ICD

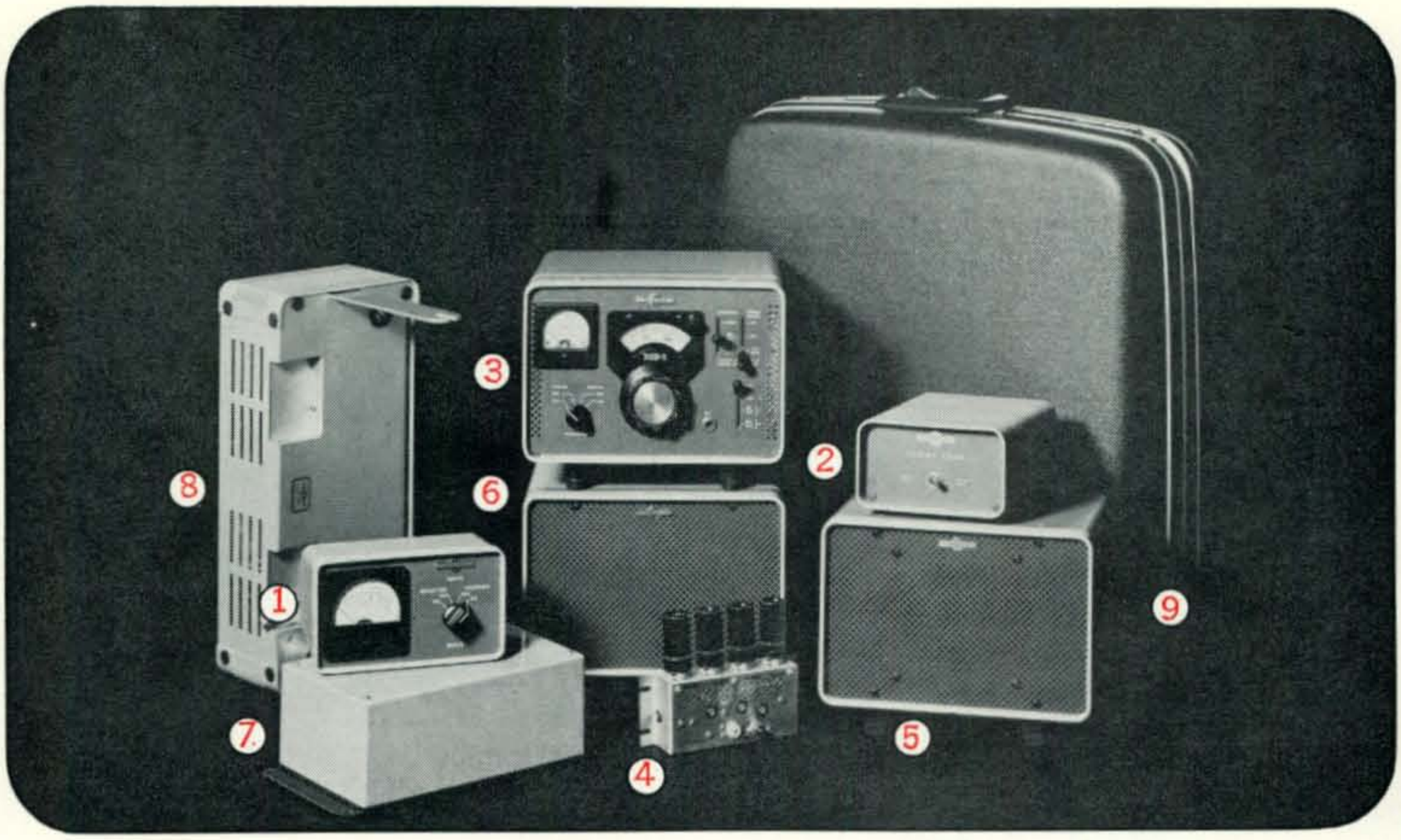
CQ

November 1965
75¢

Modern Design of High Power VHf Amplifiers

PART 1 - page 30

The Radio Amateur's Journal



Special Additives

Add them to your ham shack. Or put them with your mobile unit. They'll make your rig work better. Your authorized Collins distributor can show you all these plus microphones, mounts, adapters and other accessories which give you that something extra in performance. And ask him about our new book, *Amateur Single Sideband.* You'll find it a valuable addition to your library. 1. *302C-3 Directional Wattmeter* — For fixed or mobile applications. Measures forward and reflected power on 200- and 2000-watt scales accurately (3.4 to 30.0 mc) without calibrating adjustments. 2. *DL-1 Dummy Load* — A 100-watt resistive load for all HF frequencies. Connects permanently in antenna coax line, with in-out relay switching. Provides easy comparison of antenna SWR and non-band interference tuneup. Type N and RCA antenna connectors are provided. 3. *312B-5 Speaker Console and External PTO*—For use with KWM-2 in fixed station operation. Provides limited separation of receive and transmit frequencies, speaker, directional wattmeter, and switching for functional control system. 4. *136B-2 Noise Blanker* — For use with KWM-2 in mobile operation. Effectively reduces impulse-type noise in the transceiver. Requires separate antenna resonant at 40 mc. 5. *312B-3 Speaker* — Contains a 5" x 7" speaker and connecting cable. Styled to match S/Line and KWM-2. 6. *516F-2 AC Power Supply* — Operates from 115 v ac, 50-60 cps. Provides all voltage for 32S-3 and KWM-2. 7. *MP-1 Mobile Power Supply*—Transistorized inverter powered from a 12 v dc automobile, aircraft or boat storage battery to the voltages required for operating the KWM-1, KWM-2 or KWM-2A. 8. *PM-2 Portable Power Supply* — Compact, lightweight and supplies all voltages needed for KWM-2. Operates from either 115 v ac or 220 v ac at 50-400 cps to give you a completely portable SSB station. An auxiliary speaker is included. 9. *CC-2 Carrying Case* — Specially designed Samsonite Silhouette case for KWM-2/PM-2 or 30L-1. Molded Royalite interior protects equipment against rough handling. Also available in model CC-3 for accessories.

COLLINS

For further information check number 3 on Page 110

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The fact that more good mobiles are still going HUSTLER is proof of its superiority in every way. It's the industry's standard, second to none in mobiling performance.

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NEW SR-500

Jornado

tri-band transceiver!

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During the CW portion of the CQ DX Contest (Nov. 27-28) HV1CN, I1ICL, W8DUS, W9IOP, W9AC/W4AK, will be on the air from VATICAN CITY!

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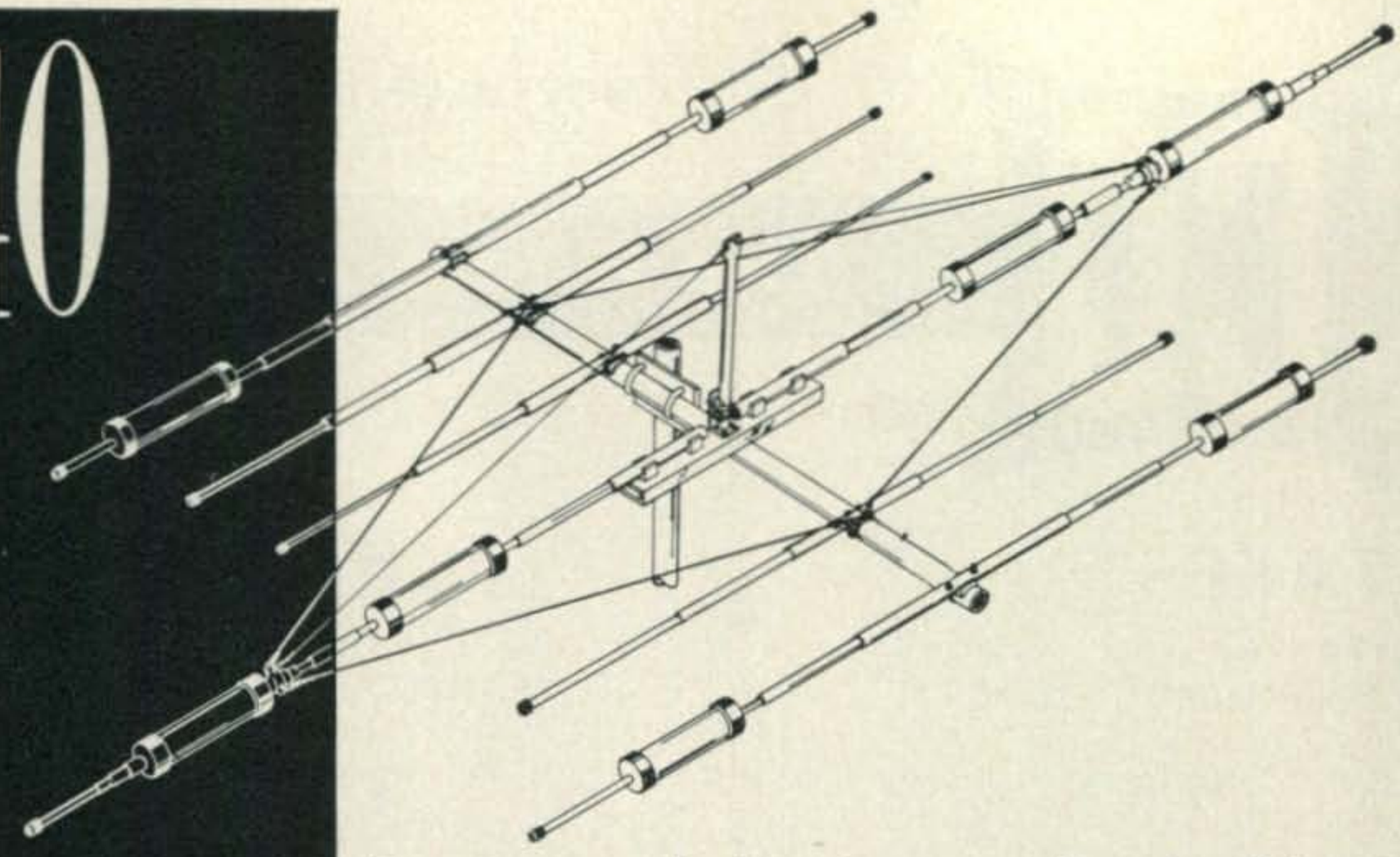
TA-3640

for 10 15 20 and 40 meters



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4610 NORTH LINDBERGH BLVD.
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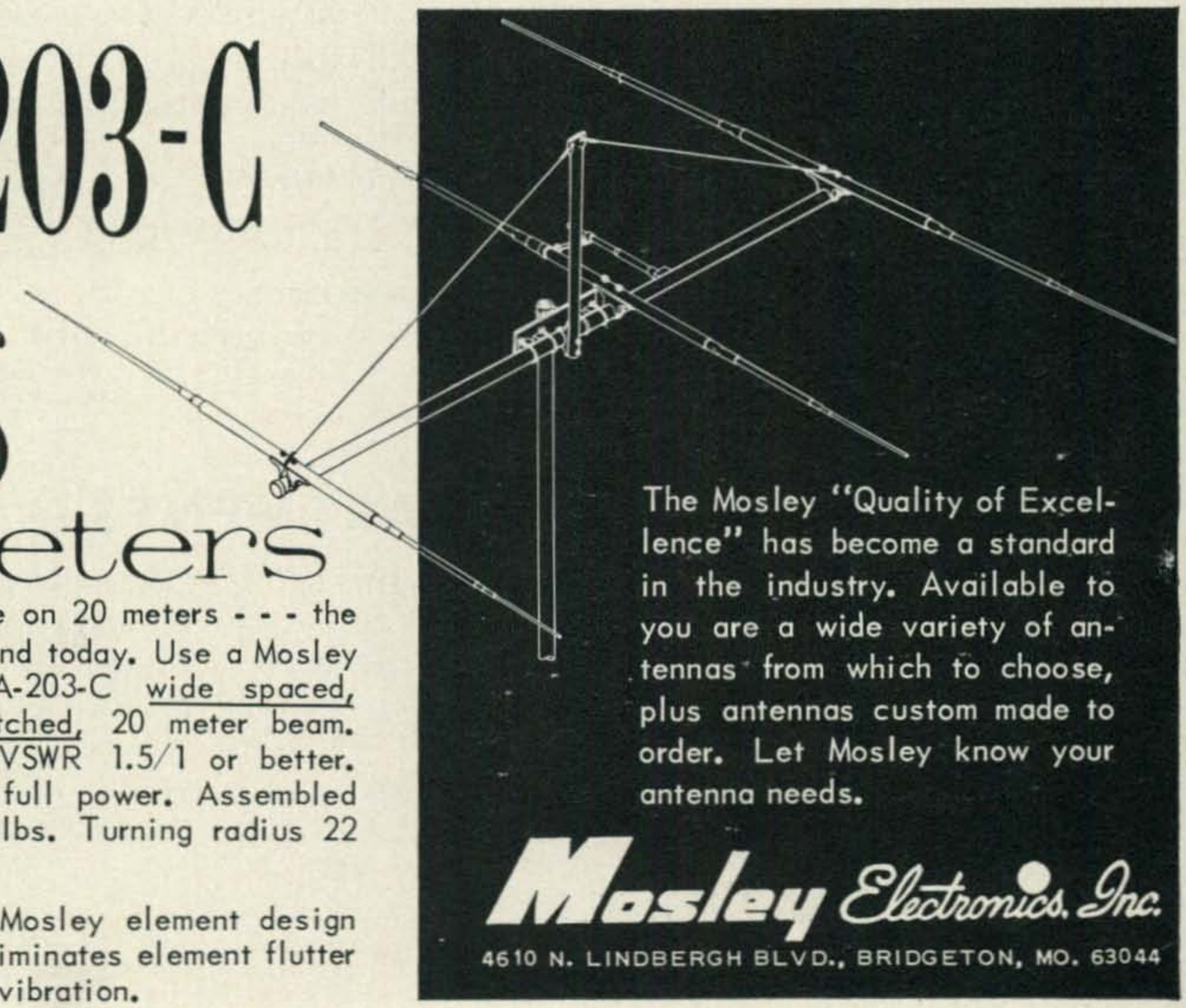
Put your signal where it counts. Use the ultimate in Ham beams - - - the Mosley TA-36 with Kit TA-40KR added to radiating element. Employs 4 operating elements on 10 meters, 3 operating elements on 15 meters, 3 operating elements on 20 meters. SWR is 1.5/1 or better at resonant frequencies over all 4 bands. Constructed of heavy-wall aluminum for maximum strength. Rated for full power.

Write for detailed specifications and performance data on the Mosley TA-3640.

For further information, check number 20, on page 110

A-203-C

for 20 meters



Concentrate on 20 meters - - - the best DX band today. Use a Mosley full-size A-203-C wide spaced, gamma matched, 20 meter beam. Features: VSWR 1.5/1 or better. Rated for full power. Assembled weight 40 lbs. Turning radius 22 feet.

Exclusive Mosley element design virtually eliminates element flutter and boom vibration.

The Mosley "Quality of Excellence" has become a standard in the industry. Available to you are a wide variety of antennas from which to choose, plus antennas custom made to order. Let Mosley know your antenna needs.

Mosley Electronics, Inc.

4610 N. LINDBERGH BLVD., BRIDGETON, MO. 63044

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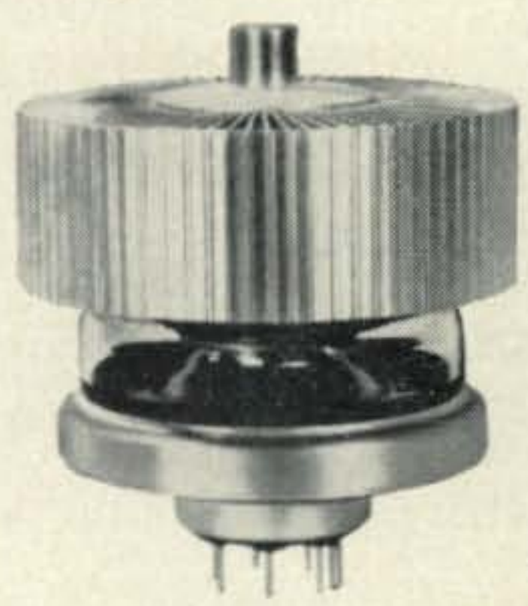
Penta Beam Pentodes for Amateur Radio

PL-175A

PL-177A



PL-8295/172

PL-8432

RATINGS

Type	Filament Voltage (Volts)	Filament Current (Amps)	Max. Plate Dissipation (Watts)	Useful Output* Class AB_1 Linear Amplifier Plate voltage in volts 1000	1500	2000	2500	3000
PL-175A	5.0	14.5	400	—	—	445W	570W	680W
PL-177A	6.0	3.3	75	96W	140W	210W	—	—
PL-8295/172	6.0	7.8	1000	—	—	1020W	1280W	1540W
PL-8432	6.0	7.8	1000	—	—	1020W	1280W	1540W

*Actual power output delivered to load from typical amplifier.

These Penta beam pentodes are finding wide use for linear amplifier service. Reason: You get higher power output at lower plate voltages with minimum distortion. For 50-watt to 200-watt peak output service, choose the PL-177A. With the PL-175A, a 400-watt tube, you can replace the 4-400A, directly, provide substantially higher output without circuit or voltage changes. Both of these plus the PL-8295/172 and PL-8432 feature Penta's exclusive vane-type suppressor grid design for extra efficiency and linearity. Ceramic construction of the PL-8432 means greater shock and vibration resistance, plus high allowable operating temperature capability. For details, write The Penta Laboratories, Inc. 312 North Nopal St., Santa Barbara, California 93102. A Subsidiary of Raytheon Company.

Penta®

For further information, check number 5, on page 110

EIMAC salutes W6DNG: first across the Atlantic on 144 Mcs!

On April 11, 1964, W6DNG of Long Beach, California and OH1NL of Nakkila, Finland established two-way 144 Mcs contact via moon-bounce! This record-breaking communication was the result of years of patient effort and experiment. The difficult earth-moon-earth path was successfully conquered by a combination of radio amateur "know-how," enthusiasm, and state-of-the art equipment. High gain antennas, low noise narrow-band receivers and a reliable kilowatt transmitter using Eimac 4CX250B's joined with VHF experience to break the VHF communication barrier between Europe and North America. Eimac joins the A.R.R.L. and all radio amateurs in saluting W6DNG and OH1NL: two radio amateur pioneers, blazing a trail of achievement in long distance VHF communication. EIMAC—a division of Varian Associates, San Carlos, California.

Eimac

For further information, check number 6, on page 110

ZERO BIAS

UNDER new British reciprocal licensing procedures radio amateur reciprocal agreements have been negotiated by the British Post Office with Austria, Luxembourg and the Netherlands. These are the first countries, outside of the British Commonwealth, with which reciprocal operating agreements have been negotiated. Similar agreements between the United Kingdom and other countries, including the U.S., are believed to be in the process of negotiation.

Publicity

An opportunity is at hand to publicize ham radio as never before. Columbia Pictures Inc. has offered hams the chance to establish simple stations in the lobbies of many theaters for the purpose of handling message traffic to US servicemen, in conjunction with the showing of a new movie, "The Bedford Incident."

The movie hasn't got the slightest thing to do with amateur radio, but is a drama set aboard a modern US Navy destroyer in the Greenland Straits. It's a fast moving, tense production starring Richard Widmark, Sidney Poitier, Wally Cox, Eric Portman and other equally prominent Hollywood personalities.

Columbia's reasoning is that a relatively large portion of the million's of anticipated patrons, will know of someone in the military service, somewhere beyond the reach of normal communications facilities. Amateur radio can supply a link to many of these fellows through its traffic nets and message handling abilities, and in doing so, add stature to the movie and our hobby.

The proposed method of operation is quite simple: local amateurs merely approach theater managers in their area requesting permission to locate a small, neat station in the theater lobby for the duration of "The Bedford Incident" run at that theater. The manager will have been forewarned of your possible arrival by Columbia's Special Projects Dept., so things should generally be pretty agreeable.

Posters will be supplied by Columbia to dress up the station a bit and tell theater patrons just what all the noise is about. Of course, there is no need to man the station continuously—a few hours during the evenings should suffice. In fact, if the local club is prepared to pitch in, the whole affair might take only 2-3 hours per member. Naturally, you'll have to assure the theater manager that all 47 members of the Podunk Hollow ARC won't be there at once to glob-up his lobby, but this is obvious.

About the messages: Keep 'em short, post the ARL standard messages (and *use* them) and use good judgment in screening out the "kooks." Remember, it's a lot easier to pass along an "ARL 24" than a hundred word love letter. Don't make promises, but in reply to queries, emphasize the volunteer nature of all amateur message handling. Above all, don't let yourself get carried away and use your hard earned license in a manner that would jeopardize it. That is, *don't* play publicity agent for "The Bedford Incident."

The opportunity also exists to give the local group some good hometown newspaper and radio coverage. If you intend to involve yourself in the project, you might just as well blow your own horn a bit. Call at the local newspaper office once you've got the ball rolling. You'll probably find them eager to lend a hand in the form of a small feature story, with ham radio right smack in the middle.

By the time you read this, stations will have been in operation in at least four theaters in four "Navy Towns," including the world premier at New London, Conn. If all has gone well, we will try to bring you some picture coverage of the operation in next month's *CQ*. We welcome any news and photos relating to "Operation Bedford" in your area.

The picture will be shown throughout the U.S. for a total of about 120 days, beginning on October 11, and nearly 10,000 theaters will be involved, so the opportunities for participation are limited only by your willingness to perform. And by the way, you just might be able to wangle a few free tickets for your efforts!

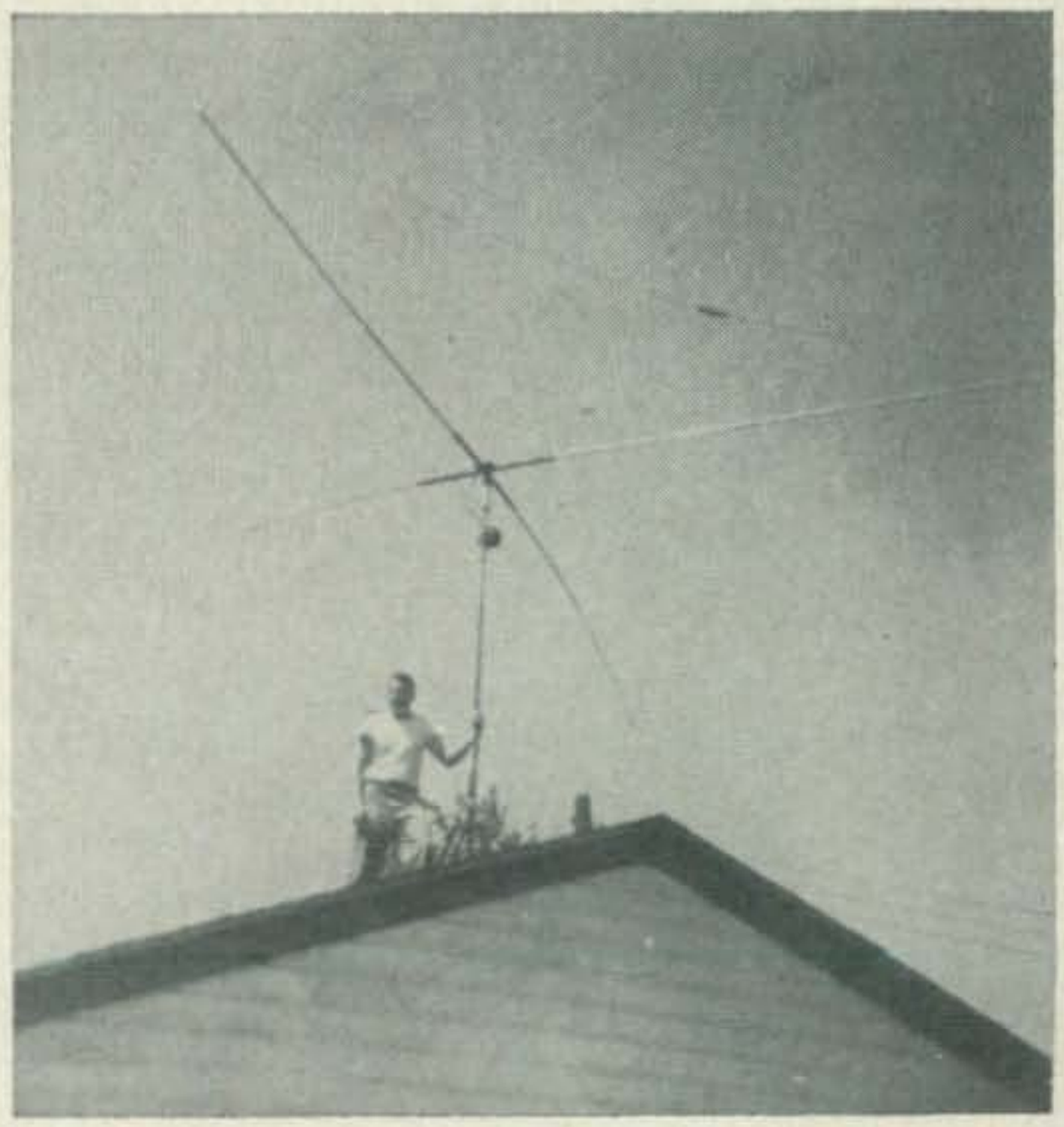
73, Dick, K2MGA

Eric Portman, Richard Widmark and Sidney Poitier in a scene from "The Bedford Incident."

G4ZU X Beam

Editor, *CQ:*

Enclosed is a picture of my recently completed G4ZU X Beam for 20. I wish to thank you people for such a fine article in your June issue and would like to report it works very well for me. It is one of few home brew projects that I have attempted and am very pleased with the results. I plan to raise it and put an antenna rotor on it soon.



Again thank you for the fine article and please keep up the good work. I enjoy *CQ* very much and look forward to its arrival each month.

Bill Steene, WB2SSK/WA4TJM
Box 22
Hamilton, New York

September Zero Bias

I have never before been moved enough by editorials to sit down "and take pen in hand," etc., etc. However, your ZERO BIAS of the September 1965 issue did the trick, particularly the one on Records. Your piece on congressman from Ohio, Frank T. Bow, was a classic and no doubt Bow is searching for a hole to crawl into—but the delightful piece was the following one covering a small (?) matter of records! Very cleverly done and in good taste with enough edge to make a strong point.

For further information, check number 8, on page 110

THE SWAN-350 SSB TRANSCEIVER

Ask the ham who owns one

For further information, check number 9, on page 110

5 BANDS—400 WATTS $395

HOME STATION—MOBILE—PORTABLE

Model 117C Power Supply.....$85

SWAN ELECTRONICS
Oceanside, California

As most editors, I realize you hate to dignify scurrilous statements on the pages of your own periodical, but when such ammunition is left available one would be a fool not to utilize it and I have to admire the course you took in this instance.

Many retaliatory comments have been published to W. Green's inane outbursts but none that should strike home more than that which we are discussing. But then again, the fortress of self-righteousness that he has built around himself, perhaps even this will not bring him to his senses.

I guess what pleases me the most is the fact that someone in his (Green's) own field took the time to air the facts whereas in the past his potshots—fall where they may, hurt whom they may—went unchallenged. The regular Joe usually didn't have recourse to defend himself against the snide comments published in *73* as was the case of Art Polley. Here's a case where a ham went to help a ham only to have his family insulted in printed form via the editorial page.

Anyway, Dick, your ZERO BIAS made my day—Thanks.

Nick J. Laub, WØIIC
Minneapolis 22, Minnesota

Editor, *CQ:*

Re: your ZERO BIAS in Sept. '65 issue. How about sending a reprint of that article to all the congressmen asking them to vote against the HR-377 account. It's illegal, offensive and maybe even a bit "stoopid." Make a monkey out of him, or maybe it's too late.

One gripe I have; it's against all these small magazines and publications that go for a while then stop and let the subscribers hold the bag. *ATV Experimenter* seems to be the latest one. Maybe there should be a law requiring all these new ones starting to be bonded to protect their subscribers. How about a comment on this? That needle should make NSD jump. Hope you have a fine vacation or perhaps you already had it.

"Al" Johnson, K7VQI
Tucson, Arizona

The Mars QSO Trophy

Editor, *CQ:*

The Elser-Mathes Mars QSO Trophy in the ARRL museum was not donated as a "tongue-in-cheek award," nor as a "wry jest," nor a "decade ago." [ZERO BIAS, Aug.]

The trophy was donated to ARRL in 1929 by myself (then Philippine K3AA) and by the late Lt. Comdr. Stan Mathes, USN (then K1CY and SCM of the Philippines), as an inspirational type award, not to be easily won, and planned to stand unclaimed for years as amateur radio slowly reached its present heights of technical perfection.

During the decade of the twenties, more and more DX records were being broken every year as the then-new short waves were exploited by the amateurs. Cup after cup, and award after award were quickly won, and the achievements quickly became passe as greater and greater perfection was attained. For this reason, Stan Mathes and I wished to present an award that would stand as a goal for many years.

Although received with some scepticism in 1929, I think you will agree that it now stands much closer to being won, and I hope you will correct the false impression you have given your other readers of the true motives we had nearly four decades ago!

Col. Fred J. Elser, W6FB/W7OX
Palm Springs, California 92262

Diode Sources

Editor, *CQ:*

In regard to silicon diode and transistor sources, you might like to know one man's opinion of various sources. I have found the following sources of them the most reliable and inexpensive: Electronic Components Co., Warren Electronic Components, Meshna Co., for some things, Alco for some things (*e.g.*, circuit boards), and TAB. Exceptions to any given experience with these firms exists and there are other suppliers which are supposed to be useful and reliable. But my principal experience has been with the above, and I offer it for what it is worth. It can be a tedious and expensive thing to find out.

R. L. Gunther, W6THI
Los Angeles, California

NOW! A TRI-BAND SSB TRANSCEIVER KIT FOR 179.95

NEW EICO 753 SSB/AM/CW TRI-BAND TRANSCEIVER

Build the finest of SSB/AM/CW tri-band transceivers with 200 watts of SSB punch and every wanted operating facility, plus the extra reliability and maintenance ease inherent in kit design. Assembly is made faster and easier by VFO and IF circuit boards, plus preassembled crystal lattice filter. Rigid construction, compact size, and superb styling make this rig equally suited for mobile and fixed station use. The new EICO 753 is at your dealer now, in kit form and factory-wired. Compare, and you will find that **only the 753 has all these important features:**

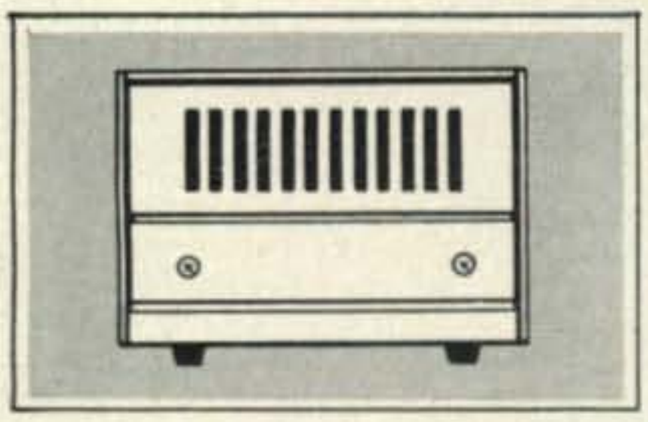
■ Full band coverage on 80, 40 and 20 meters. ■ Receiver offset tuning (up to ±10kc) without altering transmitter frequency. ■ Built-in VOX. ■ Panel selected VOX, PTT & STANDBY. ■ High level dynamic ALC to prevent flat-topping or splatter and permit the use of a linear amplifier. ■ Automatic carrier level adjustment on CW and AM. ■ Dual ratio ball drive permits single knob 6:1 rapid tuning and 30:1 vernier bandspread (over 10 degrees of scale). ■ Position of hairline adjustable on panel. ■ Illuminated S-meter/PA Cathode Current Meter and tuning dial. ■ Fast attack, slow decay AGC. ■ Grid-block break-in CW keying. ■ Product detector for SSB and CW, triode detector for AM. ■ TR relay with auxiliary contacts for use with high power linear amplifier. ■ Includes mobile mounting bracket.

