts P.E.P. on SSB (input to final amplifier).

MODEL TA-40KR

Mosley *Electronics Inc.* 4610 NORTH LINDBERGH BLVD. – BRIDGETON, MISSOURI, 63044

For further information, check number 4, on page 110

IS THIS THE ANTENNA FOR YOU?



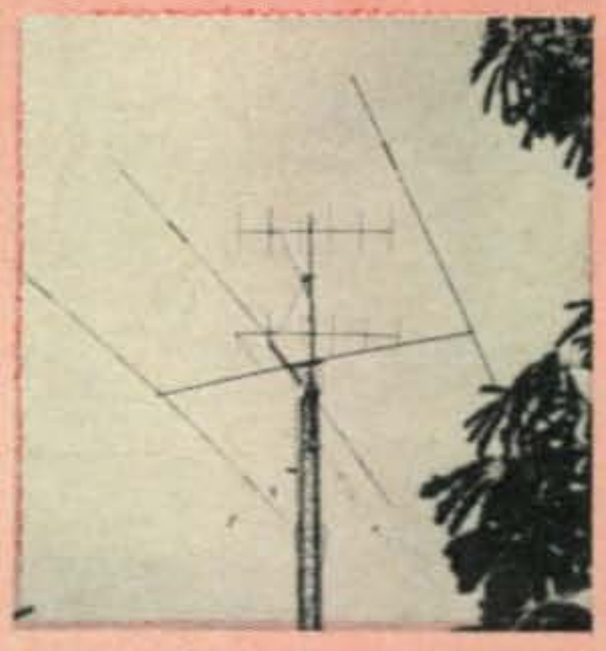
It is if you want Results!

Your Letters are PROOF.

Dear Sir:
I came on the air April 11, 1963 using the TA-33 Sr. beam. By Sept. 2, 1963 I had worked WAS, WAC and 53 countries including 5-8 from Saudi Arabia and 5-9 from Ethiopia. I am convinced the TA-33 is the reason for my success. Thank you for a wonderful beam.

Sincerely,
James A. Ogden - W9FFS
Caseyville, Ill.

Dear Mr. Mosley:
I'm inclosing a snapshot of a TA-33 Jr. which just went through the eye of Hurricane Cleo. Cranked down to 20 ft. the beam withstood the 120 m. p. h. winds With No Damage. You are to be congratulated on a fine product.



73,
Jim Wilson - WA4RXG
Ft. Lauderdale, Fla.

ISN'T THIS THE RUGGED CONSTRUCTION & PERFORMANCE YOU WANT FROM . . .
. . . "THE ANTENNA FOR YOU?"

Mosley Electronics Inc.

Originator of the All Metal Enclosed Traps

4610 N. Lindbergh Blvd. • Bridgeton, Mo. 63044

Export Division, 64-14 Woodside Ave., Woodside, N. Y., 11377

For further information, check number 5, on page 110

ZERO BIAS

THERE must be some strange magnetic quality about the amateur bands, for in addition to attracting some 280,000 licensed operators, they seem to attract the hungry eye of nearly every other radio service in existence. The latest in a long series of hungry "pecks" at the ham bands came in the November 1964 issue of *Popular Electronics*. It appears now that in the face of new and more stringent interpretations by FCC of the Citizens Band regulations, certain interests are once again looking longingly to the ham bands.

Specifically, it has been proposed that a portion of the amateur 2 meter band be given over to "code-free" operators. Why? To give a large group of gab-happy CB'ers a place to vent their desire to communicate! Why 2 meters? Because international regulations permit any country to waive code requirements on amateur bands above 144 mc. But, although it isn't spelled out, another major consideration is certainly the fact that with the impending sunspot cycle rise, the gibberish and nonsense (by a small, but noisy group) plaguing 11 meters is likely to be aired to an international audience, and two meters is less prone to international skip. Obviously the illicit rag-chewers now on 11 could then talk to their heart's content on a purely local basis.

Makes some sense—until you begin to realize that what *Popular Electronics* is advocating is a "sweeping under the rug" of a chaotic situation, rather than a firm solution to the problem of improper operation. And at whose expense? Yours!

There are those among us who will say "Fine, let's take them in and swell the amateur ranks." My friends, there is a great difference between increasing the number of legitimate amateurs, and bloating a scientific service with people whose sole concern is for telephone-type communications.

The average technical level of amateurs has decreased noticeably in the past ten to fifteen years. This very fact is a major force behind the current "Incentive Licensing" hassle. Can we, at this point, afford to push our technical level still lower by creating a "Junior" license? No, for it might well spell the end of amateur radio as we know it.

Popular Electronics states, (as partial justification for its proposal) that "The number of CB'ers that want to have a personal two-way radio system is enormous." Granted! But the number of people who would like to own a Cadillac is also enormous. What are we to do—open the radio spectrum (an admittedly valuable commodity) to every Walter Mitty who imagines himself to be Broderick Crawford of the "Highway Patrol?"

The author of the proposal, Oliver P. Ferrell, (a former editor of *CQ*, though not a ham), continues, "The flood of applications for CB licenses during these few short years [six] would seem to indicate that the Amateur Radio Service (as presently constituted) does not suit the needs of a special group of private citizens applying for CB licenses." It was never intended to! Amateur radio, *in the international definition* is a purely scientific hobby engaged in by an individual solely for the purpose of broadening his knowledge and skill in the art of radio communications. Personal two-way radio for the purpose of passing the time of day is *not* legally "within the province of amateur radio."

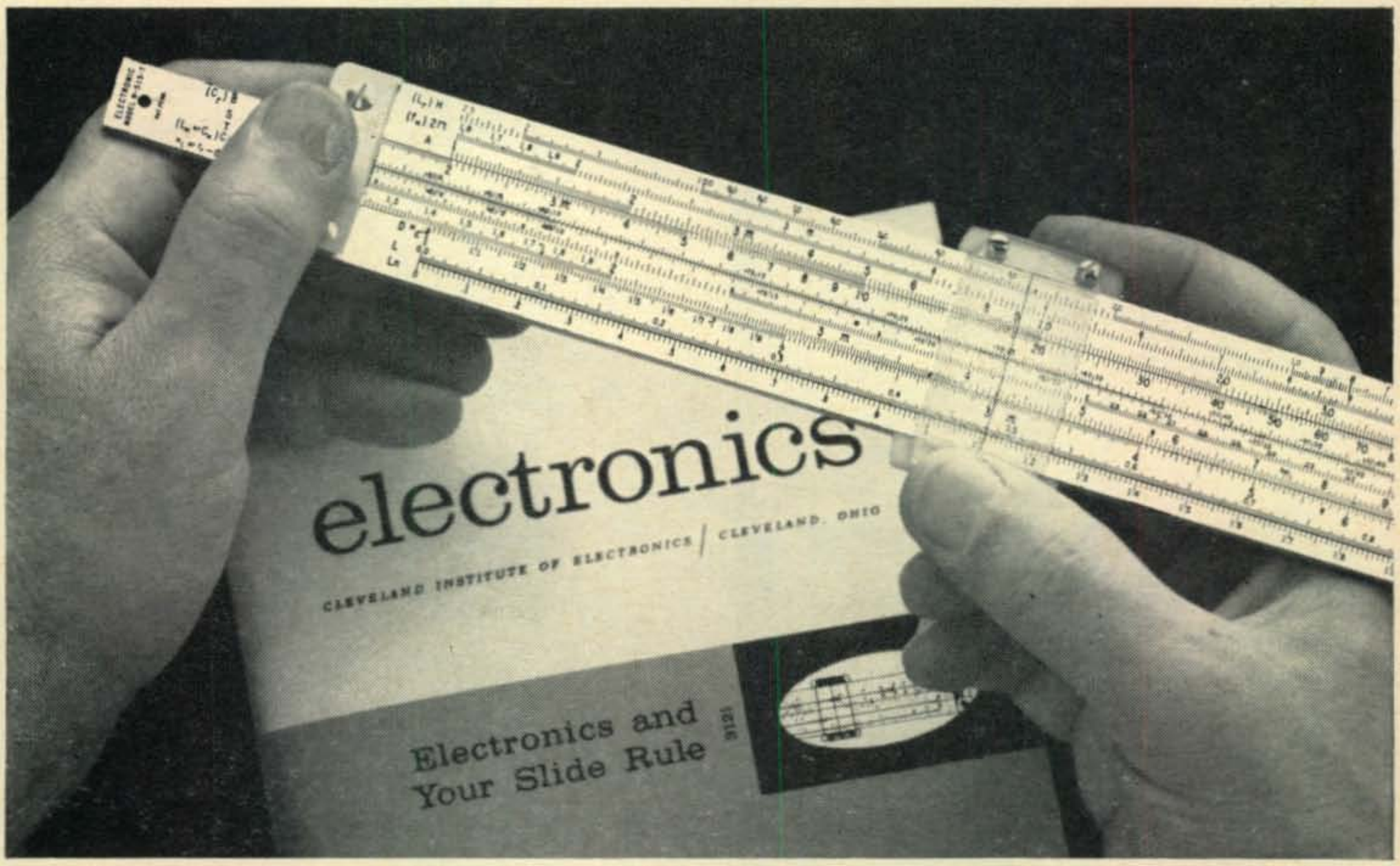
But rooted somewhere in the proposal is an idea that might prove enormously beneficial to amateur radio and at the same time alleviate crowded conditions on the Citizens Band. It is common knowledge that many electronics technicians, engineers and other technically-oriented fellows would like nothing better than to be able to experiment with new and better systems of communications (amateur style), but cannot because of their inability to master the code. It is also common knowledge that many of these same individuals have found their way to the Citizens Band for the same reason. Would it not be to our advantage (and theirs) to welcome them to the ranks of amateur radio?

But how are we to differentiate between the technician/engineer and the CB'er that even the CB'ers don't want? Perhaps an exam equivalent to the present Amateur Extra exam would do the trick. It would certainly prevent the license's corruption into another CB-type service. And while we're making proposals, consider fellows now holding their First Class Radiotelephone licenses who would like to experiment too—another potential asset to amateur radio.

Where to put them? We suggest 420 mc and up—an area where *real* technical skill is an absolute necessity for successful communications.

What are *your* thoughts?

73, Dick, K2MGA



Tune In On This New Electronics Slide Rule With Self-Training Course

Once you've seen CIE's Electronics Slide Rule, you'll know why hams across the country call it the most useful, practical tool they've come across in years. It's perfect for adjusting your rig . . . for designing test circuits . . . for figuring coil windings, db's, operating frequencies, resistor sizes and power ratings, proper inductor and capacitor sizes . . . for accurately matching antenna to final.

You'll be amazed how fast and easy it is to learn to use this terrific NEW slide rule. It comes complete with a fully illustrated AUTO-PROGRAMMED Instruction Course. You will receive four lessons and be entitled to the services of CIE's expert instructors for answering any questions. In no time at all, you'll be using special scales to solve complex problems dealing with reactance, resonance, AC and DC circuitry, etc. And, as an added bonus, you can use this rule for conventional computation, too.

The CIE Electronics Slide Rule is no toy, no gadget. It is an all-metal, 10″ precision measuring instrument that's made to our rigid specifications by one of the country's leading slide rule manufacturers. Slide Rule, Self-Training Course *and* handsome top-grain leather carrying case . . . all yours for just $14.95. Cleveland Institute of Electronics, 1776 E. 17th St., Department CQ-103, Cleveland, Ohio 44114.

SATISFACTION Warranty

The Electronics Slide Rule with Self-Training Course is available only from Cleveland Institute of Electronics, and is covered by CIE's exclusive "Satisfaction Warranty." Order it now . . . use it for ten full days. Then, *if you're not completely satisfied*, you may return the Slide Rule with Self-Training Course and CIE will refund full payment.

SEND COUPON TODAY

to: Cleveland Institute of Electronics

1776 East 17th St., Dept. CQ-103, Cleveland, Ohio 44114

☐ Please send me your Electronics Slide Rule with Self-Training Course and top-grain leather carrying case. I am enclosing $14.95. (If not fully satisfied after 10-day trial, CIE will refund payment.)

☐ Please send descriptive brochure only.

Name_____
(Please Print)

Address_____

City_____ State_____ Zip_____

A leader in electronics training . . . since 1934

Outside Looking In

Editor, *CQ:*

Although I am not a licensed amateur, I am in the process of preparing to take my exam by studying into the wee hours of the morning.

There are thousands of other people across our great country who are reading *CQ*, who are not amateurs but who are either: 1. Contemplating beginning to become one or 2. Who are genuinely interested in radio, but do not desire to be amateurs. These people in category 2 are a treasurehouse of support for the amateur either in parts-assistance, etc., or in public and spirited support. I myself have read *CQ* for three years. When I got my first spark of interest in amateur radio, I don't know, but I do know that *CQ* had a great deal to do with it.

I have just read the November '64 edition and am distressed about the amount of apparent bickering that goes on by the hams about petty matters. I believe Mr. Alfred G. Smith, WA2TAQ/WB2FNW, hit the problem right on the head, when he said in the letter he wrote to you about the fellow in New York erecting illegal antennas, "This is an adult hobby and all should approach these situations in a sensible frame of mind."

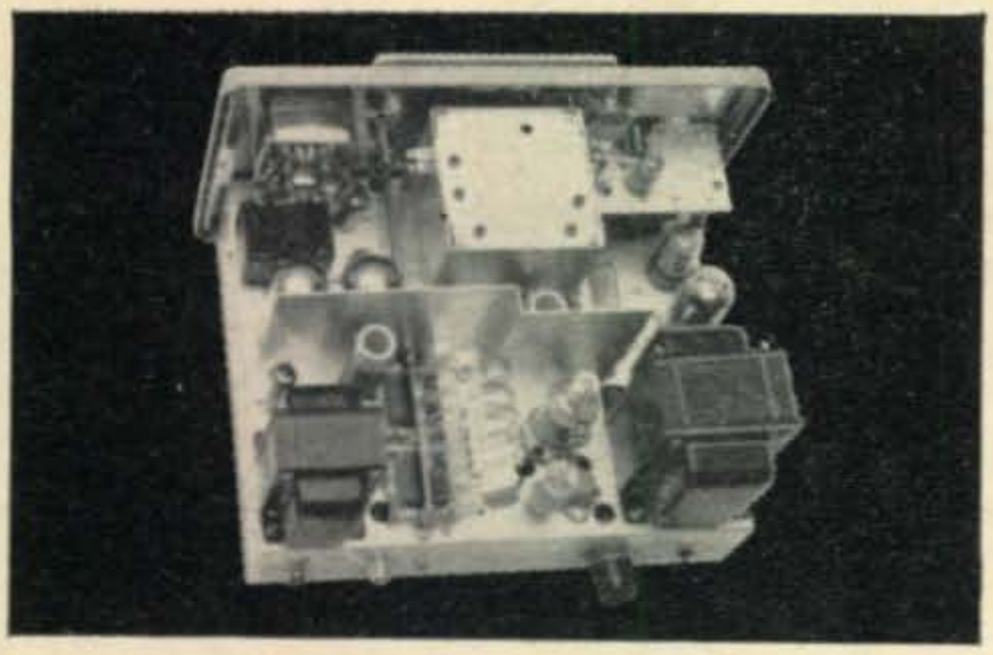
I believe that it is high time that the amateurs of the country either get that sensible frame of mind which Mr. Smith spoke of, or get a hold of those who don't have it and see to it that they do. More than one good venture has been ruined by a few sour, or rotten (as the case may be) apples. The amateurs are generally known for their observance of regulations, their courtesy and assistance in emergencies, and their *self-regulation!* There are organizations in the world, and indeed in this country, who would like nothing better than to infiltrate and undermine the amateur radio operators, not to speak of getting unduly restricting laws passed prohibiting their activities as much as possible. Let's get together, clean these sour apples out (or rehabilitate them) and pull together for a greater and better amateur world and our country.

I don't mean to be hypercritical of amateurs, but want to point out that many thousands of people read *CQ* every month who are not amateurs. They form opinions from what they read and people's opinions govern their actions to some degree in their decisions.

I would also like some amateur for a pen-pal while I am getting started to help me out over the rough places and to correspond with even after the rough spots are passed. Could I obtain a single name from the rolls of the thousands of amateurs in this country?

Thomas B. W. Nation
9576 Vicksburg Drive
El Paso, Texas 79924

For further information, check number 8, on page 110



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**
Cat. No. 240-162-2..."Ranger II" Wired **Net $359.50**

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

COMPLETE CATALOG
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.

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

For further information, check number 19, on page 110

50 Mc Propagation Effects

Editor, *CQ:*

I would like to express my sincere thanks to Morgan and Dorothy Monroe, K7ALE and K7ALF for the wonderful and most interesting article about their studies concerning 50 Mc Propagation Effects. I'd also like to thank *CQ* magazine for having published it.

Keep up the good work, I am with you all the way.

Sergio Perez, KP4BPJ
Box 939
Hato Rey, Puerto Rico

Attention '61 Cadillac Owners

Editor, *CQ:*

Interesting news for owners of '61 Cadillacs who are mobile. One evening while tuning my 100 watt mobile rig on 10 meters, I was amazed to see both amber directional signals located on top of the fenders glowing to almost full brilliance. This does not happen at the lower frequencies so it appears that the wiring for these lights are resonant at 28 mc. Serves as a handy tuning device while vehicle is in motion. I'm sure this is a "hidden option" the manufacturer had never considered.

Roy Durso, W2KTG
362 Jerusalem Avenue
Hempstead, L.I., N.Y.

An Old Friend Returns

Editor, *CQ:*

Please include my name among those in favor of your present attitude towards the ARRL.

As a League member, I realize that to keep the organization healthy, opinions, whether pro or con, must be voiced by amateurs in general. However, it is an apparent desire to weaken, rather than to strengthen the League, regardless of what differences of opinion there may be between the ARRL and amateurs, it is still the only organization which is truly attempting to further the amateur service, and it is the responsibility of each amateur to support it as best he can.

In 1961, as a result of the attitude of *CQ* towards the League, I allowed my subscription to expire. Last month, after nearly four years, I purchased a copy of the magazine, and was amazed at the change I found in the editorial policy. It is now apparent that *CQ* will carry out the job it must do; that is to support the League, yet be quick to voice a difference of opinion when it appears to be in the best interests of the League and its members to do so.

As a result of this, I have again entered a subscription to *CQ*, and look forward to having an old friend in the shack again.

Bruce F. Cushman, WØIXH
2541 Chimayo Drive
Security, Colorado

For The Benefit of Traffic Men

Editor, *CQ:*

In the matter of operating techniques, it would be of considerable assistance if W/K stations calling CQ would include their QTH (if a rather large city) or their general area, *e.g.*, "Northeast Florida" or even just "Florida." Many of us scan the bands, looking for a particular area to pass along traffic. It is quite time-consuming for us to listen through a "CQ, CQ, CQ, this is K4 - - -" and try to find the location in the *Call Book* (if it is in the *Call Book*) or listen through the ensuing QSO to possibly learn the exact QTH and try to break in if it is the desired location or spend more time in QSO with the station before gracefully bowing out to seek the desired QTH.

We suggest also that stations call CQ (or our station) only about 3 to 6 times and then say their call sign and QTH a similar number of times—this series could be repeated once or twice perhaps. We have noticed, occasionally, that a station calls CQ (or our call sign) 25 or 30 or more times before saying their call sign, and then they say their call sign only about two or three times. By that time, the QRM has built up so much that their call sign is lost in the QRM. We are curious to know which station is calling so diligently and would be better able to reply if we could hear their call sign at frequent intervals during their call.

Gloria M. Spears, KZ5GS
Operator of KZ5JW
Box 522
Balboa, Canal Zone

NOW

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

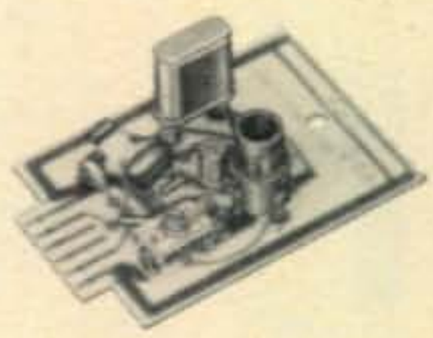
- Portable Signal Standards
- Signal Generators For Receiver Alignment
- Band Edge Markers
- Frequency Markers For Oscilloscopes
- Quick-Change Plug-In Oscillators
- Accessory Cases

HIGH FREQUENCY (20 mc — 160 mc)

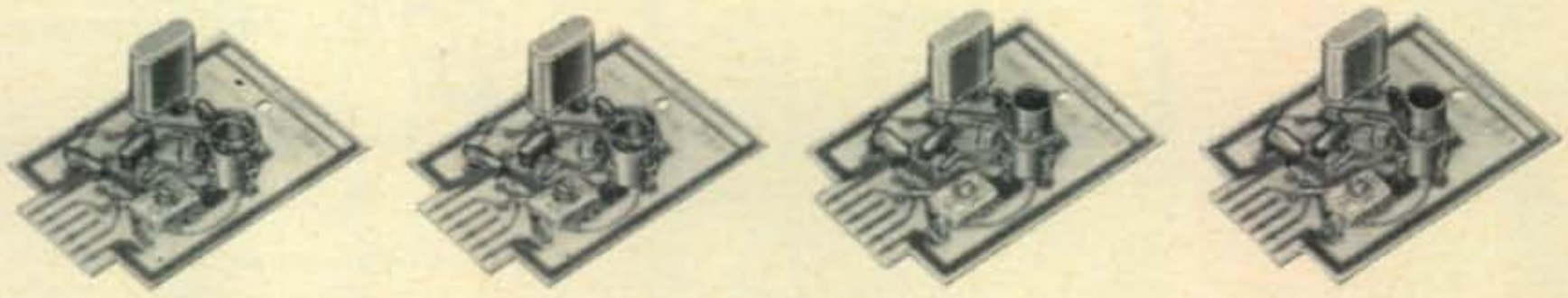
Five transistor oscillators covering 20 mc - 160 mc. Standard 77°F calibration tolerance ±.0025%. The frequency tolerance is ±.0035%. Oscillator output is .2 volts (min) across 51 ohms. Power requirement: 9 vdc @ 10 ma. max.

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	125-160 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.

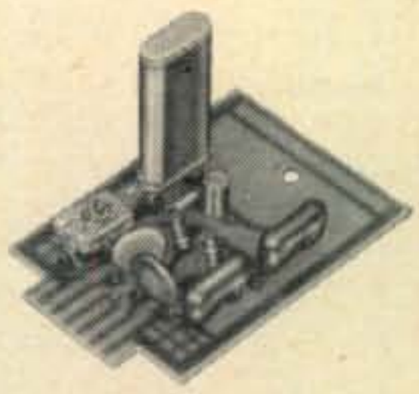


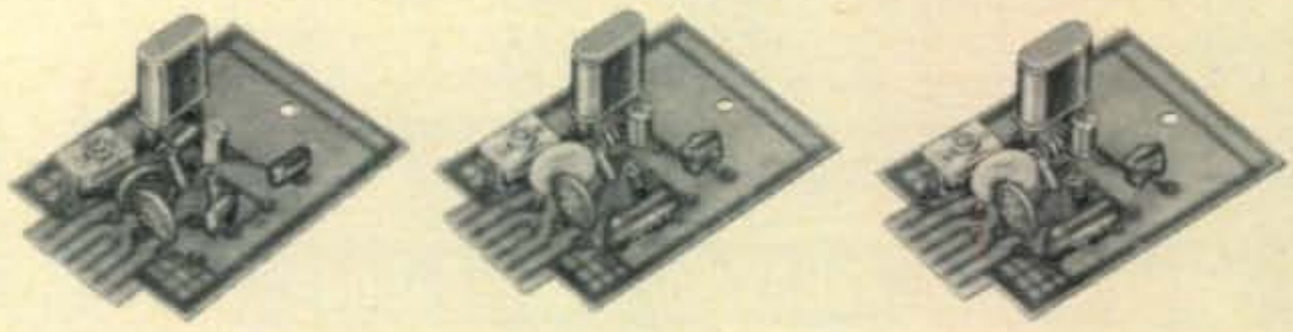
LOW FREQUENCY (70 kc — 20,000 kc)

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. —48°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.

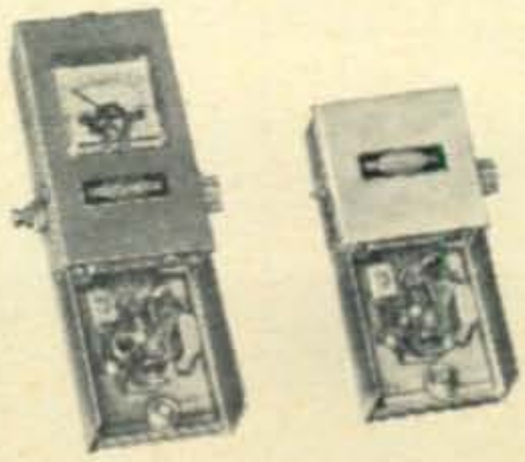
18 NORTH LEE OKLAHOMA CITY, OKLA.

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 11, on page 110

Economy Power Supply

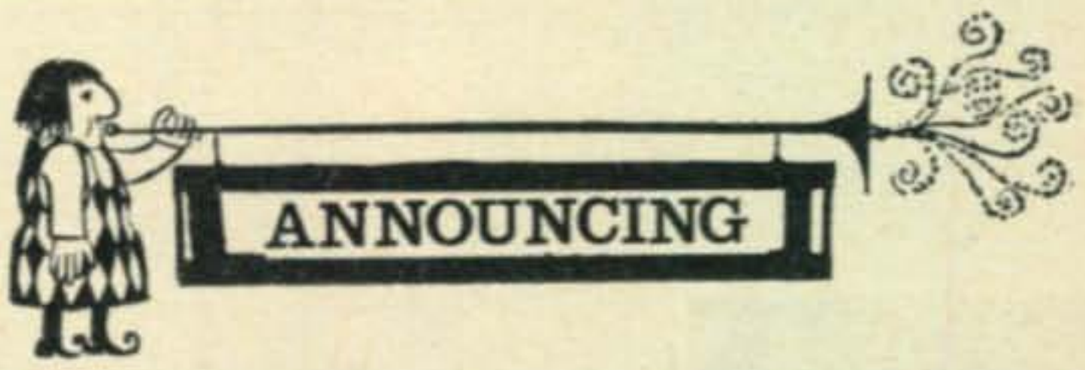
Editor, *CQ:*

In case anyone builds the "Economy Power Supply" described by W3BEF in November CQ, page 61, I'd like to point out that the HV switch shown won't work the way you might expect.

This circuit is a well-known arrangement using a bridge rectifier to deliver 600 volts, with 300 volts taken from the transformer center tap. It uses a 5U4 for half of the bridge. The other half is two strings of slicons with their anodes returned to ground through a switch.

At first glance it seems that this switch should control both the B-plus lines. What really happens is this: The silicons are taken out of action by the switch. What is left is the 5U4 in a full-wave center-tap circuit supplying 300 volts, its positive terminal to the h.v. line, negative to the l.v. line. The LV electrolytic is thus reverse

[*Continued on page 96*]



Paterson, New Jersey

The 7th annual dinner and hamfest sponsored by the East Coast VHF Society will be held at the "Swiss Chalet," Route 17, Ramsey, New Jersey, at 7 P.M., Saturday, February 27. Tickets cost $6.00 per person. Write to East Coast VHF Society, P.O. Box 1263, Paterson, N.J. for tickets and more information.

Corrections

On page 134 of the November issue, the QSL Manager for KZ5MQ is listed as DZ5MQ. This should be KZ5MQ not DZ5MQ.

The unlisted resistor in the B+ line of the "No-Clobber Converter for 6 Meters" article (Dec. '64) is 10K ½ watt.

Rockaway, New York

The first annual awards contest of the Rockaway ARC (Rockaway Beach, N.Y.) will take place Sunday, January 10, 1965, on two meters. The object is for those in the Hudson Division to work ten members of the club and for those outside the Division to work five members. The contest will run from 1800 to 2300 GMT. Submit GCR list to contest chairman: Ken Ribet, WA2OOL at 267 Beach 141st Street, Rockaway Park, N.Y. 11694. He will issue a contest certificate.

Washington, D.C.

The FCC has changed the examination point for the west central portion of Texas. As of Nov. 12, 1964 the examination point will be at Lubbock, Texas (semi-annually) instead of the annual examination point in Amarillo, Texas. Also mentioned in the FCC release is that El Paso, Texas will be changed to a Semi-annual examination point instead of annual point.

Geneva, Switzerland

Due to a continued demand, the International Amateur Radio Club is offering a reprint of the 1963 *4U1ITU Calling* for 50¢. The 1964 edition is available for $1.00. The 1965 edition of *4U1ITU Calling* can be had with IARC Membership (including certificate and membership lapel pin) for $5.00. Write to: The Secretary, International Amateur Radio Club, Geneva 20, Switzerland for membership and further information.

Curacao Certificate

A special award is being offered by VERONA in commemoration of the 10th Anniversary of its new stature in the Kingdom of the Netherlands on Dec. 15, 1954. The Award is issued for working at least five PJ2C or PJ3C stations between Dec. 15, 1964 and Jan. 15, 1965. Send log data—no QSL's—to: VERONA, P.O. Box 383, Willenstad, Curacao, Netherlands Antilles, before March 1, 1965 with $1.00 or 10 IRC's.

a KW ssb station

only 64½ cents per watt

The brilliant new **SB-34,** SSB 4-band transceiver serves as your receiver and exciter . . . the new matching **SB2-LA** Linear furnishes the big bang! This advanced design power combo costs you only 664.50, unquestionably the lowest cost per watt obtainable! But this is only part of the value story. **SB-34** has a **built-in power supply,** 117V AC **and 12V DC** . . . needs no separate inverter . . . connects directly to the 12V car battery when you want the added pleasure of 4-band mobile transceiver operation. **There's just no comparable value!**

SB2-LA LINEAR AMPLIFIER . . 249.50

Husky, heavy-duty, with 1KW p.e.p. input capability on 80-40-20 meters, 750 watts on 15 meters, this exceptionally compact amplifier matches SB-34 in general size and appearance. Designed to operate with SB-34, it will also boost the output of **any** SSB exciter to a full KW. All-solid-state 117V AC power supply is built-in. Heavy gage steel cabinet is finished in dull black. Panel is black with satin aluminum trim. Black knobs have nickel inserts.

- 4-bands, 80-40-20-15. Pi network. Band switching.
- Passive grid input for resistive load to exciter. Drive: 60W or more depending upon the linear amplifier power output.
- Low plate voltage (800V)/high plate current. Easier on capacitors, rectifiers, power transformers. Safer under environmental extremes.
- High filter capacity for dynamic regulation.
- Built in antenna relays (2). Int. blocking bias.
- HI/LO power and TUNE/OPERATE switches. Panel meters for output and plate current.
- Uses six, parallel-connected 6JE6's.
- Size: 5¼"H, 11¾"W, 11⅝"D. 35# approx.

SB-34 TRANSCEIVER 395.00

Sparklingly new . . . **SB-34** retains all the well-proved, bi-lateral and other circuit advances of SB-33, adds important new plus-performance features. As in SB-33, transistors and diodes replace vacuum tubes (except for the 2—6GB5's in PA and 12DQ7 in driver) greatly reduce size of the equipment and lower the current drain. When transmitter filaments are switched off for casual listening **SB-34 draws only 500 ma on receive standby.**

- Built-in supply, 117V AC **and** 12V DC. Just use proper power cord. (Provided).
- No relays . . . solid-state switching. **Breakthrough!**
- Delta receiver tuning, ± transmitter frequency.
- Solid-state dial correcter . . . uses Varactor.
- Extended frequency coverage—MARS—DX bands.
- Single-knob, dual speed tuning.
- USB or LSB selectable by panel switch.
- Collins mechanical filter—transmit/receive.
- Pre-wired for VOX/100kc calibrator accessories.
- Size: 5"H, 11¼"W, 10"D. 20# approx.

Please send information on SB2-LA and SB-34.

Name _____

Address _____

City _____ State _____

SIDEBAND ENGINEERS

SBE

317 Roebling Road, South San Francisco, Calif.

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

RAYTHEON

For further information, check number 13, on page 110

The Amateur Radio

Club Forum

AL SMITH,* WA2TAQ

AMATEUR radio clubs are assuming an important place in the amateur radio fraternity. TVI committees, public service activities, class programs, hamfests, auctions and the like have made the amateur radio club a hub of activity for amateurs in many communities. With more than fifteen hundred clubs in the United States and Canada alone, and more sprouting each day, it is apparent that the amateur radio club has arrived.

In its quest to keep abreast of things current in amateur radio, *CQ* has recognized this great growth and as a service to its readers, has instituted this new department. We have been assigned the task of seeking out club problems, and offering solutions. Both the problems and the solutions lie with you, the reader.

This column hopes to assist both the old, the new, and the yet-to-be-formed amateur radio club. By airing ideas of mutual interest we hope to benefit them all. We invite suggestions from the vast experience of club officers, and at the same time we sincerely hope these fellows will help with answers to questions that arise through this column.

What is your club doing that is new and different? Perhaps it is something that will benefit some other club that may be fighting off that dying gasp.

What are the objectives of your club? Any organization must have a goal—to reach for something to keep the members interest and to keep meetings from merely being eyeball ragchews.

A good example of club objectives is the "Ten Point Program" of the Rockaway ARC (Rockaway Beach, New York). This ambitious undertaking has provided the fuel needed to make this club one of the more active in the New York area. Some or all of these ten points may be just the ticket for your group:

1. To achieve 100% ARRL membership.
2. To initiate an instruction program to upgrade all classes of licenses; extra class to be goal of all members.
3. To supplement the instruction program by holding on-the-air discussions on ten and two meters.
4. To assist newer amateurs by offering, in a friendly manner, proper operating suggestions on the air.
5. To re-establish the club emergency net.
6. To promote the use of ten meters, and to promote the use of ten, two and six meters for local contacts.
7. To use, whenever possible, only the power necessary to carry on a contact.
8. To work together with nearby amateurs when overloading of receivers is a problem.
9. To stimulate more activity and interest in the club.
10. To accept into membership only those who will work for and with the club.

So, we're off and running. Just how far we'll run depends on you, so drop us a line and let us know what you think of the Forum and what you think we can add to it. 73, Al, WA2TAQ

*504 Beach 43rd St., Far Rockaway, N. Y. 11691.

POWERFUL BIG NEWS

NEW!...2 METER–6 METER RF POWER AMPLIFIERS

More power in the VHF band!... and there is *plenty* of it in the new Gonset 2 and 6 Meter RF Power Amplifiers. Model 903A (2 meter) and Model 913A (6 meter) has a power input of 500 watt in all modes of operation. A 4X150A is used in the final, and the equipment is rated for CCAS* service. Only 5 watts is required to drive the 903A and 913A to full rated output. Output impedance is 50 ohms nominal with an input impedance of 50 to 75 ohms. The all solid state power supply is self-contained within the amplifier chassis. All stages are metered and all controls are on the front panel for ease of operation. The new linear amplifiers may be used with any of the famous Gonset Communicator series, as well as being ideally compatible for the new Gonset Sidewinder series.

Amateur Net Price $295.00

**Continuous Commercial and Amateur Service.*

NEW!...GONSET SIDEWINDER 6 METER SSB-AM-CW TRANSCEIVER

The new Gonset Model 910A *Sidewinder* offers coverage of the entire 6 meter band in 1 mc segments. Like its mate—the Model 900A 2 meter *Sidewinder*—this ultra-compact transceiver features all-transistor receiver and power supply and partially transistorized transmitter (except mixer, driver, and final stages). Designed for mobile or fixed communications, the unit operates with separate AC (shown above) or DC power supplies.

...COMES IN POWERFUL LITTLE PACKAGES from GONSET

SIDEWINDER SPECIFICATIONS:

TRANSMITTER:	
Power Input:	20 watts PEP (SSB) 6 watts AM 20 Watts CW
Spurious Suppression:	—40 db
Carrier Suppression:	—50 db on SSB
Unwanted Sideband Suppression: VFO or Crystal Control	—40 db
RECEIVER:	
Frequency Stability:	Highly stable incremental tuning utilizes same VFO as transmitter
Sensitivity:	½ μv or better for 10 db $\frac{S+N}{N}$
Selectivity:	Lattice crystal filter for both receiver and transmitter
Spurious Rejection:	—50 db or better
Image Rejection:	—50 db (both receiver and transmitter utilize double conversion)
AMATEUR NET:	$399.50
AC Power Supply	$ 67.75
DC Power Supply	$ 79.50

ANOTHER NEWSWORTHY NOTE: *the Gonset GSB-201 Linear Amplifier was recently increased from 1500 to 2000 watts PEP (SSB). For those who operate on 10 to 80 meters—the GSB-201 is a natural companion for any of today's exciters.*

WOULD YOU LIKE TO BE PLACED ON OUR NEW PRODUCT MAILING LIST?

We'll send you complete information on the products above and keep you informed of new Gonset developments from time to time. Merely write Dept. **CQ-1.**

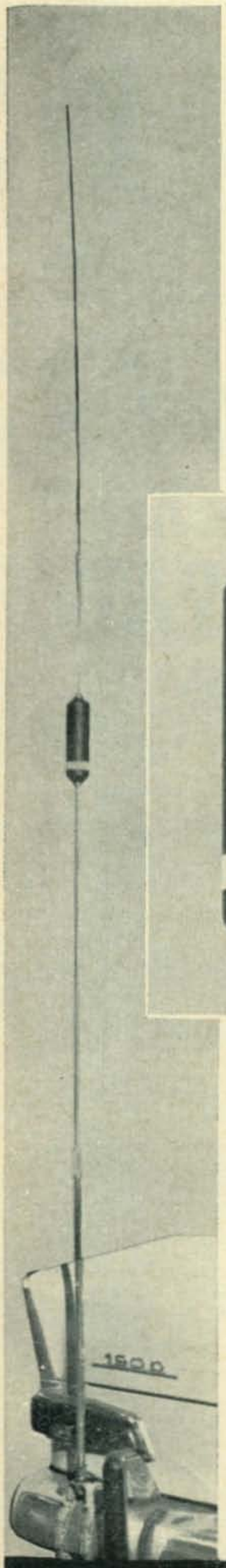
GONSET, INC.

ALTEC LANSING CORPORATION

LTV A Subsidiary of Ling-Temco-Vought, Inc.

1515 SOUTH MANCHESTER AVENUE, ANAHEIM, CALIF.

For further information, check number 15, on page 110



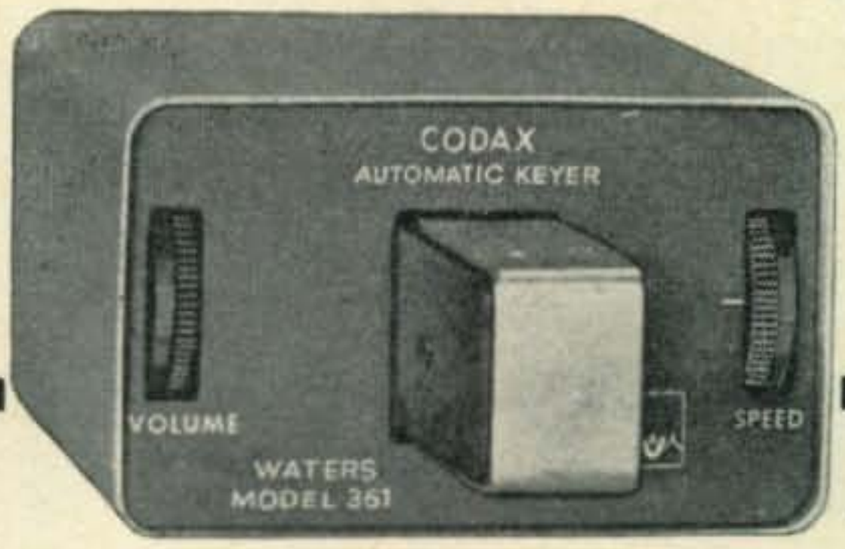
Here's *Waters* NEW AUTO-MATCH!

4db Stronger Mobile Antenna

The new Waters AUTO-MATCH—engineered to endure! Operates with only a coil change on every ham band with maximum radiation efficiency improving signal strength up to 4 db's! Top-Center loading coils are interchangeable and are molded in low-loss, waterproof Epoxy . . . Tapered radiator tip is stainless steel and adjusts to all frequencies . . . High Q stable inductance handles 500 watts of RF and at resonance presents an "Auto-Match" of 50 ohms . . . The lower mast is of aircraft aluminum tubing . . . upper mast of solid tapered-drawn aluminum rod. Built-in foldover drops AUTO-MATCH to car-top level. And AUTO-MATCH fits any standard base or bumper mount. Built to last for car after car and rig after rig you'll enjoy years of efficient mobile operation with AUTO-MATCH. At your distributor now.

PRICES

Mast 370-1	$12.95	Coil 370-20	$13.45
Radiator Tip 370-2	$ 9.95	Coil 370-15	$12.75
Coil 370-75	$15.95	Coil 370-11	$11.95
Coil 370-40	$14.95	Coil 370-10	$11.95



NEW!

Waters CODAX™ Automatic Keyer

CODAX—new rhythm-smooth automatic keyer by Waters—never anything like it! Feather-touch double paddle adjusts on each paddle for preferred gap and tension with spacing and timing from 5 to 50 WPM fully automatic. Self-powered, CODAX simply plugs into mike jack to work USB, LSB or AM. Circuitry is solid state digital with hermetically sealed "Reed" relay. Own signal can be monitored as well as station being worked. CODAX brings new adventure to CW. At your distributor now.

Model 361 ..... $92.50

WATERS
MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

For further information, check number 16, on page 110

For further information, check number 53, on page 110

Special!
DESK SET OFFER

plus

A three year subscription (new or renewal) to CQ, The Radio Amateurs Journal (normally $13.00) PLUS this beautiful desk set (retails $4.95) with your individual call letters engraved on lifetime engraving plastic. The Pen and metal microphone is mounted on a beautiful walnut base. Size 3" x 4".

ALL THIS FOR THE SUM OF $15.00

P.S. If you do not wish a subscription the Desk Set is $4.95 Postpaid.

CQ Magazine
Desk Set Offer
14 Vanderventer Ave.
Port Washington, N.Y. 11050

Gentlemen:

Please enter a three year subscription to CQ ☐ New ☐ Renewal and send me the beautiful desk set. Enclosed is $15.00.

THE FOLLOWING CALL LETTERS ARE TO BE ENGRAVED ON THE SET:

_____

Name _____

Address _____

City _____ State _____ Zip Code _____

☐ P.S. I do not want a subscription to CQ but do want the Desk Set. Enclosed is $4.95.

There Is Nothing Tougher Than Mobile Service...Except Our New Model 600E!

Model 600E
$23.40
Amateur Net

MOBILE SERVICE is the most demanding form of voice communications you use. Power and size limitations are extreme, putting an unusual premium on efficiency. The environment is tough, putting an accent on reliability. In the final analysis you will benefit fully from your mobile equipment only by paying strict attention to every detail of installation and operation.

Mobile service performance starts with the microphone—the first active element in the system—and there's no better way to start than with the new E-V Model 600E dynamic microphone. It is a little more costly than many microphones you can buy that "just work", and rightly so. For the E-V 600E is a lifetime investment in top-notch performance.

Look closely. The dynamic element of the 600E is the direct descendant of a long line of military microphones built to perform faithfully under battle conditions. This element was chosen for high intelligibility and its ability to withstand any environmental conditions. The proved ruggedness of the E-V Acoustalloy® diaphragm easily withstands ear-shattering sound pressures with no change in characteristics. But there is more to the 600E than ruggedness. Its sound quality has no equal. Here's why.

The frequency response of the 600E is ideally suited to SSB and critical AM transmission. You get highest intelligibility with any ALC circuit or frequency-shaping network in common use.That's been proved with on-the-air tests with every commercial SSB mobile transmitter and transceiver on the market today. Further, the high output level of the 600E will fully modulate even the "Scotch" input circuits sometimes found in mobile rigs. The 600E is available in 150-ohm or Hi-Z models.

Now pick up the 600E. It is shaped for comfort, with an easy-acting switch that gives you positive control, even when you are wearing heavy gloves. The case is molded of Cycolac®, a space-age plastic that absorbs a fantastic amount of abuse. The 600E never feels hot or cold to the touch, regardless of the climate. The shielded coiled cord has passed flexing tests that far exceed normal life, while the switch has test-cycled on and off over a half-million times without a sign of failure. Even so, both cord and switch are designed for easy field service, if necessary.

The E-V 600E is built to outlast every other piece of mobile equipment you may use, while outperforming every other microphone on the market. It will probably be transferred from rig to rig as the one most useful communications tool you own. Actually, the 600E, like all E-V microphones, is guaranteed forever against defects in workmanship or materials. It must perform as stated, or your money back.

The one best way to find out what the E-V 600E can contribute to your mobile installation is to try it. We guarantee you have nothing to lose. Ask your Electro-Voice distributor to help you put the new E-V 600E dynamic mircophone to work in your rig, today!

ELECTRO-VOICE, INC.

Dept. 152G, Buchanan, Michigan

For further information, check number 9, on page 110

Electro-Voice®

SETTING NEW STANDARDS IN SOUND

3 Resolutions You Should Make For The New Year!

1 Deluxe HEATHKIT® SB-200 KW Linear Amplifier!

• 1200 watts P.E.P. input SSB—1000 watts CW • 80 through 10 meter band coverage • Built-in SWR meter—Antenna relay—Solid-state power supply • Automatic Level Control (ALC) • Shielded, fan-cooled amplifier compartment • Pre-tuned cathode input circuit for maximum efficiency & low distortion • Circuit-breaker power supply protection—no fuses • Designed for 120/240 volt operation. Neat, compact and transportable (only 35 lbs.). The sturdy, yet lightweight construction of the SB-200 is achieved through the use of a heavy-gauge one-piece aluminum chassis that is partitioned for extra strength and isolation of circuits. Easy assembly is assured with clean, open circuit layout and high quality, well-rated components. The modern low-profile styling of the SB-200 makes it a neat, compact desk-top linear that is ideal for use anywhere!

Kit SB-200, 42 lbs.....$200.00

Note: Unit suitable for overseas operation.

SB-200 SPECIFICATIONS—Band coverage: 80, 40 20, 15 & 10 meters. **Maximum power input:** 1200 watts P.E.P. SSB, 1000 watts CW. **Driving power required:** 100 watts. **Duty cycle:** SSB, continuous voice modulation; CW, 50% (key down time not to exceed 5 min.). **Third order distortion:** 30 db or better at 1000 watts P.E.P. **Output impedance:** 50 to 75 ohm unbalanced; variable pi-output circuit. SWR not to exceed 2:1. **Input impedance:** 52 ohm unbalanced; broad-band pre-tuned input circuit requires no tuning. **Meter functions:** 0-100 ma grid current, 0-1000 ma plate current, 0-1000 relative power, 1:1 to 3:1 SWR, 1500 to 3000 volts high voltage. **Front panel controls:** Load; Tune; Band; Relative Power Sensitivity; Meter Switch, Grid-Plate-Rel. Power-SWR-HV; and Power Switch, on/off. **Tube complement:** Two 572B/T-160-L (in parallel). **Power requirements:** 120 volts AC @ 16 amperes (max.), 240 volts AC @ 8 amperes (max.). **Cabinet size:** 14⅞" W x 6⅝" H x 13⅞" D. **Net weight:** 35 lbs.

2 Deluxe HEATHKIT® SB-300 Receiver!

• Complete coverage of 80 through 10 meter amateur bands • All crystals included, plus provision for VHF converters • Hermetically sealed 2.1 kc crystal bandpass filter • Built-in 100 kc crystal calibrator • Smooth, non-backlash vernier dial mechanism • 100 cps stability after initial warmup • 1 kc dial calibrations—100 kc per dial revolution (provides bandspread equal to 10 feet per megacycle) • Provision for transceive operation with SB-400 Transmitter • Prebuilt linear master oscillator (LMO), wiring harness and two heavy-duty circuit boards for fast, easy assembly.

Kit SB-300, less speaker...22 lbs.....$265.00
SBA-300-1 Optional AM Crystal Filter (3.75 kc) 1 lb.....$19.95
SBA-300-2 Optional CW Crystal Filter (400 cps) 1 lb.....$19.95
SBA-300-3 6 meter converter, 2 lbs.....$19.95
SBA-300-4 2 meter converter, 2 lbs.....$19.95
Export model available for 115/230 VAC, 50-60 cps; write for prices.

SB-300 SPECIFICATIONS—Frequency range (megacycles): 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 28.5, 28.5 to 29.0, 29.0 to 29.5, 29.5 to 30. **Intermediate frequency:** 3.395 megacycles. **Frequency stability:** 100 cps after warmup. **Visual dial accuracy:** Within 200 cps on all bands. **Electrical dial accuracy:** Within 400 cps on all bands. **Backlash:** No more than 50 cps. **Sensitivity:** Less than 1 microvolt for 15 db signal plus noise-to-noise ratio for SSB operation. **Modes of Operation:** Switch selected: LSB, USB, CW, AM. **Selectivity:** SSB: 2.1 kc at 6 db down, 5.0 kc at 60 db down (crystal filter supplied). AM: 3.75 kc at 6 db down, 10 kc at 60 db down (crystal filter available as accessory). CW: 400 cps at 6 db down, 2.5 kc at 60 db down (crystal filter available as accessory). **Spurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **Power requirements:** 120 volts AC, 50/60 cps, 50 watts. **Dimensions:** 14⅞"W x 6⅝"H x 13⅞" D.

3 Deluxe HEATHKIT® SB-400 Transmitter!

• Built-in power supply • Complete transceive capability with SB-300 Receiver • Linear Master Oscillator frequency control • Built-in antenna change-over relay • All crystals supplied for complete 80-10 meter coverage • Automatic level control for higher talk power, minimum distortion • 180 watts P.E.P. SSB, 170 watts CW • Crystal filter type SSB generation • Operates SSB (upper or lower sideband) & CW • VOX & PTT control in SSB operation, VOX operated CW break-in • Crystal controlled heterodyne oscillators • 1 kc dial calibration—100 kc per dial revolution • Dial bandspread equal to 10 feet per megacycle • 500 kc coverage per bandswitch position • Switched 120 V AC for external antenna relay • Sturdy, lightweight, heavy-gauge aluminum construction throughout • Neat, modern "Low-Boy" styling! • Variable loading!

Kit SB-400, 33 lbs.....$325.00
Export model available for 115/230 VAC, 50-60 cps; write for prices.
HDP-21, Special SSB Mike, 4 lbs.....$29.40

SB-400 SPECIFICATIONS—Emission: SSB (upper or lower sideband) and CW. **Power Input:** 170 watts CW, 180 watts P.E.P. SSB. **Power output:** 100 watts (80-15 meters), 80 watts (10 meters). **Output impedance:** 50 to 75 ohms—less than 2:1 SWR. **Frequency range:** (mc) 3.5-4.0; 7.0-7.5; 14.0-14.5; 21.0-21.5; 28.0-28.5; 28.5-29.0; 29.0-29.5; 29.5-30.0. **Frequency stability:** Less than 100 cps per hr. after 20 min. warmup. **Carrier suppression:** 50 db below peak output. **Unwanted sideband suppression:** 55 db @ 1 kc. **Intermodulation distortion:** 30 db below peak output (two-tone test). **Keying characteristics:** Break-in CW provided by operating VOX from a keyed tone (Grid block keying). **ALC characteristics:** 10 db nominal @ 0.2 ma final grid current. **Noise level:** 40 db down from single tone output. **Visual dial accuracy:** Within 200 cps (all bands). **Electrical dial accuracy:** Within 400 cps (all bands). **Audio input:** High impedance microphone or phone patch. **Audio frequency response:** 350 to 2450 cps at 6 db. **Power requirements:** 80 watts STBY, 260 watts key down @ 120 V AC line. **Dimensions:** 14⅞" W x 6⅝" H x 13⅞" D.

HEATHKIT®

FREE 1965 HEATHKIT CATALOG

See the wide array of Heathkit Amateur Radio Equipment available at tremendous do-it-yourself savings! Everything you need in "mobile" or "fixed" station gear with full descriptions and specifications . . . Send for Free copy!

HEATH COMPANY, Benton Harbor, Michigan 49023
In Canada: Daystrom, Ltd., Cooksville, Ontario

Dept. 12-1

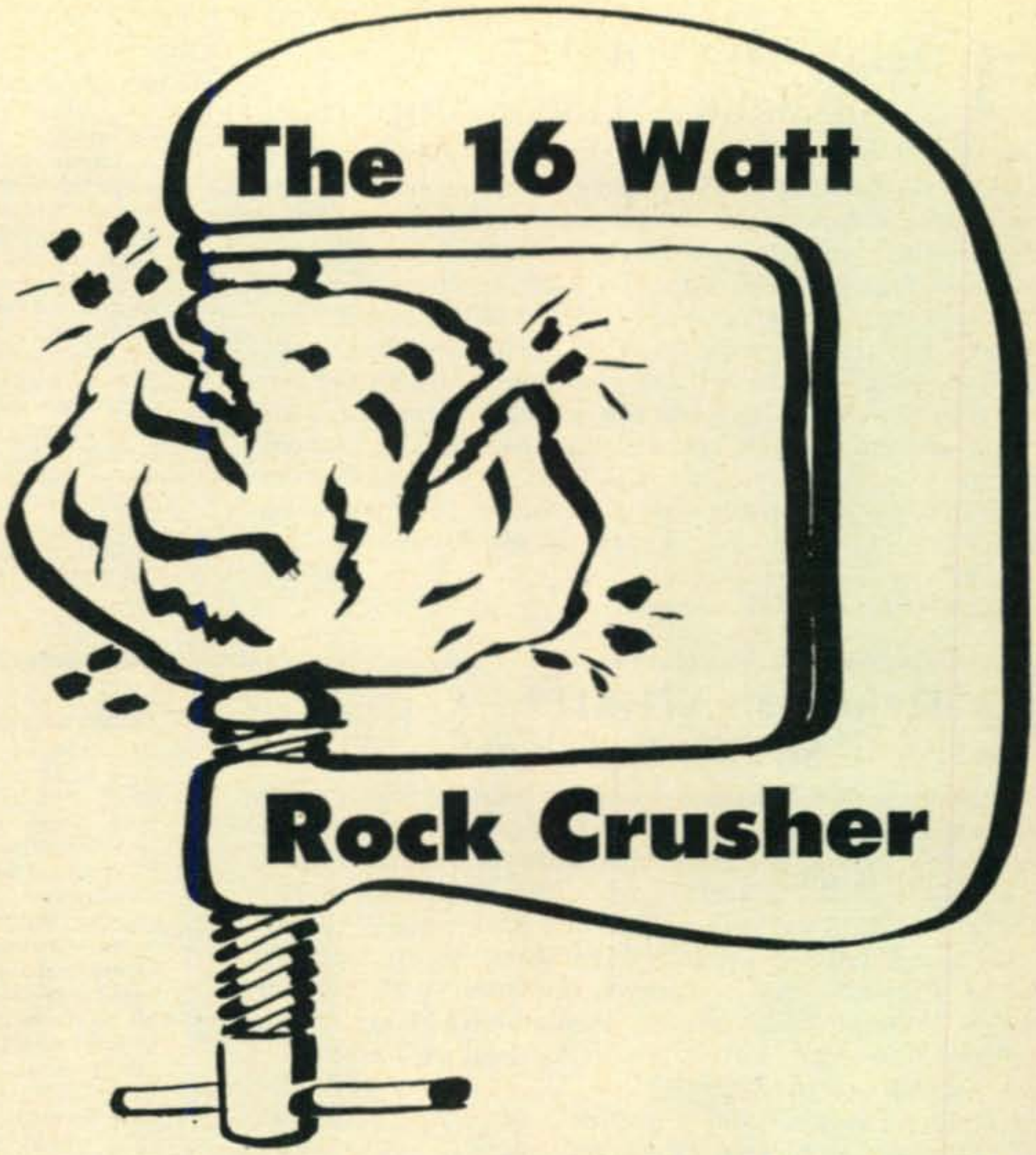
☐ Enclosed is $_____, plus shipping.
Please send model (s)_____
☐ Please send free 1965 Heathkit Catalog.

Name_____
(Please Print)
Address_____
City_____State_____Zip_____

Prices & specifications subject to change without notice. AM-151R

For further information, check number 21, on page 110

The 16 Watt Rock Crusher



BY
RUSSEL
C.
ALEXANDER,*
W6IEL

Here is an inexpensive transmitter that covers 40 and 80 meters, designed for trailer trips. It puts out a 16 watt signal, keys clearly and has almost earned a WAS from 6 land. Ideal for Novices, this transformerless rig is safe when used as directed.

A simple 16 watt "Rock-Crusher" designed and built last year proved so unexpectedly good in performance that "Rock-Crusher MK II," a refined model, now finds use at the writer's home QTH, as well as on extended trailer trips for which MK I was originally built.

This "fun rig" is not a toy, keys beautifully without chirping, delivers a true T9X signal, tunes easily, and is a natural for break-in c.w. operation. The r.f. output measures a full 16 watts, and the originally installed 50L6 final shows no distress and delivers full output after nine months of hard use.

My log book shows consistent and solid W6, W7-land ragchew contacts, and in addition is almost WAS. on 40 meters in a two-month period, W-1's and VE's included.

"Rock-Crusher MK II" is tranformerless, employs a safe, grounded chassis and does not require a polarized power plug. Voltage doubling with silicon diode rectifiers delivers 340 volts for plate supply and the regulation is excellent. Perfect chirpless keying is further guaranteed by the OA2 applied to the crystal oscillator screen.

A #47 dial lamp may be used for a plate "meter," but an inexpensive 0-100 ma meter is recommended for tuning purposes. Observation of this meter and the NE-2 neon lamp are adequate for tune-up. Fairly inactive crystals perform well in this circuit. A 15-watt lamp connected to the output terminals will aid in becoming acquainted with tune-up procedures.

Front view of the 16 watt 80-40 meter transmitter shows the simple control arrangement. On the left is PLATE TUNING and on the right, ANTENNA TUNING. On the bottom row left is a dummy control used to fill a hole left from the Q multiplier formerly in this cabinet. This is followed by a crystal socket, the key jack, the On-Off switch and the On-Off indicator. The safety indicator was added after the photo was taken.

*2890 San Francisco Avenue, Long Beach, Calif., 90806.

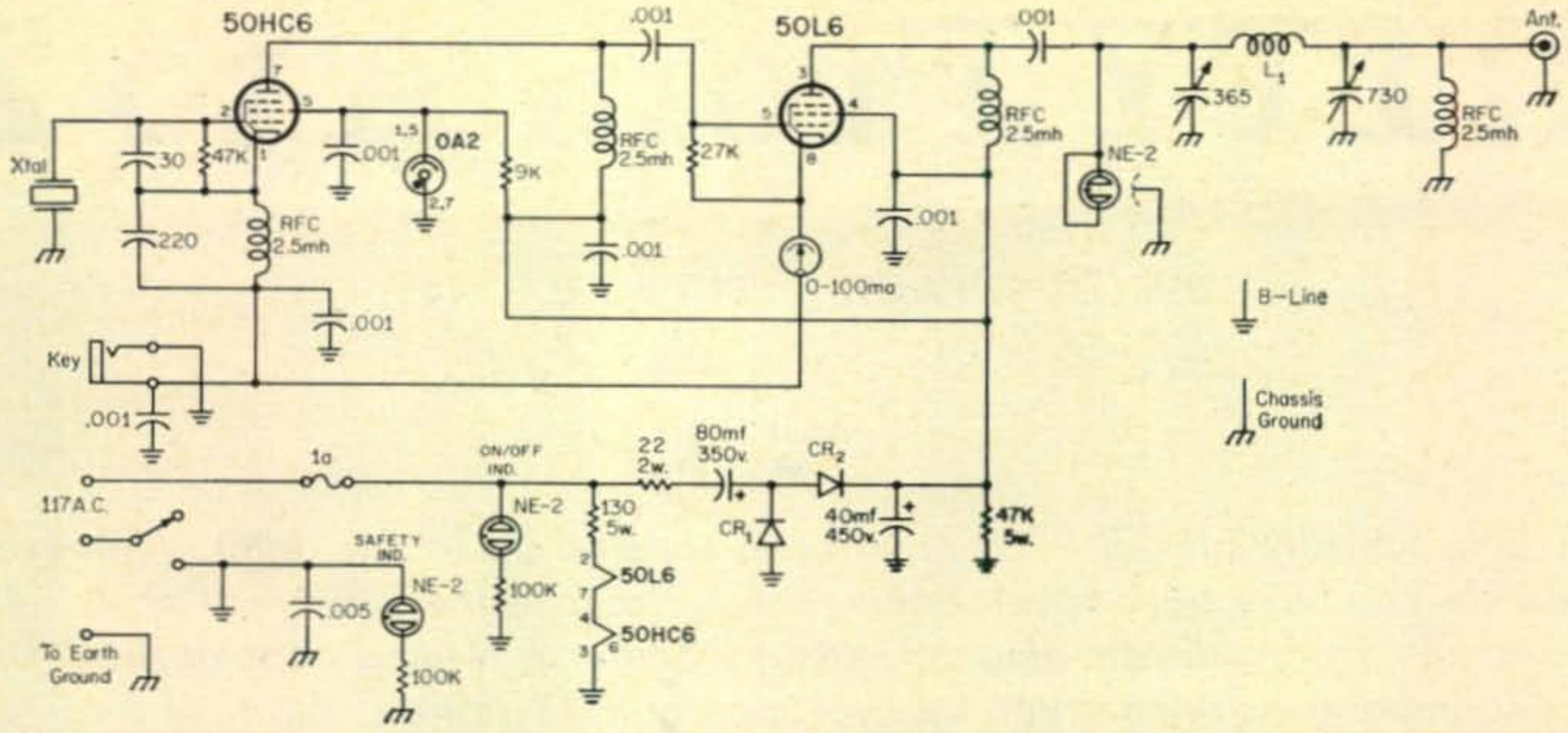


Fig. 1—Circuit of a 16 watt crystal controlled transmitters for 40 or 80 meters. All resistors are ½ watt unless marked otherwise. All capacitors greater in value than one in mmf and less than one in mf unless otherwise indicated. The diodes CR_1 and CR_2 are silicon units rated at 200 ma with a peak inverse voltage of 400 volts. Inductor L_1 is a BW #3018 unit. The two ground symbols shown in the diagram are not to be confused. As marked, one represents the B minus line and the other chassis ground.

The circuit is quite straightforward and the arrangement of the parts is not critical. Note that the 80 mf capacitor in the voltage doubler is *not* grounded. This item should be paper covered and polarity observed when connecting.

The NE-2 lamp leads, for the output indicator, should be twisted together and soldered to the hot end of the tank coil, that is the end connected to the plate blocking capacitor. It will be lighted by self-capacity to ground and may be installed protruding through the front of the control panel for convenience of observation.

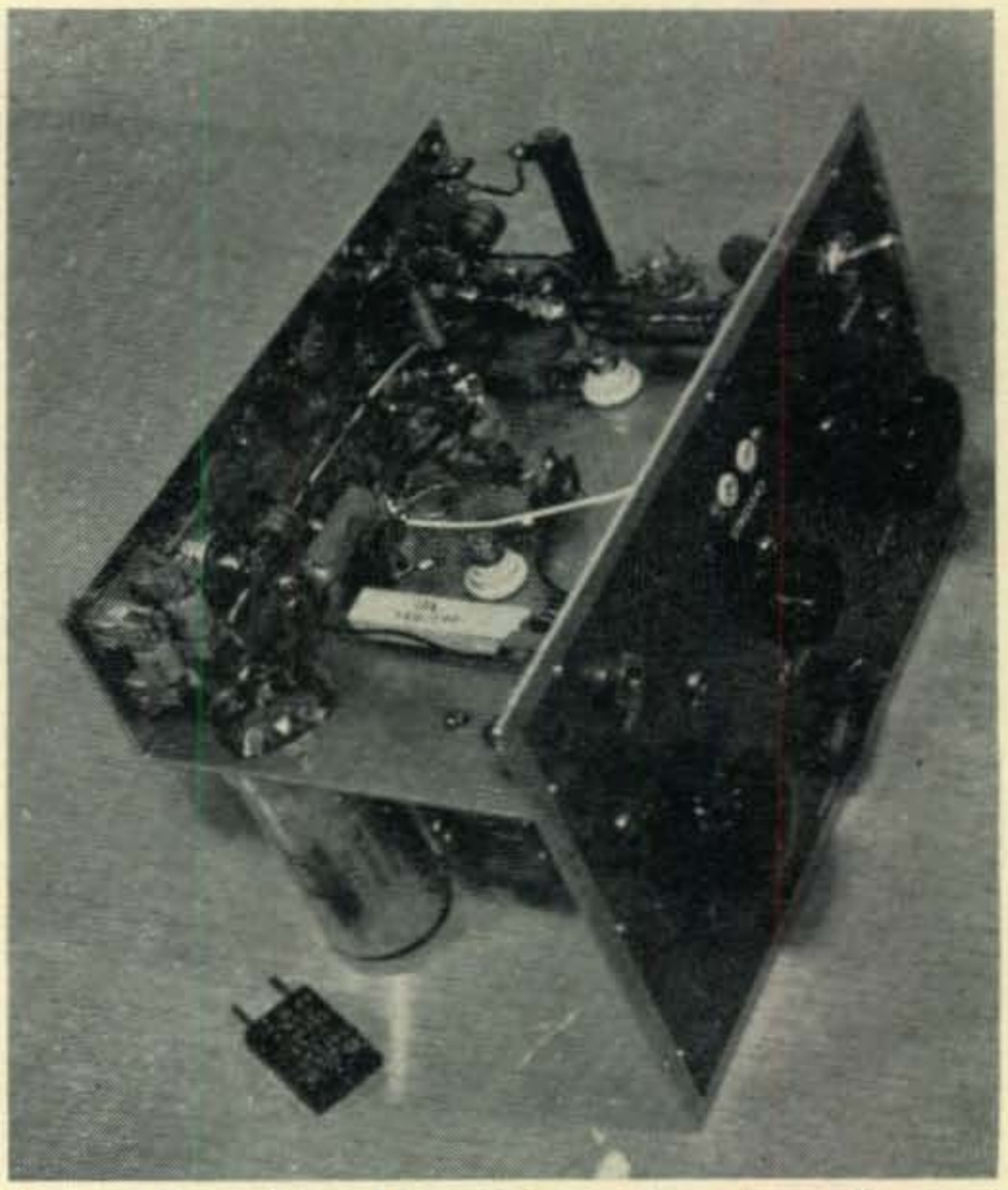
A 3-30 mmf padder capacitor is suggested for the 50HC6 crystal oscillator grid circuit, in place of the fixed 30 mmf capacitor, to obtain optimum drive from crystals of low activity.

"Rock-Crusher MK II" is constructed on a 7½" × 4¼" chassis salvaged from an old Q multiplier chassis. A unit built by WA6VLI is illustrated as a typical finished product.

None of the parts are special—most may be found in the average ham junk box. If all new parts are used, the cost will approximate $20. The coil-capacitor combination covers both 40 and 80 meters without switching, a real operating convenience, so the band is selected by changing crystals and retuning.

[*Continued on page 98*]

Rear view of the 16 watt crystal controlled oscillator shows the filter on the left, followed by the 50HC6 oscillator, 50L6 power amplifier and an 0A2. The antenna tuning capacitor (a dual 365 mmf broadcast variable with both sections paralleled) is on the left. The plate circuit is tuned by the two gang broadcast variable on the right but only the large section (365 mmf) is used. The coil is mounted on porcelain feed through insulators obscured by the tubes. The output indicator neon bulb can be seen just above the meter on the front panel. The SO-239 antenna connector is on the rear chassis lip to the left.



Bottom view of the 16 watt transmitter shows the neat wiring and parts arrangement. Note the pair of Sarkes Tarzian M-500 rectifiers on the rear lip and the porcelain feed through insulators used to mount and make connection to L_1.

RTTY From A to Z

BY DURWARD J. TUCKER,* W5VU

Part VI

The basic principles of RTTY have been covered up to this point. With each article you have been taken another step closer to the end result of a radio message, from a distant amateur, being typed on a printed page or tape. This installment goes deeper into the reception of RTTY signals, merits of receivers for RTTY reception and the production of frequency shift keying of a transmitter by means of two audio tones modulating a transmitter carrier, a system called a.f.s.k.

STRESSED, last month, was the importance of properly positioning the two f.s.k. signals, *mark* and *space*, in the passband of the receiver i.f. as pictorially shown in fig. 35. The reader's attention was also called to the fact that the b.f.o. should be set to the proper side of the center of the i.f. passband. If it is set on the wrong side then you will be copying the RTTY signal "upside down" and your teletype machine will print only gibberish. If this is not perfectly clear one should return to the text of Part 5 and also restudy fig. 35 in order to get a clearer picture of the relation of the two f.s.k. signals and their reception.

Receivers For RTTY

Space does not permit the discussion of all the merits of various receivers for use in copying RTTY signals. However, we should call attention to a few salient points if one happens to be in the market for a new receiver at this time and wishes to use it for RTTY work. Also, the discussion of the pros and cons of receivers for RTTY work may enable you to appraise your present receiver for use in RTTY work. There are a number of receivers on the market that are capable of doing a good job. There are a number of others that will do an acceptable job, although their performance may leave something to be desired. Then there are, of course, others whose performance leaves one with a rather frustrated feeling. A ham with s.s.b. experience has learned to appreciate a stable receiver with little frequency drift. One hardly gets started in RTTY before he discovers that receiver stability and low frequency drift is even more desirable for RTTY work than it was for s.s.b. work. Stability, then, should perhaps be the first consideration, as it is quite annoying to have the receiver drifting off the RTTY signal being received. Reception of an 850 cycle shift signal requires a fairly stable receiver. With a 170 cycle shift, *very* little drift can be tolerated.