ADDITIONAL SPECIFICATIONS

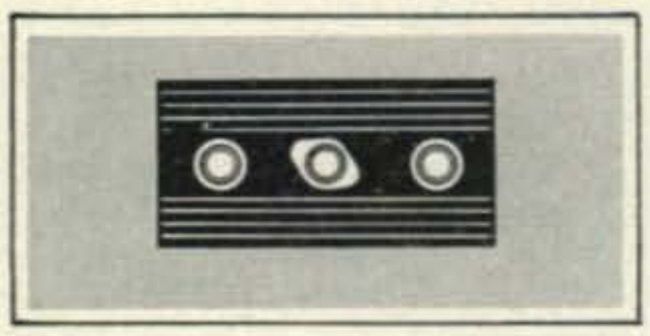
FREQUENCY COVERAGE: 3490-4010kc, 6990-7310kc, 13890-14410kc. SSB EMISSIONS: LSB 80 and 40 meters, USB 20 meters. RF POWER INPUT: 200 watts SSB PEP and CW, 100 watts AM. RF POWER OUTPUT: 120 watts SSB PEP and CW, 30 watts AM. OUTPUT PI NETWORK MATCHING RANGE: 40-80 ohms. SSB GENERATION: 5.2 Mc crystal lattice filter; bandwidth 2.7kc at 6db. STABILITY: 400 cps after warm-up. SUPPRESSION: Carrier-50db; unwanted sideband-40db. RECEIVER: Sensitivity 1uv for 10db S/N ratio: selectivity 2.7kc at 6db; audio output over 2 watts (3.2 ohms). PANEL CONTROLS & CONNECTORS: Tuning, Band Selector, AF Gain, RF Gain, MIC Gain with calibrator switch at extreme CCW rotation, Hairline Set (capped), Mode (SSB, AM, CW, Tune), Function (Off, Standby, PTT, VOX), Carrier Balance, Exciter Tune, PA Tune, PA Load, Receiver Offset Tune, MIC input, phone jack. REAR CONTROLS & CONNECTORS: VOX Threshold, VOX delay, VOX sensitivity, Anti-VOX sensitivity, PA Bias adjust, S-Meter zero adjust, power socket, external relay, antenna connector, key jack, accessory calibrator socket. METERING: PA cathode on transmit, S-Meter on receive. SIZE (HWD): 5 13/16" x 14¼" x 11¼". POWER REQUIREMENTS: 750 VDC at 300 ma, 250 VDC at 170 ma, -100 VDC at 5 ma, 12.6 VAC at 3.8 amps.

The Model 753 is an outstanding value factory-wired at $299.95.

Power Supplies Tailored for Optimum Performance of the 753.



Model 751 Solid State AC Supply/Speaker Console.
Matching table-top companion unit. Built-in PM speaker.
Kit $79.95 Wired $109.95



Model 752 Solid State Mobile Supply.
For use with 12 volt positive or negative ground systems. Fully protected against polarity reversal or overload.
Kit $79.95 Wired $109.95

For further information, check number 11, on page 110

EICO For FREE Catalog and 753 Spec. Sheet write to EICO Dept. CQ-11
131-01 39th Ave., Flushing, N. Y. 11352

Keep The Customer Happy

Editor, *CQ:*

I have never had a letter published in your magazine.

Red Blanchard
13048 Cantara Street
No. Hollywood, California

Now you have.—*Ed.*

Ham in Space, Beware!

Editor, *CQ:*

Your August editorial, though fermenting with nationalist pride, contained the seeds of a grotesque misunderstanding. First, be assured we wish your Astropersons the best of success, no less so for their being amateurs of licensed status. It is imperative, however, that both you and they be aware that a license has sovereign origins and territorial limits. Persons will not be heard operating moon for much the same reasons as prevent them from activating an automobile on the highways of Georgia using an Abyssinian operator's permit.

All electro-amateur activity on this body is authorized and regulated by this office. Transients, persons may appear here for license and examination at their convenience any third Thursday from 14:00 to 14:17. We will be pleased to receive them. They will be required to be reasonably fluent in our basic language and any seven of the subdialects in as much as all modulation must be of an oral nature. C.w. is totally prohibited unless used as a distress signal.

Violation of our law could only lead to grave relationships and some very, very high tides on your earth.

Most Cordially,
PONEROS, MØON

Thoughts From A Novice

Editor, *CQ:*

I have just subscribed to your fine magazine. I have an idea on a different type of incentive licensing—I am a Technician—I operate only 2 meters c.w., s.s.b., a.m., f.m., m.c.w. I cannot or rather dare not operate six (transistor TV boosters), I can overload them with the output of my signal generator running through a low pass filter. I want to get my general, but lack the practice needed to get proficient at c.w. There is little activity in this direction up here and to work into San Francisco on any place south (nobody to the West except Hawaii) is extremely difficult Here is my proposal:

Allow the Technician licensed amateur the chance to obtain a Novice class license.

The present law allows an unlicensed person who has never been previously licensed the chance to obtain both the technician and novice licenses. Yet the technician may not. It is obvious that the holder of both licenses can have his cake and eat it too. He may fun a kw on the Technician bands and experimenting all he wants to and then he can also get to the low bands and operate c.w. and thus obtain the needed practice. My proposal would allow the Technician licensed amateur who has never held either a higher class license or a Novice class license a chance to qualify for the Novice license. In doing so, he would still retain his present status as a Technician and would also have the privileges of a Novice. His call would be his present call with the proper Novice prefix, *e.g.*, WB6-WN6, WA6-W6. I am sure many Technicians would try for the Novice license and would eventually become General class licensed amateurs or higher.

Noland L. Lewis, WB6CKT
4711 Bridle Trail
Santa Rosa, California

It's That Time of The Year Again

Editor, *CQ:*

As Secretary of the Eight Ball Net, I have received word that Santa Clause, in his busy schedule, has once again planned to appear on the amateur Band Frequency of 50.50 mc at approximately 0230 GMT on the 25th of December during the evening session of the Eight Ball Net, to talk with amateurs and their children. . . .

Santa has asked me to accumulate the names of all the interested amateurs along with their call and location and the names of their children, their ages and what they want most for Santa to bring them... In order for me

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 644.50, 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. Operates perfectly with SB-34 but can boost the output of any SSB exciter to a full KW. AC power supply is built-in.

4-bands, 80, 40, 20, 15 meters • Full band switching • Passive grid input for resistive load to exciter. Drive: 60W or more depending upon the linear amplifier power output • **Low plate voltage** (800 volts) and high plate current • Easier on capacitors, rectifiers, power transformers • Safer under environmental extremes • **High filter capacity** for dynamic regulation • **Built-in antenna relays** (2), **internal blocking bias • HI/LO power and TUNE/OPERATE switches • Panel meters for output and plate current • Six parallel-connected 6JE6's are used in amplifier • 115V AC power supply (built-in) is all-solid-state. Size:** 5¼"H, 11¾"W, 11⅝"D. Wgt, 35 lbs. (apprx).

SB-34 TRANSCEIVER 395.00

New . . . advanced . . . with important plus performance features! Transistors and diodes replace vacuum tubes (except for the 2-6GB5's in PA and 12DQ7 in RF driver) — equipment size is reduced greatly — current drain lowered substantially. Example: **SB-34 draws only 500 ma on receive standby.**

Built-in supply for 12V DC and 117V AC • Power input: 135 watts P.E.P. (Slightly lower on 15 meters) • **Frequency range:** 3775-4025 kc, 7050-7300 kc, 14.1-14.35 mc, 21.2-21.45 mc • 23-transistors, 18-diodes, 1-zener, 1-varactor, 2-6GB5's PA, 1-12DQ7 driver • **No relays — solid state switching — breakthrough! USB or LSB selectable by panel switch • Collins mechanical filter — transmit/receive • Delta receiver tuning • Solid-state dial corrector • prewired for VOX/100kc calibrator accessories** — both units are optionally available. **Single-knob dual-speed tuning. Size:** 5"H, 11¼"W, 10"D. Weight 20 lbs. (Approx).

SIDEBAND SBE ENGINEERS

317 ROEBLING ROAD, SOUTH SAN FRANCISCO, CALIF.

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

For further information, check number 13, on page 110

to answer his request, I am asking for your help in making this happy event known to our fellow amateurs . . .

I will be putting a bulletin on the Eight Ball Net at both the morning and evening sessions, once a week during October, twice a week at each session in November and possibly daily thru the 10th in December. I will accept radiograms, phone calls, mail or in person any names who want to be included in the festivities from October 1st thru December 10th . . .

Alice MacKenzie, WB6GXI
Sec'y Eight Ball Net
23301 "C" Arlington Avenue
Torrance, California 90501

Names, Names

Editor, *CQ:*

I agree, W5BRR (Pots 'n Pans, but not W5BRR) [Sept. *CQ* Letters to the Editor] sure does have a *name!*

Robert M. Kelley, WØQVZ
Post Office Box K
Fort Dodge, Iowa 50502

Discrimination?

Editor, *CQ:*

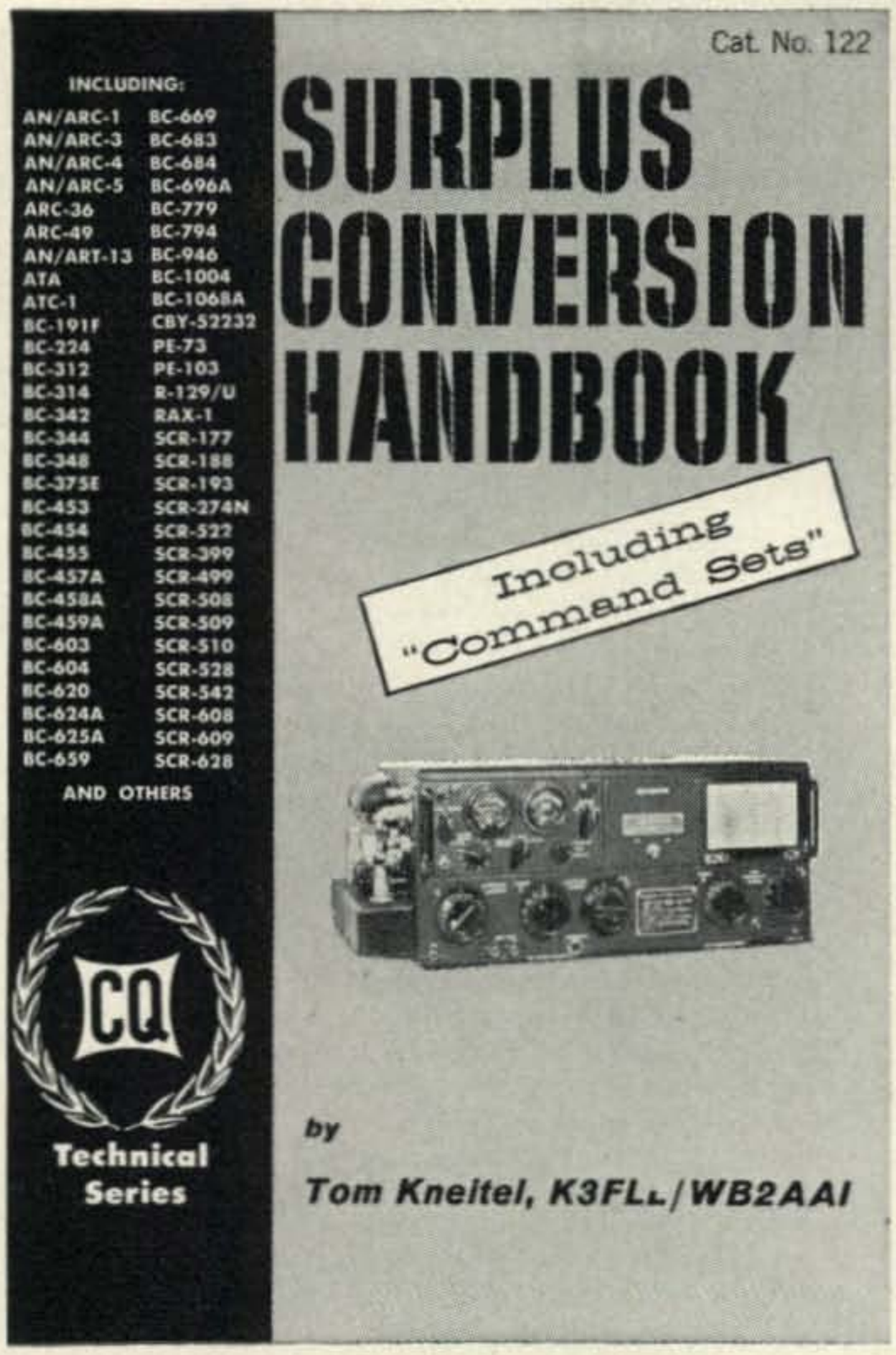
Gee Dick—Just want to let you know how surprised I was to see the irrational tirade the NOVICE Editor (W8ZCV) went on with in his July '65 column. Sure, it's fine if he doesn't agree with some of the proposed changes, but it gets my goat when people start shouting "discrimination" for something that shows a level of proficiency. When you stop and think for a moment, you will find this all around us. Why does a bus driver need a special license to drive a bus? Why does a pilot need to pass a flying test? And have a different class license for each type of aircraft he flys? Why can't the holder of a second class 'phone ticket be in charge of a radio station? (Should we do away with First 'Phone?) Or why is there a "discrimination between commercial radiotelegraph and radiotelephone licenses.

We could go on and on with examples like this, but I'm sure that if some thought is given to the subject, it's obvious that there is a reason and a place for each level of proficiency and as such deserves distinction. Suppose all the high school graduates were allowed to apply for a job by stating that "I have a *diploma,*" and college graduates by stating "I have a *diploma.*" No discrimination there, but no value either. Does a Ph.D. deserve to sign "Ph.D." after his name? Does he deserve certain privileges because he has a doctorate degree? Can anyone get a doctorate degree? Does an amateur extra licensee deserve certain privileges because he has an Amateur Extra class degree? Can anyone get an Amateur Extra degree?

Now how can Mr. Burdine compare a special call sign showing a degree of proficiency with a special call sign showing religion? Or sex? Or race? etc? . . . If that is the leadership the NOVICE Editor is going to give to the beginners in our hobby, I would strongly suggest he does take up "girl-watching" again.

James E. Cooper, W2BVE
834 Palmer Avenue
Maywood, New Jersey 07607

Our Most Popular Handbook



The most popular handbook ever to be presented in the CQ Technical Series was the venerable old "Command Sets." Countless signals on the air today are there because of the information contained in "Command Sets," which went on to become the standard reference guide and definitive work on the topic. It went through 5 sellout printings, and when the last book of the final printing was stripped from our stock room we decided that the next printing would be an even bigger, newer, expanded, revitalized version of "Command Sets."

Our new book is called "Surplus Conversion Handbook," it's 192 pages BIG (that's 58 pages more than its predecessor). We kicked out all of the space-taking ads which cluttered up the old book and replaced them with more conversions—conversions of surplus gear other than just "command sets" alone. So the new book contains all of the best command set conversions of the original edition, plus complete conversion details on a whole slew of the most popular military surplus gear available today, including such winners as: SCR-522, ART-13, BC-603, BC-620, BC-624, BC-659, BC779, ARC-1, ARC-3, ARC-4, and many more. Actually, it covers just about every piece of surplus gear which is worth the time and effort to convert for ham use.

"Surplus Conversion Handbook," Edited by Tom Kneitel, K3FLL/WB2AAI, is a book which every ham will find to be a valuable and interesting addition to the shack. It's available for immediate delivery.

COWAN PUBLISHING CORP., BOOK DIVISION
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

Gentlemen: Enclosed is $_____ for _____ copy(ies) of the brand new SURPLUS CONVERSION HANDBOOK. Please rush me one of the first copies hot off the press!

Name _____, Call _____

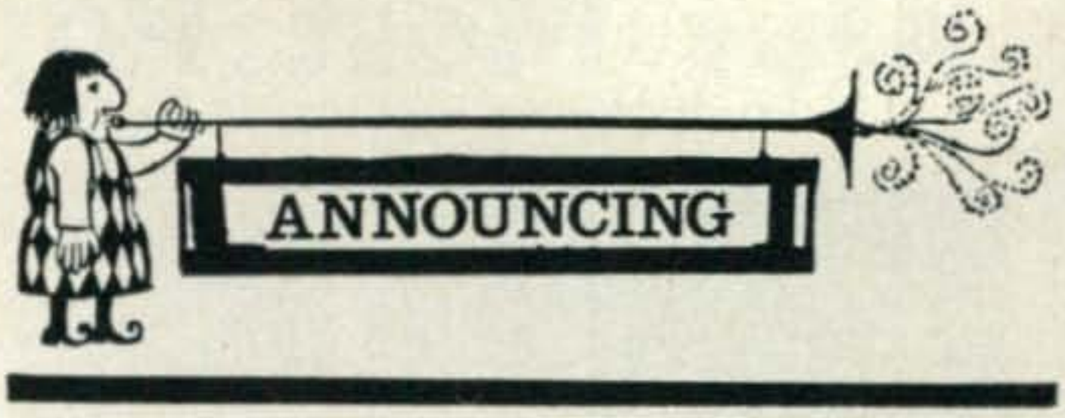
Address _____

City _____ State _____ Zip _____

PRICE: $3.00

SEND YOUR ORDER NOW!

*New York City and State residents must add sales tax applicable to your area.



Chicago, Illinois

John J. Lehman, W9NIX, of 5720 W. Eddy Street, Chicago, Ill. 60634, is compiling a list of hams who now work for, or have worked for the Bell System (A. T. and T.), Western Electric, Bell Pioneers or any affiliated telephone companies. If this concerns you, contact John and give him the information.

Ontario, Canada

Bob Wood, VE3GBW, announces the formation of the Ontario Teenage Net. All teenagers are invited to call in. The net will be held on 3680 kc every Saturday, beginning Oct. 2nd, at 1600 EST.

New Rochelle, N.Y.

The Communications Club of New Rochelle, N.Y. will hold its Annual Holiday Beef Dinner on Saturday, December 18, 1965 at the Davenport Club, New Rochelle. Reservations at $6.00 per plate may be sent to Henry Wymbs, WB2GMN, 100 Joyce Road, Hartsdale, N.Y. and should arrive before December 8th.

Anthony, Kansas

The Stateline Amateur Radio Club Picnic will be held at Municipal Hall, Anthony, Kansas, on Nov. 14. There will be a covered dish dinner at noon, (bring your own table service) and drinks will be furnished. Swap table and rag chew all day.

Stolen

The following items were stolen from the home of Wallace R. Cramond, K7AUI, 3919 Hynds Blvd., Cheyenne, Wyoming 82002: Northern Radio Co. Variable Master Oscillator, type 115 Model #1 Ser. #2430, Northern Radio Co. Dual Freq. Shift Tone Keyer type 153 Model 2, Hammarlund SP-600 JX17 Ser. #18148, Berkely Frequency meter type FR 67/U Ser. #1180, BC-221 AJ and I-177A tube tester, Heath SB-10. Anyone having information on the equipment contact K7AUI.

Springfield, Pa.

The Mobile Sixers Radio Club will hold their seventh annual Hamfest Banquet on Saturday, November 13, 1965, at the Alpine Inn, 642 Baltimore Pike, Springfield, Pa. For further details and reservations contact Mrs. Margaret Kennedy, K3FXP, 212 Blanchard Road, Drexel Hill, Pa. 19026.

Corrections

In the "Souping Up The Twoer" article (*CQ*, March, 1965, p. 35) Fig. 1 has pin 8 of the first 6AB8 grounded to Pin 6. There should be no connection or ground at this point. With reference to C_{52}, the author used a surplus capacitor. The original one can be used if the spacing between plates is reduced to about ¼ of the original spacing. This can be done by unsoldering the stater plate from the support bars and sliding it over closer to the rotor.

September LETTERS TO THE EDITOR section included a letter from Mr. C. S. Sheldon requesting that QSL cards sent by his recently deceased son be returned to the family. The son's, Charles F. Sheldon, call was listed as KØDZE, it should have been KØDZC.

"The Cortlandt Street Story" featured in the October issue should have included the following photo credits for page 31. The recent photo was supplied by Ray Hernandez of the *New York Daily News*, the older one is through the courtesy of Mr. I. Sy Seidman, 112 West 44th Street, New York, N.Y.

St. Louis, Missouri

The St. Louis Radio Club will hold its third annual Ham Gathering to present the Amateur of the Year Award on Nov. 19. The club invites nomination for the award from the St. Louis area. Numerous talks and displays are planned by notable hams. For complete details contact Ernest Roehm, 619 County Hills Dr., St. Louis, Mo. 63119.

Thanks Ted

We take our "Specs" seriously

BOB WATERS W1PRI

THEODORE F. BRIX
FRESNO, CALIFORNIA

August 21 1965

Waters Manufacturing, Inc.,
Wayland, Massachusetts.

Dear sirs:

I have just purchased one of your Model #370 Auto-Match antennas for my mobile and have been very pleasantly surprised. The antenna which I previously was using was impossible to load without some form of matching device; I used a "Z" match with a condenser combination. When I installed the Waters, and after reading the literature I noted that you stated that it would match into 50 ohms. This I could not believe however I decided to give it a try, so I removed the matching network and connected the 21' 52 ohm cable directly to the antenna base. Not only did it match perfectly but I also picked up slightly over 2 volts of r. f. measured on the field strength meter. Also I found that the transmitter tuned (final tank) exactly the same position as when the transmitter was used in the shack against a dipole fed with 52 ohm line. Now what puzzles me is; how your able to construct such a coil which will match into 52 ohms where most antennas require some sort of matching section? I have operated mobile for many years having been on the air for over 30 years. Without wanting you to give away some "trade secret" and so I won't have the coil x-rayed, I would like an answer. It really has me puzzled. Needless to say I am more than pleased with the performance which is much better than three other mobile antennas which I am comparing yours against - its far superior by actual measurement.

Thanking you, I am

RECEIVED
Aug 27 1965
WATERS

Respectfully yours
Ted Brix

Theo. F. Brix W 6 qfr
5573 No. Van Ness Blvd
Fresno 5, California

WATERS
MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

For further information, check number 17, on page 110

CLUB FORUM

AL SMITH,* WA2TAQ

We might title this months column "Let them off the hook" and/or "Move over and make room for someone else." As you read further you'll possibly find the remarks have enough merit to warrant your clubs consideration.

To consider the first title; many of our club officers have stayed on in lead positions for many years. This has come to pass in some cases because of an apparent lack of available officer material. For the most part these leaders hold on to their titles doing the same good job year after year just to keep the organization from falling on its face. It's indeed unfortunate that the same people must be continually saddled with this work primarily because other club members are hesitant to take on the responsibility of leadership.

Everybody's too busy! No one has the time or perhaps they haven't the guts to take on a job that requires leadership, or could be that some are afraid their XYL's wouldn't like it (again no guts).

But! the same bunch can find the time to attend meetings (particularly if there is a guest speaker to entertain them . . . or coffee and cake on tap following the meeting) . . . And they also seem to have endless hours to spend rag chewing. While the rest of the membership spends their leisure doing things that entertain themselves, the club leader must devote many hours to club activities and to do so must sacrifice his own pleasure.

Just for the heck of it, consider those you know in leadership positions in amateur radio. Just how many do you know that hold down more than one high position, doing the work that would normally require several people. Do any of your club officers also hold down positions in AREC, RACES, MARS, maybe a council office as well, or perhaps edit an amateur club publication. Who knows maybe he does all of those listed above.

There are many very capable people doing absolutely nothing in amateur radio other than the things that give them enjoyment. Is it fair to keep the same ones tied down year after year?

Is this situation prevalent in your club: does your club President also have to do the secretary's job, edit your publication, run the club net, secure the guest speakers, send out the meeting notices, maintain the club station, take

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

Be "winter ready" to work 10, 15 and 20 M

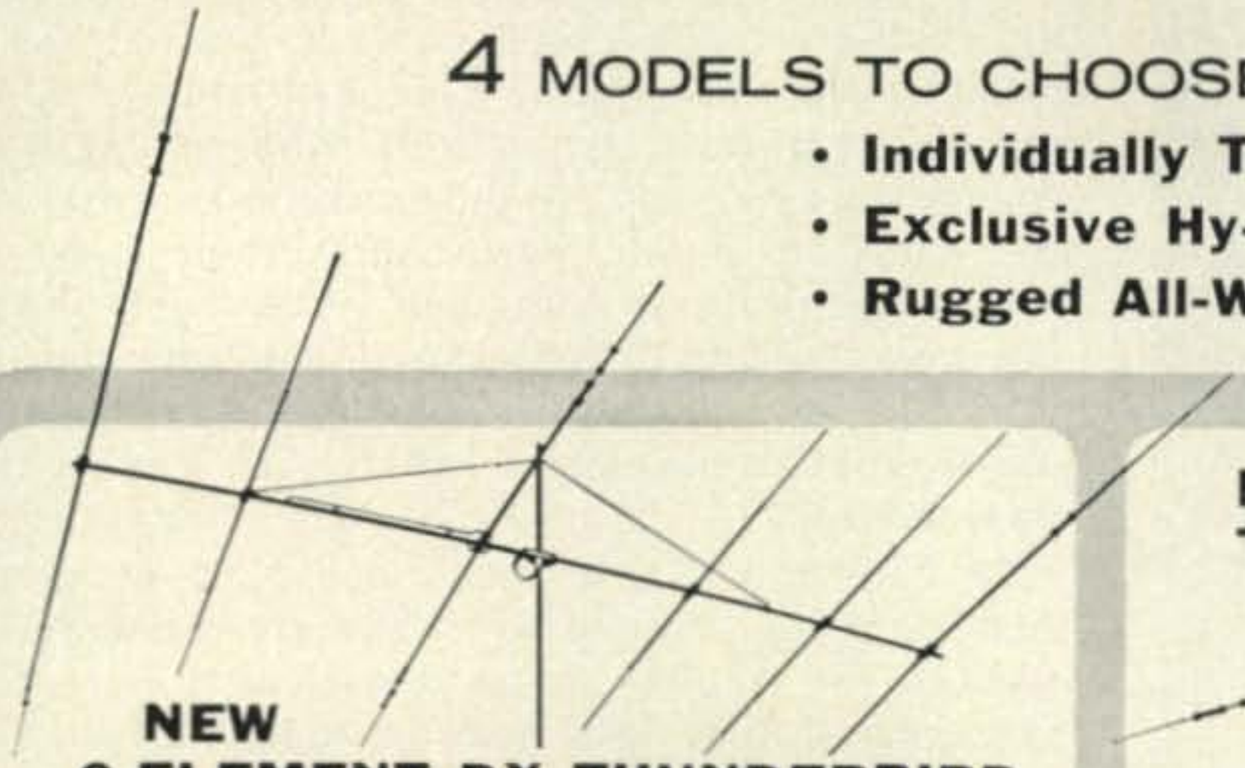
with a new hy-gain

THUNDERBIRD

10-15-20

4 MODELS TO CHOOSE FROM—ALL FEATURING...

- **Individually Tuned Hy-Q Traps for each band**
- **Exclusive Hy-Gain Beta Match**
- **Rugged All-Weather Construction**



NEW 6-ELEMENT DX THUNDERBIRD

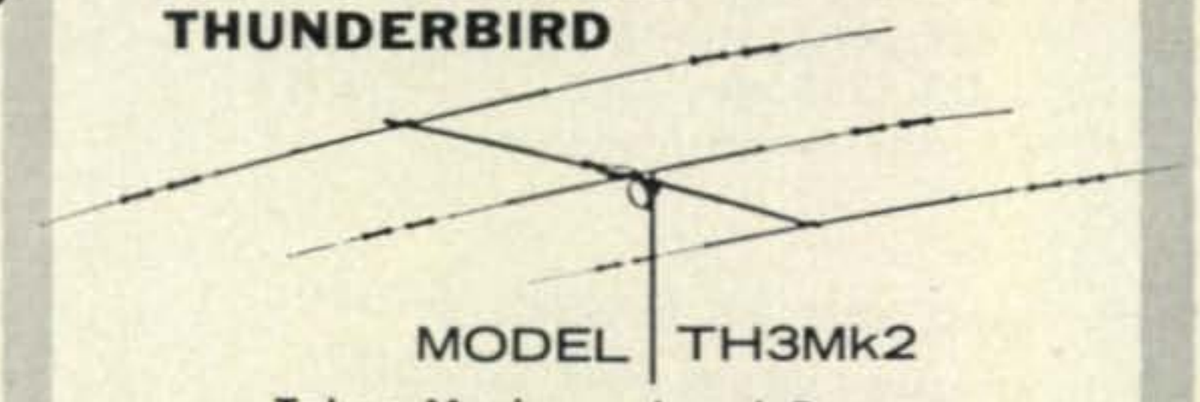
MODEL TH6DX

Takes Maximum Legal Power

The Model TH6DX offers the ultimate in tribander performance and mechanical reliability for 10, 15 and 20 meters...is superb on DX and other long haul contacts. Individually tuned Hy-Q traps for each band insure peaked performance working phone or CW. Feeds with 52 ohm coax. Beta matched for optimum gain and maximum F/B ratio without compromise. SWR less than 1.5:1 on all bands. 24' boom; longest element, 32'; 47 lbs. net. Survives winds up to 100 MPH.

MODEL TH6DX ..... **$139.50** Net.