Selectivity should perhaps be the next consideration. Generally, a receiver designed especially for a.m. usually has a broad bandwidth, possibly 5 or 6 kc. It is desirable to have a much narrower bandwidth for RTTY work, depending upon the shift. Certainly a bandwidth of 2.1 kc or even 3.1 kc is to be desired, instead of the 5 or 6 kc bandwidth invariably found in the older receivers. Greater stability, lower frequency drift, and narrow bandwidth were all due to come sooner or later. However, there is no question but that s.s.b. activity hastened these improvements in amateur receivers in general. Fortunately, these improvements are just as important in RTTY work as in s.s.b. work, perhaps even more so.

Another desirable feature for RTTY work is a product detector, to be found in the latest receivers with provisions for the reception of s.s.b. signals. Such receivers are also usually supplied with 2-3 kc bandwidth filters with fairly steep sides. Receivers equipped with product detectors have a number of advantages, such as being able to use a.g.c. while receiving c.w., which certainly helps in receiving RTTY signals in the presence (and when isn't it present) of fading, particularly severe fading. Don't forget to consult your receiver instruction manual for information on the operation of your b.f.o. and other features of your particular receiver. For instance the Collins 75S-3 has a special section (2.5) on RTTY tuning. In fact, the b.f.o. has a calibration dot near the −1 point on the b.f.o. calibration scale for RTTY copying. It also has a calibration dot near the +4 point on the b.f.o. calibration scale that reverses the *mark* and

*6906 Kingsbury Drive, Dallas 31, Texas.

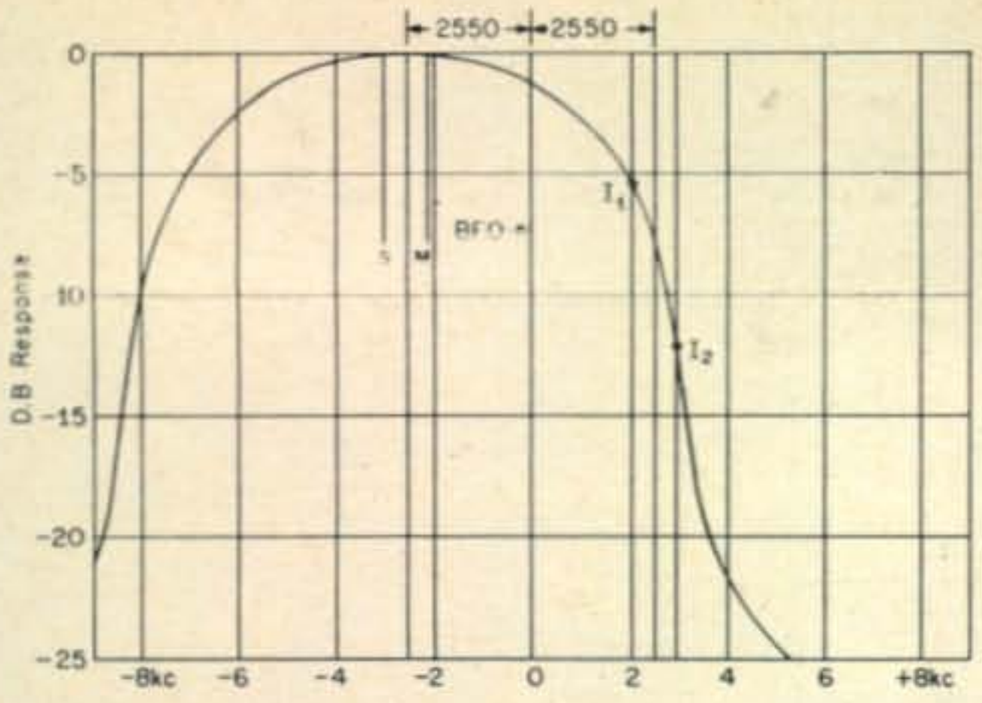


Fig. 38—Broad bandwidth in a receiver as shown in this selectivity curve makes the receiver susceptible to audio image frequencies (I_1 and I_2) which can interfere with the audio tones of *mark* and *space*.

space signals. This is for copying "upside down" signals.

Audio Image Interference

One other word of caution before you desert the 850 cycle shift for narrow shifts. Be sure that the passband of your receiver i.f. is sufficiently steep and narrow also or else you will have problems of audio image interference. A receiver with a broad bandwidth can give you trouble in trying to copy narrow shift. Unless the image is 20 db or more down from the desired signal it may interfere severely. Figure 38 shows how interference may be caused by a signal, or signals, approximately the same frequency removed from the b.f.o. on one side as the desired *mark* and *space* signals are on the opposite side of the b.f.o. frequency. In fact, it is possible for the interfering audio signal generated on one side of the b.f.o. to have the same frequency as, say, the *mark* frequency produced on the opposite side of the b.f.o. This doesn't mean, however, that they *must* be the same for audio image interference to exist. An inspection of fig. 38 indicates that the receiver i.f. in question will amplify the desired *mark* and *space* frequencies more than the interfering signals by a few db's. However, in practice the interfering signals may be strong and the desired signals may be weak, which further complicates the problem. It can be seen from this last problem posed, that, under these conditions, a receiver with a selectivity curve much improved over the one illustrated in fig. 38 can still encounter trouble in the form of audio image interference.

Receiver Appraisal

As stated previously, it is not within the scope of this article to cover the merits, advantages and shortcomings of the many receivers presently on the market, or those that are no longer in production. However, it is hoped that the preceding discussion will, in some measure, be a guide to the reader in either appraising his present receiver or the one that he may be contemplating buying.

This discussion on receivers would not be complete, however, without mentioning that the Collins receivers for a long time have been excellent for RTTY work. Is there any ham that is not familiar with the "frequency meter" characteristics, as well as the frequency stability and dial calibration of the Collins receivers? One could not end this discussion without mentioning the better grade of Hallicrafter receivers, as well as the Drake receivers. It is not the intent of the author to indicate, by omission, that all other receivers are unsatisfactory for RTTY because many RTTY'ers have found that other manufacturers such as National, Hammarlund and others, have produced or manufactured receivers that were also satisfactory for RTTY work. For the more serious RTTY'er it helps to have one of the better receivers to be found on the present day market.

A.F.S.K.

We come now to the "last frontier" in the process of frequency keying our transmitter for RTTY work. That last frontier is the frequency shift keying of a transmitter by means of two audio tones modulating a transmitter carrier; it is called audio frequency shift keying or a.f.s.k.

Frequency shift keying that creates only two carrier frequencies is the only type of frequency shift allowable on the low frequency amateur bands. A.f.s.k. as well as f.s.k. is allowable on v.h.f. However, a.f.s.k. is used mostly on the 6 and 2 meter bands. Either a.m.(A2) or f.m. (F2) is permissible, with the highest allowable fundamental modulating audio frequency being 3000 cycles. A.f.s.k. is accomplished by alternately modulating the transmitter with the two audio tones of 2125(*mark*) and 2975(*space*). This is done by frequency shifting an audio oscillator and feeding its output into the transmitter's audio system where the two tones alternately modulate the transmitter. It can be seen that this creates a transmitter signal that has a carrier, two upper sideband frequencies and two lower sideband frequencies. The operator only has to tune in the modulated carrier, with his receiver b.f.o. turned off, to receive the two audio tones. If a.f.s.k. is applied to an s.s.b. transmitter, only a single sideband is transmitted but it consists of two alternate r.f. signals whose frequencies differ by the amount of the audio shift used in the a.f.s.k. which would be 850 cycles for an audio mark frequency of 2125 cycles and an audio space frequency of 2975 cycles.

Let us suppose that the carrier of an s.s.b. transmitter was set to a frequency of 14,097.025 kc, and then nulled out. The transmitter is set to transmit on the upper sideband. Next, the transmitter is modulated with the *mark* audio frequency of 2,125 cycles which creates an r.f. upper sideband frequency of 14,097.025 kc plus 2.125 kc or 14,099.150 kc. Now the transmitter is modulated with the *space* audio frequency of 2,975 cycles which creates an r.f. upper sideband frequency of 14,097.025 kc plus 2.975 kc or 14,100.000 kc. It is seen that in the a.f.s.k. keying of the transmitter that the *low* frequency r.f.

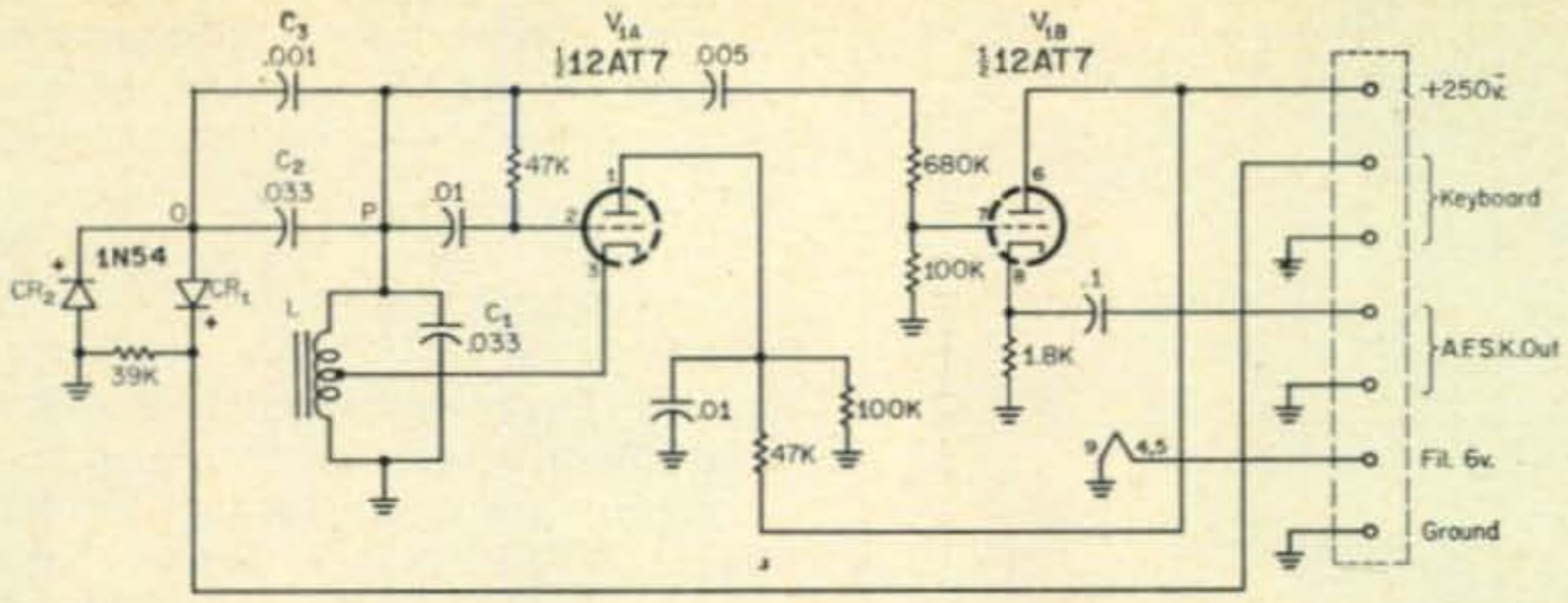


Fig. 39—Circuit of the "Twin City T.U." A.F.S.K. oscillator. The mark frequency is 2125 c.p.s. and the space is 2975 c.p.s. The operation is described in the text.

signal (14,099.150 kc) is the *mark* signal. This is in reverse to our previous discussions wherein the *high* frequency r.f. signal (14,100.000 kc) is the *mark* signal for the f.s.k. keying of a transmitter.

Let us now suppose that the carrier of the same s.s.b. transmitter was set to a frequency of 14,102.125 kc and nulled out. The transmitter is now set to transmit on the *lower* sideband. Again, the transmitter is modulated with the *mark* audio frequency of 2,125 cycles which creates an r.f. lower sideband frequency of 14,102.125 kc less 2.125 kc or 14,100.000 kc. Now the transmitter is modulated with the *space* audio frequency of 2,975 cycles which creates an r.f. lower sideband frequency of 14,102.125 kc less 2.975 kc or 14,099.150 kc. In this case it will be seen that in the a.f.s.k. keying of the transmitter that the *high* frequency r.f. signal (14,100.000 kc) is the *mark* signal. It can be seen that this is now the same as for the f.s.k. keying of a transmitter as discussed in detail previously.

Understand, that in the copying of RTTY signals produced by modulating an s.s.b. transmitter with two audio tones such as just outlined in the two examples, that the receiver b.f.o. is turned on just the same as in the copying of s.s.b. signals.

The end result of audio frequency shift keying an s.s.b. transmitter is the same as frequency shift keying of the v.f.o. of a c.w. transmitter in that it produces two keyed r.f. signals. This is the theoretical picture. In practice, it usually is not this good. In the first place, the two modulating audio tones must be pure sine waves which they probably will not be. Besides, there is the problem of the removal of the carrier and unwanted sideband (on the other side) in order for the transmission to be truly classified as F1 instead of A2. A2 is not legal in the low frequency amateur bands. If one is prone to go ahead and a.f.s.k. an s.s.b. transmitter by modulating the transmitter in one of the sideband positions he should be very sure that the two carrier frequencies thus created do qualify under the F1 classification instead of A2. Remember, the low frequency bands only authorize F1 f.s.k. operation.

A.F.S.K. Circuits

As might well be imagined, diode switching is also used for audio frequency shift keying of an audio oscillator. Here again solid-state diodes are used. However, the diode switching circuits usually used for a.f.s.k. are slightly different from those f.s.k. diode switching circuits previously covered.

An a.f.s.k. oscillator is a relatively simple device. It is also easy to build and adjust. All of its components, except possibly the inductor required to resonate the oscillator to the two audio tones (*mark*—2125 cycles and *space*—2975 cycles), should be familiar to any ham. Figures 39 and 40 show two such oscillators. Both oscillators have been around for some time; fig. 39 shows the Twin City TU[7] oscillator and fig. 40 shows the W2JTP a.f.s.k. oscillator.[8] The inductor L in fig. 39 has an inductance of 88 millihenries and is tapped at midpoint. Originally an 88 mhy toroid telephone loading coil was used. Eighty eight mhy toroid coils are fairly common in RTTY circles. However, one with a center tap may not be as easy to find. The inductor L_1 in fig. 40 has an inductance of 250 millihenries. Such a coil may not be easy to locate either, but at least it does not have to have a center tap.

Adjustments

Remember that with a.f.s.k. the high frequency, 2975 cycles, *space*, is obtained with the keyboard contacts *open*. The frequency of either oscillator should be first adjusted to the 2975 cycle frequency. Then the keyboard contact is closed (*mark*) and the oscillator is then adjusted to a frequency of 2125 cycles.

Specifically, inductance L (88 mhy.) and capacitance C_1 (0.033 mf), with keyboard contacts open should resonate the oscillator of fig. 39 to the space frequency of 2975 cycles. Chances are that you will not hit the frequency right on the nose, as stock capacitors are not exact; nor are inductors, for that matter. The simplest thing to do, if you have a supply of the 0.033 mf capacitors, is to keep trying them one by one. If the oscillator frequency is on the high side, then more capacitance is needed. In this case, you may start with a capacitor, C_1, with a value lower than 0.033 mf, adding a

[7] *CQ RTTY Handbook*, Page 116.
[8] RTTY Column, Byron Kretzman, W2JTP, *CQ*, Jan., 1961, page 94.

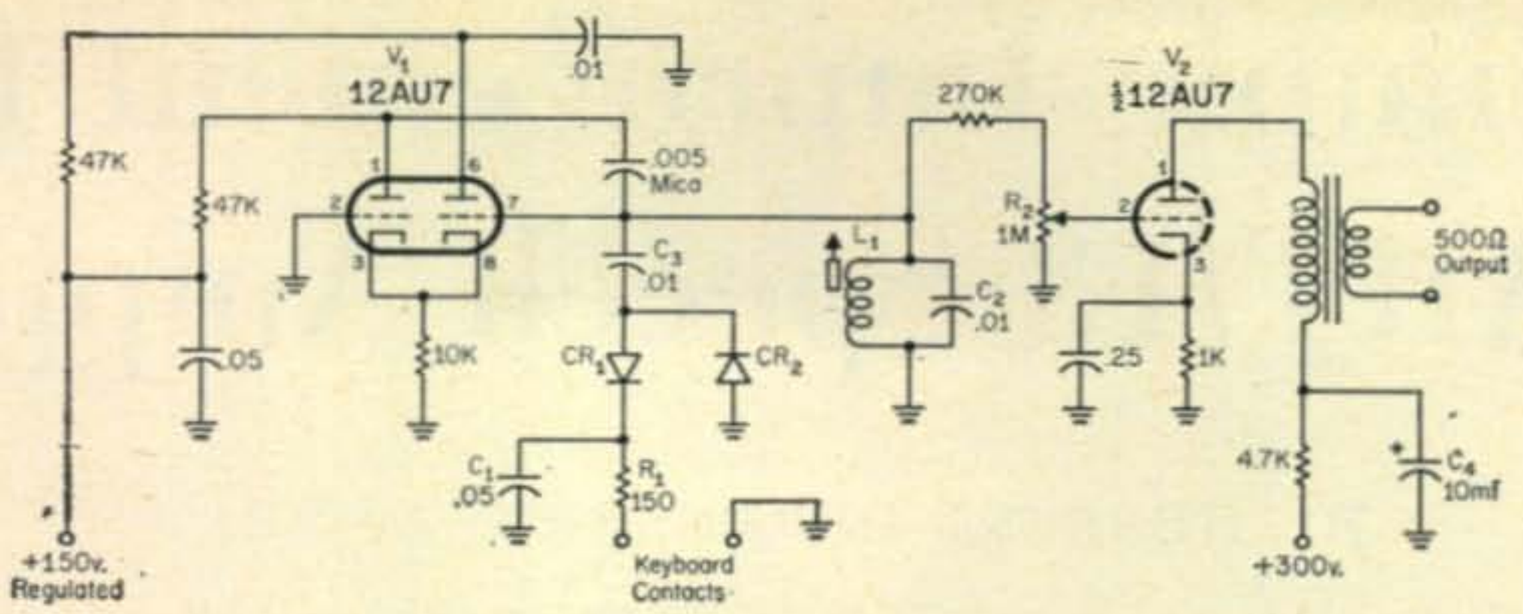


Fig. 40—Circuit of the W2JTP a.f.s.k. oscillator discussed in the text. Capacitor C_1 should be a disc ceramic. Diodes CR_1 and CR_2 are 1N34; T_1 is a Stancor A-3250.

padder of very low value if necessary. Otherwise, you have the other choice of removing a few turns at a time from one end of the inductor until the circuit resonates at 2975 cycles. Don't be too ambitious and take off too many turns at a time—remember that it is easier to take off than it is to put back on. Closing the keyboard circuit simply adds capacitors C_2 (0.033 mf) and C_3 (0.001 mf) across the coil L along with whatever value you ended up with at C_1. The chances are good that the oscillator will not be on 2125 cycles. *Do not* touch L or C_1 Do all of your substituting or adding at C_2 and C_3, otherwise, you will change your space frequency of 2975 cycles that you had just set.

The first half of the 12AT7 tube constitutes the oscillator and the second half of the 12AT7 tube is simply an audio amplifier. With the keyboard contacts open, an a.c. voltage, from the audio oscillator, (across L and C_1, to ground) is applied to CR_1 and CR_2 through capacitors C_2 and C_3. A pulsating d.c. voltage tends to develop across diode CR_2 because of its high back resistance and low forward resistance. Under these conditions, capacitors C_2 and C_3 tend to charge up to approximately the peak value of the a.c. voltage from point P to ground. Under the above conditions, there would be a measureable (with a good vacuum tube voltmeter) d.c. voltage across CR_2 to ground with the minus polarity at the ground side and plus at point O. This gives sufficient reverse bias voltage to diode CR_2 so that it will not conduct.

What about CR_1? Its polarity in the circuit is opposite to that of CR_2, therefore, it tends to build up a negative d.c. voltage from point O to ground. However, this is considerably nullified or restricted by the 39K resistor in series with CR_1 to ground. The result is that the positive voltage from point O to ground from the action of CR_2 is considerably greater than the negative voltage from the same point to ground from the action of CR_1. The algebraic sum of these voltages from point O to ground is positive. The net positive voltage from O to ground would tend for conduction through CR_1 except for the limiting effect of the 39K resistor in series with CR_1 to ground.

When the keyboard contacts are closed the 39K resistor is shorted, connecting the bottom end of CR_1 directly to ground. This gives a low resistance d.c. circuit through both CR_1 and CR_2. The net result is that capacitors C_2 and C_3 are effectively connected to ground in parallel with C_1 across inductor L, thereby *lowering* the frequency of the audio oscillator from the *space* frequency of 2975 cycles to the *mark* frequency of 2125 cycles.

The oscillator circuit shown in fig. 40 should be adjusted using the same procedure as outlined for fig. 39. Inductor L_1 and capacitor C_2 of fig. 40 should be resonated to a frequency of 2975 with the keyboard circuit open. When the keyboard circuit is closed only the value of capacitor C_3 should be juggled in order to get the oscillator on the correct frequency of 2125 cycles for *mark*. All of the first 12AU7 is used in connection with the oscillator circuit and one-half of a second 12AU7 is used as an audio amplifier. The capacitors C_1, C_2, and C_3 of both circuits should be of the mylar or mica dielectric instead of ordinary paper insulated types.

Note that the diode switching circuits and the method of shifting or changing the frequency of the audio oscillation in figs. 39 and 40 are essentially the same. However, there are a few minor differences. For instance CR_1 in fig. 39 is connected to ground through a 39K resistor, whereas CR_1 in fig. 40 has an open d.c. circuit to ground with the keyboard contacts open. With this exception, the operation of CR_1 and CR_2 in fig. 40 is essentially the same as the detailed description given for fig. 39. Naturally, with the keyboard contacts open, diode CR_1 does not figure in the circuit at all, since it has an open circuit to ground and neither does CR_2 conduct, because of the reverse or back bias that builds up across CR_2 as already explained.

If one desires, a transformer may be used in the plate circuit of V_{1B} of fig. 39 to obtain an output from this audio amplifier, as was done in fig. 40, instead of taking the output from the cathode circuit. It may be found that there may be as much as 3 db difference in level between the two tones. This shouldn't give you too much trouble. However, you may equalize the two tones by placing an inductor, capacitor and resistor in series across the oscillator output. The value of inductor coil and capacitor selected should be such that they will resonate at the frequency that you wish to attenuate. The re-

[*Continued on page 98*]

A Simple Improvement for the ART/13 Speech Amplifier

BY HERBERT GREENBERG,* W2EEJ

THE audio quality of the ART/13 can be improved and hum resulting from use of the filament supply for the carbon microphone source eliminated by a simple change. The cathode voltage of the driver stage is utilized to provide the voltage for the carbon current needed.

First, remove the speech amplifier from the ART/13. It may be advisable to remove the 837 before attempting this if there is not enough play for an easy operation. Turn the unit over and place it in the same position as shown in fig.

*821 Rutgers Road, Franklin Square, New York.

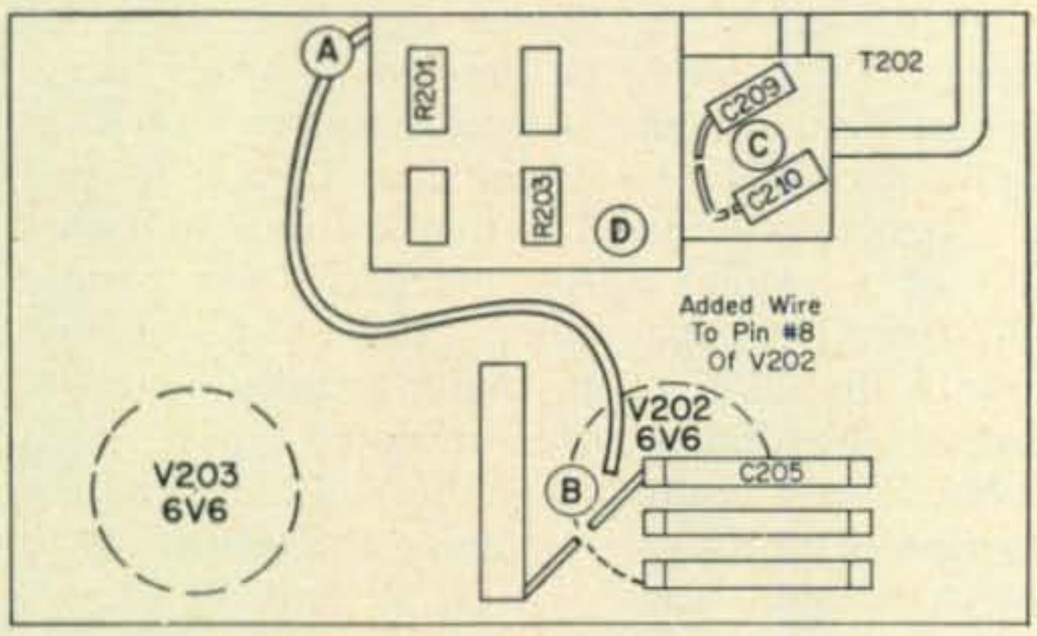


Fig. 1—Pictorial layout of the speech amp of the ART/13 showing the areas of modification.

1. Remove the two screws that hold the three mica capacitors to the chassis and save them.

Now cut the lead at Point *A* of the four resistor terminal board. This is one end of R_{201}, a 220 ohm 1 watt unit, which originally connected to the filament of the 6V6 m.c.w. oscillator and side tone amplifier (V_{203}) which physically is the one mounted in the corner of the chassis. Bend this wire back and tape the end to prevent any possible chance contact to anything.

Use a piece of insulated wire, about five inches long, first stripping and tinning the ends, and connect from point *A* to pin 8 of the 6V6 driver, (V_{202}), the one near the 12SJ7 and under the three mica capacitors.

Cut the bare wire from C_{205} at point *B*, bending the leads apart to prevent accidental contact to each other. This improves the frequency response by eliminating the 12SJ7 plate bypass capacitor and prevents some of the "boominess."

For further extension of the response range, at point *C* cut one lead to each of the 0.01 capacitors, C_{209} and C_{210}, if present. These are the 811 grid bypass audio "correction" capacitors. These were not used on some models, such as the ATC Navy version.

[*Continued on page 92*]

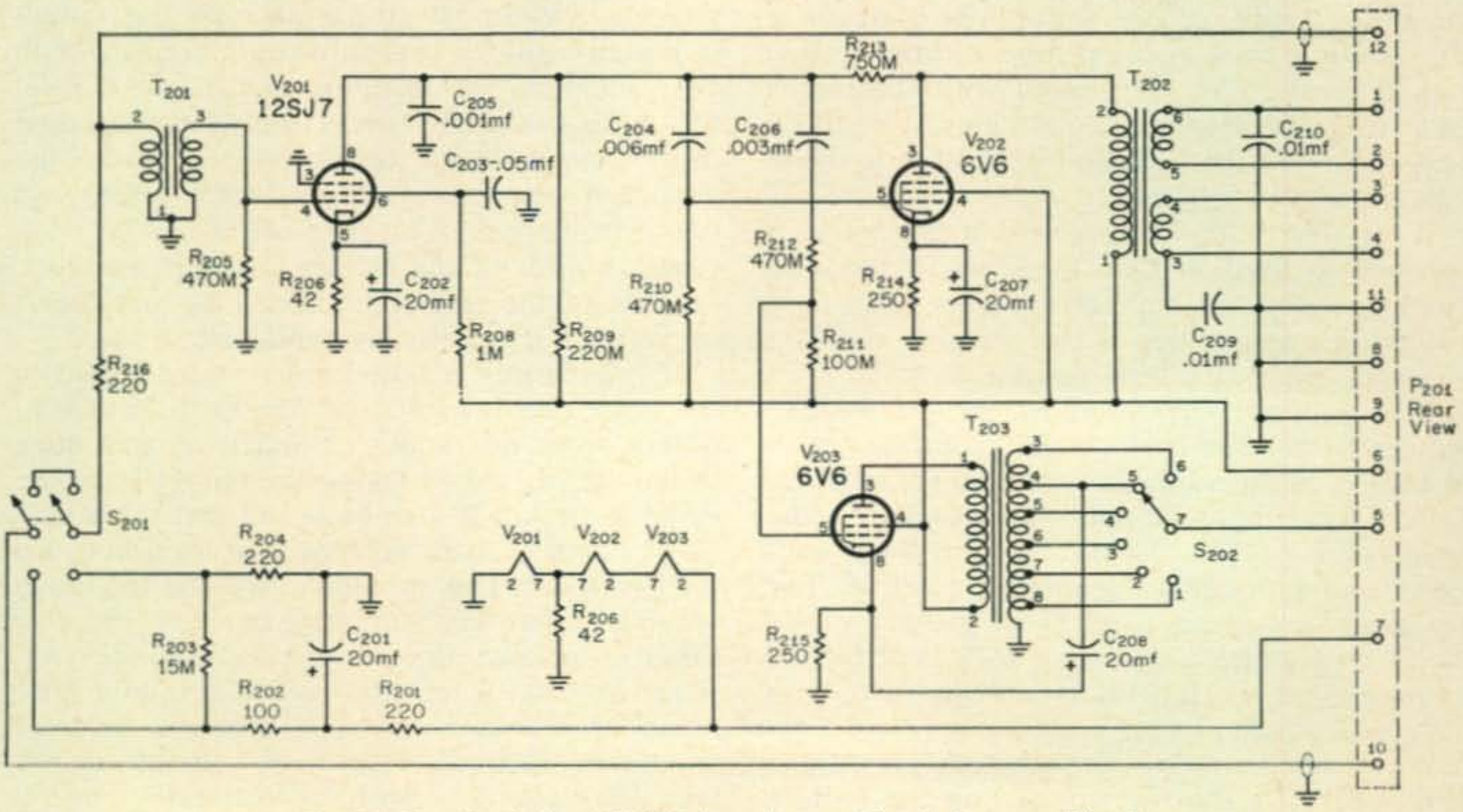


Fig. 2—Circuit of the ART/13 Speech amplifier before modification.

View of the Vox Key showing the simple arrangement of parts. Note the indicator lamp up front.

The Vox Key

BY AL HORST,* W9CUX

The Vox Key was designed for the ham who has a digital disability and still wants to operate c.w. With this device he can do so simply by singing out the code or even blowing across the mike.

"LOOK—no hands" is usually shouted in triumph, but not by a ham who likes to work c.w. and for one reason or another does not possess full use of his hands. Such a situation came to my attention recently. Such in spite of 37 years of hamming failing to make an avid c.w. operator out of me, I realize that c.w. will always be first-love with many amateurs. It did not seem fitting and proper that such strange fidelity be interrupted by a mere digital disability and the matter was therefore given further consideration.

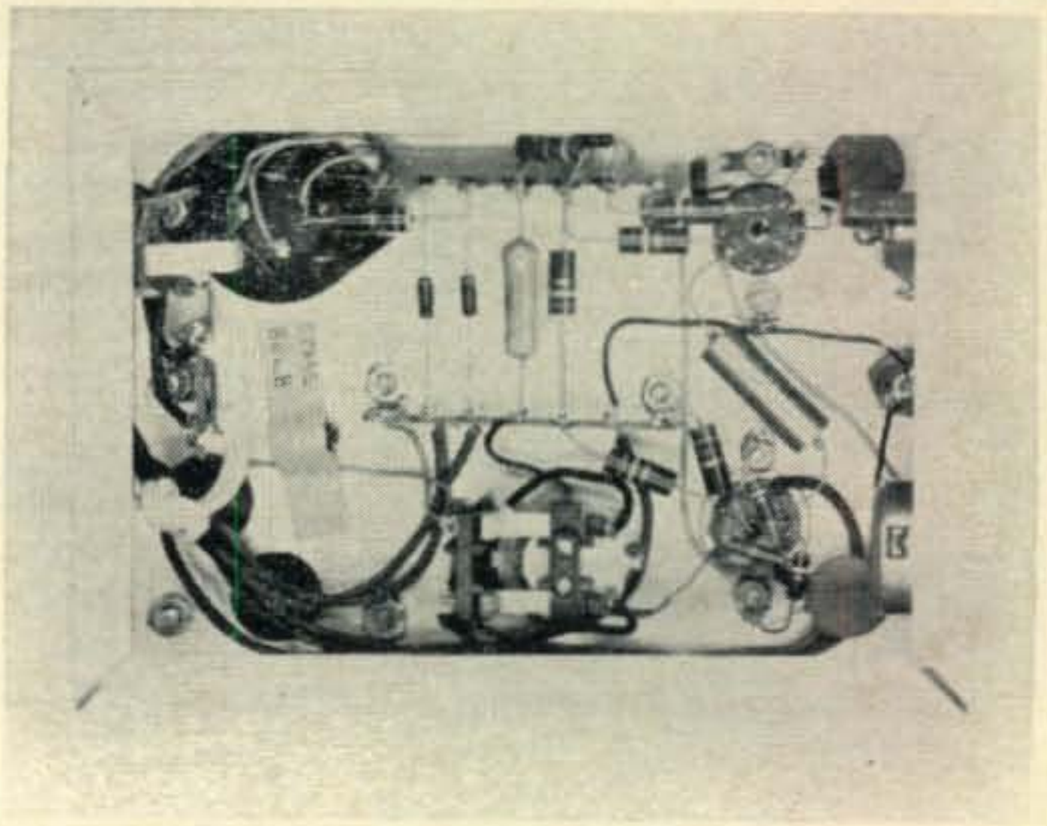
In essence, code consists of turning the transmitter on and off in more or less measured intervals of time, and the means of accomplishing this makes no difference to the fellow at the other end of the QSO. Most of the single-sideband gang turn their transmitters on and off by means of a bit of circuit wizardry called "VOX-aaaahh!" It was thought possible that this system could be suitably modified to produce no-hands code. A little bench work with reduced time-constants in vox circuitry borrowed from the HT-37 yielded very promising results. Another evening spent optimizing circuit values and the Voxkey became operational.[1]

Circuitry

The circuitry is straightforward and utilizes two dual triode tubes. Two sections of a 12AX7 are cascaded to provide the necessary voltage amplification of the microphone output. A potentiometer in the grid circuit of the second stage allows the gain to be set so that extraneous room noise will not trip the keying relay. The first half of the 12AT7 has the grid and plate tied together and is operated as a diode. The rectified signal voltage appears across R_1 and is applied to the grid of the relay tube V_{2b}. In a no-signal condition, the cathode voltage, with respect to the grid, is determined mainly by the current from B plus through R_2 and R_3. This maintains a bias of about —8 volts on the grid and limits the plate current of the tube to 0.3 milliampere. In the presence of a strong signal the rectified voltage from the diode reduces the bias to —1 volt or less and the plate current rises to 8 or 9 milliamperes. This differential is more than adequate to provide fast, reliable operation of the 10,000 ohm plate circuit relay.

Components

No critical circuit values or components were encountered in the design and testing of this device. The only component which should be selected with some care is the plate circuit relay. A miniature type with a sensitivity of 5 milliamperes or better and a coil resistance of 10,000 ohms will perform nicely up to 35 or 40 words per minute. Coupling capacitors, C_1 and C_2 should have a voltage rating of 400 volts or more and C_2 should have good insulation resistance so that d.c. leakage to the grid of V_{2A} does not occur.



Bottom view of the Vox Key shows the neat and simple construction. Note the careful inclusion of the spare bulb under the tape.

*833 Considine Road, Geneva, Illinois.

[1]Subsequent research revealed a similar device described by James Watt in QST, October 1958.

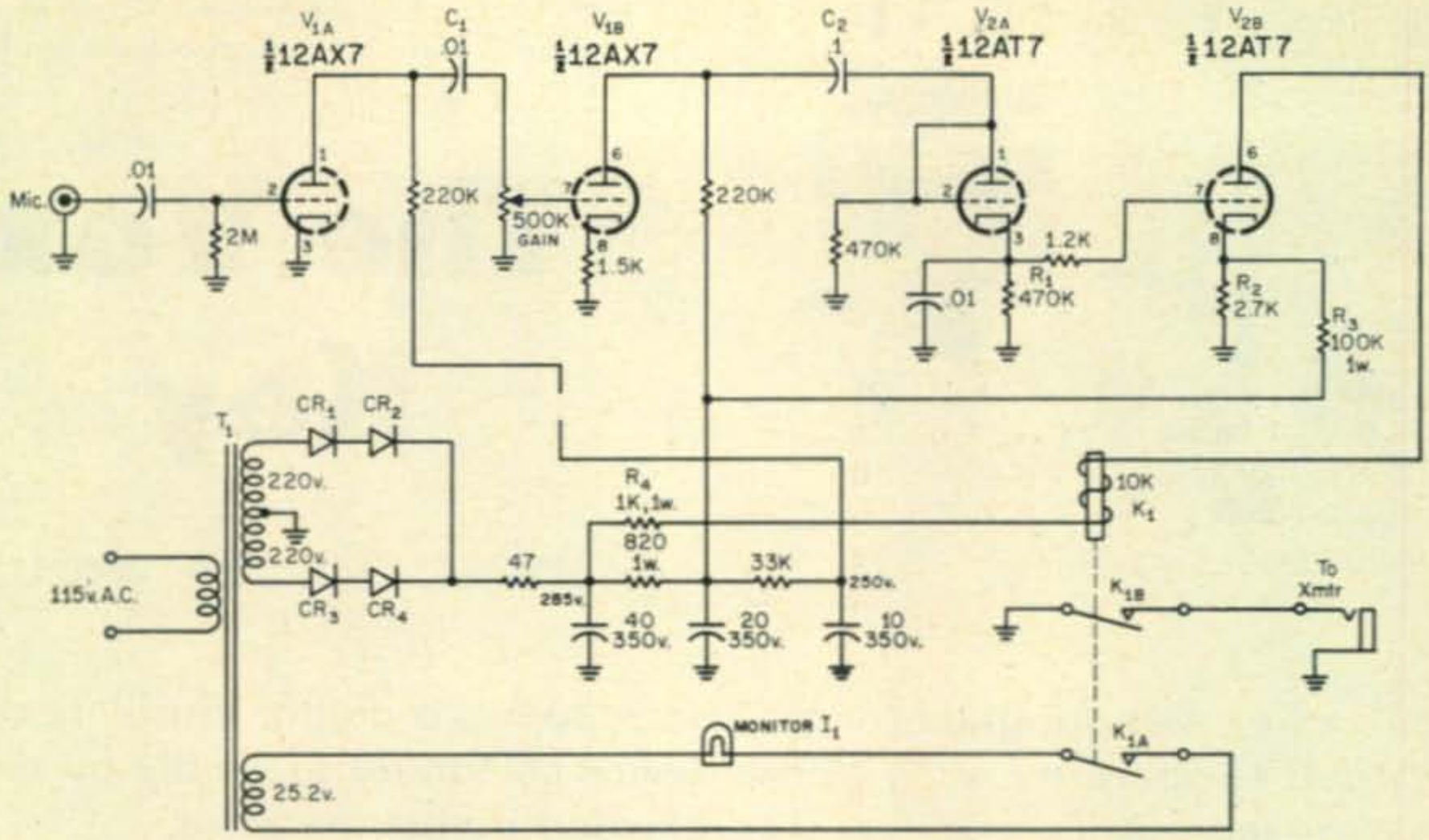


Fig. 1—Circuit of the Vox Key, a voice operated keyer. All resistors are ½ watt unless otherwise noted and all capacitors are in mf. Relay K_1 is described in the text; T_1 is a Stancor PC-8417 or equivalent. The diodes CR_1 to CR_4 are 200 ma units at 400 p.i.v.

The power transformer happened to be available but some economy could be effected by using a full-wave bridge rectifier on a transformer supplying half as much total voltage. The 28 volt keying monitor lamp could just as well be a 6-8 volt lamp supplied by a 6.3 volt source but a low-current filament is desirable in order to minimize the time lag due to the thermal inertia of the filament. Some variation was encountered in 12AT7 tubes; however, it is very simple to select one which exhibits good plate current differential. The voltage drop across the 1000 ohm resistor, R_4, is numerically equal to the plate current in milliamperes.

Adjustment and Operation

Slight adjustment of the spring tension and back-stop on the keying relay may result in improved action. Feeding a signal from a code-practice tape into the microphone input will permit testing at speeds well in excess of vox operation. Any high-impedance high-output microphone will provide sufficient input signal to the Voxkey—a cheap tape recorder-type or CB microphone is very satisfactory. Gain should be set for close talking in order to preclude tripping from background noise.

The operator may generate aural code in several ways. Well articulated dah-dit-dah-dit dah-dah-dit-dah will come out as a very respectable sounding CQ with little or no practice. For those who enjoy whistling—have fun—but it may be found necessary to have a supply of a favorite beverage at hand for long QSO's. Even blowing across the face of the microphone will produce good operation with a little practice and proper gain setting. Some difficulty may be experienced with breath control. This is a common experience of beginning pupils on wind instruments in a band and is gradually overcome with practice. Possibly the aforementioned beverage will again be useful from time to time.

No claims are made that the Voxkey will completely obsolete all existing electronic keyers. For those who need it, it will produce code at moderate speeds which in many cases will be indistinguishable from normal straight keying.

Special Application

The Voxkey lends itself to several other applications. For example, it provides a convenient means of keying a transmitter from a tape recorder for on-the-air code classes. Input to the Voxkey may be taken from the headphone monitor jack or from the speaker voice coil terminals. In the latter case it may be necessary to reduce the voltage by means of a 100 to 1 resistive divider. Similarly, real time repeater operation from a receiver output can be accomplished by feeding the electrical output of the headphone jack into the microphone input of the Voxkey. This method seems to work much better than placing the microphone in front of the speaker; however, a good steady signal is necessary to assure reliable operation.

In conclusion, I wish to extend my gratitude to the advertising department of DuKane Corporation for the photos and to the several engineering groups who knowingly or otherwise furnished parts for the prototype described herein. ■

WE WOULD WELCOME
OTHER ARTICLES
ON A
SIMILAR VEIN

WRITING FOR CQ?

BY MARCIA HIGGINS*

EACH month *CQ* receives dozens of manuscripts from would-be authors. Of these, more than half must be rejected for any one of a number of reasons. We're sure that the many authors receiving rejection notices (and many prospective authors, too) would be interested in knowing a few things about our acceptance procedure, and a bit about what they can do to improve their chances of acceptance.

What Kind of Article?

In an effort to produce an issue that has the widest appeal to our readers, we must select our articles very carefully. After all, not everyone wants to read about quad antennas or s.s.b. exciters. We try, therefore, to select at least one article (and usually more than one) on each major interest area within the hobby. So you're likely to see items on antennas, v.h.f., receivers, transmitters, mobile, s.s.b., RTTY, contests, operating, and so on. Now, please don't feel that we have forgotten your interests if one month you can't spot a "surplus" article in the Table of Contents; either we had nothing suitable available or one or our regular columns covered the area adequately. But in any case, we try our best to please you.

What all this means is that we must select articles for acceptance with an eye to what we can use reasonably soon; nothing is more frustrating to an author than having his article accepted and then having it turn moldy in our files waiting for publication! It happens. So when planning to write, keep in mind that unless you've got something earthshaking, it's liable to sit for a while.

But even before you concern yourself with how long it will be before the manuscript (m/s) is printed, think about making a favorable impression on the editors. You can accomplish this by the following suggestions:

The Manuscript: Type the manuscript double-spaced on one side of 8½ × 11 inch bond paper, with generous margins all around.

Organization: Organize all of your material (photos, drawings, captions, parts lists, etc.) in an orderly and logical sequence. A caption or parts lists should be treated as part of the typed m/s and should be grouped at the end—not written on the margins of photos and drawings.

Photos: Photos oftentimes "make" an article. So if it is at all possible, include an assortment of photos of your project, or, if it isn't a construction project, try to locate illustrative material which may "dress up" the end product. Now don't go all out with expense with a professional photographer to order to get 18 different 8 × 10 photos of your new "Super-Fantastic Code Oscillator." It isn't worth it. "Pro" shots can be costly. Just a few carefully planned enlargements from an average roll-film camera will do the trick. We find that 5 × 7's are the handiest to use.

Drawings: You don't have to be an electronics draftsman to prepare suitable schematics for *CQ*. Our Art Department handles that; but by the same token, our Art Department isn't made up of electronics experts either, so please do a clear enough job so that they can follow it. To help us even more, take a little time to study our "style." You may not realize it, but *CQ does* follow a very definite system when it comes to schematic symbols and values (*i.e.* mf, v., ma, kc). As a neat and correct m/s is always desired when scrutinizing articles, a little time spent scanning our past issues will work in your favor.

Parts Lists: A useful addition to any construction article is a carefuly prepared parts list. Looking back in *CQ* you will note that in our parts list we seldom list every component used. Instead, only components that are of a peculiar type or manufacture, or which are rather critical as to size, shape and characteristics will be found. Routine resistors, capacitors and chokes are normally identified on the schematic. Coils are usually described in the following order: number of turns, wire size, diameter of winding, turns spacing, type of form (if any).

Procedure

Every manuscript received at *CQ* is acknowledged the same day by postal card. When we are able to review the m/s, either a letter of rejection (with reasons and suggestions) or a letter of acceptance (with a contract) is sent. When we receive a signed copy of the contract, processing can begin, and usually does within a few days. In an effort to keep errors to a minimum, galley proofs of the article and photostats of drawings are sent to all authors for checking. **Please don't rewrite the article at this point!** After receiving your corrected proofs we will proceed to assemble the material into a full fledged article.

The issue in which your article appears will be sent to you just as soon as it is off the press, (about a week earlier than most subscriber's copies), but by the time you receive your copy the entire print run is completed, so don't plead with us to make a last minute change—it can't be done.

Last, but certainly the best part of the whole procedure, a check will be on its way to you shortly after the issue appears, figured at the rate of $20.00 per *CQ* page. A good return for a few evening's work, don't you think? ■

*Editorial Assistant, *CQ*.

Triodes For Linear Amplifiers

BY WILLIAM I. ORR,* W6SAI

Many of the common triode transmitting tubes will perform well as linear r.f. amplifiers for s.s.b. Unfortunately, little operating data for this class of service is available for these tubes. The purpose of this article is to provide rough guidelines whereby any triode tube may be easily and quickly evaluated as to its useability as a linear r.f. amplifier.

THE amateur owning a high dissipation transmitting triode, therefore, is often at a loss as to the proper operating parameters for linear service, or he might not know if the tube is really suited for this class of operation. Then, too, good transmitting equipment exists, designed before the advent of s.s.b., that may be easily converted to single sideband linear service, provided the correct operating potentials can be determined.

Important Tube Characteristics for Linear Service

Triode tubes[1] may be operated in either grid- or cathode driven service, and may be run in Class AB_1, Class AB_2 or Class B mode. The problem then is to determine *which* triode tubes are most suitable for linear service and in *what* circuit configuration they work best, and finally, to establish the operating potentials which will provide satisfactory results for the user.

Two triode tube characteristics which, in general, provide the information to establish the worth of the tube as a linear amplifier and which may also suggest the proper circuitry to use are *plate dissipation* and *amplification factor*. Other tube characteristics, of course, enter the picture but by merely examining these two main features, a triode tube may be easily evaluated for linear amplifier service.

Plate dissipation is important because it determines the maximum power limit that the tube may achieve under a given degree of operating efficiency. Linear amplifier efficiency commonly runs between 50 and 70 per cent with the remainder of the power being lost as plate dissipation. As a rule of thumb, therefore, 50 to 30 per cent of the maximum permissible power input to the tube represents the rated value of maximum plate dissipation. Twisting this idea around, it can be seen that a triode tube having, for example, 450 watts of plate dissipation is probably good for a power input of 900 to 1400 watts, depending upon operating efficiency. Class AB_1 operating efficiency runs close to 60 per cent, class AB_2 efficiency is about the same as class B; in the vicinity of 65 per cent. Thus, knowing the plate dissipation of the tube, we can easily determine approximate maximum power input and power output by first establishing in which class of service the tube is to be operated. It is wise to use "steady state" or single tone condition when making this rough determination of power levels. It is tempting to think that the peak envelope power (p.e.p.) rating may be greater than this level (and it may—!) but this reserve power capability varies between tube types, and can only be determined by experiment at a later stage of the game.

Small transmitting tubes having low values of plate dissipation (3C24, 35T) afford little worth in linear amplifier service as the power capability of these small "bottles" is quite low. The picture changes rapidly as the power capability of the transmitting tube increases, and large triode transmitting tubes having high values of plate dissipation are often quite reasonable in cost and are likely candidates for linear service.

Amplification factor of a triode tube expresses the ratio of change of plate voltage to a given change in grid voltage at some fixed value of plate current. It is determined primarily by the density of the grid structure and the grid-plate spacing of the tube. Amplification factors are expressed in terms of *mu* (μ), and values of μ between 8 and 300 are common for triode transmitting tubes. *High-μ* tubes are those having an amplification factor of 30 or more, *medium-μ* tubes have amplification factors in the range of 10 to 30, and *low-μ* tubes fall in the range of 3 to 10.

Amplification factor for many commonly used transmitting triodes is given in most tube manuals and in the transmitting tube section of *The Radio Amateur's Handbook*. This characteristic may be determined experimentally by operating the tube in a quiescent state at normal plate voltage. A small change in the resting bias is made, thus slightly changing the plate current. The plate current is then returned to the original

*Eitel-McCullough Inc., San Carlos, California.

[1]This discussion deals solely with triode tubes. Similar conclusions may be drawn about tetrode and pentode tubes, but these are not within the scope of this article.

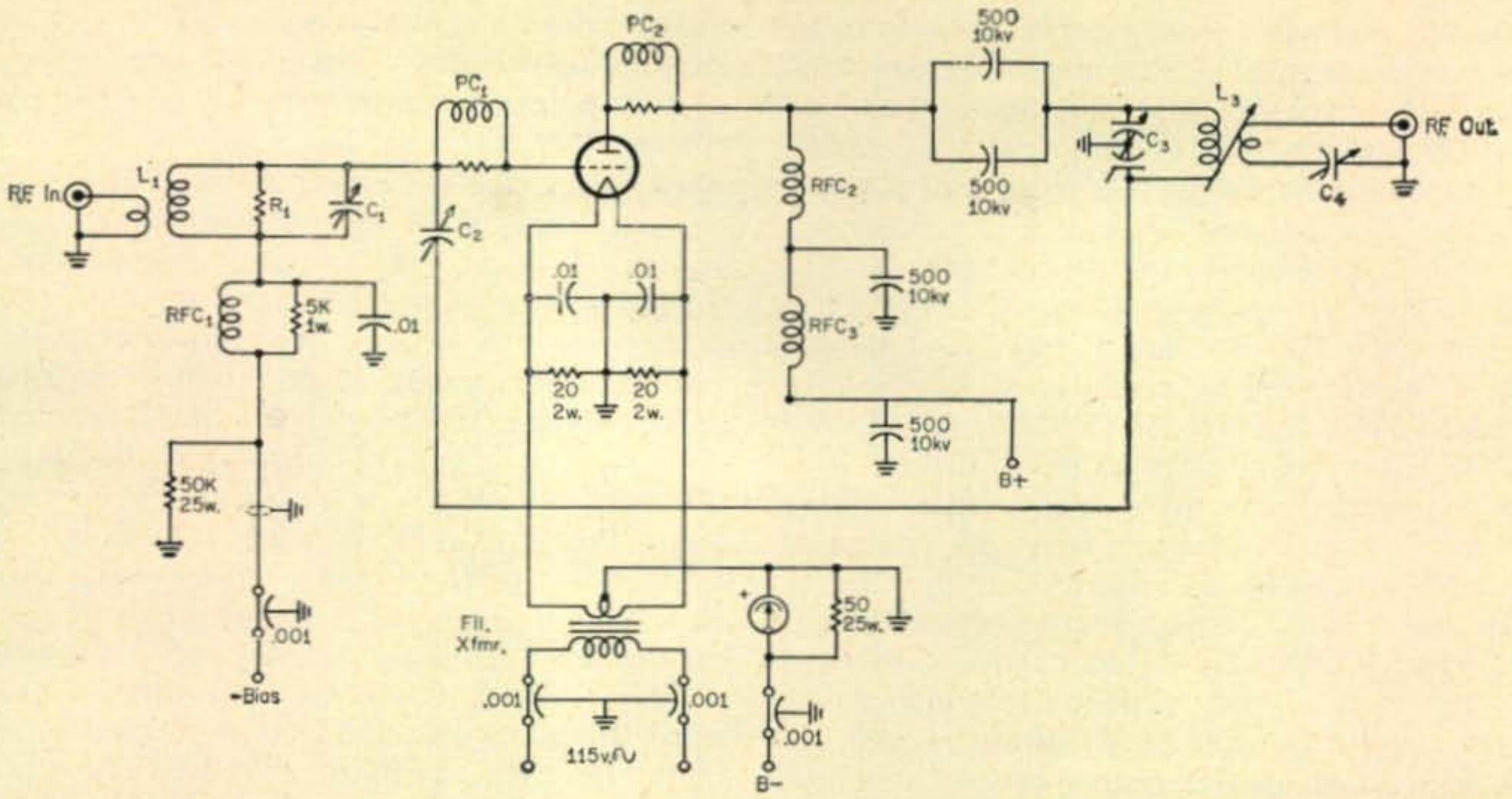


Fig. 1—Typical grid driven, Class AB_1, low mu triode linear amplifier. The 20 ohm, 2 watt composition resistors placed across the filament capacitors are to reduce the Q of bypass resonances.

C_1, L_1—Grid input circuit (Q=15). Ratio of *L* to *C* chosen to match the impedance presented by R_1, the loading resistor.

C_2—Neutralizing capacitor. Capacity equal to approximately twice the grid to plate capacitance. The breakdown voltage is equal to three times the d.c. plate voltage.

C_3, L_3—Plate output circuit (Q=15). Radio of *L* to *C* chosen to match the r.f. load resistance of the amplifier tube. Handbook charts for Class C service may be used provided single tone plate current is used in the formulas.

C_4—Series tuning capacitor for link circuit. Approximately 6 mmf per meter of wavelength. (See chapter 6, A.R.R.L. Handbook.)

PC_1, PC_2—Parasitic suppressors. Two 100 ohm, 2 watt composition resistors in parallel space wound with 5 turns, ½" diameter #16 wire.

RFC_1—2.5 mh. National R-100 or equiv.

RFC_2—High voltage choke B&W #800 or equiv.

RFC_3—V.h.f. choke. Ohmite Z-50 or equiv.

value by making an appropriate change in plate voltage. An amplification factor of 20, for example, means that if the grid potential is changed by one volt, it will take a plate voltage change of about 20 volts to restore the plate current to the original value.

Armed with a knowledge of plate dissipation and amplification factor, an intelligent choice of circuitry may now be made.

Class AB_1, Class AB_2, or Class B Grid Driven Service

These classes of operation are defined by the operating potentials applied to the tube. In general, *any* triode tube in *any* conventional linear amplifier circuit can probably work in *any* of these three modes. Results, however, depend upon circuit design considerations which may be extremely stringent in order to provide a satisfactory degree of linearity for a specific tube in a given circuit. Thus, in order to relax circuit considerations while reaching a desired degree of performance, certain tubes and circuits have been chosen which are widely used in s.s.b. equipments while other tubes and circuits have been cast aside as being economically undesirable.

The Class AB_1 Amplifier is defined as one wherein grid current does not flow over any portion of the operating cycle. That is, grid excitation is held below that value at which the applied *peak* signal level is less than the value of grid bias on the tube. Plate current flows for more than 180 degrees of the r.f. cycle but less than 360°. Once the bias value is exceeded by the driving signal, grid current will flow as the grid is driven positive with respect to the cathode, and the amplifier passes into the *Class* AB_2 operating mode. As the peak driving signal level is increased and the bias reduced to substantially cutoff, plate current flows over half the operating cycle, and the amplifier is now operating in the *Class B* mode. As the grid driving signal increases, passing the amplifier stage through the successive operating modes, the instantaneous plate voltage swing increases, and electrode voltages applied to the tube must be varied to allow optimum circuit efficiency and low distortion in each mode of operation. Good and valid reasons exist for each mode of operation, and while it is tempting to jump to the conclusion that all tubes should be operated Class B mode for highest efficiency and output, such is not the case! Other factors affect the choice of operating mode and in doing so, also affect the circuitry and potentials to be used with a particular tube.

In general, a *low-μ* triode tube is a preferable choice for a Class AB_1 grid driven linear amplifier because it is easier to obtain maximum plate current swing with this type of triode tube be-

cause AB_1 ratings do not permit the tube to be driven into the positive region of operation (fig. 1). A high-μ tube of equal plate dissipation must be driven into the positive grid mode of operation to obtain output comparable to that of a low-μ tube driven just to the point of grid current. Of the many triode tubes, the 304TL and the 211 (VT-4C) are common low-μ types that perform well in Class AB_1 service. Other low-μ triodes that are satisfactory for grid driven linear service are the 75TL, 100TL, 250TL, 806, 450TL and 750TL. Even though large values of driving voltage are needed for these tubes, little driving power is required, as the grid never draws current and only circuit losses require that the driving stage supply power to the linear amplifier in question. High-μ triode tubes are not recommended for class AB_1 service because the grid must be driven into the positive (grid current) region before appreciable power output can be obtained.

The Class AB_2 amplifier is defined as one wherein the grid current is drawn over a portion of the operating cycle, yet the plate current flows for more than 180°. Grid current flows because the existing signal has a peak value greater than the fixed operating bias of the tube, and the grid assumes a positive potential when the peak signal exceeds the fixed bias level. Electrons intercepted from the cathode to plate current flow by the positive grid create the grid current, and the power required to create the necessary positive grid swing is derived from the exciting signal that drives the linear amplifier.

The impedance the grid presents to the input circuit under conditions of grid current is a function of the ratio of instantaneous grid voltage to current which varies in a nonlinear manner. Thus, unless the r.f. power source (the exciter) has extremely good output voltage regulation, and unless the linear amplifier is properly designed to present a fairly constant load to the exciter, waveform distortion will invariably result whenever this class of amplifier loads the exciter during those intervals of the operating cycle when the grid of the tube is driven positive with respect to the cathode.[2] (*The Class B* linear amplifier represents an extension of the Class AB_2 mode, wherein grid driving power requirement is greater and the demand placed on the driving source is even more stringent.)

Class AB_2 grid driven operation of triode tubes should be approached with caution because of this problem, as most radio amateurs do not have the test equipment to properly evaluate and adjust their linear for this mode of operation. It is possible to swamp a portion of the driving signal by means of low value noninductive resistors placed across the grid circuit of the linear amplifier, and by the use of a high-C grid tank circuit achieve the best possible drive-signal regulation. Both of these methods have been used with good results when properly applied.

In most instances, the increase in output power gained from shifting from Class AB_1 to

[2]Orr, Rinaudo, "The Grounded Grid Linear Amplifier," *QST*, August 1961, page 16.

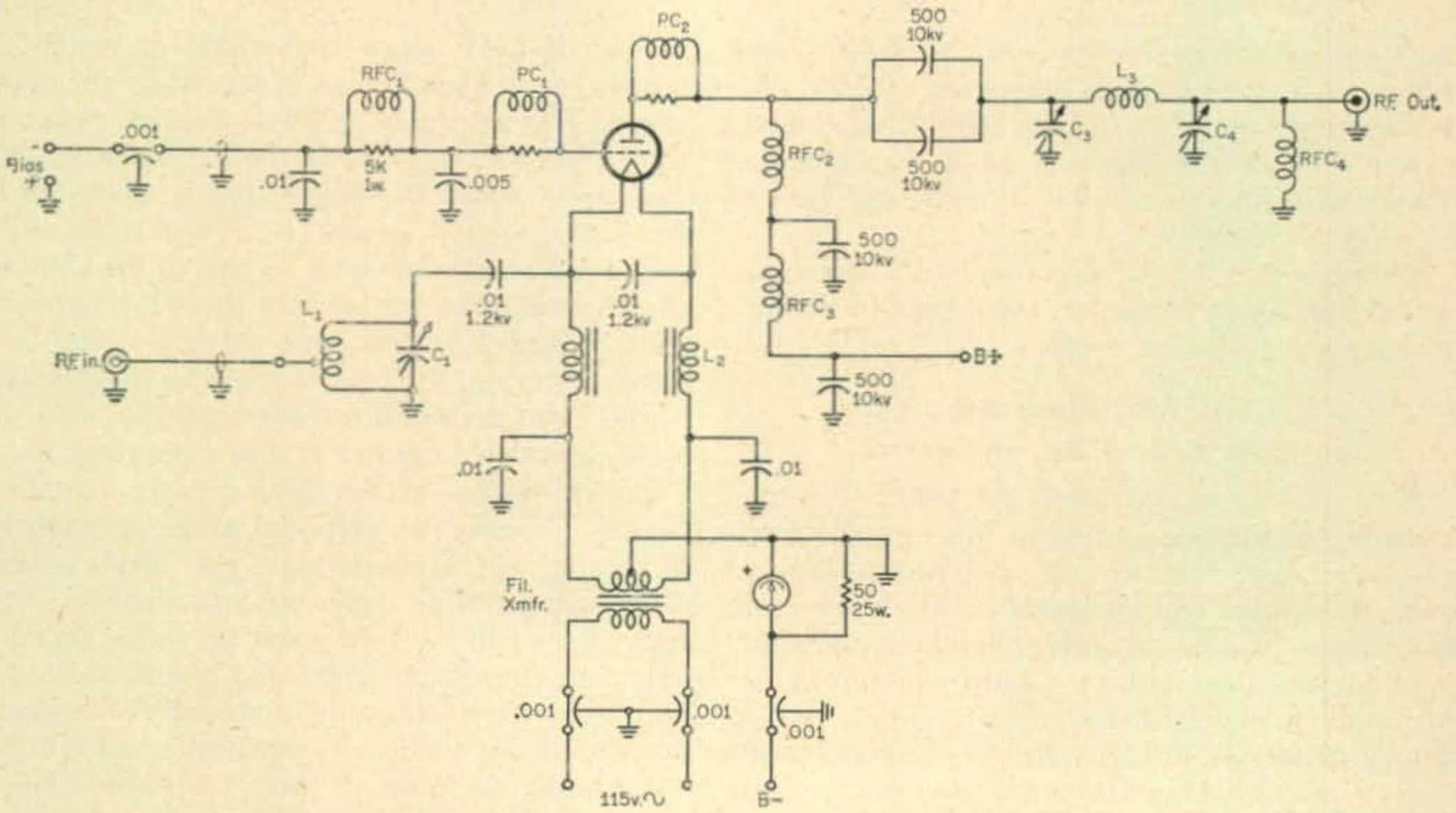


Fig. 2—Typical cathode driven, Class AB_2, high mu triode linear amplifier. Adjust the drive tap on L_1 for minimum s.w.r. on coax line to the exciter. The grid may be grounded for Class B zero bias operation with triodes having a mu of 200 or more.

C_1, L_1—Cathode input circuit (Q greater than 2). Resonates to operating frequency with approximately 20 mmf per meter of wavelength.

C_3, L_3, C_4—Pi-network output circuit (Q=15). Ratio of *L* to *C* chosen to match r.f. load resistance of amplifier tubes. For appropriate charts, see A.R.R.L. Handbook and "Radio Handbook." Use single tone plate current in formulas.

L_2—Filament choke. B&W or equiv.

PC_1, PC_2—Same as in fig. 1.

RFC_1, RFC_2, RFC_3—Same as in fig. 1.

RFC_4—2.5 mh. National R-100 or equiv.

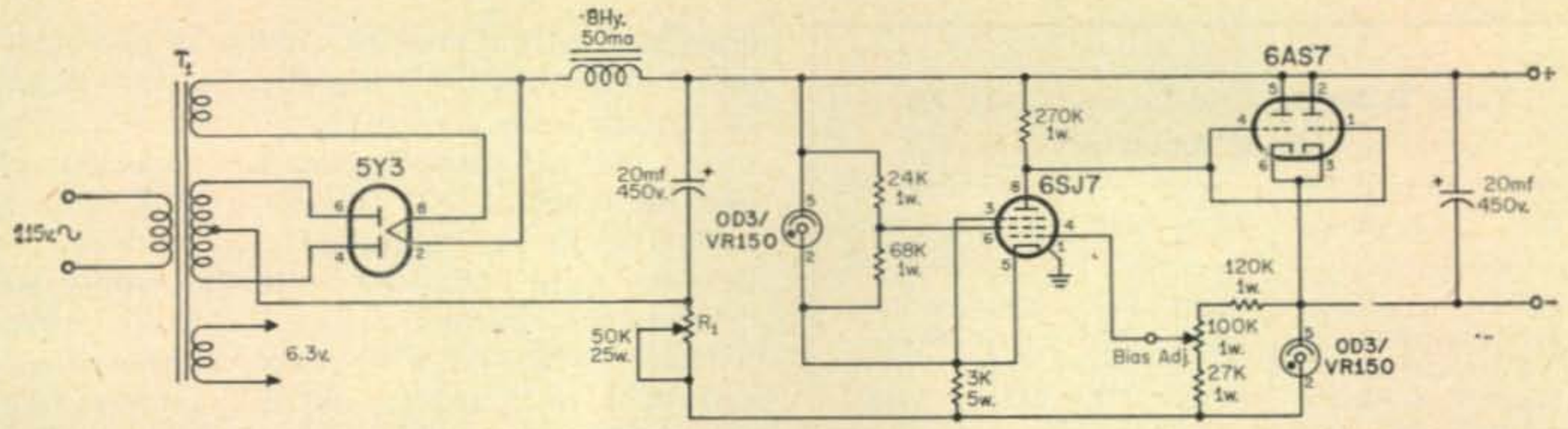


Fig. 3—Circuit of a low voltage regulated bias supply. This simple supply provides a regulated bias voltage variable over the range of —20 to —80 volts. Regulation is 0.001 volt per milliampere. Between —30 and —80 volts, the supply will regulate grid current up to 200 ma. Below —30 volts, maximum grid current is restricted to 100 ma. Transformer T_1 provides 700 v.c.t. at 50 ma and is a Merit P-3160 or equivalent.

Class AB_2 operation may not be justified, and more power output may be gained in an easier fashion by operating two tubes in parallel in the Class AB_1 mode. Driving requirements and bias supply regulation problems are thus simplified. These remarks apply equally well to Class B grid driven linear amplifiers, and their use should also be tempered with caution.

Class AB_2 and Class B Cathode Driven Service

High-μ triode tubes may be used to advantage in cathode driven (so-called grounded grid) linear amplifier circuits (fig. 2). In this mode of operation, the grid is bypassed to ground and normal Class AB_2 or Class B bias is applied to the stage. No bias is necessary, of course, in the case of zero bias tubes, such as the 811A, 3-400Z and 3-1000Z, and the grid of the tube may be grounded directly. A *high-*μ triode tube should be employed for this style of amplifier, and the inherent feedback of the grounded grid stage combined with the use of a tuned cathode input circuit insure a minimum of driver waveform distortion. Use of a high-μ tube is suggested for two reasons: First, the inherent cathode-plate shielding of a high-μ tube is better than that of a comparable low-μ tube; and second, a high-μ tube provides better gain per stage and requires less drive because of less feed-through power. Tubes such as the 811A, 805, 75TH, 100TH, 250TH, 450TH and 6C21 work well in this circuit. Resistive loading of the driving circuit is not required as long as there is sufficient "Q" in the cathode tank because of the constant "feed through" power load on the exciter. For most triode tubes, a tuned input circuit having a resonating capacitance, C_1, of about 20 mmf per meter of wavelength is sufficient.

Low-μ tubes, on the other hand, require extremely large driving signals in the cathode driven mode, and stage gain is extremely small. Thus, the use of these tubes in this particular circuit configuration is not recommended.

In summary, then, triode tubes to be used for linear amplifier service should have a large plate dissipation, and the power output to be expected from the tube will run from approximately once to twice times the rated plate dissipation. Moreover, high-μ triode tubes perform better in cathode driven, Class B circuits. Medium-μ tubes falling in the shadowy region (μ = 20 to 30) usually are easier to get working in cathode driven circuits, as a general rule.

Bias Supplies

Bias supplies for linear amplifier stages that

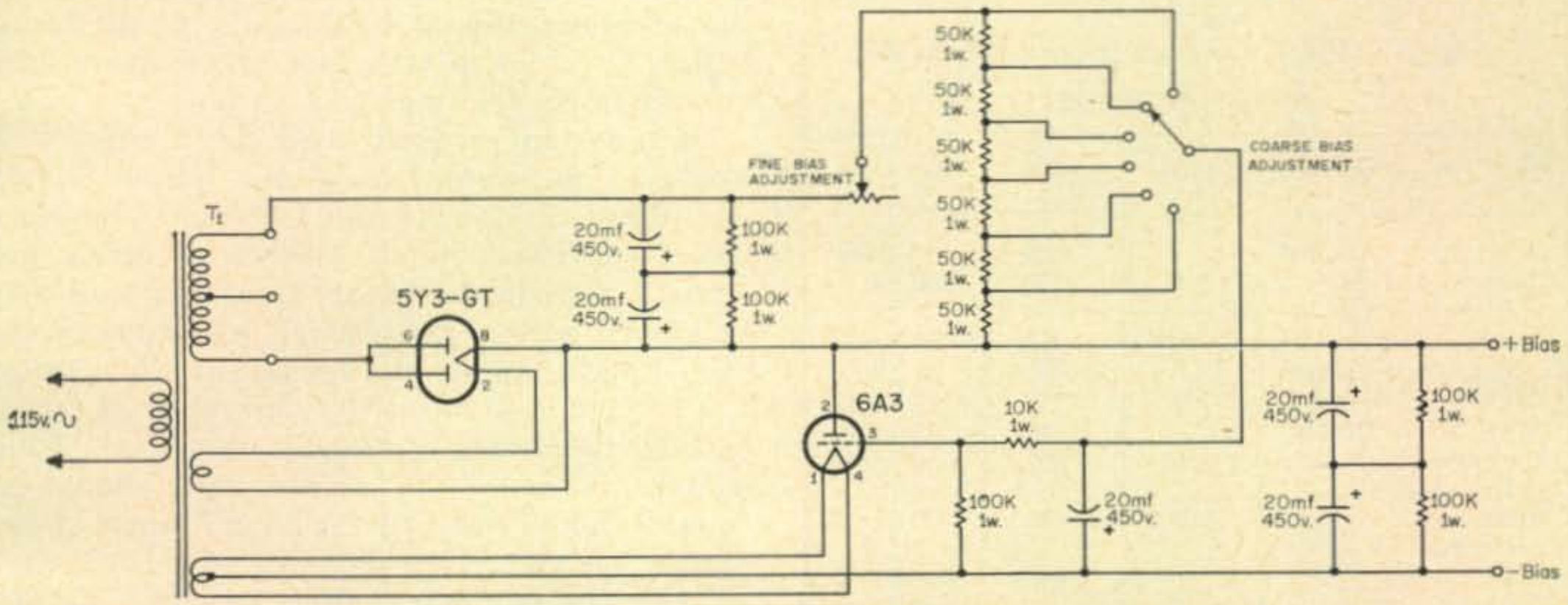


Fig. 4—Circuit of a medium voltage regulated bias supply. This series regulated supply acts as a variable bleeder resistor which automatically adjusts its resistance to a value such that grid current flowing through it will develop a constant voltage across the supply terminals. The tap switch permits rough bias adjustment over the range of about —100 to —600 volts, while the potentiometer permits a fine adjustment to be made. Maximum permissible grid current is about 100 ma in the vicinity of —100 volts, dropping to about 25 ma in the —600 volt region. Transformer T_1 provides 500 v.c.t. at 70 ma and is a Stancor PC-8403 or equivalent. "Fine Bias" control is 50,000 ohms, 5 watt.