NEW 3-ELEMENT THUNDERBIRD



MODEL TH3Mk2

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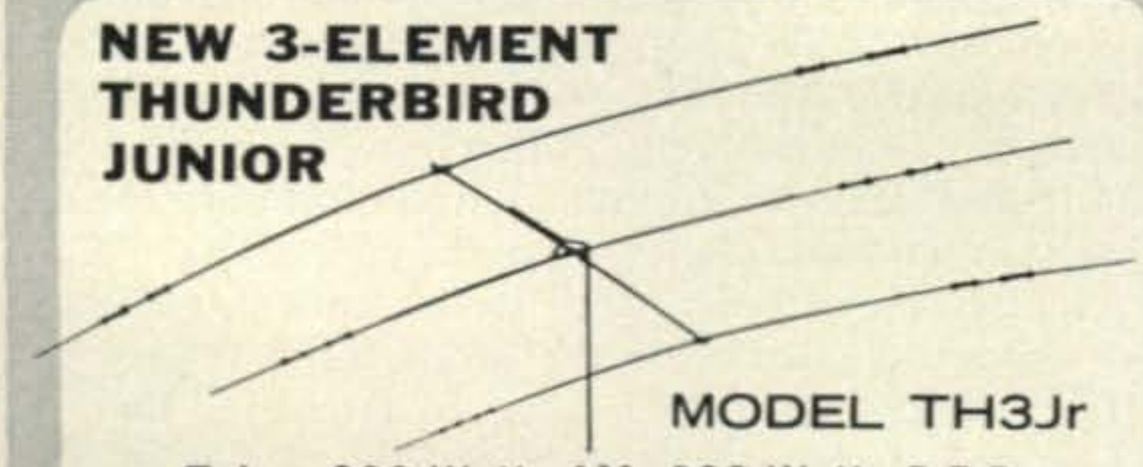
The Model TH3Mk2 is an outstanding performer on 10, 15 and 20 meters. Individually tuned, large diameter Hy-Q traps provide peaked full-size performance on each band. Feeds with 52 ohm coax. Is beta matched for optimum gain, maximum F/B ratio without compromise. SWR less than 2:1 at resonance on all bands. 14' boom. Longest element, 28'. 36 lbs. net. Heavy gauge seamless construction—survives winds up to 100 MPH.

MODEL TH3Mk2 ..... **$99.75** Net

NEW 3-ELEMENT THUNDERBIRD JUNIOR



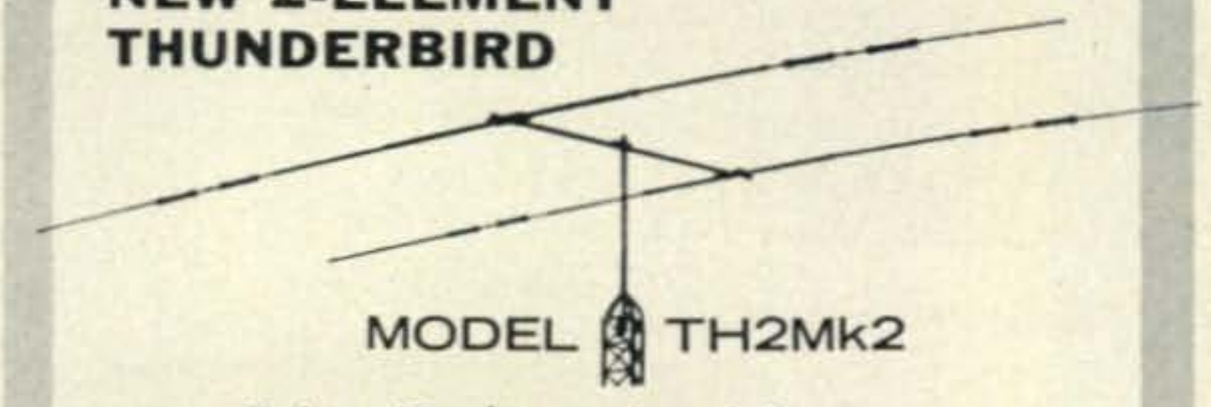
MODEL TH3Jr

Takes 300 Watts AM; 600 Watts P.E.P.

A compact, 3-element tribander designed to deliver outstanding performance where hampered by severe space limitations. Ideal for roof-top or lightweight tower installations. Individually tuned Hy-Q traps for each band. Beta matched for maximum gain and F/B ratio. Rotates with heavy duty TV rotator. SWR less than 2:1 at resonance, all bands. Rugged construction...withstands 80 MPH winds. 12' boom. Longest element, 26'. 21 lbs net.

MODEL TH3Jr ..... **$69.95** Net

NEW 2-ELEMENT THUNDERBIRD



MODEL TH2Mk2

Takes Maximum Legal Power

A ruggedly constructed compact tribander for 10, 15 and 20 meters that installs most anywhere...delivers excellent performance. Individually tuned Hy-Q traps for each band. Beta matched for maximum gain and F/B ratio without compromise. Rotates with standard TV rotator. SWR less than 2:1 at resonance on all bands. Heavy gauge seamless aluminum construction...withstands winds up to 100 MPH. 6 ft. boom. Longest element, 28 ft. 23 lbs. net. MODEL TH2Mk2 ..... **$69.95** Net

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Install yours now before the snow flies!

HY-GAIN ELECTRONICS CORPORATION

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48 different models of highest performance antennas for HF bands. Write for your copy today.

For further information, check number 19, on page 110

care of TVI problems? If this is the case, then it's time to start an aide program right now. Give the old boy a hand. Better yet, give him a chance to get off the hook.

Now then! We go to the extreme opposite of our first topic. That is, perhaps your club leaders should move over and make room for new blood. Yes, we do find some leaders that will not relinquish their jobs. Many of these so-called Club Bosses get a strangle hold on club positions and members, and won't let go for love nor money.

All too often these clubs are too one-sided and decisions made almost never go against the wishes of the ruling party. Like it or not, almost any club will have a clique of sorts and as is usually the case, they are the workers. However, this situation should never get out of hand. Many organizations with club bosses will find that some potential members will shun this type of group because they believe that new faces and fresh ideas may not be offered the deserved consideration.

Of course, we have many dedicated people that are doing yeoman work and are a definite asset to the amateur radio community. If you have one of these rare cases in your club, then the foregoing may not apply. If he or she wants to continue in office and has an open mind, displaying fairness to all, then congratulations you and your fellow club members have a winner. But remember that this ham may also be too good natured to say that he wants out.

There is an answer to both the problem of the club boss and the fellow who wants out. That is, to effect a by-law change that prohibits a President or other office involved from staying on the job too long. Some clubs put a one year limit on certain positions—others make it two. Some leave the door open for an officer to come back to office at a future date by stating that no officer (in the position designated) may succeed himself. This means that they cannot be re-elected immediately following their term, but could again be nominated and elected to the position anytime after one year.

It may make good sense to list only those in an executive position in the limitation category. If a club can get a Secretary or Treasurer that is doing a first rate job and is willing to stay on, it may be prudent to shun limitations for those offices. When it comes right down to it these positions are the backbone of any organization. The keeper of the clubs funds must be a person who is not only adept at figures but must also have the well being of the club at heart. When your treasurer pops up at meetings to question disbursements of funds to be certain its necessary, then he's your boy, hang on to him.

The keeper of the clubs books also rates high. Experience has shown that a good record of club minutes are indispensible and go a long way to helping a club grow. Minutes can quickly settle any discussion concerning action previously taken. A good secretary means good minutes and if he can type, well, then brother, hang on to this one too. 73 Al, WA2TAQ.

NOBODY CAN BEAT OUR ANNIVERSARY SPECTACULAR TRANSCEIVER SPECIAL

MOBILE GALAXY V

POSITIVELY THE BEST TRANSCEIVER BUY EVER OFFERED THE AMATEUR....

REGULARLY PRICED AT **$469.95**

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USE WRL'S CHARG-A-PLAN — JUST $20 MONTHLY

SAVE $70.00 . . . If you buy now . . . A NEW *GALAXY V TRANSCEIVER* . . . featuring 300 WATTS PEP SSB/CW; FULL BAND COVERAGE on 80-40-20-15-10 meters . . . and it boasts the BEST — SELECTIVE RECEIVER (because of its 6 Xtal filter); and UPPER and LOWER selectable SIDEBAND!

Don't Forget . . . We're still offering you a **2 WEEK FREE TRIAL*** plus you can use our *NO DOWN PAYMENT CHARG-A-PLAN.*

We'll also allow you *WRL'S TOP TRADE-INS* on your present gear.

YOU JUST CAN'T GO WRONG! TAKE ADVANTAGE OF THIS SPECIAL OFFER TODAY!

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SPECIAL PURPOSE VFO covers MARS, CAP etc. . . . $89.95 write for details

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GALAXY V & DC P.S. MOBILE STATION $489.90
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Address_____

City_____ State_____ Zip_____

For further information, check number 44, on page 110

THINK SMALL...

PERFORM BIG

GO GONSET Sidewinder 2 Mtr.

Here's coverage of the entire 2 meter band in four, one megacycle segments, operation on SSB, AM, or CW, and all packaged in a sharp little chassis only 9" wide, 5" high and 7 3/16" deep.

The Gonset Sidewinder 2 meter transceiver is so compact that it's ideal for mobile as well as fixed station application. Separate 117 VAC and 12 V DC solid state power supplies snap on to the rear of chassis, or may be remotely positioned to simplify installation.

And look at some of the features Gonset builds in to provide top performance: complete push-to-talk operation, full 20 watts P.E.P. input, crystal lattic filtering, vernier tuning, transistors at primary stages, stabilized VFO and high-sensitivity reception.

SPECIFICATIONS*

Frequency Range	143.975 to 148.025 MC
Modes of Operation	AM, SSB, CW
Carrier Suppression	50 db
Sensitivity	0.5μv for 10 db $\frac{S+N}{N}$
Selectivity	3.1 KC crystal bandpass filter
Output impedance	50 ohms
Audio Output	2.5 watts into 3.2 ohms
Antenna Input Impedance	50 ohms unbalanced

NEW* – from GONSET

- Two new power amplifiers—model 903A for 2-meter, model 913A for 6-meter
- The GSB-201 Linear Amplifier—provides 2000 watts PEP(SSB) for 10 to 80 meter operation
- Gonset Sidewinder 6-meter SSB-AM-CW Transceiver with all the features of the 2-meter.

* Complete descriptions and specifications on all Gonset equipment is yours for the asking. Write to Dept. 73-7.

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For further information, check number 22, on page 110

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NOW AVAILABLE IN MANY AREAS

PRODUCTS

HF-SSB (1.6-16 Mc/s.)
- Point-to-point
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- Military
- Point-to-point
- Voice
- RTTY
- Data

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- Military
- Point-to-point
- Voice
- RTTY
- Data

- Antennas
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A **complete line** of two-way equipment is sold —
Directly to U. S. Military Agencies, to other two-way radio manufacturers, and by dealers throughout the world.

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✓ An FCC second-class radiotelephone license.

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✓ An established business with good credit rating.

✓ Enthusiasm to promote sales of COMCO radios.

For complete information on available dealerships in your area, write or telephone today to Frederick R. Macklin, Sales Manager.

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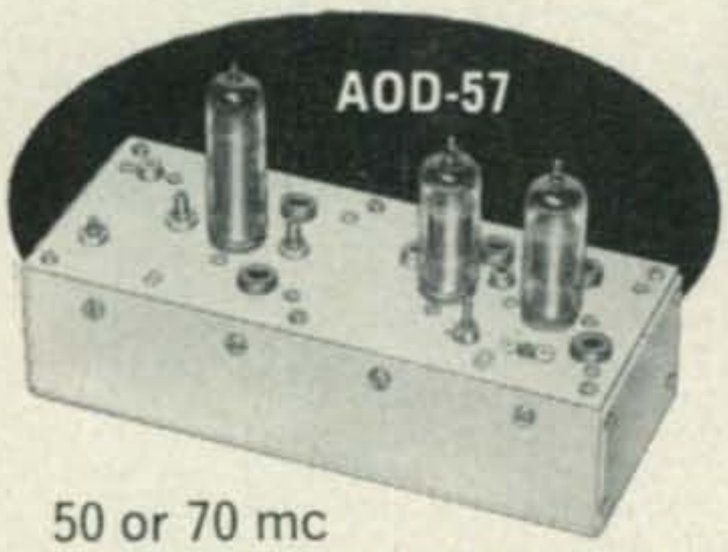
Telephone (Area 305) 445-2671

For further information, check number 24, on page 113

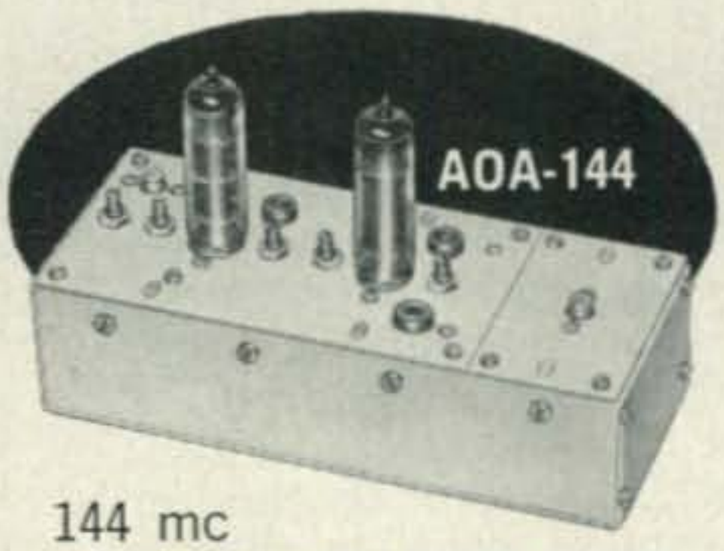
NEW FROM INTERNATIONAL

VHF/UHF UNITIZED TRANSMITTERS 50 mc—420 mc

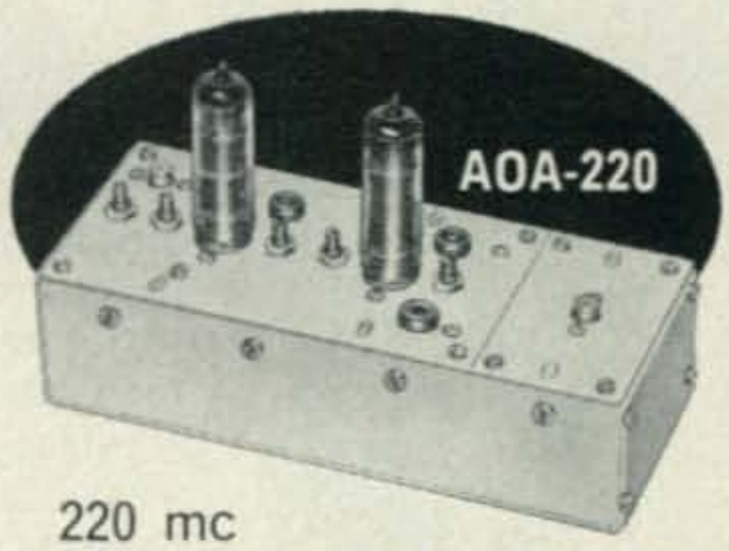
International's new unitized VHF/UHF transmitters make it extremely easy to get on the air in the 50-420 mc range with a solid signal. Start with the basic 50 or 70 mc driver. For higher frequencies add a multiplier-amplifier. All units are completely wired. Plug-in cables are used to interconnect the driver and amplifier.



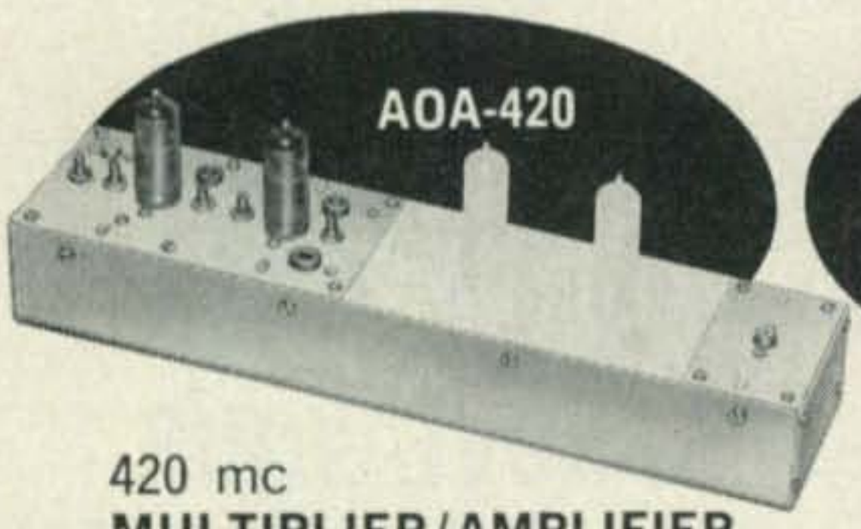
50 or 70 mc
DRIVER/TRANSMITTER
The AOD-57 completely wired with one 6360 tube, two 12BY7 tubes and crystal (specify frequency). Heater power: 6.3 volts @ 1.2 amps. Plate power: 250 vdc @ 50 ma.
AOD-57 complete.....$69.50



144 mc
MULTIPLIER/AMPLIFIER
The AOA-144 uses two 6360 tubes providing 6 to 10 watts output. Requires AOD-57 for driver. Heater power: 6.3 volts @ 1.64 amps. Plate power: 250 vdc @ 180 ma.
AOA-144 complete.....$39.50



220 mc
MULTIPLIER/AMPLIFIER
The AOA-220 uses two 6360 tubes providing 6 to 8 watts output on 220 mc. Requires AOD-57 for driver. Heater power: 6.3 volts @ 1.64 amps. Plate: 250 vdc @ 150 ma.
AOA-220 complete.....$39.50



420 mc
MULTIPLIER/AMPLIFIER
The AOA-420 uses two 6939 tubes providing 4 to 8 watts output on 420 mc. Requires AOA-57 plus AOA-144 for drive. Heater: 6.3 volts @ 1.2 amps. Plate: 220 vdc @ 130 ma.
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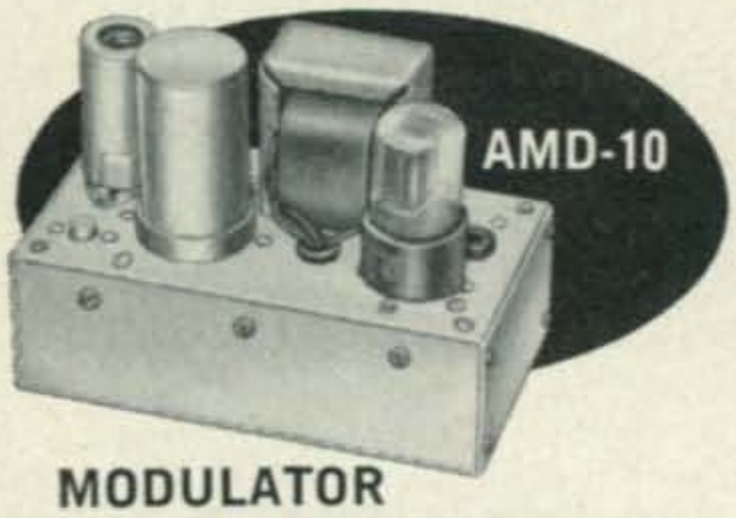
	220 mc	AOD-57 PLUS AOA-220
	420 mc	AOD-57 PLUS AOA-144 PLUS AOA-420



MODULATOR
The AMD-10 is designed as a companion unit to the AOA series of transmitters. Uses 6AN8 speech amplifier and driver, 1635 modulator. Output: 10 watts. Input: crystal mic. (High Imped.) Requires 300 vdc 20 ma, no signal, 70 ma peak: 6.3 vac @ 1.05 amps.
AMD-10 complete $24.50

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HD-10 SPECIFICATIONS — Keying: Keying Output: Keyed line to chassis ground. **Voltage polarity:** Negative to ground only. **Maximum open circuit or spike voltage:** 105 volts. **Key-closed voltage:** 0.2 volts, max. **Key-closed current:** 35 milliamperes, max. **GENERAL: Audio:** Internal speaker or high impedance headphone jack. **Transistor complement:** (7) 2N407 PNP; (3) 2N2712 NPN; (1) 2N398A PNP. **Controls:** Off-Operate-Hold switch; Speed control; Dot-To-Space ratio control. **Rear panel connections:** Keyed line; receiver audio; battery +45 volts; battery +22½ volts. External key options: hand key, dash arm, dash, dot. **Power requirements:** AC operation, 105-125 V. AC, 50-60 cps. Battery operation, 45 volts with 22½ V. tap; 14 milliamperes. **Dimensions:** 3¾" W x 4¼" H x 10½" D.

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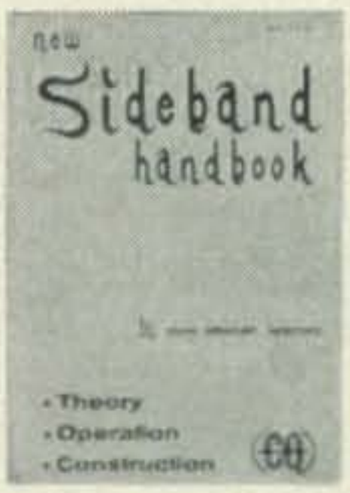

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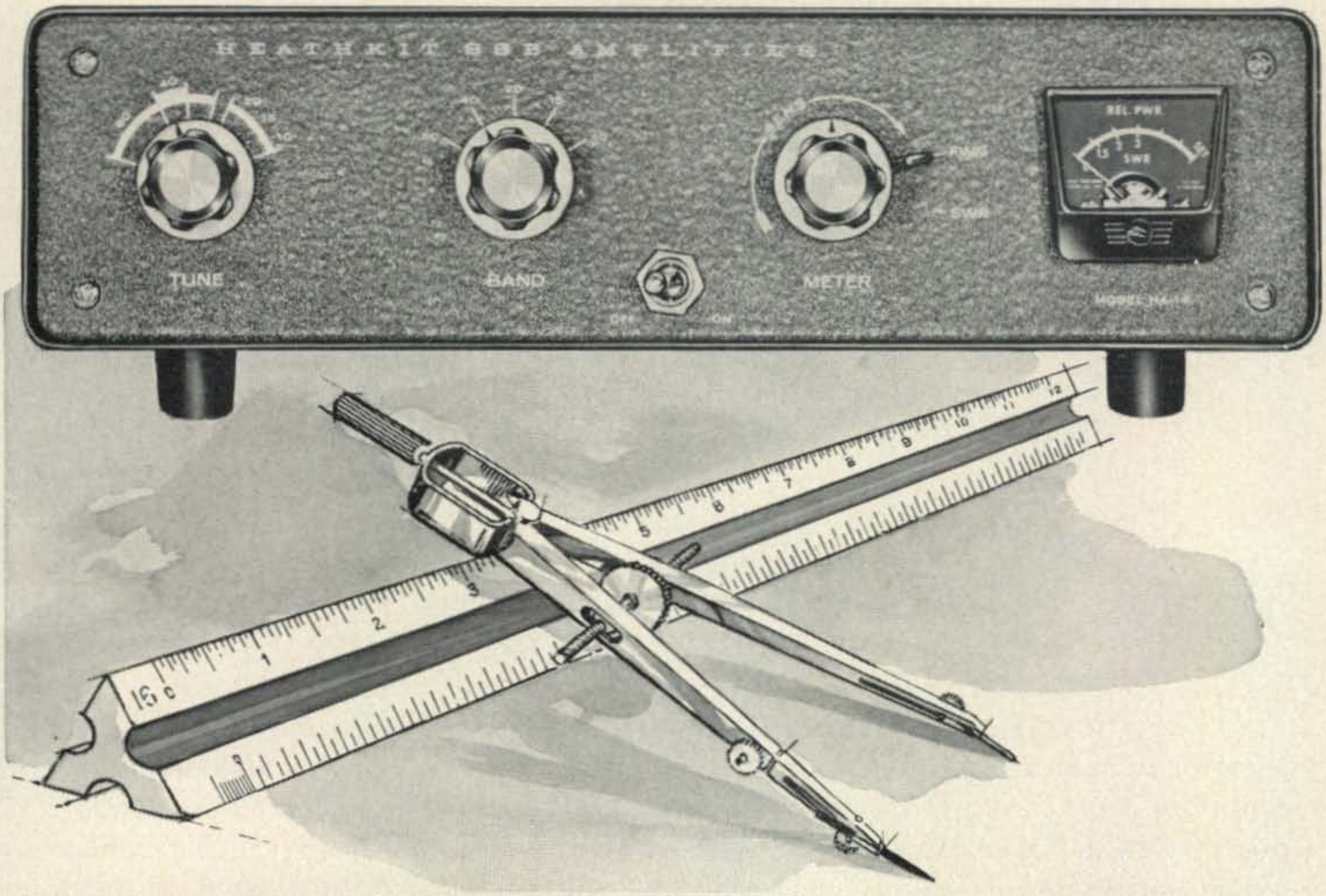

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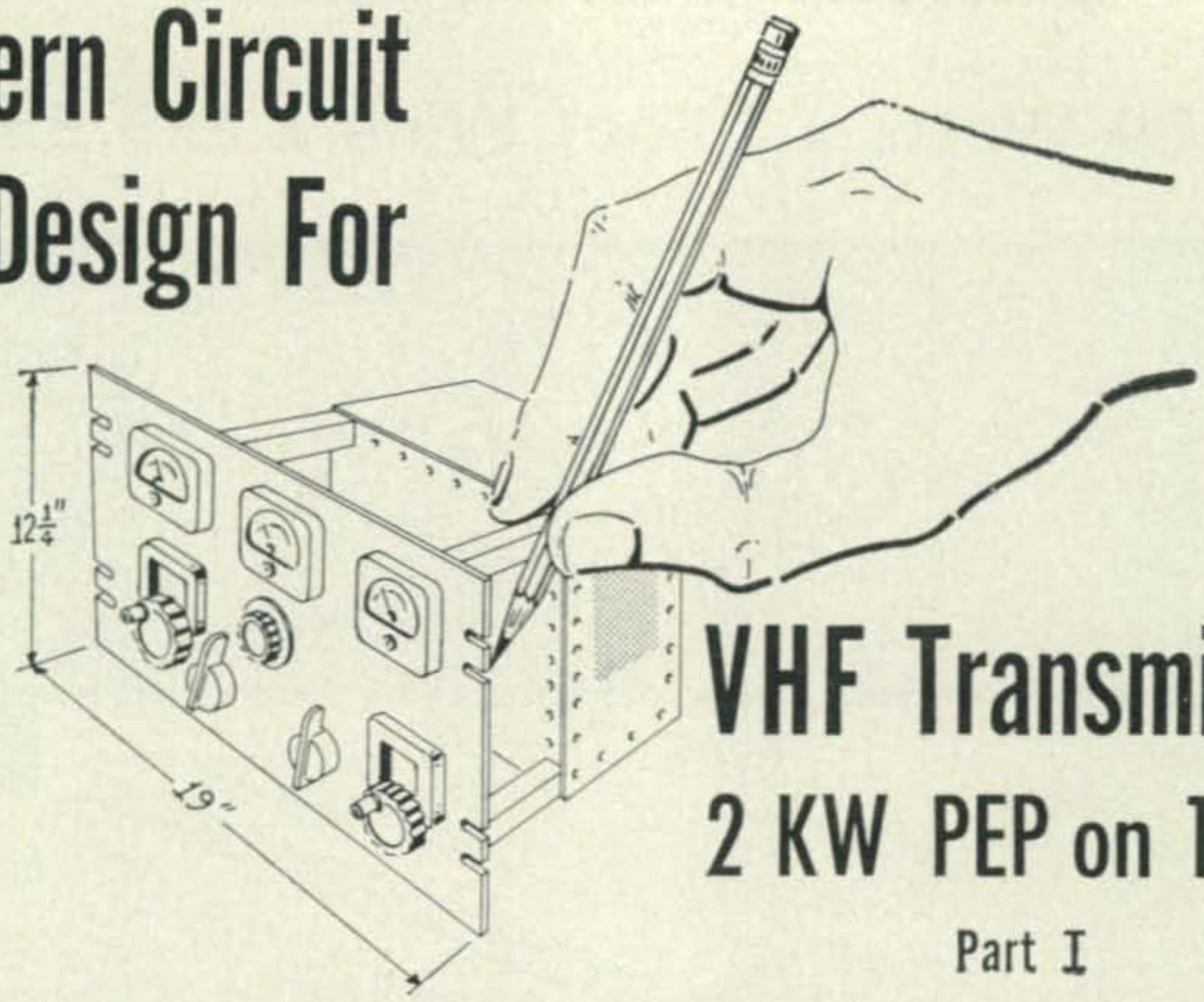
Modern Circuit Design For



VHF Transmitters

2 KW PEP on 144 mc

Part I

BY H. C. BARBER,* W6GQK; W. I. ORR,† W6SAI; R. RINAUDO,† W6KEV AND R. SUTHERLAND,† W6UOV

Part I describes the design of a two kilowatt p.e.p. amplifier for the serious 2 meter operator. Requiring less than 10 watts of driving power, this efficient amplifier loafs along at the legal amateur power level. Designed for continuous service, a lot of power is packed behind a 12¼-inch relay rack panel. Construction details of this "powerhouse" will be featured in Part II of this two part series.

THE would-be designer of transmitting equipment for the v.h.f. spectrum soon finds that he is operating in a twilight area that falls between microwave techniques and practices associated with the high frequency (h.f.) bands. He realizes, sooner or later, that at some broad, undefined wavelength peculiar things start to happen to h.f. circuitry that otherwise looks deceptively simple on paper. As he progresses from the h.f. int othe v.h.f. region, the attentive amateur soon is aware that bypass capacitors no longer exhibit the normal characteristics they possess at lower frequencies. Short bits of wire assume importance beyond their size. R.f. tends to "leak" through small chassis holes. Components that seemingly are a passive part of normal communications hardware become complex devices that bedevil, and bear little resemblance to the comfortable components that make up h.f. gear.

Viewing the microwave (u.h.f.) region, the amateur finds a new world of waveguides and plumbing. Circuit techniques, equipments, and vocabulary fall into a strange category, and engineering philosophy and hardware of this frequency region are alien to h.f. concepts and techniques.

Between the comfortable world of kilocycles and the alien world of gigacycles are the amateur v.h.f. bands of 144, 220 and 432 mc. What techniques and practices should be used at these frequencies? Are microwave techniques applicable, or is this portion of the v.h.f. spectrum

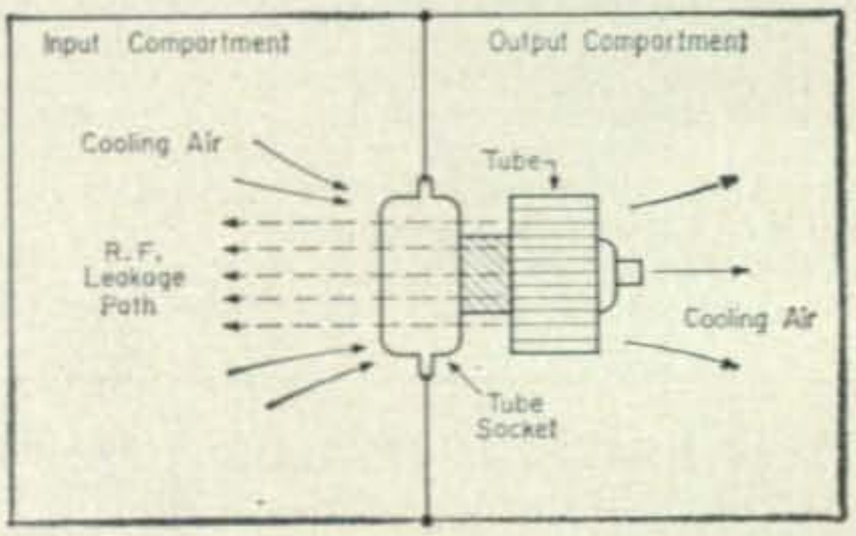


Fig. 1—Socket orfices to permit cooling air to pass across base seals of tube and through anode cooler may also create r.f. leakage path from output to input compartment. Simple "receiving type" sockets have little r.f. attenuation, while most "air-system" sockets afford 20 decibels or so of intra-stage isolation. The new Eimac SK-820 socket and 4CX1000K tube achieve better than 50 decibels of intra-stage isolation below 450 megacycles.

*45 Sherwood Court, Millbrae, California.
†Eitel-McCullough Inc., San Carlos, California.

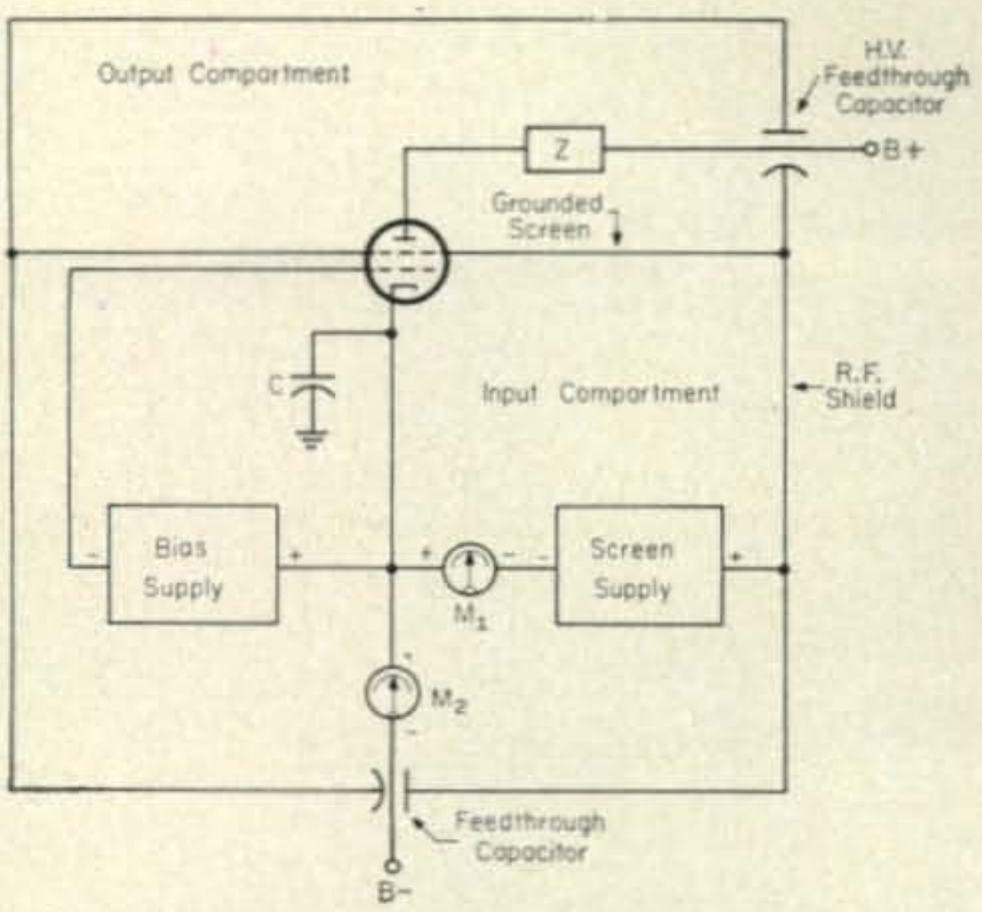


Fig. 2—To achieve maximum isolation between input and output compartments, the screen of the tube may be grounded, with bias and screen supplies placed below d.c. ground potential as shown in this circuit. The screen bypass capacitor is thereby omitted and a cathode bypass capacitor (C) substituted in its place. The B-minus lead is "negative" to the chassis by the amount of the screen voltage. Meter M_1 measures screen current and meter M_2 measures plate current.

merely an extension of the h.f. spectrum, with suitable modifications applied to equipment design and construction?

The answer to both these questions is obscured by realities. The v.h.f. amateur bands can and do use components designed for h.f. service, but these bands fall on the doorstep of the u.h.f. region wherein the components start to assume the size of the radio wave that is being generated. This physical congruence of wave and component calls for techniques and circuitry not normally associated with h.f. equipments.

One obvious solution to this problem is to reduce the size of the v.h.f. hardware so that the dimension of the radio wave is great compared with that of the components. This is commonly done; but there is a limit to this reduction technique, however, since no one has ever invented a way to shrink the *watt* in a corresponding manner. A limiting factor in the design of v.h.f. gear, therefore, is the ability of small components to radiate or otherwise dissipate the heat generated by the power dissipation of active components.

This natural law of thermodynamics becomes a limiting factor at v.h.f. in the design of a one kilowatt (2 kilowatt p.e.p.) amplifier for linear and c.w. service. To begin with, the number of tubes that will accept this power level at this frequency are but a handful. Tank circuits tend to disappear within the tubes, and the problem of dissipating five hundred watts or so within a shielded enclosure containing small tubes and tiny components poses a difficult mechanical design problem. Even at the relative "low" frequency of 144 mc, the use of "garden-variety" tubes and tank circuits provides a marginal solution.

Special tubes and hardware have been designed to work well at v.h.f., and by the proper combination of tube, hardware and circuitry, a reliable amplifier having the aforementioned power capability may be built that "tunes up just like 20 meters" and is capable of continuous, 24 hour-a-day operation. The design of such an amplifier is covered in this article, with some interesting asides directed to problem areas encountered in the construction of a practical amplifier.

Socket-Tube Intra-Stage Coupling

One source of potential trouble in the v.h.f. amplifier is *intra-stage r.f. coupling* (fig. 1). Passage of r.f. energy between two sealed metal compartments placed side by side is zero, but the introduction of power leads and cables in the compartments permits r.f. leakage; and the placement of a tube between the compartments allows the coupling of energy through the socket

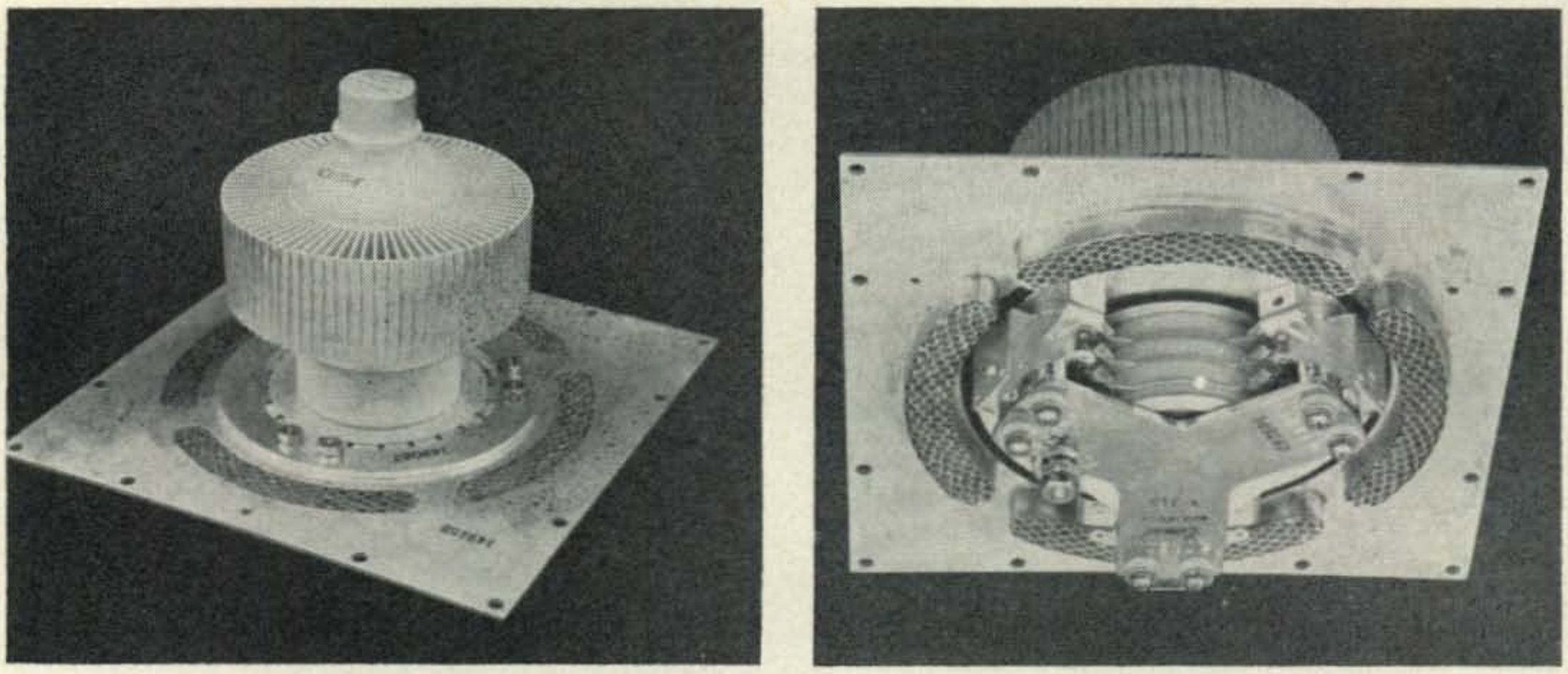


Fig. 3—(Left) Screen terminal of 4CX1000K tetrode is a ring that completely encircles the upper portion of the base structure of the tube. Flexible tabs on matching socket ring insure low impedance ground path from screen element as screen is run at d.c. ground. Cooling air is passed through the socket structure by means of "honeycomb" section of expanded metal (Right) built into socket plate which acts as a waveguide beyond cutoff frequency and provides high degree of attenuation below 450 mc. The socket provides 50 decibels or better intra-stage isolation in the v.h.f. region.

orfices, impairing the erstwhile perfect isolation between the compartments. It is possible to reduce intra-stage coupling via the power leads by proper bypassing and termination of the individual wires. Combining these techniques with the use of a new, improved tube socket and tube base, an intra-stage isolation of —50 decibels or higher may be achieved.

The degree of r.f. coupling between compartments may be determined by injecting a signal into the input compartment at the operating frequency of the gear, and then measuring the residual signal developed in the output compartment. For example, assume each compartment in the illustration has zero r.f. leakage other than the path through the tube and socket. This coupling path has an attenuation of —20 decibels, that is, the signal measured in the output compartment is 20 decibels lower in power than the signal injected in the input compartment. The particular tube in the socket has a power gain of 25 decibels, so it can be seen, without even turning the equipment on, that +5 decibels of positive coupling occurs through the socket-tube path and that the circuit will sustain self-oscillation at the frequency in question.

If the attenuation of the path is increased to greater than —25 decibels, oscillation may still occur under certain conditions of equipment tuning and loading wherein the tube gain may momentarily rise over the nominal figure. Many combinations of tubes and sockets normally used in the v.h.f. region exhibit a high degree of internal coupling since the screening of the tube is not perfect. Also, leads within the tube are long, bypass capacitors are imperfect at the design frequency, and the necessary air path through the socket permits the plate of the tube to "see" the input circuitry.

To provide the proper degree of isolation, the socket-tube intra-stage coupling should provide a degree of attenuation that is at least 20 decibels greater than the circuit gain of the stage, and the internal screening of the tube should be as excellent as the state of the art permits.

The "Grounded" Screen

In order to increase screen isolation at v.h.f. and to insure that the screen is as close to ground potential as possible, it is expedient to ground the screen to the chassis and to supply bias and screen potentials "below ground" as shown in fig. 2. The screen bypass capacitor is thereby eliminated and a cathode bypass capacitor substituted in its place. The screen capacitor usually employed in a tetrode stage is in a critical location in the v.h.f. circuit as it carries almost all of the plate circuit r.f. circulating current and, in addition, introduces regeneration in the circuit if the capacitor exhibits inductive reactance. When this cranky component is removed, the tetrode screen can be physically grounded, and the burden is transferred to the cathode bypass capacitor which carries little circulating current and tends to be a *degenerative* element if it exhibits inductive reactance.

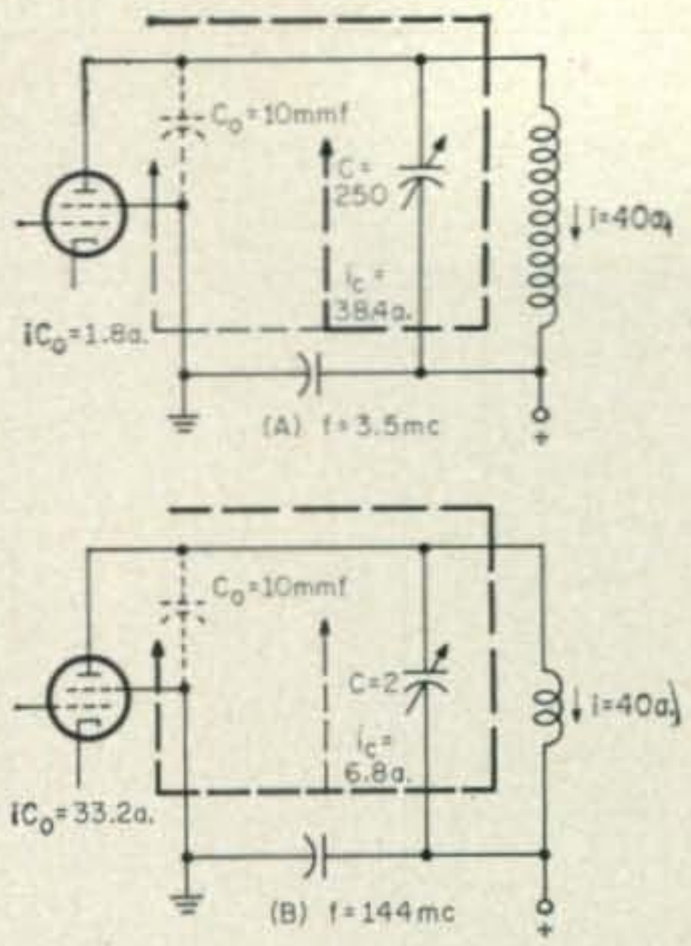


Fig. 4—At v.h.f., the output capacitance of the vacuum tube constitutes a larger proportion of the total tank circuit capacitance than in the h.f. region. Circulating r.f. tank current (i) divides through tube capacitance (C_0) and tuning capacitor (C) in proportion to capacitance of each. At 144 mc, current flowing through tube output capacitance (iC_0) is almost twenty times as great as at 3.5 mc.

Intra-stage r.f. leakage through the socket may be reduced by modiying the air vents between input and output terminations while allowing cooling air to pass across the base seals and through the tube anode.

A "Grounded Screen" Tube and Socket

Shown in fig. 3 are the new Eimac 4CX1000K tetrode and the companion SK-820 socket. The "K" tube is an improved version of the 4CX1000A having a low impedance screen grid terminal ring that completely encircles the upper portion of the base structure of the tube. The 4CX1000K is designed for improved input-output isolation and the screen terminal ring presses snugly against a circular spring-like grounding plate built into the top portion of the SK-820 socket. The screen is thus completely and securely grounded around its circumference by an extremely low impedance path, reducing r.f. intra-stage leakage through the socket to —50 decibels or better at 450 mc.

Cooling air is passed through the socket assembly by means of "honeycomb" sections of expanded metal built into the socket which act as simple waveguides beyond cutoff frequency, and provide a high degree of attenuation to r.f. currents passing between the grid and plate compartments.

Use of the 4CX1000K in the improved socket permits construction of a high power v.h.f. amplifier having excellent intra-stage isolation and that does not require neutralization. Thus, one of the big "trouble makers" in v.h.f. equipment design has been conquered!

The V.H.F. Plate Tank Circuit

The purpose of the v.h.f. plate tank circuit is twofold: First, it provides an impedance match between the tube and the load; and second, it

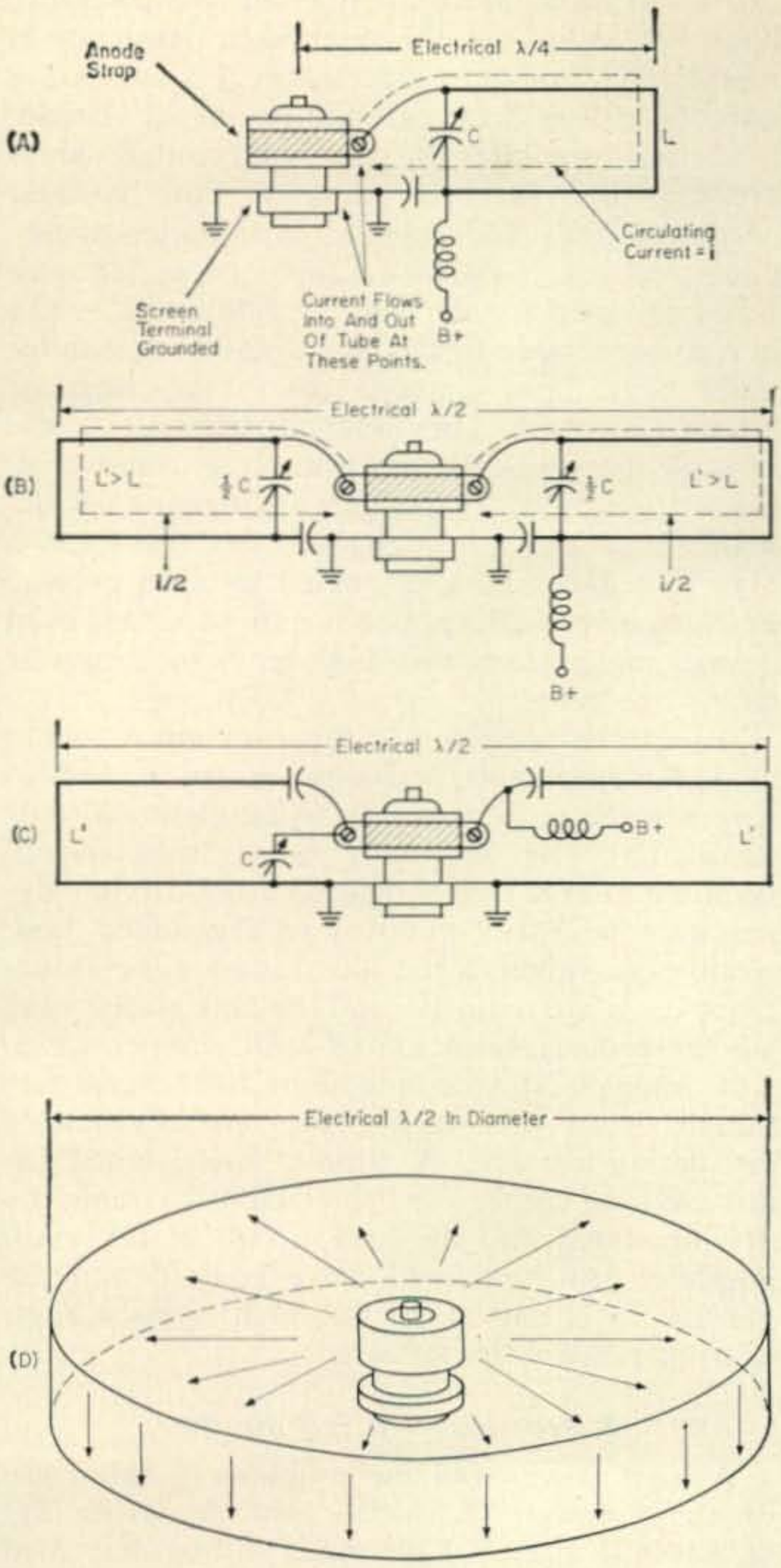


Fig. 5—Simple "quarter-wave" loaded tank (A) may be used as resonant circuit at 144 mc. However the circulating r.f. tank circuit flows into tube at one point and overheating of screen lead and vacuum seal may result from the high concentration of current. Divided tank circuit (B and C) places tube at the high potential point in half-wave line and divides circulating r.f. tank circuit between two sides of the tube. Limiting case is circular cavity (D) with tube placed at center and with circulating r.f. current evenly spread over inner surface of cavity. At 144 mc, the circuit of (C) is an efficient and practical compromise.

attenuates undesired spurious emissions. As the v.h.f. region is approached, the popular h.f. resonant tank composed of a parallel coil and capacitor shrinks in size until it is more practical to employ a different, larger resonant configuration. A capacitance-loaded section of transmission line may be used as a resonant circuit, since v.h.f. short-circuited transmission lines can efficiently replace inductances in tank circuits.[1] Such transmission line circuits exhibit considerably higher impedance at resonance and better Q than can be obtained with "lumped" circuitry. In general, the transmission line tank circuit may be designed for maximum efficiency, for maximum bandwidth, or for mechanical convenience. That is to say, given a reasonable efficiency and line impedance, the physical constants may be "juggled" about to permit a satisfactory circuit to be constructed of the material at hand so that odd sizes of tubing or unusual construction techniques need not be used.

[1] *"Fields and Waves in Modern Radio"*, by Ramo and Whinnery, Chap. 10. John Wiley and Sons.

Output Capacitance

In passing, it should be noted that the output capacitance (C_o) of a vacuum tube assumes great importance in the v.h.f. region as compared to the h.f. spectrum since it constitutes a larger percentage of the total tank circuit capacitance (fig. 4). At 3.5 mc, for example, a reasonable value of plate tuning capacitance (C) might be 250 mmf, of which 10 mmf (or 4%) represents the output capacitance (C_o) of the tube. At 144 mc, the total plate tank capacitance may be 12 mmf, and the tube contributes 83% of this capacitance. In a high-Q tank circuit, the circulating r.f. plate current may reach the order of 40 amperes at the kilowatt level and this current divides through the tube output capacitance and tuning capacitor in proportion to the capacitance of each. Thus, in the case of the 3.5 mc amplifier, 4% of the r.f. plate circuit current (1.6 ampere) flows through the output capacitance of the tube, whereas at 144 mc 83% of the current (33.2 amperes) flows through the tube output capacitance! In the case of a tetrode, the circulating current flows through the screen circuit as shown in fig. 4. The screen leads and screen bypass capacitor and a portion of the tank circuit must carry this extraordinarily heavy r.f. current. Elimination of the screen bypass capacitor removes this cranky component from the high current density path; however, the circulating r.f. current flowing through the tube terminals tends to heat the vacuum seals, often to such a temperature that the tube may be damaged. The current cannot be eliminated, but it may be distributed in such fashion as to minimize seal heating consistent with the shortest possible return path from plate to screen. Placing the screen at absolute ground potential, and using a iow inductance screen terminal on the tube aids this task.

The Modified Coaxial Tank Circuit

The condition for resonance of a capacitance loaded transmission line is:

$$X_c = Z_o \tan L$$

Where X_c is the reactance of the loading capacitor, Z_o is the impedance of the transmission line, and L is the electrical length of the line in degrees: ($\lambda/4 = 90°$).

In the general v.h.f. situation, the loading capacitance is the output capacitance of the tube, and line parameters (Z_o and L) are adjusted so as to establish circuit resonance with this capacitance.

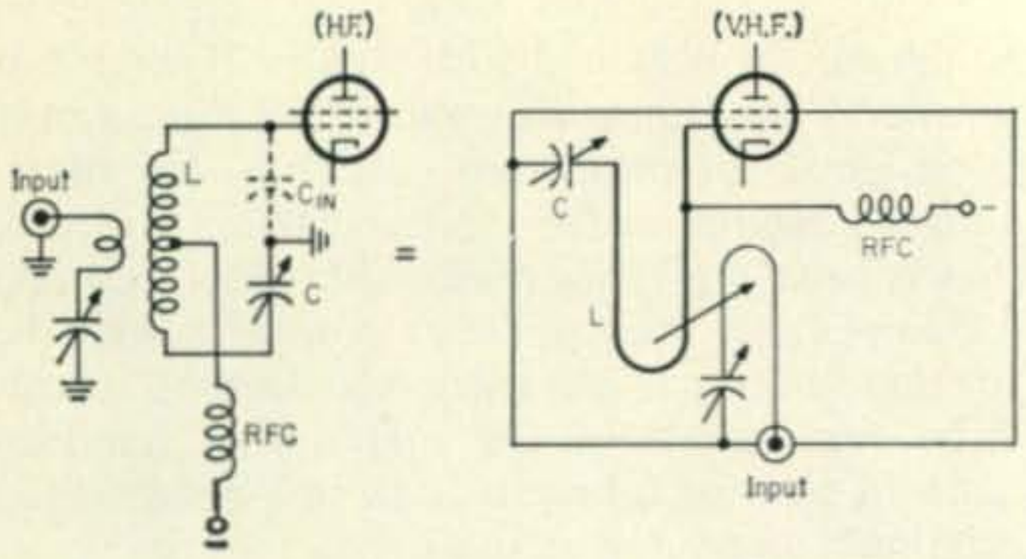


Fig. 6—"Split-stator" h.f. grid tank circuit may be duplicated at v.h.f. by the use of a loaded half-wave line. Input capacitance of tube makes use of quarter-wave line impractical, as the line tends to "disappear inside the tube".

A simple "quarter-wave" loaded line may be used as a resonant tank circuit (fig. 5A) but the circulating r.f. tank current flows through the tube via one small area and overheating of the screen terminal and vacuum seal in this particular area may result. It is possible, however, to achieve the same resonant frequency with one-half the tuning capacitance and a somewhat longer transmission line section (L') as shown in fig. 5B. Combining two of these circuits (fig. 5C) permits the use of the longer line (an electrical half-wavelength long) with the tube placed at the center. Circulating r.f. plate currents now flow through both sides of the tube, providing somewhat better current distribution than before. The longer line is easier to extract energy from because of its greater length, and it is less critical of construction. In addition, the physical mass of metal in the long line can dissipate heat more readily than can the smaller mass of the shorter quarter-wave line. The limiting design, of course, is when the tank circuit completely surrounds the tube in the form of a cavity (fig. 5D), wherein r.f. plate current is equally divided around the circumference of the tube. Such an approach is necessary in the upper regions of the v.h.f. spectrum, but at 2 meters, the simple half-wavelength line discussed here works well, and is simpler and cheaper to construct than the cavity configuration.

An optimum value of line impedance exists, which is a function of the dimensions of the resonant line. In the design of 5C the line is made in coaxial fashion, composed of a circular center conductor (made of a section of readily obtainable copper water pipe) and the outer walls of the shielded plate circuit enclosure. The impedance of a line of these rough dimensions is approximately 60 ohms, and the enclosure dimensions and spacing of the line are chosen to provide minimum surface area of the elements consistent with maximum volume, thus reducing the surface "skin resistance" of the elements.

The V.H.F. Grid Input Circuit

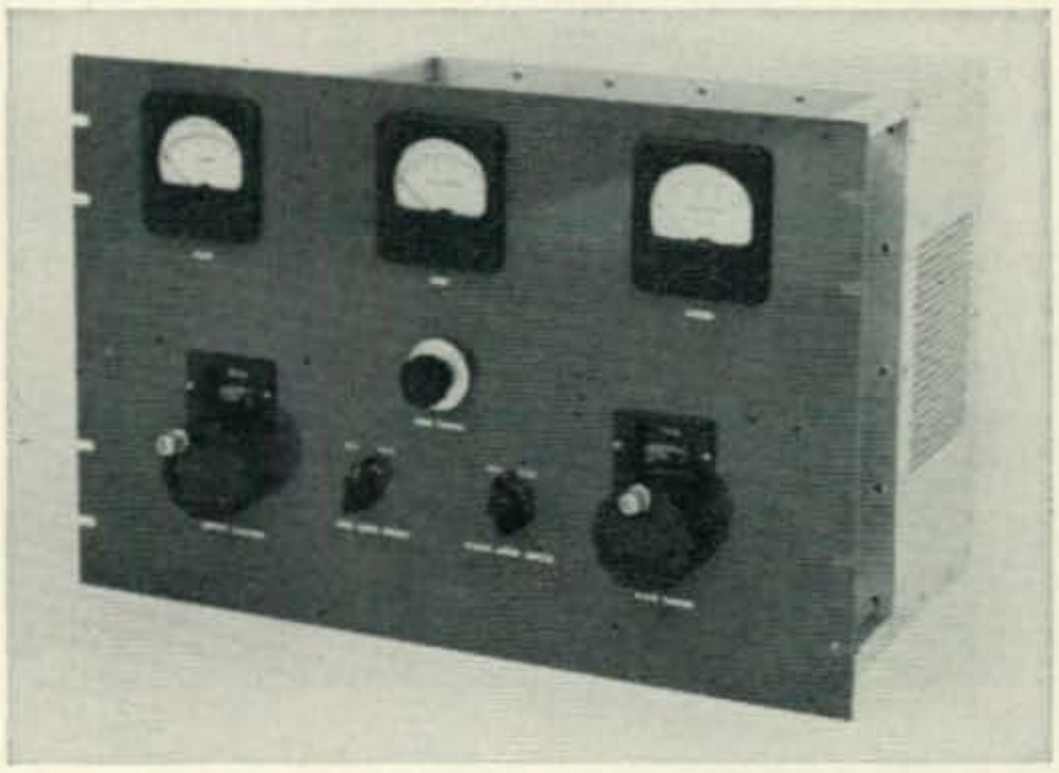
It is possible to use a quarter-wave line for the input circuit in the lower portion of the v.h.f. spectrum. However, the law of diminishing returns is at work: since the tube input capacitance does not shrink as the operating frequency is raised, the line must necessarily be drastically reduced in length to maintain resonance. Broad, low resistance circuits and wide contact areas are very fine for heat radiation but, by their very area, they add residual capacitance to any circuit built around them. Input capacitance of tubes designed for the v.h.f. region tends to run into a respectable figure, and some of the better tubes have input capacitances in the range of 50 to 100 mmf. The input capacitance is the sum of the grid-cathode, grid-screen, and grid-plate capacitances. Considerable ingenuity is demanded of the v.h.f. engineer to construct a high impedance tank resonated by such a value of capacitive loading, but it can be done, even though the quarter-wave tank tends to disappear within the tube!

An effective solution to this problem is to add a capacitance-shortened quarter wave line to lengthen the tank assembly to an electrical halt wavelength (fig. 6). A form of "split stator" resonant circuit is achieved, and the driving signal may be easily coupled to the added tank section, as shown in the illustration. Low inductance leads are required, and the tank circuit may advantageously be made of wide copper strap, with multiple strap connections to the grid terminals of the tube to insure proper division of circulating current. A simple series tuned inductive loop can be used to efficiently couple the driving signal into the grid circuit of the v.h.f. amplifier. At best, grid drive is hard and expensive to obtain at v.h.f. and it is poor engineering practice to waste it!

A Practical V.H.F. Amplifier

A high power 144 mc amplifier making use of these design techniques and featuring the 4CX1000K and SK-820 socket will be described in the second part of this article.

[*To be continued*]



The next part will deal with the construction of the above amplifier. This is a front view of a compact two kw p.e.p. linear amplifier suitable for s.s.b., a.m., f.m., or c.w. It requires less than ten watts of drive to reach the maximum legal power.

Front view of the capacity meter. Centered binding posts are for unknown capacitor. Standard switch, test button and corrector control are on the bottom. The meter itself connects to the side binding posts.

A DIRECT READING CAPACITY METER

BY ARTHUR C. ERDMAN,* W8VWX

This adaptor, with any 50 microampere meter, can provide direct readings for capacitance from 0 to 0.1 mf in four ranges. It can be built for less than $16 if everything is purchased new.