Table I—304TL, Grid-Driven, Class AB_1 Linear Amplifier

D.C. Plate Voltage	1500	2000	2500	3000 volts
D.C. Grid Voltage[1]	—118	—170	—230	—290 volts
Zero Signal D.C. Plate Current	135	100	80	65 ma
Single Tone Max. D.C. Plate Current	280	275	245	225 ma
Max. D.C. Input	420	550	615	675 watts
Max. Drive Power	0	0	0	0 watts
Plate Load Impedance	1270	2650	4250	6000 ohms
Max. Output	128	245	305	365 watts

[1]Adjust to give stated zero-signal plate current.

Table II—304TH, Cathode-Driven, Class AB_2 Linear Amplifier

D.C. Plate Voltage	1500	2000	3000 volts
D.C. Grid Voltage[1]	—65	—90	—145 volts
Zero Signal D.C. Plate Current	130	100	75 ma
Single Tone Max. D.C. Plate Current	480	380	320 ma
Max. D.C. Input	720	760	960 watts
Max. Drive Power	70	55	60 watts
Cathode Input Impedance[2]	195	260	385 ohms
Plate Load Impedance	1850	3000	5500 ohms
Max. Output	510	530	715 watts

[1]Adjust to give stated zero-signal plate current.
[2]Fundamental frequency component. High-C, tuned cathode tank should be employed to obtain lowest intermodulation distortion.

Table III—450TH, Cathode-Driven, Class AB_2 Linear Amplifier

D.C. Plate Voltage	1500	3000	4000 volts
D.C. Grid Voltage[1]	0	—50	—85 volts
Zero Signal D.C. Plate Current	50	200	150 ma
Single Tone Max. D.C. Plate Current	400	450	335 ma
Max. D.C. Input	600	1350	1340 watts
Max. Drive Power	70	105	70 watts
Cathode Input Impedance[2]	262	322	350 ohms
Plate Load Impedance	2200	4100	6400 ohms
Max. Output	416	992	1000 watts

Note: 1500 volt operation is zero bias service.
[1]Adjust to give stated zero-signal plate current.
[2]Fundamental frequency component. High-C, tuned cathode tank should be employed to obtain lowest intermodulation distortion.

draw grid current must be capable of good regulation so that the fixed bias does not vary as grid current increases. Shown in fig. 3 is a simple bias supply that will provide a regulated bias variable over the range of —20 to —80 volts. Regulation is 0.001 volt per milliampere of grid current. Between —30 and —80 volts the supply will regulate grid current up to 200 milliamperes. Between —20 and —30 volts, maximum grid current is restricted to 100 milliamperes. The adjustable resistor R_1 is set to produce about 20 milliamperes current through the first regulator tube.

A regulated supply for the —100 to —600 volt range is shown in fig. 4. The tap switch of this supply permits rough bias adjustment over the range, while the potentiometer permits a fine adjustment to be made. Maximum permissible grid current runs from about 100 milliamperes in the vicinity of —100 volts to about 25 milliamperes in the —600 volt region.

Operating Potentials for Linear Service

Once the circuit and class of service have been determined for the particular tube at hand, the proper operating potentials for the tube must be determined. Luckily, much of this data is at hand, although in a disguised form. Most data sheets provide Class AB_1 or AB_2 *audio data,* usually for push-pull operation. As the tube doesn't know if it is being driven by an audio signal or an r.f. signal, this data applies to a significant degree to r.f. linear amplifier service. For a single tube, it is only necessary to divide the indicated currents by two, as the currents are for two tubes. (Actually, only one tube in the push-pull audio service is "working" at one time, but the current meters register currents that are averaged for the two tubes). For example, Table I provides operating data for a 304TL, grid driven, Class AB_1 r.f. linear amplifier, used in the circuit of fig. 1. A plate circuit Q of 15 should be used, and the grid circuit of the amplifier should be high-C (Q of 15 or better) in order to take care of accidental grid current peaks. Normal grid current is zero.

In order to properly load the exciter, it is necessary to swamp the exciter output with a non-inductive load so that the exciter develops nearly full rated output when grid current just starts to flow in the linear stage. The load may be placed across the coaxial line between the exciter and amplifier and consists of a number of 2 watt composition resistors arranged in series-parallel to present a near-52 ohm load. Total wattage rating of the resistor bank should be equal to about one-half the p.e.p. output of the exciter.

Table II provides operating data for a 304TH, cathode driven, Class AB_2 r.f. linear amplifier used in the circuit of fig. 2. At 3000 volts plate potential the 304TH is good for a p.e.p. input close to one kilowatt, and two tubes in parallel can provide the "so-called" two kilowatts p.e.p.

[*Continued on page 105*]

Modifying The R-390A/URR

BY JOHN W. DELL,* WØAXQ

The R-390/URR and R-390A/URR are beginning to find their way into the MARS Program and have shown up in limited quantities on the surplus market. This article outlines modifications for the R-390A to improve reception of s.s.b. and c.w. signals.

MODIFY the R-390A/URR? How can you possibly improve on a receiver that offers such outstanding operational characteristics as rockbound mechanical stability, 0.5 to 32 mc continuous frequency coverage with direct reading Veeder-Root frequency dial, 300 cycle reset accuracy, selectable i.f. bandwidths of 0.1, 1, 2, 4, 8, and 16 kc, built in 2, 4, 8 and 16 kc Collins mechanical filters, adjustable a.v.c. time constants of 0.015, 0.3 and 5 seconds, metered 600 ohm line audio output, *etc.*

With all of these fine features, the receiver does not offer the optimum for reception of s.s.b. signals. It can do an acceptable job; however, use of the a.m. detector for s.s.b./c.w. limits receiver performance in these operating modes. For military s.s.b. applications, the R-390A employs a companion s.s.b. converter having 44 tubes (CV-157).

At first, any thoughts concerning modification of such a well designed and functional receiver were rejected. It was only after many hours of riding the gain on SSB roundtables that the decision was made to install a product detector. At the same time this modification was undertaken, an IF noise limiter was installed and provisions made to accommodate a Q multiplier.

Product Detector

The 7360 product detector used in fig. 1 is an adaptation of a previously published circuit[1] Study revealed that no major chassis rework or circuit changes would be required to mount the new detector in the i.f. sub-chassis. First, the RT-150 current regulator tube was relocated between tubes V_{502} and V_{506}. The 7360 was installed in the original current regulator tube socket. This location was ideal both from the standpoint of wiring and isolation of the b.f.o. from the i.f. string. A hole is then drilled in the i.f. sub-chassis front panel to accommodate the mode selection switch S_1, a 5 pole, 3 position, two wafer, miniature steatite switch. This hole was drilled midway between and ¾ of an inch below the bandwidth and b.f.o. control shafts.

It was decided not to extend the shaft of S_1 through the receiver front panel. Easy access to the switch can be gained by reaching over the top of the receiver. If the receiver is enclosed, it will be necessary to provide for front panel control. Switch S_1 operating positions include A.M., S.S.B./C.W. and S.S.B./C.W.-N.L. Variable capacitor C_5 was mounted beneath C_{538} on the left side of the sub-chassis and to the front of the b.f.o. unit. Mounting and adjusting holes were drilled in the sub-chassis. The deflection balance potentiometer, R_6, was located on the underside of the sub-chassis and directly beneath S_1. This location permits ease of access for adjustments. Control R_6 should be as small as possible due to the limited space available. Components C_1, C_2, C_3, C_9, L_{502}, R_1, R_4, R_5, R_7, R_8, R_{10} and R_{11} are mounted on S_1. Without this extra mounting aid, it would be almost impossible to properly install and secure all components. Care must be taken to insure proper layout and dressing of components and circuits. Space is very limited and care should be taken in the layout to prevent shorting of components. High voltage for the 7360 was taken from the r.f.-i.f. switched B plus line at the junction of R_{525} and R_{551}.

Adjustment

Adjustment is accomplished by setting C_5 to give a maximum of 10 volts r.f. peak-to-peak

15 Crescent Lane, Colorado Springs, Colorado, 80904.

[1]Vance, H. C., "S. S. B. Exciter Circuits Using a New Beam Deflection Tube", *QST*, March, 1960, p. 33. Filipczak, J. M., "Using The 7360 in The HBR-16", QST, Dec., 1960, p. 36.

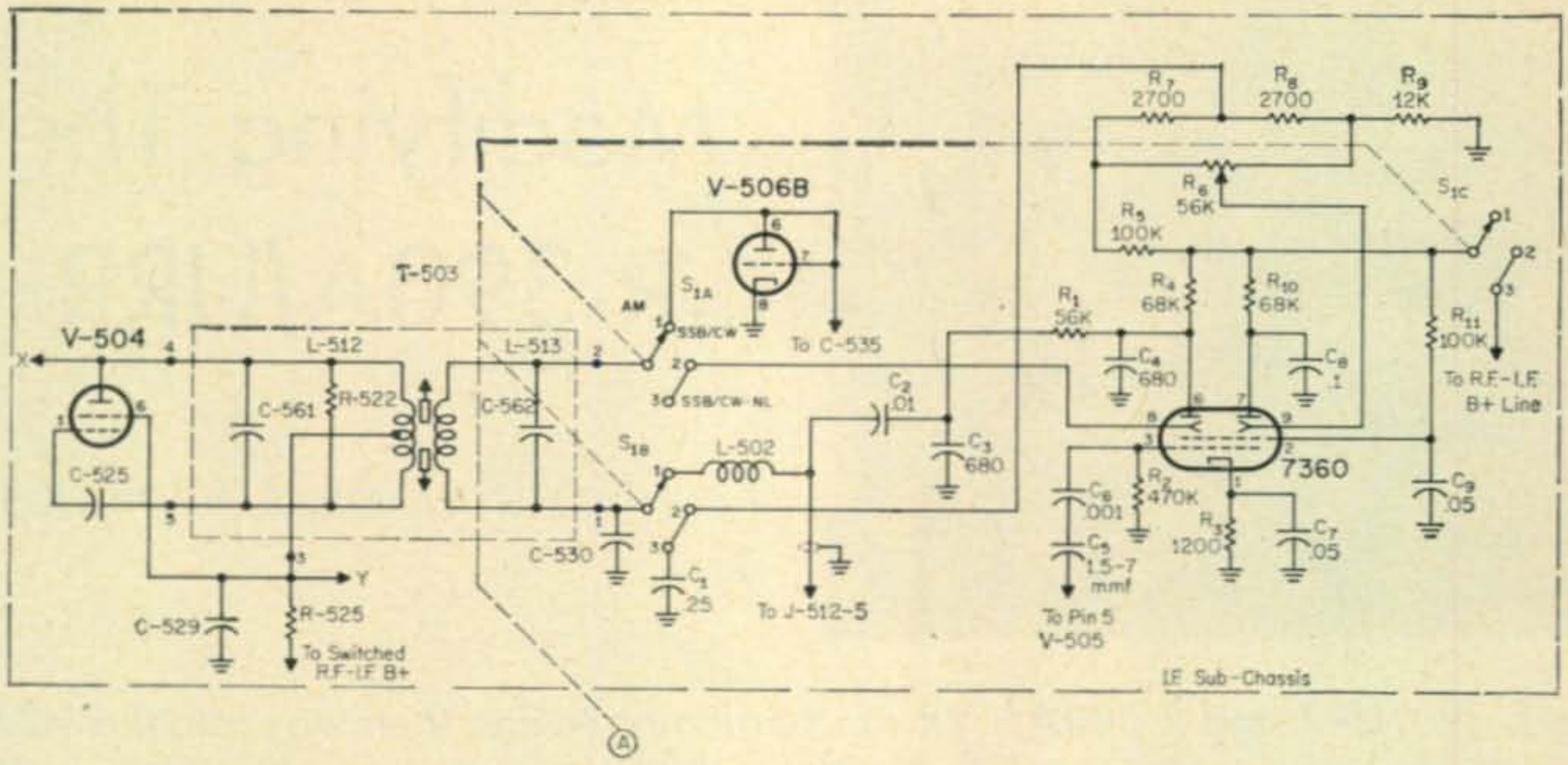


Fig. 1—Circuit of the product detector added to the R-390A/URR receiver for improved s.s.b. and c.w. reception.

(3.5 volts r.f. r.m.s.) to No. 1 grid of the 7360. Setting of balance control R_6 should be made for minimum audio output with S_1 in the S.S.B./C.W. position and the b.f.o. off. Signals from a commercial broadcasting station can be used for this adjustment. Transformer T_{503} should be touched up for best reception with the product detector switched into the circuit.

Receiver a.v.c. operation remains satisfactory when the product detector is in use. Best action is obtained in the MEDIUM A.V.C. positions. It was not considered necessary or worthwhile to modify the receiver a.v.c. circuit for s.s.b./c.w. operation.

I.F. Noise Limiter

Receiver noise limiter operating parameters are upset when the product detector is employed. This problem was solved by installing the i.f. noise limiter shown in fig. 2.[2]

There was not sufficient space for installation of all the i.f. noise limiter components in the i.f. sub-chassis. Components were installed in a small i.f. can and mounted on the left side of the receiver above the receiver bandwidth switch shaft. Five pieces of mini-coax cables were run between the limiter i.f. can and the i.f. sub-chassis. A hole was drilled in the sub-chassis just above the b.f.o. shaft to accommodate these cables. Connections are made as shown in the drawing with each of the individual coax shields tied together and grounded. Precaution must be exercised to prevent the coax shields from shorting out components under the sub-chassis.

The limiter is activated when S_1 is switched to the S.S.B./C.W.-N.L. position. Potentiometer R_{20} is adjusted to give the desired degree of limiting. Readjustment of the control should not be necessary once the position is found that gives the desired degree of limiting action. Touch-up of T_{503} should be accomplished.

Q-Multiplier

The capability to notch out annoying heterodyne carriers is considered a worthwhile addition to any receiver. A connector was installed at the rear of the receiver to accommodate a Heath Q-multiplier. Taps were made to provide necessary operating voltages (150 v. d.c. regulated and 6.3 v. a.c. filament supply). The coaxial lead between the 50 ohm IF output connector and R_{552} was removed and a new length of coax was installed between pin 5 of V_{502} and the 50 ohm output. Connection of the Q-multiplier coaxial connector is made at this point. Realignment of T_{501} is necessary.

Conclusions

Installation of these modifications has made the R-390A a top-notch s.s.b./c.w. receiver. The operational advantages gained by incorporation of these changes far outweighs the time and effort required for their accomplishment. One word of advice, take time to plan component layouts before beginning any wiring. For further information, send a stamped self-addressed envelope in care of the author at the above address. ■

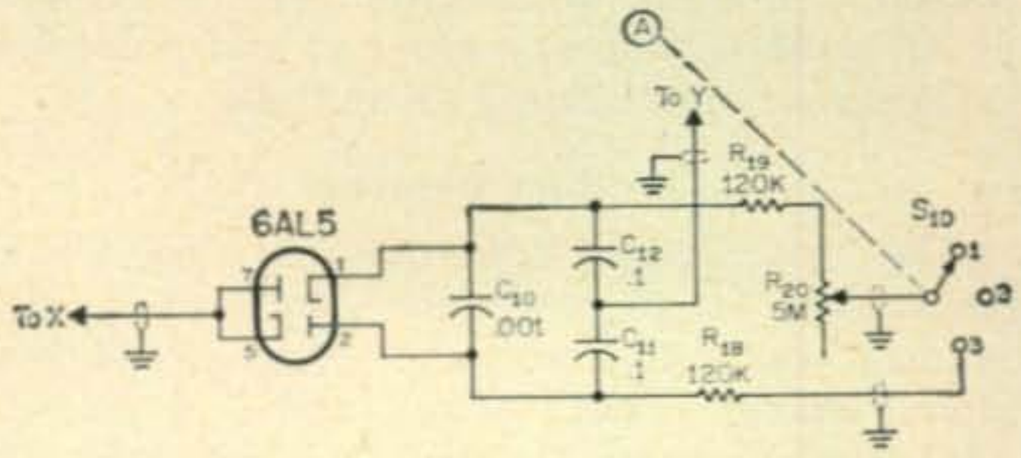


Fig. 2—Circuit of the i.f. noise limiter added to the receiver as described in the text. Switch section S_{1D} is part of the switch S_1 shown in fig. 1.

[2]Stiles, W. J., "I. F. Noise Limiter", *QST*, June, 1960, p. 16.

Results of the

Summer, 1964 CQ *V.H.F. Contest*

BY BOB BROWN,* K2ZSQ

Murray Lesser, WB2CYL, of Brooklyn, New York, took the New York State certificate for his 144 mc work in the August contest.

SOMEONE must have put their curse on our August contest. For the second straight year enthusiastic v.h.f. men found themselves with absolutely no help from either Mother Nature or George Jacobs. The most exciting thing noted in this respect was one lonely comment from a 50 mc participant who experienced "good ground wave." The rest of us searched in vain for even half-way decent tropo conditions, just a wee smattering of Sporadic-*E*, or maybe aurora. But alas, no such luck. And to add insult to injury, most of the country was wet with rain that weekend, making mountain-topping a bit uncomfortable.

Another regrettable incident was that the 50th Anniversary ARRL Convention was in full swing on the same weekend as our beloved contest, taking its toll from our East Coast returns.

One good thing came out of all this, however. For perhaps the first time, stations were competing more or less on the same scale everywhere in the country. The activity in the East was lower than normal, leveling the scores considerably. Although the certificates are awarded on a statewide, rather than countrywide basis, who can help but take notice of outstanding work in other areas?

Fundamentally, our August contest is one directed solely at the individual operator. No club scores are accepted in this competition, making it a station-against-station fight to the finish. No relief operators are permitted during the 24 hours either.

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, L. I., N.Y.

High Scorers

In spite of the adverse conditions prevailing on the weekend of August 22-23, the 50 mc crew worked harder than ever for top honors. Of all six meter contestants, the highest overall score was turned in by Al Goodman, K3DUW/3, who racked up a mighty 494,304 points, closely followed by Harry Brandt, K3LOM, with his 488,808. Both scores, by the way, were well over last year's record of 458,880 set by WA8EHI/8. Gear at K3DUW consists of his homebrew "Six Appeal," a 250 watt final using push-pull 4-65A's driven by a G-50 and a 6 element Telrex up 100 feet.

Other outstanding work done on 50 mc can be credited to K8UQA who compiled the largest county total ever recorded in our Summer contests: 79. Closely following was WA2UCE/2 with 78 counties.

Switching over now to two meters, we find Mike Brown, W8DJY, of Middletown, Ohio, walking away with all the honors. Mike accumulated the nation's highest point total: 318,000, the nation's highest contact total: 166, *and* the country's highest county total: 75! Still more outstanding is the fact that this is the first time W8DJY ever entered a v.h.f. contest . . .

Notes and Comments

K4BEI—Operation was from Cheaha Mountain in Cleburne County, the highest point in Alabama. All on emergency power including electric skillet for breakfast . . . *W4UAR*—Weather conditions very bad in this area;

Here's Mike Brown, W8DJY, who not only won the Ohio State certificate but also had the highest overall score in the 144 mc competition: 318,600.

low, overcast, raining . . . *K1PVT*—Was a great contest, but no band opening. I was really hoping for one . . . *WA9FIH*—Most unusual QSO was with WA9KAY/9 walkie-talkie mobile about three blocks away running about 100 mw . . . *K1OYB*—Too few stations can tune s.s.b., so I decided not to run the sideband rig—too frustrating . . . *WA8CDF*—Band was lousy because of storm in area and also lack of activity on band . . . *K3YJE*—Not enough local stations on but good conditions into Pa., Del., and N.J. made the contest a lot of fun. Looking forward to the next one . . . *WAØIKI*—Band was really dead. No Sporadic-*E* openings and ground wave was poor. Had to concentrate on prime evening hours . . . *WA2UZI/2*—Suggest changing the spacings on logsheets so they match standard spacing on a typewriter. Otherwise, no complaints . . . *K6UMV/6*—Was on only one hour when I had a neighbor complain of TVI. Had to quit till after the Late, Late Show at midnight. Then at 10 A.M. more reports of TVI. More TVI than QSO's . . . *K9GHR*—New QTH on hill helped in the contest. Should have an 11 element (at least) Quad up over 50 feet for the next contest . . . *WA9ASZ*—Good contest! Let's have more of them! . . *WA4DKR/4*—Operating portable from same 950' elevation as last year, but much better results this time . . . *K1TOL*—Anybody have a noise limiter to cut down my S5 noise level? Heard through Squire, W1WHL, that Del., Pa., and N.J. boys were hearing me very well, but I could just barely hear their carriers. Picked up five new counties, making it 400 on six meters for me now . . . *K1PLX/1*—Too bad everyone was at the Convention in the NYC area . . .

The highest score recorded in this contest was accumulated by K3DUW/3, Al Goodman. With a ground elevation of 1000 feet coupled with a 250 watt final and 6 element Telrex, Al took the Pennsylvania State award on 50 mc with his 494,304 points.

Number groups after call letters denote the following: number of contacts, number of counties, hour multiplier, and final score. Note: Since many contestants took advantage of the 1.25 power multiplier, simple multiplication of the number groups shown will not always result in final score presented here.

50 Mc Scores

Alabama

K4BEI/4	116	48	19	103,588
W4UAR	11	6	7	588

California

WA6WTD	74	6	19	10,170
K6UMV/6	41	4	11	2255
WB6DZW/6	10	5	6	300

Connecticut

K1PVT	80	38	17	64,600

Delaware

K3UHU	81	35	11	38,981

Georgia

WA4MQE	47	20	14	13,160

Meet Dick Mitterlehner, WN2KHD, who walked away with this year's first place Novice certificate as well as second place honors in New Jersey.

Illinois

K9GHR	123	19	24	70,110
K9DWR	124	17	24	63,240
WA9FIH	84	7	18	13,230
W9EET	51	8	12	6120

Indiana

K9DZK/9	73	29	17	44,986
WA9ASZ	81	18	21	38,273
WA9JKT	89	7	15	11,681
WA9CJS	24	10	10	3000

Iowa

WAØCVA	32	16	13	8320

Kentucky

WA4DKR/4	126	52	24	196,560
WA4SKP	67	16	17	18,224

Maine

K1TOL	75	34	13	41,438
K1OYB	12	6	5	450

Maryland

K3YJE	54	14	14	13,230

Massachusetts

K1PLX/1	181	55	23	286,209
K1YLU/1	144	42	13	78,624
K1OHE/1	157	32	13	65,312
K1MIM	84	24	10	20,160
K1JQQ	69	17	15	17,595

Michigan

W8HJR	100	27	21	56,700
WA8CDF	84	32	18	48,384
WA8JWD	48	18	19	20,520

One of the "big five" (stations submitting scores in excess of 400,000 points) is Don King, WA2UZI, who easily snagged the first place New Jersey award on 50 mc. Note the 500 watt p.e.p. linear at the far right.

WA9ETE	25	6	17	2550
K9DIB	37	6	8	1776
K9SRI	16	6	9	864
W9OOX/9	21	3	7	551
W9CEK	21	6	4	504
W8BDV	52	12	19	11,856

Minnesota

WØTRP	72	11	24	19,008
KØPWR	58	10	21	15,225
WAØCCK	50	9	15	8438

Missouri

WAØIKI	35	9	16	6300

New Hampshire

K1NTS/1	16	11	4	880

New Jersey

WA2UZI/2	267	68	24	435,744
WB2KLH	164	69	24	271,584
WB2JGO	138	37	24	122,544
WA2HFI	113	53	14	83,846
WB2LGJ	73	27	17	41,884
WN2KQD	15	7	7	919

New York

WA2UCE/2	216	78	24	404,352
WAZBAH/2	162	61	24	296,460
WA2NZA	121	38	24	137,940
WB2DZZ	96	26	24	74,880
WA2PMW	120	34	12	48,960
WA2WVW	108	34	12	44,064
WB2GQZ	69	25	9	19,406
WB2IPX	23	7	12	2415
WB2NZL	6	5	4	120

North Carolina

WA4BBY/4	84	46	13	67,620

Ohio

K8UQA	246	79	24	466,416
W8KKF	136	50	24	204,000
WA8NIL	110	33	24	109,100
WA8CJJ	47	23	15	20,268
W8JRN	55	27	13	19,305
W8EWP	3	1	3	11

Pennsylvania

K3DUW/3	271	76	24	494,304
K3LOM	279	73	24	488,808
K3LNJ	146	44	24	192,744
K3JGU	148	38	24	168,720
W3JMP/3	128	52	19	126,464
K3IPM	104	51	10	53,040
K3VTP	84	20	17	35,700
K3ZAS	58	19	24	26,448
W3ETB	60	25	11	20,625
K3YQN	28	10	1	3500
WB2AXW/3	12	5	1	75

Tennessee

K4EJQ	87	44	23	110,055

Texas

K5MLD/5	85	10	24	25,500
K5IVB	84	12	17	21,418
WA5FYF	81	6	20	12,150

[*Continued on page 104*]

One of our most avid "younger" readers is the daughter of John Attaway, K4IIF, Frances Marie. By the way, Frances Marie is two years old.

PEOPLE AND PLACES

WAØGBQ—Gillette State Hospital for Crippled Children, St. Paul, Minn., has its own amateur radio station thanks to three Minneapolis-St. Paul area men, Sperry Rand Corporation's UNIVAC Defense Systems Division, St. Paul, and the Paul Light Christmas Fund of the St. Paul Pioneer Press. WAØGBQ, a 200-watt station went on the air for the first time November 2, 1964. Gillette patients have been using radio equipment donated by UNIVAC, the Light Fund and various Twin City hams for two years. Ray Maurstad, seated at the station's console, and H. A. "Mick" Alsop, standing right, both UNIVAC employees, are two of the three men who have voluntarily taught radio and electronic classes to patients every Monday night for two years. George J. Selin is the third volunteer. Miss Jean Conklin, Gillette superintendent, standing center, looks on at opening night ceremonies with great interest. "This is something we have dreamed about for five years," she said.

This photo was taken at the RSGN exhibition in London last October. The RSGB received permission from the G.P.O. for all amateurs attending the exposition to operate the station (GB3RS). Operating GB3RS is Chet Lambert, W4WDR, standing l. to r.: Jeff Stone, G3FZL, Pres. of RSGB, and John Boyce, G4NI, a member. Logging for Chet is Ron Vaughn, G3FRV, Sec.

Father Ralph Bastion, K9LED, Trav Marshall, (Hallicrafters), K9EBE, and Domenico Petti, HV1CN are shown at the operating position of HV1CN, the amateur radio station at the Vatican.

A Test Unit For The T-23/ARC-5

BY BYRON E. FORTNER*, W9FYM

For the past several years, articles have been written about the T-23/ARC-5 v.h.f. transmitter and present articles attest to the popularity of this fine transmitter on the two and six meter bands.

At the present time, nothing has been said or nothing is known of the test unit that was originally designed to tune up the T-23/ARC-5 transmitter. The author is the fortunate possessor of the test unit and it is the purpose of this article to describe it and show that it can be duplicated very easily.

The test unit is known as the U.S. Army Signal Corps Test Unit I-155-A and was built by Western-Electric. It consists of an 0-1 ma meter with a function switch and appropriate resistors to bring the meter in the proper range for the circuit being tested. A tuning stick is included in a compartment with a sliding cover on one end of the case. The case measures 7" long, 4" wide, and 2" deep.

On the bottom of the unit will be found a set of readings for the BC-950-A transmitter and they are as follows:

Switch Position	*Function*	*Operating Range*
1	Osc. Grid Current	4-70
2	1st. H-G Grid Current	25-90
3	2nd. H-G Grid Current	25-90
4	R-F Amp. Grid Current	20-80
5	R-F Amp. Cath. Current	40-55
6	Heater Voltage	54
7	Plate Voltage	53-55

Nothing is known of the BC-950-A transmitter and since the test unit was designed to be used with the T-23/ARC-5 also, it is assumed that the same readings can also be used. The author tuned for maximum in positions 1, 2, 3, and 4. Position 5 was used to tune the final, tuning for a dip in reading with the R.F. AMP. TUNING on the transmitter and for increase in readings with the ANTENNA COUPLING. Later a set of readings will be given as used with a transmitter in this locality.

Figure 1 shows the schematic of the test unit. The color coding of the cable is shown. However, in a homebrew unit the color coding need not be followed. The connections to the female plug PL-152 are shown with the outside of the plug facing the viewer.

Figure 2 gives the location of the test unit in each position of the test switch. Switch position 1 finds the meter located in the grid circuit of the 1625 oscillator and shunted across R_{302}.

In switch position 2 the meter is in the grid circuit of the 1625, the first harmonic generator, shunted across R_{305}. In position 3 the meter is in the grid circuit of the 832 second harmonic generator, shunted across R_{310}. For position 4 the meter is now in the grid circuit of the 832 final amplifier, shunted across R_{314}. However, in position 5 the polarity of the meter is reversed and is now in the cathode of the 832 final amplifier. It is shunted across R_{315} and C_{321}.

For switch position 6 the meter is reading filament voltage. The T-23/ARC-5 used here has the negative side of the filament voltage grounded. If, in some installations, the positive side is grounded, the meter will not read. Reversing the leads within the test unit for position 6 should correct the problem. Position 7 the meter reads the plate voltage.

This takes care of the Test Unit I-155-A and a study of the diagrams will show that the unit

U. S. Army Signal Corps Test Unit 1-155-A with tuning stick.

*R.F.D. 10, Box 486 Indianapolis 19, Indiana.

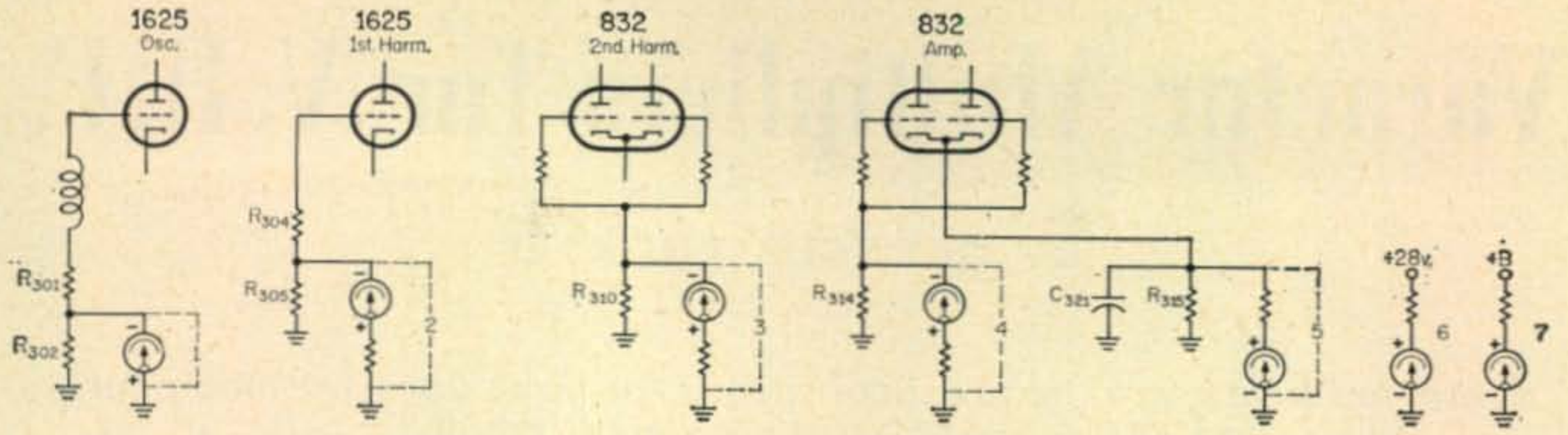
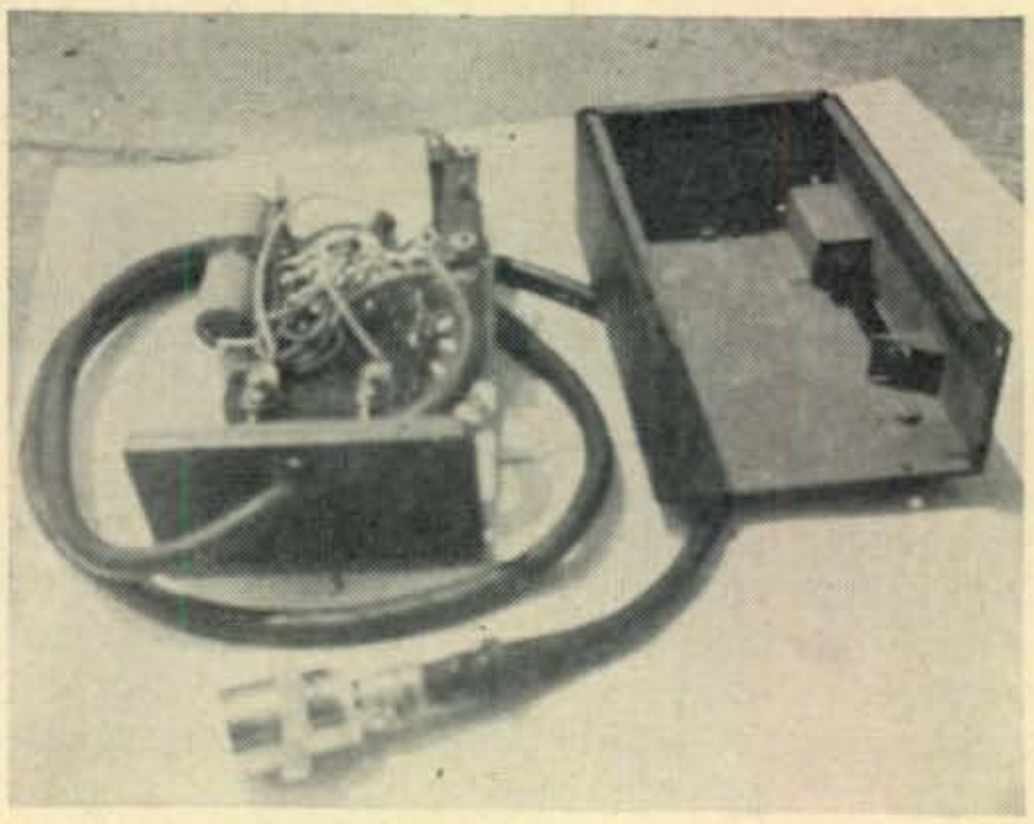


Fig. 2—Test points on the T-23/ARC-5. Numbers correspond to test switch positions.

is quite simple. For those who plan to build a homebrew unit; it is felt that precision resistors are not needed although, if available, should be used. The main thing to remember is that the readings are relative and will vary according to the transmitter and activity of the crystal used. Tune the grid circuits for maximum readings and use the cathode current position (5) for tuning and loading the final.

The following set of readings are those that were found on the T-23/ARC-5 transmitter tuned to 145.3 mc. at the QTH of KN9WEI.

Sw. Pos.	*Rdg.*	*Sw. Pos.*	*Rdg.*
1	15	5	59
2	56	6	46
3	47	7	40
4	16		



The inside of the test unit.

Plate voltage on the 1st. 1625 .....400V
Plate voltage on the 2nd. 1625 .....400V
Plate voltage on the 1st. 832 .....390V
Plate voltage on the Final 832 .....410V

Test unit in conjunction with the T-23/ARC-5.

■

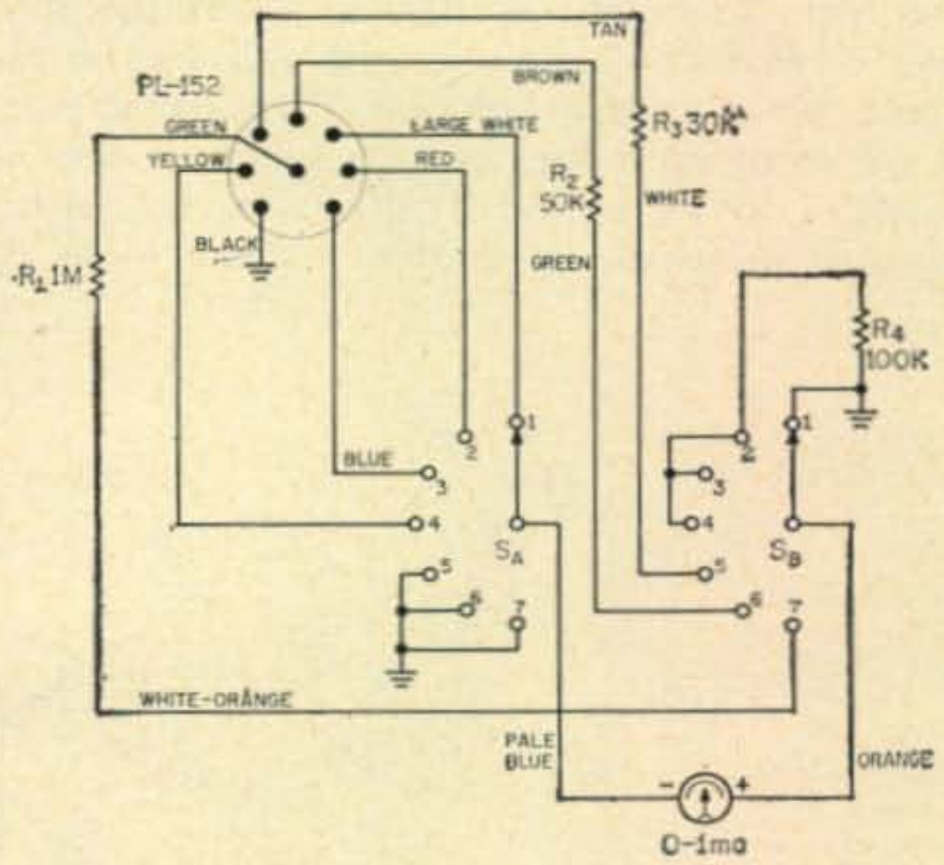


Fig. 1—Circuit of the test unit showing connections to PL-152 plug. The 1 meg resistor consists of four 250K ½ watt units. All other resistors are 1 watt 1%. The meter has an internal resistance of 150 ohms and is equivalent to a Weston 301.

A new "Surplus Conversion Handbook" is now available from Cowan Publishing Corp. This new book is 50 pages larger than the old "Command Sets" and includes most of the popular Command Set articles in addition to other conversion features. Order your copy soon.

Varactor Multipliers for V.H.F.

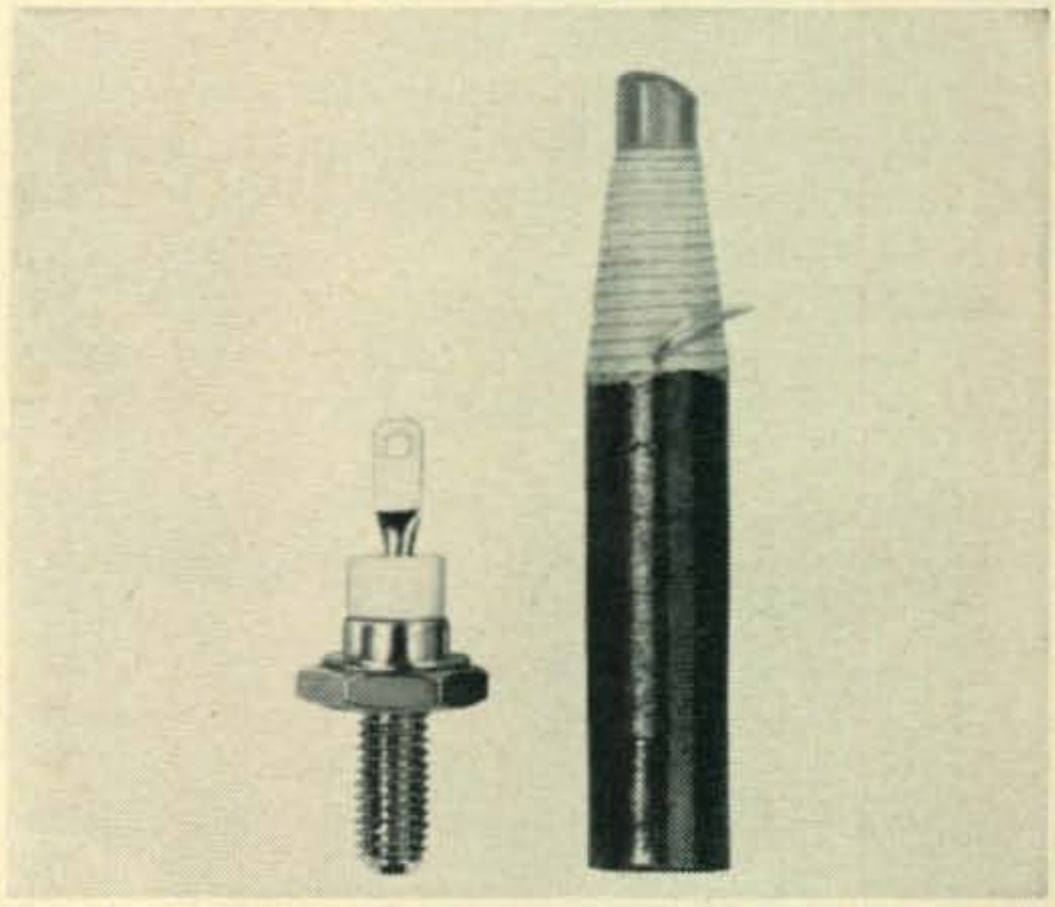
BY DARRELL THORPE*

Presented below are the practical circuits for three varactor multipliers, a doubler for 144 mc output, a tripler for 144 mc output and a doubler for 420 mc output. Also included is a clear presentation of the theory of operation.

THE varactor diode offers a new means for the v.h.f. enthusiast to conveniently "band hop." The varactor diode, when combined with appropriate frequency selective elements, is a very efficient generator of harmonic frequencies especially in the v.h.f. and beyond frequency spectrum. Efficiencies from 50 to 90%, depending upon device, frequency and number of times multiplied, are achievable from varactor multiplier circuits. Besides being efficient, a varactor circuit has the additional advantage of not requiring a d.c. power supply. The only required power source is the r.f. signal to be multiplied from either an a.m. or c.w. (s.s.b. doesn't work) transmitter.

How They Work

A varactor diode is basically nothing more than a device which uses the inherent capacitance across a p-n junction. This capacitance, as we shall later see, can be made to vary in response to an applied voltage or the instantaneous value of an applied signal. Most p-n junctions (rectifiers, detectors and zener diodes) exhibit this voltage-variable capacitor characteristic, however, the varactor diode is subjected to manufacturing processes which have been designed to enhance this characteristic.



A varactor shown for size in relationship to a china marking pencil.

When a p-type material and an n-type material are joined as shown in fig. 1, the positive ions which are fixed in the structure of the n-type material repels the "holes", which are mobile in the p-type material, away from the junction. Likewise, the negative ions in the p-type material repel the electrons in the n-type material away from the vicinity of the junction. Thus, the region near the junction is depleted of free carriers and is termed the *depletion layer*. The electric field between the opposing ions behaves as though it were a battery which is illustrated as the contact potential. This structure acts like a charged capacitor with the depletion layer representing the dielectric and the boundaries of the current carriers appear as the two plates of a capacitor.

If an external voltage is connected across this p-n junction so as to reinforce the contact potential (reverse bias), the depletion layer becomes larger because the carriers are forced father away from the junction and the capacitance across the junction decreases (fig. 2). If a small forward voltage is applied, the depletion

*POB 955, Phoenix 1, Arizona.

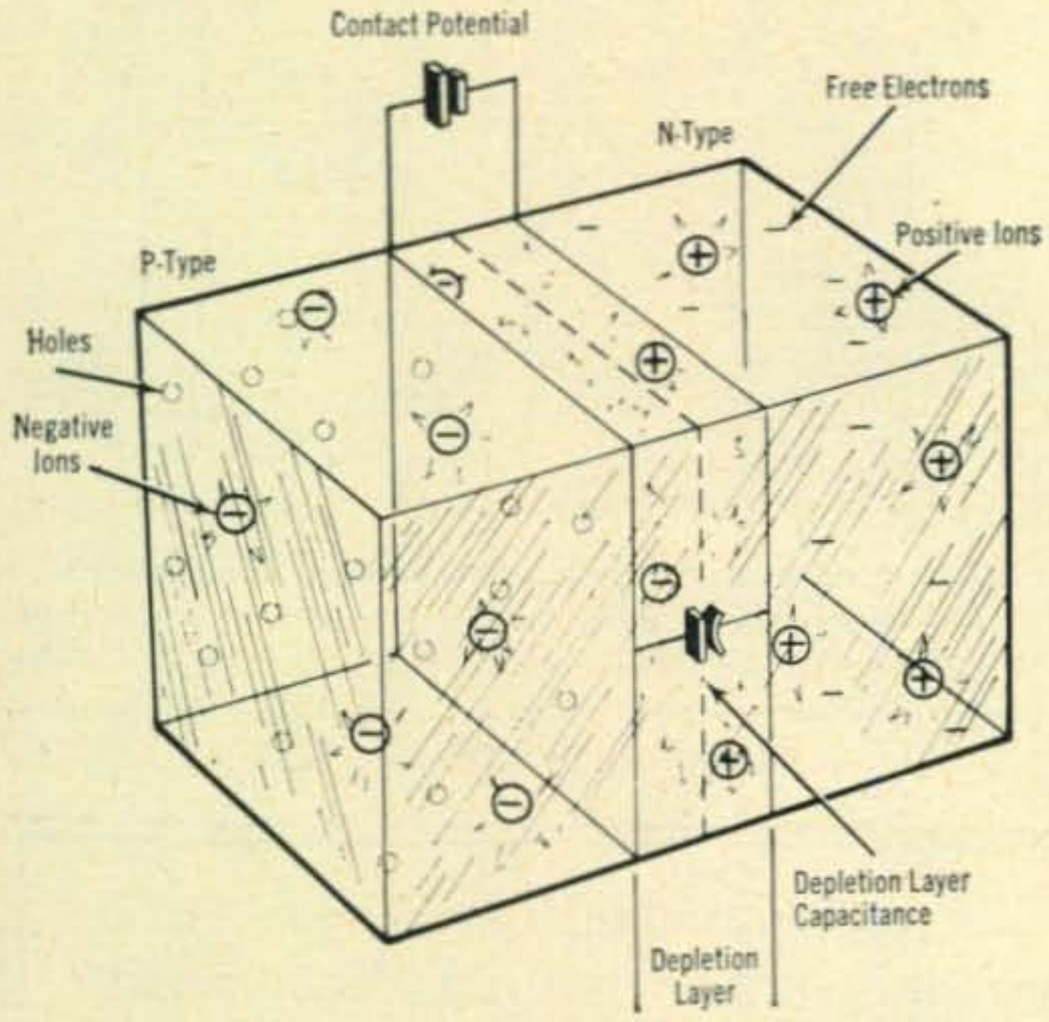


Fig. 1—A representative p-n junction. The battery represents the contact potential which must be overcome before current can flow. Current carriers act as capacitor plates and the depletion layer is the dielectric.

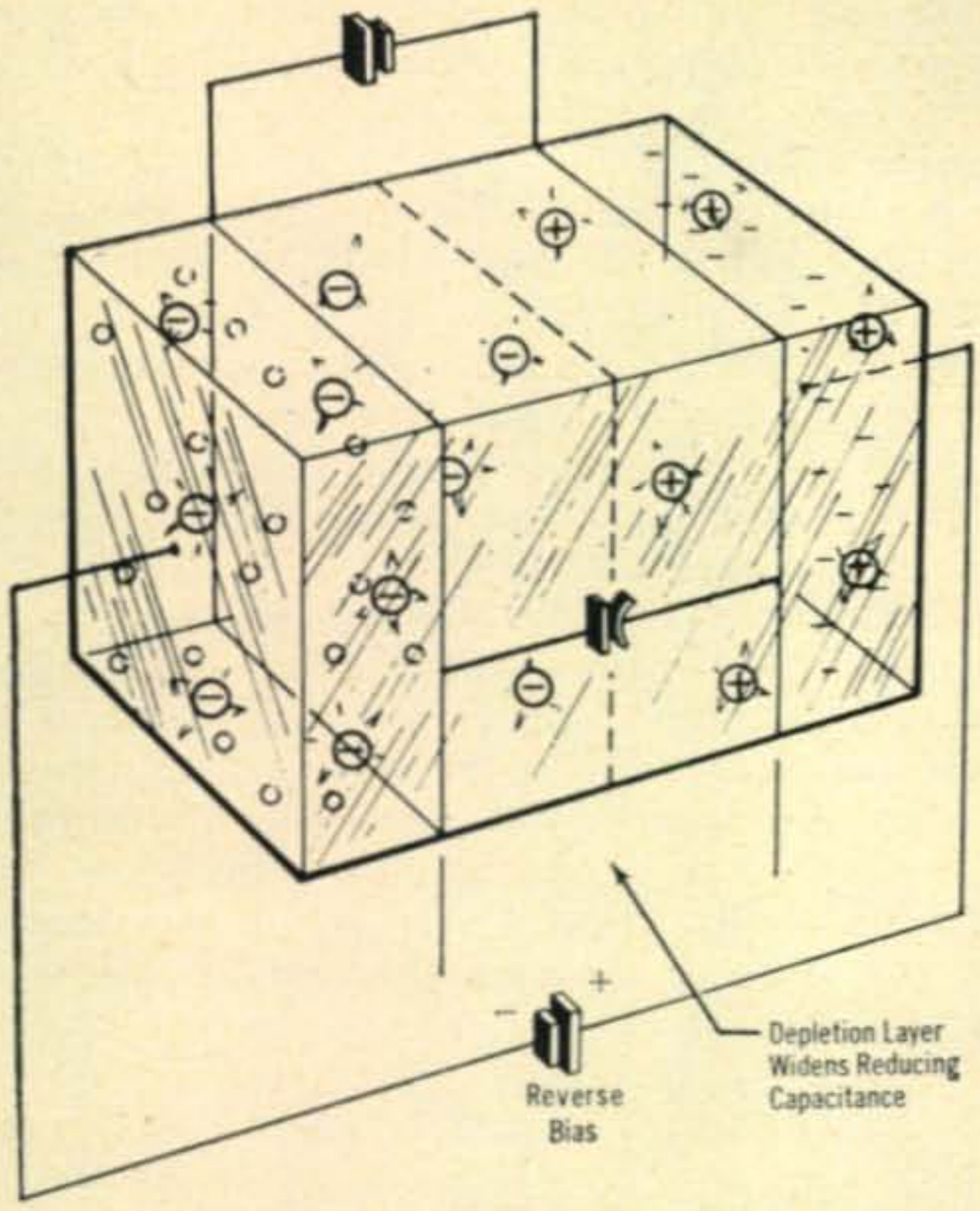


Fig. 2—Reverse voltage forces carriers away from junction. This widens the depletion layer and reduces capacitance.

layer decreases and the capacitance increases (fig. 3). In other words, the capacitance across a p-n junction varies in response to a changing voltage and hence, the p-n junction behaves just like a voltage-variable capacitor.

As fig. 4 shows, the capacitance varies continuously and nonlinearly as an applied signal or voltage itself changes. It is this nonlinear capacitance change that results in the generation of harmonic currents which in turn, can mix with themselves or the fundamental current. In other words, a sine wave input generates a non-sine wave voltage rich in harmonics.

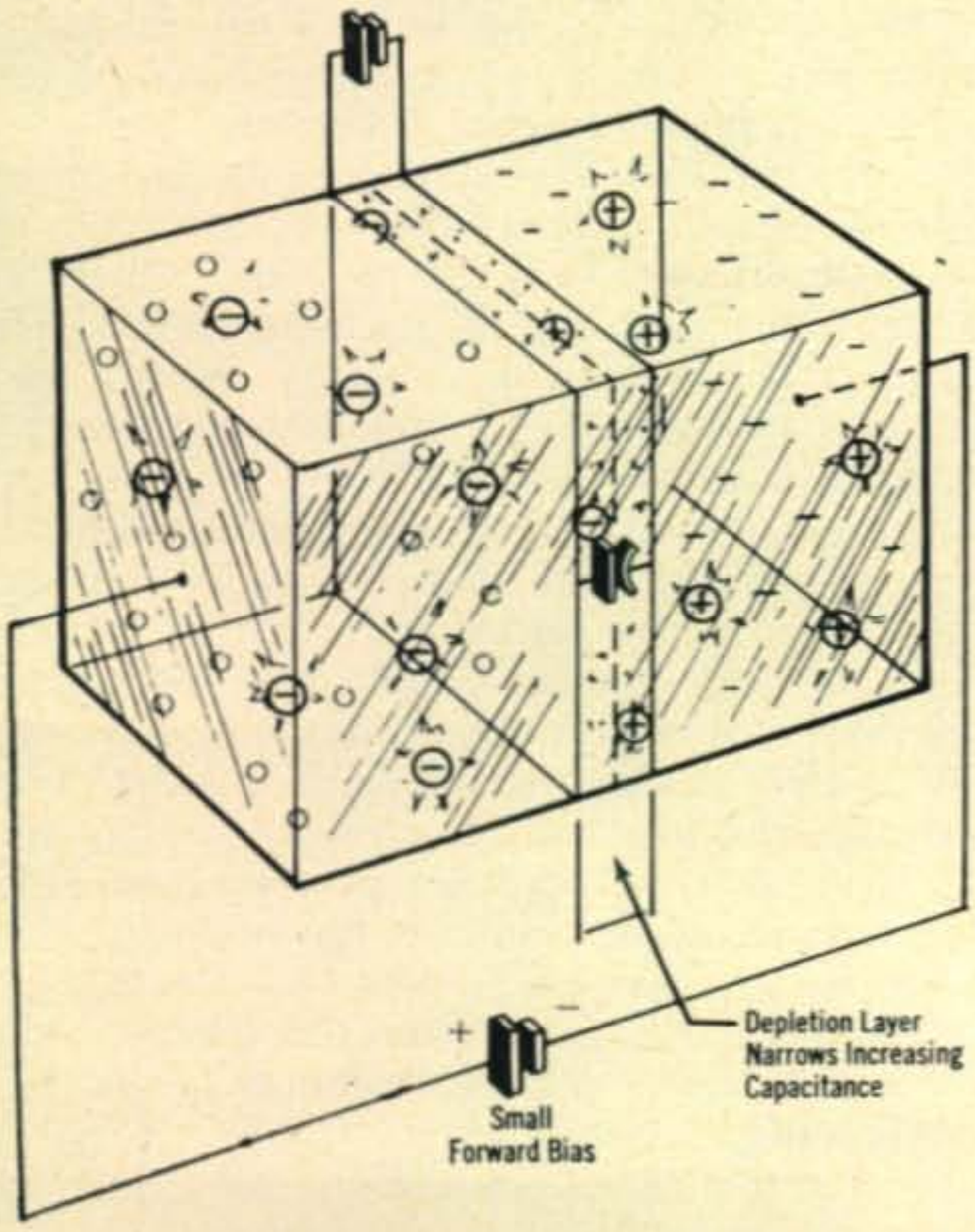


Fig. 3—Forward voltage forces carriers closer to junction or across junction again changing capacitance.

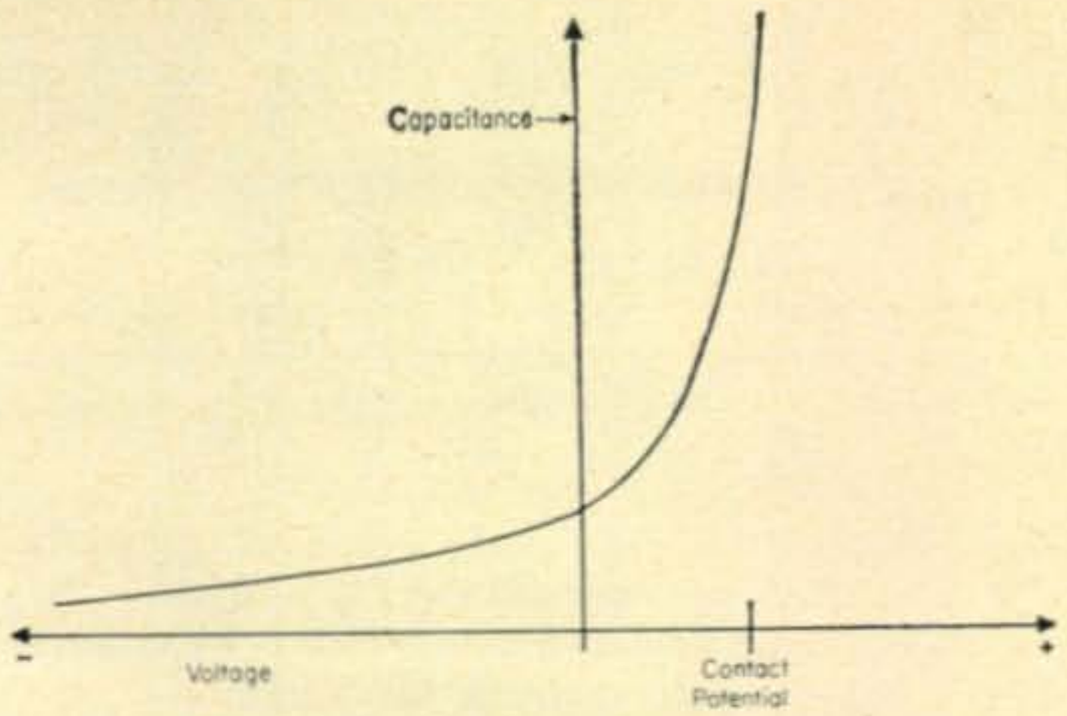


Fig. 4—Voltage-capacitance relationship for a typical varactor diode.

Some varactor diodes, and in particular the ones used in the circuits shown later in this article, have an additional nonlinear capacitance effect when driven in the forward direction with a signal greater than the contact potential (0.6 volts). However, instead of conducting like an ordinary diode, the applied signal is changing at such a fast rate that the carriers that cross the junction during the positive going pulse are called back by the negative pulse before they have a chance to permit a d.c. current flow. These abrupt changes of current within the varactor improves the harmonic generation.

Since the nonlinearity mechanism is a variable reactance (capacitive), the generation process is very efficient. A pure reactance dissipates no power. The most influential factor in reducing efficiency is parasitic series resistance, which can be made quite small in a varactor by modern design and fabrication techniques. This parasitic series resistance, (R_s), which is shown in the varactor equivalent circuit of fig. 5, results primarily from the bulk resistance of the semiconductor material.

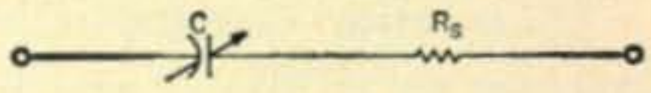


Fig. 5—Equivalent circuit of a varactor diode.

How The Varactor Is Used

A varactor harmonic doubler circuit is shown in fig. 6. The circuit consists of an input tuned circuit $(C_1L_1V_1)$ which is resonated to the fundamental frequency; an output tuned circuit $(C_2L_2V_1)$ which is resonated to the second harmonic and a bias resistor (R_1). Notice that the varactor is common to both tuned circuits. Bias voltage is developed when the input drive peaks causes a slight forward conduction of the varactor.

When the signal to be multiplied is applied, it

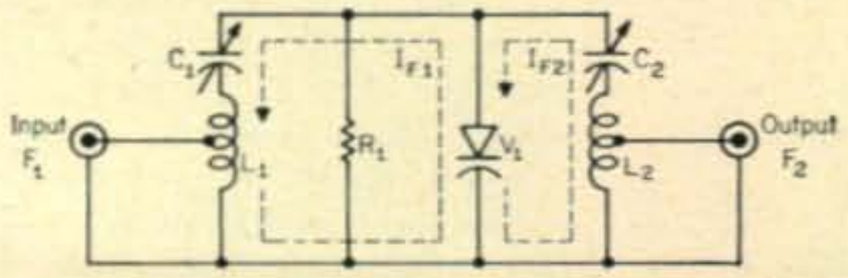


Fig. 6—Varactor doubler circuit. The input circuit is tuned to the fundamental and the output to the second harmonic.

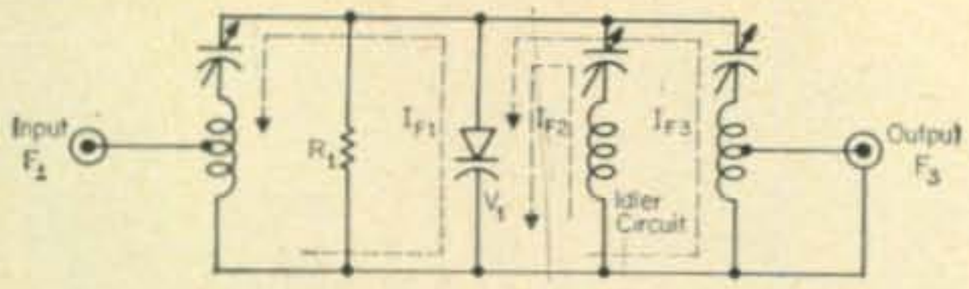


Fig. 7—Varactor tripler circuit. The second harmonic current from the idler circuit mixes with the fundamental in the varactor to increase the third harmonic output.

circulates through the varactor and, since the characteristics of the varactor are nonlinear, the signal is distorted creating numerous harmonics (2nd, 3rd, 4th, *etc.*) of the fundamental signal. The output is resonant to the second harmonic, therefore, only the second harmonic appears at the output connector.

There is some loss of power due to the series resistance *(R_s)* of the varactor plus some loss in the tuned circuits: However, the efficiency of a varactor doubler, can be as high as 90%, depending upon the frequency of operation and the device quality. While it is possible to resonate the output to the third or fourth harmonic and thus triple or quadruple, greater output can be obtained by adding another tuned circuit called an idler as shown in fig. 7. The idler circuit is tuned to the second harmonic and allows the second harmonic currents to flow. The output is tuned to the third harmonic in case of a tripler or the fourth harmonic for a quadrupler.

Since the idler circuit permits the second harmonic signal to flow freely through the varactor, a mixing action takes place in the varactor (2nd harmonic + fundamental = 3rd harmonic) producing additional 3rd harmonic power and thus give better tripler efficiency than if the idler were omitted. In a quadrupler circuit, the circulating second harmonic component doubles, adding to the original 4th harmonic giving greater quadrupler efficiency.

Practical Circuits

A practical varactor tripler circuit for use with an existing 6 meter a.m. or c.w. transmitter to provide output on 2 meters is shown in fig. 8. This circuit is similar to those previously discussed except, in this case, impedance matching is provided by capacitor tapping. With the varactor specified, a Motorola 1N4386, this circuit can handle input powers up to 50 watts and typically provide an output power in the 2 meter band of about 35 watts. The expected power output for other input powers is shown in fig. 9 which plots output power as a function of input power and frequency.

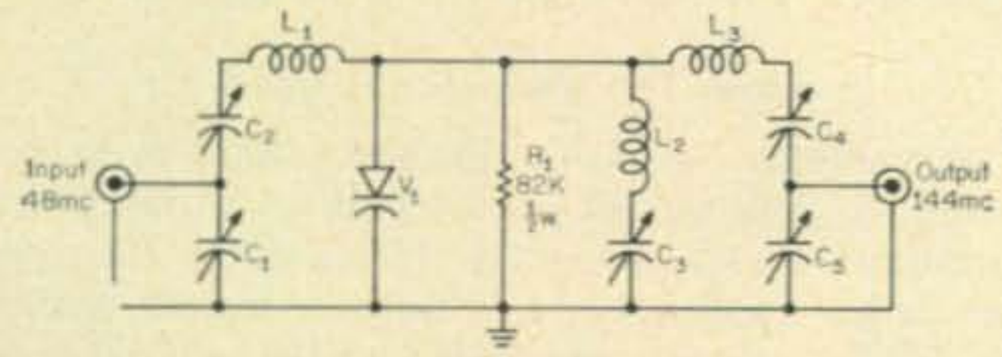


Fig. 8—A 2 meter varactor tripler produces 144 mc output with 6 meter input of 48 mc. With the diode shown the input is limited to a maximum of 50 watts for a maximum output of 35 watts.

C_1—2.8-11 mmf. E. F. Johnson 167-1 or equiv.
C_2—6.7-140 mmf. Hammarlund APC-140 or equiv.
C_3—3-25 mmf. Hammarlund APC-25 or equiv.
C_4—2.9-35 mmf. Hammarlund APC 35 or equiv.
C_5—3-25 mmf. Hammarlund APC 25 or equiv.
L_1—7t. 1/8" copper tubing, inside diam. 1-1/16", length 1 3/8".
L_2—4 3/4t. 1/8" copper tubing, inside diam. 1-1/16", length 1 1/2".
L_3—3 1/2t. 1/8" copper tubing, inside diam. 1/2", length 1 1/4".
V_1—1N4386 Motorola.

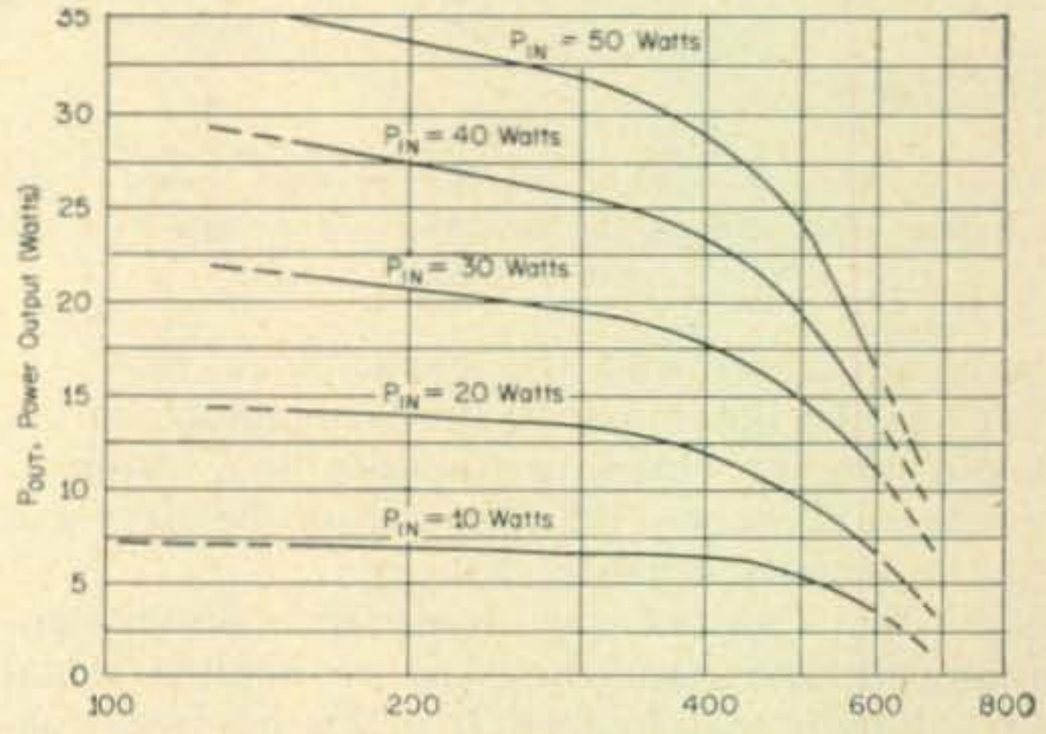


Fig. 9—Power output versus output frequency for harmonic tripling.

After tune-up, it is only necessary to connect the input of the 2 meter varactor multiplier to an existing 6 meter a.m. rig and a 2 meter antenna to the output and away you go on 2 meters.

This circuit can be conveniently built in a 5" × 4" × 3" aluminum minibox with coaxial input and output connectors. The varactor is stud mounted and can be attached directly to the minibox using a 1/8" thick piece of copper or aluminum as a back-up plate. This additional metal is needed to carry away the heat produced by the varactor dissipating about 20 watts of power.

Tune-up of a varactor circuit for maximum efficiency can be a little tedious. For this circuit, it is recommended that the input, output and idler circuits be resonated to their proper frequency range with a grid dip meter. Then, with an input signal applied and a 50 ohm dummy load and a power output indicator connected to the output, adjust C_4 and C_5 in small steps for maximum output. When maximum output is achieved, the 50 ohm load impedance has been transformed to the impedance that the varactor wants to see. The idler circuit *(C_3)* should then be peaked for maximum output.

The input tuning capacitors *(C_1* and *C_2)* are then adjusted in small steps for maximum output. The above procedure should be repeated several times to account for any interaction of the input and output circuits.