THIS article is written for those who do not already have some form of a capacitance measuring device. How often have you wondered just what color code to use in reading a surplus mica capacitor or what the capacitance range of that shiny, unmarked surplus variable was? Recent literature[1] described a highly accurate and stable direct-reading capacitance meter. However, I felt that the capacitance meter will not be used often enough to warrant the inclusion of an expensive microammeter and zener diode regulation. This circuit makes use of the 50 microampere movement already in my v.o.m. (Simpson 260) and an expensive battery is used for power. A corrector rheostat is included to permit manual compensation for battery aging. The oscillator used is a relaxation type[2] utilizing a unijunction transistor. The capacitance range of the unit shown in fig. 1 is 0-100 mmf, 0-1000 mmf, 0-0.01 mf, and 0-0.1 mf.

Every attempt was made to keep the cost at a minimum. At present there are no kits available for reading capacitance on a microammeter. Heathkit Model CM-1 was an excellent direct reading capacity meter but for some reason it was dropped from production. Commercial kits using null-balancing are still available for about $20. The adaptor described in this article costs $16 if every component and every piece of hardware is purchased new. A good juke box full of parts can materially reduce the cost.

Theory of Operation

The unknown capacitor in fig. 1 charges through the diode and discharges through the microammeter. The d.c. value of the discharge current is $I_{d.c.} = C\ f\ V_p$, provided the capacitor discharges to zero each cycle. $I_{d.c.}$ is in microamperes; C in mmf, f in mc and V_p is in volts, the peak positive voltage of the pulse.

The equation means that if the frequency and the amplitude of the pulse can be kept constant over any range of capacity the value of d.c. current is directly proportional to the value of the capacity.

The resistor R, must be small enough so that the capacitor can discharge to almost zero each cycle. The time constant of the unknown capacitor and the combined resistance of R and the meter movement must be about one-fifth the "off" time of the pulse generator. If R is too large for a given range, the linearity will be degraded. However, R may be changed on each range, increasing for the higher capacity ranges. A leakage resistance of ten times the circuit resistance will cause a 10% error. However, I chose to let R remain at its lowest value (4.7K). Any 0.1 mf capacitor (or smaller) that has 47K leakage is no good anyway.

The complete circuit is shown in fig. 2. The resistance in Base 1 of the unijunction is switched in the 100 mmf range in order to get 50 microamperes with a 100 mmf capacitor connected. The Base 1 resistance is lowered on the higher ranges in order to preserve linearity.

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*241 Garden Road, Columbus, Ohio.

[1]Watters, R. L., "Direct Reading Capacitance Meters," *Radio Electronics,* August 1963, p. 32.

[2]*Controlled Rectifier Manual,* any edition, General Electric.

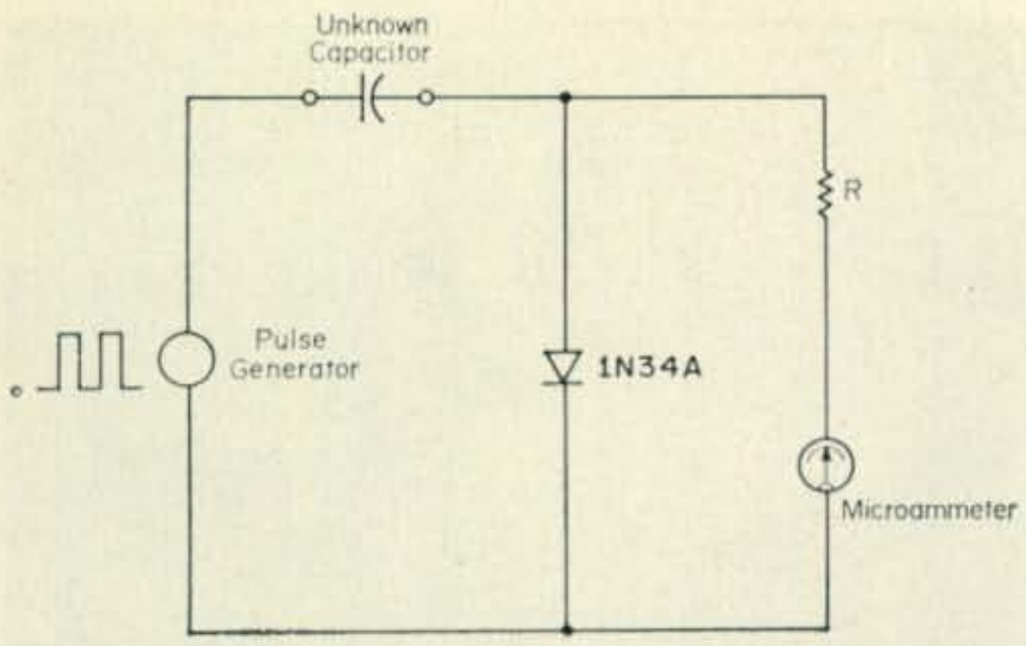
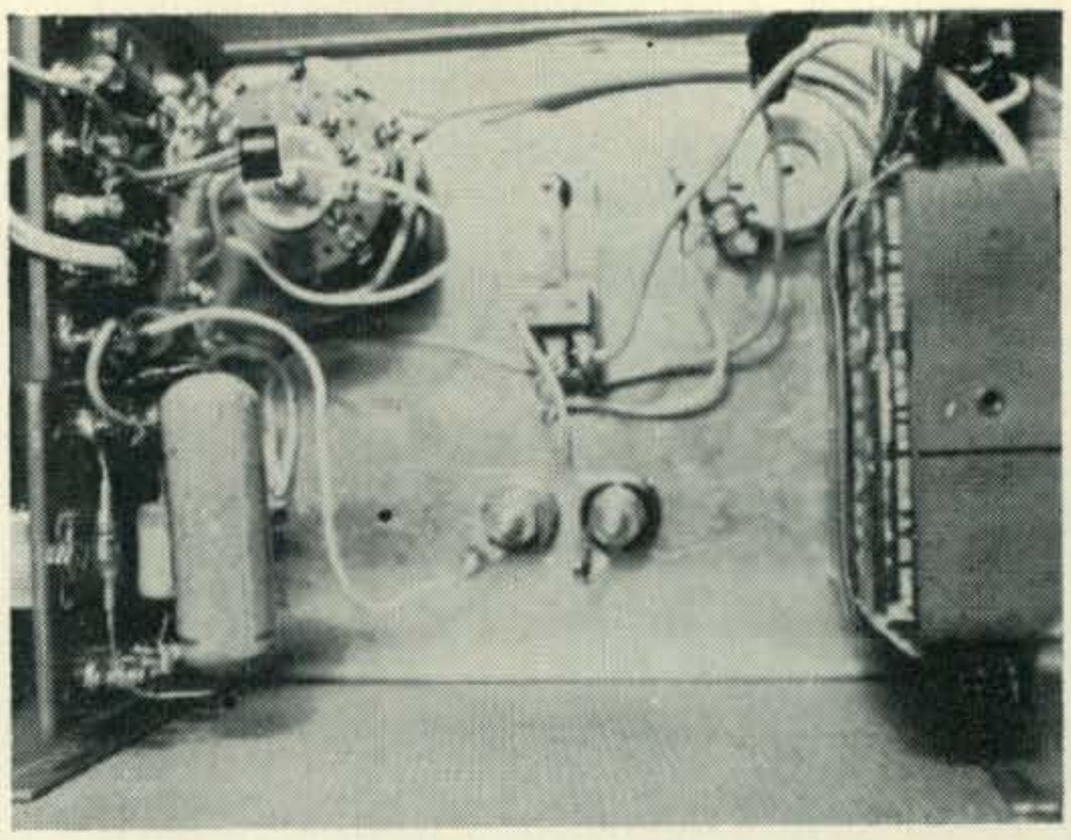


Fig. 1—Circuit illustrating the basic method of measuring the unknown C.

Note that the unknown capacitor floats electrically above ground. I tried grounding either terminal of the unknown capacitor and letting the minus of the battery float, but there was always a non-zero reading in the 100 mmf range. The meter could be d.c. corrected by summing in a positive voltage to the microammeter, but the amount of voltage would have to be changed for each range. This only complicates the switching. If the circuit is wired as shown and the internal leads to the capacitance jacks are spaced from the chassis and spaced from each other, the microammeter will not move from zero when no external capacitor is connected to the jacks.

Adjustment

If you have access to commercial bridge, trim four capacitors to exactly 100 mmf, 1000 mmf, 0.01 mf and 0.1 mf. Begin on the 100 mmf range. Insert the 100 mmf capacitor and adjust the CORRECTOR for a full scale reading. On the other ranges insert the proper capacitors and adjust the appropriate 100K pots. *Do not touch the* CORRECTOR. Now the meter is calibrated and ready for use. As the battery ages, it is only necessary to readjust the CORRECTOR. The other ranges will automatically be adjusted assuming the drift was due to battery voltage shift. As check on the linearity two capacitors were adjusted separately to read a nominal full scale value of 100 mmf. In other words each capacitor,



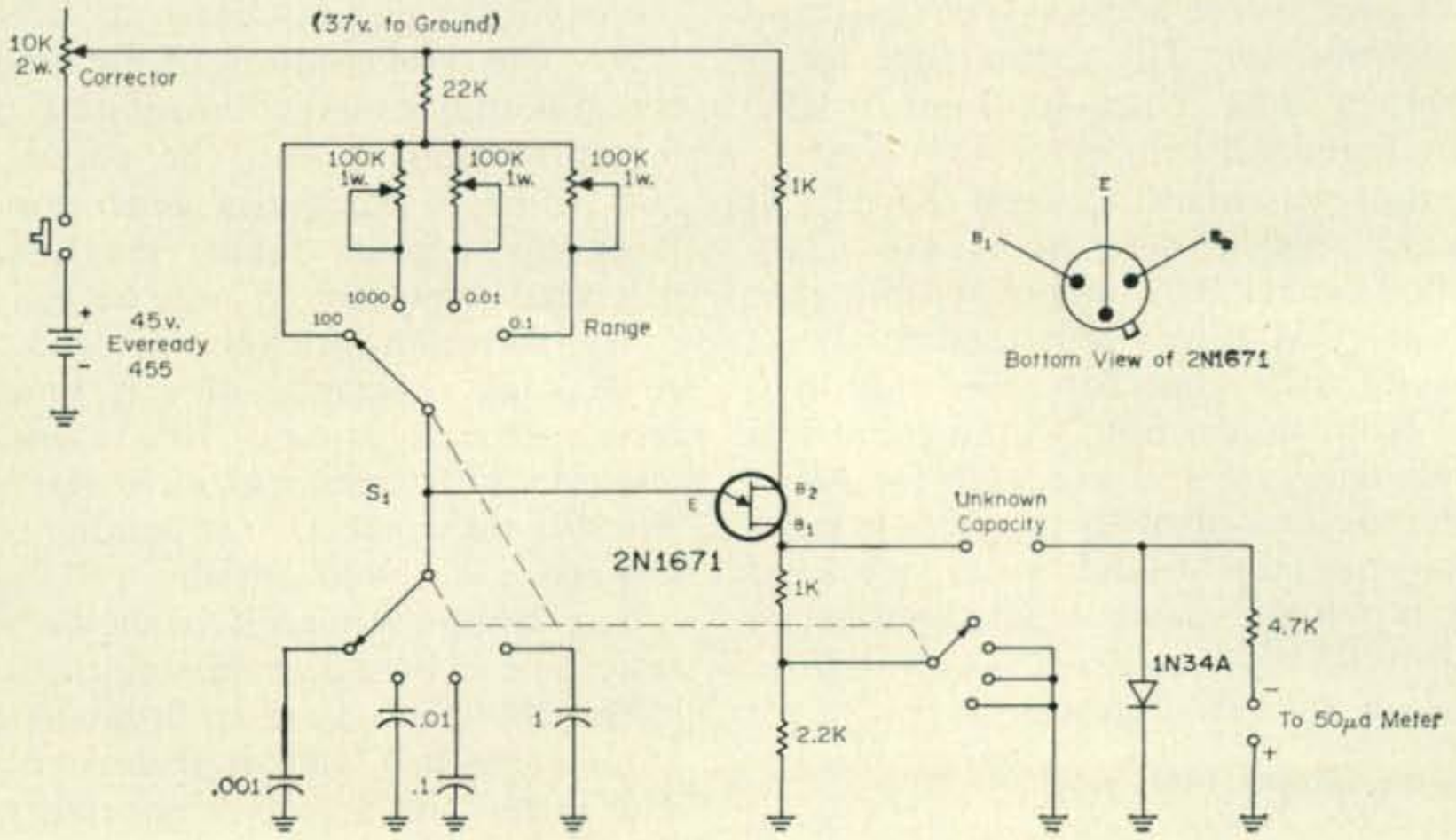
Inside view of the capacity meter. The batteries are on the right and the circuit board on the left.

separately, was the same value. I then connected the same two capacitors in series. The reading was half-scale or 50 mmf, as close as I could read the meter. A 5 mmf, ± ¼ mmf, surplus mica gave a reading of one minor scale division which was 5 mmf.

The circuit is designed to operate at about 37 volts so the battery can be used for a long time. The nominal current drain is 5 ma. On the 0.1 mf range there is a slight meter flutter. This flutter can be eliminated by adding a 50 mf, 50 volt capacitor from the arm of the CORRECTOR to ground. The flutter depends on the microammeter damping. My particular meter did not need the capacitor.

If you do not have access to a bridge and do not want to spend the money for 1% capacitors, simply use ordinary 10% capacitors as standards. In most cases 10% accuracy is sufficient. ■

Fig. 2—Circuit of the adaptor for direct reading capacity on a 50 microampere meter. All resistors are ½ watt unless otherwise noted and all capacitors are in mf. The switch, S_1, in a 3 pole, 4 position rotary. Capacitors in range switch are 10% tolerance, with 50 v. rating.



RTTY From A to Z

BY DURWARD J. TUCKER,* W5VU

Part XV

The ever present distortion makes it necessary for the serious RTTY'er to bend every effort to eliminate or minimize it. This part covers the design and construction of a device to aid in tracking down and measuring RTTY distortion.

THE need for some device for locating and measuring distortion has been discussed and established. The basic circuitry for this test device, as well as other RTTY devices, has also been discussed and now the device itself can be covered. It is called the Polar Relay Keying Test Set.

The Test Set

The Polar Relay Keying Test Set, designed to aid in making bias distortion measurements, is shown in figs. 99 and 100. The set was primarily designed to be used with a scope to measure polar relay bias distortion. After test set was built, it was discovered that with a little external circuitry bias distortion in a Model 14 Transmitter Distributor, Model 14 Typing Reperforator, Model 15 Teletype, Model 19 Teletype machine. *etc.*, could also be made using the set. This required no changes within the set itself and was quite an added bonus.

Design Considerations

The design of the test set is influenced somewhat by the square wave generator used to drive it. Experience with low frequencies such as 23 cycles has shown that audio transformers for oscillators and amplifiers can double or even triple the cost of such an instrument. For that reason, the manufacturers of such devices often avoid the use of audio transformers altogether. Such is the case with the Heathkit IG-82, Square Wave Signal Generator which was used by the author. The generator has a cathode follower output stage with the output voltage, with respect to ground, plus at all times. If such a voltage is applied directly to the grid of a tube such as V_{1A} through J_1 or J_2 of fig. 101, the grid polarity is plus with respect to ground for all of the square wave being put out by the generator. It so happens that V_{1A} functions *only from a signal on its grid that is positive* with respect to ground.

The reader should have no difficulty in recognizing V_{1A} and V_{1B} in fig. 101 as the Schmitt Trigger circuit of fig. 98. The output from V_{1B} is a cathode follower configuration (fig. 86); the NE-51 neon glow lamps were covered in the text associated with fig. 90 and the 6AQ5 stage (V_2 and V_3) is essentially the keyer tube circuit given in fig. 83.

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Circuit Operation

Under static conditions (no input signal) V_{1A} is cutoff and V_{1B} is conducting, the NE-51 neon lamps are glowing and keyer tubes V_2 and V_3 are in an *"on state"*. A suitable *positive signal* on the grid of V_{1A} causes a plate current to flow, resulting in a very high voltage drop across the plate resistor, R_3. This, in turn, results in a very low positive voltage on the plate of V_{1A} and the grid of V_{1B}. This reduces the plate current of V_{1B} and the positive voltage drop from the arm of R_2 to ground drops too low to sustain the NE-51 lamps and they "turn off" the keyer tubes V_2 and V_3.

A less positive or a negative signal on the grid of V_{1A} causes the plate current to decrease. As the plate current through R_3 decreases, so does the voltage drop across the resistor. This allows the positive voltage on the plate of V_{1A} and the grid of V_{1B} to increase. This naturally causes the cathode current of V_{1B} to increase, which in turn increases the positive voltage from the arm of R_2 to ground. The neon lamps will conduct when their firing voltage is reached. This positive voltage then counteracts the negative

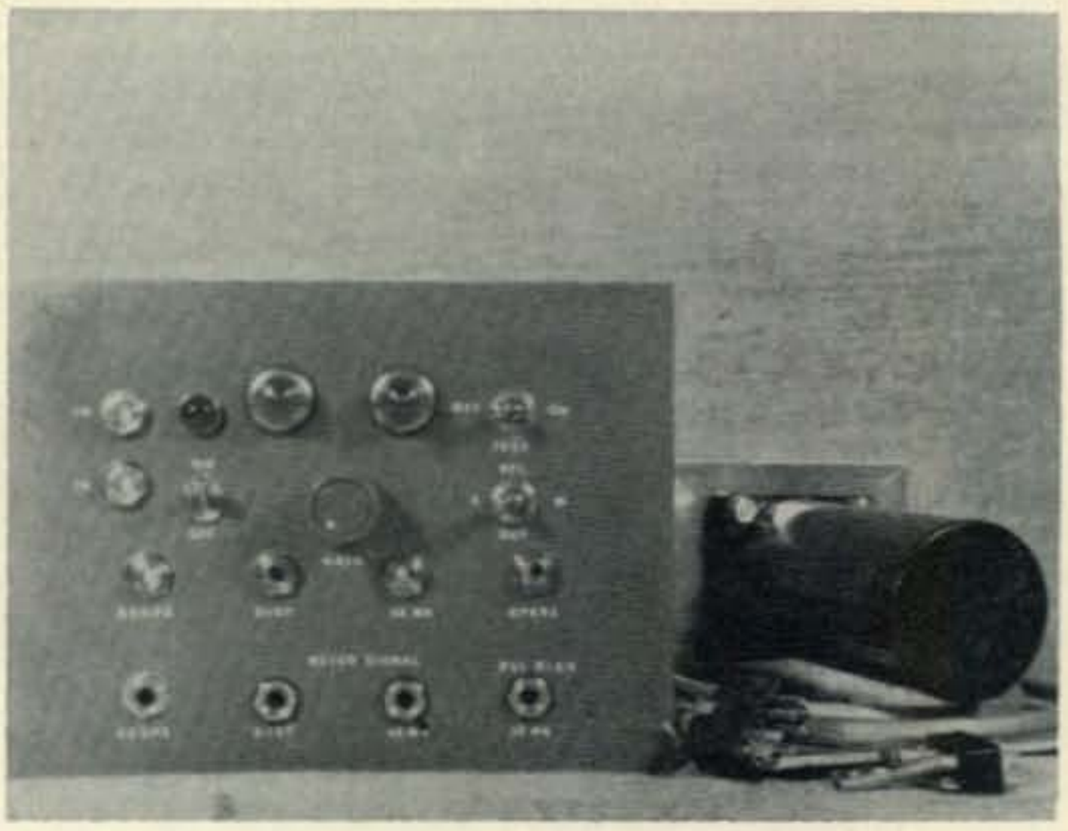


Fig. 99—The polar relay keyer test set is shown on the left and the external polar relay test socket and mount, together with a 215A polar relay, is shown on the right. The dummy test plug may be seen just to the front of the relay. Actually, it is not necessary to panel mount both of the NE-51 bulbs as shown above. One will do nicely since they are in series and when one lights, the other will also.

bias of the keyer tubes, causing them to conduct. The plate current of the two keyer tubes instantly rises to the preadjusted value of 60 milliamperes, which operates the signal winding of the polar relay under test.

A 50 ohm resistor, R_4, was placed in the cathode circuit of the two keyer tubes, in order to monitor their action with a scope plugged into jack J_6. A 50 ohm resistor, R_5 was placed in the ground return of the keyed circuit in order to be able to monitor the keying action with a scope plugged into jack J_8.

The keyer tube output contains three jacks (J_3, J_4, and J_5). One of these jacks can be used to measure the plate current and one can be used for a distortion measuring set. A selector magnet coil of a teletypewriter can be plugged into the third jack when a properly keyed teletype signal is fed into the input of the test set. A distortion measuring set would be plugged into the tube keyer output to determine the amount of distortion, if any, present at this point. Naturally, none would be expected here if the test set is in proper working order and the input signal to the keyer test set is free of distortion.

The polar relay keyed output contains an extra output jack (J_9) for measuring any distortion in this circuit. In fact, this is the point where distortion is expected to be found if the polar relay under test is not properly adjusted. Jacks J_3 through J_{10} should be connected into the circuit with the *same polarity*, as shown, otherwise, the current would be reversed through the milliammeter that is used to check current at the various points.

It will be noted that bias distortion, or end distortion, is not measured directly by this instrument. That is the reason it is called a polar relay keyer test set, which it is, instead of a distortion measuring set. This means that there are no tedious or tricky calibrations to worry about. A scope is used to make the actual distortion measurements. The use of an external scope rather than building one into the keyer set is strongly recommended.

Scope Requirements

It takes a pretty good scope to view a 23 cycle square wave without the trace being distorted from its true form as produced by the generator. When the trace shows up on the face of the scope tube distorted, it places the operator in the position of not knowing, for sure, which to believe, the square wave generator or the scope. Naturally, this problem has to be resolved before using either instrument for further tests. Older type scopes tend to drop off in response at low audio frequencies, especially if the scope is not of the D.C. type. A D.C. type is one that has a direct coupled amplifier (covered previously) from the scope-input to the input to the vertical deflector plates of the c.r.t.

A relatively late scope, such as the Heathkit Model 10-12, has a very good low frequency audio response. Although it does not use direct coupled amplifiers, this scope responds satisfactorily to a square wave of 23 cycles per second.

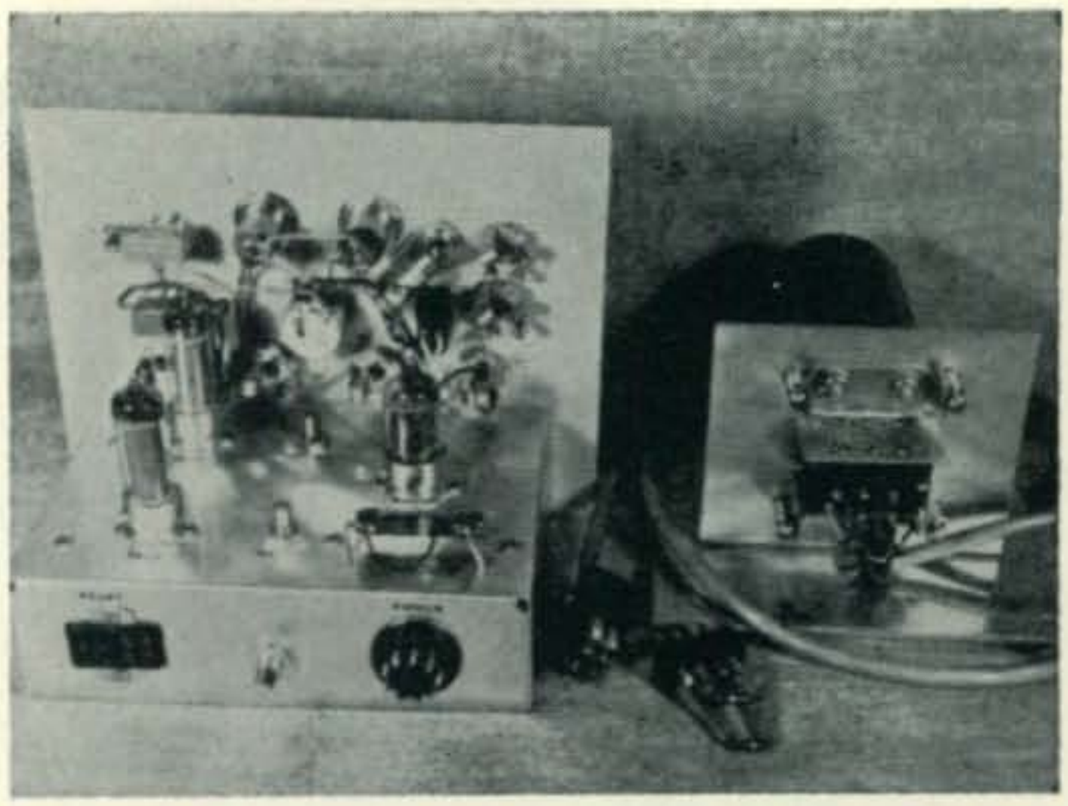


Fig. 100—Rear view of the polar relay keyer test set, showing the general chassis layout. The plug for power cord, and plug for the externally mounted polar relay socket may be seen at the rear of the chassis.

Construction

The chassis measures 2" × 5" × 7" and the front panel is 6" × 8½" × ⅛" aluminum. The general layout of the chassis is shown in the figs. 99 and 100. The power plug and the polar relay cable socket are both located on the rear wall of the chassis.

It was found convenient to have a dummy plug to fit into the relay socket. This dummy plug is wired so that terminals no. 1, 4 and 5 are shorted and a 125 ohm 1 watt resistor is connected between terminals 3 and 6 and another 125 ohm 1 watt resistor is connected between terminals 2 and 7. The dummy plug makes it possible to set all of the preliminary adjustments without subjecting a polar relay to excessive currents or other abuses. This also makes it possible to make all of the preliminary adjustments on the keyer set with only one instead of two cords plugged into the rear of the chassis while alternately turning the set on its back and up again.

Front Panel

Some of the jacks shown are insulated from the panel (jacks $J_{3,\ 4,\ 5,\ 9,\ 10}$) since they are "hot" with B+ voltage, as shown in fig. 101. It is highly recommended that all of the jacks, or at least the ones with high voltage on them, be mounted on a sub-panel recessed behind the main panel. Access to each jack would be through a hole in the front panel large enough for a barrel of a plug to pass through. The rear sub-panel could be bakelite or other insulating material.

Polar Relay Socket

The polar relay socket was not mounted directly on the main chassis. One might wish to inspect or make slight adjustments on the polar relay while under test and it wouldn't be easy to do this with the relay plugged into the rear of the test set. The relay socket was mounted on a special support external to the test set. It was constructed with a flexible seven con-

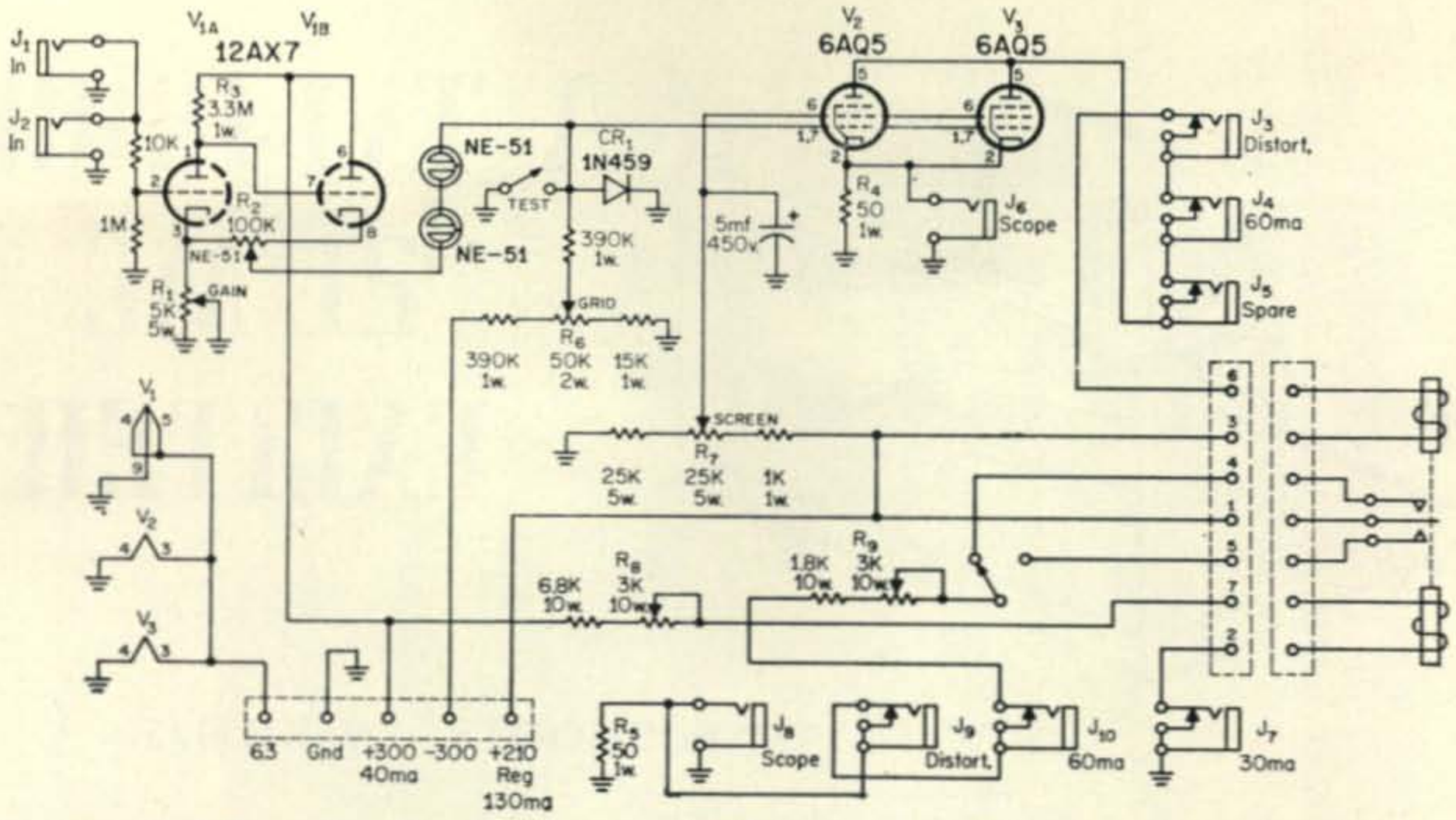


Fig. 101—Circuit of the polar relay keying test set. All resistors are half watt unless otherwise noted. The function of CR_1 is to provide a low resistance path when the NE-51's fire and short the grids of V_2 and V_3 to ground. The TEST switch can be a momentary push button switch or spring return toggle.

ductor shielded cable, approximately four feet in length, and a suitable plug at the test set end.

Power Supplies

The test set was powered with existing supplies used to operate the Terminal Units, local loops, etc. If desired, a supply could be included and some applicable circuits will be covered later. Two three hundred volt supplies are necessary, one plus and one minus with respect to ground. The plus three hundred volt supply has a 40 ma drain while the minus three hundred supply has a drain of less than a mil. The 210 volt supply must be regulated and supply approximately 130 ma.

Preliminary Adjustments

There are a few preliminary adjustments to be made before the set is ready for use. Insert a polar relay or the dummy test plug in the circuit and procede.

The cathode feedback control, (R_1) is designated as GAIN and is located on the front panel. Potentiometers R_2 and R_6 have slotted shafts for screwdriver adjustment. They are mounted on the top of the chassis and designated respectively as NE-51 and GRID. Potentiometer R_7, designated SCREEN, also has a slotted shaft for screwdriver adjustment and is mounted on the rear flange of the chassis. These, together with the sliders on R_8 and R_9 are all "set and forget" controls.

Set the slider of R_9 for 60 milliamperes through J_9 and J_{10}. Set the slider on R_8 for 30 milliamperes through J_7. The plate current (60 ma total) of keyer tubes V_2 and V_3 is determined by the screen voltage (R_7) and the plate voltage.

Close the TEST SWITCH and adjust R_7 for a plate current of 60 ma. Now open the test switch and turn potentiometer R_2 to zero and adjust potentiometer R_6 so that the plate current of V_2 and V_3 is approximately zero. This gave a negative bias of —27 volts, measured from grid to ground of V_2.

Set the feedback control, R_1, with *full resistance in the circuit* which should be the *full clockwise position*. This is the setting for maximum feedback; be sure to check this with a meter.

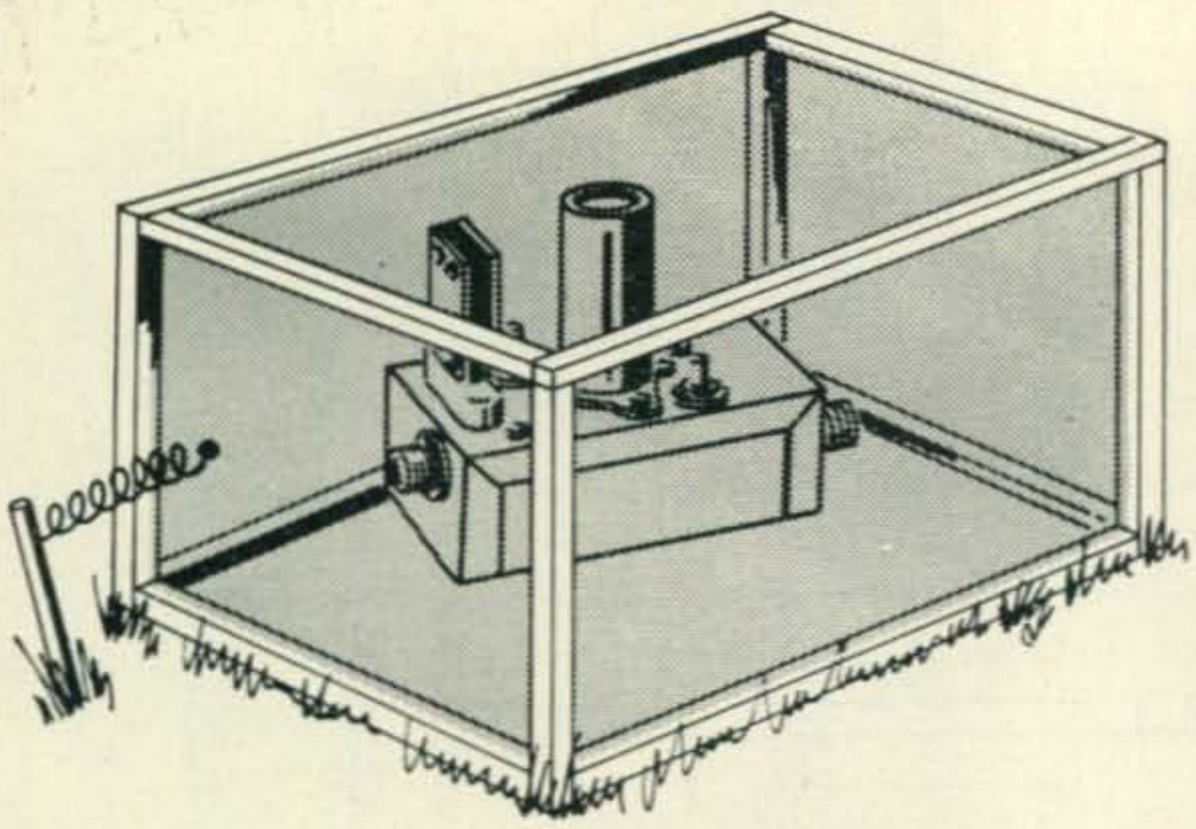
Place a shorting plug into one of the input jacks. Bring up the level of potentiometer R_2 slightly above the point at which the two NE-51 lamps fire. Reduce the feedback control, R_1, slightly below the point at which the two neon lamps turn off. This is an indication that bias for V_{1A} is too low, feedback is too low, and the state of the circuit has switched with V_{1A} now conducting and V_{1B} at cutoff. If this is true there is no longer sufficient voltage from the arm of R_2 to ground to fire the neon lamps. There would be the relatively small voltage across the cathode pot, R_1, due to the plate current of V_{1A}.

If the NE-51's should start glowing again, it is an indication that some part of the circuitry has not been wired properly. If the lamps do not come back on with the test, all is in order. Now go back through the same procedures (plug shorting input and R_1 full on) and again set control R_2 slightly above the point at which the two neon lamps fire. Again, reduce the feedback gain control R_1 until the neon lamps turn off. Now turn R_1 *up* (increase) slightly above the point at which the neon lamps again turn on.

It might be necessary, at this point, to readjust the screen grid voltage potentiometer, R_7, for 60 milliamperes of plate current. Under these load conditions, the plate voltage was 202 volts and the screen voltage was 148 volts for the 6AQ5 keyer tubes, V_2 and V_3. The no-load voltage was 214 volts for both plate and screen at the tube sockets.

The keyer is now ready for use, and none of

[*Continued on page 106*]



A TVI-PROOF 21 MC EXCITER

BY WILLIAM R. SHOOTS,* W6BMM/5

A DOZEN or so years ago, when the 15 meter band was released to the hams, most of us were timid about using it due to TVI. The eyes of Satan with the then-popular 21 mc i.f.'s automatically commanded a high-pass filter. But this was not a cure-all. Unfortunately, most commercial and home brew rigs, then, used Pierce (literally?) oscillators (guaranteed to make any crystal, without a hole burned in the center of it, oscillate at its resonant frequency) which, because of being rich in harmonics, saved multiplier stages. The unused harmonics had to then be elaborately dealt with, of course.

At that time, during an eyeball roundtable, someone brought up a challenge for someone (else) to design a generator that was rich in 21 mc fundamental and nothing else. This exciter is what I ginned up, tnx to W6TSC's encouragement. And the years passed. Well, a couple of years ago, when Fifteen was really swinging, WA6ZCA, then a Novice, asked me to lay out something clean for him that he could build in a hurry. Being lazy I broke out the yellowed print of this unit and showed him the one I had constructed. His acquisition of a Navigator and a General ticket, shortly afterward, kept him from building this, but he filed the map for future use. So! While miniature twin-triodes are still available, here 'tis.

Operation

The oscillator is straight-forward overtone type. It is stable and easily keyed, due to light loading of its output, and any 7 mc crystal works FB. The Class A1 cathode-follower/driver needs no neutralization. No matter how the tanks are tuned the cathode follower reflects light loading on the oscillator. The reason for this is that although the grid resistor for V_2 is only 10K, by returning the grid to the cathode, *above* signal ground, the reflected impedance to V_1 is eight or nine times R, or nearly 100K. The power gain is slightly more in a cathode follower, such as this, than in a conventional plate-loaded amplifier.

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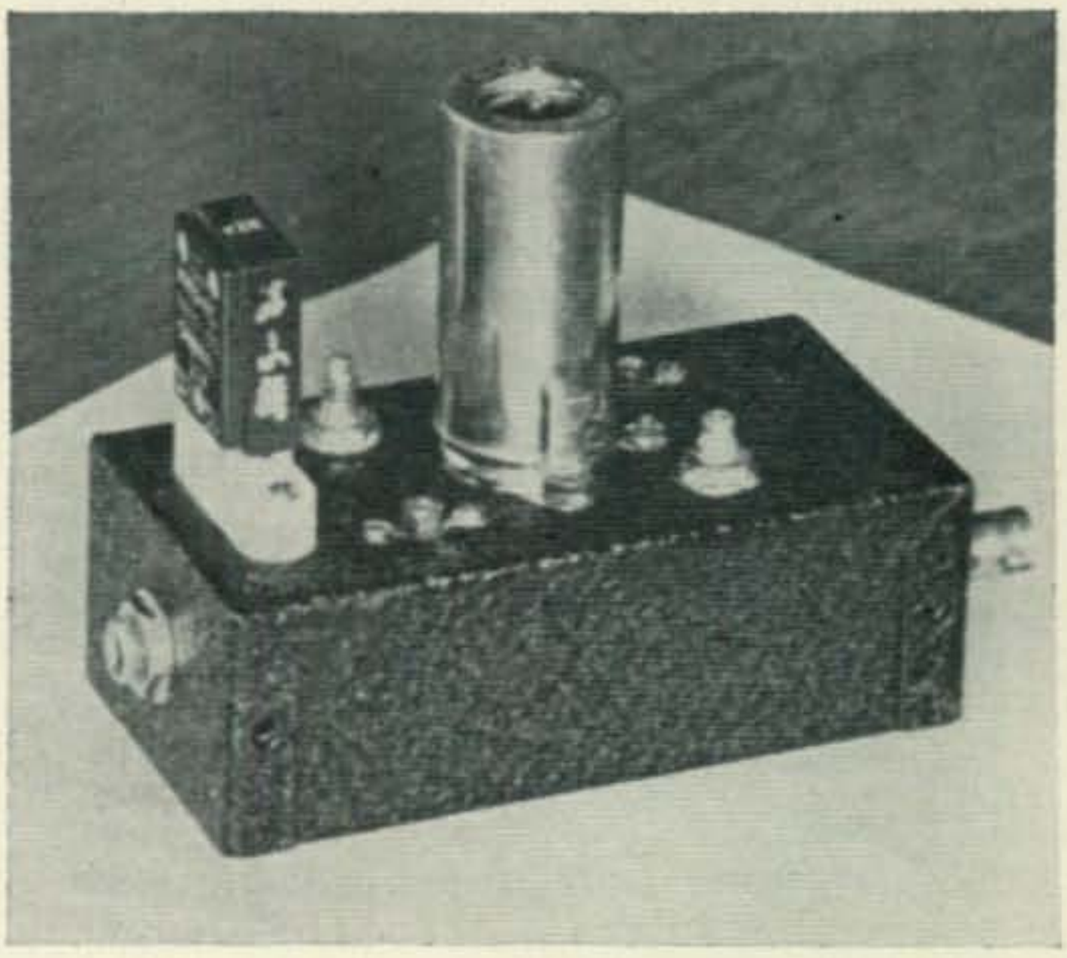
Construction

Construction is simple, and the values given are not especially critical, but they are near optimum, and quality components should be used. A 10K load seemed to be it for maximum output, at 40 to 45 volts, perfect for a Class B 6146. For increased voltage for a given power output (into a higher impedance load, natch, such as AB[1] for harmonic-free c.w.) modify the L_2 circuit as shown by the dotted lines, and break the circuit at X. The RC network in the cathode of V_2 protects this stage, yet it has negligible effect on the r.f. output. It may be desirable to install protective bias in the cathode of V_1 also. Tubes with characteristics differing from those of the 12AT7 can be used as well by changing the grid resistors, but the output is plenty to drive a 6146, possibly to even Class C.



Top view of a 21 mc exciter. View shows (from left to right) key jack, crystal, L_1, C_1, V_1, C_2, L_2 and BNC output connector.

Bottom view of the 21 mc exciter.

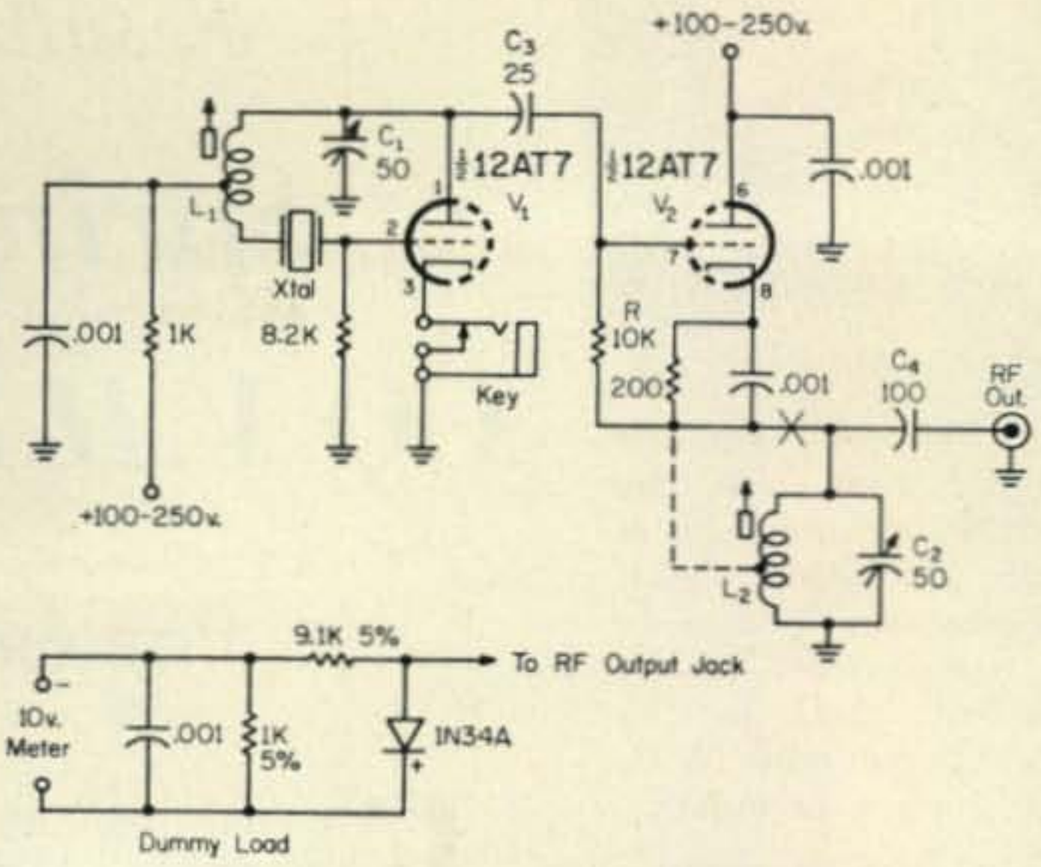


Fig. 1—Circuit of a harmonic free 21 mc exciter. All resistors are ½ watt 10%. The 0.001 capacitors are disc ceramics in mf; all other capacitors are in mmf. Also shown is a recommended dummy load circuit. A 0-10 voltmeter will have a true reading of 10 volts for a 1 volt scale reading.

C_1, C_2—50 mmf, Hammarlund MAPC-50 or equiv.
L_1—18 t #20 e. closewound on ⅜" dia. iron slug tuned form, tapped 5 t. from bottom.
L_2—12 t #20 e. closewound on ⅜" dia. iron slug tuned form. Tap 4 t. up for maximum output as explained in text.

Operation

Tuned components C_1, C_2, L_1 and L_2 can either be staggertuned, or peaked for maximum output from the exciter. Turning the slug of L_1 too far in, though, will increase the feedback to the point of self-oscillation. This is recognized on a receiver as an a.c. note and, also, by the broadening of the peak when tuning C_1. Care should be taken so the cathode follower doesn't draw grid current, otherwise, harmonic generation will result. This might be desired for other purposes, however, as rocks between 7.0 and 8.5 mc, fundamental *and* harmonic cut, work equally well in this circuit with the values given.

Final

Eleven years ago I demonstrated this box at a meeting of the Inglewood (Calif.) ARC and described it in an issue of this club's BULLetin (of which I was—*ahem*—editor). A fellow in New Mexico asked for a reprint of that pub (he couldn't read the mimeo job I sent him the first time) and queried as to its use on six. I suggested he double (yes, *double*) in the cathode follower—by reducing L_2 and C_2, and increasing R. The last I had heard he and his buddies made out FB.

One other thing, except for a barely perceptable amount of 42 mc content generated by the diode in the dummy load, the only frequency detected—by a sensitive grid-dipper—in the output of this exciter was 21 mc (no 7 mc either, of course, due to the overtone type of oscillator). In fact, 21 mc is the only frequency *within* the job (as determined by g.d. sniffing with the cover removed), so you young oldtimers can breadboard *this* one, if you wish. ■

New Amateur Product

Sydmur Electronic Specialties

THE Sydmur Electronic Specialities Company announces the availability of the Sydmur Transistorized Capacitor Discharge Ignition System.

The Sydmur system uses the automobile's original equipment, and guarantees to improve the performance of the engine, and save gas, points, miles, but most important for the ham, ignition noise is sharply reduced.

The Sydmur unit is available in either 6 or 12 volts using a negative ground system. It is unconditionally guaranteed for two years and sells for $60.00, and in kit form for $44.50. For further details write to: Sydmur, Box 25T Midwood Station, Brooklyn, N.Y. 11230, or circle 71 on page 110.

Results of the

Spring 1965

CQ V.H.F. Contest

BY BOB BROWN, K2ZSQ*

The deserted mansion pictured here was the WB2LYP/2 contest site in South Plainfield, N.J. Stations were located in the two dormers on the front of roof. In the M.O.M.B. category, WB2-LYP/2 came in eighth.

President of the high-scoring Six Meter Club of Dallas and himself the third highest nationally in the S.O.S.B. competition, Harold Cox, K5IVB, is pictured in a more relaxed post-contest pose. His rig? A G-50, with which he's worked 45 states since May 1962.

Operating W8FT in Findlay, Ohio, were WN8PVN (logging) and WA8GAU. Both boys are H.S. sophs.

Snow in May?!! Lots of it if you operate where W8KNC/KL7 did — 125 miles south of the Arctic Circle. This year's Alaskan return surprised everyone.

FOR the first time in longer than I care to remember, Mother Nature graced the nation's contest-minded v.h.f. addicts with good weather the weekend of May 2-3. After years of reading log comments like "rained out after the first two hours" and "almost literally swept off the mountaintop," what a pleasant surprise to find stations actually working for a full 24 hours and better! Actually, some areas did report minor showers of short duration, but for once the majority of the country found themselves eager to climb mountains and get out into the open. Unfortunately for many, however, the competition was tougher than ever. This Spring's turnout was the largest in recent memory, making for generally more contacts, but allowing little extra time for a leisurely 807 between. Complicating things somewhat was a good Sporadic E opening that markedly changed the overall nationwide picture, as can be seen in the results. What happened was that the Southwest found itself in one extended opening, the Midwest and South with scattered E, the Far West with practically nothing other than tropo and the East with a little bit of everything. Two meters, on the other hand, resulted in scores that were generally higher the country over, which could partially be attributed to temperature inversions more or less coinciding in many sections.

While at the Dayton Hamvention in April, K9DZK and the writer spent some time reminiscing about Connersville, Indiana, at which time K9DZK vowed he would walk away with our Spring multi-operator certificate. As you can see, he is as good as his word. The gang at the Connersville overlook (Elephant Hill to us natives) racked up a total of 2,352,900 points, the highest recorded for this contest.

What with Six Meter Club of Dallas' members making Texas S.O.S.B. standings look like forty meters, K1MRI somehow still managed to accumulate the highest point count in quite a while: 1,310,904. With poor to average participation in the NYC area, this was quite a trick. Perhaps the most important factor in Kirk's case, though, was his exceptionally high county figure, which ran at 84, giving him a multiplier that made all the difference.

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050

Another surprise this year was the Indiana high-score award, which went to Joel Bush, WA9JBF, at 15, the youngest state winner ever. Joel, of Knightstown, racked up his 211,575 on six meters with just 25 watts to eight elements.

The VHF camera catches the WB2LYP/2 gang in action: Left to right, WB2-LRQ, WB2LYP & WB2LDE. Seated is WN2RLC.

W1ASZ/1, located itself upon the Ski Lodge at Mt. Agamenticus in N.H., which was evidently high enough to put the University of N.H.'s score into the top five in our club aggregate returns.

A native of Tennessee, "Bunky" Botts, K4EJQ/4, provided a "first Virginia contact" to many from his mountaintop site. With 730,750 points, K4EJQ/4 came in seventh in the nation's top ten (S.O.S.B. category).

The operating positions at W1ASZ/1, recipient of the 4th Place award for M.O.M.B. The boys who accumulated the over 1½ million points are shown here (left to right): WA2ULP at the six meter controls, and K1WHS calling CQ on two.

One interesting finding was that very few single ops took advantage of the full 31-hour multiplier, while the hilltoppers used it much more extensively. The hour average ran about 26 for the winners. Another result that is unusual in such competitions was the relatively high percentage of youngsters participating this year from the Midwest. Indiana state winner WA9JBF is 15, while dozens of logs were received from members of the Lawndale Chicago Boys Club. Several high-scoring groups in the Club Aggregate competition noted that their best operators this year were under 20 years of age.

Novice participation reached an all-time high, with a substantial block of Alaskans adding their scores to the pile. But the East Coasters still captured the top certificates with scores running roughly twice their norm.

Seven clubs crept into the elusive inner circle (scoring in excess of one million points) signifying both an increase in percentage of members turning in scores, and an overall upswing in the activity for the weekend. Among them, for the Berkshire VHF & Booze Society (no kidding!) and Thunderbolt VHF Society, it was their first crack at the Club Aggregate competition. But perhaps the most remarkable incident was the University of N.H.'s phenomenal rise from a combined score in the last contest of 313 to a respectable 1,526,676 this time. They're threatening more for the '66 contest, and if enthusiasm is any factor, they will probably make it.

The Power Multiplier: A Surprise

Having set the Spring contest multiplier at 1.25 for stations running less than thirty watts input, we quite expected this almost negligible item to be ignored. It wasn't. To our complete surprise over 90% of all participating stations took advantage of the multiplier, preferring to crank the power down. And apparently their approach was a sound one, since a high percentage of certificate winners fell into this category.

This is especially interesting to us in view of the fact that it has been a 'sign of the times' in recent years to go for more and more power. Also to be considered here is that a great number of contest regulars, who for years have not used the multiplier, "ran barefoot" in this one. A possible trend?

Stay Tuned—More To Come

The date of the next Spring *CQ* V.H.F. Contest, consistent with our first-weekend policy, has been set for May 7-8, 1966. (Club officials would do well to make note of this date). Meantime a year of fame awaits those high on the lists here. August 12-Hour results will appear soon. For now, our congratulations to the winners!

73, Bob, K2ZSQ

HIGH SCORES

M.O.M.B.	K9DZK/9	2,352,900
Club	Six Meter Club of Dallas (Tex.)	2,043,039
S.O.S.B.	K1MRI, Conn.	1,310,904
Novice	WN2OJU	107,820

THE TOP TEN — S.O.S.B.

K1MRI, Conn.	1,310,904
K3DUW/3, Pa.	1,226,484
K5IVB, Tex.	836,300
K5MLD, Tex.	716,100
WA2VLR, N.J.	660,060
K4EJQ/4, Va.	656,250
WA5AUA, Tex.	381,940
K2MHJ, N.J.	375,624
WB2FXB, N.Y.	284,580
K8VEX, Mich.	282,596

Club Scores

Six Meter Club of Dallas (Tex.)	2,043,039
Butler Co. VHF Ass. (O.)	1,803,084
Reading R.C. Inc. (Pa.)	1,695,817
Berkshire VHF & Booze Society (Mass.)	1,623,072
University of N.H. A.R.C. (N.H.)	1,526,676
Thunderbolt VHF Society, Inc. (N.J.)	1,374,388
Montachuset A.R.C. (Mass.)	1,078,180
South Plainfield H.S. A.R.C. (N.J.)	742,574
Peninsula A.R. Klub (N.J.)	660,060
St. Benedict's Prep R.C. (N.J.)	593,712
High Point A.R.A. (N.J.)	387,504
Dobyns—Bennett A.R.C. (Tenn.)	346,920
Cleveland A.R.C. (Tenn.)	333,900
Six and Two Ham Club (Ill.)	313,996
Communications Club of New Rochelle (N.Y.)	284,580
Lawndale Chicago Boys Club A.R.A. (Ill.)	271,755
Five Towns R.C. (N.Y.)	228,228
Marion VHF High-Banders (O.)	112,896
San Fernando Valley R.C. (Calif.)	90,181
East Palestine R.C. (O.)	89,504
Six Meter Club of Chicago (Ill.)	88,628
West Knoxville A.R.C. (Tenn.)	63,750
Argonne A.R.C. (Ill.)	63,358
West Los Angeles A.R.S. (Calif.)	57,195
Case A.R.C. (O.)	54,750
Oxford Furnace VHF Club (Va.)	41,390
Portland Amateur Wireless Assn. (Me.)	39,200
Stout Radio Electronics Club (Wisc.)	37,680
Artic A.R.C. (Alaska)	29,603
Lakeview Ham Club (Mich.)	20,240
Nashville A.R.C. (Tenn.)	13,650
Findlay R.C. (O.)	6728
South Bay A.R.S. (Calif.)	6268
Morris R.C. (N.J.)	6256
Merrimack Valley A.R.C. (Mass.)	6156
Rockaway A.R.C. (N.Y.)	4060
Cobb County AREC (Ga.)	1925
Whitman A.R.C. (Fla.)	20

Single-Band Single-Operator,

The number groups after the call letters denote the following: number of contacts; number of counties; hour multiplier; band operated and final score. The other competition classifications follow suit.

Alabama

K4BEI/4	67	42	18	6	59,094
W4UAR	12	6	4	6	288

Alaska

WL7FIB	62	1	24	2	1860
KL7EWH	64	1	22	2	1760
WL7FHN	56	1	21	2	1470
WL7FHF	54	1	21	2	1417
WL7FHK	60	1	18	2	1350
WL7FHI	52	1	15	2	975
KL7EPG	48	1	15	2	900
KL7BEI	52	1	15	2	780
WL7FHM	56	1	11	2	770
KØRAX/KL7	44	2	8	2	704
KL7EPS	52	1	13	2	676
KL7FCG	22	1	8	2	220
KL7EPH	24	1	6	2	180
KL7EWR	20	1	6	2	150
WL7FHL	26	1	4	2	130
KL7FHX	12	1	2	2	30

California

K6JHV	198	16	22	2	69,696
K1PLX/6	316	6	26	6	61,620
K6UMV/6	360	5	30	6	54,000
WB6GFD	113	4	31	2	35,030
WA6TGH	130	3	18	2	8775
WA6RTM	41	10	17	6	6970
WB6JLC	59	5	17	2	6268
WB6LNS	66	4	17	6	4488
WB6EYK	18	1	3	6	54
K6UMV/6	6	1	3	2	23

Canada

VE3ASO	138	12	24	2	49,680
VE3FXN	11	4	4	6	132

Connecticut

K1MRI	578	84	27	6	1,310,904
K1VDZ	216	32	25	2	172,800
K1FJV	146	17	18	2	44,676
WN1CWN	60	5	17	2	6375
WA1ANB	18	7	7	2	1053

Florida

WA4JZT	178	12	25	6	53,400
K1WYS/1	8	1	2	2	20

Georgia

K4ZMQ/4	196	52	23	6	54,416
K4YZE	28	5	11	2	1925

Illinois

WA9FJW	121	25	31	6	234,437
WA9FIH	228	19	25	6	135,375
W9VWY	190	16	31	2	94,240
WA9KAY	219	15	28	6	91,840
WA9FSN	144	17	26	6	79,559
K9ZWV	146	11	23	6	36,938
K9ZWV	104	9	17	2	19,890
WA9EJE	92	14	13	6	16,744
K9ZWU	100	9	17	6	15,300
WN9MRF	93	5	23	2	13,369
K9ZWU	90	9	14	2	12,600
W9AVE	80	9	13	2	11,700
WA9OGN	84	5	18	2	10,920
WN9NUB	92	4	22	2	10,120
WA9KQO	52	6	11	2	4290
WA9CFK	62	8	6	2	2979
WN9OCX	56	7	6	2	2520
WA9KAY	50	4	9	2	2250
WA9IRX	50	3	11	2	1650
WN9NVC	36	3	9	2	1215
WA9AIJ	47	3	8	6	1128
K9TBZ	54	4	4	2	920
W9OJR/9	24	4	5	2	600
K9YHF	38	5	3	2	583
WA9KGA/9	24	3	5	6	450
W9KYA	36	2	4	6	360
WA9BRE	30	3	3	2	326
W9WJC	16	3	1	2	60
K9DZX	14	2	2	6	56
WA9FIH	14	1	1	2	18

Indiana

WA9JBF	156	35	31	6	211,575
WA9ASZ	156	24	30	6	140,400
W9HVY	136	14	23	2	43,792
WA9GNC	34	12	9	6	4590

Kentucky

WA4SKP	209	32	26	6	173,888

Kansas

WØZXO	56	18	4	6	5040
WAØDZI	25	4	10	6	2000

Maine

K1OYB	100	28	14	6	39,200
K1MTJ	70	9	18	2	11,340
K1MTJ	40	15	5	6	3000
K1OYB	38	5	14	2	2660

Massachusetts

K1MIM	182	28	18	6	91,728
K1ZGH	100	20	22	6	44,000
W1MTV	86	14	15	2	18,060
K1JQQ	36	19	9	6	6156

Michigan

K8VEX	212	43	31	6	282,596
WA8CDF	208	41	27	6	230,256
WA8JEI	88	8	23	2	20,240
K8ZQE	66	16	9	2	9504
WN8OLD	18	5	13	2	1170

New Jersey

WA2VLR	386	57	30	6	660,060
K2MHJ	376	37	27	2	375,624
WN2OJU	210	29	18	2	107,820
WB2JKU	168	22	21	2	106,260
WB2RNO	42	15	14	6	11,025
WB2MJF	40	11	6	6	3300

New Mexico

W5CK	104	31	4	6	12,894

New York

WB2FXB	340	27	31	2	284,580
WA2NZA	226	26	28	6	205,660
WN2RFG	108	17	16	2	43,520
WN2POM	106	15	20	2	39,750
WA2WIY	50	20	11	6	13,750
K2MBJ	70	8	18	6	12,600
WN2QLP	154	17	15	2	8818
K2UHD	58	7	8	2	4060

Mike Fahmie, WA6ZTY, who operated at K6JHV, pulled a real upset in California by taking the state away from some tough competition. The secret: Mike's sole antenna—a two meter groundplane! His 16-county record on 144 mc should stand for quite some time.

Here's Jim Novak, WA9-FIH, who took 2nd Place honors in the tough Illinois State competition.

Meet Kirk Fourcher, K1MRI, of Connecticut, this year's highest scoring S.O.S.B. station. Kirk piled up a contact total of 578 in 84 counties for a whopping 1,310,904.

Joining in May's California competition was Ulo Vilms, WB6LNS (ex-ES6E). Coincidentally, May 1st and 2nd were Ulo's first two days on 6 meters!