A circuit that is a little more sophisticated in that it provides improved rejection of spurious signals and has less interaction between the input and output tuned circuits is shown in fig. 10. These additional benefits result from the use of double tuned input and output circuits. Since

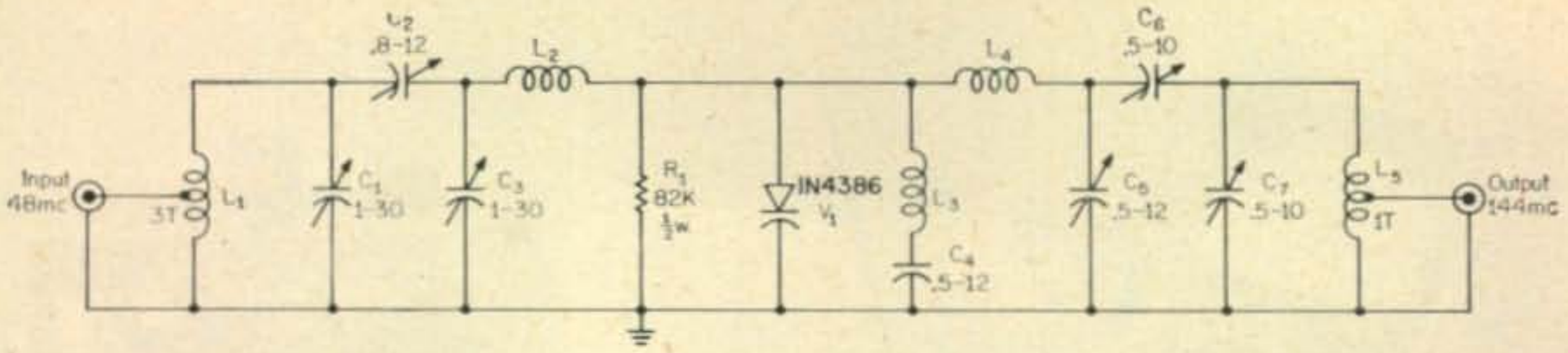


Fig. 10—A 2 meter varactor tripler using double tuning to reduce spurious response. The input is limited to 50 watts. All capacitors are in mmf.

L_1, L_2—11t #14e. ⅜" dia., 1" long, L_3—3½t #14e. ⅜" dia., ½" long, L_4, L_5—4t #14e. ⅜" dia., ½" long.

the output circuit is capable of tuning over a broad range, this circuit can be used either as a tripler to 2 meters or as a quadrupler to 220 mc. The recommended tuning procedure to obtain maximum efficiency is:

Set C_2 and C_6 to minimum capacitance.

Resonate L_1C_1 to the input frequency, L_5C_7 to the output frequency and L_3C_4 to the second harmonic using a grid dip meter.

With a 50 ohm dummy load and power indicator connected to the output, adjust C_1, C_3, C_5, C_7, in sequence, for maximum output.

Adjust C_2 in small steps and adjust all other capacitors except C_6 for maximum output.

When the optimum value of C_2 is obtained, repeat the procedure for C_6, except do not adjust C_2.

Repeat the previous two steps until no further increase in efficiency is obtained.

Output At 420 Mc

Output at 420 mc can easily be obtained by connecting a varactor doubler to an existing 220 mc transmitter or by cascading the previously described circuit tuned up as a quadrupler (54 mc to 216 mc) with the doubler shown in fig. 11. This circuit is similar to the double tuned circuit shown in fig. 10 except that it uses a Motorola 1N4387 varactor which has higher frequency capabilities and, since it is only a doubler, the idler circuit is omitted. This varactor doubler can easily handle power inputs up to 40 watts and provides about 25 watts out at 420 mc with that power input. Lower power inputs can be used with the output running at about 60% of the input power. ■

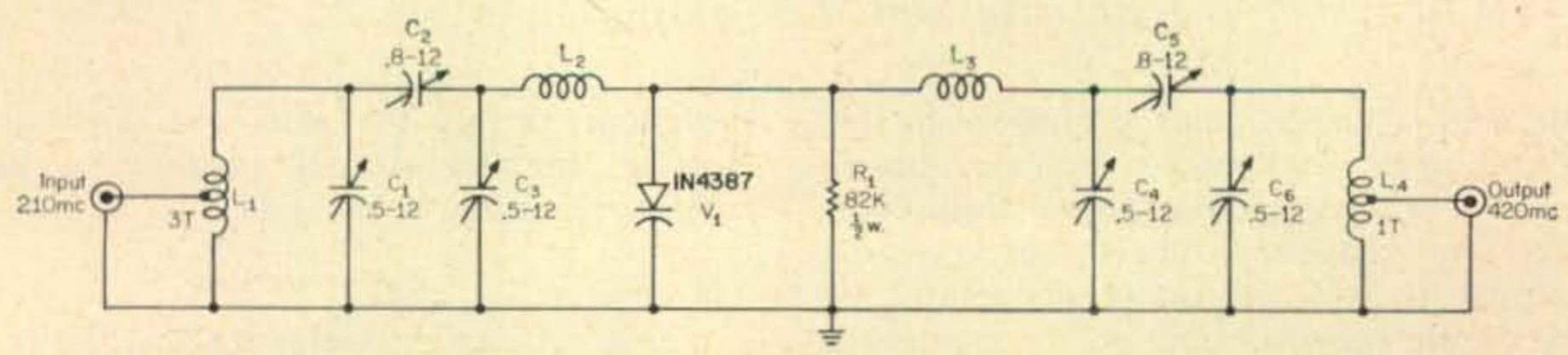


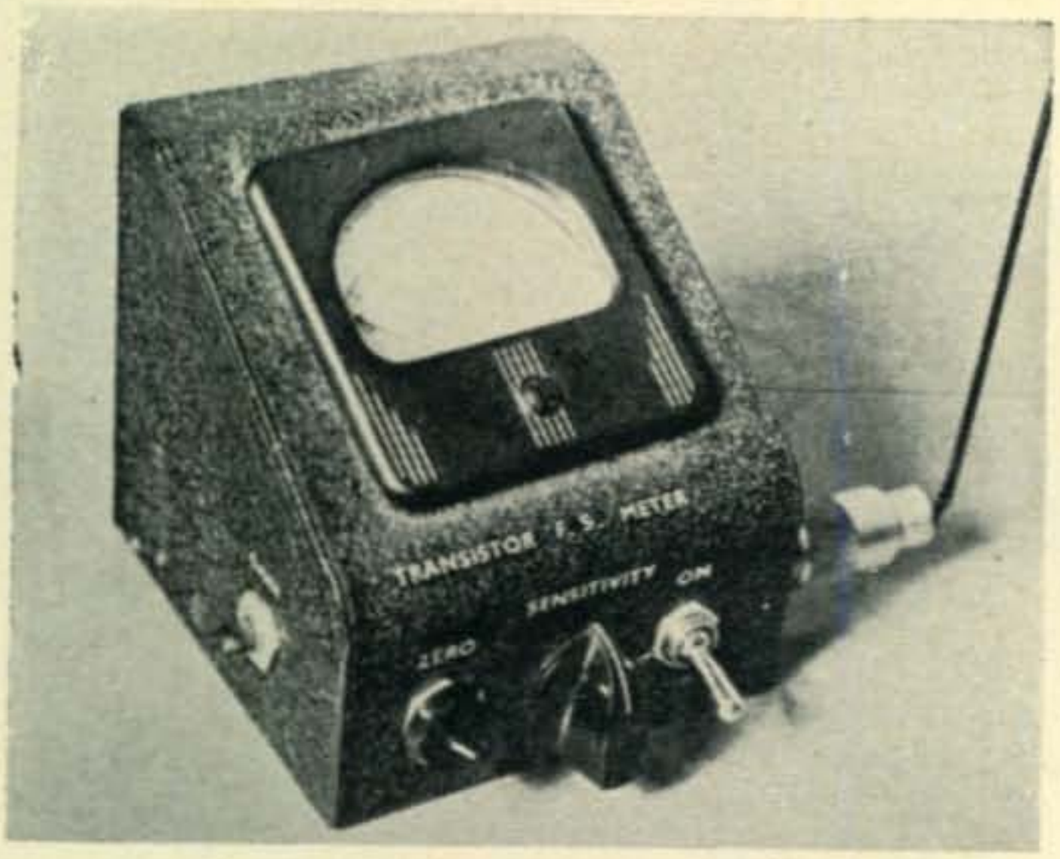
Fig. 11—Varactor double circuit for 420 mc operation. All capacitors are in mmf.

L_1—6t #16e. ⅛" dia., ⅝" long tapped 3t up.
L_2—5t #16e. ¼" dia., ⅝" long.
L_3—4t #16e. 3/16" dia., ½" long.
L_4—4t #16e. 3/16" dia., ½" long. tapped 1t up.
V_1—1N4387 Motorola.

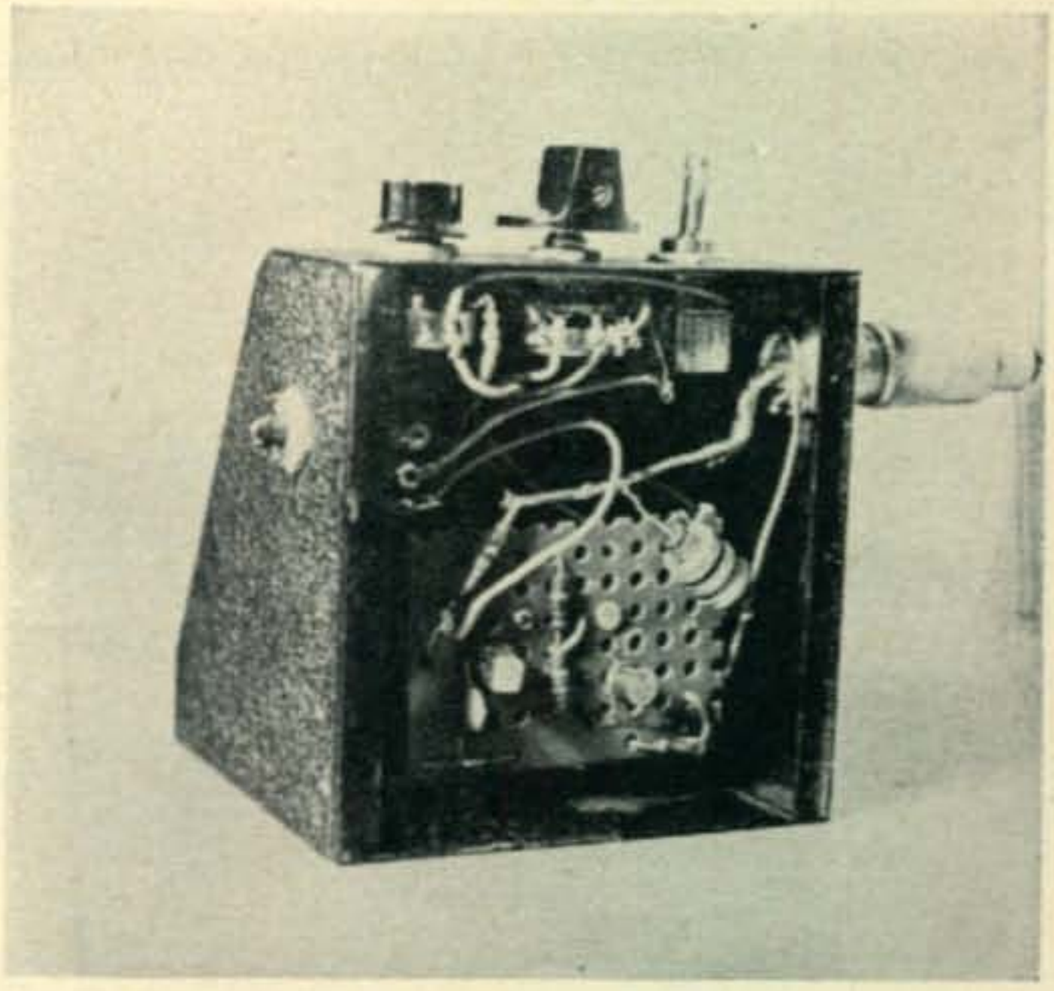
Need An Audio Oscillator?

MANY amateur stations are equipped with an oscilloscope, but they often do not have a variable audio-frequency oscillator on hand for sine-wave testing or for making scope observations with transmitting equipment. A very simple substitute can be the station receiver if it is stable and is equipped with a crystal calibrator. All that is necessary is to tune in the crystal calibrator on the receiver for a suitable beatnote, place the microphone in front of the loudspeaker or hold a headphone, connected to the receiver, up to the mic and you'll have a fine audio tone with which to work. A 1000-cycle tone is used in most cases, but other audio frequencies from a few hundred to several thousand cycles may be obtained using the receiver in the suggested manner. If the receiver is calibrated in 1 kc steps, a close a.f. readout can be obtained according to the deviation from zero beat. Care must be taken to be sure the receiver's audio system, the speaker or the headphones are not overloaded. To ensure good waveform, use as low a level as possible for the work on hand. Also disconnect the antenna from the receiver to minimize background noise. The receiver output also may be connected directly to the transmitter, but this will require a mic connector to fit the receptacle on the transmitter and there also may be the chance of picking up residual hum from the output stage of the receiver.

—W2AEF



Front view of the transistorized field strength meter shows the simple control arrangement. The GAIN control is on the left side of the case while across the front there is ZERO, SENSITIVITY, ON-OFF. The antenna can be seen on the right on a PL-259 connector.



Bottom view of the field strength meter shows the construction of the d.c. amplifier on perforated board.

A High Gain Field Strength Meter

BY M. D. SMITH,* WA4DXP

This high gain field strength meter is untuned thus eliminating the need for plug-in coils or bandswitching. To develop the sensitivity required a transistorized d.c. amplifier is used.

THIS field strength meter is unusual in that it combines two features into one instrument. The simple diode f.s.m. requires no tuning for any frequency, but it does require a lot of signal to give adequate deflection. By adding a simple tuned circuit on the input side of the meter, it would be very sensitive, but require tuning and a full set of plug-in coils for coverage between 100 kc and 100 mc or higher.

In this meter, an untuned choke input is combined with a highly sensitive d.c. transistor amplifier[1] to provide deflection of the meter from a transmitter up to 100 feet away. With the gain wide open and the sensitivity turned up all the way, the meter was reading half scale from a local radio station two miles away. With the meter in the ham shack on the other side of the room, setting the gain and sensitivity controls at the nine o'clock position, a 100 watt transmitter drove it off scale.

Construction

Construction is straightforward; the transistor amplifier circuit is wired on small circuit board, and any component in the circuit could vary 20% without causing any difficulties. If preferred, a cheaper 0-1 ma meter, rather than the 500 microamp unit, could be used with some loss in sensitivity. The two Raytheon CK722 transistors are very inexpensive and any equivalent transistors will work just as well.

Initial Adjustment

With the gain and sensitivity controls turned all the way down, turn the unit on. The needle should deflect in one direction or the other. By adjusting the ZERO control, set the meter to read zero. Then turn the sensitivity control up

[*Continued on page 105*]

*Operations Manager, WAAY-TV, 1000 Monte Sano Boulevard, S.E., Huntsville, Alabama.

[1]Turner, R. P., *"Transistorized Circuits,"* Gernsback Library, Inc. New York, 7th printing, 1962, page 39, fig. 304.

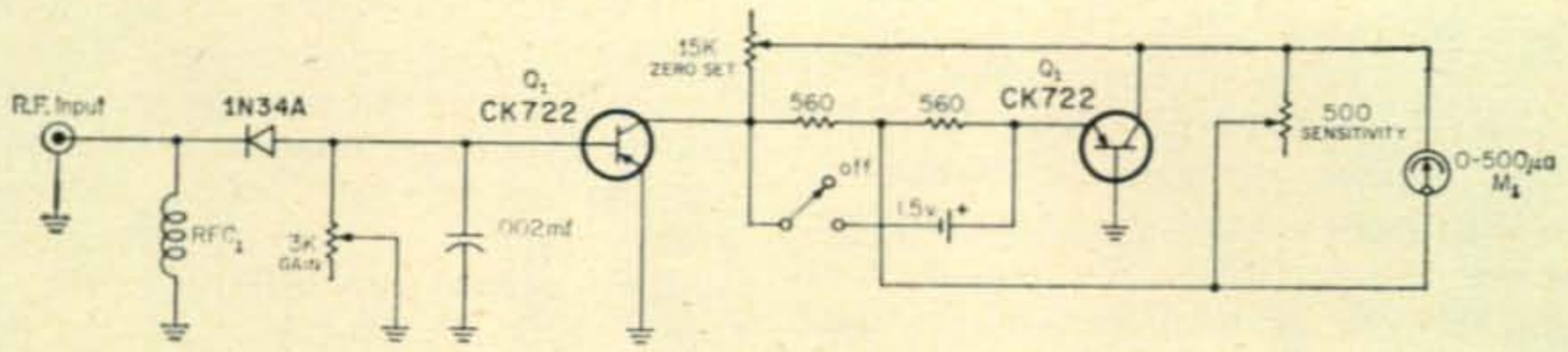


Fig. 1—Circuit of the high gain untuned field strength meter. The CK722 transistors are Raytheon units and RFC_1 is 10 Milihenries, (Ohmite R-50 or equiv.). All resistors are ½ watt.

CQ Special Winter Feature:

ANTENNAS

Antennas? In January? Why not! After all, is there a ham alive who hasn't risked his neck on an icy roof to string that new dipole in the dead of winter? Or decided to finally tune the beam atop a 60 foot tower in 12° weather? No, we've all done our share of cold weather antenna work, but aside from "tradition," January's the ideal time to begin to plan for the warm weather ahead. Being notoriously slow-moving, the average ham will no doubt have just barely enough time to firm up his spring antenna plans if he starts now.

To help your planning, we have gone to great lengths to tell you as much as possible about each and every type of antenna, each and every manufacturer and practically every ham antenna now being commercially made. No attempt has been made to recommend any particular antenna or any particular manufacturer because the individual's QTH, finances, and personal preference are ordinarily the deciding factors and, obviously, vary widely. But we are sure that our "encyclopedia" of antenna information will prove helpful in your planning. So read on . . . and when you do venture up to your roost, don't forget the warm mittens and that flask of 110 proof cough medicine!

A CATALOGUING of antennas available from various manufacturers is presented here along with their electrical and physical characteristics in the hope that it will aid prospective buyers in selecting the type and model most suited to his needs and purse. It also may serve as a handy reference-source from time to time for others. Before proceeding with such a listing, however, it might be well to take a generalized look at the various types of antennas involved.

Dipoles

Half-wave Dipole: (fig. 1A) This fundamental antenna is the shortest single conductor that will resonate at the operating frequency. This requires an element that, electrically, is one-half wavelength long. The half-wave antenna often is called a half-wave dipole or doublet. Most of the energy is radiated in a broad figure-eight pattern at right angles, or broadside to the line of the conductor. When the dipole is mounted horizontally, as usually is the case, the radiation will be bi-directional in the horizontal plane and will be horizontally "polarized." On the other hand, looking at the antenna end-on, the energy is radiated equally in all directions around the conductor, so when mounted vertically, omnidirectional radiation will occur in the horizontal plane and the signal will be vertically polarized. Dipoles may be fed at one end or at the center; however, center feed generally is used. The center impedance of a half-wave radiator depends on the height above ground and on the effects of nearby objects.

Folded Dipole: (fig. 1B) A folded dipole consists of two half-wave dipoles placed parallel to each other and spaced up to a few inches apart. The adjacent ends of the dipoles are connected together and the center of one of the dipoles is left open. The feedline is connected at this point where the impedance is raised by the square of the number of dipole elements. A broader bandwith for a given standing-wave-ratio range also is obtainable.

Loaded Dipole: As already stated, a resonant antenna is an *electrical* half wave long. As such

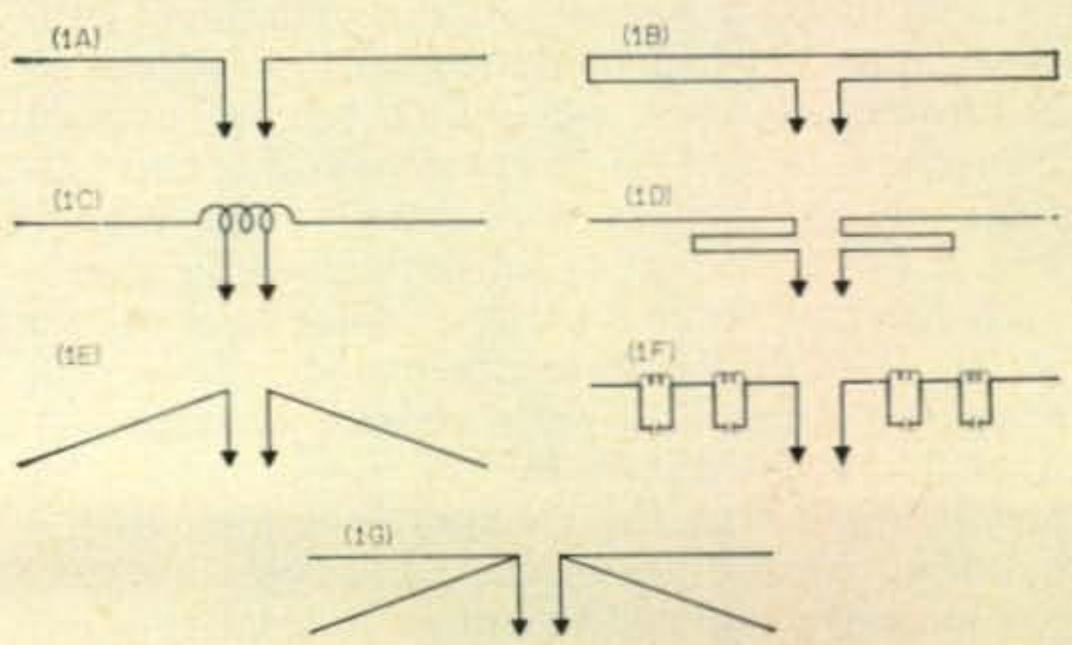


Fig. 1—Basic antenna configurations.

it is *physically* shorter than a natural half wave in space. In certain instances it may be desireable to have a dipole which is still shorter *physically*, as may be required due to space limitations. One way this can be done, while still maintaining the correct *electrical* length, is by means of inductive loading with a coil inserted at the center of the antenna. (fig. 1C) Alternatively, two coils may be used, one each inserted nearer the ends of the dipole. This can be more efficient.

A shorted transmission-line stub can be made to look like inductance, so it too may be used to provide *linear* loading as shown at fig. 1D and described later.

Inverted-V Doublet: (fig. 1E) With inverted-V doublet, the main high support is at its center. Each half of the antenna is drooped down at an angle and is held at the ends by lower supports. Thus, only *one* tall support is needed and less horizontal linear space is required than if the antenna were horizontally mounted. The middle portion of the doublet is held at a high elevation, so efficient radiation is maintained. Directivity is mostly broadside, but some signal may be expected off the ends.

Rigid or Rotable Dipole: If the dipole is made of rigid material, such as metal tubing, it may be supported only at its center and be rotated for maximum radiation in any favored direction. It also may be supported from a window ledge.

Remotely tunable 3-band rotatable dipole. (New-Tronics Cliff Dweller.)

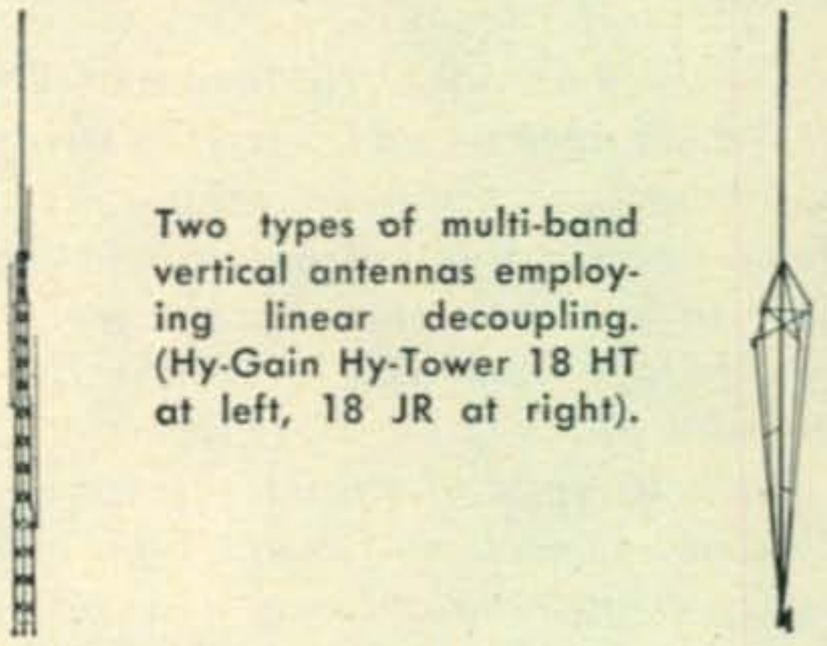
Multi-Band Antennas

A multi-band antenna is one which may be operated on two or more bands. In this respect, a half-wave radiator may be operated at harmonically-related frequencies, but this may present feedline problems unless operation is limited to the odd-harmonic frequencies, so the schemes listed below are often used instead.

It must be remembered, though, that when compromises are made for shortening antennas or for providing multi-band operation, something is not gained for nothing, so the radiation efficiency can be expected to generally be lower than otherwise.

Trap Antenna: A trap antenna employs parallel-tuned resonant circuits (lumped constant traps) which automatically function as electronic switches, according to the applied frequency, to add on or cut off various end sections of an antenna and make it the proper length for operation as an individual dipole on each band. A three-band trap antenna is shown at fig. 1F. For the lowest frequency concerned, a trap antenna is slightly shorter (physically) than a normal dipole for the same band. The power applied to the antenna is limited to the handling capabilities of the traps.

Linear-Decoupled Antenna: A quarter-wave stub appears as a resonant circuit. In this capacity it can be employed in place of a lumped-constant trap to function as an electronic switch for isolating antenna sections. Fig. 1D shows a two-band affair. A second function of the stub is that when operation is conducted on the lower band, the stub appears as an inductance which effectively inductively loads the antenna (linear loading) increasing its electrical length and making it possible to reduce the overall physical length to about two-thirds normal size. Somewhat higher efficiency may be realized using linear stubs in place of lumped-constant devices.



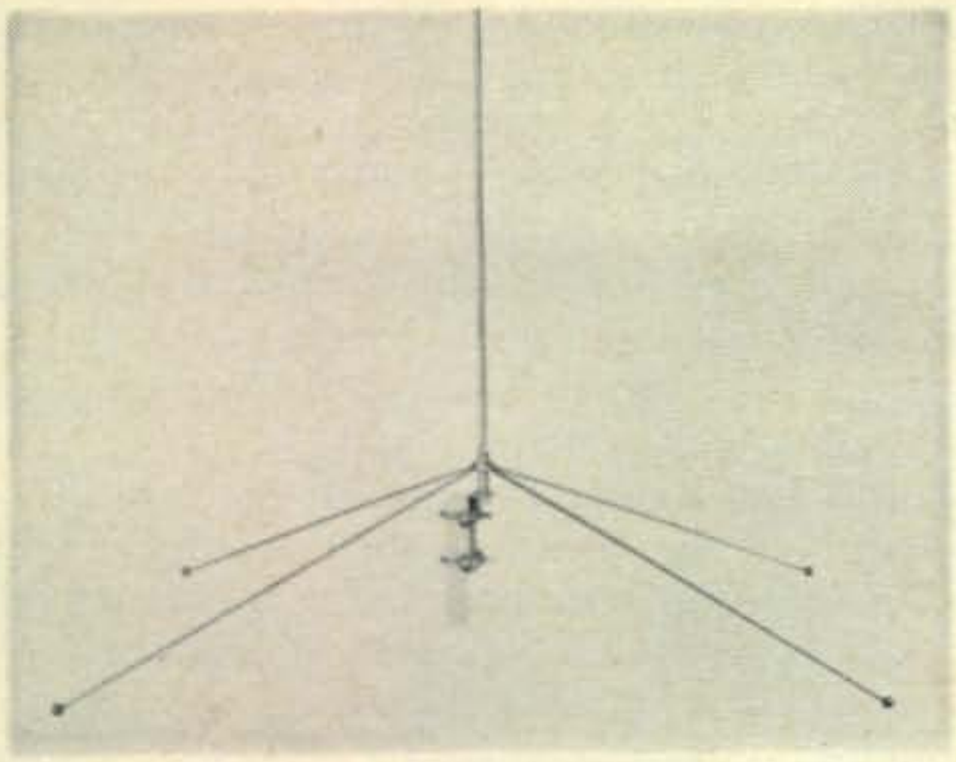
Two types of multi-band vertical antennas employing linear decoupling. (Hy-Gain Hy-Tower 18 HT at left, 18 JR at right).

Double-Doublet: A double-doublet (or fan-type doublet) consists of two split dipoles having a common connection at the center feedpoint, while the dipoles are individually suspended with their adjacent halves spread out in a double-V or fan-shape. See fig. 1G. Each doublet is cut for operation on one of two different bands, but operation also is possible at odd harmonics of either doublet. Fan-type doublets also may employ traps for extended multi-band use.

Vertical Antennas

Quarter-wave Vertical: The commonly used vertical antenna employs only one-half of a dipole, or a quarter-wave radiator, with its bottom end grounded, in which case the ground essentially functions as the other half of the dipole. Vertical antennas produce vertically-polarized omni-directional radiation in the horizontal plane with low-angle radiation in the vertical plane. Inductive loading may be employed where the physical length must be reduced. This is widely done for mobile installations where, incidentally, the car body is the ground system. In general, the higher the coil is placed up the radiator, the better the antenna performance, but an advantage gained with a base-loading coil is that it can perform double duty as an impedance-matching transformer for properly terminating the transmission line. Traps in their various forms also may be used for multi-band work with vertical antennas.

Ground-Plane Antenna: The ground-plane antenna is a vertical system which uses an artificial ground consisting of several radials fanned out from the base of the quarter-wave radiator. The entire arrangement may be highly elevated to obtain optimum "line-of-sight" coverage with h.f. operation.



Quarter-wave ground plane antenna. Radials are slightly drooped to obtain proper impedance match for transmission line. (Antenna Specialists Model M-7A).

Gain in Antennas

Broadly speaking, the *total* power radiated by an antenna of given efficiency cannot be increased; however, measures can be employed to concentrate the radiated power in a given direction where power gain then will be realized, but with a corresponding loss in other directions.

The concentration of power in a horizontal plane is mainly accomplished by the use of additional antenna elements, while the horizontal gain at a given distance is highly dependent on the vertical directivity which, for a given antenna, largely is a function of the antenna height above ground. In general, radiation at increasingly lower angles takes place as the antenna is raised above a height of one-quarter wavelength (low-angle radiation is desirable for DX work). At lower heights, most of the radiation is directly upwards and is useless.

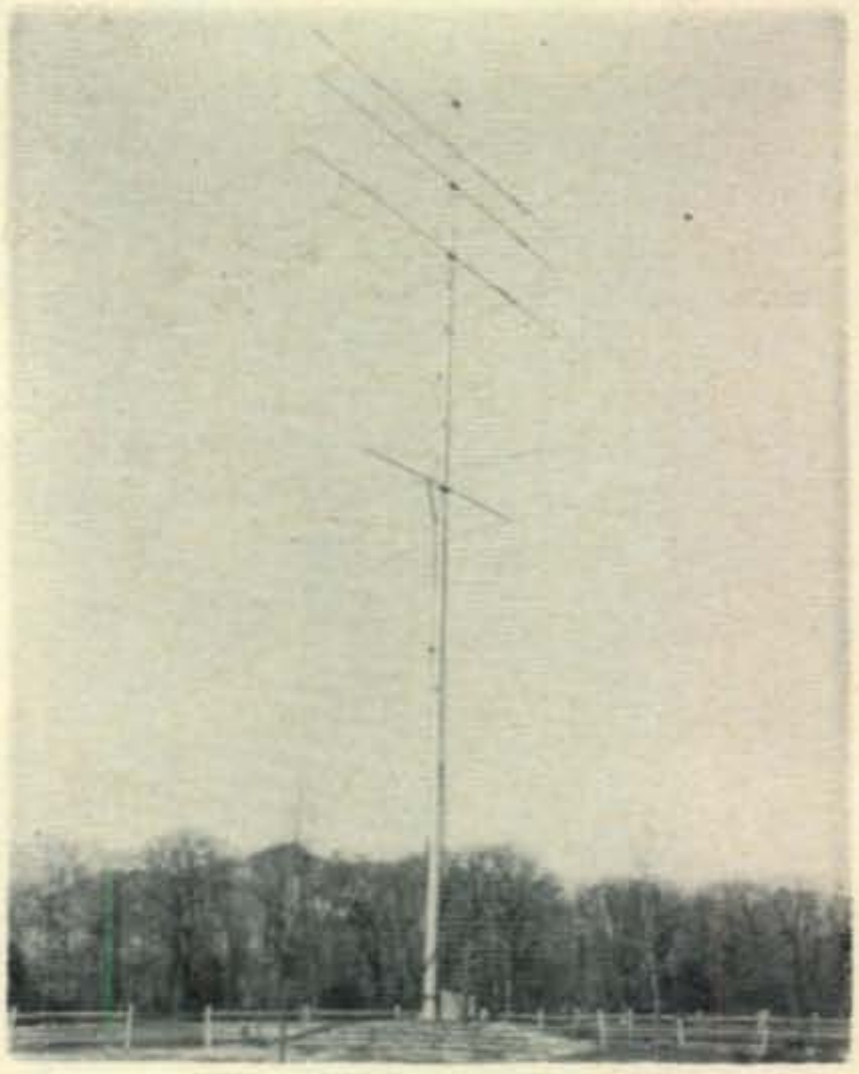
A beam antenna concentrates the radiated power over a relatively narrow width in one direction (forward direction). High attenuation results off the sides and at the rear. The difference between the forward gain and the rear attenuation is the "front-to-back" (F/B) ratio. By making the beam rotatable, maximum effectiveness can be obtained over a desired target area, while the attenuation in the other directions is useful for minimizing interference by the transmitted signal or by signals from these areas during reception.

Colinear Antennas: When additional dipole sections are placed in line with the main radiator, the antenna is a colinear one. With a horizontal system, broadside horizontal directivity and power gain may be obtained if a phase-reversal device (non-radiating resonant element) is installed between each colinear section. Parasitically excited colinear elements are sometimes used in connection with v.h.f. beams.

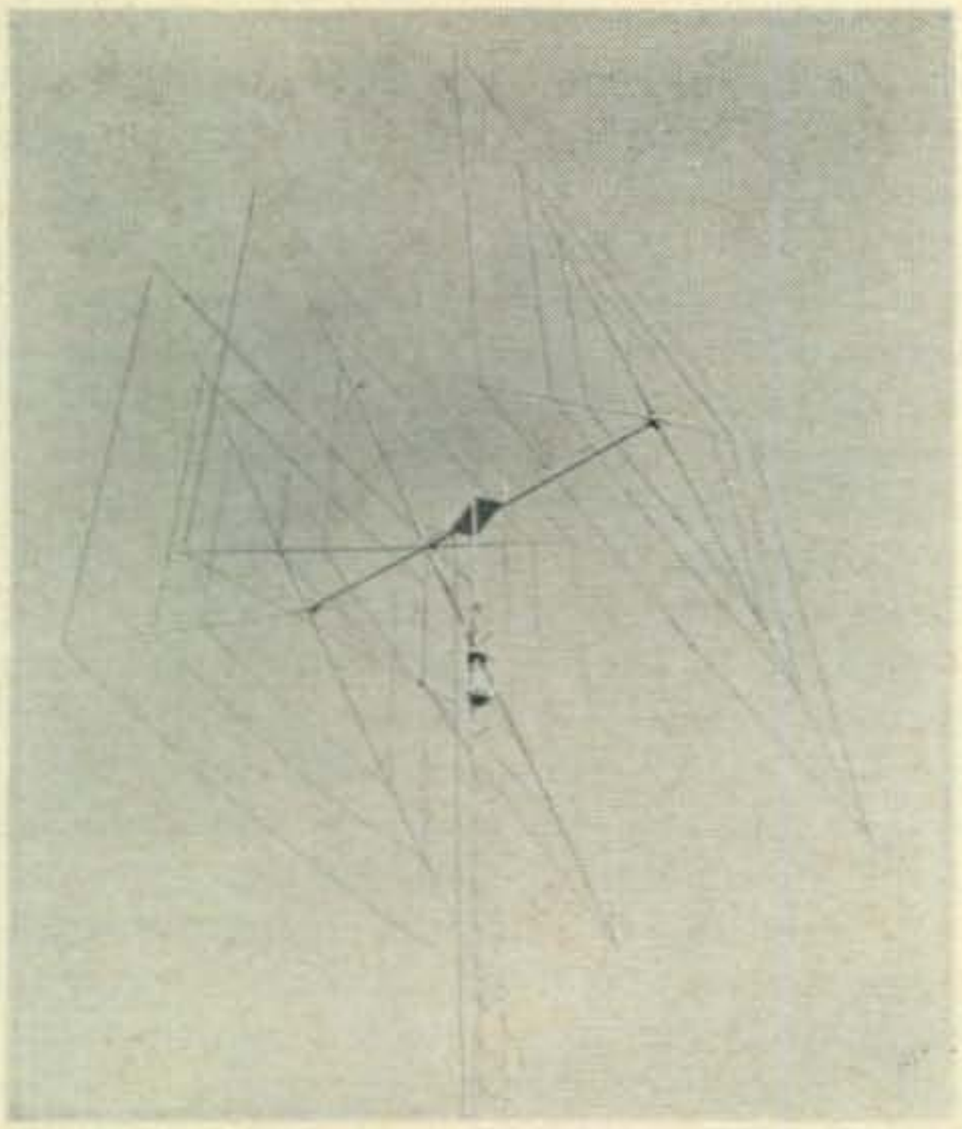
With a vertical colinear antenna, the radiation angle is lowered with a consequent realization of useful omni-directional gain. A colinear system, not requiring phase-reversal elements, may be a 5/8 wave or longer grounded radiator. Effectively it is a harmonically-operated system which also lowers the vertical angle.

Parasitic Beam: The commonly used beam employs a horizontal (or vertical) half-wave dipole with "reflector" and "director" elements adjacently parallel to it. The dipole is driven directly by the transmitter through a transmission line, while the other elements are parasitically excited by the driven dipole. The forward gain and the F/B ratio are a function of the number of elements, their length and the spacing between them. A reflector is slightly longer than the driven element, directors are slightly shorter. Spacing usually varies between 0.1 and 0.25 wavelength. "Close" or "medium" spaced beams have a little lower gain and F/B ratio than do "wide" or "optimum" spaced ones. Also, the adjustment may be more critical, feedpoint impedance lower and the bandwidth for a given s.w.r. range less. On the other hand, the smaller spacing shortens the length of the boom required to support the elements, thus reducing the turning radius, overall space required, weight, windload and cost. Comparative figures in the various categories may be obtained from the accompanying antenna listings where it also may be noted that the gain increases and the bandwidth narrows as the number of elements and the spacing (indicated by the boom length) is increased. On bands up to 30 mc, two to five elements are commonly employed, while on the higher bands, where physical dimensions are smaller, more elements are used, in which case the beam often is called a Yagi.

Stacking: Beams of the same type may be stacked above one another or side by side for additional gain. Such an arrangement is often used on the v.h.f. bands where it becomes practical. Two stacks provide 3 db extra gain, four stacks 6 db, but the effective useful gain may be even greater due to a lowering of the vertical



A "Big-Bertha" rotatable mast with 10, 15 and 20 meter full size beams in a "Christmas Tree" configuration at the top. A Tri-Band TM-30C beam is below. (All by Telrex).



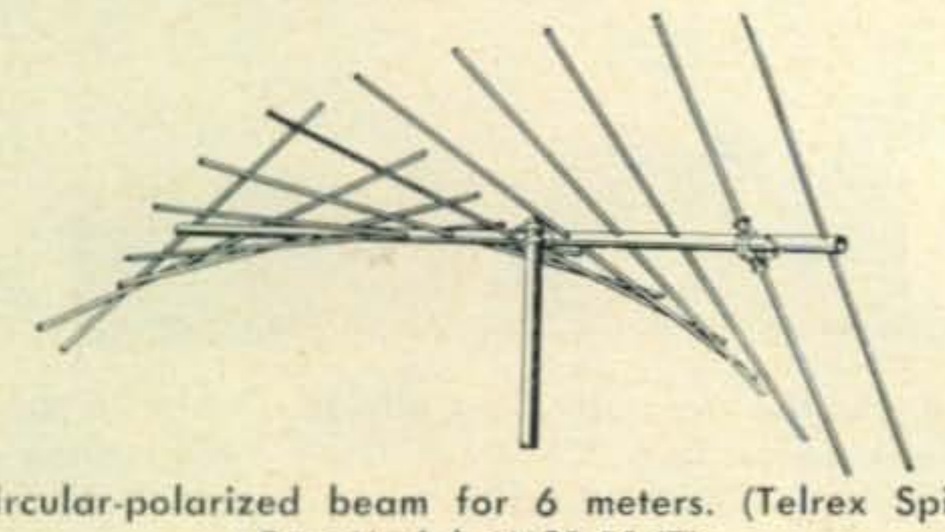
A 3-band 3-element quad antenna. The coax feedline is connected to the junction of the three loops in the middle section and is draped over the boom. (Skylane Products).

radiation angle which can result. The beamwidth also is narrowed.

Quad Antenna: The Quad antenna consists of two or more square-shaped wire loops a quarter-wavelength long on each side supported parallel to each other. One loop is the driven element, the others are reflector and directors which are adjusted with stubs or coils. High gain and excellent F/B ratio is attainable and the system has a relatively low-*Q* resulting in good bandwidth. For a given height, the vertical radiation angle of the Quad is much lower than that of a horizontal beam, making it particularly attractive for DX work.[1] Thus the Quad can be more effective, especially when antenna height must be restricted. In addition, its smaller horizontal dimensions reduce the turning radius and space requirements. The Quad also has a large "capture area" for better hauling in received signals and it is less susceptible to pulse static and noise.

Rhombic Antenna: The Rhombic is a long-wire antenna with four legs arranged in a diamond formation. Each leg is several wavelengths long. The transmission line (usually 600 ohms) is connected at one corner of the diamond with a terminating resistor installed at the opposite corner. A uni-directional beam pattern is produced in the direction pointing from the feedpoint toward the terminated end. High forward gain is obtained at very low angle radiation and F/B ratio is very high. A rotatable rhombic is not mechanically feasible at low frequencies. Point-to-point communications companies have used the rhombic for years, as it has proven to be exceptionally reliable.

[1]Ross, Jr., Donald G., W2JMZ, "How DX Kings Rate Antennas," *QST*, Jan. '64.

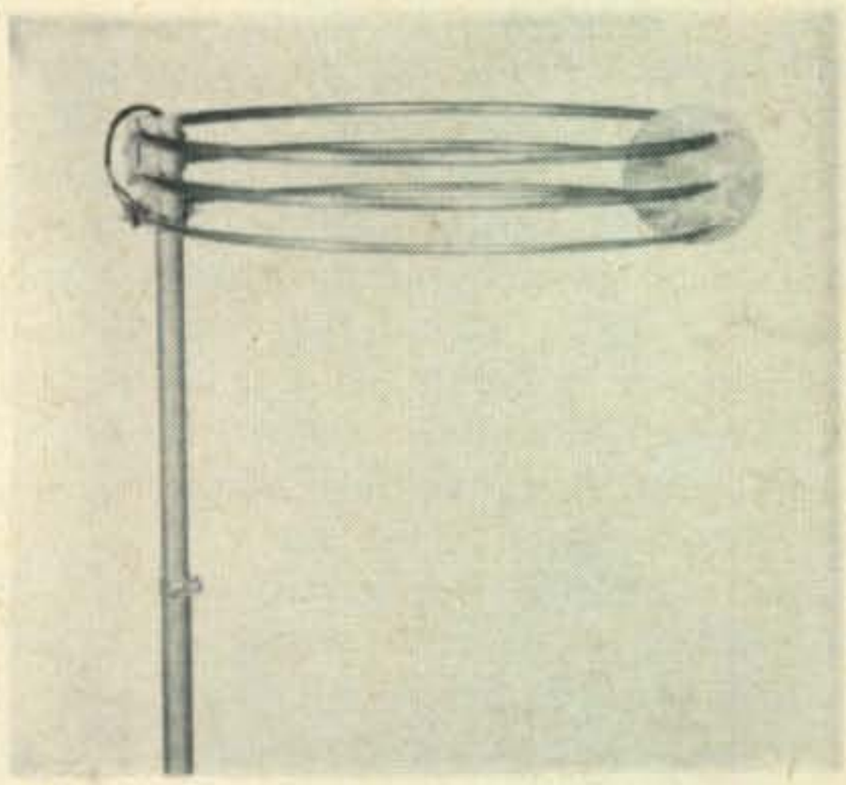


Circular-polarized beam for 6 meters. (Telrex Spiral Ray Model 6MSR-1147).

Spiral Ray Beam: The Spiral Ray basically is a parasitic Yagi beam with skewed elements, producing linear response to any radiation angle, vertical, horizontal or oblique, for optimum performance with various propagation or ducting phenomena. Noise and fading also is minimized.

Special Antennas

Halo Antenna: The Halo is a half-wave radiator, or folded dipole, formed in a small circle with capacitively-loaded ends and is horizontally mounted. The result is horizontally-polarized and omni-directional radiation, which together with the reduced space requirements make it very popular for v.h.f. mobile applications where flutter and noise usually experienced with vertical whips, also is eliminated. Gain also may be obtained by stacking.



A 6-meter halo antenna made up of a three element folded dipole with capacitively loaded ends. (Hi-Par Saturn-6).

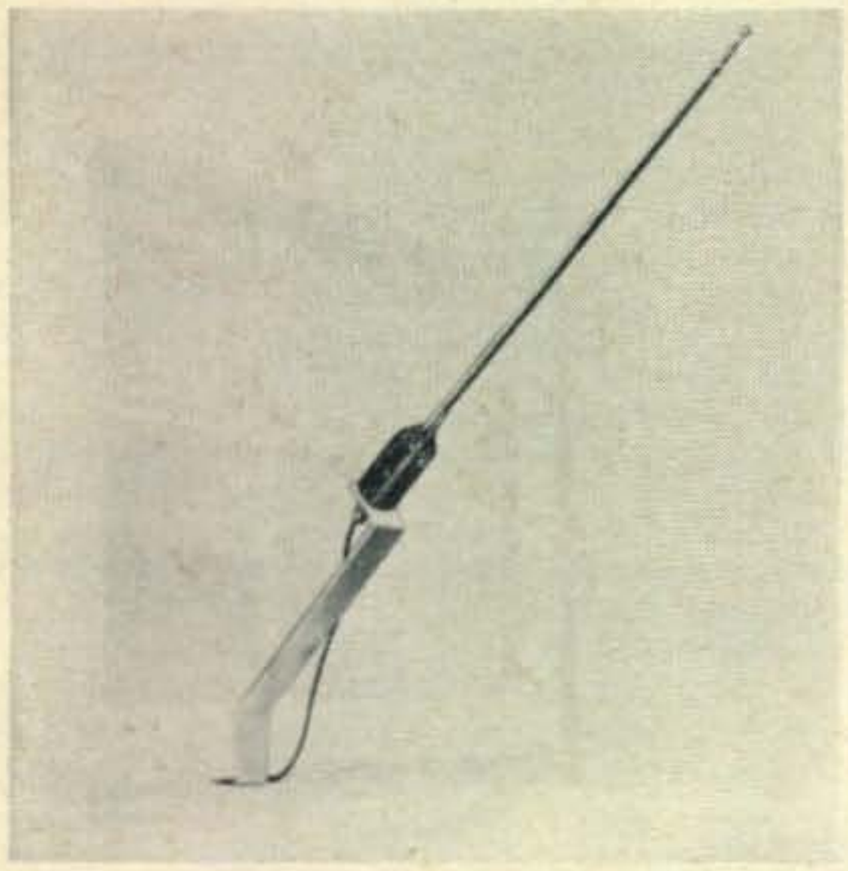
Foldover Mobile Antenna: The fold-over antenna, used for mobile work, is one which employs a locking-type hinged arrangement for tilting the upper section of a vertical mobile antenna over at a right angle to provide clearance when the vehicle is garaged. The upper section employs inductive loading.

Multi-band Vertical: An interesting and efficient multi-band system consists of a single grounded mast from the bottom of which a number of wires are extended upward to the ends of a double cross-arm located part way up the mast. The wires are arranged to provide automatic linear decoupled radiating elements for the individual bands.

Multi-band Tunable Dipole: A special type of commercial multi-band tunable dipole is a shortened affair which may be used for 10, 40 and 80 meters. For 80 meters, end-loading coils are employed. For 40, part of each coil is

shorted out by a mechanically-linked switch driven by a motor in the center housing. The ends of the dipole are telescoping sections which can be individually extended or retracted by two separate motors for tuning the radiator to exact resonance. By making it possible to tune each half of the dipole separately, the feedpoint in effect can be moved either side of center to where the impedance matches that of a coax line, thereby ensuring a low s.w.r. at all times. On 10 meters the coils act as r.f. chokes and isolate the end sections leaving only the middle portion operational. The entire system may be remotely controlled from the radio operating position. An s.w.r. bridge is required for determining the proper adjustments. The antenna also may be turned with a separate rotator.

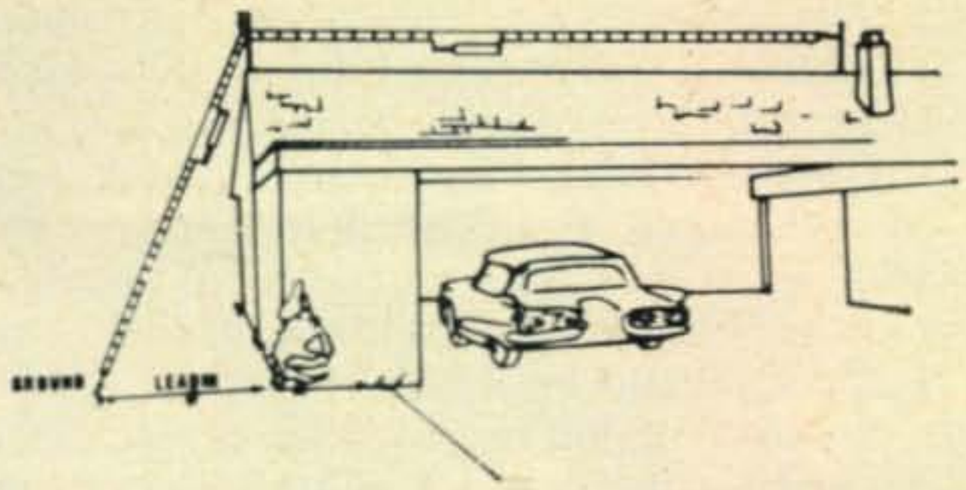
Portable Antenna: Portable antennas designed for temporary installation on a window frame or ledge, a fence railing, on boats, etc., often consist of a telescoping quarter-wave radiator with a base-loading coil held on a bracket which may be clamped to a suitable support. An insulated wire lead is connected to the bracket and run along the floor or ground surface for several feet. This acts as an artificial ground or "counterpoise" to make up the other part of a half-wave antenna system. When disassembled, the elements may be carried in a brief case.



Portable base loaded antenna for window, fence rail, or similar mounting (Barker and Williamson "Vacationeer").

Transmission-Line Antenna: A trap-type antenna, using a principle similar to linear decoupling, is made of quarter-wave sections of 450-ohm open-wire transmission line in conjunction with capacitors in one leg between each section. It is designed for use as a quarter-wave grounded radiator suspended vertically, angularly or in an L-shape. A double arrangement may be used as a horizontal half-wave antenna.

Log Periodic Antenna: The log periodic antenna is a multi-element beam, similar in appearance to a Yagi, but the elements are uniformly spaced and are made progressively shorter toward one end of the boom. The result is a system which provides gain and directivity over vary wide bandwidths (2:1 or more).



Grounded quarter-wave transmission line type antenna. It may be suspended vertically, angularly, or tilted. (Mosley El Toro).

Impedance Matching and Balancing

A transmission line may be connected directly to a split dipole if the antenna impedance matches that of the line. If the antenna does not present the proper impedance, special matching devices may be employed as shown at fig. 2. Such systems require additional and sometimes critical adjustment along with a narrowed bandwidth; nevertheless, they may be worthwhile for achieving an optimum result.

Balancing arrangements are often desirable. When coax line is used, unbalance of the system can take place which may produce radiation from the transmission line with subsequent distortion of the radiation pattern from the antenna itself. The possibility of t.v.i. and of noise pickup on reception also is increased.

Delta Match: The Delta match functions as an impedance step-up transformer. The impedance transformation is determined by dimensions *a* and *b*.

T-Match: The T-match, a variation of the Delta, is an adjustable device more suited for use with beams.

Beta or Hairpin Match: The Beta match is a short adjustable stub which may be used to slightly "hairpin" tune the antenna as well as provide a suitable impedance at the point where the line is connected. The arrangement may be likened to a small loading coil with the line tapped on it. The end of the stub may be grounded for lightening protection.

Folded Dipole: As pointed out earlier, an im-

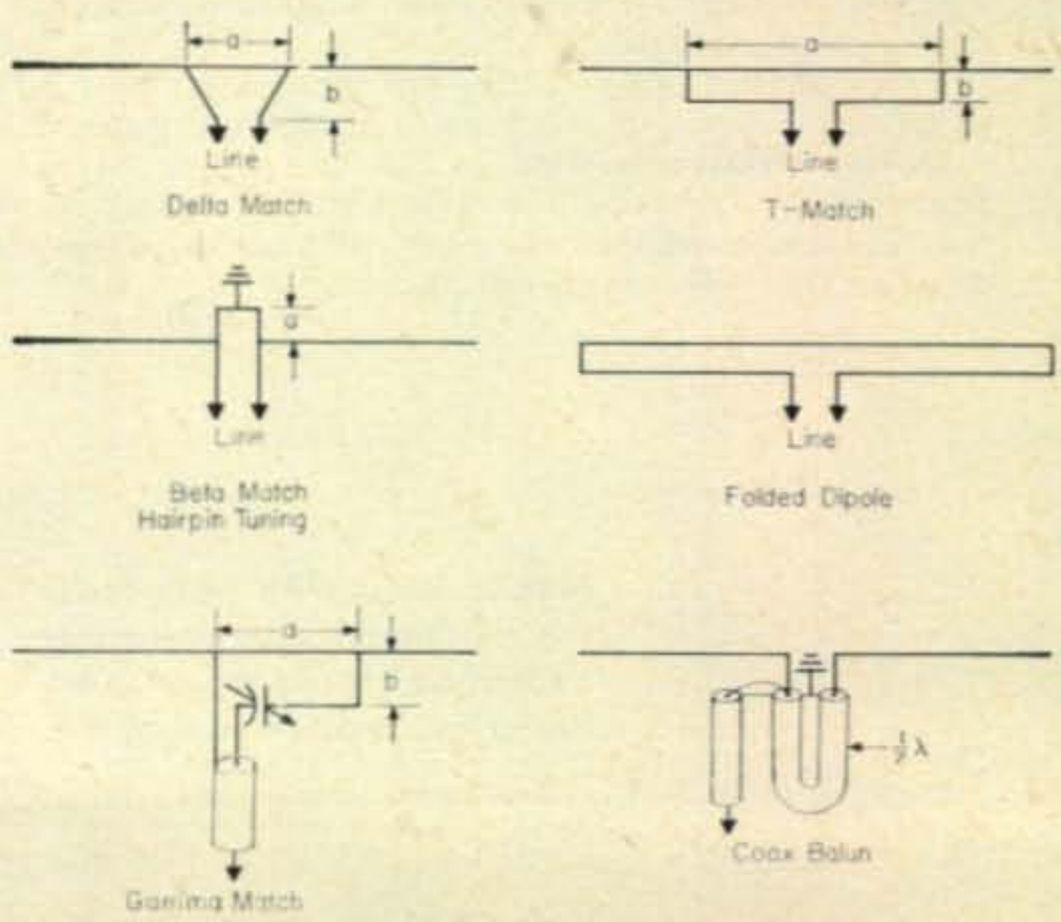


Fig. 2—Feedline matching and balancing systems.

pedance step-up over that of a single dipole can be obtained with a folded dipole. This expedient is sometimes used with beams.

Gamma Match: The Gamma match, one-half of a T-match, is designed to improve balance with coax line. The reactance of the Gamma loop is balanced out by the capacitor which in practice should be weatherproofed.

Balun: A Balun is a coupling device especially devised for use between an unbalanced line and a balanced circuit. It may have a 1:1 impedance ratio or it may be designed to present an impedance transformation and thereby also do away with other matching devices. Baluns may be constructed using coax cable as shown, or using coils for compactness and convenience.

The Manufacturers

The following paragraphs present a brief rundown on the products offered by nearly all of the manufacturers of ham antennas. An attempt has been made to outline any particular construction techniques or materials used by a manufacturer. A very detailed listing of individual antennas by manufacturers begins on page 56.

Antenna Specialists Co., 12435 Euclid Ave., Cleveland 6, Ohio: Features a wide line of 2, 6 and 10 meter antennas for mobile and base station use. Stainless steel radiators are used for mobile; rigid aluminum and cadmium-plated steel for base models. Base-loading coils or line matching transformers are sealed and tamper-proof. A large selection of mobile mounts and accessories is also offered.

Barker & Williamson, Inc., Bristol, Penna.: Features a portable antenna called the Vacationeer. Collapsible whip is chrome plated, separate loading coils for each band are high-*Q* air-wound type with protective hood, bracket is of iridited aluminum. When disassembled, fits into KWM-2 carrying case.

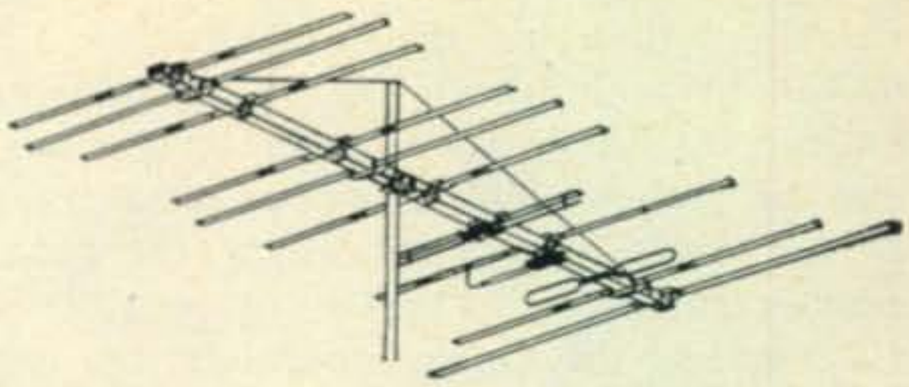
Columbia Products Co., R.F.D. 3, Columbia, S.C.: Features the Wondershaft Antenna for mobile work. Quarter-wave whips for use from 10 to 6 meters provide full quarter-wave efficiency in antenna lengths about ten-percent shorter than metal whips. The radiating element is sheathed in fiberglass which has a high damping factor, thus tending to reduce road sway, precipitation static and serves as a natural insulation to reduce the hazard of working under live wires.

The normal-mode helical mobile antennas are inductively loaded with the coil space-wound around an air core and embedded in a laminate of fiberglass. Antennas are white fiberglass terminated with 3/8"—24 threaded ferrules. The fiberglass is spirally wrapped for high-impact strength.

Three-quarter wave whips for 6 meters have 2.7 db gain and a more uniform omni-directional pattern.

Dorco Electronics, 109 E. Elm St., Compton, Calif.: Features the Orbitop, a mobile antenna top-hat section for improving performance of coil-loaded systems and enabling the use of shorter radiators.

Mobile whip with base loading coil/matching transformer and trunk groove mount. (Antenna Specialists Model M-87).

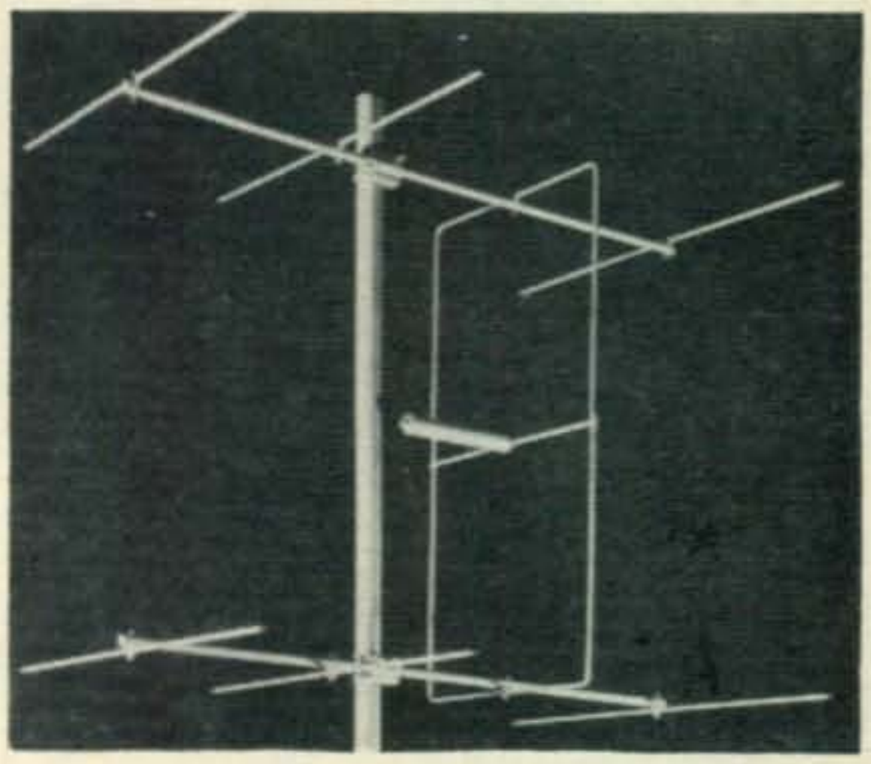


Two-band beam for 6 and 2 meters. On 6 meters four elements are used as a Yagi, the driven element being a folded dipole. For 2 meters there are five parasitic elements each consisting of three colinear sections. The driven element is a long folded dipole functioning as a three-section colinear element produced by a special phasing stub in front of the dipole. The 2-meter arrangement is thus equivalent to 18 elements. (Finco—Model A-62GMC).

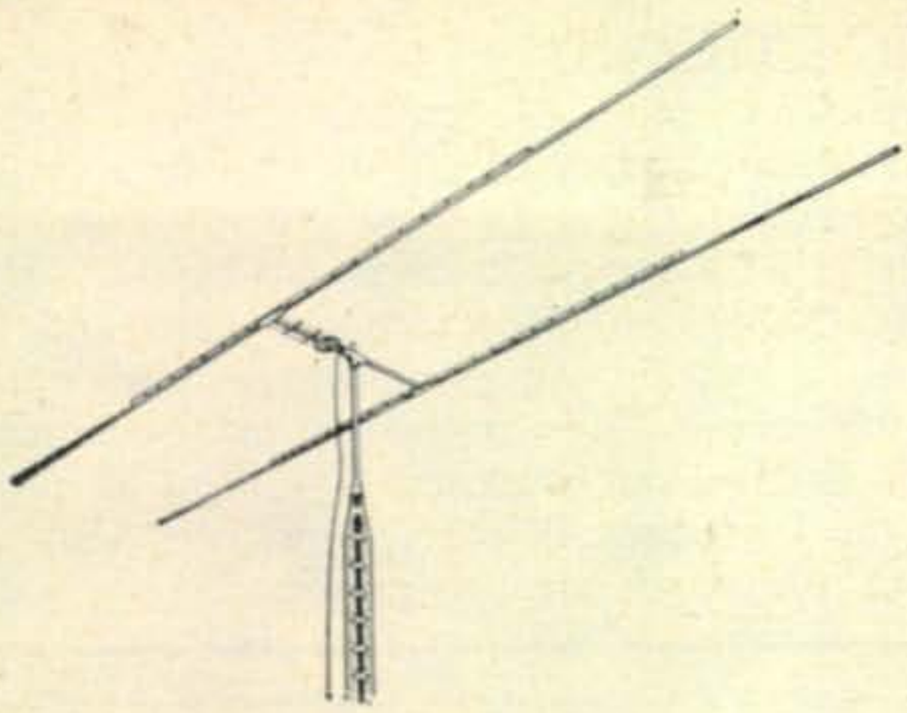
Finco—The Finney Co., 34 West Interstate St., Bedford, Ohio: Specializes in a line of 1¼, 2 and 6 meter beams. Antennas are pre-assembled with positive-locking snap-out construction on all elements for simple installation. Booms are 1" square with multiple-suspension type bracing. Elements are aluminum tubing with reinforced sleeves. Finish is gold corodized for corrosion protection. Except for the 300-ohm models, Gamma-match is supplied with all necessary coax connectors including that to be installed on the end of the transmission line. Collinear elements are used for 2-meter operation with Models A-62GMC and AB-62GMC. Detailed instruction sheets include complete graphs of the gain, F/B ratio, and s.w.r., all plotted against frequency. With some models s.w.r. curves also are furnished for different Gamma adjustments. 50 or 75 ohm lines may be matched. Data also is included for making stacking harnesses using coax cable.

Gain, Inc. 1209 West 74th St., Chicago 36, Ill.: Features stacked v.h.f.-u.h.f. "J" beams which are "slot" antennas similar to a Yagi in which the array is fed at an infinite impedance rather than by the normal low-impedance method. There are no side-radiation lobes, the beam-width is sharper, s.w.r. uniformly low. It is a compact affair with modular construction, so by starting with a basic model, additional gain can be had by adding sections as needed. The basic unit provides 11 db gain, added units each provide 2 to 3 db more gain. All models can be vertically or horizontally polarized without additional hardware. Construction is of heavy-walled aluminum tubing. Clamps and fittings are forged with a special alloy that cannot rust or form electrolytic corrosion.

Gotham, 1805 Purdy Ave., Miami Beach, Florida 33139: Gotham prides itself in its long record of consecutive advertising and acceptance of its line of vertical antennas. These are base loaded with High-*Q* B & W air-wound coils. Gotham beams are full size made of strong aluminum alloy and are designed to furnish high



A 2-meter double-J beam. The horizontal cylinder projecting at the left of the rectangular vertical element is a balun for 52 ohm coax line. (Gain, Inc. Model 144-S-4).



A 2-element 40-meter beam employing linear loading, reducing element length to two-thirds of normal size. (Hy-Gain Model 402-B).

gain for the number of elements. No tuning stubs, baluns, coils, traps or insulators are used.

Hilliard Laboratories, Box 2614, Macon, Georgia: Features 10, 15 and 20 meter Rhombics, four wavelengths per leg. Supplied with #12 hard copper wire, insulators and terminating resistor. Feed impedance is 600 ohms. Requires four supports.

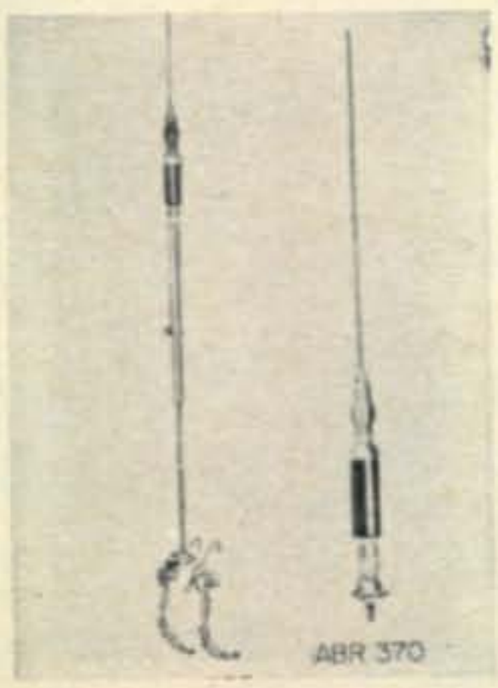
Hi-Par Products Co., 347 Lunenburg St., Fitchburg, Mass. 01421: Specializes in 2 and 6 meter antennas. Their original Saturn-6 Halo has long been popular. The 6-meter Long-John beams employ "plumbers delight" style with no holes drilled in either the boom or elements. Electrolysis from unlike metals in contact with each other is eliminated by using only aluminum where important parts are fastened together.

A new design of Gamma-match is used which increases the operating bandwidth of the antenna. The reactance-cancelling capacitor is located at the outer end of the arm, rather than at the inner end, and is completely weatherproofed and sealed. No critical adjustments are needed. Coax connector is built in.

Hy-Gain Antenna Products, N.E. Highway 6 at Stevens Creek, Lincoln, Nebraska: The large beams utilize a 2" boom. Telescoping elements are employed to minimize droop. Material is 6063T832 aluminum. New formed aluminum gusset bracket assemblies are used. All parts are pre-drilled. Light weight "Hi-Q" slim traps (2" dia.) are weather-proofed, wound and completely enclosed in aluminum housings. Junior beams made with lightweight taper-swaged aluminum tubing and brackets are die-formed aluminum. Traps use high-impact Styron coil forms and are weatherproofed in die-formed aluminum. Hy-Gain beams feature the Beta-match. Linear loading and decoupling is used with the 20 and 40 meter Duobander and Hy-Seven beams.

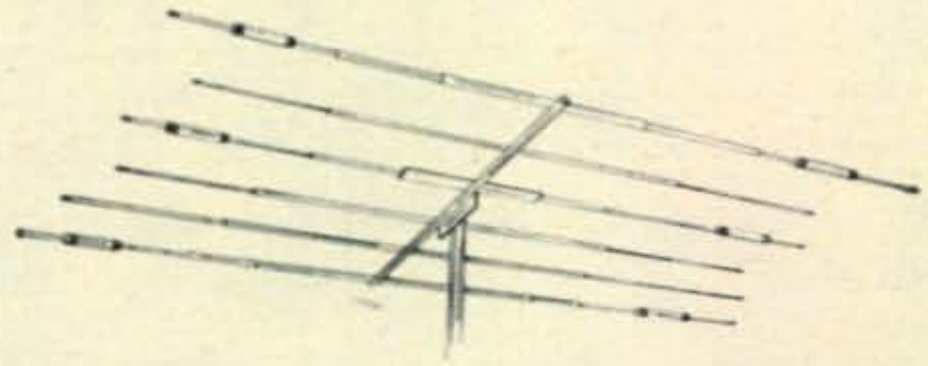
A series of self-supporting vertical antennas employs both traps and linear decoupling. They are furnished with Cycolac base with weatherproofed coax connector. Interesting data on phasing two or more verticals for directivity and gain is given in the literature. Bandwdth s.w.r. charts are supplied with beams and verticals.