This shot was taken early Sunday morning, May 2, at the K1YLU/1 site on Mt. Wachusett, Mass. (ele. 2025'). Left to right: K1PSS, K1VPD, K1YLU, and K1ZGR. The group placed sixth in the M.O.M.B. category and came in seventh.

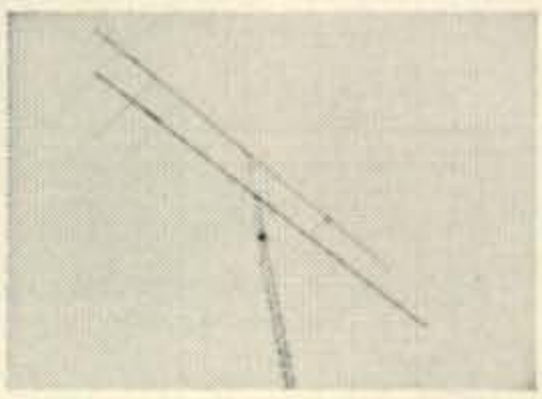
Meet Bob Rice, K1MIM, of Hyde Park, Massachusetts. Bob took the state with 91,728, away from arch-rival K1ZGH. Who'll get the August certificate?

Meet Hershel Mathews, K4DTP, of Norfolk, Va., who lost the state to that Tennessee renegade, K4-EJQ/4. A good 51,000 points, however, still reflects plenty of hard work.

The Case Institute of Technology A.R.C. went all out for the May contest. Standing: K8LCC, WA8MED, K8YMK. Sitting: WA2USG & K8TIE.

M.O.M.B. participant Bobby McCallie, WA4-VAW, of Knoxville, Tenn.

High-scoring Maine station: Martin Feeney, K1-OYB with 39,290.



These antennas may look small, but that bottom one is the 47' Telrex for six meters that the Thunderbolt VHF Society used in N.J. this year. Operating under the call WA2SAB, the group came in 5th in the nation in the M.O.M.B. category. (Small antenna: 38 element Telrex!).

Fourth Place Novice winner this year is Steve Marshall, WN9MRF, of Cicero, Ill. His Dad, who also participated, is WN9NUC, while younger brother is WN9NUB, and sister, WN9NUD. This fam hamily use the Heath Twoer exclusively.

WB2QFI	38	4	12	6	2278

North Carolina

K4VAA	42	14	10	6	5880
WA4WZQ	32	8	12	6	3840
WA4WZP	28	7	10	6	2860

Ohio

WA8KBD	152	29	21	6	113,988
K8ZES	147	32	24	2	112,896
WN8PHT	22	8	9	2	3960
WA8DOM/8	12	1	2	3/4	30

Oregon

K7ZFG/7	44	7	11	2	4235
K7WXW	14	5	8	6	700
WA7BIN	26	2	7	2	455

Pennsylvania

K3DUW/3	628	63	31	6	1,226,484
K3ZJM	307	32	26	6	255,424
W3ETB	224	25	22	6	123,200
K3IPM	140	39	10	6	54,600
W3MAA	31	20	7	6	5425
K3YIZ	48	7	9	2	3780
K3IIJ	42	4	10	2	2100
WN3BHF	26	3	7	2	682
WA3CPQ	32	2	8	2	640
WN3BHD	36	2	7	2	630
K3ALQ/3	18	4	4	6	360
WA3CPR	20	1	5	2	125
WN3BJE	18	1	5	2	112

Tennessee

WA4WDU	76	13	13	6	12,844
K4FJW/4	44	7	13	6	5005

Texas

K5IVB	364	75	31	6	836,300
K5MLD	330	70	31	6	716,100
WA5AUA	226	65	26	6	381,940
WA5LPA	234	43	27	6	271,674
K5CMC	166	36	20	6	119,520
WA5EOI	118	31	19	6	86,877
WA5CLX	72	13	13	6	12,168
WA5IYX	12	12	8	6	2980
K5TYP	10	13	5	6	1625
WA5KUK	20	4	4	6	400

Virginia

K4EJQ/4	300	7	25	6	656,250
K4DTP	100	17	24	6	51,000
W2UZN/4	17	6	4	6	408

Great Britain

G2DHV/P	13	5	4	2	650

Novice Results

WN2OJU	210	29	18	107,820
WN2RFG	108	17	16	43,520
WN2POM	106	15	20	39,750
WN9MRF	93	5	23	13,369
WN9NUB	92	4	22	10,120
WN2QLP	154	17	15	8,818
WN1CWN	60	5	17	6,375
WN8PHT	22	8	9	3,960
WN9OCX	56	7	6	2,520
WL7FIB	62	1	24	1,860
WL7FHN	56	1	21	1,470
WL7FHF	54	1	21	1,417
WL7FHK	60	1	18	1,350
WN9NUC	36	3	9	1,215
WN8OLD	18	5	13	1,170
WL7FHI	52	1	15	975
WL7FHM	56	1	11	770
WN3BHF	26	3	7	682
WN3BHD	36	2	7	630
WL7FHL	26	1	4	130
WN3BJE	18	1	5	112

Multi-Operator, Multi-Band

K9DZK/9	528	115	31	6, 2	2,352,900
W8CCI	524	111	31	6, 2	1,803,084
K1UVP/1	528	106	29	6, 2	1,623,072
W1ASZ/1	642	82	29	6, 2, 1¼	1,526,676
WA2SAB	690	86	23	6, 2	1,374,388
K1YLU/1	470	74	31	6, 2	1,078,180
W3WJC/3	440	69	31	6, 2	941,160
WB2LYP/2	413	62	29	6, 2	742,574
K4LZO	350	54	31	6, 2, ¾, 1215	732,375
WA2TWG/2	336	57	31	6, 2	593,712
WB2MRK	360	53	31	6, 2, 1¼	591,573
WB2QJB	376	44	26	6, 2	537,680
W2HGR/2	230	77	26	6, 2	387,504
W3UCA	258	45	31	6, 2, 1¼	359,910
K4PYK/4	236	56	21	6, 2	346,920
WA4VNP	252	53	25	6	333,900
K4NCP	196	41	26	6	208,936
K3TSQ/3	216	31	31	6, 2	207,576
WB6MGR/6	184	28	25	6, 2	161,000
WØCCD	140	41	26	6	149,240
K3QJJ/3	162	29	29	6, 2	136,242
W3ZZR	156	25	31	6, 2, 1¼	120,900
W8GM	162	17	26	2	89,504
WA8GES	200	15	28	6, 2	84,000
WA4VAW	120	25	17	6, 2	63,750
K3TRY	106	14	31	6, 2	57,505
WB6FEW/6	246	6	31	6, 2	57,195
W8EDU	146	12	26	6	54,750
WA4JNL	72	20	23	6	41,390
KØPAT	70	19	8	6, ¾	40,142
K9YHH	94	16	21	6, 2	39,380
W4VTN/9	110	11	26	6	39,325
W9CPB	66	30	19	6, 2	37,680
WA4OSR/4	77	26	18	6	36,036
WA2KIZ/2	112	9	18	6, 2, ¾	22,680
WA9LED	74	10	17	6, 2	15,775
K7UGD	50	19	6	6, 2	7125
W8FT	46	9	13	2	6728
WA2CMG	68	23	4	6, 2	6256
KL7ENO	80	3	26	6, 2	6240
WB2JDD	36	11	9	6, 2	4459
KL7EJQ	81	3	18	2	4374
KL7ENZ	74	1	21	6, 2	1942
KL7ECO	60	3	10	2	1800
WA2VTE	19	16	4	6, 2	1520
W8KNC/KL7	64	1	18	6, 2	1440
K9YHB	54	4	5	6	1080
WB6NST	14	7	7	6, 2	858
WA2PJL/2	18	6	3	6, 2, ¾	405
K3FOC	30	3	3	6, 2	337
KL7AZJ	42	1	6	6, 2	315
WA6VEP	36	1	6	6, 2	216
KL7AEQ	32	1	3	6, 2	120
K7ZFG	16	2	2	3.3. 10 gc.	80

Representing the top-ranking Six Meter Club of Dallas is Ken Rushing, WA5LPA, who scored third in the individual club's competition with his 271,674. Ken reports picking up 20 new counties in the May bash.

First Place Michigan winner is none other than Ivan Smith, K8VEX of Wayland.

Step by step instructions for

PUTTING THE APX-6 ON 1215 MC

PART II

BY BOB BROWN,* K2ZSQ AND ALLEN KATZ,* K2UYH

Part II, the conclusion of this discussion of APX-6 covers the conversion of the cavities, testing and tune up procedures.

PART I of this series, published last month, covered the construction of the modulator-power supply chassis and the conversion of the i.f. strip. We are now prepared to work on the cavities.

Step 5—Those Cavity Modifications

The local oscillator cavity requires no conversion; however, the transmitter cavity modifications more than make up for this. The transmitter was originally designed to operate on voltages used for pulse modulation, and will not function on the low voltages used for a.m. phone. To make the transmitter circuit oscillate, a new feedback system must be constructed.

First, remove the tubes from the cavities by pulling up on the spring clamps and pulling out on the tube sockets (note which tube is for the transmitter.)

Two holes will have to be drilled in the transmitter cavity for a feedback loop. The position of these holes can be found exactly by drawing a vertical line up the transmitter cavity, starting from the back left-hand corner of the chassis on which the cavities are mounted. (See photos.) On this line, measure ¼" down from the top of the transmitter cavity and center-punch to fix the position of one hole. Now measure up 1⅛" from the cavity chassis and center-punch to fix position of the other.

Next, remove the 18 screws holding the grid and plate halves of the cavities together. In the top section of the transmitter grid cavity will be found two protruding metal lobes. These must be broken off. This can be accomplished by swinging them back and forth until they snap. There are also two holes in this part of the cavity which divide the grid and plate sections of the transmitter cavity. These holes must be filled in. Cut two lobe-shaped pieces of copper sheet (a small square of copper flashing can be purchased at any hardware store), making them a little larger than the holes they must cover. Solder the two copper pieces over the holes. (A Benzomatic torch is recommended for this operation, and for all other cavity-soldering. A conventional soldering gun just doesn't get hot enough.)

Now drill the ⅜" holes whose position was fixed by center-punch earlier.

Put the cavity ring (metal) around the upper part of the transmitter cavity and solder a BNC connector in the hole drilled in this section. A copper strap about 3/16" across must be soldered between the end of the BNC fitting and across the center of the cavity as shown in fig. 6.

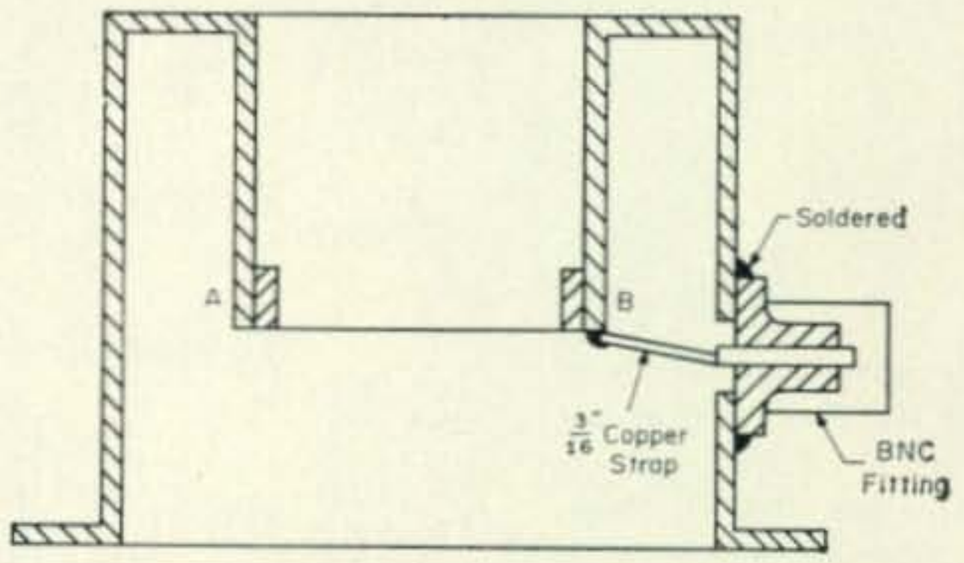


Fig. 6—Sectional view of the top part of the transmitter cavity showing the BNC fitting and the copper strap feedback coil.

Over the hole in the bottom part of the transmitter cavity, solder a ⅜" nut to the outside. A special BNC fitting should be purchased to screw into this nut. (The type of BNC fitting needed has no flange and is threaded to fit a ⅜" nut. If one cannot be found, you can make one from a standard BNC fitting. Bend the flange back and forth with the aid of pliers and a vise until it breaks off, then file smooth and tap the connector.)

A small coil made from a piece of copper ⅛" wide and 1" long must be soldered to the fitting (see fig. 7). The feedback loop is a length of

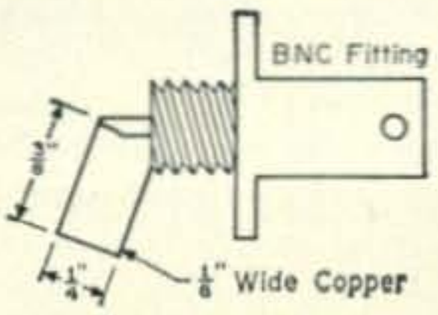


Fig. 7—Dimensions of the feedback loop placed in the lower section of the transmitter cavity.

*Contributing editors, VHF COLUMN.

RG-59/U coax connected between the two BNC fittings. The length of this loop must be 1½ wavelengths long on the frequency of operation.

Although the receiver covers the entire 1296 mc band (1215-1300 mc), the transmitter cavity will only tune to about 1225 mc without further modification. This limitation is not really serious, since the length of the feedback loop will stop the transmitter from oscillating over more than a few mc. Most APX-6 operation in the U.S. is concentrated around 1220 mc.

A feedback loop for this frequency is about 7.8" long; however, to make certain your APX-6 is transmitting in the band, experiment with the length of the feedback loop until maximum output is obtained at the very top of the transmitter frequency scale.

The only modification of the TR cavity usually needed is that of the flasher tube, a 1B40. This was designed to conduct on transmit, detuning the TR cavity and stopping r.f. from overheating the mixer diode. The 1B40, however, will not flash on the low voltage used in the converted APX-6. A small neon bulb such as an NE-2 can be used to do the 1B40's job.

Break the glass of the 1B40 and solder one lead from a NE-2 to the disk at the bottom of the tube. The other neon lead is soldered to a pin from a miniature tube socket which just fits around the 1B40's center pin (see fig. 8).

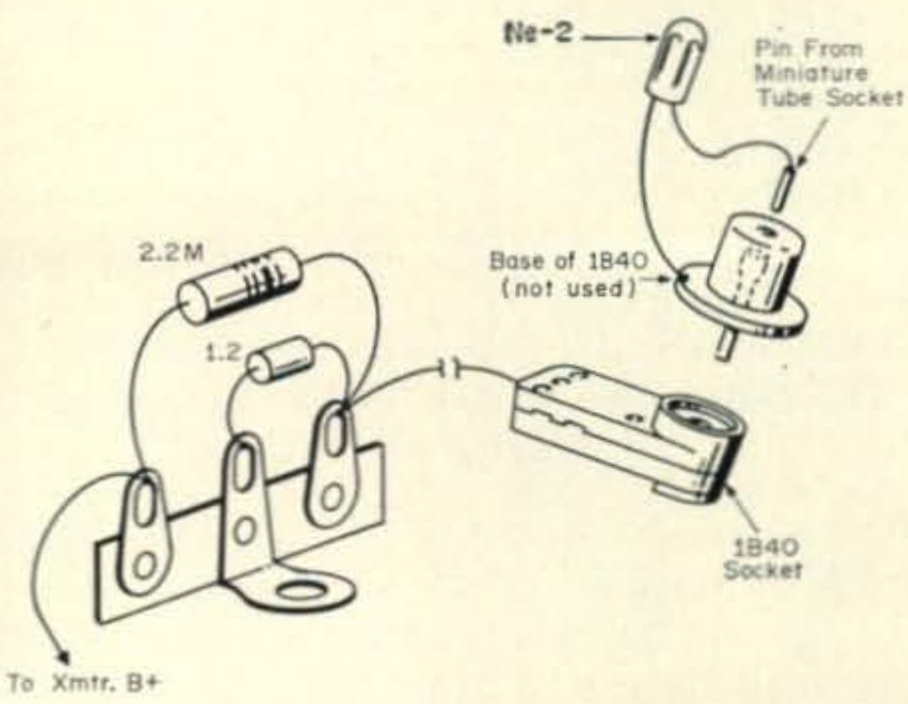


Fig. 8—Arrangement used to substitute a neon bulb for the 1B40 flasher in the *TR* cavity. The terminal strip is mounted on the front panel and the Xmtr B+ is taken from the T-R switch.

The red and white lead from the 1B40's socket should then be connected to the transmitter high-voltage through a 2.2 meg resistor, bypassed with a 1.2 mmf capacitor and mounted on the front panel.

In some APX-6's it was found that the TR cavity would not tune to 1220 mc. This can be corrected by cutting ¼" off the length of the cavity's plunger. To get at the plunger, unscrew the six screws holding the cavities to their chassis. Then clamp the TR plunger in a vise and saw off its end.

Step 6—More Drilling

The next phase of the APX-6's conversion is to drill any new holes needed in the front panel and cover the old ones not used. Figure 9 shows the front panel's final layout. The large holes from the control and power sockets are covered with a plate in which smaller holes have been drilled for the TRANSMIT-RECEIVE switch and pilot light.

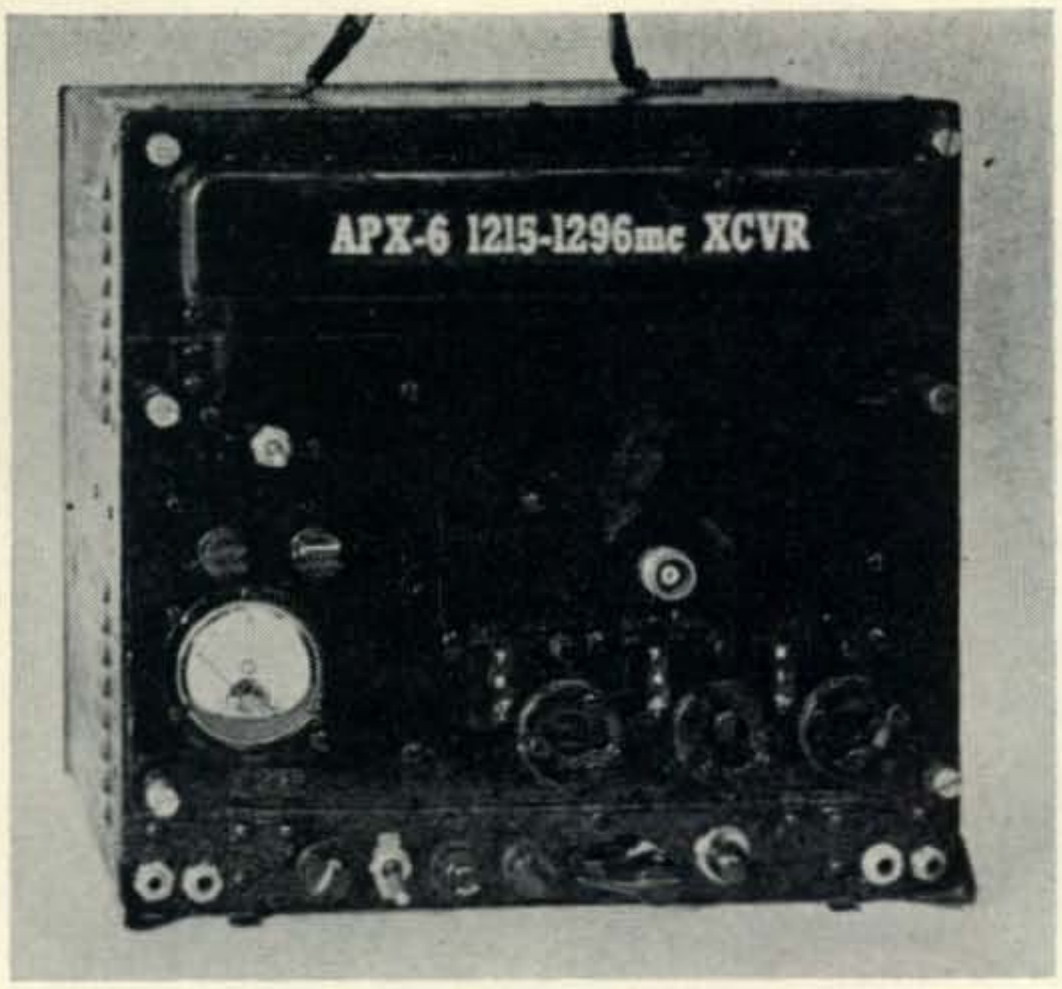


Fig. 9—Front view of the APX-6 showing the control groupings. Above the meter are the transmitter 1K CATHODE POT and the receiver AUDIO GAIN. The toggle switch controls the meter to enable reading either crystal or transmitter cathode current. Along the bottom row are; mic jack, trans. cathode jack, transmitter audio, A.C. On-Off, fuse, receiver SENSITIVITY, TRANSMIT-RECEIVE switch and the Pilot light. The jacks are for phones and a spare. Above the controls on the right are the cavity tuners; TRANS. FREQ., REC. FREQ. and L.O. FREQ.

The modulator/power supply chassis is mounted next. Mount this chassis using the same holes that were used for the pulse power supply. The back cover can be attached to this new chassis with sheet metal screws.

Next, the cavities must be put together and mounted on the front panel along with the other controls.

Step 7—Wiring Sections Together

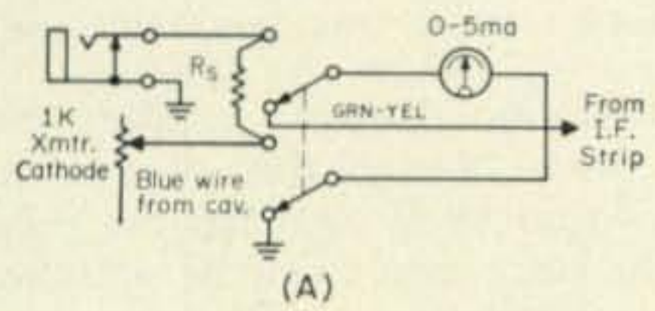
The last stages in the APX-6 conversion is the connecting together of the unit's main parts (modulator/power supply, cavities, and i.f. strip) and the wiring of control system at the main terminal strip on the front panel.

This operation is accomplished as follows: To pin 1 on the main terminal strip (located next to the cavities) connect the green (receiver monitor) lead from the i.f. strip. To pin 2 connect the green/white (video output) lead from the i.f. strip. To pin 3 goes the blue/yellow (audio feed) wire from the i.f. strip and a lead from the 500K audio gain control mounted on the front panel. To pin 4 connect the blue/white a.v.c. lead from the i.f. strip and wire to ground. To pin 5 connect the brown/white (sensitivity) wire from the i.f. strip and the lead from the 5K sensitivity control mounted on the front panel. To pin 6 run the red (i.f. plate voltage) wire from the i.f. strip, the brown/white (local oscillator plate voltage) lead from cavities, and the lead (marked #6 in fig. 10) from the T-R switch. To pin 7, connect the B+ lead of cable 1 (300

volts) from the power supply and the 300 volt lead to the T-R switch. To pin 8, run the black (ground) wire from the i.f. strip, the black (ground) wire from cavities, and the *K* lead of cable 1 from the power supply.

To pin 9, connect the black/white (heater) lead from i.f. strip, the black/white (heater) lead from cavities, and the "A" lead of cable 1 from power supply. To pin 10, solder the "D" lead of cable 1 (plate voltage to transmitter) from power supply, red/white (neon bulb) lead from cavities, and plate voltage to transmitter lead from the T-R switch (marked 10). To pin 11, fasten the "C" lead of cable 1 (150 volts) from power supply, and 150 volt lead to TR switch. To pin 12, connect the "G" lead of cable 1 from power supply (audio amplifier plate voltage).

Miscellaneous connections: The "F" lead of cable 1 goes to the center of the 500K audio-gain potentiometer mounted on the front panel. The "H" lead from cable 2 runs to the mike jack. The "I" and "J" wires from cable 2 run to the 500K transmitter audio gain potentiometer, also mounted on the front panel. The blue wire from the cavities (transmitter cathode) goes to the 1K variable on the front panel and then to the metering circuit. The crystal current lead, a yellow/green wire, from the i.f. strip goes to the metering circuit.



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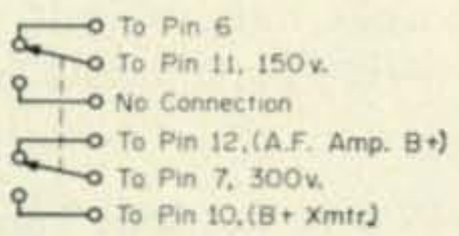

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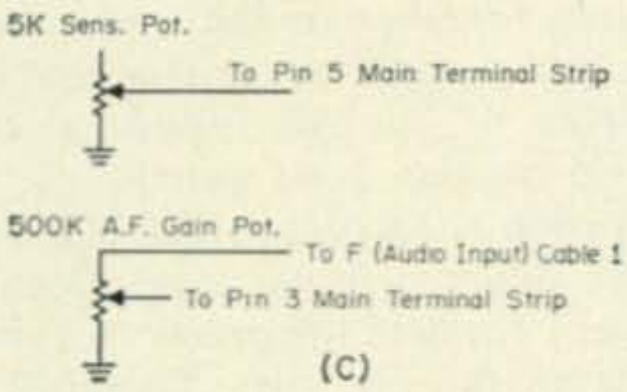

(C)

Fig. 10(A)—Metering circuit, in upper position measures transmitter cathode current. Shunt R_s is 6' of #30 wire but may vary with meter used. (B) Wiring of the T-R toggle switch or rotary mounted on the front panel. All conncetions are made to the main terminal strip. (C) wiring of the receiver SENSITIVITY and A.F. GAIN controls.

Figure 10 shows the wiring for the control and metering circuits. The shunt indicated may not be the correct one for the internal resistance of the meter you use. If it gives an off-scale reading, or one too low, change the shunt value accordingly.

Now you'll need some power. Run the a.c. leads directly to the 110 volt On-Off switch and from there to the a.c. line through a fuse. Okay, conversion complete.

Meter Readings

In the metering circuit, the cathode current to the final should read approximately 50 mils. This can be accomplished by adjusting the 1K cathode potentiometer for maximum output current.

Crystal current should normally run about 1 ma or just a bit over. It should be mentioned here that an extremely strong signal will occasionally result in a slightly increased crystal current.

If the neon flasher is functioning properly, the crystal current should never exceed 5 ma. A current reading in excess of this amount will overheat the crystal mixer and probably burn it out.

F.M.

It seems only reasonable that since much of the converted APX-6's modulation is still f.m. to a great degree, an f.m. detector at the receiving end might produce better results. W9JIY[3] tried the idea and found that he obtained more than two "S" units gain by making the change. This

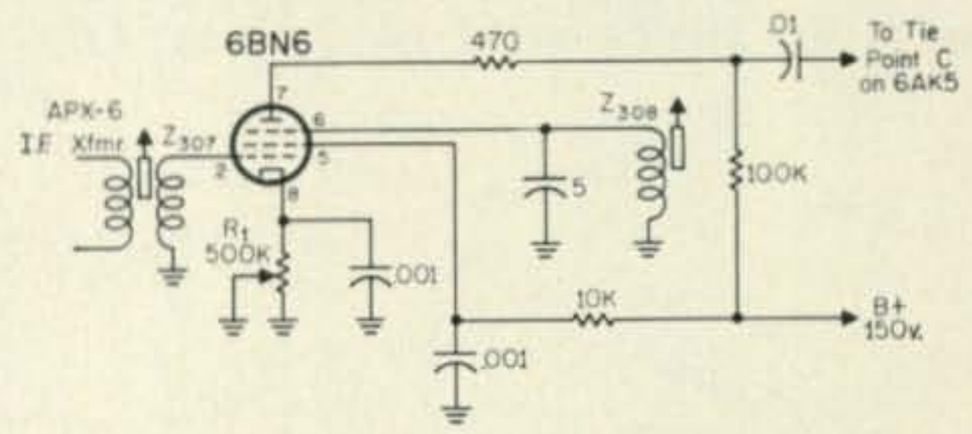

Fig. 11—Modification of the APX-6 receiver for f.m. detection.

additional modification (see fig. 11) has the added advantage of eliminating radar signal interference and being adjustable via the buzz control to copy a.m., f.m., or a combination of the two. To modify, remove V_{307}, V_{308} and V_{309} tubes and replace with this circuit. Transformer Z_{308} is used as a quadrature coil and should be tuned for maximum audio. Adjust R_1 for best speech quality and volume.

Tuneup

Using a 3" piece of wire as an antenna, turn the transmitter on and vary the transmitter cavity frequency control until the transmitter's cathode current begins to rise. A point will be found where the current is at a maximum, at which time turn the special threaded BNC connector until the current peaks up even further. This orients the coil (fig. 7) for maximum pick up. If your feedback loop has been cut to the right length, this maximum-current point should be near the top of the frequency scale.

A simple field strength meter can be constructed and the cathode potentiometer adjusted for maximum output accordingly, or you can simply test against another APX-6 for best output. [*Continued on page 106*]

Homebrew Your Meter Scales

BY GARY L. ERLAND,* KØGBT

HAVE you ever wished you had the right meter scale for that new homebrew project? Well, if so, read on. Changing the meter face and calibration is not as hard as you might expect.

You just built a new receiver or standing wave ratio bridge and are looking for a suitable meter. You could order one from a manufacturer, but this takes time and is expensive. Even then, the calibration, say for an "S" meter, probably won't correspond with the a.v.c. characteristics of your receiver. The solution to this problem is a simple one. Let's put a new scale on the existing meter.

First a few precautions should be mentioned before you open the meter. Clean your workbench and all tools with which you will be working. Be sure no dust or metal filings are left. Place a large piece of paper down to work on. A white one will help illumination. A closed room will keep the air circulation down. These precautions will better ensure against meter contamination.

Place the meter on its face and remove the three screws holding the case. Extract the movement by grasping at the terminal posts. If the movement is frozen, carefully and gently twist, then lifting straight up. Be careful in handling, and lay the movement on its back. Using a jeweler's screwdriver, remove the two screws holding the face to the movement. Take note of the pointer stops and grounding strap if applicable. Be extremely careful with this removal as the pointer can be damaged.

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Now is a good time to examine the movement for contamination. Inspect, with a magnifing glass, between the pole pieces for metal particles. Any dust or lint can cause pointer sluggishness. Do not blow to remove this. Fine point tweezers will remove the larger particles. The meter movement should then be placed where it won't be damaged. Cover it with a plastic container or similar object.

Modification

Examine the meter face and decide on your new markings. We don't want to remove anything which can be used. For example, we'll calibrate a 0-1 ma meter for indicating s.w.r. A 100 microamp meter can be calibrated in the same manner. Using a typewriter eraser or an ink eraser, carefully remove all unwanted markings. These will usually come off very easily and without harming the white background. Use light strokes and take your time at this point. In our example, we'll remove only the wording "D.C. Milliamperes", as the original scale can be used. (See fig. 1A.)