The Topper mobile antenna uses fold-over mast made of ½" diameter solid aluminum rod with a positive lock quick-disconnect sleeve. Upper antenna section is ⅜" fiberglass rod with encapsulated top-loading coil tunable with a stainless steel rod. A "quick disconnect" is used between mast and antenna sections.



Left — ⅝ wave arrangement with adjustable coaxial tuning skirt and double chain bumper mount. (Master Mobile ABR-360). Right — A mobile ⅝ wave roof-top antenna with matching transformer at base. (Master Mobile ABR-370).

Master Mobile Mounts, 4125 W. Jefferson Blvd., Los Angeles, Calif. 90016: Has long specialized in mobile antennas but the line also includes base station models. The Dart-Line mobile antennas feature a fold-over stainless steel mast with brass fittings and is corrosion resistant and weatherproofed. A slim locking sleeve holds a rigid vertical position when conditions subject the antenna to lateral pressure. A one-piece whip and coil resonator are adjustable to move in and out of frequency. The 2-meter High-Gain antennas have stainless steel whips with set-screw type adapter for field cutting to frequency. When supplied, mounting spring is stainless steel, mount is plated and matching transformer is Cycolac molded. A wide line of mobile mounts and accessories is available.



A trap-type beam antenna with four elements on 10 meters, and three elements each on 15 and 20 meters. (Mosley Model TA-36).

Mosley—Carloma Corp., 4610 No. Lindbergh Blvd., Bridgeton, Missouri: Beam antennas are designed to give maximum gain wtih low s.w.r. using direct feed without the necessity of matching or balancing devices. The antennas are of heavy-duty construction, yet are light weight. Heavy-walled components are used to stand up under severe winds and ice loading. Elements are secured with husky stainless steel U-bolts, lockwashers and nuts, while other hardware is of non-ferrous metals and plastic. Penetrox solution is used as extra insurance against corrosion of metal parts.

The coils in Mosley traps are space-wound with #10 wire on grooved forms molded of high-impact polystyrene with coil leads held by screws. The coil form is molded directly on the aluminum element which, along with the outer aluminum trap casing, comprises the capacitor elements which are thus solidly fixed to ensure stability. The traps "breathe" and cannot collect condensation.

A series of multi-band doublets and self supporting vertical antennas employs traps. The Trap Mobile antenna uses a trap and base loading with a stainless steel whip which may be laid forward over the car for garaging. It is guaranteed not to warp or take a set. Also available are 2 and 6 meter beams, a transmission-line antenna—the El Toro, and a portable half-wave antenna for window sill mount—the Tote-Tenna.

New-Tronics Corp., 3455 Vega Ave., Cleveland, Ohio 44113: Features the "Cliff Dweller" remotely controlled tunable dipole which employs a sturdy aluminum die-cast housing for motor and gear trains which drive the end sections of the dipole, heat-treated aircraft type 1¼" heavy-walled aluminum tubing and waterproofed resonator coils and housings. It is self supporting, accepting a 1¼" threaded pipe for mounting on standard rotators. May also be mounted on top of a beam assembly.

The Hustler mobile antenna employs a ½" aluminum fold-over mast which may be rigidly locked in the vertical position by a slide-proof sleeve clutch arrangement. The resonator sections embody inductive loading with the mast adjustable for precise tuning. No matching devices are needed and any length 52-ohm line may be used.

The Coveya-6, a new type beam for 50 mc, produces a cardiod pattern with no side nulls. It consists of a

[*Continued on page 87*]

CQ's Winter Special Antenna Catalog-next page. ➧

LISTED SPECIFICATIONS

In regards to the listing which follows, the specifications in each case are those given in the manufacturers' literature.

The antenna-gain figures are related to the radiation obtained from a half-wave dipole having the same height and orientation as the antenna concerned; however, neither the height nor the vertical radiation angle is indicated. In addition, surrounding objects and ground conditions may affect performance, so some discrepancies can be expected.

Vertical-antenna gain is related to a quarter-wave radiator at a given height using the same type ground system (real or artificial).

It should be noted that the gain and F/B ratio figures are the maximum values obtained at the center-design frequency or resonance, so performance can be expected to drop off slightly as the frequency deviates from this point (toward the band edges).

Model and Type	Band	No. El.	Gain (db)	Max. F/B	Beam W. (°)	Pwr. (Kw.)	Max. El. L.	Boom L.	Turn. Rad.	Wt. (lbs.)	Wind Load (lbs.)	Notes	Price
Antenna Specialists Co., 12435 Euclid Ave., Cleveland 6, Ohio													
M-7A - Ground Plane Vertical	2											U-Bolt mounting	5.40
G-3 Ground Plane Vertical	2					3						Heavy Duty-S0239 Connector in base—weathertight.	20.46
ASP-244 Vertical Coaxial	2	Field Tunable					89"					Supplied with 8' RG 8/U & N Type Connector	29.95
M-105 Vertical Ground Plane	6											Low Cost Type.	12.15
M-92 End fed ½ λ	6		6			.2	11' 10"					Dual U-Clamps-Uses shortened decoupling radials (supplied).	28.43
M-91 End fed ½ λ	10		6			.2	16' 10"						34.50
M-12 Vertical Ground Plane	6 or 10					.3						Heavy Duty-S0239 Connector in base—weathertight (Specify Frequency band).	42.21
ASPR1 Mobile, Roof top ¼λ	2											⅜" mtg. hole -Solderless lead connection	2.85
ASPR1L Mobile, Roof top ¼ λ	2											Same as ASPR 1 but with 12' RG58/U & PL259 Connector.	4.95
ASP 157 Mobile Gutter Mount ¼λ	2											With 12' RG58/U & PL259 Connector.	8.10
ASPR 177 Mobile Roof top ½ λ	2		3									⅜" mtg. hole, has spring mount, sealed matching transformer & 12"RG 8U & PL259 Connector.	24.00
ASPR 197 Mobile	2											Same as ASPR 177 but cowl mount.	30.00
ASPR 200 Mobile	2											Same as ASPR 177 but with double-chain bumper mount.	36.00
ASPC 201L Mobile Roof top	2											⅜" mtg. hole - has snap-on mtg. - Supplied with 12' RG 58/U & PL259 Connector.	5.55
ASPC 201 Mobile Roof top	2											Same as ASPC 201L but without coax cable.	3.08
ASP 242 Mobile Vertical Coax	2											Field Tunable, Bumper Mount.	21.00
ASP 243 Mobile Vertical Coax	2											Field Tunable, Cowl Mount.	18.00
ASP 249 Mobile Vertical Coax	2 & 6											Pre-tuned, cowl mount.	15.00
ASP 250 Mobile Vertical Coax	2 & 6											Pre-tuned, for Standard base with ⅜"–24 thread.	10.50
M-84 - Mobile, Roof top - base loaded	6											With matching transformer, 20' RG 58/U – PL 259 Connector.	15.68
M-85 Mobile Whip	6											59" Whip with cowl mount, gutter clip & 54" Coax Cable.	8.97
M-88 Mobile Whip base loaded	6											With 44" Whip for cowl, deck, fender mount Matching Transformer in base, with 20' RG58/U & PL 259 Connector.	19.32
M-87 Mobile Whip base loaded	6											Same as M-88 but trunk-groove mount.	17.06
M-86 Mobile Whip base loaded	10											Same as M-88.	19.32
M-89 Mobile Whip base loaded	10											Same as M-86 but trunk-groove mount.	17.06
MR-60 Mobile Whip - Center loaded	6						37"					Fiberglass - Spiral wound	9.96
MR-61 Mobile Whip - Center loaded	10						45"					Fiberglass - Spiral wound	9.96
MR-62 Mobile Whip - Center loaded	15						61"					Fiberglass - Spiral wound	9.96
MR-63 Mobile Whip - Center loaded	20						61"					Fiberglass - Spiral wound	9.96
MR-64 Mobile Whip - Center loaded	40						73"					Fiberglass - Spiral wound	11.05
MR-65 Mobile Whip - Center loaded	80						73"					Fiberglass - Spiral wound	11.05
Barker & Williamson, Inc., Bristol, Penna.													
Vacationeer - Portable - base loaded	2, 6, 10, 15, 20					.3P	57"	2				With mounting bracket & all loading coils - retracts to 18½".	19.95
Columbia Products Co. R.F.D. 3, Columbia, S.C.													
10-1 Wondershaft Mobile Whip ¼λ	6						50"-60"					Fiberglass	6.95
10-2 Wondershaft Mobile Whip ¼λ	10						61"-102"					Fiberglass	7.50
29-1 Base Extension							18"					For extending whips or using coil between whip & extension.	5.95
29-2 Base Extension							27"						6.29
29-3 Base Extension							36"						6.95
73-3 Helical Whip	10					4'						Distributed-load antenna with coil wound in lower section of Fiberglass whip.	11.25
73-4	15					4'							11.25
73-5	20					6'							15.90
73-6	40					6'							15.90
73-7	80					6'							15.90
73-8	40					8'							18.75
73-9	80					8'							18.75
238 - High Gain Whip - Col. ¾λ	6		2.7				84"-108"			11 oz.		Fiberglass	12.50
Dorco Electronics 109 E. Elm St., Compton, Calif.													
Orbitop - Mobile Top-Hat Antenna	Section												15.45
Finco-The Finney Co., 34 West-Interstate St., Bedford, Ohio													
A 1¼-10 Yagi	1¼	10	13	21	40		118¾"	62"	3	22		For 300-ohm line	13.20
A 2 - 10 Yagi	2	10	13	19	45		118¾"	62"	3	24		For 300-ohm line	13.20
A 2 - 10 GMC Yagi - G	2	10	13	19	45		118¾"	62"	4¼	38			19.77
A 2 - 15 GMC Yagi - G	2	15	15	18	31		15½'	95"	6½	58			31.80
A 6 - 3 GMC Yagi - G	6	3	7.5	19.5	61		69¾"	66½"	3½	26			15.30
A 6 - 4 Yagi	6	4	9	18	60		118¾"	82"	4½	38		For 300-ohm line	18.60
A 6 - 4 GMC Yagi - G	6	6	9	18	60		118¾"	82"	4½	38			22.17
A 6 - 6 GMC Yagi - G	6	6	11	18	56		15½'	110"	8¼	61			33.30
A 6 - 7 GMC Yagi - G	6	7	13	18	49		19½'	132"	9½	75			37.50
A - 62 - Two Band Yagi	6	4	9	18	60							300 ohms - on 2M, 3 Colinear	
	2	18	10	17	45		118¾"	80"	7	58		Yagis of 6 elements each.	33.00
A - 62 GMC - Two Band Yagi - G	6	4	9	18	60							Same as above	
	2	18	10	17	45		118¾"	80"	7	58		but 50 ohms.	34.50
AB - 62 GMC - Two Band Yagi - G	6	6	11	18	56							On 2M, 3 Colinear Yagis	
	2	30	12	18	38		15½'	110"	21	89		of 10 elements each - 50 ohms.	52.50

Model and Type	Band	No. El.	Gain (db)	Max. F/B	Beam W. (°)	Pwr. (Kw.)	Max. El. L.	Boom L.	Turn. Rad.	Wt. (lbs.)	Wind Load (lbs.)	Notes	Price
Gain, Inc., 1209 West 74th St., Chicago 36, ILL.													
NOTE: A Double - 2 Booms													
144-S-2, J-Beam, One Double 2	2	4	8	14	70	1		20"				300 ohms	18.95
144-S-4, J-Beam, One Double 4	2	8	11	18	25	1		56"				Basic Antenna	23.50
144-S-6, J-Beam, One Double 6	2	12	13	22	20	1		90"					29.95
144-S-8, J-Beam, One Double 8	2	16	14	24	15	1		124"					36.50
144-S-16 J-Beam, Two Double 4	2	16	14	22	13	1		56"				300 ohms	46.50
144-S-16A, J-Beam, Four Double 4	2	32	17.2	24	8	1		56"					93.00
144-S-32, J-Beam, Two Double 8	2	32	17.5	23	8	1		124"					71.95
144-S-64, J-Beam, Four Double 8	2	64	20.9	27	6	1		124"					143.50
144-S-128, J-Beam, Eight Double 8	2	128	24.2	29	5	1		124"					285.95
50-S-4, J-Beam, One Double 4	6	8	11.8	21	24			124"				300 ohms	74.95
50-S-6, J-Beam, One Double 6	6	12	14.2	23	18			155"				300 ohms	84.95
50-S-16, J-Beam, Two Double 4	6	16	15	23	12			124"				with linear matching transformer.	145.95
50-S-24, J-Beam, Two Double 6	6	24	17.4	24.5	9			155"					166.45
A0-4 Add-on elements	2											Increases 144-S-4 to 144-S-6-Adds 2 db gain.	13.95
A0-8 Add-on elements	2											Increases 144-S-4-to 144-S-8-Adds 3 db gain.	17.95
		Stacked J-Beams are also available for 220 and 420 MC											
220 FD5-Conventional Beam, 1-Boom	1¼	11.6	18									52 ohms with Balun included.	14.95
220 FD8-Conventional Beam, 1-Boom	1¼	13.8	20									52 ohms with Balun included.	17.95
144 FD4-Conventional Beam, 1-Boom	2	10.4	16									300 ohms	12.45
144 FD6-Conventional Beam, 1-Boom	2	12.4	18									300 ohms	15.45
144 FD8-Conventional Beam, 1-Boom	2	13.4	20									300 ohms	17.95
50 FD3-Conventional Beam, 1-Boom	6	8.5	16									300 ohms	18.95
50 FD4-Conventional Beam, 1-Boom	6	10.4	17									300 ohms	23.45
50-5-E1-Conventional Beam, 1-Boom	6	11.5	24									50 ohms	23.95
Gotham, 1805 Purdy Ave., Miami Beach, Florida 33139													
Beam-One Band	2	12	14					12'					24.95
Beam-One Band	6	4	9.5					12'					25.95
Beam-One Band	10	4											40.95
R-15 Beam-One Band	15	3	8										49.95
Beam-One Band	20	3	8					12'					59.95
Beam-Two Band	15, 20											Separate 52 or 72 ohm lines for each band-no loading coils or traps.	49.95
Beam-Three Band	10, 15, 20											Separate 52 or 72 ohm lines for each band-no loading coils or traps.	59.95
V 40 Vertical-Base loaded	6, 10, 15, 20, 40						23'					No radials or guys needed.	14.95
V 80 Vertical-Base loaded	6, 10, 15 20, 40, 80						23'						16.95
V 160 Vertical-Base loaded	6, 10, 15, 20 40, 80, 160						23'						18.95
Hilliard Labs., Box 2614, Macon, Georgia													
Rhombic	10		12	100			137'	O-L-245', O. W. 125'				For 600 ohm line	29.95
Rhombic	15		12	100			191'	O-L-340', O. W. 175'				Terminating resistor supplied.	37.95
Rhombic	20		12	100			282'	O-L-500', O. W. 260'				Vertical Steering 0 - 20 degrees.	44.95
Hi-Par Products Co., 347 Lunenburg St., Fitchburg, Mass. 01421													
2M8 Lunnenburg Yagi G	2	8	14	26	35			124½"		5			14.95
GM6 Lunnenburg Yagi G	6	5	10	30	30			12'		10		Adjustable 50-75 ohms.	22.50
HT2M Hilltopper Portable Yagi G	2	8	14	26	35			124½"		5		Boom in 3 sections, supplied with carrying case.	13.95
6MHT Hilltopper Portable Yagi G	6	3	8.5	25				78"		3¾		Boom in 2 sections, supplied with carrying case.	16.95
LJ6 Long John Yagi G	6	6	13	23	45			21½"		15		Adjustable 50-75 ohms.	34.95
2H-Mobile, Lunnenburg Halo	2											With 3-piece adjustable mast.	9.95
2H-Mobile, Lunnenburg Halo 2H2	2									7 oz.		Antenna only. 3-Piece 5½' Mast for stacking 2 Halos (3 db gain).	6.95 / 3.50
S-1 Saturn-6 Mobile Halo	6									2		With 2-piece adjustable mast	16.95
S-2 Saturn-6 Mobile Halo	6											Antenna only.	11.95
Hy-Gain Products, N.E. Highway at Stevens Creek, Lincoln, Nebraska													
313 VHF Yagi O.S.	¾	13	16	25		1	14"	8'	4'6"	3		450 ohm line.	12.95
111 VHF Yagi O.S.	1¼	11	14.2	25		1	27"	12'	6'8"	3¾		450 ohm line.	13.95
23 VHF Yagi O.S. (B)	2	3	9	20		1	42"	3'	4'	3		with Balun	6.95
28 VHF Yagi O.S. (B)	2	8	14.5	30		1	42"	14'	7½'	7		for 52-ohm	16.50
215 VHF Yagi O.S. (B)	2		17.8	30		1	42"	28'	14'	17		line.	33.50
63B VHF Yagi O.S. (B)	6	3	10	25		1	9'10"	8'	6'	5		with Balun	16.95
64B VHF Yagi O.S. (B)	6	4	12.7	25		1	9'11"	12'	8'	8		for 52-ohm	21.50
66B VHF Yagi O.S. (B)	6	6	15	25		1	9'9"	24'	12½'	17		line.	38.50
611B VHF Yagi O.S. (B)	6	11	19	30		1	9'8"	47'	24'2"	90			195.00
DB62 VHF 2 Band	6 2	4 18	8 15	20		1	10'	10'	7'			Colinear elements on 2M.	32.95
LP62 Log Periodic	6 2		8 15	25		1	9'	24'	16'	20			83.50
GP-3C Ground Plane ¼	1¼ or 2									4		Solid elements.	14.97
SGP-2 Ground Plane ¼	2						19"			2		U-Clamp Mtg.	5.90
GPG-2 Ground Plane Colinear	2		3.4				48"			2		U-Clamp Mtg.	14.95
GP-2C Ground Plane ¼	2		Heavy Duty							7		Telescoping Radiator and radials.	21.90
SPG-6 Ground Plane ¼	6						4'7"			3		U-Clamp Mtg.	13.95
GPG-6 Ground Plane Colinear	6		3.4				11'7"			9		Double U-Clamp Mtg.	24.95
GP-62 Ground Plane ¼	2,6						4'7"			4		Double U-Clamp Mtg. Uses decoupling stubs.	19.95
GP-1C Ground Plane ¼	10		Heavy Duty							10		Telescoping radiator and radials.	32.70
103BA Beam 1 Band F.S.	10	3	8	25			17'	8'		12			32.95
153BA Beam 1 Band F.S.	15	3	8	25			23'	12'		19			38.50
203BA Beam 1 Band F.S.	20	3	8	25			35'	16'		35			65.95
402B Hy-Seven-Linear loaded	40	2	5.2	30			43'	16'	23½'	24	149	(B)	99.75
DB24 2 Band Linear loaded	20 40	3 2	8 5	30 20		5P	43'	24'	24'2"	54		With balun (B)	69.95
TH2 Thunderbird-3-Band-Trap (B)	10,15,20	2	5	20		2P	26'	6'		19	86		69.95

Model and Type	Band	No. El.	Gain (db)	Max. F/B	Beam W. (°)	Pwr. (Kw.)	Max. El. L.	Boom L.	Turn. Rad.	Wt. (lbs.)	Wind Load (lbs.)	Notes	Price
Master Mobile Mounts, 4125 W. Jefferson Blvd., Los Angeles, Calif. 90016													
GP-4 Vertical Ground Plane ¼ λ	2												5.95
ABR-365 Dynamaster Colinear Ground Plane 1½ λ	2		5.8				7'					Supplied with SO-239 connector and cutting chart for 144-174 mc.	34.95
AM-106 Dynamaster Colinear Ground Plane #¾ λ	6		3.7				7'					Supplied with SO-239 Connector at base.	34.95
B-20 Mobile, Roof mount ¼ λ	2											7/16" Mtg. hole-has self-tapping threads.	2.25
ABR370 Mobile, Roof mount 5/8 λ	2		3				57"					With stainless steel spring, plate mount, matching transformer, 12'RG58/U.	22.95
ABR360 Mobile, Roof mount 5/8 λ	2		3				57"					Coax antenna using #370 whip with adjustable tuning skirt and double-chain bumper mount.	32.95
Dart-Line, mobile whip	10					1P	38"					Length does not include lower mast section. Frequency is tunable.	5.95
with center-loading coil	15					1P	38½"						6.95
for use with	20					1P	39"						7.95
fold-over	40					1P	40½"						8.95
lower mast	80					1P	46"						9.95
AM-29 Fold-over Mast												36" Lower mast section, breaks at 18" for deck or fender mount.	11.95
AM-35 Fold-over Mast												48" Lower mast section, breaks at 36" for bumper mount.	14.25
RM-10	10					.3P	80"					Length includes lower mast, frequency tunable.	5.95
RM-15 Hustler mobile whip & resonator (center loaded)	15					.3P	81"					Length includes lower mast, frequency tunable.	6.95
RM-20 for use with fold-over	20					.3P	83"					Length includes lower mast, frequency tunable.	7.95
RM-40 lower mast	40					.3P	92"					Length includes lower mast, frequency tunable.	9.95
RM-80	80					.3P	97"					Length includes lower mast, frequency tunable.	11.95
MO-1 Fold-over mast												54" lower mast section-Folds at 15" for deck or fender mount.	7.95
MO-2 Fold-over mast												54" lower mast section-Folds at 27" for bumper mount.	7.95
Telrex Laboratories, Asbury Park, N.J. 07712.													
Unless noted, all beams balun ted, balun supplied													
430M-1511 Yagi W.S.	¾	15	16.5	24	27		13"	9'	5'	3	26	Hairpin Resonated, Balun Supplied.	39.70
A430/CR-30*2 λ Corner Reflector	¾		13	20	45		30"		3'	15	40	Balun Supplied.	75.00
220M-54 Yagi O.S.	1¼	5	12.8	24	51		28"	4'	26"	1	15	Balun Supplied.	14.00
220M-1520 Yagi O.S.	1¼	15	17.2	24	27		28"	20'	11½'	10	50	Balun Supplied.	39.00
2M-5C Yagi M.S.	2	5	12.4	23	57		3½'	5'	3½'	1½	13	Hairpin Resonated, Balun Supplied.	14.00
2M-609 Yagi O.S.	2	6	14.6	23	42		3½'	9'	5½'	3	21	Hairpin Resonated, Balun Supplied.	23.00
2M-814 Yagi O.S.	2	8	16.5	23	35		3½'	14'	7'	5	36	Hairpin Resonated, Balun Supplied.	39.00
2M-1528 Yagi O.S.	2	15	17.2	23	27		3½'	28'	14'	15	65	T-Matched Balun Supplied.	65.00
6M-309 Yagi O.S.	6	3	10	23	58		10'	8'	6'	5	28	T-Matched Balun Supplied.	23.00
6M-516 Yagi O.S.	6	5	13	24	51		10'	16'	9½'	11	47	T-Matched Balun Supplied.	39.00
6M-624 Yagi O.S.	6	6	15	24	42		10'	24'	12½'	17	67	T-Matched Balun Supplied.	69.00
6M-1136 Yagi W.S.	6	11	17.8	24	33		10'	36'	19½'	42	134	T-Matched Balun Supplied.	135.00
6M-1147 Yagi Monarch O.S.	6	11	19	24	31		10'	47'	24½'	82	263	Balun Supplied.	225.00
6MSR-1147-Spiral Ray	6	11	18.7	24	32		10'	47'	24½'	82	308	T-Match Balun Supplied.	225.00
2VS2M-814 Stacked	2	16	19.2	23								Two Model 2M-814 Stacked.	90.00
4VS2M-814 Stacked	2	32	23.2	23								Four Model 2M-814 Stacked.	196.00
2VS2M-1528 Stacked	2	30	21	23								Two Model 2M-1528 Stacked.	146.00
4VS2M-1528 Stacked	2	60	24	23								Four Model 2M – 1528 Stacked.	295.00
TY6M-624 Stacked	6	12	18	24	20 42							Two Model 6M-624 Stacked-Complete.	195.00
10M-309B Standard M.S. Beam	10	3	8.5	24	60		18'	9'	11'	12	59		49.00
10M-310B Deluxe W.S. Beam	10	3	8.5	24	59		18'	10'	10'8"	21	75		79.00
10M-313B Super Deluxe O.S. Beam	10	3	10	24	57		18'	14'	12'	21	82		125.00
10M-518B-Deluxe M.S. Beam	10	5	11.6	24	56		18'	18'	14'	30	96		185.00
10M-523-Monarch O.S. Beam	10	5	13	24	49		18'	23'	17'	65	138		285.00
10M-636-Monarch O.S. Beam	10	6	14.6	24	48		18'	36'	20'	80	170		425.00
15M-312B-Standard M.S. Beam	15	3	8.5	24	60		23½'	12'	13½'	32	171		125.00
15M-317B-Super Deluxe O.S. Beam	15	3	10	24	58		24'	17'	14½'	37	107		159.00
15M-525 Super Deluxe M.S. Beam	15	5	11.6	24	55		24'	25'	17'	74	245		285.00
15M-532 Monarch O.S. Beam	15	5	13.4	24	53		24'	32'	19½'	95	310		365.00
20M-207CM Mini-beam	20	2	3.4	16	74		20'	6'8"	8½'	11	87	Inductively loaded, balun supplied.	68.00
20M-313HS Super Mini-Beam	20	3	7	24	63		27'	13'	15'	25	135	Hairpin Resonated, balun supplied.	90.00
20M-317B Deluxe M.S. Beam	20	3	8.5	28	60		36'	17'	22'	48	184	Hairpin Resonated, balun supplied.	159.00
20M-321B Super Deluxe W.S. Beam	20	3	9.5	28	59		36'	21'	23'	58	259	Hairpin Resonated, balun supplied.	195.00
20M-326B Super Deluxe O.S. Beam	20	3	10	28	58		36'	26'	24'	71	266	Hairpin Resonated, balun supplied.	235.00
20M-436 Super Deluxe O.S. Beam	20	4	11.5	28	53		36'	36'	26'	108	382	T-Match, coax-type balun supplied.	315.00
20M-536 Super Deluxe W.S. Beam	20	5	12	28	52		36'	36'	26'	113	432	T-Match, coax-type balun supplied.	385.00
20M-546 Monarch O.S. Trap-Beam	20	5	13	28	50		36'	46'	29'	150	448	T-Match, coax-type balun supplied.	595.00
20M-646 Monarch O.S. Trap-Beam	20	6	14	28	48		36'	46'	29'	176	533	T-Match, coax-type balun supplied.	688.00
40M-24 Super Mini Beam	40	2	3.4	16	77	1.2	46'	14'	24'	44	224	Inductively loaded, custom built to order.	265.00
40M-214 Deluxe M.S. Beam	40	2	5.6	16	66	3	64'	14'	34'	60	252	Custom built to order.	365.00
40M-329 Deluxe M.S. Beam	40	3	8.3	28	59	3	64'	29'	35'	110	406	Custom built to order.	515.00
40M-335 Super Deluxe W.S. Beam	40	3	8.7	28	58	4	64'	35'	36'	150	480	Custom built to order.	635.00
40M-346 Super Deluxe O.S. Beam	40	3	9.0	30	58		64'	46'	40'	177	427	Custom built to order.	785.00
DC-105 Duo Band Trap Beam	10,15	3	8.5	24	60		23'2"	12'	13½'	41	125	Single feedline, balun supplied.	225.00
DB-99D Duo Band Trap Beam	15,20	3	8.5	28	60		36'	18'	22'	49	184	Single feedline, balun supplied.	249.00
DB-30C Duo Band Trap Beam	15,20	3	10	28	59	3P	36'	26'	28'	85	300	Single feedline, balun supplied.	398.00
TC-88D Tri-Band Trap Beam	10,15,20	2	5.5 av.	14	72	1P	29'	8'	16½'	30	116	Single feedline, balun supplied.	149.00
TC-99D Tri-Band Trap Beam	10,15,20	3	8.5 av.	28	60	2P	36'	18'	22'	49	210	Single feedline, balun supplied.	249.00
TM-30C Tri-Band Trap Beam	10,15,20	4 3	10 av.	28	59	3P	36'	26'	28'	85	300	Single feedline, balun supplied.	398.00
ST-4BM/3 4-Band Trap Beam	10,15,20,40	4 3	8.2	23	63		58'	31'	35'	176	420	Single feedline, balun supplied	999.99
Inverted-V Kit Monoband	10 thru 80					1P						Any one band combination, balun supplied.	16.95
Inverted-V Kit Monoband	10 thru 80					2P						Any one band combination, balun supplied.	21.00
Inverted-V Kit Duo Band Trap	10 thru 80					1P						Any two band combination, balun supplied.	32.00
Inverted-V Kit Duo Band Trap	10 thru 80					2P						Any two band combination, balun supplied.	45.00
Inverted-V Kit Tri-Band Trap	10 thru 80					1P						Any three band combination-balun supplied	48.00
Inverted-V Kit Tri-Band Trap	10 thru 80					2P						Any three band combination-balun supplied	65.00
Inverted-V Kit Four Band Trap	10 thru 80					1P						Any four band combination-balun supplied.	64.00
Inverted-V Kit Four Band Trap	10 thru 80					2P						Any four band combination-balun supplied.	87.00
Inverted-V Kit Five Band Trap	10,15,20,40, 80					1P						Balun supplied.	80.00
Inverted-V Kit Five Band Trap	10,15,20,40, 80					2P						Balun supplied. Above Inverted-V Kits are supplied with copperweld wire, traps, & insulators.	109.00

Model and Type	Band	No. El.	Gain (db)	Max. F/B	Beam W. (°)	Pwr. (Kw.)	Max. El. L.	Boom L.	Turn. Rad.	Wt. (lbs.)	Wind Load (lbs.)	Notes	Price
TH3 MK2 Thunderbird-3 Band-Trap (B)	10,15,20	3	8	25		2P	26'	14'2"		29	144		99.75
TH3 JR Thunderbird-3 Band-Trap (B)	10,15,20	3	8	25		.6P	26'	12'	14'9"	28			69.50
TH6 Thunderbird-3 Band-Trap (B)	10,15,20	6	8.5	25			32'	16'	17'10"	38	225		117.50
HD-1 Doublet F.S.						.5	16'					Supplied with 50'RG 58/U center and end insulators.	6.25
HD-1 Doublet F.S.	15					.5	22'						6.25
HD-2 Doublet F.S.	20					.5	33'						6.50
HD-3 Doublet F.S.	40					.5	65'						7.50
HD-4 Doublet F.S.	80					.5	125'						8.95
3BDT Multi-Band Trap-Doublet	10,15,20					1P	33'						17.50
2BDT Multi-Band Trap-Doublet	40,80					1P	110½'						19.95
4BDT Multi-Band Trap-Doublet Fan Type	10,15,20,40					1P	68½'						24.50
5BDT Multi-Band Trap-Doublet Fan Type	10,15,20,40 80					1P	111½'						34.95
2BDP Multi-Band Trap-Doublet Fan Type	15,40,80					2P	131½'						19.95
248BDT Multi-Band Trap-Doublet Fan Type	20,40,80					.5	110'			2			22.50
12AVQ Vertical Trap	10,15,20					2P	13½'			9		with base insulator Requires L680Q coil for 80M, requires short radials.	21.95
14AVQ Vertical Trap, Linear Decoupling	10,15,20,40					2P	21'			11			29.95
18V-Vertical, Base loaded	10 thru 80						18'	Retracts to 5'		o 5'		With base insulator. Requires short radials.	16.95
18HT-Hy-Tower Vertical, Linear Decoupled	10,15,20,40, 80	No Guys-Self Supporting				5P	50'			100	503	Requires 6' Grounding Rod	139.50
18JR-Hy-Tower Vertical, Linear Decoupled	10,15,20,40, 80	No Guys-Self Supporting				2P	38'			30			79.95
HH2BA Mobile Halo (B)	2									1½		Center Mounted	5.95
HH6BA Mobile Halo (B)	6											Center Mounted	10.95
HH6BK Mobile Halo (B)	6											HH6BA with HMBA Mast BPRS steel strap, bumper mount.	16.50
TL10 Mobile Topper	10					.3P						Top loaded whip for use with foldover mast-has quick-disconnect fitting.	7.95
TL15 Mobile Topper	15					.3P							7.95
TL20 Mobile Topper	20					.3P							7.95
TL40 Mobile Topper	40					.3P							9.95
TL75 Mobile Topper	75					.3P							11.95
TM-36												36" Foldover Mast for above Toppers, Bumper or Cowl Mount, with quick-disconnect fitting.	7.95
Mosley-Carloma Corp., 4610 Lindberg Blvd., Bridgeton, Missouri													
A-92-S Beam-VHF Scotchmaster	2	9	14	20		2P	3'5"	12'	6½"	4	25	300 ohm feedline (Folded dipole radiator).	16.40
A-56-S Beam-VHF Scotchmaster G	6	5	10	20		2P	118"	12'	7'9"	7½	25		28.16
A-76-S Beam-VHF Scotchmaster G	6	7	12	20		2P	118"	22'	13'	12½	50		35.10
A-310 One Band-Power Master Beam	10	3	8	25		2P	18'7"	12'	11'1"	25	69	F.S.	41.36
A-315 One Band-Power Master Beam	15	3	8	25		2P	23'4"	12'	13'2"	26	87	F.S.	46.87
A-203C One Band-Power Master Beam G	20	3	8	24		2P	37'	24'	22'	40	140		113.95
TA-32 Three Band-Trapmaster Trap Beam	10,15,20	2	5	20		2P	28'	7'	14'6"	26	74		72.98
TA-32JR Three Band-Trapmaster Trap Beam	10,15,20	2	5	20		1P	26'8"	6'	13'9"	22	62		51.98
TA-33 Three Band-Trapmaster Trap Beam	10,15,20	3	8	20		2P	28'	14'	15½'	40	114		104.75
TA-33JR Three Band-Trapmaster Trap Beam	10,15,20	3	8	20		1P	26'8"	12'	14'9"	20	86		72.98
TA-3340 Four Band-Trapmaster Trap Beam	10,15,20 40	3	8			2P	38'7"		19'6"	50			147.35
TA-36 Three Band-Trapmaster Trap Beam	10,15,20	4 3	9 8	20		2P	29'	24'	19'3"	69	210		132.10
TA-20-40 Two Band-Trapmaster Trap Beam	20 40	3 2	8 5			2P	54'8"	20'	29'	150	405	Has tilting head.	354.39
S-402 Signal Master (center loaded)	40	2	5	20		2P	44'3"	20'	24'4"	58	200		130.73
TA-31-Rigid Rotable Trap Dipole, 3 Band	10,15,20	1				2P	23'11"			11	40		27.14
TA-31JR Rigid Rotable Trap Dipole, 3 Band	10 15,20	1				1P	24'7"			9	30		23.85
TD-2 Wire Trap Dipole, 2 Band	40-80					2P	114'11"			7		Supplied with wire, traps & insulators	39.42
TD-3JR Wire Trap Dipole, 4 Band	10,15,20, 40					1P	60'			1¾		Supplied with wire, traps & insulators	15.23
V-3 Vertical Trap 3 Band	10,15,20					2P	11'6"			4		Requires short radials-supplied with plastic guy rope, base & coax fitting	24.10
V-3JR Vertical Trap 3 Band	10,15,20					1P	11'9"			2			18.85
V-4-6 Vertical Trap 4 Band	10,15,20 40					2P	20'			10		Requires 4-33' Radials.	28.50
V-4-8 Vertical Trap, 2 Band	40,80					2P	52'3"					Requires 12 radials 64' — supplied with plastic guy rope, base & coax fitting.	89.25
V-5 Vertical Trap, 5 Band	10,15,20 40,80					2P	43'8"						124.43
RV-4 Vertical Trap, 4 Band	10,15,20 40					2P	20'9"			10		No radials required with good ground.	30.42
TW-3X (El Toro-Transmission-Line type Multi-band antenna 3-bands)	20,40,80					2P	58'			2		For vertical, angle or L-mounting — must be suspended.	19.95
TW-3XJR	20,40,80					1P	58'			2			14.95
NS-3	Novice 15,40,80					1P	58'			2			14.95
MA-3 Mobile Trap	10,15,20					1P	7'8"					May be used with 40-80 M base loading coil.	22.00
TT-31 Portable Tote-Tenna	10,15,20 40	Window Sill Mtg.				1P	14'					With L-tuning network-retracts to 36".	88.20
TT-31A Carrying Case for TT-31													30.26
R1-6 S.W.R. Bridge for TT-31													52.54
TT-31X – TT31 Tote-Tenna with carrying case & S.W.R. Bridge													164.84
New-Tronics Corp., 3455 Vega Ave., Cleveland, Ohio 44113													
Coveya 6-Beam G	6	4	10	25		1	59"	34"	55"	8½		Similar to Corner Reflector.	39.90
Cliff Dweller-Remotely tuned dipole	10,40					1	28½'		14'3"	20		Rotatable, end loaded.	92.50
Cliff Dweller-Remotely tuned dipole	10,80					1	30½'		15'3"	20		Rotatable, end loaded.	99.50
Cliff Dweller-Remotely tuned dipole	10,40,80					1	31'4"		15'8"	24		Rotatable, end loaded	129.50
HF-62 Mobile-Top loaded	2 & 6					1	44"					Tunable with upper & lower sections adjustable.	10.44
HF-2 Mobile - Top loaded	2 & 6					1	44"					Tunable with upper & lower sections adjustable.	8.64

[Continued on page 96]

CQ Reviews:

The National NCL-2000 Linear Power Amplifier

BY WILFRED M. SCHERER,* W2AEF

WHAT is a juggernaut? Merriam-Webster defines it as "any massive inexorable force that advances irresistibly, crushing whatever is in its path." The National Radio Company NCL-2000 linear power amplifier is just that—a real crusher—powered with a highly efficient p.e.p. input of 2000 watts at 29¢ per watt!

A complete table-top unit with built-in power supply, the NCL-2000 includes the following other features: operation on all amateur bands from 3.5 through 30 mc with overlap at the band edges; maximum legal d.c. input of 1000 watts for c.w., a.m., f.m. and RTTY; *average* legal input of 1000 watts (2000 watts p.e.p.) for s.s.b.; separate rear-illuminated plate voltage and current meters for monitoring power input; 65% efficiency in all modes on every band; drive power of 20 to 200 watts p.e.p., adjustable (no external pads needed); passive input circuit (no tuning required) with internal 50-ohm dummy load for accurate exciter tuneup together with metering of exciter relative-output power; built-in relays for transceiver or for separate receiver and exciter operation; instantaneous switching for exciter feedthrough or linear-amplifier output; time-delay relay to ensure adequate warm-up period; electrical interlock and automatic high-voltage shorting bar for personnel safety protection; electrical overload protection with plate overload relay backed up by line fuses; air blower, solid-state electronically-regulated bias supply with separate solid-state screen and plate supplies; operates from 115 or 230 v.a.c. 60-cycle primary power source.

*Technical Director, *CQ*.

Class of Operation

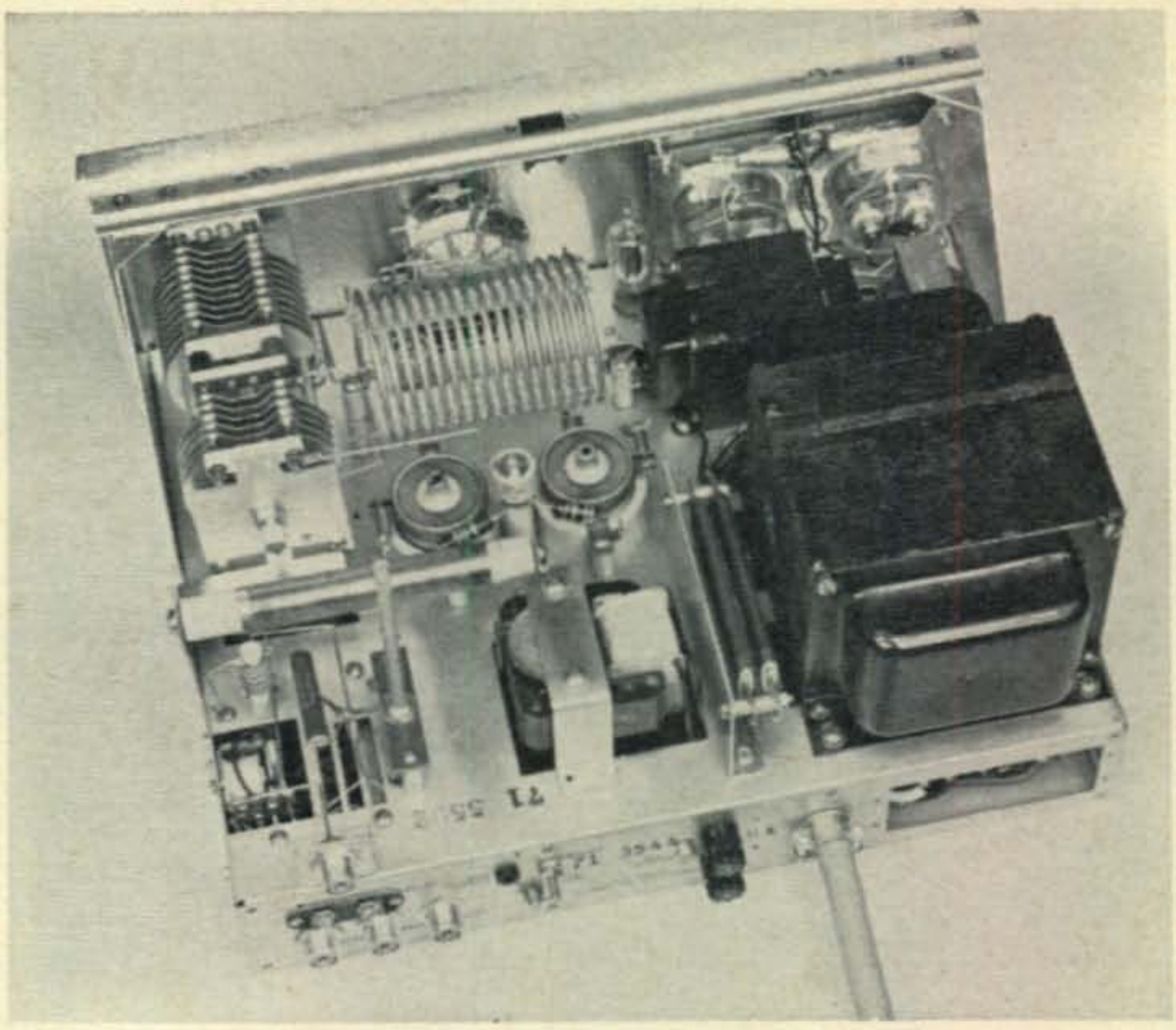
Higher efficiency can be realized with class AB_2 amplifier operation than with class AB_1, but due to stiff bias requirements, plate and screen currents may rise to dangerously high levels when the grids are overdriven; whereas, these currents can be limited with the less efficient overdriven class AB_1 amplifier, because, in this situation, a self bias is created through the poorly regulated bias feed usually used, which holds plate and screen currents to safe values. In order to realize the advantages of both classes of operation, the National Radio Company has developed the grid-current-limited class AB_2 system[1] which is used in the NCL-2000.

The system consists of an electronically series-regulated grid-bias supply designed to hold a constant grid bias for class AB_2 operation under normal drive levels, but which allows bias to abruptly increase when the grid current exceeds a predetermined value, in this case 15 ma.

Operation of the bias regulator is as follows: A current of 15 ma is drained from the output of the bias regulator by means of a bleeder. When the grid current *rises*, it flows in reverse polarity to the bleeder current and causes the regulator current to *decrease* toward zero, so when the grid current reaches the predetermined value of 15 ma, current flow in the series regulator ceases with a subsequent loss of regulation. When drive is increased beyond this point, the grid potential becomes more negative and plate and screen currents are held to safe limits.

[1]Patent pending.

The NCL-2000 linear power amplifier. It is housed in a perforated tilt-up cabinet and has a heavy extruded-aluminum panel. Plate meter is at left with multi-meter at right of it. The power, plate, and c.w./s.s.b. rocker-type switches are at lower left with the indicator lamp bezels at their right. The bandswitch is at top center with the multi-switch below it. The P.A. tuning and loading are at right.



Top view of NCL-2000. The 8122 tubes are at the center with the thermal time-delay tube at upper right of the tank coil. Plate capacitor is at left. The blower motor is at center foreground and the vertical rod at the left of it is the mechanical link for operating the h.v. shorting bar with the case lid. The 115/230 v. barrier terminal block is recessed behind the cutout on the right of the chassis apron.

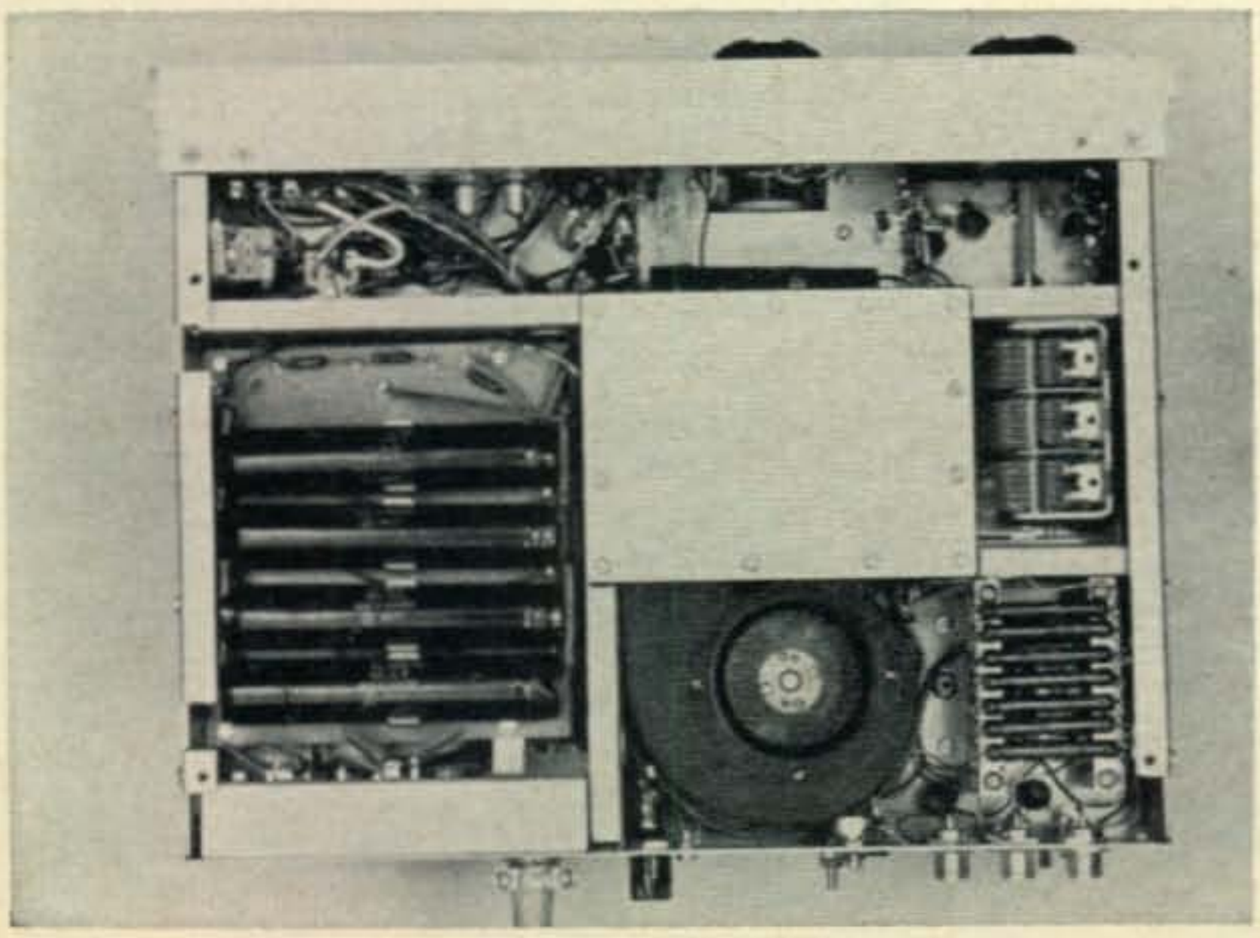
Circuitry

Two RCA 8122 air-cooled miniature ceramic tetrodes are used in parallel with a grounded-cathode circuit. Each tube has a rated plate dissipation of 400 watts, for a total dissipation capability of 800 watts which is more than enough margin for operation at 2000 watts p.e.p., especially when the efficiency *into the load* is in the order of 65%, such as it is in the NCL-2000. Also, a solid average kilowatt can be obtained with no strain.

A passive untuned grid circuit is used which enables the amplifier to be driven to full output with anywhere between 20 and 200 watts. The arrangement consists of 14 non-inductive "swamping" resistors shunted across the grid input in a series-parallel combination totalling 50 ohms. Inasmuch as currently used exciters usually put out more than 80 watts p.e.p., excessive drive would be applied to the NCL-2000 if the grids were directly fed. To avoid this, only half of the available drive potential is applied to the tubes by connecting their grids at the midpoint of the swamping network.

On the other hand, if a lower-power exciter is used, the tube grids may be connected across the entire swamping resistor to obtain full drive potential. Internal provisions are available for making the change if needed. In any case, no external r.f. input pads or critical cable lengths are required, and a perfect match to the exciter is always obtained.

The low resistive-input impedance provides several other desirable features. First, it represents a constant load to the exciter under all signal-level conditions, and thus ensures the necessary exciter regulation required for maintaining linearity when driving a class AB_2 linear. Second, the low non-reactive impedance across the grid of a grounded-cathode setup eliminates the need for neutralization and results in extremely stable operation at all times. This also does away with the need for resorting to grounded-grid circuitry which requires higher drive power.



Below chassis view of the NCL-2000. Blower fan is at center foreground with the forced-air chamber above it. The loading capacitor is at right with the swamping resistors at right foreground. Four of the h.v. filter capacitors are at the left.

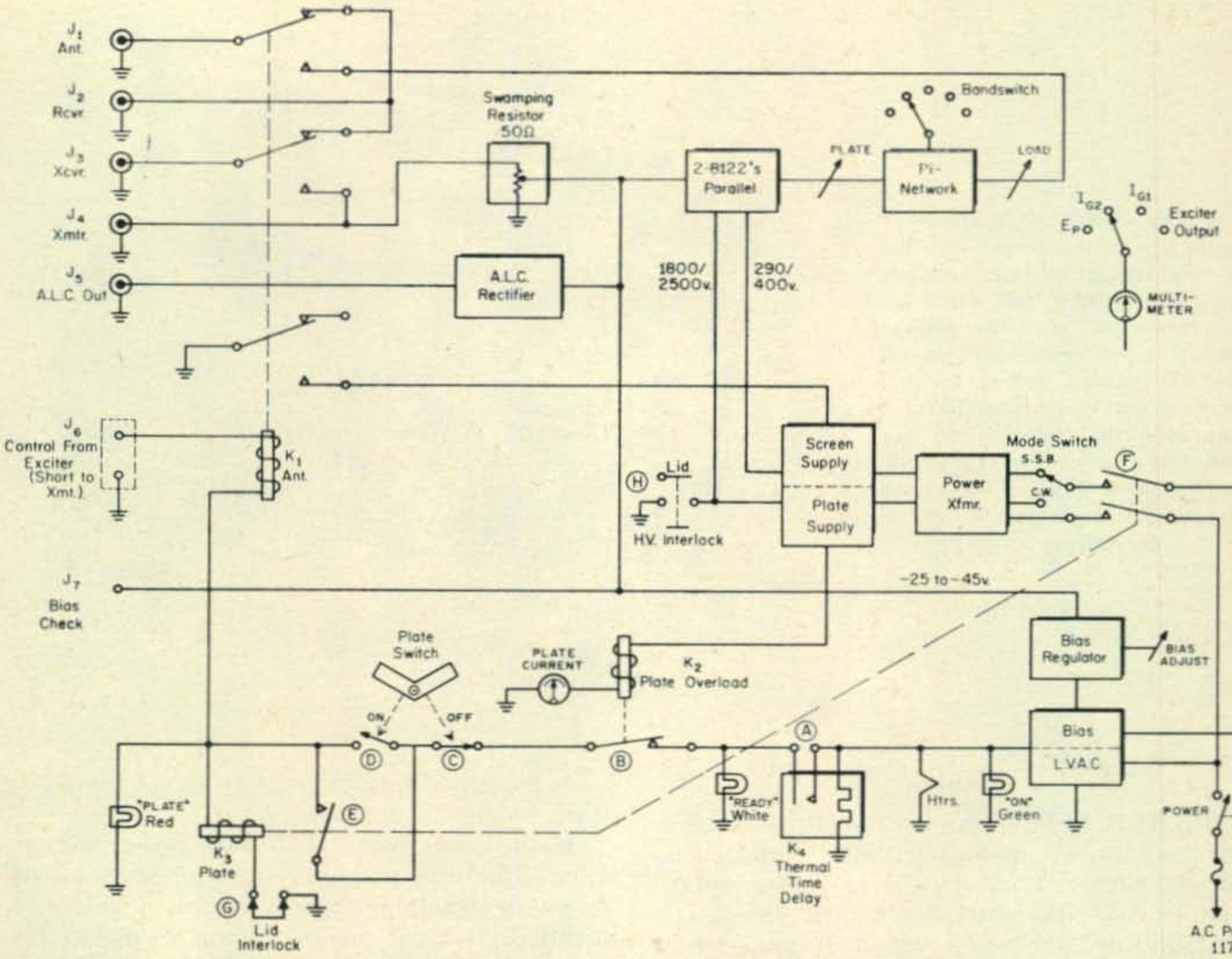


Fig. 1—NCL-2000 block diagram along with control circuitry which functions as follows: The power switch turns on the air blower along with the bias and heater supplies. After one minute, the thermal time-delay relay contacts at *A* close and the *ready*-light goes on. A momentary closing of the spring-return plate-switch ON contacts at *D* actuates the plate relay, K_3, closing its latch-up contacts at *E* which now hold in the relay. At the same time the relay contacts at *F* apply line power to the plate and screen supply transformer. The PLATE lamp also lights. Plate voltage appears at the tubes, but the screens do not receive voltage until the antenna-relay circuit is completed when the exciter is actuated. Besides switching the r.f. circuits as needed for linear-amplifier output, the antenna relay applies voltage to the screens (by closing the ground return of the screen supply) and the amplifier is ready to go.

Should a plate overload occur, the contacts at *B* on the plate-overload relay will open and de-energize the other relays and thereby remove power, but the relays will not re-close until the overload relay closes and a momentary contact at *D* is again made with the plate switch momentarily pressed to ON, since the latch-up contacts at *E* will have opened in the meanwhile. Similarly, during normal operation, plate power may be removed by making a momentary contact-opening at C when the plate switch is pressed to OFF. Since the antenna relay operates in conjunction with the plate-power relay, pressing the plate switch to ON or OFF will provide instant changeover between exciter feed-through and linear amplifier output operation.

When plate power is on and the cover of the unit is raised, the lid-interlock contacts at G will open and remove power by de-energizing the relays. At the same time the mechanical h.v. "interlock", will short the B-plus to ground. Personnel safety is thereby assured. The 3-wire connections for 230-volt operation are not shown.

Finally, the swamping resistors serve as a dummy load for correctly tuning and matching the driver to obtain linear exciter operation.

Output Circuit

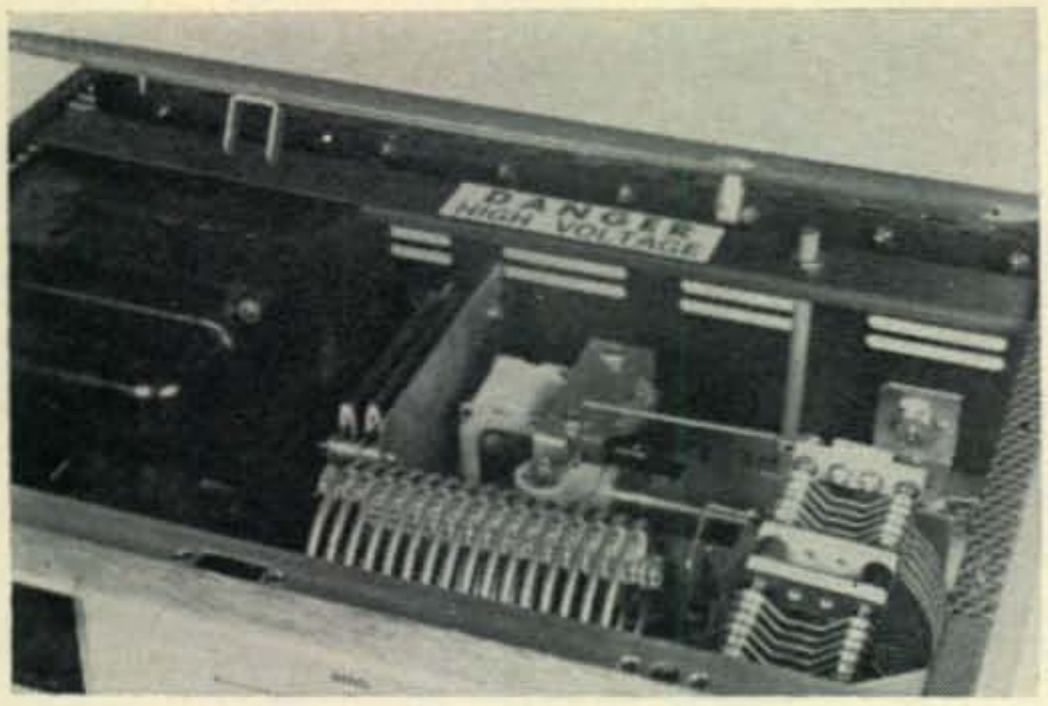
The output circuit employs a conventional Pi-network with fixed capacitors switched in across the variable plate-tuning and loading capacitors as needed to obtain an adequate tuning range, proper plate load impedance, and to match output loads of from 40 to 60 ohms on each band. The plate inductor is tapped with a bandswitch having paralleled contacts for low r.f. resistance and good current-carrying capacity.

Equalization of Efficiency

A special feature of the NCL-2000 is that it operates with equal efficiency at 1000 watts d.c. input for c.w., and at 2000 watts p.e.p. for s.s.b. This is accomplished by the selection of the optimum operating conditions of plate voltage and current needed to provide the proper plate impedance for peak efficiency at each desired power level. This is in contrast to the often-used method of reducing the power input down for c.w. simply by reducing the plate current while still using the same plate potential, resulting in poor impedance relations and lower efficiency. Plate and screen potentials for c.w. are 1800 and 290 volts respectively, for s.s.b. they are 2500 and 400 volts.

Power Supply

Separate windings are used on the power transformer for supplying plate and screen potentials, thereby providing good regulation. Silicon recti-



Closeup view showing the h.v. shorting-bar link at left rear of the tuning capacitor. The inverted U-shaped prongs on the lid, seen above the power transformer, are part of the electrical interlock. When the lid is closed, they plug into the oblong receptacle on the top edge of the panel, closing the control circuit for the plate-power relay.

fiers are used in a full-wave bridge configuration for the screen supply and in a full-wave doubler with a bank of high-capacitance electrolytic capacitors for the plate supply. The primary of the transformer is tapped so that the proper plate and screen potentials may be selected by a c.w./s.s.b. panel switch. A separate transformer is used for heater and bias, the latter using silicon diodes in a full-wave center-tap circuit.

A.L.C.

A.l.c. is obtained from the grids of the 8122's where more than the allowable drive of 15 ma on modulation peaks produces an a.f. voltage which is rectified by a pair of diodes in a voltage-doubler circuit to provide negative d.c. bias which can be fed back through an output jack on the NCL-2000 to an a.l.c. stage in the exciter.

Metering

Two meters are provided. One is left in the circuit at all times to indicate amplifier plate current. The other meter can be switched to read plate volts, screen-grid current, grid current or exciter relative-output power during exciter tuneup. Control-circuit operation is explained at fig. 1.

Construction

The NCL-2000 is ruggedly built "like a juggernaut should." The chassis, brackets and compartments are made of very heavy-gauge plated steel, while the panel is one-eighth-inch extruded aluminum. Heavy-duty components, rated to withstand continuous service, are used throughout. The unit is well ventilated in a perforated cabinet and the tubes are forced-air cooled by a quiet blower. SO-239 type coax receptacles are used for all r.f. connections, while a phono jack is used for a.l.c. output and two screw-type terminals are provided for power relay control from the exciter. A husky recessed barrier terminal block, with a protective cover, is used for connecting a 3-wire 230-volt cable which is supplied with the unit. Alternate connections are available on the terminal block for 115-volt service. The size of the unit is 7⅝" h., 16½" w., 12¾" d. Weight is 62 lbs.

Installation and Operation

Although the NCL-2000 may be operated from either a 115 or 230 volt source, the use of a 230-volt supply is preferable, since the ensuing current requirements are less and better regulation will result (peak current with 115 volts is about 25 amperes, at 230 v. it is 12 a.).

In business or industrial areas, the "230 volt" service may actually supply only 208 volts, in which case the best performance will not be obtained from the NCL-2000. Such was our situation, and although a 230-volt Variac might have been a solution, it would have been an expensive one; however, a dandy expedient was found to be an autoformer designed to step 208 volts up to the 230 volts for air conditioners. The one we used was a 3 kva unit, Stancor Model No. PSU-3000.[2]

One or two coax cables must be connected to the r.f. input terminals of the NCL-2000, depending on whether or not the exciter is a transmitter or a transceiver. No separate antenna-changeover relays are required for operation in either case. In addition, a two-wire connection must be made from the exciter control relay (vox) to the control-relay terminal strip on the linear. If the exciter has an a.l.c. input for externally obtained control, the a.l.c. output from the NCL-2000 may be connected thereto.

When the amplifier is to be tuned up, the "multi-meter" switch is placed at EXCITER TUNE. With the swamping resistors serving as a 50-ohm dummy load, the exciter may be adjusted for correct loading with maximum output indicated by the meter. The meter switch is then set to indicate screen current and with the c.w./s.s.b. switch at c.w., the linear is tuned for resonance according to the peak *screen* current on the meter and for loading shown by the plate meter. The plate-current dip also may be observed for resonance; however, tuning for the screen-current peak is recommended, as this will be a more accurate indication of correct adjustment. After the tuning has been made for 1 kw input on c.w., the operating conditions will be such that when the c.w./s.s.b. switch is next set for s.s.b., you're ready to go with a full 2 kw p.e.p. input. An advantage of this arrangement is that in the event a dummy load is not available, on-the-air tuneup can be correctly made without exceeding the maximum legal 1 kw d.c. input.

[2]Available from Allied Radio, 100 N. Western Ave., Chicago 80, Ill., Cat. No. 63 G 968 and from Lafayette Radio Electronics, 111 Jericho Turnpike, Syosset, L.I., N.Y. 11791, Cat. No. 33 G 8206 Shipping weight is 10 lbs. and price is just under $20.00. The output voltage of the autoformer is higher on one leg than the other, so before installation is made, check the output voltages between the neutral and each outside terminal. Then connect the neutral to the white lead from the left terminal of the barrier block on the NCL-2000 and the lower voltage leg to the black lead on the second terminal from the left on the barrier block.

Exciter feedthrough to the antenna or linear amplifier output may be obtained instantly simply by pressing the plate switch to OFF or ON for the respective type of operation.

Performance

The performance of the NCL-2000 came well up to expectations. Operation was checked out using three different exciters and no difficulties arose with any of them. Tuneup was easily accomplished by following the manual instructions. Plate and screen currents may vary for different tubes, but maximum power input with best efficiency is obtained with the plate loaded to just near saturation, at the point where the plate and screen currents do not rise with increased drive. Grid current will be in the order of 15 ma.

With 1000 watts input on c.w. the output into a 50-ohm load was 650 watts. Switching over to s.s.b the *steady d.c.* input was 2000 watts[3] with 1300 watts output for an efficiency of 65% in both cases. These figures measure up to the manufacturer's specifications. With s.s.b. the instantaneous voltage and current peaks, checked with an oscilloscope during modulation, indicated that the p.e.p. input may be actually higher than 2 kw when an average metered-input of a legal kilowatt is maintained. This is because the dynamic regulation due to the filter capacitance maintains a higher plate voltage during modulation. Readings on all bands, including 10 meters, were the same. Prolonged key-down checks at 1 and 2 kw d.c. input also were made, since National places no restrictions on 1 kw c.w., a.m. or RTTY operation and it is understood that the unit may be operated at 2000 watts d.c. input (into a dummy load, of course) under i.c.a.s. ratings of 5 minutes on, 5 minutes off.

A condition that exists in the NCL-2000 is that during tuneup, the screen current fades slightly downward after a few seconds of operation. According to the manual, this is a normal condition due to expansion of the screen with heating. An interesting occurrence in this respect was that in one case the screen current drop-off appeared more drastic than a "normal" condition. Investigation proved the main cause to be a fade-off of output from the exciter which used TV type tubes in its final!

Using a.l.c. fed back to the exciter during s.s.b. operation, an average metered input of 1000 watts was obtained with the p.e.p. at 2000 watts[4]. Without a.l.c., the characteristics of some voices may be such that the average indicated input for the full 2 kw p.e.p. without flat topping may be a little less than 1 kw. In this respect, the maximum permissible plate-current swing, without distortion, may be determined from the grid meter which should not be allowed to kick up during modulation, except for an occasional slight flicker.

If the exciter has no provision for a.l.c., speech processing with a clipper or compressor, will produce a real solid legal kilowatt input without flat topping at 2 kw p.e.p. and the NCL-2000 has the guts to handle a husky average input obtained in this manner.

Spectrum analyzer observations have indicated 3rd and 5th order distortion to be down 29 and 50 db with splatter down at least 45 db, even though a slight curvature is evidenced on a trapezoid pattern. There were no indications of instabliity, nor were any critical adjustments or touchy operation experienced on any band.

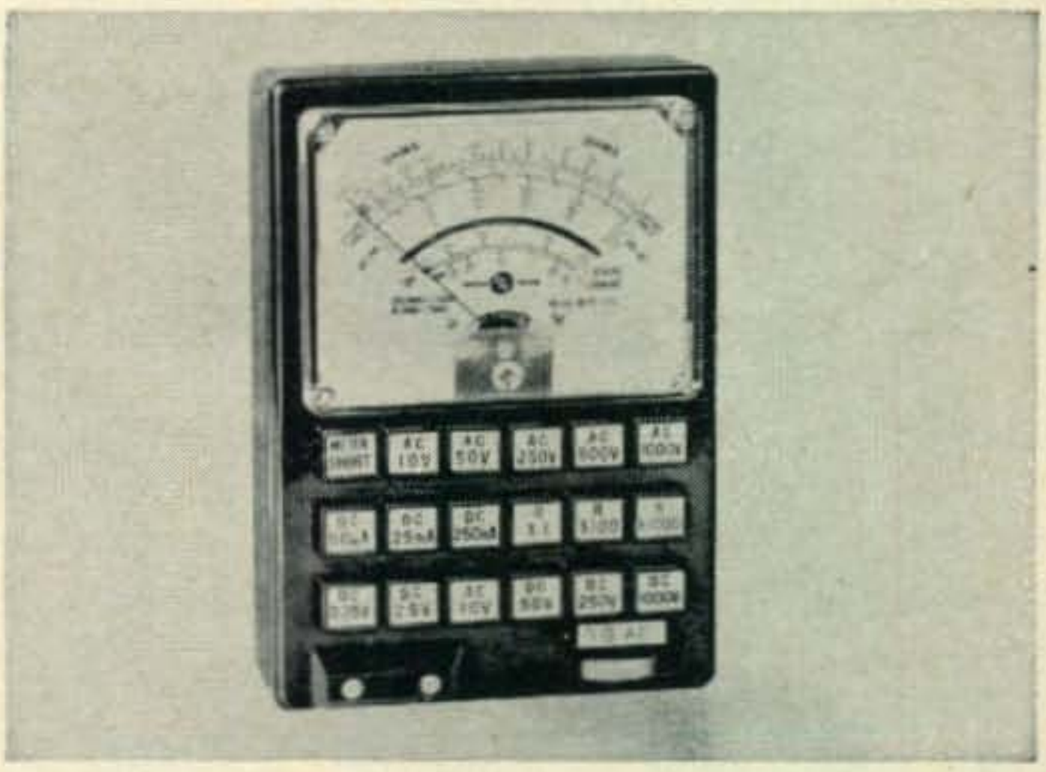
On-the-air reports indicate that the NCL-2000 packs a real hefty wallop. Its high-quality components and rugged construction are befitting the powerhouse it is, even though it is remarkably small in size for the job at hand. The interlocking safety features are reassuring, as is the knowledge that it is designed to "take the gaff."

The NCL-2000 is manufactured by the National Radio Company, 37 Washington St., Melrose, Mass. and it is priced at $585.00, with one year guarantee. In response to a customary inquiry, replacement cost for each 8122 amplifier tube is $31.50. ■

[3]At a.c. line potential of 234 volts under load.

[4]With early models an a.l.c. sjike on the initial attack tends to paralyze the exciter for a few seconds. This may be corrected by a simple modification described in National's Customer Service Bulletin No. CIB-64-IL on the subject "ALC Switching Changes." This modification has been incorporated in all current production units.

New Amateur Products



Inter-Tech Model MPB-420

THE Inter-Tech Model MPB-420 is a push button v.o.m. It features 20,000 ohms per volt for d.c. and 8,000 ohms per volt on a.c. Complete with mirrored scale, the unit is also protected against overload by dual silicon diodes. The scales read to 1,000 volts a.c. and d.c., up to 250 ma. —20 to +62 db (5 ranges), and 0 to 10 megohms with a 70 ohm center scale. It is 6" x 4¼" x 2". The v.o.m. is available for $23.95 from Inter-Tech Instruments Corp. 80-00 Cooper Ave., Glendale, N.Y., 11227. Write them for further information.

DX

BY URB LE JEUNE,* W2DEC

THE following thoughts from Ken, DL4IO, ex-EL4A, will serve as this month's soap box.

"For the past month, I have been here at a portable location and now know exactly how the typical European ham feels when it comes to ham radio operations. I'm running a 40 watt rig to a 40 meter Hertz antenna and the shack is a very small and cold place. But, to my very great surprise, I have worked 27 countries on c.w., my best DX being Korea and Baltimore, Maryland. About nine out of ten of the hams I have met here have the same problems I have, no space for antennas, a small cold shack, etc.

"One of the greatest things over here is the use of the QSL "Out Bureau." That is to say that about 99% of the QSLs are received and sent out via the same bureau. Why not the same in the USA. Send all of the outgoing cards, say once a month to a central location. They in turn sort them and send them in bulk to the overseas bureaus. I might add that a good many stations in the states evidently have no envelopes in their area bureau. A reminder should be posted in the ham magazines.

"From what I hear over the air and read in the magazines, we need some public relations work to boost activity on the 10 and 15 meter bands. I have a little set up where I can make my own rubber stamps. Thus I have made up the stamp that you see on the envelope. This stamp will be put onto all out-going QSL cards from this station and on all mail going to other amateur operators. Let's use these bands or else we may lose them.

"Has anyone who teaches the code classes thought of making all new operators learn to use the key with the opposite hand that they write with. In a contest just think of the time this can save. You send with one hand and have the other free to keep the log. My XYL writes right handed and eats left handed (European style) so I taught her to use the key with her left hand too. Guess it's too late for me to change to the left but have done the very next best thing. I am making up a system where I can flip to send and receive with a foot switch leaving hands free to send and write. Very simple to do, just put a push button switch in one side of your relay control circuit.

"Would like to give this tip to all stations sending QSLs to DL4 and DL5 stations, you can save about one month's time if you will send these cards to the following address: DL4-DL5 QSL Bureau MARS, Radio Station HHD, 12th Sig. Group, APO 46, New York City, N.Y. This will save them going first to DARC in Munich and then being forwarded. M/Sgt. Phillips is now in charge of the DL4 and 5 QSL Bureau and doing a very FB job there."

*Box 35, Hazlet, New Jersey 07730.

Here and There

CEØ Easter Island: George, VE3DGX, should already be operational on Easter Island as CEØAG. He will remain until February 14th. Operation will be 60 per cent s.s.b. and 40 per cent c.w. using two SR-150 transceivers. The antenna is a 14AVQ vertical. George is accompanying a United Nations-sponsored group of twelve Canadian scientists who are planning to research "a biological portrait of an ancient and isolated people before civilization takes over". (Chile is building an air strip on the island next year which will make Easter a central stopping-off point for travellers enroute to the South Pacific.) George joined the group primarily as an amateur radio operator; and it is expected that thousands of hams throughout the world will work Easter Island for the first time during the two months of this operation. QSL to George Hrischenko, VE3DGX, 3156 Bruce Ave., South Windsor, Ontario, Canada.

VK9 Norfolk Island: A full page mimeographed sheet from "down under" informs us that January is "Norfolk Island Month." The call sign VK9TL will be operated by VK3TL from Jan. 1 to Jan. 31, 1965. Operations will be on 15, 20, 40, and 80 and all QSLs should go to the VK Bureau or Ken Matchett, VK3TL, Smiths Rd., Templestow, Victoria, Australia. Comments Rich, VK3ARX, in a letter to W2MES: "Ken works plenty of DX from his home QTH and may be expected to put on a good performance on both modes—s.s.b. and c.w." *(Tnx L1DXA).*

9J2 Republic Of Zambia: Formerly Northern Rhodesia, VQ2, is currently active with new prefix 9J2. Active stations include PJ2s, BB, BV, W, DT, GR, WR, and JN. *(Tnx Puerto Rican DXer).*

9M8 Sarawak: Sarawak formerly VS4 has been assigned prefix 9M4. 9M8 active on 20 meter c.w. *(Tnx Puerto Rican DXer).*

160 Meters

Annual trans-atlantic and world wide 160 meter DX tests reminiscent and symbolic of the original pioneering transatlantic crossings by Marconi, DeLoy, Schnell, Reinartz, Godley, 1901-1921, and continuing a yearly operating activity established in 1932 and held every year since, (except war years). The annual trans-atlantic and worldwide "top band" DX tests will be held on 160 on the following Sunday mornings from 0500-0730 GMT, Jan. 3rd and 17th, Feb. 7th and 21st. During these tests special efforts will be made to establish new records. W/VE stations should call CQ DX Test the first five minutes of the hour, and then the third, fifth periods, etc.,

The following certificates were issued between the period from October 6th to and including November 5th, 1964:

CW-PHONE WAZ

2059	SM7EH	Gosta Jonsson
2060	DL1KS	Klaus Sauer
2061	G3AIM	L. S. Wright
2062	SP9NH	Andrzej Oskedra
2063	KØEUV	Larry Woolis
2064	SP2HL	Jan Knull
2065	OH3UO	Heikki Inovaara
2066	K4RZK	John F. Berryman
2067	HA1KSA	Radio Club of Gyor
2068	W4VMS	William DuHart
2069	FA9RW	Gaston Deville
2070	OK1GT	Jiri Zizka
2071	W1IJO	Edward F. Van Gasbeck
2072	K8JWC	Kenneth E. Booher

ALL-PHONE WAZ

270	G3HCT	John Bazley
271	OE3NH	Hans Pfannhauser
272	WA2RAU	Sam Rosen, M.D.
273	SM5AZU	Bertil Durberg
274	W8CUT	Daniel F. Parks

TWO-WAY SSB WAZ

266	G3HCT	John Bazley
267	W4SHP	Jack Van Hutten
268	WA2RAU	Sam Rosen, M.D.
269	W1ZW	Philip K. Baldwin
270	WA6MAZ	Marcia Guest
271	W8CUT	Daniel F. Parks
272	K7HJN	J. Milton Condit
273	K1IDW	Fred G. Alden
274	K3TPL	Brad Sheppard

CW WPX

587	W2UGM	Richard Marsino
588	HB4FD	Hans Saggioro
589	DL3YQ	Heinz Schwaderlapp
590	W6PQT	Cleon B. McKnight
591	ZS6AJQ	A. G. Carmichael
592	PAØLV	G. Vollema
593	HA5KBP	Central Radio Club
594	CE4AD	L. Adalberto Brito. R.

SSB WPX

200	GW3NWV	Robert C. Holt

MIXED WPX

105	ZL1AMO	Ron W. Wright

listening in between. DX will call CQ DX Test, the 2nd, 4th, 6th five minutes periods, etc. Adhere to this schedule except when QSOs are in progress. Use authorized frequencies. W/VEs East 1800-1825, West 1975-2000 kc. Europe—mostly 1825-30, ZL-1875-1900, VK-1800-1860, JAs-1880 kc spot, Africa—1800-1825 mostly. These transatlantic tests should be exciting. All hams are reminded however to be alert for unusual DX openings anywhere over darkness paths at sunset or sunrise times at either end of the path—just as long as the path is a darkness path and at or near twilight or sunrise at either end of the path. This is when 160 meter signals "peak." Remember these are tests and not contests and are for pleasure in an unusual operating activity without competition and to particularly develop some propagation information which may make a worthwhile contribution to the art of radio. W/Ve stations send reports of test, listening activity, or unusual accomplishments to W1BB immediately after each test—Stewart S. Perry, 36 Pleasant St., Winthrop, Mass. for logging and reporting. G, GM, GW, GD, etc. send reports to L. H. "Tommy" Thomas, G8QB, DX Editor, Short Wave Magazine, 49 Winchelsea Lane, Hastings, Sussex, England. Other DX may send their reports to either of the above, however, in any event be sure to send in your reports. W1BB will always be glad to arrange special skeds with any DX station wishing to test unusual paths and conditions and will send full instructions. Remember to set your clock accurately and keep to the periods.

JA1CR, Takeo, reports permission for 160m. operation granted April 6th, 1964 after 12 years of effort by himself, Mr. Hara Taian, Director, JARL who, with patience, negotiated with the regulatory board, W1BB, who wrote letter summarizing world wide situation on 160 and substantiating reasons for authorization, and other efforts. 200 watts is allowed on c.w. only spot frequency 1880 kc. Only licensed first class operators allowed special 160 certificates. First ones: JA1CR, CO, 6AK, 2JW, 3AA. Much credit goes to JA boys and JARL for patience and perseverance. This season will be especially interesting with them on. Record for first ever JA 160 meter QSO since opening goes to JA3AA, Isaji Shima, who on July 27th QSOed with VS1LP, Bob Snyder in Singapore, 1505 GMT. Congratulations to both.

VP2A, Ted, Antigua, BWI, after some correspondence, made himself a 160 meter transmitter, got up a skywire and came on 160, putting a new country on the DX agenda, giving several W/VEs a new one and W1BB his 82nd country on 160. Ted's signal was 339 to 549 with slow QSB. He also worked VE3AGX, VE3DU, K8CRJ and others. It is expected that Ted will be on quite regularly this season.

OX3DL, Ole, Egesminde, Greenland who, after one year's correspondence with W1BB and arrangements for special license, opened up unexpectedly and after two hours of calling, worked W1BB and a contact was made. First 160 meter operation from Greenland. His 1826 kc signals varied on deep fade from zero to 449 peaks using 10 watts to a 45 foot vertical wire and inhaling with an AR88. Reported W1BB/1 peaking 599 to give W1BB country #83. *(Tnx W1BB for the above).* 73, urb, W2DEC

★ ★ ★

Here is the BIGGEST list *ever* published of QTH's and QSL Managers. Be sure to keep it handy for the coming year.

AC3PT ..... via W4ECI.
AC5A (/AC4) via W4ECI.
AC5PN ..... via W8PQQ.
AC7A ..... via W4ECI.
AP2AR ..... via W8QWI.
ex-AP2F ..via VE3BWY.
AP2IJ ..... via KH6IJ.
AP2R ..... via G3GJQ.
AP5AH ..... via AP5CP.
AP5GB ..... via W4ECI.
AP5B ..... via W4TO.
AP5JA ..... via AP5CP.
CEØAC ..... via CE3HL.
CEØZI ..... via W4QVJ.
CN2BK ..... via W2CTN.
CN8EU ..... via W6EDU.
CN8FE ..... via W2CTN.
CN8FN ..... via K4UNW.
CN8FW ..... via W2CTN.
CN8FX ..... via K8GVK.
CN8GB ..... via W2CTN.
CN8MB ..... via K4VUR.
CP1DJ ..... via K9PNV.
CP5EL ..... via W1BAN.
CP5EZ ..... via W2CTN.
ex-CR5AR ..now CT1LL.
CR6CA ..... via K4ICA.
CR6FW ..... via W8GIU.
CR7CI ..... W/K only via K9GZK.
CR7GF ..... via VE4OX.
CR7IZ ..... via K3HQJ.
CR8AB ..... via W4QCW.
ex-CR8AB ...now CR6JJ.
CR9AH ..... via W7ZAS.
CT2AH ..... via K8RTW.
CT3AV ..... via W3KVQ.
DL5AO ... via W5EJT or DARC or Jahnstra 36, 867 Hof/Saale, Germany.
DL5CR ..... via W5ADZ.
DL5QA ..... via W1YIS.
DU1GF ..... via W6ZJY.
DU1JC ..... via W6ZJY.
DU5SM ..... via DU1CE.
DU1VQ ..... via W6ZJY.
EA6AZ ..... via K2VQQ.
EA8BA ..... via W4MXL.
EA9EO ..... via EA4GZ.
EI8P ..... W/VE only via W4OPM.
EL2AC ..... via K5SGJ.
EL2AD ..... via K5SGJ.
EL3A ..... via W3NNC.
EL3D ..... via W3NMC.
EL8C ..... via VE3DGX.
EP2DM ...via WB2FMK.
EP2RC ..... via K1KOM.
EP2RV ..... via G5RV.
ET3FW ..... via K3HOJ.
ET3JK ..... via K3HQJ.
ET3PP ..... via K4QDC.
ET3PT ..... via W8IEB.
ET3RC ..... via K1KOM.
ET3RS ..... via W2JXH.
F9UC/FC ...via DL9PF.
F9RY/FC ....via HB9TL.
FA9UO ..... via K4TWF.
FB8YY ..... via F9AH.
FF4AL ..... via W3KVQ for QSOs after March 1.
FG7XJ ..... via W2CTN.
FG7XK ..... via W2CTN.
FG7XT ..... via K5AWR.
FH8CE ..... via W4ECI.
ex-FI8AD ..... via F9RO.
FI8AP ..... now F3KG.
FK8AU ...via VK3AHO.
FK8AW ..... via W2CTN.
FL5A ..... via W4ECI.
ex-FL8AB ...now F8UD.
FM7WQ ..... via W4OPM.
FO8AN ..... via W8EWS.
FP8AS ..... via W2EOS.
FP8BD ..... via VO1FB.
FP8RR ..... via K1MOD.
FP8RX ..... via W1RAN.
FP8CA ..... via K2OJD.
FP8CB ... via WA2WBH.
FP8CB/FO8 .via W2JAE.
FP8CD ..... via K2UTN.
FP8CG ..... via W1DDF.
FP8DC ..... via W1ISO.
FB8YY ..... via 5R8BC.
FH8CD ..... via 5R8BC.
FP8CA ..... via K2OJD.
GB2LS ..... via G3MCW.
GC3SEE ..... via G3SEE.
GD2HFD ... via G2HFD.
HBØAFM ..... via HB9GJ.
HBØGJ ..... via HB9GJ.
HKØQA ..... via K9ECE.
KC4AAD ... via WØBAT.
KC4USB ... via W1UFW.
KC4USK ..... via W2CTN.
KC4USV ..... via K1NAP.
KC6BO ..... via W4YHD.
KG4AM ..... via W2CTN.
KG4BX ..... via W2CTN.
KG6ID ..... via W9VZP.
KG6SX ..... via KH6FBJ.
KG6SZ ..... via WA6ZIQ.
W6POP/KJ6 ..... via KH6EGO.
KJ6CA ..... via KH6DOX.
KP4BCL ... via W9AQW.
WA6CJL/KP6 ..... via W6AFI.
KR6LY ..... via K5PSO.
KS4BF ..... via W4DQS.
KS6AM ..... via W1BYH.
KV4CI ..... via W2CTN.
KV4CM ..... via WØGEK.
KZ5AF ..... via KZ5AZ.
KZ5LC ..... via W2CTN.
KZ5MQ ..... via K5VTA.
LA9RG/P ... via LA8LF.
LU1ZL ..... via W9LGR.
LU1ZL ..... via W9DHQ.
LU8XH ... via LU4DHR.
LX3KP ..... via W2CTN.
LX3MA ..... via DL4US.
LX3TA ..... via DL1TA.
LX3QX ..... via ON4QX.
LX3TA ..... via DL1TA or DARC.
M1FT ..... via DL7FT.
M1SVZ ..... via I1SVZ.
M1VU ..... via DL1VU.
M1XS ..... via DL1XS.
M1ZD/P ..... via W7ZDP.
MP4BDD ... via W2JXH.
MP4DAH ... via G5GH.
MP4QAQ ... via W2JXH.
MP4QBB ..... via K4TJL.
MP4TAI ..... via W2JXH.
MP4TAM ..via MP4TAC.
MP4TAO ..... via DJ1BZ.
OX3JV ..... via SM7ACB.
PJ3AR ..... via KØRDP.
PJ5CG (/B) .via KØGZN.
PJ5CH (/B) .via KØGZO.
PJ5MB ..... via K9KDI.
PJ5MC ..... via W3ZO.
PJ5ME ..... via WLJYH.
PJ5MF ..... via VE6TP.
PX1FO ..... via W2CTN.
PX1HX ..... via F8HX.
PX1IK ..... via HB9KU.
PX1OK ..... via HB9DX.
PX1KK ..... via K2JFV.
PX1MO ..... via K2JFV.
PX1OAC ..... via F7OAC.
PX1OX ..... via DL2OX.
PX1VW ..... via F9VW.
PY1MCC ..via WA6UZA.
PZ1AX ..... via W2CTN.
PZ1BH ..... via WA6SBO.
PZ1CE ..... via W1NTH.
SM6CPI ..via WA9AEA.
SM7CPI ..via WA9AEA.
SP6FZ ..... via W2JWK.
SV1AB ..... via W4HUE.
SVØWF ..... via W2PCJ.
SVØWQ ..... via W4YWX.
SVØWT ..... via KØRDP.
SVØWZ ..... via W7FTU.
TA2AR ...via PAØWWP.
TA4RZ ..... via K4WIS.
TC3ZA ..... W/VE via W2JXH, others via G8KS.
TF2WFX ..... via K4IUV.
TF2WHB ... via K4MOD.
TF2WHT ... via K9RNQ.
TF2WIG ... via K9RNQ.
TG5FJ ..... via K2DDK.
TG6PB ... via WA4AYX.
TG9AL ..... via W2CTN.
TI2CME ..... via W2CTN.
TI2J ..... via K5PSO.
TI2WA ..... via K9TZH.
TI9FG ..... via VE4CP.
TI9RC ..... via W4ECI.
TL8AC ..... via W8KML.
TL8SW ..... via W1BPM.
TN8AM ..... via W2CTN.
TT8AG ..... via W2KVQ.
TT8AJ ..... via WØLYQ.
TT8HA ..... via WØLYQ.
TU2AL ... via W3KVQ.
VE3BSB/5V4 ..... via VE3AXC.
VE8MZ ..... via KØRDP.
VK2VC/LH .via W4ZRZ.
VK4JQ (Willis Is.) ... via W6HYG.
VK9GK ..... via W2CTN.
VK9GL ..... via W1ETF.
VK9GP ... via VK3AOM.
ex-VK9LA ..via VK6RU.
VK9NT ..... via W2CTN.
VK9PC ..... via WØAKR.
VP1WS ..... via K8ONV.
VP2AC ..... via VE6BY.
VP2AL ..... via K4LRA.
VP2AP ..... via W5NOP.
VP2AR ..... via W3KVQ.
VP2AV ..... via W2CTN.
VP2CC/C ..via W8EWS.
VP2DA ..... via W3AYD.
VP2GAA ... via W4OPM.
VP2DU ..... via W3AYD.
VP2GAC ... via W8EWS.
VP2GAQ ..... via K9UTI.
VP2KJ ..... via W4SSU.
VP2KT ..... via W2YTH.
VP2LD ..... via W2CTN.
VP2LS ..... via K8ONV.
VP2MB ..... via W4CKB.
VP2MC ..... W/VE via W4OPM; DX via G8KS.
VP2ML ..... via K8ONV.
VP2MM ..... via K8ONV.
VP2MZ ..... via W2ZMT.
VP2SL ..... via K4LRA.
VP2SM ... via WA4AYX.
VP2SQ ..... via K3COW.
VP2SX ..... via G8KS.
VP2SY ..... via K2MRB.
VP2VH ..... via W2YTH.
VP2VS ..... via VE6TP.
VP4BY ..... via VE6BY.
VP4TR ..... via W2CTN.
VP5AH ..... via K4UFE.
VP5BB ..... via W3MRR.
VP5BL/VPS via W3AYD.
VP5BP ..... via VE3CJ.
VP5DB ..... via WA2IFY.
ex-VP5FP ..via W2DGW.
VP5IG ..... via W2CTN.
VP5LG ..... via K4UTE.
VP6LJ ..... via W2CTN.
VP5NK ..... via VP5BB.
VP6PV ..... via W2CTN.
VP6WD ..... via W4OPM.
VP6WR ..... via W9JFJ.
VP6ZX ..... via W9JFJ.
VP7BC ..... via W4CNS.
VP7BP ..... via W2CTN.
VP7CT ..... via W3LBJ.
VP7CX ..... via W9VFO.
VP8AI ..... via W2CTN.
VP8BP ..... via G8FC.
VP8HD ..... via G3PEK.
VP8HE ..... via GM3JDX.
VP9WB ..... via WØORH.
VPØGAC ... via W8EWS.
VO1DR ..... via W2TSD.
ex-VO1IZ ... via K6PUC.
VO2WM ..... via W2CTN.
VO8AM ..... via W8EWB.
VO8BFA ..... via G8KS.
VO9AA ..... via W4ECI.
VO9HD ..... via G3PEK.
VR1G ..... via W6BSY.
VR1N ..c/o Hammarlund, General PO Box 7388, New York 1, N. Y.
VR2EA ..... via G3JFF.
VR2EK ..... via W6AL.
VR4CB ..... via W7PHO.
VR4CM ..... via K5HVW.
VR4CU ..... via W6UOU.
VR4CV ..... via K6EC.
VR5RZ ..... via VK4RZ.
VS1GZ ..... via W4YWX.
VS1JV ..... via W6BAF.
VS6AE ..... via W6DIX.
VS9AAC ... via W3KVQ.
VS9ADV/P/4W1 ..... via VS9AAA.
VS9ALD/P/4W1 ..... via W9JJF.
VS9APH ... via W3HQO.
VS9ASS ..... via W4ECI.
VS9HAA ..... via W4ECI.
VS9HRK ..... via W4ECI.
VQ4IN/VS9H via W4ECI.
VS9KDV ..... via W4ECI.
VS9PHH ..... via W2CTN.
ex-VU2GI .via VE3BWY.
VU2JA ..... via W2CTN.
VU2LNZ ... via W2ODZ.
VU2NR ..... via WØZSZ.
VU2RM ..... via W3KVQ.
VU2SO ... via W8QNW.
VU2US/AC5 via VU2BK.
W4KKA/VK9 via K4SCT.
XT2AU ..... via VE4OX.
XT2Z ..... via HB9ZY.
XW8AL ..... via K4KTR.
XW8AU ... via W4QCW.
XW8AW ..... via W4ECI.
XZ2SY ..... via W4ANE.
YA1AN ..... via DL3AR.
YA1AO ..... via DL6YI.
YA4A ..... via K4KMX.
YA5A ..... via W4ECI.
YJ1MA ..... W/VE via W1HGT; others via GW3LQP.
YJ1RH ..... via W4ANE.
YJ1ZA ..... via VK2QJ.
YN1TAT ..... via KØRDP.
YN3KM ..... via K1KDP.
YNØKVC ... via K4KCV.
YNØNWO .via W8NWO.
ZB1BX ..... via W2CTN.
ZB1HC ..... via W4MS.
ZB2AD ..... via W3AYD.
ZD3P ..... via G2BVN.
ex-ZD6HK ..via W2ELW.
ZD6OL ..... via G3JUL.
ZD7BW ..... via G3PEU.
ZD8DW ..... via W5SWX.
ZD8HB ..... via W2CTN.
ZD8WF ..... via W3PN.
ZE1JE ..... via W6YMV.
ZE4JN ..... via W5RHW.
ZE4JS ..... via W3HNK.
ZE5JJ ..... via W6BAF.
ZK1AR ..... via K4SHB.
ZK1PK ..... via W2CTN.
ZK2AD ..... via W9GFF.
ZL1ABZ ..... via ZL2GX.
ZM6AB ..... via K8RTW.
ZM6AW ..... via W8EWS.
ZM7AD ..... via K6ERV.
ZP5CN ..... via K4RSM.
ZS1AB ..... via WA2FQG.
ZS1ACD ... via W2EVV.
ZS2GF ..... via W1BPM.
ZS3E ..... via K4PUS.
ZS3EW ..... via W2CTN.
ZS3LW ..... via W1BPM.
ZS4PB/ZS9 via W8SMQ.
ZS7M ..... via W2CTN.
ZS9A ..... via W8EFS.
3A2AE ..... via G3LKZ.
3A2BW ..... via W4ECI.
3A2BZ ..... via DL9KP.
3A2CZ ..... via ON4QX.
3A2DA ..... via G3CWL.
3V8CA ..... via W4YWX.
4S7PG ..... via W3KVQ.
4S7WP ..... via W3KVQ.
4X4DH ..... via W5VSQ.
4X4DK ... via WA2KNC.
4X4IX ..... via WA2KNC.
4W1B ..... via HB9YZ.
ex-5A1TS ... via W4DPX.
5A3TR ..... via W3ZZE.
5A4TC ..... via W2CTN.
5A4TH ..... via K5ODD.
5B4TC ..... via W2CTN.
5B4WS ..... via K1LBH.
5H3BJ ..... via W7PHO.
5H3JR ..... via W2SNM.
5H3HH ..... via W2CTN.
5H3HV ..... via W2CTN.
5N2ACB ..... via W2CTN.
5N2JKO ... via W4MCM.
5N2NFS ..... via K9QIZ.
5N2PJB ..... via W7VEU.

[*Continued on page 98*]

SPACE COMMUNICATIONS

BY GEORGE JACOBS,* W3ASK

THE year 1964 witnessed several major accomplishments for radio amateur activities in space, as well as being a banner year for space-listeners. Although the much hoped-for launch of the OSCAR III amateur radio communication satellite did not materialize during the past year, radio amateurs blazed new paths and established new DX records in moonbounce, or earth-moon-earth communications.

On April 12, the first two-way 2 meter trans-Atlantic QSO took place between Bill Conkel, W6DNG of Long Beach, California and Lenna Suominen, OH1NL of Nakkila, Finland, via moonbounce. This c.w. QSO established a new DX record for the 2 meter band, with the distance between both stations being approximately 5800 miles. It was also the first trans-Atlantic two-way QSO to take place above the 50 mc band.

Following on the heels of the W6DNG-OH1NL earth-moon-earth QSO, more radio amateur moonbounce history was made during May and June. On May 20, KP4BPZ, using a 1000-foot diameter dish antenna installed at the Arecibo, Puerto Rico Ionospheric Laboratory, established the first 420 mc two-way amateur radio moonbounce QSO when he worked W1BU in Medford, Mass. c.w. signals were R 4 S 6 at both ends of the circuit.

On June 13, the 420 mc record was broken when KP4BPZ worked HB9RG near Zurich, Switzerland. The QSO established a new DX record for the 420 mc band, with the distance measured unofficially as 4600 miles. During this same period, KP4BPZ also worked G3LTF in Essex, England, and W9GAB, W1BU and W1FZJ (on a.m. phone).

KP4BPZ also managed 2 meter moonbounce QSOs with several stations in the USA, England and Germany.

OSCAR III—1964

Work continued during 1964 on the design and construction of OSCAR III, which is expected to be amateur radio's first active communication satellite.

Early in the year, Project OSCAR Inc., the group of California radio amateurs who conduct the project, reorganized in order to be in a better position to push ahead with the final details of the satellite. John Sherman, W6KAS, was elected Chairman of the group, while Bill Orr, W6SAI was elected President.

Most of the year was spent in clearing away bugs which had developed as the satellite was being constructed. By the end of the year, the satellite had been completely assembled and placed into test operation atop a 30-foot pole at W6VMH's QTH. More than a dozen radio amateurs in the San Francisco Bay area have communicated through the satellite, in the same manner that it will be used when in orbit. Among these are W6SAI, W6HB, W6ASH, W6VW, and W6BPV. All forms of modulation have been tested (s.s.b., a.m., RTTY and f.m.), and several different QSOs were handled simultaneously by the satellite. All-in-all, OSCAR III has performed exceptionally well on the ground, translating 2 meter signals over a range of about 40 miles.

The final OSCAR III package has been assembled, and the satellite is expected to undergo final environmental tests early during the new year (to check it for temperature and vibration suitability). Once these tests are passed, the satellite will be certified for launching.

Communication Satellites—1964

Three communication satellites were launched successfully by the USA during 1964. On January 21, RELAY 2 joined RELAY 1 and TELSTAR 2 in relaying radio and television signals across the Atlantic Ocean. On March 27, RELAY 2's orbit was also favorable for the first two-way live television exchange between Japan and the USA.

On January 25, the ECHO 2 passive reflector satellite was placed into orbit. Measuring approximately 135 feet in diameter, this huge satellite was used to reflect u.h.f. radio and television signals from its rigidized aluminum surface. Unfortunately, an organized attempt by radio amateurs to communicate via the satellite on 2 meters did not prove to be successful.

On August 19, SYNCOM 3 was rocketed into space from Cape Kennedy. By an intricate combination of celestial mechanics, rocket power, and ground control, SYNCOM 3 was placed into a stationary synchronous orbit 22,300 miles over the Pacific Ocean, directly above the intersection of the equator and the 180th parallel (the international date line). In this orbit, the satellite is stationary in relation to the earth, so that the spacecraft appears to be absolutely motionless in the sky.

From its high altitude, SYNCOM 3 can "see" almost one-third of the earth's surface extending from the western regions of the Western Hemisphere to the eastern regions of Asia. The satellite can maintain 24-hour communication over a large part of this area.

Although originally designed for radio relay only, SYNCOM 3 was modified shortly before launch to handle television signals as well. This made possible live television relays of the Japanese Olympic games to the USA and Canada.

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

On July 31 at 6:25 a.m. PDT, RANGER 7 successfully impacted on the Moon. During the last thirteen minutes of the spacecraft's 68-hour trip from Cape Kennedy, six television cameras on board took nearly 4000 photographs of the Moon which were transmitted back to earth by RANGER's communication system. Although not a communication satellite, the communication system aboard RANGER 7 was one of the most complex ever designed for space use. The system operated flawlessly during the entire 243,655 mile trip, and the spectacular lunar pictures transmitted back to earth were of such high quality and definition that objects as small as 3-feet in size could be easily seen.

During 1964 NASA launched two ionospheric research satellites, EXPLORER 20 on August 25, and EXPLORER 22 on October 10. Both satellites are exploring the ionosphere in great detail in an effort to learn more about this region of the earth's atmosphere which makes possible long-distance h.f. radio communications.

Space-Listening—1964

Space-listening grew by leaps and bounds during the past year, mainly as the result of the large number of orbiting satellites whose signals could be received by listeners on the ground. By the end of the year there were no fewer than 39 satellites transmitting radio signals to earth on 77 different frequencies in the h.f. and v.h.f. ranges. Many of the signals in the h.f. range (on frequencies near 20 and 30 mc) could often be heard well on relatively inexpensive shortwave receivers, while many of the signals in the v.h.f. range (mainly on frequencies near 90 mc, and between 136-137 mc) could be received with relatively simple frequency converters.

Next month's column will contain a complete up-to-date listing of all satellites transmitting radio signals back to earth in the h.f. and v.h.f. ranges.

New Book—1964

The first book to be written on the subject of space communications, with the space-listener and radio amateur in mind, made its appearance towards the end of 1964. "*Space Communications*", written by Stanley Leinwoll, handles a complex subject in a simple-to-read, easy to understand language. Published by John F. Rider Publishers, Inc. of New York, the 166-page soft-cover book can be obtained from your local booksellers or amateur radio supply house for $3.95. Copies autographed by the author are available for $3.95 postpaid by ordering direct from the Editor of this column (W3ASK). For more information on this book see the review in October, 1964's SPACE COMMUNICATION column.

Amateur Radio in Space—1965

If all goes according to plan, 1965 will be the year in which amateur radio's first active communication satellite—OSCAR III will be launched. Dubbed the "radio amateurs TELSTAR", OSCAR III will operate in much the same manner as the more complex TELSTAR and RELAY satellites. It will receive 2 meter radio amateur signals from the earth, amplify them, and then retransmit them over distances many times greater than the line-of-sight range of stations on the ground. Depending on the actual height of OSCAR III's orbit, the maximum distance that may be achieved by communicating through the satellite will vary between 2000 and 4000 miles. Radio amateurs throughout the world are expected to participate in the project.

For more information see "OSCAR III—An Active Communication Satellite for Radio Amateurs," by George Jacobs, in November, 1964's *CQ*. A second part to this article, describing how the satellite can be used by radio amateurs for communication purposes and by space-listeners for scientific purposes will appear in *CQ* shortly before the satellite is expected to be launched.

At the present time the satellite is undergoing final environmental tests, and the earliest launch date appears to be late winter or early spring.

There is also a good possibility that 1965 will see increased activity on both 2 meters and 420 mc in the field of radio amateur earth-moon-earth communications. Stations capable of communicating by this method are now in operation in several European countries as well as in the USA. There is also a possibility that KP4BPZ again will be permitted to make use of the 1000-foot dish antenna at Arecibo for additional earth-moon-earth communication experiments.

Communication Satellites—1965

The year 1965 may see an important change in satellite communications. During the past year, as in previous years, satellite communications were conducted on an experimental basis. No American experimental communication satellites are planned for 1965. The first commercial system, however, may be placed into operation during the new year.

In the USA, the Communications Satellite Corporation has been established to develop a commercial satellite system. The governments of at least sixteen other countries have joined with the Corporation to give the planned system global status. Many other countries are expected to join with the Corporation during 1965 to bring operational communication satellite circuits to as many areas of the globe as technically possible.

Early technical plans released by the Corporation indicate their preference for the high altitude, or synchronous, system for operational use. The Corporation plans to launch an "Early Bird" synchronous satellite during 1965. The first satellite will be placed 22,300 miles above the Atlantic Ocean to establish a link between North America and Europe. Links to other areas of the world will follow at a later date.

[*Continued on page 98*]

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

January	9-10	ARRL VHF SS
January	16-17	ARRL CD C.W.
January	23-24	ARRL CD Phone
January	**30-31**	**CQ WW 160 DX**
January	30-31	REF C.W.
February	5-7	QCWA Party
February	13-14	ARRL DX PHONE
February	20-22	YL/OM Phone
February	20-21	RSGB BERU
February	20-21	Vermont QSO Party
February	27-28	ARRL DX C.W.
February	27-28	REF Phone
March	6-8	YL/OM C.W.
March	13-14	ARRL DX Phone
March	20-21	YL Int. SSB
March	23	Pakistan DX
March	27-28	ARRL DX C.W.
April	**10-11**	**CQ WW DX SSB**

CQ WW 160

Starts: 0200 GMT Saturday, January 30
9 p.m. EST Friday, January 29
Ends: 1400 GMT Sunday, January 31
9 a.m. EST Sunday, January 31

Most of the activity in this contest will be confined to stateside contacts. But with more and more DX stations showing up on the Top Band, there is bound to be a keen interest by some of the DX chasers. W1BB has a fantastic total of 82 countries at this writing. And don't forget, foreign contacts by W/VE/VO stations are worth 10 points per each QSO, so its worth the effort to dig for the DX.

You will find most of the European DX between 1825-1830 kc. However much of the rest will have to be dug out of the 1800-1825 kc mess. The West Coast stations generally use the high end of the 1975-2000 kc segment and work the East Coast cross band.

You will also find that DX signals usually peak at sunset or sunrise at either end of the path, just as long as the path between the two stations is in darkness. Last year it was possible to work Europe when it was twilight here on the East Coast.

It is also hoped that more use will be made of the other two segments of the 160 meter band, 1875-1900 kc on the East Coast and 1900-1925 kc on the West Coast. And of course indicate where you will be listening if you are working cross-band.

If you are new on the Top Band it is highly recommended that you study the latest FCC Regulations for 160 on this page.

*14 Sherwood Road, Stamford, Conn. 06905.

Area	Maximum D. C. Plate Input Power in Watts							
	1800 to 1825 Kc		1875 to 1900 Kc		1900 to 1925 Kc		1975 to 2000 Kc	
	Day	Night	Day	Night	Day	Night	Day	Night
Alabama	200	50	No oper.		No oper.		100	25
Alaska	200	50	200	50	No operation			
Arizona	100	25	100	25	100	25	500	100
Arkansas	200	50	No oper.		No oper.		200	50
California	No operation				200	50	500	200
Colorado	200	50	100	25	100	25	500	100
Connecticut	200	50	100	25	No operation			
Delaware	200	50	100	25	No operation			
Dist. of Col.	200	50	100	25	No operation			
Florida	100	25	No oper.		No operation			
Georgia	100	25	No oper.		No operation			
Hawaii	No operation				100	25	100	25
Idaho	100	25	200	50	200	50	500	100
Illinois	200	50	100	25	100	25	200	50
Indiana	200	50	100	25	100	25	100	25
Iowa	500	100	100	25	100	25	200	50
Kansas	500	100	100	25	100	25	200	50
Kentucky	200	50	100	25	100	25	100	25
Louisiana	200	50	No oper.		No oper.		100	25
Maine	500	100	100	25	No operation			
Maryland	200	50	100	25	No operation			
Mass.	500	100	100	25	No operation			
Michigan Up. Pen.	500	100	100	25	100	25	200	50
Michigan Lo. Pen.	500	100	100	25	100	25	100	25
Minnesota	500	100	100	25	100	25	200	50
Mississippi	200	50	No oper.		No oper.		100	25
Missouri	200	50	100	25	100	25	200	50
Montana W. of 111°W	100	25	200	50	200	50	500	100
Montana E. of 111°W	200	50	200	50	200	50	500	100
Nebraska	500	100	100	25	100	25	500	100
Nevada	100	25	200	50	200	50	500	200
New Hamp.	500	100	100	25	No operation			
New Jersey	200	50	100	25	No operation			
New Mexico	200	50	100	25	100	25	500	100
New York N. of 42°N	500	100	100	25	No operation			
New York S. of 42° N	200	50	100	25	No operation			
North Carolina	200	50	No oper.		No operation			
North Dakota	500	100	200	50	200	50	500	100
Ohio	200	50	100	25	100	25	100	25
Oklahoma	500	100	No oper.		No oper.		200	50
Oregon	No operation				200	50	500	100
Pennsylvania	200	50	100	25	No operation			
Rhode Island	200	50	100	25	No operation			
South Carolina	100	25	No oper.		No operation			
South Dakota	500	100	100	25	100	25	500	100
Tennessee	200	50	No oper.		No oper.		100	25
Texas E. of 103° W	500	100	No oper.		No oper.		200	50
Texas W. of 103° W	200	50	100	25	100	25	500	100
Utah	100	25	100	25	100	25	500	100
Vermont	500	100	100	25	No operation			
Virginia	200	50	100	25	No operation			
Washington	No operation				200	50	500	100
West Virginia	200	50	100	25	No operation			
Wisconsin	500	100	100	25	100	25	200	50
Wyoming	200	50	100	25	100	25	500	100
Puerto Rico	No operation				100	25	100	25
Virgin Islands	No operation				100	25	100	25
Swan Island	500	100	No oper.		No oper.		100	25
Serrana Bank	500	100	No oper.		No oper.		100	25
Roncador Key	500	100	No oper.		No oper.		100	25
Navassa Island	No operation				No oper.		100	25
Baker, Canton, Enderbury, Guam, Howland, Jarvis, Johnston, Midway & Palmyra Islands	No operation				500	100	500	100
American Samoa	500	200	500	200	500	200	500	200
Wake Island	500	100	500	100	No operation			

Complete rules appeared in last month's CALENDAR. There is still time to obtain log sheets and a copy of the latest FCC Regulations for 160 from *CQ*. A large s.a.s.e. will do the trick.

Mailing deadline for your logs is February 28th and they go to: *CQ*, Att: 160 Contest, 14 Vanderventer Ave., Port Washington, L.I. N.Y.

REF

C.W.—Jan. 30-31. **Phone**—Feb. 27-28
Starts: 1400 GMT Saturday. Ends: 2100 GMT

This year's contest is in celebration of the 40th anniversary of the REF. Unfortunately a better choice of dates would have been desirable. Rules are the same as last year.

Results 1964 French Contest

USA & Canada
C.W.

W1BPW	4455
W2HPV	12
W4ZYQ	1638
W4SHX	969
W4HOS	147
WA4QPV	12
W5KC	108
W7BTH	48
W8KPL	2808
W9ZB	2754
VE3EVK	330

Phone

VE2AFC	14124
VE2DDR	540

1. The usual serial numbers. RST/RS report plus a progressive 3 digit QSO number starting with 001.

2. French stations will give their Department in the form of a number after their call letters. (ie: F8TM/78) This is your multiplier. Stations outside of France proper do not use this Department identification, their prefix will identify the DUF country for the multiplier.

3. Your multiplier therefore will be each Department and DUF country worked on each band. (excluding F and FC)

4. Each completed contact counts 3 points.

5. The final score is the total number of QSO points times the total multiplier from each band.

6. Certificates will be awarded to the highest scorer in each country and each W/K and VE call district. This year a special certificate will be awarded to any station with a score of 1000 or higher.

Contacts on your log can be applied for any of the French awards. Log credits however are only valid for a period of 2 years after the contest. Applications for awards go to: F9IL (DUF)—F3ZU (DPF)—F3JI (DDFM) and F3FA (DTA).

Contest logs go to: Reseau des Emetteurs Francais, BP 42-01, Paris R.P., France.

QCWA Party

Starts: 2200 GMT Friday, February 5
5 p.m. EST Friday, February 5
Ends: 2200 GMT Sunday, February 7
5 p.m. EST Sunday, February 7

This year's party is being sponsored by the Northwest Chapter of the QCWA. Only members are eligible for the QCWA Plaque donated by the National Headquarters and only contacts with other members will count toward this award.

There is no point scoring or multiplier involved, this is primarily a party to renew old acquaintance and see how many members you can contact.

To make it easier for the judging committee to determine the winner of the QCWA Plaque, your log should show in this order: Date and time in GMT, contact number sent and received, station worked, RST/RS report, frequency, QTH, name and QCWA membership number.

The activity will be found on these frequencies: ± 5 kc.
C.W.—3540, 3655, 3790, 7005, 7030, 7100, 14100, 21110, 28110.
A.M.—3810, 3950, 7230, 14240, 21340, 28900.
SSB/LSB—3804, 3999, 7204, 7299.
SSB/USB—14300, 21410, 21440, 28690.
RTTY—7105, 21140.

Your logs should be in the mail before the end of the month and this year they go to the Party chairman: Dr. F. Clifford J. Spike, W7OS, 1015 Medical Arts Bldg., Tacoma, Washington 98402.

Claimed Scores

1964 CQ World Wide Phone Contest

Single Operator

K2HLB	473,556	KH6FBJ	127,350
9M4LX	289,884	DL5AO	119,000
W7ESK	233,825	KZ5HH	92,400
5N2CKH	187,110	TG9SC	89,388
W8JIN	134,640	EP2AU	85,466
VP7CX	133,422	KA2RJ	71,214
OA4KY	124,650	YV1LA	69,552
VP9BY	92,300	W8HUD	64,376
KP4BPG	91,982	WB2CCO	56,028
		K6EVR	52,032
		VE1TG	50,481

21 mc

WA2SFP	100,287
W2WZ	37,848
ON5SK	27,874
W4HKJ	27,636
W5JWM	19,170
K1HVV	19,074
W6BSY	17,030

14 mc

VE8RG	274,778
SM5AM	209,050
W3JNN	129,642

7 mc

K2GXI	14,706
W3PHL	14,190

Multi-Operator

Single Transmitter

WØYDM	100,340
7Q7GN	51,908

Multi-Transmitter

W8NGO	200,990

ARRL DX

Phone—February 13-14 and March 13-14
C.W.—February 27-28 and March 27-28
Starts: 0001 GMT Saturday. Ends: 2400 GMT Sunday in each instance.

Not much object in us telling you about this one. Its been around a long time, this is the 31st year, so you should know all about it.

Briefly, it's the world working the W/K, VE/VO, KH6 and KL7's.

DX stations will send a RS/RST report plus a 3 digit number representing their power input. Our guys will also send the RS/RST report followed by the abbreviated name of their state or province.

Each completed QSO counts three (3) points, and the same station can be worked once on each band.

DX stations derive their multiplier from the total call areas (not states) worked on each band, a total of 21 possible per band. Our side will use countries worked for their multiplier.

Your final score is figured by multiplying

[*Continued on page 92*]

THE VHF COLUMN

BY BOB BROWN, K2ZSQ
and ALLEN KATZ, K2UYH*

SEVERAL months back we promised to analyze the ***CQ* V.H.F. Contest** policy and come up with the best program possible. The reason for this decision was the near fiasco of having one of our contests occur on the same date as a national amateur convention and the feeling that our contest rules were good but not the best. Coming up with the best possible contest program is no small order; but after several midnight discussion sessions many more sleepless nights, pounds and pounds of data from past v.h.f. contests (poor Gloria, Bob's secretary!), and a half hearted attempt to program the whole thing on the IBM 1620 (that is dog work); we have a plan which may approach it. We are sure the contests won't satisfy everyone, but do believe they will come darn close.

In the future the contests will fall on the same weekend each year; the *first full weekend in May* for the Spring V.H.F. Contest, and the *first weekend in August* for the Summer V.H.F. Contest. This schedule should alleviate any question of date and make it possible for you to plan for a contest well in advance. By the way, it is not too early to start thinking about the May contest now!

Contest time will be extended. Both contests will now run from 1300 local time Saturday to 2000 hours Sunday. We feel the addition of these hours will make Sunday an important part of the contest operating time and yet give the mountaintoppers and those who have to get up early Monday morning plenty of time to rest.

There will be two divisions in both the spring and summer contests; single band—single operator, and multiband—multioperator. We find that most amateurs concentrate their efforts on one particular band. The single-op division allows you to compete where you are best equipped. It does not stop you from entering scores from more than one band. We are looking forward to seeing more entries on the u.h.f. bands where a certificate can be obtained in many cases with only a few minutes effort. The multi-operator division is designed to make you work if you are going to team-up, since you will be scored as if you operated all v.h.f. bands no matter how many you are equipped for. Everyone benefits from a high-power station on a distant mountain-top. We are going to do everything we can to encourage this type of operation; see section on awards.

The rules for scoring have been changed very little. Each complete contact on 6 and 2 meters will count two points. Complete contacts on 220—4 points, 432—6 points, 1296 & above 8 points. A one way exchange of information counts half. (We hope this clause eases the conscience of a few operators on a QRMed QSO and makes others more careful.) A complete exchange is defined as the transmission of signal report, county, state and handle in both directions besides rogers on the information. You don't have to worry about date and time. Each different county worked counts as a multiplier of one. We have continued to use the county as our basic distance multiplier for three reasons. First of all, our contests are international and there are no A.R.R.L. sections outside of North America. We assume that entrants from countries where the term county is not used will use the appropriate geographical division—whatever it may be called. Secondly, a study shows that counties in general are better distributed throughout the country (or at least as well distributed) as any other geographical division we could think of. Finally, rare counties are a lot closer and easier to get to than rare states or A.R.R.L. sections. A multiplier will also be obtained for each hour of operation a valid contest contact is made in. This multiplier we believe will insure optimum use of contest time and add some skill to deciding who and when to contact. An added multiplier of 1.25 is obtained by stations operating with 30 watts input or less. We hope this rule will encourage low-power stations to enter the contest and more portable operation. Multi-operator-multi-band stations add their scores for individual bands to obtain their total score.

A handsome certificate and associated patheous will be awarded to the highest scoring

Here's the giant antenna we were talking about last month. Located on the equator near Lima, Peru, at Jicamarca Observatory, what you are looking at above is 9,216 crossed-dipole elements. It is utilized in a method known as scatter radar for studying the ionosphere and exosphere.

*c/o *CQ*, 14 Vanderventer Avenue, Port Washington, Long Island, N.Y. 11050.

single operator station in each state (province, or country) on each band entered. A certificate will also go to the highest scoring multi-operator station in each state entered. Besides this, a beautiful trophy will be awarded for a year to to the club with the highest aggregate score of its members in the Spring contest. Any club winning the trophy three years in a row gets to keep it. Similarly, the multi-operator station with the highest score in the Summer v.h.f. contest will receive a trophy for a year. Any station able to win the trophy three years in a row gets it for keeps.

We have done our best, now it is up to you. Start spreading the gospel and making those plans. Let's make '65 a big year contest wise!

From the Mailbag

Ron Finger, KA2RJ (W9VCH): "Since I am VHF/Technical editor of the *Far East Amateur Radio News*, I thought I should fill you in on the VHF activity in Japan." *(Good idea).*

"We have only two VHF bands here, 50-54 mc and 144-146 mc. Power input is limited to 50 watts. The normal microwave bands (starting at 1296 mc) are available also with the 50 watt maximum limit." *(We understand special permission can be obtained to operate TV on 432?)*

"Almost all of the operation here is on 50 mc phone. KA2's CM, DF, JW, KS, LD, MB, NA, PA, RD, RJ, SF, YP and KA9's AB and FH are on six meters regularly. KA2KS, KA2RJ and KA9FH are on two meters also. KA2RJ is on v.h.f. s.s.b. with transverters."

"Six meter DX from Japan includes Korea and Okinawa via sporadic-*E* in the summer and Australia via trans-equatorial skip in the fall and spring." *(How about some particulars—Ron?)*

"I hope this information will be of some interest to the fellows back home, especially to those contemplating duty in Japan soon." *(I am sure it will be! Though, don't keep us in the dark this long before your next letter. And why don't you put a word in for moonbounce in your next bulletin. Some of the gang around here would sure like to work Japan before the next six meter F2 session.)*

Bill Roberts, W9HOV (of Gain Inc.): "It is no secret that the signals your antenna pours into the ground do not help you in getting that new state. The forward lobe of every beam mounted on a horizontal level sends a portion of its forward lobe into the ground, from which it is usually reflected at a high angle into space." *(This is one reason why you want to get your antenna as high above the ground as possible.)*

"Vertically stacking beams has the happy faculty of narrowing the vertical radiation pattern, and thereby lowering the composite vertical radiation angle. However, a portion of the lower part of the lobe still slams into old *terra firma*. Over the years we have tried tilting our beams slightly to overcome this problem. At times we thought that we had accomplished something, but never could convince others. We would sure like to hear of your experiences and that of others." *(Tilting your beam slightly is an old trick Bill. It seems to be particularly effective in poor locations. We have found for our old location, that about 10 degrees was optimum. The effect, however, does vary with location and direction of the beam.)*

VHFing, European style. This photo was snapped by OE6AP while doing a bit of 2 meter DXing atop the 3000 meter high mountain "Zupspike" on the German-Austrian border. From here he has consistently worked into Finland, England, and Italy.

Vic Vicksell, W5HPT: "Back in operation on 432. Ears were plugged for a while due to failure of 8058 nuvistor. Band conditions have been good with the path to Houston open all the time. K5SDM has the strongest signal from Houston followed by W5LDV. W5AJG of course remains tops in the Dallas area.

On 1296 mc. using APX-6's we have been experimenting with W5SO on different antenna configurations. To date four bay helixes appear best. I hope in due time to get away from self excited APX-6, to something xtal controlled." *(Vic has also been making some comparisons of 432 mc front ends, and still finds the 8058 and "good" 416 B's tops. Although he does say that some of the transistor preamps around bear watching. From what we have seen it looks like the new R.C.A. low noise transistor will beat*

everything except a paramp (and perhaps even equal it) on 432 mc. Even more astounding is that Bell labs is experimenting with a new field effect transistor which is supposed to have such a low noise figure that their gear is indicating negative values of noise due to inaccuracies! We will try and have more on this subject next month.)

Harry Blakeman, K1WYS/Ø: Thought I'd let the six meter gang know we're now stationed at Lowy Air Force Base, Colorado, activity here in the Denver area on 6 meters is good, but comes nowhere near the activity back in Eastern Massachusetts. Most of the stations here operate on 50.55 mc. We are not on the air here yet, but sure would have liked to have been able to operate last Thursday night (October 8) as the band was wide open from 1800 hours to 1900 hours M.S.T. into Ohio." *(Bet you'll get on the air soon now!)* "We are looking forward to being on the air from home during December when we are on leave. It will sure be nice to hear the boys in "one" land again." *(Yes sir; we will be looking for you then.)*

Ben Hall, W9HOV: "Not too much 220 activity during vacation time, but operations are now picking up. Stations can be found on 220 in the Chicago area on Monday, Wednesday, and Friday nights between 8 and 9 P.M. CST." *(Many thanks for the activity report. Keep those 220 reports coming (and not just Ben)! This is the only way to get real 220 activity. Incidently 220 night in the New England area is Tuesday night between 9 and 10* EST. *We usually give the band a listen about the same time on Saturday nights—we are only at our shack on week ends.)*

San Mateo, California: A short note from WA6-BAN reveals the secret of the mysterious "M.O. valve."

"In the October 1964 VHF column you wondered about the M.O. valve. This is a pair of 4CX250B's in a rectangular cavity. See December 1962 *Wireless World* by GB3GEC for more details. I am building a similar rig, but using grounded grid 4CPX250K's." *(Many thanks for the info, Willie. Our stock of* Wireless *is far from complete, but we are trying to get our hands on a copy. Meanwhile let us know how you make out!)*

William Wetzel, W8TTU: "Thank you for the fine certificate that I have received for the Spring *CQ* V.H.F. Contest. I had a lot of fun winning the West Virginia section.

"I noticed a few years ago that some members of the *CQ* staff invaded the mountains of West Virginia to operate a v.h.f. contest. The purpose of this letter is to invite you to West Virginia again and see if an all-time high can't be worked. I feel the locations that I use are about the best in the state. I am only 60 miles from Pittsburgh, 90 to the Cleveland area, 222 from Columbus, etc. I am able to operate 6, 2 and 220 mc in all modes from a.m., c.w., n.b.f.m., s.s.b. Homebrew long johns for all bands that are made to collapse for mountain trips are included in the line-up.

"Groundwave from either of my two operating locations is about 350-400 miles. Elevation is 3523 with a 120 foot fire tower as an antenna farm." *Well, Bill, we just might take you up on your most kind invitation. Sounds like we could really put W. Va. on the map, excepting that you've probably already done that. If we can get away for the weekend, you can start the coffee perking. Will be in touch in a few months for more definite plans. Meantime, you've got a standing invite at both K2ZSQ and K2UYH. Equipment might not be quite so elaborate, but our coffee's a specialty!*

Bill Blazina, Jr., K3EAV: "Just thought I would drop you a line and say hello. Wonder if you could tell me where I can find some information on varactor triplers? I have looked through all the *CQ* magazines I own, but could find nothing." *Where have you been, Bill? See page 75, July 1964 CQ; p. 82, August; p. 67, September; and p. 108, November!*

"I am presently operating six meter s.s.b. with a C.E. 10B into a homebrew 815 mixer into a 6146 linear into a Johnson 6N2 Thunderbolt. I am working on a mixer for 2 meters and a 220 mc nuvistorized converter. I have a 4X150 tripler for 432 and a homebrew converter (that doesn't work yet). By the spring I should be on 6, 2 and 220 s.s.b. and 432 mc a.m. Antennas are going on 100' of Rohn tower." *That's one setup I'd like to see, Bill. May be out your way in the summer. See you then?*

Carl Schultz, WA2IMG: We're still getting letters on our disastrous Slide Mt. expedition of last Spring. But we are aware that there are some who would still like to attempt it. For these Paul Bunyans we offer the following letter from WA2IMG:

"I was looking through the August column and much to my dismay I spied the comment on Slide Mt. Now that you live in the state of N.Y. you should know the following: Slide Mt. is not the highest in the state; it is only the highest in the Catskills. The N.Y. State Conservation Dept. lists it as 4204 feet." *See profound apology, Nov. column.*

"Last year there was a bit of legislation that *almost* passed to prohibit the use of vehicles or *any* gas-driven generators, motors, etc., in the Catskill Preserve. The highest peak in N.Y. is Mt. Marcy, located 9 miles W.S.W. of St Huberts, N.Y., near Lake Placid (there is a state highway to the top). It is in Essex county and 5344 feet high. Ironically, it is 3 miles south of Slide Mt. (a small 1800 ft. Adirondack peak of the same name).

"Yes, K2OIQ/2 operated from there, but the greatest feat accomplished was the forces of K2CVG whose gang hauled a jeep to the top with the aid of winches in 1959." *(Gads!)* "WA2-FQH who lives at the base of the trail can supply the details. To my knowledge there have

[*Continued on page 105*]

The United States Of America Counties Award

RULES and PROGRAM

The United States of America Counties Award sponsored by **CQ**, is issued for confirmed contacts with specified numbers of U.S. counties under Rules and conditions hereafter stated.

A. Awards Classes

The USA-CA is issued in seven (7) different classes, each a separate achievement as endorsed on the basic certificate by use of special seals for higher class. Also, special endorsements will be made for all one band or mode operations subject to the rules.

Class	Counties Required	States Required
USA-500	500	any
USA-1000	1000	25
USA-1500	1500	45
USA-2000	2000	50
USA-2500	2500	50
USA-3000	3000	50

USA-3079-CA for ALL counties and Special Honors Plaque

B. Conditions:

1—USA-CA is available to all licensed amateurs everywhere in the world and is issued to them as individuals for all county contacts made, regardless of calls held, operating QTHs or dates whatever.

Special USA-CA's also available to s.w.l.'s on a heard basis.

2—All contacts must be confirmed by QSL and such QSLs must be in one's possession for identification by certification officials.

3—Any QSL card found to be altered in any way disqualifies applicant.

C. County Identity:

1—The Directory of Post Offices (P.O.D. Publication #26) will be the official guide in determining identity of counties of contact as ascertained by name or nearest municipality. It is suggested a copy of P.O.D. Publication #26 be obtained to facilitate operating reference and precheck cards for application purpose. Publication #26 is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Price $2.50)

2—Unless otherwise indicated on QSL cards, the QTH printed on cards will determine county identity.

3—For mobile and portable operations the postmark shall identify the county unless information stated on QSL cards make other positive identity. When in doubt of location, mobile stations should name the nearest municipality as identified by road sign or road map.

4—In the case of Cities, Parks or Reservations not within counties proper, applicants may claim any one of adjoining counties for credit.

D. Administration of USA-CA Program:

1—The USA-CA program will be administered by a **CQ** staff member acting as USA-CA Custodian, and all applications and related correspondence should be sent direct to him at his QTH.

2—Decisions of the Custodian in administering these Rules and their interpretation including future amendments are final.

E. Record Book and Bookkeeping:

1—The scope of USA-CA makes it mandatory that special Record Books be used for application. For this purpose, **CQ** has provided a 108 page, 8½ × 11" Record Book which contains application, and certification forms, a USA county map, maps of each of the 50 U.S. States showing county outline, and which provides record-log space meeting the conditions of any Class award and/or endorsement requested.

2—A completed USA-CA Record Book constitutes medium of basic application and becomes the property of **CQ** for record purposes. On subsequent applications for either higher classes or for special endorsements, applicant may use additional Record Books to list required data or may make up own alphabetical lists conforming to requirements. In this connection, through a printer's bust, the Record books left out the column for naming Cities/Towns, mandatory to validate County identity, so it is suggested that the time/date column be renamed and used for this purpose.

3—Record Books are to be obtained directly from **CQ**, 14 Vanderventer Ave., Port Washington, L.I., N.Y. for $1.25 each. Recommend two be obtained, one for application use and one for personal file copy.

F. Application:

1—Make Record Book entries necessary for county identity and enter other log data necessary to satisfy any special endorsements (band-mode) requested. It is mandatory that Cities and Towns or other specific location be named.

2—Complete application forms provided in Record Book, or, if preparing own lists for later applications, use special application forms available from the Custodian for s.a.s.e. or 1 IRC.

3—Have the certification form provided signed by two licensed amateurs (General Class or higher) or an official of a national-level radio organization or affiliated club, verifying that QSL cards for all contacts as listed have been seen. The USA-CA Custodian reserves the right to request any specific cards to satisfy any doubt whatever. In such cases applicant should send sufficient postage for return of cards by registered mail.

4—Send original completed Record Book and certification forms and handling fee of $1.00 U.S. or 10 IRC's to USA-CA Custodian, Ed Hopper, W2GT, 103 Whittman St., Rochelle Park, N.J. For later applications for higher class seals, send either Record Book or self prepared list per the rules and 25¢ or 3 IRC's handling charge. For application for later special endrosements (Band/Mode) where certificates must be returned for endorsement, send certificate and 50¢ or 5 IRC's for handling charges. Note: At the time any USA-CA award certificate is being processed there are no charges other than the basic fee regardless of number of endorsements or seals; likewise, one may skip lower classes of USA-CA and get higher classes without losing any lower awards credits or paying any fee for them.

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

SEEMS the Boss always gives the new help a little extra leeway (but only in the beginning), so you will notice that this column features awards from the state of New Jersey, my home state. We will be following this pattern for a while in an effort to convey as much information as possible about the various awards offered within a state which supports USA-CA in one way or another.

This month, also, a little bit of a rundown is in order on the history of USA-CA, in conjunction with the complete USA-CA rules on the previous page. The United States of America Counties Award Program, sponsored by *CQ*, was started in 1961 under the prodding of Clif Evans, K6BX. The Program immediately created world wide interest and rekindled the competitive spirit in thousands of newcomers and old-timers alike. Rare counties are now as much sought after as that elusive Zone 23. USA-CA also helps to promote good will both nationally and internationally. It helps to provide support and publicity for radio clubs which use award achievement programs to help publicize amateur radio and improve public relations. The county award program has created so much interest that nearly all of the fifty states now have a county award program in operation, and some have more than one.

A Reminder—Your QSL is Important

It is important to be sure that *your* QSL mentions your county and in fact shows all the things for which it can be used. For example, list your different memberships in QCWA, CHC, FCC, TOPS, RCC and clubs. Be sure to QSL, seems like there are always complaints about not receiving QSLs. It was with pleasure that I read a letter received from William Schultz, President, Newark News Radio Club (NNRC), in which he mentioned that one of their members, Jimmy Hart of Irvington, N.J., has 333 countries verified out of 334 heard. This is based on the NNRC Countries List which has about a half dozen more countries than the *CQ* version. Mr. Schultz also mentioned that the club is the oldest listeners' club in the world and in December marked the start of their 38th year—congratulations!

Thanks for the Help

Long before you read this, it is hoped that all records will have been transferred to your new USA-CA Custodian, so that all applications for endorsements and future awards can be quickly and correctly processed. It is an extreme pleasure to join the fine team at *CQ*, many thanks for their patience, help and cooperation. Also many thanks for the nice letters, comments, offers of help, and above all, the quick answers to my requests for information. Above all, please keep the letters, comments and information rolling in—without your kind help I'm a dead duck.

Glossary of Common Abbreviations

Here is an explanation of some of the common abbreviations internationally used:

S.A.S.E.: Means self-addressed stamped envelope of adequate size with postage stamps of the

*103 Whittman St., Rochelle Park, New Jersey.

"The Garden State Tercentenary Award" is also presented by the New Jersey VHF CHC Chapter No. 28. Stations within 50 miles of Morristown, N.J., work 25 stations located in N.J. since Jan. 1, 1964, to include at least two full CHC members. Over 50 miles work ten N.J. stations including one CHCer. Send GCR list and $1. to WA2QCQ, Don Gillmore, 1435 Parkview Ter., Hillside, N.J. 07205. For more data on endorsement seals and membership list, send s.a.s.e. The award is available to SWLs on same basis.

This is "The Garden State Award" presented by the New Jersey VHF CHC Chapter No. 28 which has 35 full members (CHCers) plus 48 associate members. Stations within 50 miles of Morristown, N.J. work ten members, all others work four members. Full CHC members no date required, associate members must be worked since April 29, 1964. Send GCR list and $1. to WA2QCQ, Don Gillmore, 1435 Parkview Ter., Hillside, N.J. 07205. For additional details on endorsement seals and membership list, send s.a.s.e. The award is available to SWLs on the same basis.

This is the Achievement Award given by the North Jersey DX Association for working NJDXA members. U.S. stations work 25 members, others work 15, all after Sept. 1957. Send log data, not QSLs, to K2BZT, 26 Parkview Ter., Summit, N.J. Cost to U.S. stations $1., no charge to others. Members K2BZT, DCA, DSW, HLB, JGG, QHL, W2AGW, AIW, AOX, BHM, BOK, BXA, CQX, CWK, DEC, DNG, EQS, FXN, FZY, GHK, GUM, GT, GZZ, HTI, HZY, JAE, JLH, JT, JVU, LAX, LNB, LV, MJ, OKM, RGV, SHC, TP, TQC, VCZ, YTH, ZGB, ZX, WA2DIG and ELS.

Nights at the Round Table sponsor this 50 mc certificate for contacts made with members after Nov. 1, 1963. Within 25 miles of Newark, N.J. work 12 members, 25 miles to 100 miles from Newark work 8 members, and 100 miles and over work 3 members. Endorsement seal for working all 15 members. No charge, send GCR list to WA2PVB, Phyllis McCarthy, 86 Ohlson Ave., Nutley, N.J. 07110. Members are K2EFN, OKA, WA2BXP, FEQ, HOW, HQQ, MVI, JNG, PVB, PWZ, QCQ, QCP, VTJ, VYM, YWM. This group does not want to be confused with a 2 meter group with similar name.

Here is the SFARC award sponsored by the Sierra Foothills Amateur Radio Club, P. O. Box 565, Auburn, California. The club has a real live "swinging" group of 35 active members and club station K6CBP. Requirements: QSOs with ten SFARC members if you are in California, others need five QSOs. QSOs made on club net at 9:00 A.M. Sundays on 3.975 mc do not count. Send log data and 50¢. Most members are in Placer County and some of the more active members are K6ARR, ASU, BIJ, KSE, QKO, TFD, ZWZ, W6PMF, WA6EMU, HYO, JIT, MEC, UHF, WB6AEU, DGE, GTN, HNC, IGH, WN6KUQ & KUT.

A beautiful award is this "The Garden State County Award" offered by the New Jersey VHF CHC Chapter No. 28. It is presented in three stages for proper completion. Basic award for contacts in ten N.J. Counties, next endorsement for 7 additional counties and then for the final four counties. For stations more than 50 miles from Morristown, N.J., basic award given for 5 counties but an additional 5 must be made before going for the other 7 and 4 endorsements. Send GCR list and $1. to WA2QCQ, Don Gillmore, 1435 Parkview Ter., Hillside, N.J. 07205.

recipient's country so that the recipient can send you a QSL or requested material or information at your expense and it greatly helps you get quick replies as it saves the recipient time, effort and money.

S.A.E.: Means self-addressed envelope, used with necessary IRCs when you can not obtain his stamps from his country.

IRC: Means International Reply Coupons obtainable at major Post Offices of most major countries. One IRC purchased at a U.S. Post Office costs 15¢ and is exchangeable for one regular mail postage stamp anywhere in the world where IRCs are honored by international agreement. Your radio amateur call book also lists number required in each country to cover airmail postage.

GCR: Means General Certification Rule, indicating that an award sponsor will accept as proof that an applicant holds the listed QSLs, a certification that such have been seen, signed by two other licensed amateurs, a radio club or organization official, a Notary or other official authorized to take oaths. It also means the sponsor reserves the right to request an applicant to send one or all listed QSLs should doubt arise or should the sponsor desire to make a routine check of the GCR honor system.

AOMB/M: Used to signify that an award sponsor will give endorsements for all one band or all one mode or mixed operations as might be claimed by an applicant.

Things To Do

Have you checked your standing in the *CQ* Awards Honor Roll on pages 59-62 in the December issue of *CQ?* Let's see how many new ones can be added to the list by November '65. Be sure to check CONTEST CALENDAR for news of QSO Parties, Field-Days, VHF Contests, YL Contests and others that could help you get the needed county. Also keep an eye on LETTERS TO THE EDITOR as well as ANNOUNCEMENTS. In fact, if you don't read each and every item in *CQ* you could be missing a lot. And last but not least, be sure to read the complete and latest information on USA-CA rules and program in this issue.

A Sad Group of Three

Good and bad things seem to come in groups of three and recent happenings haven't been good. First, the passing of Herbert Hoover, Sr., who as Secretary of Commerce in the 1920's signed all our radio licenses and promoted amateur radio in many ways including the Hoover cup, presented to the outstanding amateur radio station of the year. Of course, you all know of his famous son, W6ZH, President of the ARRL. Then, the passing of John Reinartz, K6BJ, also famous in the 1920's for his pioneer work in short waves. And then the passing of Earl Williams, W2EG, The Old Timers Club Secretary.

Editor's Note

Well, even amateurs like stories, so here goes —"Once upon a time there was a ham who had a QSO with someone in Trenton, N.J. On checking in his atlas (or was it his good road map or perhaps his U.S. Post Office P. O. D. #26), well anyway, he found that Trenton is in Mercer County, so there was a card towards his USA-CA. Checking the *CQ* WAZ map showed that Trenton was in Zone 5, so the card would be good for WAZ and WPX awards. He suddenly realized that Trenton was the Capital of New Jersey, one of the original 13 Colonies, so the

[*Continued on page 92*]

Propagation

BY GEORGE JACOBS,* W3ASK

THE following is a thumb-nail picture of h.f. band conditions forecast for January, 1965. For specific times of DX openings refer to the *DX Propagation Charts* for January which appeared in last month's column. This month's column contains *Short-Skip Propagation Charts* for January and February, as well as Charts centered on Hawaii and Alaska. The Short-Skip Charts contain propagation forecasts for circuits varying in length between distances of 50 and 2300 miles.

10 Meters: Only an occasional DX opening is expected during the daylight hours, mainly to southern or tropical areas. Occasional sporadic-*E*, meteor-type and auroral short-skip openings may also occur up to distances of approximately 1300 miles.

15 Meters: Conditions are expected to be slightly better this year than during last January. Generally good DX openings are forecast to many areas of the world during the daylight hours. Fairly consistent trans-oceanic openings are forecast for the month, with somewhat more frequent openings expected on north-south paths. During many openings, signal levels are expected to be relatively strong. During the early afternoon hours, there may be times when DX conditions on this band will be as good as, or better than on 20 meters. Short-skip openings between approximately 1000 and 2300 miles should be possible on most days of the month. Once the sun sets, however, 15 meter signals propagated by the regular layers of the ionosphere are expected to disappear almost entirely.

20 Meters: Good DX openings to almost all areas of the world are forecast for this band between sunrise and early evening hours. When conditions peak, signal levels are expected to be exceptionally strong. Some north-south openings may extend well into the hours of darkness. Good short-skip openings, over distances ranging between approximately 750 and 2300 miles, are also expected to take place during the daylight hours on most days of the month. During most of the daylight hours, 20 meters is expected to be the best band for DX openings during the month of January.

40 Meters: The band is expected to open for DX during the late afternoon hours, and remain open to one part of the world or another until shortly after dawn. During this period, fairly good openings are expected to many areas of the world, often with relatively strong signals. During the daylight hours, good short-skip openings should be possible between distances of approximately 100 and 750 miles. During the hours of darkness, the short-skip range is expected to increase to between 1000 and 2300 miles. On many occasions, 40 meters is expected to be the optimum DX band during the early evening hours and the hours of darkness.

80 Meters: Fairly good 80 meter DX openings are predicted to many areas of the world during the hours of darkness and sunrise. During the daylight hours, short-skip openings should be

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for January

	Forecast Rating and Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **1, 7, 13, 27**	A	A-B	B-C	C
Normal: **2-3, 5-6, 8, 10-12, 14, 17-18, 20, 25-26, 29-30**	A-B	B-C	C-D	D-E
Below Normal: **9, 15, 19, 21, 23-24, 31**	C	C-D	D	E
Disturbed: **16, 22**	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 parenthesis 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 February 28, 1965. These Charts are prepared from basic propagation data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

possible between distances of approximately 50 and 350 miles; during the hours of darkness, as the skip increases, short-skip openings should be possible between distances of approximately 250 and 2300 miles. Ionospheric absorption and static levels are expected to be at low seasonal values during the month, and this should result in exceptionally strong signals during periods of peak conditions on this band. On some occasions, DX conditions on 80 meters during the hours of darkness may be as good as, or better, than on 40 meters.

160 Meters: Some DX openings are predicted for this band from a few hours after sundown to shortly before sunrise. Short-skip openings up to 2300 miles should also be possible during the same period. Because of extremely high solar absorption, even during the period of low solar activity, ionospheric propagation is generally not possible on 160 meters during the daylight hours. If the correlation between DX propagation conditions and solar activity observed on this band during the past few years continues, conditions during January should be as good as, or possibly even slightly better, than the record-breaking conditions observed last year. Propagation test transmissions will be held on 160 meters between 0500-0730 GMT on January 3 and 17. Check last month's column for more details.

VHF Openings

The *Quadrantids* meteor shower is expected to take place during the first week of January. Since this is a moderately active shower, v.h.f. meteor-scatter type openings are likely to occur during this period.

V.h.f. short-skip openings due to sporadic-E or auroral-reflection are likely to occur during the month when ionospheric conditions are below normal or disturbed. Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are expected to be disturbed or below normal.

Sunspot Cycle

The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot number of 5.6 for October, 1964. This results in a smoothed sunspot number of 12 centered on April, 1964. A smoothed sunspot number of 8 is predicted for January, 1965.

Most experts investigating the sun's activity expect the present sunspot cycle to end sometime between October 1964 and April 1965. (See "A Look At The Remainder of The Present Sunspot Cycle," pp. 26-27, *CQ*, March, 1964). While it will take at least another year of sunspot data to confirm the actual date, it now appears that the cycle may have already reached a minimum value, or will do so within the next few months.

1964 In Review

The year 1964 was a year of very low sunspot activity. It began with a smoothed sunspot number of 18 and it was expected to end with a number in the neighborhood of 9.

Observations during the year further confirmed that the 10 meter band could not be used for DX communication during periods of low sunspot activity. Except for an occasional daytime opening on north-south paths, DX propagation was generally not possible on this band during 1964. On the other hand, numerous and wide-spread short-skip openings, between distances of approximately 500 and 1400 miles, were possible, mainly during the late spring and summer months as a result of intense sporadic-E propagation.

Fifteen meter DX openings were noticeably fewer during the first 9 months of 1964 as compared to previous years, although a marked improvement appeared to take place from November through the end of the year. Despite low solar activity good north-south DX openings (for example, from the United States to South America), were possible during the daylight hours throughout the entire year. Fairly good east-west DX openings were also observed on many days during the early spring, fall and winter months. DX-wise, the 15 meter band appears to have weathered the period of low solar activity, even though it opened for shorter periods of time and to fewer areas of the world than during periods of high solar activity.

Without question, 20 meters was THE band for DX during 1964. DX propagation conditions were favorable to almost all areas of the world sometime during the period between sunrise and the early evening hours. On some occasions, especially during the summer months, the band remained open for DX well into the hours of darkness. Observations during 1964 confirm that 20 meters is a good DX band throughout the solar cycle. During periods of low solar activity, peak conditions occur during the daylight hours; during periods of high solar activity peak conditions tend to occur during the late afternoon and evening hours.

Most observations appear to indicate that DX propagation conditions on 40, 80 and 160 meters were as good as, or possibly even slightly better, during 1964 than during previous years. Forty meters opened to many areas of the world shortly before sunset and generally remained opened until after sunrise. Eighty meters remained open for DX to one area of the world or another during the hours of darkness, with conditions peaking during the early spring, fall and winter months. The 160 meter band opened to more DX areas of the world during 1964 than was reported during previous years, with conditions peaking just after sundown and before dawn during the late fall and winter months.

Outlook 1965

At the present time there is some uncertainty about the date the present sunspot cycle has, or will end. There are some indications that the new cycle may have begun during November, 1964, while there is other evidence which points

to an early spring date for the birth of the new cycle. In any event, rising solar activity is certain to take place during 1965! It is doubtful, however, if the rise of the new cycle will be rapid enough to result in marked propagation changes in the h.f. amateur bands until 1966. Some changes will, however, take place, and these are summarized in the following paragraphs.

Until the fall of 1965, conditions on 10 meters are expected to remain about the same as during 1964. During the fall and winter months, however, the chances are good that DX propagation conditions will improve on 10 meters, with an increased number of openings during the daylight hours on north-south paths, and the possibility of some east-west openings as well.

Conditions on 15 meters are expected to continue much the same as they were during 1964, with the possibility of the band opening for east-west DX more often during the daylight hours of the fall and winter months of 1965 than during the previous year.

Twenty meters is expected to continue to be the best DX band during 1965. The band is expected to open to almost all areas of the world during the period between sunrise and the early evening hours. This coming summer, the band is also expected to remain open during the hours of darkness more often than during 1964.

DX propagation conditions on 40, 80 and 160 meters are expected to remain much the same during 1965 as they were observed last year.

73, George, W3ASK

CQ Short-Skip Propagation Chart

January-February, 1965

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

Band Openings Given in Local Standard

Band (Meters)	*50-250 Miles*	*250-750 Miles*	*750-1300 Miles*	*1300-2300 Miles*
10	*Nil*	*Nil*	10-15 (0-1)	10-15 (1)
15	*Nil*	10-16 (0-1)	08-10 (0-1) 10-15 (1-2) 15-16 (1) 16-18 (0-1)	08-10 (1) 10-15 (2-3) 15-16 (1-2) 16-18 (1) 18-19 (0-1)
20	*Nil*	08-10 (0-1) 10-14 (0-2) 14-17 (0-1)	06-07 (0-1) 07-08 (0-2) 08-10 (1-4) 10-14 (2-4) 14-17 (1-3) 17-20 (0-1)	06-07 (1) 07-08 (2) 08-10 (4) 10-14 (4-3) 14-16 (3-4) 16-17 (1-4) 17-18 (1-3) 18-19 (1-2) 19-20 (1)
40	08-09 (0-1) 09-10 (1-2) 10-11 (3) 11-15 (3-4) 15-16 (2-3) 16-18 (1-2) 18-20 (0-1)	07-08 (0-2) 08-09 (1-3) 09-10 (2-4) 10-11 (3-4) 11-15 (4-3) 15-16 (3-4) 16-18 (2-3) 18-20 (1-2) 20-02 (0-2) 02-07 (0-1)	07-08 (2) 08-09 (3-1) 09-11 (4-1) 11-15 (3-1) 15-16 (4-2) 16-18 (3-4) 18-20 (2-4) 20-02 (2-3) 02-07 (1-2)	07-08 (2-1) 08-15 (1-0) 15-16 (2) 16-18 (4-3) 18-20 (4) 20-02 (3-4) 02-04 (2-3) 04-07 (2)
80	08-09 (3-4) 09-19 (4) 19-21 (2-3) 21-23 (2) 23-08 (1-2)	07-08 (2) 08-10 (4-2) 10-14 (4-0) 14-16 (4-1) 16-18 (4-2) 18-19 (4-3) 19-21 (3-4) 21-23 (2-4) 23-07 (2-3)	07-08 (2-1) 08-10 (2-0) 10-14 (0) 14-16 (1-0) 16-18 (2-1) 18-20 (4-3) 20-23 (4) 23-05 (3) 05-07 (3-2)	07-08 (0-1) 08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-23 (4) 23-03 (3) 23-05 (3-2) 05-07 (2-1)
160	09-17 (1-0) 17-19 (3-2) 19-05 (4) 05-07 (3-2) 07-09 (2-1)	17-19 (2-1) 19-21 (4-2) 21-04 (4) 04-05 (4-3) 05-07 (2-1) 07-09 (1-0)	17-18 (1-0) 18-19 (1) 19-21 (2-1) 21-04 (4-3) 04-05 (3-2) 05-06 (1) 06-08 (1-0)	18-20 (1-0) 20-21 (1) 21-01 (3-2) 01-03 (3) 03-04 (3-2) 04-05 (2-1) 05-07 (1-0)

Hawaii

Openings Given in Hawaiian Standard Time†

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

Alaska

*Openings Given in GMT**

TO:	*15 Meters*	*20 Meters*	*40 Meters*	*80/160 Meters*
Eastern USA	21-23 (1)	20-22 (1) 22-00 (2) 00-02 (1)	03-13 (1)	07-12 (1)
Central USA	20-22 (1)	19-22 (1) 22-00 (2) 00-02 (1)	03-14 (1)	07-12 (1)
Western USA	21-00 (1)	17-18 (1) 18-22 (2) 22-00 (3) 00-01 (2) 01-03 (1)	04-05 (1) 05-12 (2) 12-15 (1) 15-16 (2) 16-17 (1)	05-12 (1) 12-15 (2) 15-17 (1) 12-15 (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.

*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.

§Indicates possible 10 meter openings.

‡Indicates possible 160 meter openings.

NOVICE

WALTER G. BURDINE,* W8ZCV

TO REALLY enjoy amateur radio after the first few months on the air (and sampling each mode of communications available to us) we might try a building project, or set a definite goal to test our ingenuity and engineering capabilities. In this way we can become more interested in the theoretical and mechanical aspects of our wonderful hobby. In other words we should possibly promote a pet project, not to the point that we become a bore to those not interested, but to the point where those not interested *want* to become interested. Then we should be *ready and able* to help them. This will take a lot of studying but it will also help build our educational background and mechanical ability. Make a few mistakes; that will do more to improve our techniques than any other way; the man that hasn't made a mistake has done nothing worthy of talking about anyway.

I have been called a v.h.f.er for so long that most people have forgotten that I've worked 113 countries with low power on phone (n.b.f.m.). I became interested in v.h.f. back during the war while operating the War Emergency Radio Service (WERS) on the 2½ meter band. I operated on the frequency of 115.9 mc. After the war the band was moved to 144 to 148 mc and necessitated the rebuilding of all equipment. With the opening of the low frequencies the v.h.f. bands went begging for a spell but the old love returned and a few of us began trying to interest the locals in operating the new two meter bands. For a number of years, W8ZCV, W8NAF (now K7YSE) and a few others tried to interest the folks, to no avail, and we were not the most popular members of the Dayton Amateur Radio Association, possibly due to our approach they thought we were howling in the dark.

After actually getting on the air and working a few distant stations we began to get inquiries about antennas, converters, i.f. strips, how to hook up a converter (I get many queries about that even to-day), about xtal controlled converters versus tunable oscillators and the many whys and hows of the game. We had the usual arguments about polarization and number of antenna elements and "what is the best height above ground?" We are still working on this and many other problems. There is enough v.h.f. activity here now to give you a QSO almost any time of the day or night. During one opening I worked 15 states and 142 contacts with about 7 watts input on two meters. My pet project is v.h.f. and low power communications.

As the years have sped by, the transmitters have become smaller and actually less complicated. My first ten meter transmitter was a big 807 rig that started with a 7.0 mc crystal and took up plenty of space. It was three feet high and about 20 by 14 inches. My six meter rig is 2×4×6 inches (*CQ*, Nov. 55) and it has 36 states, 8 countries, and 3 continents. Sure, I had to wait until the high power boys worked them first, but *I worked them*. This week I called CQ and WA8JIK's answer made 3,500 consecutive daily contacts above 50 mc. I figger thet is a record uv sum sort, don't you? Now, *there* is v.h.f. activity. Well on to 432.

Hunt your project, work up the activity by first being the best and most consistent part of that activity and be willing to help newcomers. You will enjoy your radio activities more and you will be surprised to find what it will do for *you*. For this winter I plan a new television camera using a 6198 Vidicon and some power at 432 mc; to get my Heath SB-10 working at about 100 watts and to be able to receive RTTY from both methods up to two meters, AFSK for the higher frequencies. I would like to be a good all around ham.

Next month will begin the fourth year of my second hitch as your editor. I was looking over some of the letters that have arrived since I started this column and find that I now have letters from 43 countries and every state in the good old USA although I have not received a letter from each state this hitch. All continents are represented and interest is just the same in all lands. People all over the world are interested in the same things. Of course I try to answer most of the letters that require an answer but some are just impossible for me to answer because the address was not given or was not readable. And some of them I just don't know how to answer. I try to help as much as possible. I hit upon the idea of having a hodge-podge column and answer some of the more often asked questions in this column. I will use excerpts from the letters and answer them so that others can profit(?) from your answer, sort of like the question and answer forum's conducted at hamfests. I hope you will get your question answered.

Letters

From Slippery Rock, Pennsylvania. "I have now become the owner of a BC-348-N receiver which tunes through 20 meters. This set has no tubes and is wired for a dynamoter. As I have read, the tube types used in these receivers are different for the letter suffix in these. I certainly would like to know where to obtain the schematics for this set."

You can get the original manual (complete) for the receiver from The Propagation Products

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

Co., P.O. Box 242, Jacksonville 1, Florida. Write them for the price of the manual, it is very complete and will be of help for a long time, the manual has a lot of operational theory inside. This helps you to understand how it works. Other companies will also be able to send you this information. The new *CQ "Surplus Con-Version HandBook"* available for $3.00 from *CQ* should solve your problem, I haven't seen a copy yet. It is one of the many surplus conversion books from *CQ*. The tubes used are: VT-116 -6SJ7, VT-117 -6AC7 can use 6SK7, VT-150 6AS7 mixer, VT-152 -6K6 audio, and VT-233 -6SR7 can use 6SQ7. The i.f. frequency is 915 kc. The *TO* number is *TO-12R2-3BC348-2* formerly *16-40BC348-3*. This is the *Handbook of Maintenance Instructions for the BC 348-J, -N and -Q*. A number of conversions have been printed for the conversions of the BC348-Q and they should apply directly to the -N model. As a new ham it would do no good to give you a list of these as you would not likely have a number of back issues of the popular magazines. A perusal of the literature available at your local parts outlet should turn up the needed information.

From a soldier stationed in Munich and many, many others. "I have an Ameco 15 watt transmitter, can I increase power output by substituting a 6L6 tube for the 6V6, would it help to change to an 807?" A 6L6 or an 807 would undoubtedly give more power output but I would not advise you to use them in this circuit because the power transformer would not be able to furnish the needed additional power. The 6L6 would need a higher voltage to gain a significant voltage-current-power ratio. I would advise you to build another circuit as an amplifier for the Ameco, it will drive two 807/1625 type tubes as an amplifier. Circuits are available in almost any handbook. I think the Ameco would work on 15 meters if you used a 15 meter crystal and a 15 meter coil in the tank circuit. Don't forget that power is the product of voltage *and* current.

This question has been asked about as often as any and in many different ways. I will try to answer them here: "When you described the simplest converter you mentioned a *gimmick* condenser. What in the world is it? Where can I buy it as it is not listed in my catalog?" "Are 6D10s available; my dealer has none?" "Can I use this converter at some other frequency?" "How do you get a different i.f. frequency?" "Where do I hook into the i.f. of my receiver?" "Will this converter work with my Drake 2-B?"

Now, hold on a moment, I know that *you* know the answers to these questions, *or do you?* Many old timers have asked one of these questions in one way or another, and this column is written for beginners, Novice, Technician and the General class license that doesn't know it all *yet*.

A gimmick is a condenser made by twisting two pieces of wire together to form a condenser of small capacity. The insulation, wire size and

Fig. 1—A gimmick condenser. Notice the ends are *not* soldered together. To decrease the capacity, simply trim the twisted wire shorter.

length of the twist will determine the capacity and the voltage at which it can be safely used, the better the insulation, the higher the voltage rating. Any two conducting metals separated by a dielectric will form a condenser, the value of which will depend upon the area of the conductor, the spacing between the conductors and the dielectric constant of the dielectric. When I need three or four of these I put two wires in the chuck of my drill and have someone hold the ends. The drill makes a very nice twisted wire cable if you are careful. Short lengths of this are used for the gimmick. Fig. 1 shows the gimmick capacitor. Reducing the value of the condenser is easy, just cut it shorter. *Be sure* no voltage is on the condenser when cutting the wires. By the way, neutralizing condensers for almost any rig of two hundred watts or less can be made of short lengths of RG-8U coax, it should be able to withstand voltages of 1500 volts. You can replace most gimmicks with a 1 or 2 mmf. Most converters use the interelectrode capacitance of the tube for oscillator injection if they use the same tube for the mixer and oscillator or frequency multiplier. The 6D10 is available from Allied and many of the mail order houses if your dealer doesn't have them. General Electric introduced these and they have a large group of these multi-purpose tubes. They are the answer to the experimenters prayers, each tube serves the function of from three to six tubes. I wish they were easier to come by and that more information was available on the compactron line. I have been working on a super six tube compactron receiver and it will appear in print sometime this winter after all tests and constructional practices have been completed.

The different i.f. frequency is easy to come by, simply put in a crystal that has a frequency difference between the wanted signal frequency and the i.f. frequency you want to use and tune the i.f. coil on the converter, if one is used, to the i.f. frequency. In other words the i.f. frequency is the difference between the signal you want to receive and the injection frequency of the local oscillator or frequency multiplier chain. If the wanted signal is too high for direct crystal frequency control, a frequency is multiplied by electronic means to maintain crystal control.

This multiplied frequency is then the injection frequency.

As an example a 50 mc converter is to be used with a receiver that tunes 8.0 to 12.0 mc. The crystal would be 50 minus 8 equals 42 mc for the oscillator then 51 mc would be at 9 mc on the dial and so on.

We might want to go to 144 mc and we can get no crystal for 144.0 minus 8.0 or 136 mc so we can take a low frequency and multiply it electronically. I use a 6.8 mc crystal and multiply 20 times for a result of 136 mc. 144 minus 136 gives me the required 8.0 mc for my i.f. frequency.

The higher frequency bands will require more frequency multiplication to arrive at the frequency required for a low frequency i.f. strip.

The converter is not coupled into the receiver i.f. section, it is coupled into the receiver antenna terminal and the receiver becomes a tunable i.f. strip. This method is used with a receiver because the oscillator becomes more stable as the frequency of oscillation is lowered. Crystal control is used in almost all v.h.f. converters because of this stability problem. It in effect gives crystal control of the high frequency spectrum by using the low frequency of the receiver as the variable function of controlling the i.f. frequency. Use the best receiver that you can afford for the tunable i.f. strip, the converter needs no adjustment during operation save supplying the necessary power and antenna connections. Be sure all antenna connections to the converter and receiver are shielded to prevent i.f. feedthru of unwanted signals. Most converter oscillators operate on the lowside of the wanted signal, the receiver tunes up the frequency in this case, the low frequency end of the bands appears on the low end of the receiver dial.

"Can a 50C5 be used in the circuit of the transmitter in your *CQ* column of August 64? What parts are needed to use a 50C5 or 50L6 in this transmitter." This received from WN7-VYE and many others.

Almost any simple transmitter circuit can be changed to use a tube of similar electrical parameters, if the necessary socket changes, filament and supply voltages are supplied to the tube elements. A 50C5 must have 50 volts on the filament furnished by a filament transformer or through a dropping resistor. A 50 volt transformer can be used or a series resistor can be used to drop the voltage to the desired 50 volts. The value of the resistor can be found by using Ohm's law, $R = E/I$ 117 volts minus 50 volts equals 67 volts to be dropped. The 50C5 draws 0.15 amperes therefore: 67 divided by 0.15 is about 450 ohms. The power of the resistor can be found by using the formula $P = I^2R$. Use at least 10 watts for the dropping resistor. Watch the socket connections, redraw the diagram and number the corresponding connections. The other power supply voltages can be approximately the same as shown in the diagram. About 30 different tubes can be used with this circuit by being careful with the socket connections and size. The tube manual or the tube section of the handbook can be used to supply all of the information. It is also a good time to start in using the old noodle to think with. The gray matter stored there is your best electrical instrument.

A good many of the foreign writers ask if there is any supplier over here that will ship small orders to them. Verbatim from one of these: "Another big problem, and *we need help:* the U.S. stores do not send us small orders. They just accept the big orders—$$10.00 or more, usually. So who is able to send us the small and cheap parts we often need—coils, capacitors, rectifiers and such parts to use in *CQ* circuits." This is a statement used in many of the letters received from overseas. Those hams need our help and I'm sure that this help will do as much good as a Peace Corps effort. Some big supplier could do a lot to help this effort along, preferably a seacoast city, to lessen the postal charges. The postage charges will be quite large I know but if a ham needs a small part, he will just have to pay the postage. Can you help them, I will do my best to help. Let me know and I will supply your name to any one needing this information. It just might cut down your margin of profit but it will do more than many of the tax dollars we spend for similar purposes.

Here is a letter such as I have never received since taking over the column. Thanks for it Jerry. "Dear Walt: I just received your card a little while ago concerning my questions about how to change the i.f. of a converter. I want to take the time to tell you thanks a lot for the info. I remember now about changing the crystal, but the rest was a little hazy. So, again Walt thanks for the information. 73. Jerry—WB2PDN."

By the way I answer about twenty letters a week and some of your letters have not been answered because I just didn't know the answer or I haven't been able to find it in my files. I'll still answer especially if you enclose a stamped self-addressed envelope. That is another thing, do you realize how much time and money it takes to answer them, and I always try to be very correct with my answers, the wrong answer wouldn't help you any. I need pictures and letters for this column, I know you are not news to yourself or neighbors *buuuuut* you do enjoy reading about others. You are *others* to them.

I hope this kind of a column has answered some of your questions, all hams have the same problems and what affects one affects all. Therefore the reason for this kind of a column.

Help Wanted

These fellows need help: Warren W. Brown, 2608 Bull Run Drive, Decatur, Ga. Phone 24101278, needs help with the code and someone to give him the test. He would like to hear about an organized club in his area.

Ray Martin WAØDZI, 7523 Pawnee, Prairie Village, Kansas would like a regular sked on

[*Continued on page 94*]

HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV

WE HAVE been asked why we frequently publish service notes on ham equipment when these are generally available (for the asking) from manufacturers. Well, we do this mainly for those who have purchased second-hand equipment and are not registered with a manufacturer. We also do this for those who have purchased new equipment and who neglect to send in their warranty cards.

Why a ham does not send in his warranty card when he purchases new equipment is difficult to understand. Service managers tell me that ham customers are often responsible for worthwhile improvements that are made to equipment and that these improvements are published and released as service notes to all *registered* set owners.

Engineers are only human. Their design and testing (in most cases) of new ham gear is carried on under ideal laboratory conditions. How really good a set is, is known only after it has been in the hands of a number of hams "in the field." For *no* set can be tested in the lab as thoroughly as it is under actual *field* operating conditions. Circuit changes and mechanical improvements generally result from "field reports" submitted by hams.

Make no mistake, *everyone* realizes that *no* manufacturer makes all of the components that go into his sets, but he is the one blamed (and unrightly so) for a failure. Although every manufacturer re-tests components purchased for installation in his equipment, this is no guarantee that a part will not fail. There is no set manufactured in the world today that contains all fail-proof components! If 100% fail-proof electronic construction was possible there would be fewer missile failures and no need for maintenance technicians. But electronic gear does fail and this is an accepted fact. No manufacturer can truthfully say his set will *never* fail!

As we have said before, when we publish service notes or trouble-shooting information we do so to help you the ham, and you the manufacturer. We realize that even sets off the *same* assembly line can develop different troubles, and we do not state that every set in a series will develop the same fault. When you (the manufacturer) are kind enough to send us service or improvement notes (as many of you do) for publication, you *show* the ham that you *are* interested in helping him.

When you see *nothing* of a service nature on a specific set in this column, you can bet that we are not on the manufacturer's service bulletin mailing list.

Recently while in the U.S., working 20 meters, we heard one ham complaining about a certain transceiver. Had he been on the manufacturer's mailing list he would have received a service bulletin which would have shown him how to correct his trouble. If he had written to HAM CLINIC we would also have been able to help him. But this ham will continue to berate his set and naturally give it bad publicity. This is one of the main reasons why manufacturers' service managers should make sure HAM CLINIC is on their service bulletin mailing list. Needless to say, those hams who do not read *CQ* and this column miss a lot of good useful information which they can use or pass on to friends.

Mail in those warranty cards! If you are a second-hand set buyer, write to the manufacturer and ask him to place you on his mailing list. Be sure to give the serial number of your set.

Ham Clinic Anthology

During the past two years we have received a large number of letters from readers (new and old) who have suggested that we re-edit the last 7 years material appearing in HAM CLINIC and come out with a HAM CLINIC Anthology. It was suggested by some that the book also contain "useful information for the ham" in the form of tables, transistor substitutions, tube info etc. The mechanics for this "venture" have not yet been worked out and we are thinking of including information prepared for the Ham Scope Book that we have not been able to finish because of lack of time. If you are interested in such a book, would you please drop a card *to me* which I can pass on to our editor and the executives at Cowan for their consideration? Thank you. No response, no book.

Questions

Complaint (Back Issues)—"You often give references in your column to *back* issues of *CQ* (and other publications) containing information of real interest. But when I try to get copies of *some* of the back issues you refer to I find out they are not available. I believe your references should go back to those issues of the publications that are still generally available. Don't you agree?"

No, I do not agree. First of all, if you want a copy of a publication bad enough that contains the information you are seeking you *can* find it if you are patient and persistent enough. How? By advertising for it (average charge in *CQ*'s Ham Shop—$1.00) or watching for ads in the ham mags offering *CQ* etc. for *whole years* for sale. Remember, most articles do not appear twice (except in an anthology). Articles were written in 1947 which covered subjects still of interest today and on which nothing has appeared since.

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, L. I., N. Y.

SR-150 (Intermittent)—"I think the SR-150 transceiver is the best set on the market today, but lately (after nearly two years of trouble-free operation) the receiver section has developed an intermittent. This manifests itself after a transmission and it is necessary for me to flip the operation switch from VOX, MOX or STANDBY to OFF, and then back ON again. What should I look for?"

First, check all the tubes associated with the receiver function. Next, check the cleanliness of the relay contacts (especially K-1). If you did not find a bad tube, or cleaning relay contacts (with a burnishing tool—and NOT sandpaper) did not help, then check the coupling capacitors C_{17}, C_{47}, C_{49}, C_{59}, C_{111} and any others handling *either* r.f. or a.f. Bet your trouble is relay contacts. Yes, the SR-150 is indeed a fine set.

NCX-3 Suggestions and Operational Hints—"I just purchased an NCX-3 transceiver and with it I have literally worked the world. National did a real bang-up job in putting this set on the market. However, I bought the NCX-3 second-hand and do not receive any literature from National. What I would like to know is whether or not there has been any late information issued on the NCX-3 since it came out? Will National put me on their mailing list for releases concerning this set?"

The NCX-3 has been and is receiving real fine reports. Its "big" brother the NCX-5 is beginning to make a name for itself too.

Sure National will put you on their mailing list. Write to them.

On July 7, 1964, *Customer Service Bulletin Nr. CIB-64-9* was issued to all *registered* NCX-3 owners. If you do not have a copy of this bulletin we urge you to write to National for one. For those too lazy to write or who have not received one, here (in paraphrased form to save space) is the gist of that bulletin. We are indebted to Mr. Harvey Whitmore, National's Customer Service Manager, for keeping HAM CLINIC posted—as he has done so ably for such a long time.

"The suggestions contained in this bulletin are only to remedy existing difficulties in specific units—*not* necessary or recommended where 'trouble' does not presently exist.

"Some mikes used with the NCX-3, especially those using 'coil cord' have a tendency to introduce r.f. feedback into the NCX-3 through the mike pre-amplifier. The r.f. feedback usually shows up after you have had the NCX-3 fully loaded and start to increase the mike gain control. Suddenly the plate current will jump up to 300 mils *without* audio input and sometimes the oscillation can be heard on the signal. This feedback may also manifest itself by the "breaking up" of the transmitted audio when the mike gain is advanced beyond a certain point. We have found that simple by-passing will eliminate this r.f. feedback. The following is suggested: add a .003 mf/500 volt d.c. capacitor from the hot side of the mike jack to ground. Add a .001 mf/500 volt capacitor from pin #2 of V_{7A}, which is ½ of the 6GH8 to ground. If your NCX-3 uses the 6AN8 in place of the 6GH8, the correct pin connection for the 6AN8 is pin #8.

"If the r.f. feedback persists, add an additional .001 mf/500 volt capacitor from pin #2 of the V_{6B}, which is ½ of the 12AT7 speech amplifier to ground. The leads for all capacitors should be as short as possible.

"This item is relative to vox adjustment. Some NCX-3 owners set the VOX SENSITIVITY much too high. This results in lack of anti-vox action and there is interaction between the VOX SENSITIVITY and the VOX DELAY controls. The interaction will cause erratic VOX DELAY operation. Set the VOX SENSITIVITY control so that it *just* trips the vox circuit when the mike is close talked, and VOX DELAY control is set for minimum delay. In vox operations, the mike should not be farther than two inches from your lips for normal speech conditions. One-tenth of a second should be the elapsed time between transmitter and receiver action. Then adjust the VOX DELAY control clockwise for proper delay to suit you. Check the vox diodes, D_4, D_5 and D_6 if you continue to experience difficulty. The back resistance of these should be two megohms when one end is removed from the circuit. National will replace any defective ones at no charge.

"Eratic operation in the vox mode may be caused by a small a.c. voltage (hum) being fed into the NCX-3 when insufficiently shielded mikes are used. This erratic operation shows up in the form of chattering or hanging-up of the relay and can be prevented by making the simple change as follows: there is a yellow wire which runs from the VOX-PTT switch to the rear apron of your NCX-3 to the mode switch on the front panel. If this yellow lead is replaced with a *shielded* lead, with the shield grounded, this condition is eliminated and normal vox operation can be obtained.

"Occasional complaints of vox hang-up can usually be traced to unusually high negative bias voltage from the power supply. The recommended bias voltage is 80 volts. Higher bias voltage may be due to unusually high line voltage. If the high line voltage persists try some resistance in series with the bias line.

"The NCX-D d.c. power supply is designed and guaranteed for a nominal input voltage of 12.6 volts with maximum voltage excursions from 11.5 to 14.0 volts. Input voltage higher than 14 volts will permanently damage the power transistors. Check your generator system voltage! Before installing an NCX-D adjust the voltage at maximum (and/or idling) speeds for *no* more than 13.5 volts.

"Mobile noise seems to be a problem with a number of hams, but a little patience and know-how can eliminate most of it. Using resistor-type sparkplugs will help immensely. Using coaxial condensers in series with wires *feeding* the high tension coil, ignition switch etc., will help tremendously. Generator whine on 20 meters can be reduced or eliminated with a tuned trap in the generator output lead.

"If you want additional vox delay change C_{118} from .1 mf to .25 mf.

"Transmit-receive clicks" heard on some NCX-3s, caused by switching transients, can be reduced as follows: on the TRANSMIT RECEIVE RELAY, there is an additional contact marked pin #19. If a lead is run from this contact to pin #5 of the Jones power plug, which is on the rear apron of the NCX-3, and then very carefully dressed along the inside edge of the underside of the chassis, it will provide you with a ground for the speaker leads. This lead should follow the cable harness that runs to the relay as closely as possible, and should be kept very close to the harness. If care is not taken, carrier leakage could develop.

"Finally, cleaning the NCX-3 panel is best done with a good soap detergent. Never use an ether keytone base material such as acetone."

Next month, watch for a few minor changes on the NCL-2000.

Using 572-B Tubes as Replacements for 811A Tubes—"Would you please give me some information on using the new UEW-572-B tubes as replacements for 811A tubes?"

First of all, I would suggest that you write the Waters Mfg. Co. Inc., Boston Road, Wayland, Mass. They will be happy to send you a full complete technical bulletin on the 572-B—including a diagram for modifying the Collins 516F-2 AC power supply (so that the new tube can be used) to provide more power for a KWM-2 or 32S driver.

The 572-B is a fabulous tube! With the Collins 30L-1 and modified power supply, you can get up to 200 watts *more* r.f. output, for example. By modifying the KWM-2 or 32S Series power supply to provide the power for more r.f. drive, and using the UEW 572-Bs instead of 811's, the r.f. output of the 30L-1 will be 1050 watts. Something to consider! Check the October *CQ*, page 57 for more on the UEW-572-B.

Reverse, Linear and Audio Tapers—"What is meant by reverse, linear and audio tapers as applied to a potentiometer (pot)?"

Simple, it is the way the resistance of the potentiometer changes as the shaft is rotated. Reverse taper (often called right hand logarithmic) provides a large change in resistance in the first half of shaft rotation and very little in the last half. This taper is used with cathode voltage controls such as TV contrast and many bias voltage controls.

The Linear taper is where the resistance change is exactly proportional to shaft rotation. All standard wire-wound controls have linear tapers. Carbon controls with linear tapers are commonly used in tone controls, sweep controls and other straight voltage-division uses.

Audio taper (sometimes called left hand logarithmic) gives a small increase in the resistance at the beginning of the shaft rotation and a faster increase toward the end (clockwise rotation). The response of the human ear is matched and is the reason audio tapers are used in volume controls and similar shunt circuits.

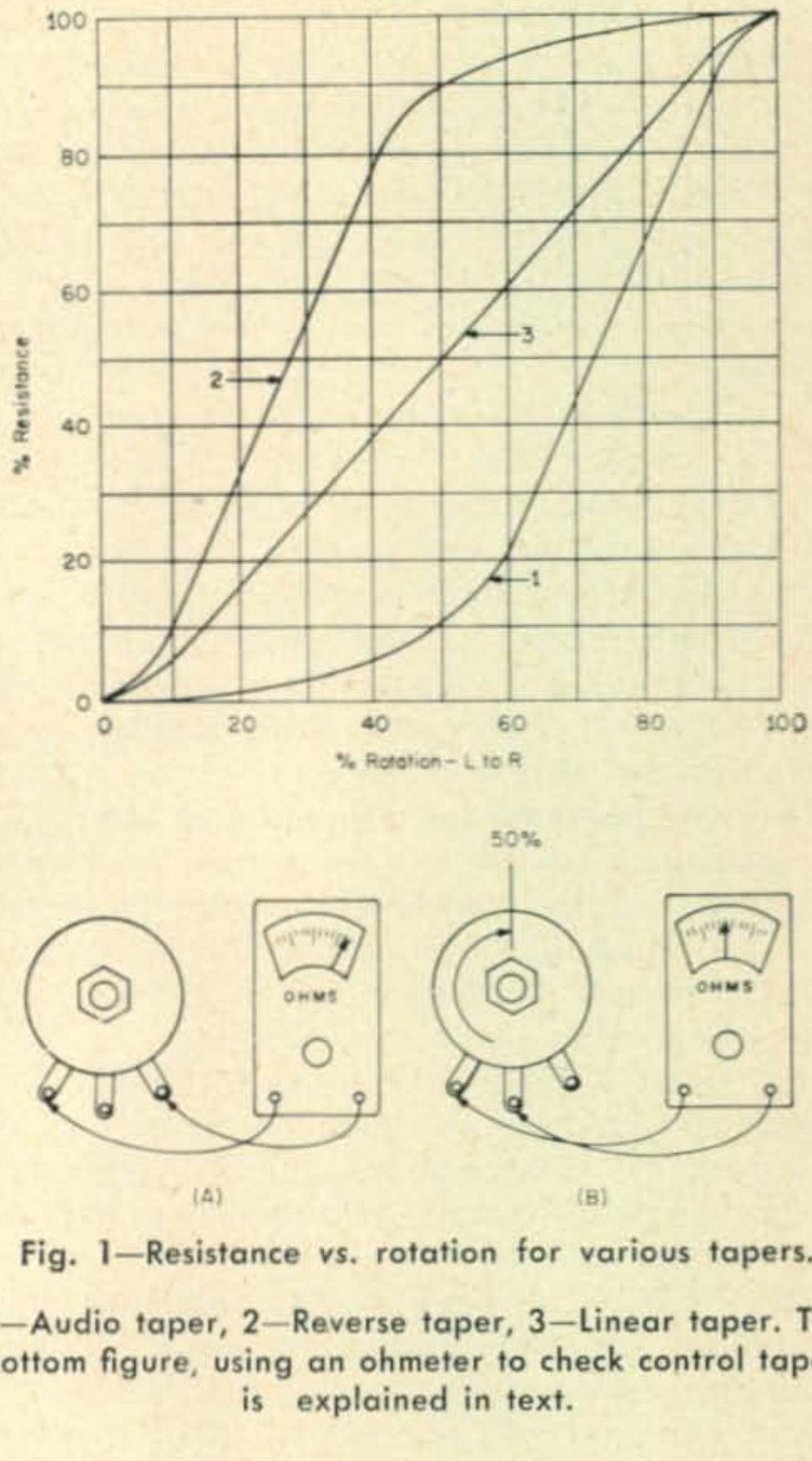


Fig. 1—Resistance vs. rotation for various tapers.

1—Audio taper, 2—Reverse taper, 3—Linear taper. The bottom figure, using an ohmeter to check control taper, is explained in text.

Figure 1 shows a graph illustrating taper and how to measure for taper.

When measuring for taper, connect the pot to an ohmmeter as shown. First measure the total resistance. Then turn the shaft to 50% of rotation. If the resistance is 50% of total, you have a linear taper. If it is 10% to 20% of total you have an audio taper. If it is around 80% of the total resistance you have a reverse taper. We thank Mallory Distributor Products Co. makers of the Sta-Loc (R) control for assisting us with the information presented.

Transistorized Speech Clipper—"Please publish a diagram for a transistorized speech clipper. Use parts that are easy to find."

See Fig. 2. This is a speech clipper whose complete description and operation appear on page 25 of the book "*Transistorized Miniature Amplifier and Tuner Applications*" written by Rufus Turner, K6AI, for Lafayette Radio Electronics Corp. Syosset, L.I., N.Y. The book is worth having and can be obtained from Lafayette for $1.50. It contains many circuits of interest to hams and the CB'er.

The speech clipper uses a Lafayette PK-544 packaged transistorized amplifier, which has an output of 360 milliwatts. It sells for $6.95. Any amplifier having similar input (high-Z) and output (low-Z . . . 8-11 ohms) characteristics may be used in the clipper. With the ready-made amplifier however, making the clipper is only a matter of about 1½ hours. We thank Stan

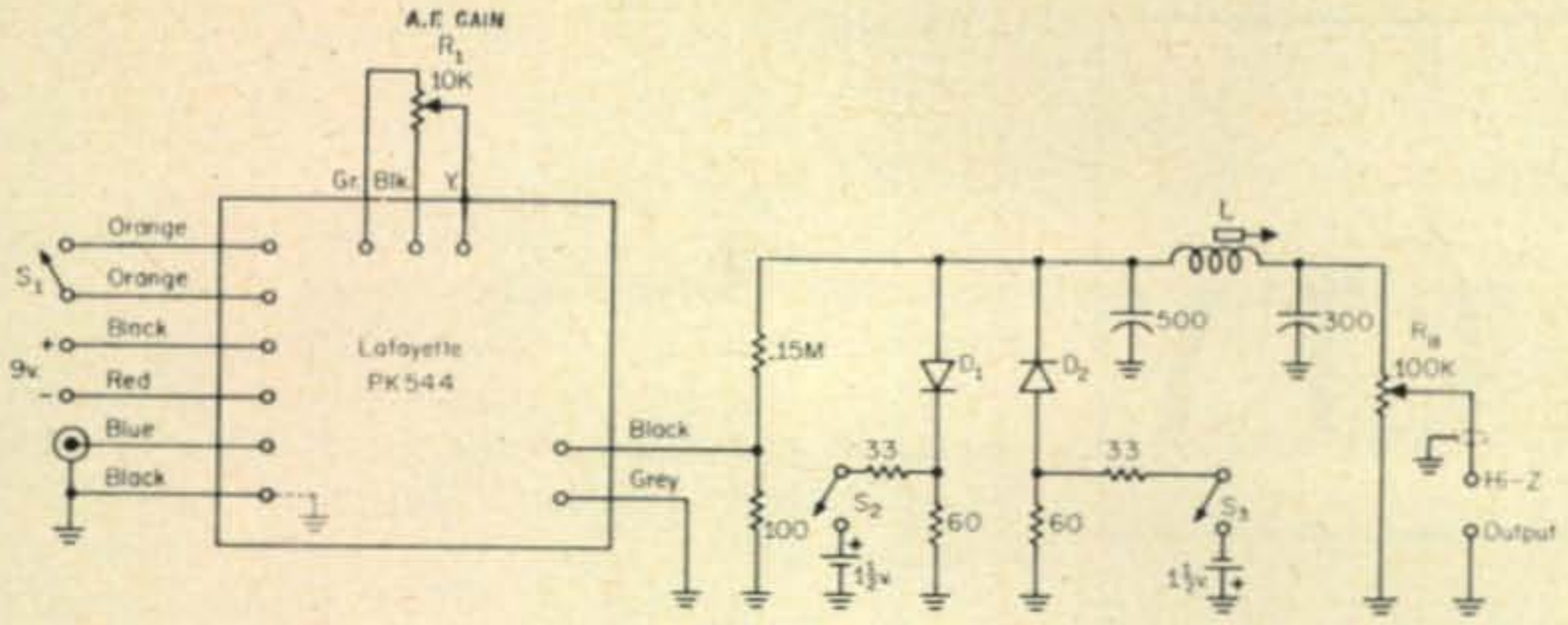


Fig. 2—A clipper using a packaged amplifier. "L" is a 20 Henry adjustable inductor. D_1 and D_2 are germanium diodes. The output of the unit must go to Hi-Z input of 500K or more. The wires of the amplifier are color coded for easy identification.

Isaacs of Lafayette for allowing us to use the info printed here.

It is suggested that the output elements be installed in a shielded case. As K6AI suggests, "the simplest way to adjust the clipper is as follows: (1) connect mike to input jack, (2) connect an oscilloscope or an a.c. v.t.v.m. to the output terminals to read output voltage, (3) close switch S_1-S_2 and S_3, (4) set R_8 for maximum output, (5) set R_1 so that the faintest whistle into the mike gives output voltage of approximately 1 volt. Note that a loud whistle then produces the same output voltage. R_1 now needs no further adjustment, (6) connect the output terminals to the input of the main amplifier in the transmitter, and, with the main amplifier gain control set to its normal position for 100% modulation of the transmitter, set R_8 for 100% modulation without overload distortion."

Thirty

We are now beginning our 8th year piloting HAM CLINIC through the pages of *CQ*. We are indeed happy that we have been able to help so many hams the world over. At times the going has been rough. Ever try to write for 7 years without repeating yourself?

We enjoyed our visit to the U.S. so much and enjoyed working so many of you on all the h.f. bands. At this point we would like to express our appreciation to Ted Henry of Henry Radio in Los Angeles for helping us out equipment-wise. His whole staff, especially his technicians were indeed helpful to us. Ted proved to us that he really does give *personal* service. We also want to thank W6VZS and WB6HTG who also helped us among others.

Being a ham anywhere is truly great! We now hope our Department of State will "get cracking" and implement the reciprocal law PL 88-313—they seem to be the only ones holding it up—other countries are waiting. 72, 73 and 75 Chuck & Elfriede.

Antennas [*from page 55*]

V-shaped radiator with three similar reflectors functioning like a corner reflector. Gamma match is used. Its appearance is like that of a TV antenna, so it is not apt to arouse the suspicions of neighbors!

Skylane Products, 406 Bon Air Ave., Temple Terrace, Florida: Features two and three element Quads which are precut and pre-tuned with rugged all-weather aluminum construction. Supplied with imported bamboo (waterproofing recommended) or with fiberglass spreaders. Boom is seamless tubing 1¼" dia., .046" wall. Slide-fit hardwood dowel extends inside entire length of boom for added strength. End spiders are 24" diameter high-strength aluminum alloy and are webbed and drilled. Mast casting is 24" long webbed aluminum alloy and is fastened to boom with U-bolts and saddles. Quad wires are #14 soft-drawn enameled wire. Reflector coils for each band are #14 enameled wire wound on non-hygroscopic tubing. Type 83-1R coax connector is mounted on plexiglass plate with lugs for easy soldering.

Telrex Laboratories, Asbury Park, N. J. 07712: Features arrays of "educated aluminum." They are engineered for optimum performance and are constructed using aluminum dural, micarta insulation, stainless steel hardware and heavy-duty cadmium-plated steel gusset-plate mount. Booms are 2" diameter. Except as noted, beams are hairpin-resonated and matched while baluns are supplied with *all* antennas for obtaining best balance, symmetry and efficiency. Most of the arrays are single band full-size, except a few multi-band models which employ traps using high-voltage high-*Q* ceramic capacitors and which are permanently weathersealed with seven coats of 3-M epoxy. Single and multi-band trap inverted-V antenna kits also are available. The 6-meter Spiral Ray is circularly polarized for optimum performance with any type propagation. Based on the premise that a beam optimized for a single band performs better than a multi-band one, the Telrex Tri-Band "Xmas Tree" is made up of separate beams each stacked above one another. Two beams for a single band are often stacked for additional gain. Bandwidth s.w.r. curves and beamwidth patterns are furnished with all beams. Mounting accessories, stacking harnesses for v.h.f. beams, broadband baluns, heavy-duty masting and rotators are available.

Unadilla Radiation Products, Unadilla, N.Y.: Features a two-element tri-band low-cost Quad which is pretuned using #14-gauge 7-strand copper wire and pre-cut air-wound high-*Q* coils in the reflectors. Spreaders are eight selected heavy-walled Korean-bamboo poles at least 1" diameter at the butt. End spiders are high-strength webbed aluminum to accommodate an eight-foot boom made of 2" diameter seamless tempered-aluminum tubing. Spreaders are fastened to the spiders by stainless steel-strap compression clamps, thereby eliminating holes which might otherwise weaken the spiders. Mounting plate for the boom is heavy dural plate drilled to accommodate boom-mounting clamps, U-bolts and saddles.

At one-quarter wavelength height, the angle of maximum radiation for the main lobe of the Quad is specified as 40 degrees compared to 90 degrees for a dipole, with the angle dropping to 16 degrees at ⅜ wavelength height.

Waters Manufacturing, Inc., Wayland, Mass.: The Waters Auto-Match is a fold-over type mobile antenna employing "top-center" loading for maximum radiating efficiency. Resonance is obtained with an adjustable radiator tip which is made of tapered drawn 17-7 PH stainless steel. The coils are interchangeable, so only a coil change is needed when bands are switched. They are molded in low-loss Epoxy and are completely sealed against moisture and water seepage. The high-Q coils also will handle 500 watts and at resonance present an "Auto-Match" of 50 ohms for coax feedline. The lower part of the foldover mast is made of 6061 ST6 aircraft aluminum tubing with stainless-steel mounting stud welded in standard base-mount thread.

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

AUTOSTART. This is amateur radioteletype in one of its most interesting and practical forms. Besides being very fascinating from a technical stand-point, autostart on v.h.f. can be a very useful tool to those who operate other modes on the h.f. bands. For example, there are many DX-hunter groups, both c.w. and s.s.b., who use it as a means of advising each other of a "hot-one" coming through, say on 20-meters. Phone nets on v.h.f. for this purpose are not new, but autostart makes it unnecessary for the operator to be sitting right at the microphone or machine. Date, time, frequency, band conditions, etc., are all printed out, ready to be read upon the convenience of the operator. Traffic handlers, too, find autostart RTTY a very convenient means of passing traffic across town, from one net to another.

Autostart, Part I

To explain further, autostart is the automatic starting and stopping of other teleprinter machines at the other end of a radio circuit by the station transmitting. It is used for the most part in metropolitan and suburban areas where there is a large active ham population. We would like to emphasize that this can be a completely unattended receiving operation. Monitoring of the channel can be continuous, or monitoring can be programmed for only certain times. The teleprinter machine motor is turned on and off by the received RTTY signal.

In its most simple form this system uses a commercial sign or light control which turns on the receiver and terminal unit (TU) at a preset time, say 6 p.m., and turns them off at another preset time, say 11 p.m. Remember, the machine motor only goes on if and when an RTTY signal appears.

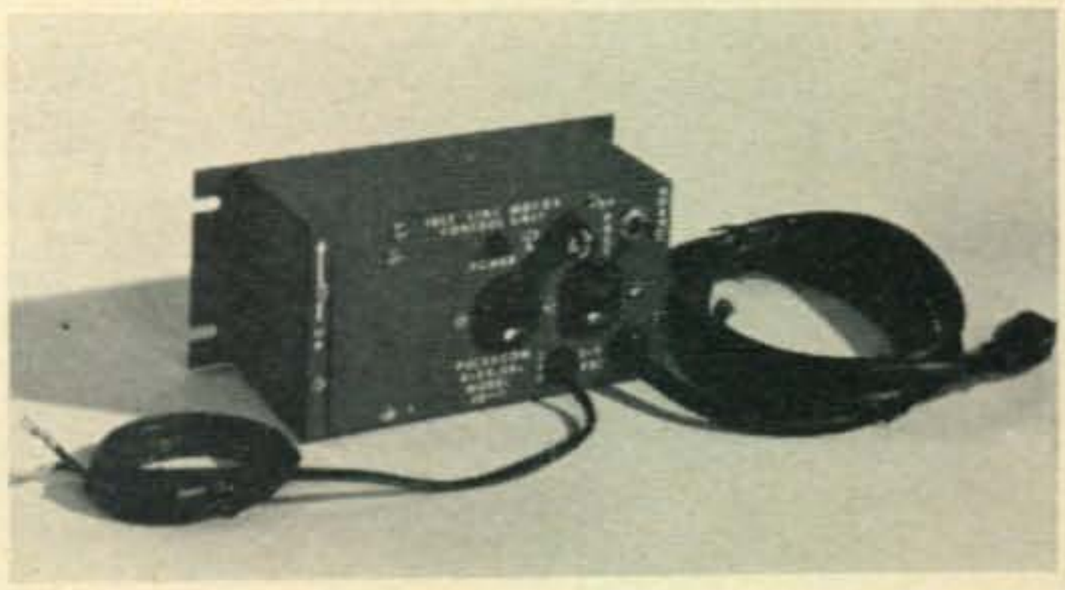
In its most sophisticated form, autostart consists of a more complicated clock arrangement with time delay and control relays. This arrangement turns on the radio receiver and TU at preselected hours. (Standard practice today leaves the receiver on continuously but unconnected to obtain long tube life.) If no signal is heard during a monitor period of about 1½ minutes, receiver and TU disconnect until the next clock time. If an RTTY signal *is* heard, the motor of the teleprinter machine is started, and stopped, by the stations transmitting on the channel. The receiver and TU disconnect only after 1½ minutes pass after the last RTTY transmission on the channel.

The autostart system is controlled by the reception of the standard 2125 cycle *mark* tone. Other tones, random noise, phone signals, etc., must not be allowed to start the motor of the machine. Therefore, the system is designed so that a steady *mark* tone of about 5 seconds is required to start the motor of the machine. An absence of *mark*, or a steady *space* signal, of about 1 to 2 seconds should shut down the motor.

Components

Fig. 1 is the Block Diagram of the system. The receiver and TU are obvious. The block labeled AUTOSTART is the heart of the system. This is the device that turns on the machine motor by sensing the *mark* signal. It usually is associated directly with the TU *mark* channel, but need not be. (Another method is to build a completely independent unit, working directly from the receiver audio.) A simple autostart unit, such as for the Twin City TU, consists of a high-mu triode, a plate relay, and a few capacitors and resistors.

The clock unit, at first glance, appears to be complex. Basically, it consists of two electric clock motors, one revolving at 1 revolution-per-day and the other at 1 revolution-per-hour. The 1 r.p.d. clock drives a 24-position tap switch which selects the particular hour, through a toggle switch for each hour, while the 1 r.p.h. clock operates a micro-switch at the desired



Commercial autostart is available in the *Pulsecom* (Alexandria, Va.) Idle Line Motor Control Unit Model 201-1. For use on wire line circuits, this unit will automatically stop the motor of any teleprinter when connected to sense excessive idle periods or open circuit conditions. Receipt of the next signal transition instantly restarts the motor.

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

minute. The clock unit supplies the pulse (contact closure) at the desired times which locks up the start relay in the Relay Control Unit.

The Relay Control Unit, the epitome of simplicity, consists merely of two a.c. relays and a thermal time delay relay, which determines the monitor period. Construction details on all these units may be found in Chapter 3.4 in the *New RTTY Handbook*. ($3.95, postpaid, direct from *CQ*.)

Part II of this necessarily brief rundown on autostart will appear in next month's RTTY Column. We hope to then describe a compact transistorized autostart unit which can be connected directly to the receiver audio.

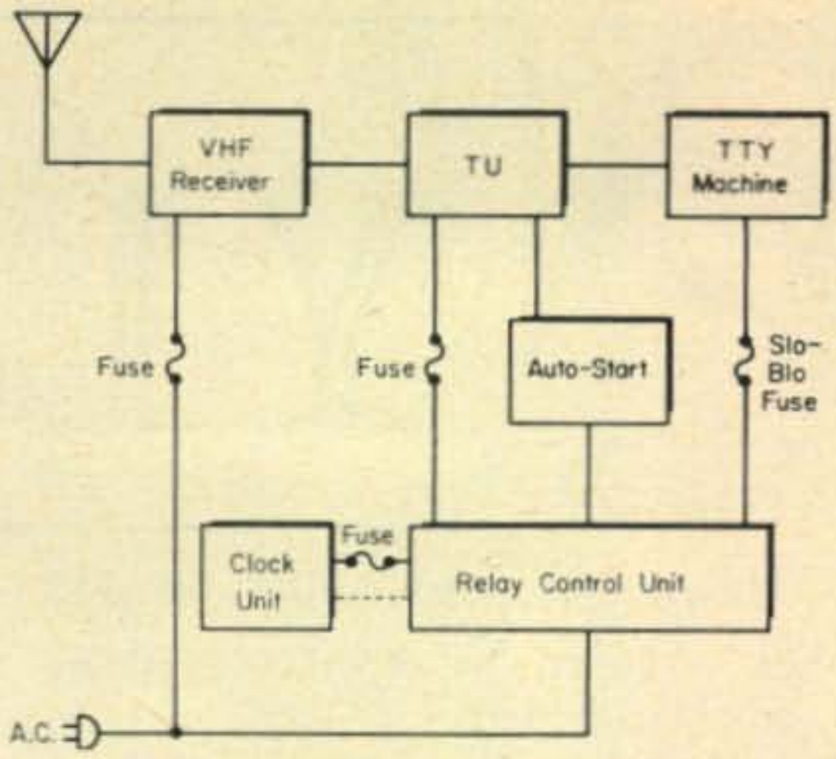


Fig. 1—Autostart Block Diagram

2-Meter Gear for Autostart

When autostart began, shortly after the end of WW II, RTTYers used military surplus such as the SCR-522, ARC-3, ARC-4, and ARC-5 sets. These were a.m. sets with 832's in the final which gave about 10 watts output. The receivers were not too sensitive; several fellows disconnected the military front-end and fed in a homebrew converter, resulting in considerable improvement. The significant fact, which made autostart really work, was that the *receivers* of these sets were crystal controlled. This made possible a new technique in amateur v.h.f. operation. No more tuning around, looking for a QSO. Everyone was on channel. Also, since these fixed-frequency receivers had "squelch" circuits which kept speakers quiet until a signal showed up, a new and painless technique of monitoring was born.

About 3 or 4 years ago another era in autostart began. This era began when commercial surplus, inexpensive ex-taxi and police car sets became available.[1] These are *f.m.* sets, and they represent a very high degree of the state-of-the-art of v.h.f. communications. Receiver sensitivities are in the order of 0.6 to 0.8 microvolt, and transmitter power *output* is usually 30 watts. The result? Greatly increased range and reliability for our autostart operation.

Most of the f.m. sets available in quantity to hams through a planned distribution program are those made by Motorola. These are available mainly from FM Surplus Sales, 1100 Tremont Street, Boston, Massachusetts; and, Northwest Electronics, Box 7, Chesterton, Indiana. Sets made by GE, RCA, and Link are available to a much lesser extent. They might be found in small quantities at some surplus dealers. As the result, many areas have "standardized" upon the Motorola sets. The big advantage is that, since more of these sets are in operation than any of the others, there is much more technical information available from local hams using them.

On the Bauds

K1FKO uses narrow shift on 80-meters. W1LWV of Millinocket, Maine, has a Model 15 for sale for $60. K1LVV of Danvers, Mass., uses tape on 80. W2IDX of Westbury, L.I., is on 20. W2RPL of Gloversville, N.Y., works 80. W2PEE of Old Brookville, L.I., has Motorola -140D f.m. gear on 146.70 a.f.s.k. and 146.94 phone. WA2AUQ of Garden City, L.I., has a Model 15 with a W2JAV transistor TU for sale for $100. W2JHY of Red Bank, N.J., is on 80.

W3FQR was /3 near Frederick, Md., and on 80, operated by W3JGK. W3LDQ of Elkins Park, Pa., is also on 80, with K3SOG /3 in Altoona, Pa., W3ILZ of Philadelphia, Pa., K3KYT of Everett, Pa., K3EMU of Emmitsburg, Md., K3LLI of North Wales, Pa., K3GWX of Gibsonia, Pa., and K3YAH. K3SNQ of Lansdale, Pa., uses a 32S-1 and a 75S-1 with a "gutless" TU consisting of just two tuned circuits ahead of a TT-63A regenerative repeater. K4ACZ of Roanoke, Va., uses a Viking II on 80 but is building another rig for RTTY and s.s.b. K6JFP of San Diego, Calif., uses Model 14 equipment with his kilowatt. He also uses a.f.s.k. on 2-meters.

K8TID of Chagrin Falls, Ohio, is looking for automatic carriage return and line feed for his Model 15. W8DLT of Detroit, Mich., is on 80-meters. W8SDZ of Toledo, Ohio, and K8DKC of Ann Arbor, Mich., run some real fast QSO's on 80 with tape gear. K9LBA of Indianapolis, Ind., works narrow shift on 40. W9EWC of Hilbert, Wis., runs tape on 80. W9ZGC of South Bend, Ind., and W9ECC of West Bend, Wis., are also on 80.

WØYTL of St. Paul, Minn., uses a pair of 4-125's, a 3-element beam, a 75A-3, a "beat-up" Model 15, and a CV-89 TU on 20, and on 80 with narrow shift. WAØHHV is also on 80-meters.

G2FUD reports the availability from G3LSD of 60 Creed Model 7B machines (November). VE3CM of Toronto, Ont., joins the narrow shift net on 40 Sunday mornings. I1GMF reports Italians can now transmit RTTY in all bands. KP4AXM worked I1AHN on 20. DJØDD is on 20. YV5AVW can use narrow (170 cycles) shift. VE3ABX of Kingston, Ont., is on 80-meters.

[*Continued on page 96*]

[1]Kretzman, B. H., "A New VHF Operation: FM", *CQ*, Aug., 63, p. 74.

YL

LOUISA B. SANDO,* W5RZJ

BACK in April '61 K5BJU, Harriett, was written up here for public service work in assisting in making arrangements for several heart patients from Peru to receive treatment at Houston; and while they were hospitalized housing their families and keeping skeds with relatives back home. Now another Houston YL, K5PFF, Audrey Beyer, has received fine publicity in the Houston *Post* for similar public service work.

Houston's large medical center, with world-renowned heart specialists Drs. DeBakey and Cooley, draws a number of heart patients each week from all over the world, but most of the ham communications are with South American countries. Audrey says it has become well known that the hams of Houston will help patients keep in touch with loved ones. They arrive complete with the hams' phone numbers and even addresses. It may be her's or Harriett's, K5BJU, or Phyllis, W5CXM, or Gabe, K5GHL—they all help, plus many more hams in the city.

Busy with five jr. ops—Alvin Jr., 16; Charles, 15; Diana, 13; David, 10; Veronica, 2—Audrey has had to limit her hamming to service work, checking into the Intercontinental Net every morning between 6 and 8 to pick up traffic. Every week for 2½ years she has kept skeds for a student at the Univ. of Houston to talk to his parents in Bolivia. Houston being a seaport also brings many MM hams to town and more phone patches. During the Alaska earthquake Audrey worked round the clock handling traffic.

OM Al is W5ULZ, and they enjoy talking via radio with Alvin Jr. who attends school in Canada. Licensed as a ham in 1958, Audrey received radio training much earlier, having attended radio school in Minnesota in 1942. In '43 she joined the WAC (Air) and served with the AACS in the States and in Europe. A charter

[*Continued on page 94*]

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

16th Annual YL-OM Contest

Time: Phone—Sat. Feb. 20, 1965, 1300 EST (1800 GMT) Sun. Feb. 21, 1965, 2400 EST
CW—Sat. Mar. 6, 1965, 1300 EST (1800 GMT) Sun. Mar. 7, 1965, 2400 EST

Eligibility: All licensed OM, YL and XYL operators throughout the world are invited to participate.

Operation: All bands may be used. Cross band operation is not permitted.

Procedure: OMs call "CQ YL." YLs call "CQ OM."

Exchange: QSO number, RS or RST report, ARRL section or country. Entries in log should show band worked at the time of contact, time, date, transmitter and power. (ARRL Section list for SASE to V.P.)

Scoring: (a) Phone and CW contacts will be scored as separate contests; submit separate logs.
(b) One point is earned for each station worked, YL to OM or OM to YL. A station may be contacted no more than once in each contest for credit.
(c) Multiply the number of QSOs by the number of different ARRL Sections and Countries worked.
(d) Contestants running 150 watts input or less at all times may multiply the results of (c) by 1.25 (low power multiplier).
(e) SSB contestants running 300 watts P.E.P. or less at all times may multiply the results of (c) by 1.25 (low power multiplier).

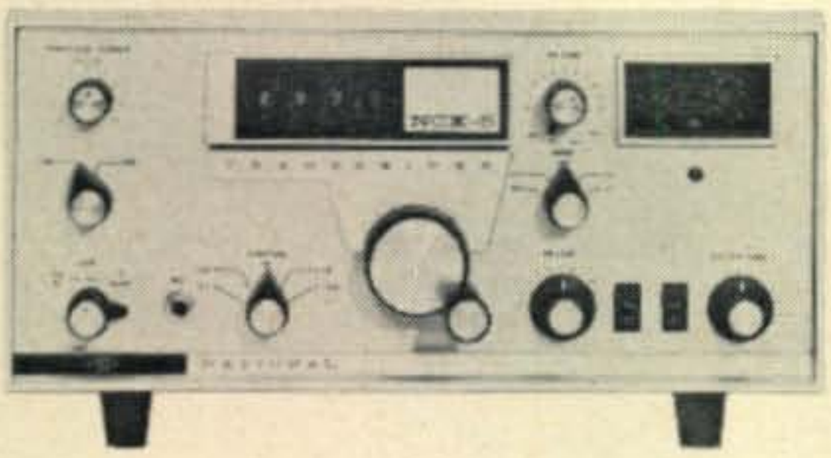
Awards: 1st place phone: YL—Cup OM—Cup
1st place CW: YL—Cup OM—Cup
The winner of the phone cup is also eligible for the CW cup. Certificates will be awarded to high place CW and phone winners in each ARRL District and Country.

Vhf Section: Scoring—Number of contacts times low power multiplier. There is no multiplication by ARRL Sections and Countries. Use of both low and high power for any portion of the contest will not allow your use of the lower power multiplier. Awards—1st place phone and CW on VHF both YL and OM will receive special awards.

Logs: Copies of all phone and CW logs, showing claimed scores and signed by the operator must be postmarked no later than Mar. 31, 1965, and received no later than Apr. 15, 1965, or they will be disqualified. Please file separate logs for each section of the contest. NO LOGS WILL BE RETURNED. BE SURE IT IS A LEGIBLE COPY OF YOUR LOG. Send copies of logs to YLRL Vice President Kayla Bloom, WØHJL, 175 South Jasmine St., Denver, Colo. 80222.

Members of the MINOW Net who attended the Walla Walla, Wash. Hamfest in Sept. '64. L. to r., standing: K7's MRX, VHN, RBC, RBE, RAM. Seated: W7IXR, W7FDE, K7PVG, K7MFS, W7WMS. Also attending, but not in photo, was the MINOW's youngest member, KA7VSG, Vicki, who is a high school freshman.

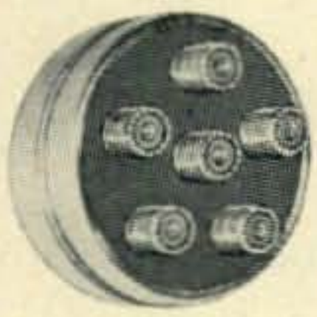
THE BEST HAM BUYS ARE AT HARVEY



NEW NCX-5 ALL-BAND TRANSCEIVER FROM NATIONAL

The new NCX-5 transceiver represents the finest money can buy at half the cost of closest comparable equipment. Designed as a **total** amateur station for the 80, 40, 20, 15 and 10 meter bands without compromise for either mobile or fixed station operation. Incorporates a linear solid state VFO with essentially no warmup drift. Dial calibration by means of a digital counter read-out accurate to one kilocycle on each band with additional calibration to 100 cycles. Transmit and receive selectivity by means of National's new 8-pole crystal lattice filter. Selectable upper or lower sideband included with new Transceiver Vernier control providing up to ± 5 Kc. separation of receiver frequency from the transmitter. 200 watt input on SSB or CW, 100 watts AM. Mobile mount included. One-year warranty. Dimensions: 6 5/16" x 13 5/8" x 11 5/8". Shipping weight: 26 lbs.

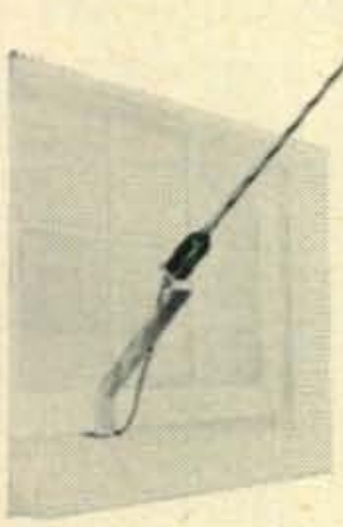
NATIONAL NCX-5 ALL-BAND TRANSCEIVER **$585.00**



NEW B & W 590 COAXIAL SWITCH

Simple solution to complex switching problems. By the twist of a knob test instruments, antennas, transmitters, receivers, etc., may be switched in and out of a circuit. Single pole, 5 position switch. UHF-type connectors. 1 KW amplitude modulated. 52-75 ohms, non-reactive loads. Frequency range from audio to 50 Mc. Cross talk & 45 db between adjacent outlets (at 30 Mc) and 60 db between alternate outlets (at 30 Mc). Panel mounted through single 3/8" hole. 4" overall diameter, 2 1/4" depth behind panel, shaft 1" long, 1/4" diameter with flat. Net weight 14 ozs. Shipping weight 2 lbs.

B & W 590 COAXIAL SWITCH **$8.25**



VERSATILE B & W "VACATIONER" PORTABLE ANTENNA

Designed as a highly efficient transmitting and receiving antenna for the travelling amateur. Can be installed and disassembled in minutes. Ideal for operation at motels, hotels and apartment houses as well as aboard boats. Power rating — SSB, 300 watts input PEP; CW, 180 watts input; AM Phone, 180 watts input. Frequency — 20, 15, 10, 6 and 2 meter amateur bands. Maximum extension, 57 inches; minimum, 18½ inches. Weight, 2 lbs. complete with coils and counterpoise.

"VACATIONER" PORTABLE ANTENNA, COMPLETE **$19.95**

Send check or money order including shipping charges. We return any excess.

It takes a ham to talk to a ham. Make it your business to get equipped at Harvey . . . midtown New York's ham center. Harvey serves the world right here at the crossroads of the world. In addition you receive many exclusive extras at Harvey's. This includes opening sealed cartons for complete equipment check-out at your request – at no extra charge. The man from Harvey also guarantees everything you get – including his advice. And with liberal trade-in allowances you can be sure you are getting the best values for your ham dollar. So come to Harvey where the finest ham equipment and the best service go hand in hand. It pays to check us first.

HARVEY RADIO CO., INC. OUR 38TH YEAR

103 WEST 43rd STREET / NEW YORK, N.Y. 10036 / (212) JUdson 2-1500

For further information, check number 39, on page 110

USA-CA [*from page 77*]

card could be used for the State Capitals Award, Worked All State Capitals Award and Colonial America Award. Although using low power he did receive a report of 599, so he had one for the 599 All Continent Award and one towards three of the five awards issued by the QRP ARC as well as the regular WAS and WAC Awards. He started to dream that when the QSL arrived perhaps it would mention that the operator was a member of CHC or FOC or TOPS and perhaps the QSO had been with an XYL and the card

The East Coast VHF Society, another live wire club with 50 members and club station (WA2WEB) offers this Award of Achievement. Send log data showing QSO's with ten or more members on 50 mc or higher to P.O. Box 1263, Paterson, N.J. Contacts made during regular Friday night net sessions at 10 do not count.

could be used towards the many YL Awards and if she was not young and had been born in England it could be used towards the Old Timer and Old Timers Club Awards as well as the Ex-G Award. Suddenly he realized it was all too good to be true—perhaps it was a dream. That one card *might* be used towards 15 or 20 awards!" Well it was, and you may think this is the end, well it is!

Hope you all had a wonderful Christmas and that you will enjoy *CQ* and your hobby all through the New Year. CU next month.

73, Ed, W2GT

This State Capitals Award is presented by the Newark News Radio Club (The Pioneer of Radio and DX Clubs) in three classes. Class C for working 30 State Capital Cities, Class B for working 40 and Class A for working all 50 State Capital Cities. All contracts after January 1, 1960. Send certified list and $1 or 10 IRCs to S. J. Knox, WN2MRA, 212 North Jerome Ave., Margate City, N.J. 08402. There is no charge for higher endorsement seats, but send s.a.s.e. with certified list. This award is also available to SWLs.

Contest Calendar [*from page 71*]

your total QSO points by the total multiplier from each band.

A complete outline of the rules and other pertinent information should appear in the January issue of *QST*. Your request for official log forms should go to the ARRL Communications Dept., 225 Main St., Newington, Conn. 06111.

YL/OM Party

Phone–Feb. 20-22 **C.W.**–Mar. 6-8
Starts: 1800 GMT Saturday. Ends: 0500 GMT Monday in each instance.

This is the 16th annual YL/OM contest. It's open to all licensed OM, YL and XYL operators throughout the world. Phone and c.w. are separate contests, therefore submit a separate log for each one.

Louisa Sando, W5RZJ will have all the details in her YL Column (on page 72) this issue).

Editors Note

The CHC Chapter of New Mexico has decided not to run their usual party in January this year.

The Canal Zone Radio Assoc. reports that their 50th Anniversary Amateur Radio Week activity, which took place August 8th—16th, was a huge success.

Club members made over 7000 contacts with 48 states and 63 countries and that 711 certificates have been mailed out to qualifying stations.

If you made five contacts with KZ5 stations during the above period, send your 5 QSL cards to the CZRA, Box 917, Howard A F B, Canal Zone, for a special commemorative certificate.

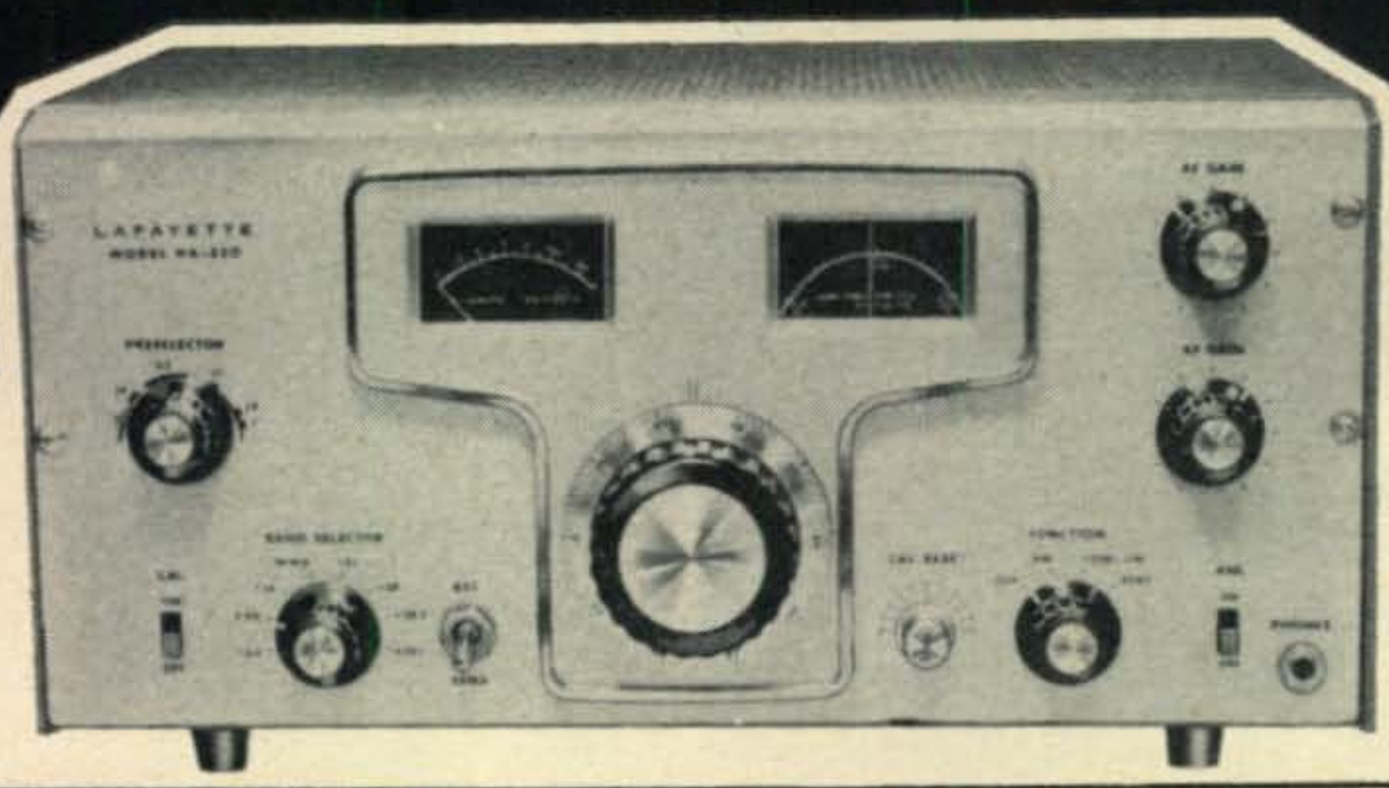
Early reports and my observation during the Phone contest indicate that conditions were good and that George Jacobs has again come up with another good one. The most productive bands were 15 and 20, altho they folded up early. 40 and 80 produced their usual quota of DX, if you had the equipment and know how, that is. A few of the more interesting claimed scores have been listed to give you an idea of what to expect this year.

Predictions for the c.w. week-end don't look too encouraging at this writing. (two weeks before the contest) They could start good and fade down to below normal before the end. However if George is a day late in his prediction we could come up with another good one. Here's hoping, let's see what happens.

Stewart Perry, W1BB again announces the yearly 160 meter tests. They will take place between 0500-0730 GMT on January 3rd and 17th, February 7th and 21st. W/VE stations will call CQ DX TEST on the even five minute periods beginning on the hour and listen for DX stations who will be calling on the odd five minute periods. Adhere to this schedule except when contact has been established. Your reports should be addressed to Stew at 36 Pleasant Street, Winthrop, Mass.

73 for now, Frank, W1WY

NEW! LAFAYETTE



10-80 METER DUAL CONVERSION AMATEUR RECEIVER

MODEL HA-350

99-2524WX

189.50

Uses Mechanical Filter For Exceptional Selectivity— Offers 2KC Bandwidth!

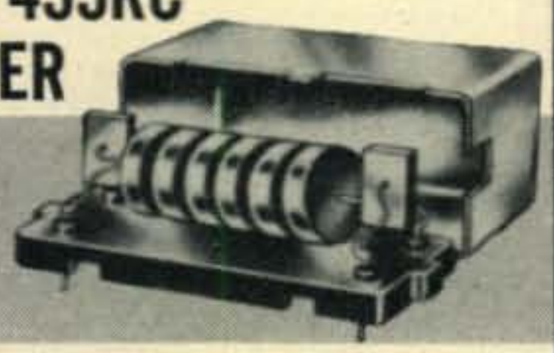
Lafayette's newest! A dual conversion superheterodyne communications receiver covering the 10 through 80 meter amateur bands and offering a high order of electrical and mechanical stability for superior AM, CW and SSB operation. Check some of the exceptional features!

- Sensitivity 1 μv or Better
- 7 Band-Switching Positions—3.5, 7, 14, 21, 28, 28.5 and 29.1 MC, plus WWV on 15 MC
- Tuning Dial Covers 600 KC for Each Band
- 12 Tubes
- Crystal-controlled 1st Oscillator
- Transmitter-type VFO for 2nd Oscillator
- Preselector Tuning
- Crystal-controlled BFO (Dual frequencies)
- All Heterodyning crystals supplied
- Selectable upper and lower Sidebands
- Geared Tuning Mechanism
- 100 KC Calibrator Circuit (crystal optional extra)
- Separate Diode AM Detector and CW/SSB product Detector
- Coax Antenna Input
- 8 and 500 ohm outputs
- Imported

NEW! AUTHENTIC 455KC MECHANICAL FILTER

19.95

99-0123



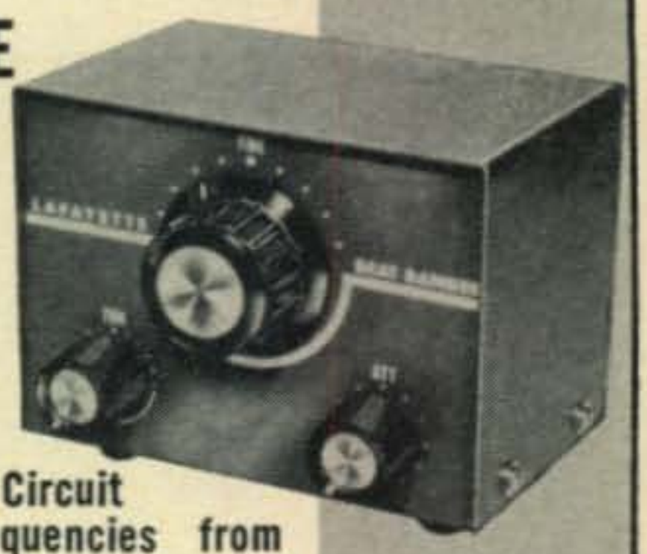
- For Tube receivers with 455KC IF
- 2 KC Bandwidth
- Ideal For CB & Amateur receivers . . . A "must" for CW or SSB reception
- Adds Super-Selectivity To Your Receiver

Upgrade your receiver with this authentic 455KC mechanical filter. Easily installed between mixer and 1st IF to provide ultra-sharp selectivity. Precision made, rugged filter and two miniature coupling transformers on printed circuit board that measures only 2¾Wx ⅝Hx1⅜"D. Send for complete descriptive literature. Imported.

NEW! LAFAYETTE "BEAT-BANDER" EXTERNAL BFO

99-2502

11.95



- Stable, Transistorized Circuit
- Provides "beat" frequencies from 3.5-32MC
- Connects to Receiver's Antenna Input
- Ideal for receivers without BFO, or those using a combined Q-Multiplier/BFO
- Complete with coax cable and 9-volt battery • Imported

FREE! *Lafayette 516—Pg. 1965 Catalog No. 650. Write: Lafayette Radio Electronics Corp., Dept.CA-5, P.O. Box 10, Syosset, L. I., N. Y. 11791*

For further information, check number 38, on page 110

Novice [*from page 83*]

two meters and he would also like help in setting up a two meter am net in the general area of Kansas City, Missouri. Maybe we here in Ohio could work into that area more often if you fellows would get on the air more often.

John Doss, 4036 Patte Ann Drive, Memphis, Tenn., 38116, phone 397-1061 would like help with code and theory.

Henry A. Strimple, 319 East St. John, Topeka, Kansas needs help in getting started and some one to give the test. He has a receiver. Please help this fellow get going.

That is just about the column for this month, but as I said last month, Merry Christmas and a Happy New Year. I have the chance to say this for two or three months because of the distribution system for the magazine. I know we are read in 42 countries, I have envelopes from that many. Merry Christmas and much DX in 65. 73. Walt.

YL [*from page 90*]

member of GAYLARK, she has been both president and VP of the club.

German-English Dictionary

Would you like to learn enough of the German language to be able to use it in your DX contacts? Our good friend Chris, OE9CZI, has just published a new book, "*Radioman's Dictionary*," with the words and terms in German and

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Act of October 23, 1962; S. 4369, Title 39, United States Code) (1) Date of filing—October 1, 1964. (2) Title of Publication: **CQ THE RADIO AMATEUR'S JOURNAL.** (3) Frequency of issue—Monthly. (4) Location of known office of publication: 14 Vanderventer Avenue, Port Washington, County of Nassau, New York 11050. (5) Location of the headquarters of general business offices of the publishers:—14 Vanderventer Avenue, Port Washington, County of Nassau, New York 11050. (6) Names and Addresses of Publisher, Editor and Business Manager: Publisher—Sanford R. Cowan, 6 Embassy Court, Great Neck, New York; Editor—Richard A. Ross, 45-12 217 Street, Bayside, New York; Business Manager—Richard A. Cowan, 6 Embassy Court, Great Neck, New York. (7) Owner (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given)—Sanford R. Cowan, 6 Embassy Court, Great Neck, L.I., N.Y. (8) Known bondholders, mortgages and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities (if there are none, so state) —NONE. (9) Paragraphs 7 and 8 include, in cases where the stockholder or security holder appears on the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear on the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner. Names and addresses of individuals who are stockholders of a corporation which itself is a stockholder of bonds, mortgages or other securities of the publishing corporation have been included in paragraphs 7 and 8 when the interests of such individuals are equivalent to 1 percent or more of the total amount of the stock or securities of the publishing corporation. (10) this item must be completed for all publications except those which do not carry advertising other than the publisher's own and which are named in S132.231, 132.232 and 132.233, Postal Manual) S4355a, 4355b and 4356 of Title 39, United States Code). (A) (average no. of copies each issue during preceding 12 months) Total No. Copies printed (net press run) 75,338 (B) Paid Circulation—(1) to term subscribers by mail, carrier delivery or by other means 33,079 (2) sales through agents, news dealers, or otherwise 37,586. (C) Free Distribution (including samples) by mail, carrier delivery, or by other means 3,046. (D) Total No. of copies distributed (sum of lines) B1, B2 and C) 73,711. (A) (single issue nearest to filing date) Total No. Copies Printed (net press run) 76,575 (B) Paid Circulation—(1) to term subscribers by mail, carrier delivery or by other means 34,179 (2) sales through agents, news dealers, or otherwise 38,426 (C) Free Distribution (including samples) by mail, carrier delivery, or by other means 2,179 (D) Total No. of copies distributed (sum of lines B1, B2 and C) 74,784. I certify that the statements made by me above are correct and complete. (signed) Richard A. Cowan, Business Manager.

English. It includes some 4,000 words and abbreviations for daily use by hams, electronics technicians, and anyone else interested in radio-electronics. The book contains 70 pages, size 8¼ × 11¾, and may be ordered direct from OE9CZI for $1. His QTH: Christian Zangerl, Dornbirn I, Nachbauerstr. 28 Vbg., Austria. Good luck with your book, Chris; may it be very successful!

Here and There

Our sympathy to Peggy Detsch, W6PCN, whose OM Jack, W6GCV, became a Silent Key in September, following a sudden heart attack. Peggy earned her degree from S.F. State and has been doing social service work for over a year. Two jr. ops, Drew, a freshman in high school, and Dorothy, in 7th grade, will help keep her occupied.

Officers for the Portland Roses, are: Pres., K7VFC, Cecil; secy, K7PEE, Edith; P/C, W7NJS, Beth; V.P. & treas., W7NOK, Pat.

Pioneer YLs

Chap. Eight in our book *"CQ YL"* and the YL column in *CQ* for Dec. 1960 were devoted to accounts of the earliest YL participation in ham radio. Now we have more to add to that already published.

W4ID, Col. Marcy, of Eau Gallie, Fla., writes: "In Vol. 1, issue No. 4 of *The Radiogram* published by The Mignon Wireless Corp. of Elmira, N.Y. in August, 1915, and before *QST*, I find on page 11 a picture of the radio station of Miss N. Warnecke, 2834 Harriett Ave., S. Minneapolis, Minn. Miss Warnecke is seated at her set and the caption states she is the only girl operator in Minnesota.

"In the same issue (only 4 issues were published) on page 14 is a picture of M. Eiffert, Elmira Heights, N.Y. at her set, both receiving and transmitting, and the old helix is quite in evidence. The caption states she uses a four inch spark and a homemade helix for transmitting. Her aerial consisted of four wires of 3-ft. spacing, 200 feet long, 40 ft. high at one end and 30 ft. high at the other."

Some time ago ex-9HO, Dr. Baird (now a Silent Key), sent the following, which he found

in *Modern Electrics* for August, 1913: "A little Honolulu girl has the honor of being the first girl to pass the federal wireless examinations, which qualifies her to take a position as an operator for the government. The girl's name is Mary Ann Nobriga, and she is only 14 years old. Her complete outfit for sending and receiving is as follows: One loose coupler, double slide tuner used as a loading coil, one variable condenser, 2000 ohms receiver, galena detector, one fixed condenser, 1½ inch spark coil, one brass spark gap, six dry batteries. Her aerial consists of four No. 14 copper wires, spaced two feet apart, 60 ft. long and 55 ft. high."

Several other YLs also claimed to be "first licensed" (under the 1912 Law), as written up in the Dec. '60 YL Column. No calls were given for any of the above-mentioned gals.

33, W5RZJ

RTTY [*from page 89*]

Comments

In several past RTTY Columns we have suggested that you ask your Division Director, "Why doesn't W1AW put out the official ARRL bulletins on RTTY?" We further suggested that you, as an RTTYer, acquaint your Director, Vice-Director, and SCM, with a simple explanation of how this would *tremendously* increase the effectiveness of the OBS system. Well, already the letters have started to come in; actually copies of letters to various Directors. Have you written *yours* yet?

Would you like to see a picture of your RTTY ham shack in *CQ?* Very simple; just send us a glossy print, any size.

73, Byron, W2JTP

LETTERS [*from page 12*]

biased, so it shorts (not permanently). A voltmeter will then show plus 300 volts on the h.v. line and a few volts negative on the l.v. line. The l.v. electrolytic will not be damaged unless there is a load on the h.v. line, because current through it is limited by the h.v. bleeder.

I found this out the hard way several years ago when I built a similar supply for a small 10-meter rig. It took a bit of head-scratching to figure out what was happening. One way out is to use a double-pole switch or delay and break both h.v. and l.v. outputs. Another way is to replace the 5U4 with more silicons and control the supply in the primary.

Craig Allen, WB6IAQ, ex-W9IHT
1985 Alameda Terrace
San Diego, California 92103

S.W.L.'s Are Appreciated

Editor, *CQ:*

As a loyal subscriber to *CQ* for the past two years, and one who spends from two to three hours daily and nightly s.w.l.'ing on 10-meters to 80-meters a.m. and s.s.b., I have come to the conclusion that: 1. You have not given very much thought to the possibilities of s.w.l. recognition; 2. Insufficient numbers of licensed General ticket holders have any respect for s.w.l.'ers; 3. Those General ticket holders who recognize the friendship and assistance we s.w.l.'ers can give them are in the minority, and wouldn't stand a chance of being heard if they attempted to speak in our favor.

Much to my pride, I have many written expressions of appreciation for my assistance via long-line to two and three letter ticket holders. I have never been, and never will be a "QSL Hound," and have never requested a QSL card. Those I have received (from all over the world) have been sent to me for favors done with no anticipated recognition anticipated. Many letters of appreciation—in lieu of cards—have been more eloquent than any QSL card could have been.

As in my particular case, there may be many other s.w.l.'ers who have good reasons why they probably won't become licensed operators. Sensing the relative importance of XYL's—YL's in your publication, cannot there be a recognition of s.w.l.'s in your publication?

Norman D. Roberts
2480 16th N.W. #417
Washington, D.C.

ANTENNAS [*from page 59*]

Model and Type	Band	No. El.	Gain (db)	Max. F/B	Beam W. (°)	Pwr. (Kw.)	Max. El. L.	Boom L.	Turn. Rad.	Wt. (lbs.)	Wind Load (lbs.)	Notes	Price
Skylane Products, 406 Bon Air Ave., Temple Terrace, Florida													
Quad, 3-Band	10,15,20	2	8	25	75	2P	17'6"	8'	9'10"	28		Height 17'6" Bamboo Spreaders.	59.95
Quad, 3-Band	10,15,20	2	8	25	75	2P	17'6"	8'	9'10"	28		Height 17'6" Fiberglass Spreaders.	99.95
Quad, 3-Band	10,15,20	3	10	30	60	2P	17'6"	12'	10'8"	40		Height 17'6" Bamboo Spreaders.	99.95
Quad, 3-Band	10,15,20	3	10	30	60	2P	17'6"	12'	10'8"	40		Height 17'6" Fiberglass Spreaders.	149.95
Unadilla Radiations Labs., Unadilla, N.Y.													
W2AU-Quad, 3-Band	10,15,20	2	8	30	60	2P	17'	8'	9'11"	30		Height 17'-Korean-Bamboo Spreaders A single or separate feedlines may be used.	44.95
Waters Manufacturing, Inc., Wayland, Mass													
Auto-Match, Mobile Antenna													
370-1 Fold-over Mount													12.95
370-2 Radiator Tip													9.95
370-10 Coil	10											Top-center loading 50-ohms Approximate Overall length-8ft.	11.95
370-11 Coil	11												12.75
370-15 Coil	15												13.45
370-20 Coil	20												14.95
370-40 Coil	40												15.95
370-75 Coil	75												

Legend

Unless otherwise noted, antennas are designed for use with 50-ohm transmission lines. Accessories such as stacking harnesses, special mounting components, baluns, etc. are not listed, but are available from most of the manufacturers. Abbreviations: B = Beta Match, F.S. = Full Size, G = Gamma Match, M.S. = Medium Spaced, O.S. = Optimum Spaced, P = P.E.P., W.S. = Wide Spaced. Beamwith is at ½ power points. Windload is rated at 100 m.p.h.

BRYAN EDWARDS, JR.

W5 KFT "The Kid from Texas"

RECOMMENDS

GALAXY III $349.95

80-40-20 METERS (Illustrated)

GALAXY V $469.95

80-20-15-10 METERS

IMPORTANT FEATURES OF THE GALAXY III AND GALAXY V . . .

- ✓ 300 Watts SSB/CW Input conservatively rated.
- ✓ "Hottest Receiver" because of advanced design.
- ✓ Best Filter Available: 2.1 kc bandwidth with exceptional 1.8: 1 shape factor. The only 6-crystal filter used in amateur equipment.
- ✓ Most Compact 300-Watt Transceivers: 6" high, 10¼" wide, 11¼" deep; weight —only 13 lbs.

ORDER TODAY!

★ LUBBOCK, TEXAS
THE HOME OF
THE KID FROM TEXAS
WHO GIVES TEXAS-SIZE TRADES
P.D.Q. DELIVERY
AND A
TIME PAYMENT
PLAN.

PERSONAL
INDIVIDUAL
SERVICE
GUARANTEED

WE WANT YOUR BUSINESS!

Edwards Electronics

TELEPHONE POrter 2-8759
1320 19TH ST. / LUBBOCK, TEXAS 79401

Edwards Electronics
1320 19th Street
Lubbock, Texas 79401

I'm interested!

- ☐ Enter order for equipment listed on attached sheet.
- ☐ Send Galaxy III and V literature.
- ☐ Send quotations for trade in allowances on equipment listed on attached sheet.

Name_____ Call_____
Address_____
City_____ State_____

For further information, check number 37, on page 110

Space [*from page 69*]

Space-Listening—1965

The USA expects to launch a large number of satellites during 1965, as does the Soviet Union. The number of signals that can be heard from satellites is expected to increase considerably during the new year. Space-listeners should be able to tune in to satellites exploring interplanetary space, orbiting solar and astronomical observatories, research satellites probing the secrets of the earth's atmosphere, and to men in space. Next month's column will contain a listing of satellites expected to be launched by the USA during 1965. 73, George, W3ASK

DX [*from page 67*]

5N2RSB	via K3MNJ.	9G1DN	via VE4IM.
5R8AD	via W8QNW.	9G1DT	via W4HUE.
5R8CJ	via W6BAF.	9G1DV	via W2CTN.
5U7AC	via W9RKP.	9G1DZ	via WØEQN.
5U7AH	via K9EAB.	9G1EF	via W4HUE.
5X5IG	via W2CTN.	9G1EO	via VE4OX.
5Z4ERR	via KØLFY.	9G1GN	via VE4OX.
5Z4IV	via W2CTN.	9K2AM	via W3KVQ.
5Z4RF	via W4MCM.	9K2AQ	via G3FJU.
606BW	via WA4FXE.	9L1GM	via W3BYX.
6W8BQ	via W9RKP.	9L1JC	via WA4CXR.
6Y5AH	via K4UFE.	9M2AF	via W8DPF.
6Y5MJ	via KØTYO.	9M2GV	via W7EMU.
7X2VX	via W4UWC.	9M4LV	via K8VDV.
9ALIJ	via I1AIJ.	9M4MB	via K7GCM.
9A1CWN	via I1CWN.	9N1MM	via W3KVQ.
9A1NU	via I1NU.	9Q5GE	via W8WBT.
9A1VU	via DL1VU.	9Q5PW	via HB9GX.
9G1BQ	via W2CTN.	9Q5RK	via LX1RK.
9G1CY	via K1EJO.	9Q5TJ	via DJ4OP.
9G1DE	via K8IQQ.	9U5AS	via ON4HK.

RTTY A-Z [*from page 27*]

sistor is to control the amount of attenuation and its value should be determined experimentally.

Next month we will take up a completely new RTTY subject, and that is the RTTY converter that follows the receiver. Finally we reach the subject of the mysterious black box! You can rest assured that we will not jump right into construction details. That part will not come for several more articles of this series. We will first cover some of the basic fundamentals, then touch on some of the earlier pioneering converters, tracing the developments and improvements made through the years.

[*To be continued*]

Rock Crusher [*from page 23*]

Construction

The circuit, shown in fig. 1, is liberally sprinkled with two ground symbols. One indicates the B minus line and the other indicates chassis ground. It is extremely important to observe these two symbols. For reasons of safety the B

[*Continued on page 102*]

THESE OM'S
HAVE RECENTLY
SWITCHED TO A

SHURE 444 MIC

WB2OQS	WA5FYJ
WB2OSS	WB6AIS
K3QHY	WB6GFJ
WA3AZP	K7ZGH
W4TZG	W7JBJ
WA4BAA	W8ATW
WA4CLR	WA8DEX
WA4EMY	WA9FHJ
WA4VJR	WA9HKB
WA5FVE	WA9KUA/Ø

. . . notice their improvement in intelligibility and added punch?

Shure Brothers, Inc.,
222 Hartrey Avenue, Evanston, Ill.

For further information, check number 50, on page 110

URGENT, NEED IMMEDIATELY

Very high prices paid. Freight prepaid. AN/GRC; PRC; APR; APN; ARC; ALT; URM; UPM; TS. We also buy all military and commercial test, radar, and communication equipment.

CALL COLLECT. IT COSTS YOU NOTHING TO HEAR OUR HIGH OFFER.

SPACE ELECTRONICS
4178 Park Ave., Bronx, N. Y. • (212) CY 9-0300

NEW! 6 METER TRANSMITTING CONVERTER 6 TRC

$289.50
F.O.B.
Oak Ridge, N.J.

- Built to commercial specs for continuous service
- Power input: 175 watts PEP on SSB and CW, 90 watts AM FM RTTY
- Self contained, heavy duty power supply
- Virtually TVI proof (all radiated spurious down 85 db as per EIA specifications RS-152-A)
- May be driven with any commercially built 14 mc exciter
- Uses ultra linear 8117 in final
- Exceptionally quiet blower incorporated
- No external swamping Pads required-exclusive 50 ohm load at input
- Choice of colors, two-tone grey or grey and white
- Illuminated plate current meter
- Efficient Pi network output
- Frequency select switch doubles range of 14mc exciter (second crystal optional at $3.95).
- Unconditional money-back guarantee!!! Send for complete information.

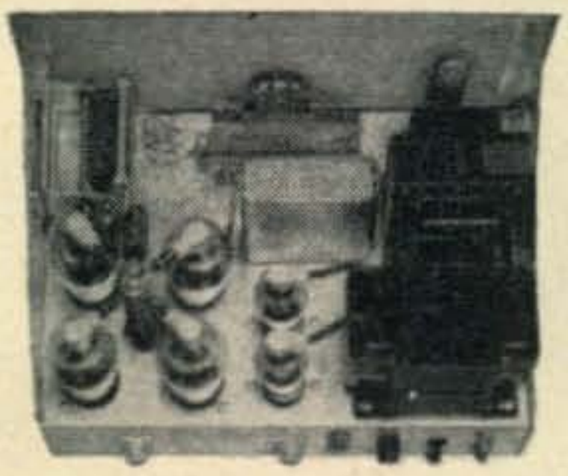
Commercial users: **MODELS AVAILABLE** FROM 40 to 160 MC. Submit your requirements for price and delivery quotation.

SSB

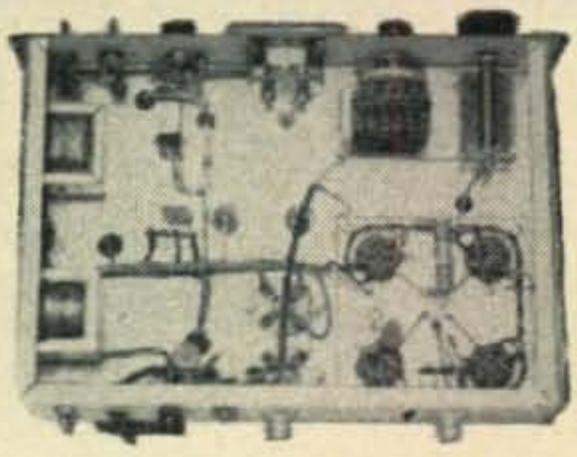
SIMON SIDE BAND CO.
HOLLAND MT. RD.
OAK RIDGE, NEW JERSEY 07438
Telephone (201) OXbow 7-4246

For further information, check number 51, on page 110

YOU CAN'T BEAT THIS KIT FOR VALUE!



P&H LA-400C LINEAR AMPLIFIER 800 WATTS PEP ONLY $179.95*



IT'S EASY TO ASSEMBLE AND WIRE — QUALITY THRU AND THRU

The P&H LA-400-C is not an ordinary kit, because a lot of the assembly has already been done for you. The plate transformer, filter choke, plate tuning capacitor etc. are mounted. Plate coil and band switch are assembled and mounted. Output loading capacitor network is assembled; in fact — about all you have to do is mount small parts, mount sockets and finish the wiring. As for performance — just ask anyone who uses an LA-400-C. Just compare his signal with the so-called "talking kilowatts" — it will be mighty hard to tell 3 DB difference. The difference in cost will pay for a good scope, plus a top notch receiver. One other point — Where else can you get a warranty such as P&H gives you on the LA-400-C ?

The 80 thru 10 meter band-switching pi network is designed for 800 watts PEP SSB, 400 watts CW, FM or FSK and 230 watts Linear AM (controlled carrier) or 185 watts (constant carrier) with 50-70 ohm output. Popular 100 watt SSB exciters require no swamping or matching networks to drive the low Z untuned input. Grounded grid circuit uses four 1625's or 837's on customers request. Meter reads RF drive, plate current, RF amps output. New modern compact 9" X 15" X 10½" gray cabinet also contains power supply using 816's. TVI suppressed, Parasitic Free.

LA-400-C Wired & Tested $219.95
Slightly higher West of Rockies.

ONE YEAR WARRANTY ON ALL PARTS AND TUBES !

P&H **ELECTRONICS INC.**
424 Columbia • Lafayette, Ind.

For further information, check number 52, on page 110

important message to manufacturers and dealers

Every Publication for Radio Amateurs EXCEPT CQ has just had a drastic advertising rate increase.

Now CQ is at least 25% lower on advertising rates than QST.

Compare:		CQ	QST
12 time rate	Full Page	$320.00	$422.40
	Half Page	175.00	228.80
	Fourth Page	100.00	128.00
	Eighth Page	56.00	64.00
	Sixteenth Page	28.00	32.00

And ONLY CQ offers these extra BONUSES:

- ☆ Cash Discount of 2% for prompt payment
- ☆ No extra charge for typesetting (QST charges $10 plus 10% extra)
- ☆ Advertising contracts earn rate from first insertion (QST bills you at the highest rate, and then issues rebate when earned. This means your dollars are resting in the QST bank account, rather than working for you.)

WHAT'S MORE—CQ is read by more active amateurs today than ANY other amateur publication. You pay less for CQ advertising and you get much more.

More and more advertisers are making the logical switch to CQ.

isn't it time you changed?

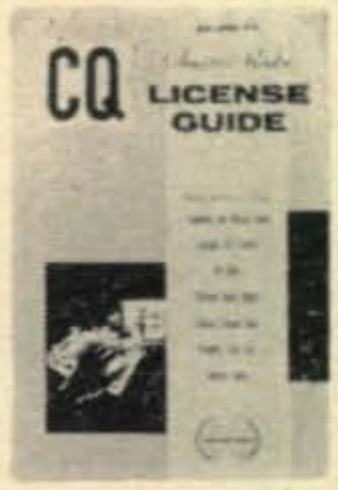
CQ TECHNICAL BOOKS

CQ ANTHOLOGY I

We've looked back through the years 1945-1952 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out and are unavailable.

CQ LICENSE GUIDE

212 pages of everything the Amateur must have to get his license and progress toward the general class ticket. Plus many additional pages of vital information for the ham operator.



ANTENNA ROUNDUP

A common denominator for all ham stations is the antenna. Here at last is the cream of antenna information packed into a 160 page book. Forty-seven information-packed articles that will dispel much of the mystery surrounding antennas.

THE NEW RTTY HANDBOOK

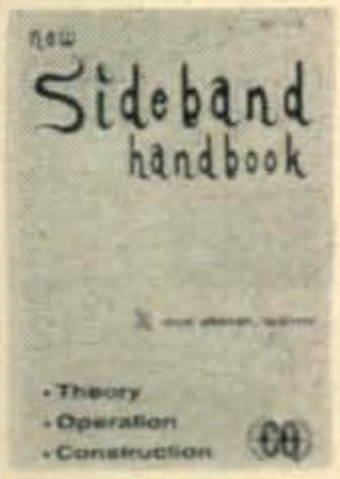
A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section in getting started, all written by Byron Kretzman, a well known authority in the field. First printing sold out. Second printing on hand.

CQ ANTHOLOGY II

Top favorite CQ articles from 1952 to 1959 . . . including some you may have missed . . . compiled into one new information-packed book! No more need to try to locate sold out back copies of CQ. This Anthology includes past articles of lasting interest to every amateur radio enthusiast. Over 250 pages of text. Over 75 different articles. A definite Must for your shack!

MOBILE HANDBOOK

This new Mobile Handbook by Bill Orr, W6SAI, has been getting raves from top experienced mobile operators. Written for advanced, as well as beginning mobile operators, much of this information cannot be found anywhere else. This is NOT a collection of reprints.



SIDEBAND HANDBOOK

Written by Don Stoner, W6TNS, who was almost one full year in the preparation of this terrific volume. This is **not a technical** book. It explains sideband, showing you how to get along with it . . . how to keep your rig working right . . . how to know when it isn't . . . and lots of how to build-it stuff gadgets, receiving adaptors, exciters, amplifiers.

VHF FOR THE RADIO AMATEUR

If you are, or are planning to be a VHF operator, you can't afford to be without this dynamic new handbook written especially for you. Filled from cover to cover with all new and original construction material presented so you can understand it. Written by Frank C. Jones, W6AJF, nationally acclaimed for his VHF pioneering.

SURPLUS SCHEMATICS

This is a book literally loaded with schematics for all the currently popular pieces of surplus gear. Most amateurs are well aware of the problems encountered in purchasing seemingly inexpensive surplus units, only to find that no schematic diagram is available. Trying to figure out the circuitry cold turkey can be many-times more difficult than the most involved puzzle, and purchasing a single instruction book can run as high as $3.50.

COWAN PUBLISHING CORP.
Book Division
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

CQ ANTHOLOGY I	$2.00	☐
CQ ANTHOLOGY II	3.00	☐
ANTENNA ROUNDUP	3.00	☐
SIDEBAND HANDBOOK	3.00	☐
VHF FOR THE RADIO AMATEUR	3.50	☐
SURPLUS SCHEMATICS	2.50	☐
CQ LICENSE GUIDE	2.50	☐
"NEW RTTY HANDBOOK"	3.95	☐
MOBILE HANDBOOK	2.95	☐
ELECTRONIC CIRCUITS HANDBOOK	3.00	☐
SHOP & SHACK SHORTCUTS	3.95	☐
SURPLUS CONVERSION HANDBOOK	3.00	☐
UNLIGHTED GLOBE	19.95	☐
ATLAS	15.00	☐
CODE RECORD	3.50	☐
REGULAR LOG SHEETS (100)	1.00	☐
SSB LOG SHEETS (100)	1.00	☐
HAM'S INTERPRETER	1.50	☐
TVI HANDBOOK	1.75	☐
BINDER—YEAR WANTED	4.00	☐
DX ZONE MAP	3.00	☐
DIODE SOURCE BOOK	2.50	☐
USA-CA RECORD BOOK	1.25	☐

SIRS: My check (money order) for $_____ is enclosed. Please send the following items to:

Name_____

Address_____

City_____ Zone_____ State_____

Rock Crusher [*from page 98*]

minus wires are not to be connected to the chassis. All B minus connections should be tied to a buss line insulated from the chassis. The key jack, connected to the B minus line, must be insulated from the chassis with shoulder washers.

To reduce TVI, the cabinet should be tied to earth ground through a water pipe or a direct ground pipe if possible. If care is not exercised a shock hazard exists between the key and the grounded cabinet. The hazard is eliminated when the line plug is properly inserted in the outlet. The second neon bulb, marked Safety Indicator, lights up when a shock hazard exists due to wrong plug polarity. When this is observed, reverse the lineplug, the light will go out and the rig is safe.

Operation

Set up the transmitter by first connecting the earth ground to the cabinet. Plug the line cord in, turn the power switch on and check the safety indicator. If it lights, reverse the plug. Plug in the proper crystal for the 40 or 80 meter band. With the coil and capacitor combination used, the tank tunes both bands. Forty meter crystals will tune with the 365 mmf plate capacitor mostly unmeshed and 80 meters rocks will tune with the plates mostly meshed.

Set the ANTENNA tuning capacitor fully meshed and the PLATE capacitor (365 mmf) meshed or unmeshed, depending upon the band. With a 15 watt bulb connected to the antenna terminal, press the key. Tune the PLATE capacitor for minimum reading on the meter. Decrease the capacity of the ANTENNA capacitor until the plate current rises to 50 ma. Retune the plate capacitor to minimum. Repeat once or twice and you should be set. Connect the antenna, retune quickly and you are on the air.

Be sure not to operate the MK II when the safety light is lit. The MK II is a delightful and simple fun project. Make no mistake, it is not a toy but puts out a clean, respectable and very useful signal. ■

ART/13 [*from page 28*]

Since the cathode voltage is less than the original source, resistor R_{203} should be changed from 15,000 ohms or 4700, whichever was the value used originally, to 3300 or 2700, depending on the output of the microphone used. A slight increase in modulation percentage will result if the smaller value is used. This resistor is at point *D* in fig. 1.

The total result of the changes, which require no drilling, or special tools, and which can be accomplished in little time, will be a better sounding ART/13. For those who are absent minded, remember to replace the mica capacitors and the screws holding them before reassembling the speech amplifier in its cabinet.

Another bonus as a result of these changes is that the power supply for the filament, relay, and motor supply need not be filtered at all!

Removing the large capacitors in the power supply filter will permit the rectifiers to run cooler. Any choke in the supply can also be removed or shorted across the terminals. If a.c. is used for the filaments as in some conversions, the need for a battery microphone supply is eliminated as well.

The net result will be a much better sounding signal from the ART/13 with a minimum of changes. If a telephone type F-1 or N-1 is used, little difference from most signals will be noted, and a substantial improvement over military types will result. ■

VHF Contest Result [*from page 40*]

Vermont				
K1JTO/1	75	26	18	43,875
Virginia				
WA4APG	1	1	1	1
Washington				
Wisconsin				
K7VMA	34	7	19	5538
WA9JCY	125	28	24	105,000
K9YGR	108	39	18	94,770
WA9CBP	106	25	24	79,500
W9HWQ	15	3	5	281
Canada				
VE3EWZ	8	4	8	256

144 Mc Scores

Alaska				
W8KNC/KL7	7	1	4	28
California				
K4CHE/6	126	19	22	65,835
W6YIO	116	20	20	58,000
WB6KAP	77	16	17	20,944
WB6CTY	61	9	18	12,353
WA6RTM	29	10	14	4060
WB6APK	25	6	17	3188
W6YLL	11	6	9	743
WN6KOK	10	5	8	500
Connecticut				
K1PXE	103	36	18	66,744
WN1AOS	62	15	24	27,600
WN1ANB	65	21	16	27,300
K1RTS	33	16	12	7920
WA1ARO	29	10	15	5437
K1PKQ/1	14	7	2	245
District of Columbia				
K1PBX/3	23	10	15	4313
Georgia				
K4YZE	14	5	12	1050
WN4SRH	1	1	1	1
WN4SJI	1	1	1	1
Illinois				
K9RVG	115	15	22	47,438
WN9KTG	33	6	14	3465
WA9MGI/9	10	4	7	280
Indiana				
K9OYD	54	11	17	12,623
Maryland				
K3VJH	47	29	12	20,445
Michigan				
WA8DMN	43	7	20	7525
W8VRH	39	12	16	7488
WA8JEI	20	4	9	900
Missouri				
KØFPC	1	1	1	1
New Jersey				
W2NNL	144	41	19	140,220
WN2KHD	85	28	14	41,650
WB2MWU	61	22	17	28,518
WN2KTO	67	16	21	28,140
WN2OAB	58	17	18	22,185
WB2DDA	46	19	15	16,388
WN2LVW/2	30	14	14	9600
WA2ZOW	31	7	17	4611
WN2OAD	21	9	13	3071
WN2OJU	18	10	2	450
New York				
WB2CYL	166	51	23	243,398
WA2GHN/2	105	48	24	120,960
WA2YHS	128	26	21	69,888
WB2CPC	67	19	19	30,719
K2GSF	36	20	13	11,700
WA2DRK	38	20	15	11,400
WN2LBW	33	16	13	8580
W2DGZ	34	13	13	7183
KN3ZXI/2	16	4	8	640
WB2NHN	6	2	3	45
WB2FXB	1	1	1	1
North Carolina				
WA4REX	30	6	19	4265
WA4MFG	28	5	19	3325
Ohio				
W8DYJ	177	75	24	318,600
W8SPR	32	16	12	7682
K8YWF	26	13	10	3380
K8RXD	18	14	12	3024
WA8JSL	12	3	8	360
Oregon				
KN7ZFG/7	35	5	14	3063
K7GWE/7	23	5	8	1150
KN7AWJ	14	5	10	938
Vermont				
K1RSJ/1	53	8	11	5830
W1KBI	23	14	5	2138
Wisconsin				
W9CIZ/9	28	6	14	2352
WA9FMQ	20	6	10	1500
Canada				
VE3EWZ	60	11	16	10,560

220 Mc Scores

K3IUV	6	3	2	36
K5WWQ	3	1	3	11

1215 Mc Scores

WA5DJU	3	1	3	11

Novice Scores

WN2KHD	85	28	14	41,650
WN2KTO	67	16	21	28,140
WN1AOS	62	15	24	27,600
WN1ANB	65	21	16	27,300
WN2OAB	58	17	18	22,185
WN2LVW/2	30	14	14	9600
WN2LBW	33	16	13	8580
WN9KTG	33	6	14	3465
WN2OAD	21	9	13	3071
KN7ZFG/7	35	5	14	3063
KN7AWJ	14	5	10	938
KN3ZXI/2	16	4	8	640
WN6KOK	10	5	8	500
WN2OJU	18	10	2	450
WN4SRH	1	1	1	1
WN4SJI	1	1	1	1

VHF [*from page 74*]

been some 12 parties who have 'contested' from there in the past four years."

"Last year before the Summer *CQ* V.H.F. Contest WA2FQA, WB2BML and I climbed up on a Wednesday to look over the possibility of operating from there. Well, it was a nice walk. We have been building transistorized 10 watt transceivers for six and two meters in the hopes of making it this year or next.

"For the time being, I'll be contented with operating from my home—360 degrees clear shot, 480 foot elevation. With my 50 watter and 6 element monster I can be heard. Well, enough blab. Keep up the swell work in *CQ!*"

Just an early bird reminder for the new year that we are always on the lookout for v.h.f. and u.h.f. circuits of interest to the experimenters among us. Drop us a line when you come across something you think we might be able to use.

73, Bob, K2ZSQ and Allen, K2UYH

Field Strength Meter [*from page 48*]

gradually to full clockwise, re-adjusting the ZERO control as you go. The meter is now ready for operation.

Place the meter somewhere in the room, turn the transmitter on and bring up the gain control until the meter reads full scale. Then bring down the sensitivity control until the meter is reading about half scale. You are now able to observe when your transmitter is peaked up for maximum r.f. output. Later, you can walk around your house and neighborhood to observe the field strength pattern and direction of greatest signal. This trouble free, simplified, untuned, sensitive field strength meter should provide you with a better working knowledge of your equipment *and* a stronger signal where you want it. And by placing 2,000 ohm headphones in the circuit instead of the meter, you will be able to hear your off-the-air a.m. signal. ■

Triodes as Linears [*from page 36*]

Table III provides data for the 450TH in cathode driven, Class AB_2 r.f. linear amplifier service.

It should be noted that steady state conditions are given, and p.e.p. operation should be held to these limits, unless the oscilloscope tells the operator that the tube may be "pushed" a bit before peak flattening or distortion occurs. Use of the oscilloscope should be tempered with caution, however, as it is nearly impossible to read distortion or peak flattening on the "scope" until the degree of intermodulation distortion approaches a level near —20 decibels below one tone of a two tone test signal. By this time, the operator will probably receive a brick through the shack window! To be on the safe side, then, meter readings of grid and plate currents should be one half or less of those indicated in the tables for *voice peaks.* ■

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 25¢ per word. **Minimum Charge $1.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day of the second month preceding date of publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

HUNDRED QSL's: $1.00. Samples, dime. Meininger, Jessup, Iowa.

QSL's . . . CB cards . . . Free samples . . . Filmcrafters . . . Martins Ferry, Ohio.

QSL's? CB's WPE's? Largest variety samples 25¢. (Refunded). Sackers, W8DED, Holland, Michigan.

EXCLUSIVE QSL's—Price—Quality—Delivery Samples 10¢. KINCZ Press, 535 Walpole Street, Norwood, Massachusetts.

QSL's. Samples, dime. Print Shop, Corwith, Iowa.

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.

RUBBER STAMPS for QSL Cards. Kits available. Free sample impressions. E & R Stamp Co., 50 Gerald Rd., Rantoul, Illinois.

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.

RUSPRINT QSLs—SWLs 100 2-color glossy $3 postpaid. QSO file cards $1 per 100. Rusprint Box 7507, Kansas City, MO. 64416.

QSL's 3-color glossy. 100 $4.50. Rutgers Vari-typing Service. Free Samples, Thomas Street, Riegel Ridge, Milford, N.J.

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.

QSL's Samples 25¢. Rubber Stamps; Name, Call, Address, $1.55. Harry Sims, 3227 Missouri Avenue, St. Louis, Mo. 63118.

QSL's, CB, WPE samples 10¢. Nicholas & Son Printery, P.O. Box 11184, Phoenix, Arizona. 85017.

QSLs $2.00 per 100 postpaid. New style glossy 2-colors. Free sample. Hobby Print Shop, Umatilla, Fla. 32784.

PICTURE of yourself, home, equipment etc. on QSL cards made from your photograph. 250—$7.50 or 1000—$14.00 postpaid. Samples free. Write Picture Cards, 129 Copeland, La Crosse, Wis.

HRO-60 coil sets wanted, state type, price, and condition in first letter. WB2FIL, RD-1, Box 315, Old Bridge, New Jersey.

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.

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.

ATTENTION HAMS! We buy, sell ham gear. Repair and alignment facilities available. Hold Advanced and First phone. Used gear always reconditioned. Money back guarantee. KitKraft Company, P.O. Box 406—Canal St. Station, New York N.Y. 10013.

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.

TOROIDS uncased 88 mh 60¢ each or 5/$2.50. Fasold, WA6VVR, Box 34, Dixon, California.

BUY, SELL, TRADE Ham, CB Directory. 12 issues $1.00. Philupi, 1225 Hillside, North Bergen, New Jersey.

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.

WANTED—AN APR-14, 13 receivers. SG-13, H-p4, SG-1, SG-2, MD-83, 479 Collins, in any condition. T-368-C xmtrs. R-390, 390A, R-388, 389, 391. Receivers. RT-66 thru 70 Rt units RT/77-GRC-9, GRC-10, GRC-19. RCA, Bendix, Collins Aircraft Radio and Radar Equip. Hewlett Packard, General Radio, Tektronix, etc., Test Equipment. GRC, PRC, GRR, TCC, ARC, sets. ARM, PRM, URM, UPM, URM, SG Test sets any and all types. You name it. Call E. Charol, Tech Systems Corp., 42 W. 15th Street, N. Y. 11, N. Y. CH 2-1949 Collect.

CENTRAL ELECTRONICS 10A W/QT-1 Harvey Wells TB5-50 W/v.f.o. Knight TV-FM Sweep Generator Heathkit impedance Bridge @ 1 kc ferris noise & field intensity meter 32A Wheatstone Bridge 1-49. Best offer Takes. Gordon Ostlund, 212 Market Street, Pocomoke City, Md.

BUY OF A LIFETIME for VHF homebrewers 100 Watts output up to 250mc. Type 5894 Tubes made by Amperex including Johnson recessed ceramic sockets $14.95 each. Ruggedized for mobile use. Brand new in original cartons. 1 yr. REPLACEMENT GUARANTEE shipped postpaid. Cash or M.O. WØFUV, Box 463, Troy, Ohio.

SELL: Apache TX-1 Transmitter, $225. National NC-125 Receiver, $75. Both units are in A-OK condition. Chas. Fink, W2BXD, 33 Chittenden Ave., Tuckahoe #7, N. Y.

TECHNICAL MANUALS for military surplus electronics. Stamp for list. W3IHD, 4905 Roanne Drive, Washington, D.C. 20021.

FREE! BLUE BOOK LIST. WØGFQ offers you discounts on hundreds of reconditioned equipment bargains. SX-140 $71.96; AF-67 $49.96; SR-160 $260.10; Warrior $196.00; NC-109 $89.10; HT-32 $254.40; RME-6900 $180.20; Cheyenne $49.18; HRO-50 $125.48; Meteor $59.65; HT-41 $254.20; 51-SB Generator $99.66, and many more. Ask for our new 1965 catalog. Write Leo, Box 919, Council Bluffs, Iowa.

JOHNSON Desk KW with Desk, latest model, last manufactured, serial 100632, pair 4-400As and all modifications, Absolutely mint conds, cannot be told from new. Complete with spare tubes, manuals and cables, $1000 FOB. Ranger, PTT, new condx. D-104 and relay, with KW as package $1150. 75A4 serial 4764 with speaker, 3.1, 6 kc, filters, vernier know manual, mint conds. $450. Complete station $1500. K4ACJ, Saul Cohen, 4524 Michigan Avenue, Miami Beach, Florida.

VHF SURPLUS GOODIES, Collins ARC-1 VHF transceiver, 100-156mc. The Best VHF Buy In Surplus for 2 Meters or Aircraft Monitor. Price, $16.50. ARC-3 transmitter $12.50. ARC-3 receiver $16.50. T-23/ARC-5 transmitter $12.50. TDQ transmitter $65.00; URR-13 receiver, crystal controlled on cap 148.14mc, $65.00; ARC R-19 receiver 118-148 $28.50. ARC T-11 transmitter $25.00. Gonset ground to air communicator 108-128 mc $135.00. Signal generator 1-130 tunes 100-156mc $12.50. S-36 vhf receiver, needs condenser replacement and alignment $20.00. BC-797B transmitter vhf version of the BC-610 $75.00. Slep Electronics, Drawer 178C, Ellenton, Florida, Phone 722-1843.

AR-22 OWNERS—know where your beam is pointing. Compass rose for your indicator calibrated 6° increments, $1.00 postpaid. WAØDGM, 2411-57th, Des Moines, Iowa.

WANTED: Commercial, Military, All types, ARC, ARN, ARM, GRC, PRC, URR, URM, TS, 618S-1T, 17L, 51R-V-X, APM, Others, Ritco, P.O. Box 156, Annandale, Va.

RTTY SURPLUS GOODIES: OS-11/FGC-5 Oscilloscope $20.00. T-372B/FCC-3 carrier $25.00. Collins O-243/FRT-24 r.f. oscillator $150.00. Model 15 printer, $65.00. TG-26A model 14 reperforator and transmitter $75.00. Slep Electronics, Drawer 178CQ, Ellenton, Florida.

WALKIE TALKIES: PRC-6, 44-57mc, $40. PRC-17 121.5, 243mc $20.00. BC-611, 3.5-6 mc, $25.00. BC-746 Pogo Stick, 2-6mc $7.50. PRC-14 200-400mc $25.00. URC-4, 121.5-243 mc, $20.00. All less batteries. 10% discount on pairs. Large stock of parts on above. Send requirements. Slep Electronics, Drawer 178CQ, Ellenton, Florida.

RTTY CHANNEL FILTERS. Octal mounted, tuned 2125/2975 cps $5.95 pair. Torroids 88mh, like new, uncased, 5 for $4.00. WA6JGI, 3232 Selby Avenue, Los Angeles, California 90034.

CAPACITORS Clerinel 40 HFD 330 AC $5.95. Filament transformers Stancor 117/107 volts 60 cycles Secondary 6.3 volts CT @ 6.0 amps $3.95 all new postpaid. Goodman 5826 South Western, Chicago, Illinois 60636.

REMOTE CONTROL UNIT, brand new $5.00. Postpaid. (cost Navy $125.00) MDC, 923 W. Schiller, Phila. 40.

AUTHORS MODEL: 80-40 CW Transmitter-Receiver Nov **CQ** 64 with power supply $35. 811 GG Amplifier Mar 60 $60, BC-953 BDC Band ARC-5 Receiver $20. Zipper Bag Transmitter May 62 $15—W6BLZ 528 Colima St., La Jolla, California.

For further information, check number 25, on page 110

For further information, check number 26, on page 110

DAYTON HAMVENTION—April 9 and 10, 1965 . . . For information write: Box 44, Dayton, Ohio 45401.

SB-300 and SB-400 for sale. Fabulous brand new Heathkits wired by a professional. Rec. has all opt. fltrs. Must sell. $610 takes all. Write—F. Klein, #4 Rayes Dr., Hudson, N. H.

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 paid for your excess inventory (New Only—Commercial Quantities). Metropolitan Supply Corp., 443 Park Avenue South, New York, N.Y. 10016, 212-MU 6-2834.

INTERESTING OFFERS GALORE in the new combined "Equipment Exchange—Ham Trader". Next 12 issues $1.00. Sample free. Brands, Sycamore, Illinois.

FOR SALE: 500 watt G.G. Linear Amplifier using pair of 800-A's all band B&W pi-network output. With tubes—$25.00; Globe Scout model 65A—65 watts CW, 50 watts phone, all band pi-network output, Heathkit vfo w/pwr spply, TR switch w/pwr supply—all for $65.00 or together with 500 watt Am/SSB linear $80.00. Gerson May, W4HPE, 1301 Gamble Ave., Jasper, Alabama.

Looking? Shopping? Trading? Trying to save money? Write Bob Graham for Special Deals on New and reconditioned used gear. Cash or Budget. Graham Radio, Dept. B, Reading, Mass. 01867, Tel: 944-4000.

HEATH HX20, HR20 with HP20 power supply and mobile mount $275. WRL Globe Chief 90 $35; 4-1000A $50. K2SOX, Northfield, N.J.

FOR SALE: Heathkit DX-40, $40; HQ-110 $125; HY-Gain TH-4 $25; Paul Hurney, WA211E, 36-21 208 Street, Bayside 61 NY. BA 4-9134

COLLINS KWS-1 SN-1260 $585; 75A4 SN-2312 $395; Extra filter avail. SCS-101 control homebuilt $120; No shipping, offers accepted, K6HZU Box 833, Hawthorne, Cal. PH 213 398-1332.

HAMMARLUND HQ-180 receiver for sale. Two years old, mint condition, in original carton. $220. Berk WB2LCZ, 8 Bassett Ave., Brooklyn, N.Y.

WANTED: A few RK-65 exmitting tubes for high power final and spares. Write card stating quantity, condition and price. All replies answered, John Mayes, W4VJA, Route #13, Knoxville, Tennessee 37918.

CALIF. KW PP 450TL 20 mtr. final $40. Pwr supply 4KV @ 1.2A. $40, Tower 54 ft. Tristao crankup HDL $75. No shipping, Offers accepted, K6HZU Box 833, Hawthorne, Cal. Ph: 213 398-1332.

FOR SALE—Hammarlund SP600 TXH receiver $350; Knight T-150 transmitter $80. Ray Robertson, 37 Ogden Place, Morristown, N.J.

FOR SALE: Back issues of QST and CQ. Large S.A.E. for list. Will swap. W2TAM, 140 Summit Ave., West Trenton, N.J. 08628.

REGULATED 8-tube power supply (110 v.a.c.)—delivering 350v. @ 350 ma. plus filaments—circuit breakers $25. Barry's sells for $49. WA2SZM. OL 8-0837.

COLLINS 32V2 Good condition $150. Will deliver within 150 mile radius or your pay shipping. R. P. Kasprzak K9RJO, 467 S. Broadway, Peru, Ind.

FOR SALE—Johnson Thunderbolt $300, Walkie-Talkie BC-611 pair $80, Hammarlund SP-600-JX Rack $415, receiver vhf ARC-5 100-156mc cont. tuning 115 ac $30, tube tester 1-177B $15, Saref 2 meter xmtr w/ps $50, Packard Bell power supply input 115-230 ac output 830-250—70 dc $35. All in excellent condition, Geno-Drive new $30. Bunge, Box 4099, Tucson, Arizona. Phone: 623-1278.

2,000 WATT AMPLIFIER & COLLECTOR'S ITEM FOR SALE. This 80-10 meter amplifier, with pair of NEW amperex 4-400's, was the cover story in **CQ** MAGAZINE, October '63. Refer to article for complete details. This is the author's original linear, containing features not found in even the most expensive amplifiers. Linear (Refer to photo in October '63 CQ) is housed in Hallicrafter's hinged-top cabinet for desk-top operation. Complete less Screen and Final supply. Will sell this original amplifier everyone has read about for $950. Weight 60 pounds. Power supply in 14" rack panel delivering 3500 volts at 650 mils plus screen voltage, contains new commercial plate transformer, 3B28's, and oil-filled capacitors. 115 pounds of brute power for above linear. Will sell WITH linear for $150. THIS IS A ONE-OF-A-KIND COLLECTOR'S ITEM & REAL WORK HORSE that author must sell. First check received gets linear, shipped express collect. Other checks will be returned. Write to: M.C. Smith, IV, WA4DXP, 1000 Monte Sano Blvd., Huntsville, Alabama.

20-meter beam Telrex wide spaced 6 element with reflectors list price over $700. Sacrifice for $275. Telrex heavy duty largest rotator indicator cables switches and all ready to work list price over $600 sacrifice $200. Vesto tower 40 ft sacrifice $100. Johnson 6N2 xmitter TapeTone receiver converters for 6 and 2 meters with power supply, list price over $350, sacrifice $195 for all 6&2 meter listed above. Viking Ranger, late model, factory wired grid block keying $150. All kinds of tubes relays. No time to ham, am selling all but one small rig. Send money order first come first served. WA4URQ, Harry Weinberg, Georgetown Airport, Georgetown, S.C.

FOR SALE—Heath Warrier, Johnson Valiant, Johnson Pacemaker $200 each. SX-71 $100. Mobile AF67 and G66B both $150. Command xmtr 1626 tubes, postpaid 3 for $5. J.C. Millikin K5ABL 1023 Sunglo, San Antonio, Texas 78221.

ANTENNA tuning unit, brand new $3.00 postpaid (cost Navy $85.00). MDC, 923 W. Schiller, Phila., 40, Pa.

SELL: Valiant $160 and RME-4350 $90. Both F/W and excellent condition. You pay shipping. K8TCV, 711 Alton Street, Defiance, Ohio.

FOR SALE: Collins KWM-2 w/516F-2 $850; 312B-5 $200; 30S-1 $900; 351D-2 $50; MP-1 $100; Th-4 $50; HAM-M $50; 65' tower, $100. Package $2000. Model 15, $125, CV-31 $75. f.o.b. Petersburg, Va. K8JIM/4, 129 North Park Drive, Petersburg, Va. 23805, 703-732-8346.

CANADIANS: Ideal first or mobile rig. Heath Cheyenne Commanche. Used two years new tubes. VE2BQA, 4984 Circle Rd., Montreal, Quebec.

HALLICRAFTER FPM-200 Transistorized Transceiver with two-vfo. Only a few hundred ever manufactured but in my opinion, the finest piece of equipment ever developed. Sold new at $2650. Make offer. WA6TLS, 7549 E. 4th Place, Downey, California.

COLLINS 32S-1 xmtr $300; J. F. Young W5HXW, 1234 Glen Cove Richardson, Texas. Tel: 214-235-6927.

FOR SALE: RME 6900 $200; Heathkit Marauder $300; $50 or best offer takes both. Both in excellent condition with manuals. W5GBG, D-205 Carlson Terrace, Fayetteville, Arkansas.

CENTRAL ELECTRONICS 200V like new. Cost $795. Make offer. WA6TLS, 7549 E. 4th Place, Downey, California.

WANTED: Novice crystals. Reply with airmail post card stating frequencies and price. Pete Essex, 234B Cassino Rd., Ft. Lee, Va.

SELL: WRL Meteor, matching supply; Eico 722 vfo; Drake 2B, xtal cal.; WA2ZJV, 2115 East 27 Street, Brooklyn, N.Y. Sh 3-2525.

MUST SELL extra gear: Plate transformer, 6kvct, @ 1 amp unused $35; Link FM transceiver, complete with manual $25; Garrard AT-6 changer $40, Electrovoice 664 mike, $25; K3WFZ, 4446 Kilmer Drive, Murrysville, Pa.

COLLINS 75S3, 32S3, 516F2 used less than 10 hours. All offers considered. K1KRO, 83 Fairlane Drive, Wethersfield, Conn. Tel: 529-9281.

RTTY; adjust polar relays for maximum sensitivity and minimum bias. Test sets I-193A make it easy. Rack-mounting, with wooden case. 5 available. Manuals $2.50. James Cooper, W2BVE, 834 Palmer Avenue, Maywood, N.J. 07607.

FOR SALE: Collins 32S-1 and 75S-1. Factory modifications. Less power supply $600. No scratches, perfect condition. Hal Franks, K7BIX, 841 E. 6th Ave., Helena, Montana 59601.

TCK-7 Navy Transmitter Mfd. By G.E. two final two 304 TL Mod. All one unit with ac supply $375. Don Mathews, W6BRY Box 761 Paso Robles, Cal.

USED MYLAR TAPES—1800 feet, 1 mil $1.00 each. Send check with order. B. Freeman, 800 W. 87 St., Kansas City, Mo. 64114.

HIGH VOLTAGE SUPPLY 3200-0-3200 volts at 800 ma. 110v. primary, choke 10 H at 1 amp. 15 ufd. cap. two 3B28s plus two spares, filament xmfr, $70. Two new 813s $11. Write Bob, K8SWC, 1320 W. 28 St., Apt. 91. Cleveland, Ohio 44113.

MIDLAND (TEXAS) Amateur Radio Club Annual St. Patrick's Day swapfest, March 21. This one will be the biggest ever. Swan 350 Grand Price—Contests—Examinations—Annual outstanding Amateur Aeard—Social Activities on Eve of March 20—Complete Dealer-Manufacturer Displays. Inquire 510 Midland Savings Building, Midland, Texas 79704.

RTTY Gear for sale. Write for list, 88 or 44 mhy torroids five for $1.75 postpaid. Elliott Buchanan W-6-VPC, 1067 Mandana Blvd., Oakland, Cal. 94610.

FOR SALE: Swan 240 and 110 volt power supply, $350. K3MHK, 338 Grandview Ave., Chambersburg, Pa., Phone 264-4547.

WANTED: May 1945 issue of CQ for CQ collection. Issue must be complete and in good condition. Contact the CQ editorial office with price and condition.

WANTED early issues of **QST.** 1922—Jan., Feb., Mar., 1921—all but May and July, 1920—all but April, May and June. K2EEK, **CQ,** 14 Vanderventer Ave., Port Washington, L.I., N.Y., 11050.

BOUND VOLUME 1964 **CQ** for sale. Order now and be sure to receive your copy. Limited quantity. First come first served. Send $15.00 to Dept. H.W. **CQ** Magazine, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

READER SERVICE

NAME_____ CALL_____
(Please Print)

ADDRESS_____

CITY_____

STATE_____ ZIP CODE_____

Please send me more information on your ads in the Jan. 1965 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77			Total Inquiries				☐

Void after Jan. 29, 1965

CQ MAGAZINE, Dept. RS

14 Vanderventer Ave.

Port Washington, L. I., N. Y. 11050

For further information, check number 40, on page 110

advertisers index

DESIGNED TO SOLVE YOUR TRANSCEIVER PROBLEMS . . . THE SB-34

Completely new, the SB-34 retains all of the best features of the SB-33, but adds many important new features, including built-in 12 V DC and 117 V AC power supply (no inverter need) At only $395.00 the SB-34 is an even greater value than it's predecessor.

Space does not permit a complete description. For complete specifications call or write your nearest Henry Radio store.

and— DESIGNED TO SOLVE YOUR FINANCING PROBLEMS . . . HENRY RADIO'S EASY TERMS

6% FINANCE CHARGE • 10% DOWN OR TRADE-IN DOWN • NO FINANCE CHARGE IF PAID IN 90 DAYS • GOOD RECONDITIONED APPARATUS. Nearly all makes and models. Big savings! 15 day trial — 90 day warranty. 90 day full trade back on new apparatus. Write for bulletin.

Henry Radio Stores

CALL DIRECT . . . USE AREA CODE

Butler 1, Missouri	816 679-3127
11240 W. Olympic, Los Angeles, Calif.	213 477-6701
931 N. Euclid, Anaheim, Calif.	714 772-9200
431 E. Green St., Pasadena, Calif.	213 684-0861
6116 N. 27th Ave., Phoenix, Ariz.	602 AM 4-3895

"Worlds Largest Distributors of Short Wave Receivers"

For further information, check number 23, on page 110

FREE

send today for your 490-page

ALLIED

1965 CATALOG

world's largest electronics catalog

BIGGEST SELECTION
BIGGEST SAVINGS

EVERYTHING IN ELECTRONICS FOR THE AMATEUR

get every Ham buying advantage

LARGEST SELECTION

ALLIED stocks the station gear you need—at lowest, money-saving prices. Get same day shipment from the world's largest stocks.

HAM-TO-HAM HELP

Our staff of more than 60 licensed hams goes all-out to give you the personal help you want. Whether you write, call, or visit our Ham Shack, you'll like the friendly interest and attention you always get at ALLIED.

EASY TERMS

Make full use of the convenient ALLIED Credit Fund Plan—have over 24 months to pay.

ALLIED RADIO

serving the Amateur for 44 years

- Ham Receivers, Transmitters, Transceivers
- World's Largest Stocks of Station Supplies
- Great Build-Your-Own Ham Knight-Kits®
- Citizens Band 2-Way Radio
- New Automotive Electronics
- Electron Tubes and Semiconductors
- Test Instruments and Meters
- Everything in Stereo Hi-Fi
- Tape Recorders and Tape
- Everything in Electronic Parts, Tools & Technical Books

FREE

SEND FOR YOUR COPY TODAY

ALLIED RADIO, Dept. 12-A
100 N. Western Ave., Chicago, Ill. 60680

☐ Send FREE 1965 ALLIED Catalog

Name_____
PLEASE PRINT

Address_____

City_____ Zone____ State_____

For further information, check number 22, on page 110

six pack

National offers six of the world's finest receivers to meet *your* particular requirement.

Receiver number one provides greater amateur band performance and features than any amateur receiver ever built. ■ Receiver number two has the widest frequency range (from 5 Kc to 30 Mc) of any general coverage communications receiver ever built for lab or commercial application. ■ Receiver number three is *completely* solid-state for high reliability, versatility and portability. It operates from 12/24 V.D.C. or 115/230 V.A.C. This receiver draws less current than a couple of dial lamps (when its dial lamps are switched off), and provides instant-on operation. ■ Receiver number four incorporates specific features for high selectivity and has a six-pole filter to provide built-in steep-skirted 500 cps, 2.5 Kc, 5.0 Kc, and 8 Kc bandwidths with *passband tuning* for CW and SSB. Also *AGC threshold control* to knock out background QRM. Also a 50 db notch filter. ■ Receiver number five has a phase-locked frequency synthesizer to replace conventional high frequency oscillator crystals for superior stability and over-all calibration. ■ Receiver number six offers frequency meter performance with 1 Kc dial calibration and accuracy over its entire tuning range, 24 feet of bandspread per megacycle, and 10 Kc per turn tuning rate.

Each of these receivers is called the HRO-500. National's new HRO-500, at $1295, is the finest *total* receiver you can buy . . . at any price. Interested in trying out National's new sixpack? See your National dealer for an opener.

NATIONAL RADIO COMPANY, INC. 37 WASHINGTON STREET, MELROSE, MASS. 02176

World Wide Export Sales: Auriema International Group, 85 Broad St., N. Y. C.; Canada: Tri-Tel Assoc., 81 Sheppard Ave. W., Willowdale, Ont.

For further information, check number 3, on page 110

Tops for mobile!

RCA High-Perveance Beam Power Tubes

For the mobile man who wants a hefty signal from a compact rig, RCA High-Perveance Beam Power Tubes are the answer.

High-Perveance design enables you to get the power you want at lower plate voltages—making it easier to work with practical values of pi-network components, use more compact tank circuits and lower voltage-rated filter capacitors, simplify rf and dc insulation problems.

Another feature of RCA Beam Power Tubes for mobile service is their special heaters—designed to withstand the strain of repeated on-off operation and to operate efficiently over the wide range of voltages encountered in car electrical systems.

At "cruising" speed or engine "idle", RCA Beam Power Tubes have the ruggedness and performance capability it takes for mobile service. Check the Power Chart for the types you need.

Available through your RCA Industrial Tube Distributor.

Select your Power and Tube Number

Plate Input Watts			RCA Tube Type
CW	AM	Conditions	
9.9	—	CCS Max.	8077/7054
17	15	CCS Max.	6417
24	17.5	ICAS Max.	7551
40	27	ICAS Max.	6893
85	55	ICAS Max.	6850*
120	85	ICAS Max.	6883B/8032A
210	175	Typical	8072

*Twin Type (total for both sections)

For more technical data on any of these RCA Beam Power Tubes, write: Commercial Engineering, Sect. A-15-M, RCA Electronic Components and Devices, Harrison, New Jersey.

The Most Trusted Name in Electronics