A graph in the ARRL Handbook, measurements section, will give us s.w.r. values versus current for a zero to one calibrated meter. We find a standing wave ratio of 3 to 1 corresponds to a reading of .5 ma on our meter. Likewise, 2.5 to 1 equals 0.45 ma, 2 to 1 equals 0.35 ma and 1.5 to 1 equals 0.21 ma.

By using decals, we will place our calibration marks on the meter face. I've found the dry

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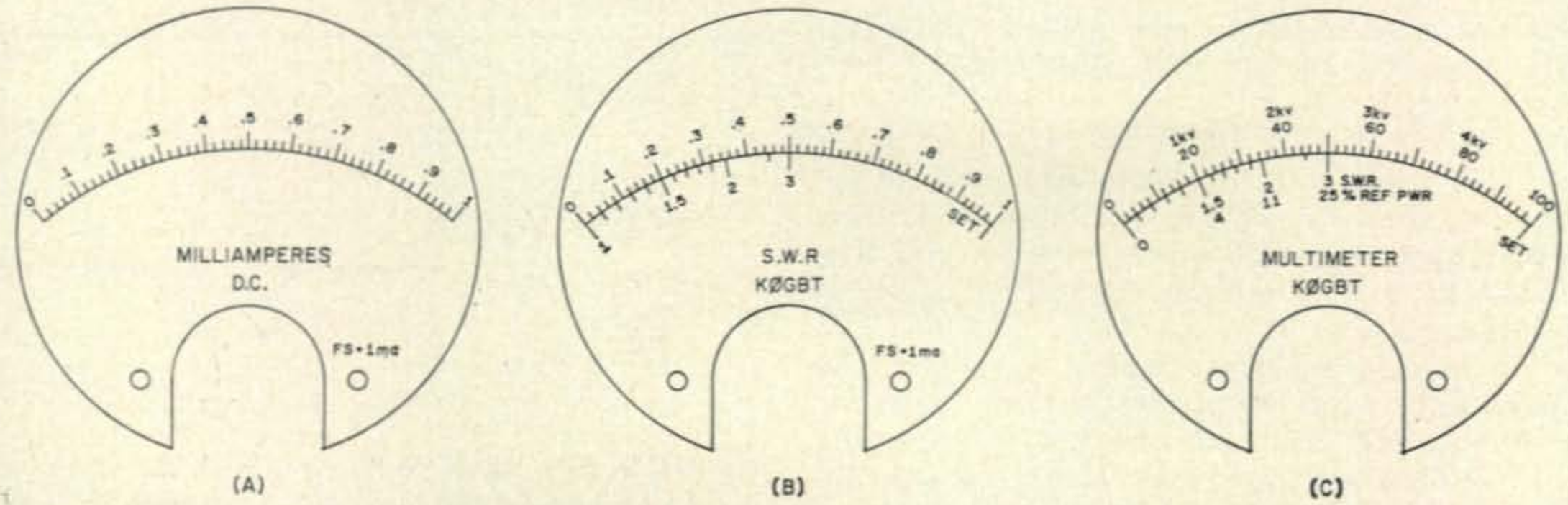

(A) (B) (C)

Fig. 1(A)—Basic 0-1 ma meter scale. (B) Same meter scale after modification for s.w.r. function. (C)—A meter scale modified to measure plate voltage, grid current, s.w.r. and per cent of reflected power for use in a linear amplifier.

The Perfect Dummy Load!

BY R. H. FRANSEN,* VE6TW

This dummy load is suitable for use with 52 ohm coax at powers up to 100 watts, continuous. The tuning arrangement permits the removal of inductive reactance to provide a purely resistive load. This may be used to calibrate s.w.r. bridges as explained in the text.

I HAVE an s.w.r. of 1.1:1, old man. I have heard this or similar statements time and again and it always is good for a laugh or two. The thing is how does he know it is 1.1:1; because the meter says so? If he is like most of us his s.w.r. bridge is either a kit or a homebrew unit in the Monimatch style. But, if one wants to read the s.w.r. to a gnat's eyelash, and most hams seem to, one needs a dummy load to calibrate the s.w.r. bridge; otherwise an s.w.r. reading does not make much sense. A light bulb is utterly useless as a load except that it shows the presence of r.f.

The dummy load we want should have some special characteristics:

1. No reactance whatever at the frequency we want to use it on. (In this case 3.5 mc-30 mc.)
2. Be able to dissipate at least 100 watts so it can handle the average transmitter.
3. The impedance should not change with a change in input power.
4. The dummy load should be suited for the most popular coax cable in use; this seems to be 50 ohms at present.

The Circuit

Looking at fig. 1 we see a resistor (special type) in series with a variable capacitor and by means of this arrangement we are able to tune out all reactance in the dummy load. This provides a pure resistive impedance at the input connector over the range of 3.5 mc-30 mc.

Construction

The resistor is mounted on the bottom of the case and spaced at least ¾" from the back using the special non-magnetic brackets that are supplied with it. The variable capacitor specified is a broadcast type having ceramic standoffs and is mounted on surplus ceramic standoffs. The coupling between the vernier dial and capacitor is also ceramic insulated. I had these parts in the junkbox but any good type insulation will do. Do use a vernier dial if at all possible because the tuning is rather sharp at the higher frequencies and it makes the capacitor so much easier to reset.

Calibration

If you do not have an s.w.r. bridge yet by all means make or buy the type of the 2-unit design, the coupler and the indicating unit. It is the easiest to calibrate and use. Whatever you use, connect it *directly* to the dummy load with a double male coax connector and use 50 ohm coax of any length between the bridge and the transmitter. Make a special cable just for the dummy load and you will always have it when you need it.

A double male coax connector can be made by joining two connectors Amphenol 83-1SP with a piece of copper tubing (⅜" o.d.). Solder this and slide a piece of #10 wire through the center contacts; solder this also.

Set the dummy switch to 50 OHMS and tune up rig at the bridge calibration frequency, usually ± 29 mc if used on 10-80 meters. Now, set the dummy switch to position #1 and, starting from the low capacity side of C_1, tune for minimum reflected power on the s.w.r. bridge. Retune the final of the rig and again check to

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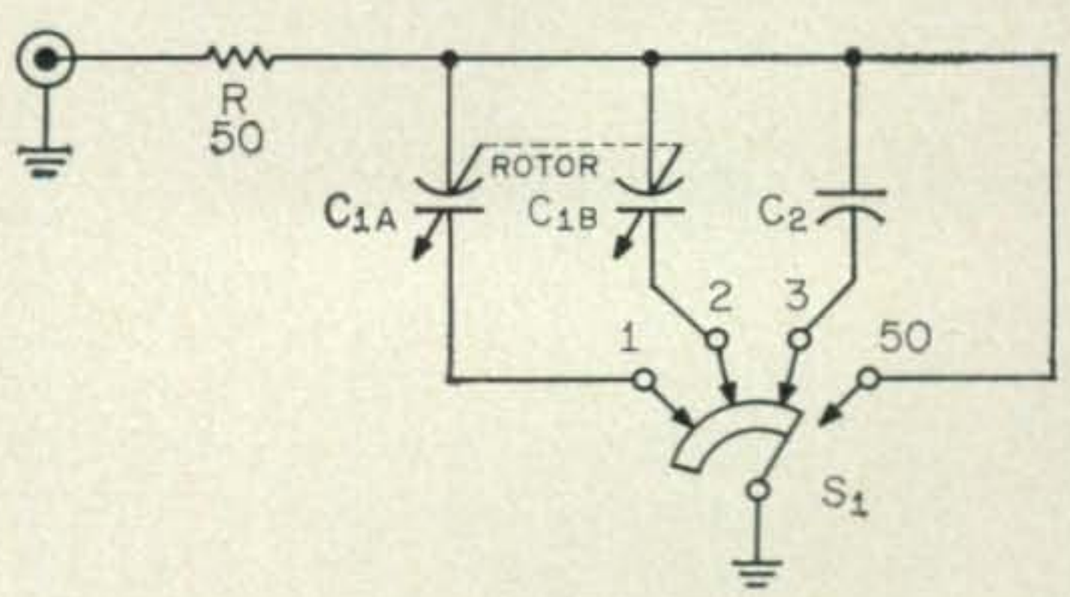

Fig. 1—Circuit of the perfect dummy load. The capacitor is used to tune out the reactance. The resistor is a 50 ohm non-inductive 100 watt unit made by Ohmite (#2204). Capacitor C_1 is a dual 365 mmf broadcast type variable and C_2 is a 1300 mmf 600 volt fixed unit.

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CQ Reviews:

The National HRO-500 Receiver

BY WILFRED M. SCHERER,* W2AEF

JUST at the time we were looking for an accurately calibrated general-coverage receiver to use as a tunable 6.5 mc i.f. with a 136 mc converter for Doppler measurements on some of Oscar III's companion satellites, the expressman arrived with exactly "what the doctor ordered"—the National HRO-500, 5 kc to 30 mc continuous-coverage receiver.

After recording a couple of satellite passes with the v.h.f. converter ahead of the receiver, we could not resist setting aside the converter and our scheduled satellite activity to spend the remainder of the day combing through the v.l.f. and the h.f. spectrum to see what could be heard over the extensive range afforded by the HRO-500.

Of course all the usual h.f. signals were picked up, such as those of the short-wave broadcasters both foreign and the V.O.A., the marine radiotelephone channels, RTTY, ship-to-shore commercial services, commercial s.s.b. channels, WWV and CHU, satellites on 15 and 20 mc, MARS nets, the amateurs including those on 160 meters—and alas, the CB'ers too. At the low frequency end were the standard broadcasters, and this ole brass pounder had a touch of sea fever listening to the ship-to-shore gang on 500 kc, but especially intriguing were the v.l.f. signals of aeronautical beacons, weather reports and the 60-17 kc signals from WWVB-L, the U.S. Naval channels, GBR in England and even our a.f. oscillator on 5 kc! What's more, all signals were spotted on frequency right down to the last kilocycle, making the set a good frequency meter too.

Well, this is only part of the story about this exciting receiver, so let us now delve into the HRO-500 for more details.

*Technical Director, *CQ*.

The v.l.f. and h.f. coverage is obtained using 60 different 500 kc wide ranges distributed over 5 separate bands. The 1 kc calibration steps, tuning ratio, accuracy and stability are identical for each range. All modes of reception are available with facilities for s.s.b., a.m., c.w., f.a.x., or f.s.k. Selectivity can be optionalized with a choice of a 0.5, 2.5, 5 or 8 kc bandwidth along with passband tuning and a rejection-notch filter. Also included are an S-meter, a 50 kc crystal calibrator and an a.g.c. threshold control.

Complete transistorization eliminates heat problems, minimizes deterioration of components and ensures dependability and high stability. Instant operation may be had from either a built-in 115/230 v.a.c. operated power supply or directly from a 12 v.d.c. source. With the latter, a current drain of only 200 ma makes economical battery operation feasible for field applications.

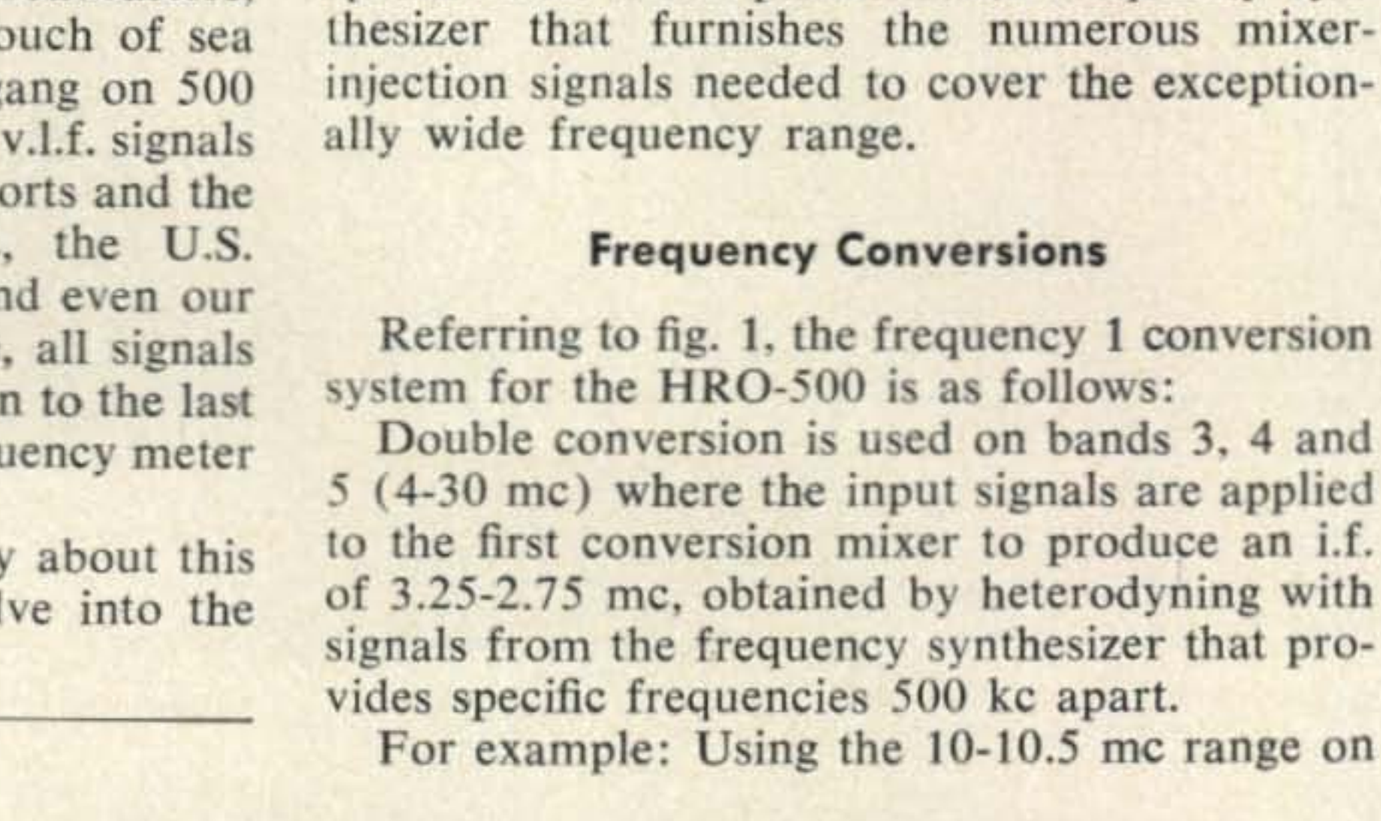
The most up-to-date solid state circuitry is used and highly advanced design features are included that have not heretofore been found in commercially available receivers. Of special note is the phase-locked frequency synthesizer that furnishes the numerous mixer-injection signals needed to cover the exceptionally wide frequency range.

Frequency Conversions

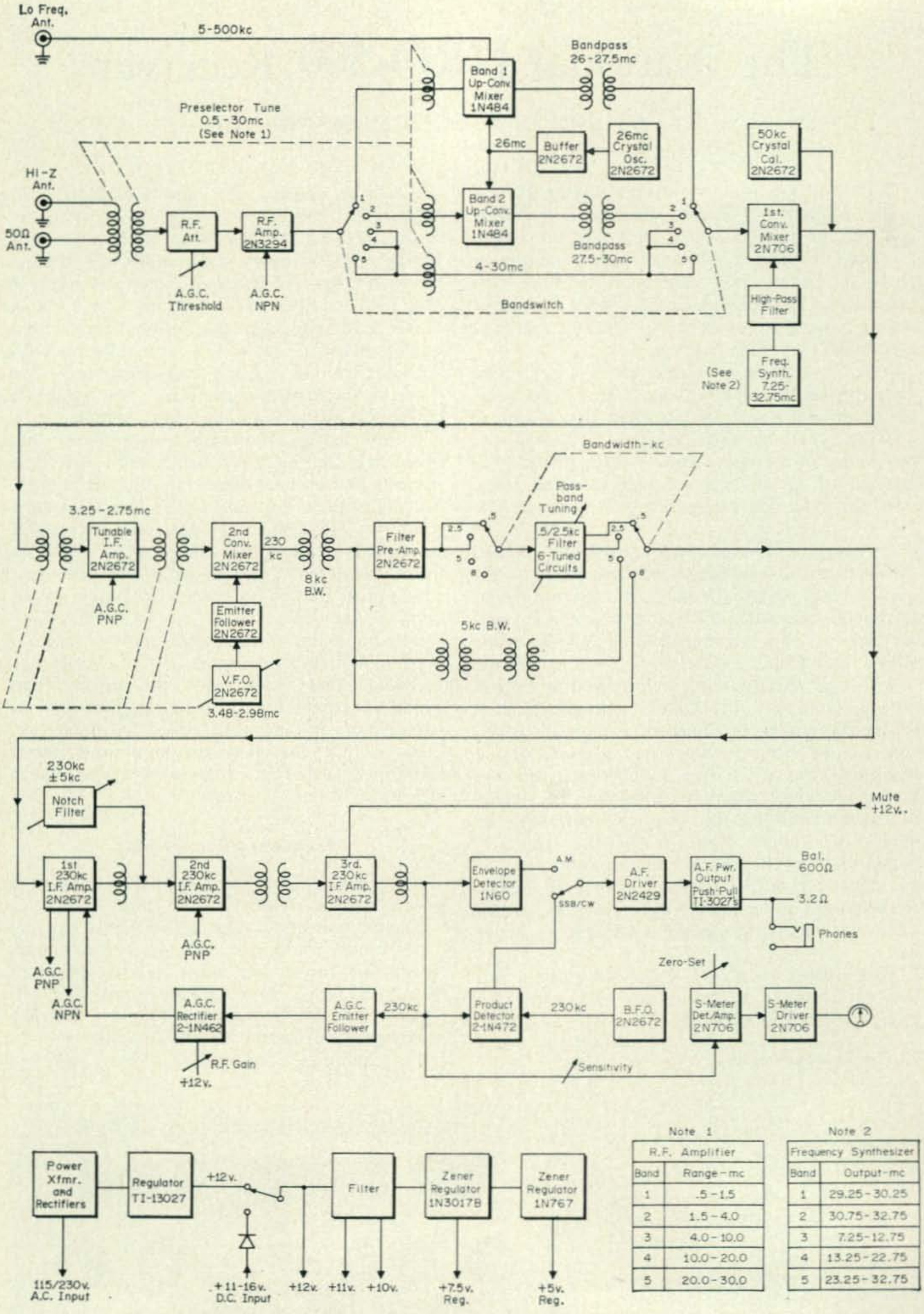
Referring to fig. 1, the frequency 1 conversion system for the HRO-500 is as follows:

Double conversion is used on bands 3, 4 and 5 (4-30 mc) where the input signals are applied to the first conversion mixer to produce an i.f. of 3.25-2.75 mc, obtained by heterodyning with signals from the frequency synthesizer that provides specific frequencies 500 kc apart.

For example: Using the 10-10.5 mc range on



The HRO-500. The preselector dial window is at the left and the S-meter is at the right. The low-frequency end of each range is indicated in megacycles by numerals that show up in the center window. The 1 kc steps for each range are read from the PW dial at the center.



Note 1

R.F. Amplifier	
Band	Range-mc
1	.5-1.5
2	1.5-4.0
3	4.0-10.0
4	10.0-20.0
5	20.0-30.0

Note 2

Frequency Synthesizer	
Band	Output-mc
1	29.25-30.25
2	30.75-32.75
3	7.25-12.75
4	13.25-22.75
5	23.25-32.75

Fig. 1—Block diagram for the HRO-500. The 5-500 kc input at the Band 1 mixer is untuned. The r.f. gain control is in the a.g.c. rectifier return path where it varies a positive voltage used as a reference above which initial a.g.c. bias is developed. The S-meter operates full time. Its sensitivity is controlled by varying the coupling to the S-meter det./amp. The zero set is obtained by varying the a.g.c. det./amp bias. A basic block diagram for the frequency synthesizer is shown elsewhere.

band 4, the synthesizer output is 13.25 mc which when mixed with a 10 mc signal, produces a 3.25 mc i.f., and with a 10.5 mc signal the i.f. is 2.75 mc. On the next range, 10.5-11 mc, the synthesizer output is 500 kc higher, or 13.750 mc, so a 10.5 and an 11 mc signal also will produce the respective i.f.'s of 3.25 and 2.75 mc. Thus, for each 500 kc range change, the synthesizer output is accordingly switched to the required 500 kc increment that produces the desired i.f.

The output of the 1st mixer goes through a tunable i.f. amplifier and to a 2nd converter where a 230 kc output is obtained by mixing with the v.f.o. frequencies of 3.48-2.48 mc. The 230 kc signals then pass through either a 0.5 or 2.5 kc tunable bandpass filter or through a 5 or 8 kc fixed filter, then through the 230 kc i.f. amplifier and to a product and an envelope detector. The a.f. output is then taken from the appropriate detector.

Triple conversion takes place with bands 1 and 2 (5 kc-4 mc) by feeding the input signals to an additional converter that can be switched in ahead of the regular 1st mixer to provide "up" conversion to 26-30 mc, accomplished by heterodyning with a 26 mc crystal-controlled frequency. The system is one that eliminates images and spurious responses that might otherwise occur.

Circuit Highlights

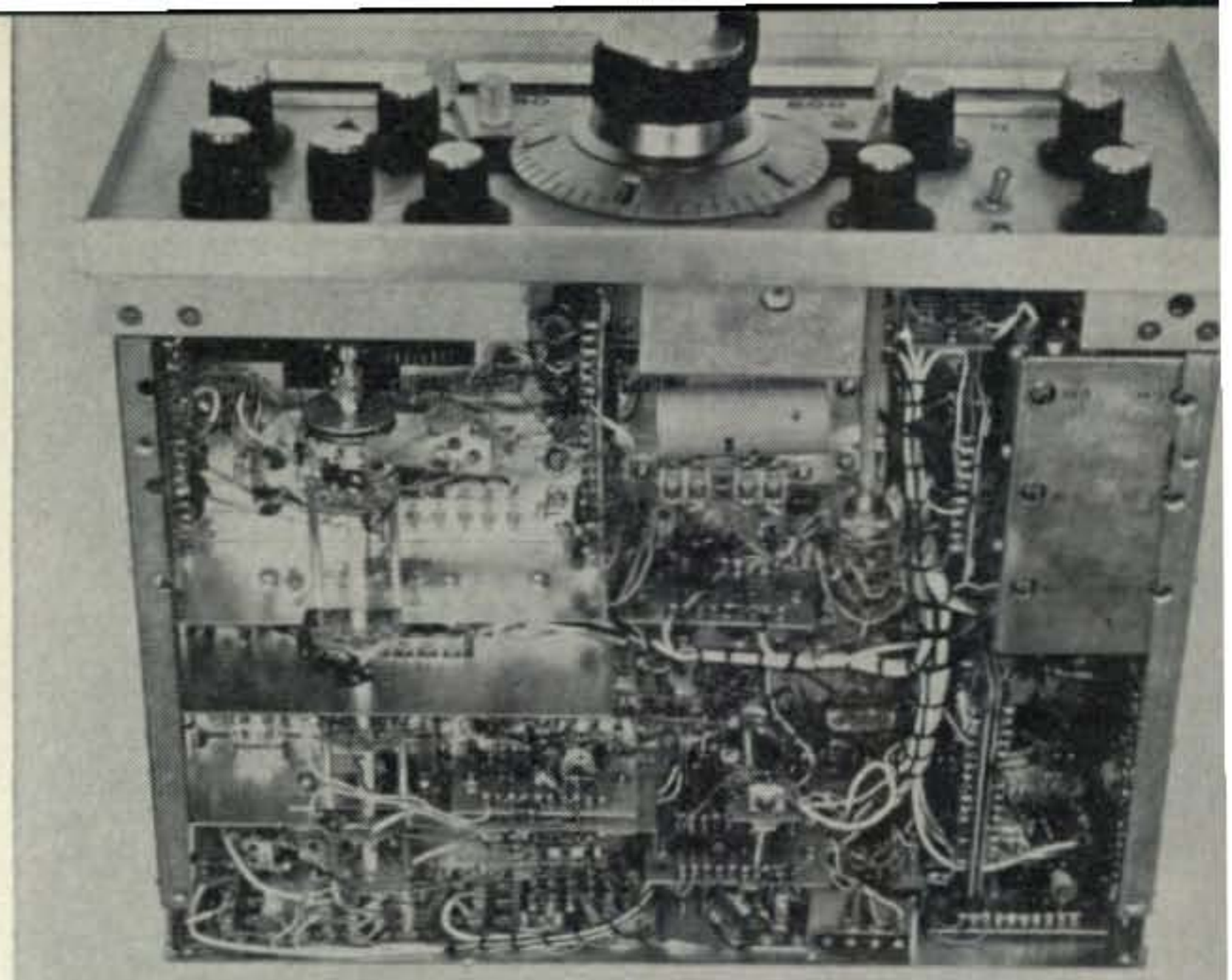
A silicon n.p.n. transistor is used for the r.f. stage which is employed for all band ranges except the 5-500 kc segment of band 1. "Preselector Tuning" employs a three-section variable capacitor to gang tune three resonant circuits that are arranged to provide optimum impedance matching and the maintenance of high Q for excellent front end selectivity.

The 1st conversion mixer has an n.p.n. transistor with the r.f. signal applied to the base and the synthesizer signals injected to the emitter through a high-pass filter that eliminates undesired low-frequency components from the synthesizer. There are two up-conversion mixers, each using a single diode. One is used for band 1 and has a 26-27.5 mc bandpass-coupled output to the 1st mixer, while the other is for band 2 and has a 27.5-30 mc bandpass output. When the 5-500 kc range on band 1 is used, the preselector is bypassed and a separate low frequency antenna input is connected directly to the band 1 mixer.

A.G.C. Threshold

An a.g.c. threshold control is inserted between the secondary of the input transformer and the base of the r.f. transistor. This control actually is a 4 step attenuator that provides an insertion loss of 0, 10, 20 or 30 db. Its use minimizes overload, desensitization or cross modulation from exceptionally strong adjacent signals and reduces residual background noise between signals, particularly during s.s.b. and c.w. reception.[1]

[1]Scherer, W. M. "A Step Attenuator," *CQ*, Oct. '64, p. 43.



Bottom view of the HRO-500. Most of the components are mounted on vertical terminal boards, providing ready accessibility.

The tunable i.f. amplifier that follows the 1st mixer consists of a single p.n.p. stage with double tuned input and output transformers that are gang-tuned with capacitors along with the v.f.o. used for the 2nd conversion mixer. Here, proper impedance-matching taps ensure high Q and selectivity as well as gain. No compromise has been made using bandpass circuits. A p.n.p. transistor also is used in the 2nd mixer, with signal and v.f.o. injection to the base and emitter respectively.

V.F.O.

The v.f.o. operates as a grounded base oscillator with feedback obtained from a low impedance tap on the tuned tank in the collector. Temperature compensation provides stability which is augmented by wide-spread heavy plates in the tuning capacitor. Specially shaped plates and a non-cumulative serrated tracking section make a linear-tuning scale possible.

An emitter-follower is used between the v.f.o. and the mixer to provide isolation and impedance matching. It is lightly coupled to the v.f.o. tank through a 3 mmf which, in conjunction with a shunt-connected 150 mmf capacitance at the emitter-follower input, washes out load variations from this stage.

The filters following the 2nd mixer consist of a double-tuned transformer for 8 kc bandwidth, two double-tuned transformers for 5 kc and six tuned circuits, capacitively coupled and impedance-matched, for the 0.5/2.5 kc steep skirted filter. With the latter, either bandwidth is obtained by switching coupling capacitors, while passband tuning is had using a 6 gang variable capacitor that tunes each individual resonant circuit at the same time. The filter preamplifier makes up for the insertion loss of the narrow filter.

A passive rejection-notch tunable filter is located between the 1st and 2nd stage of the i.f. amplifier that feeds an envelope and a product detector. The product detector uses a pair of

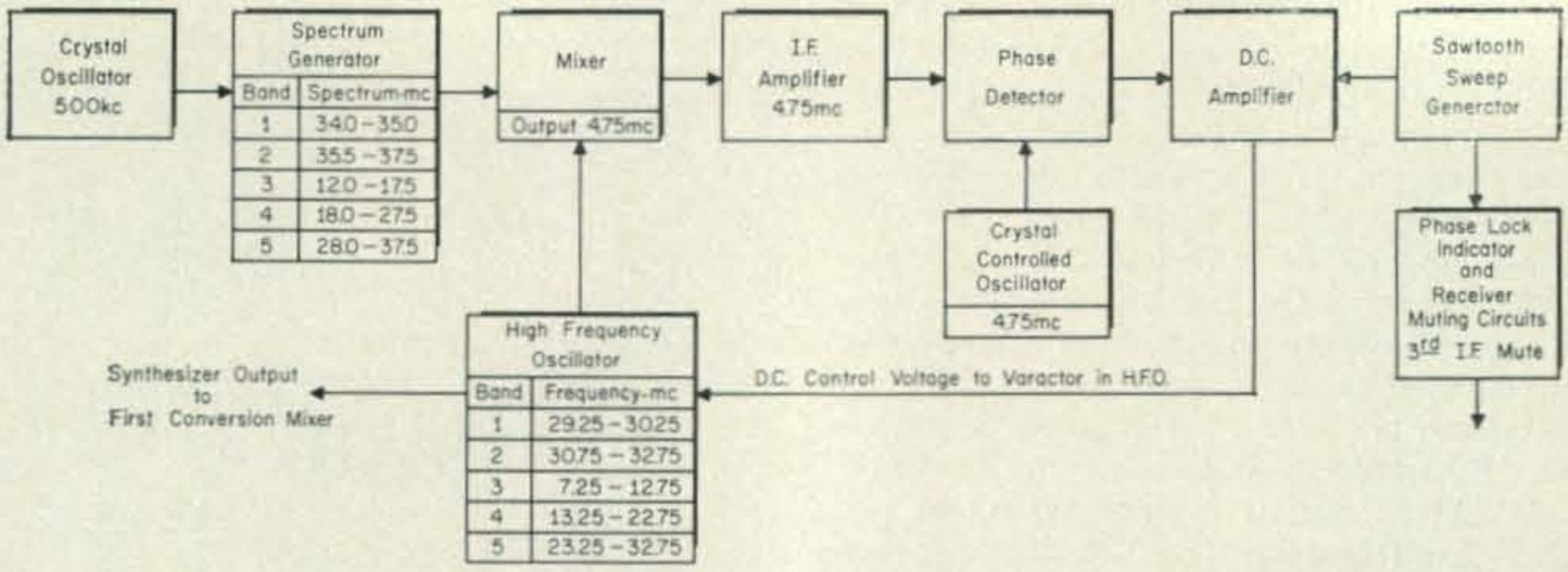


Fig. 2—Block diagram for the basic lineup of the frequency synthesizer used in the HRO-500.

diodes in circuitry comparable to that used for balanced modulators in s.s.b. transmitters.

The a.f. section has a 2N2429 stage that drives a pair of push-pull TI-3027 power transistors to 2 watts for an external 3.2 ohm speaker. Headphone output also is available, as well as a 600 ohm balanced output with a floating or grounded center tap.

A.G.C.

A unique method is used to obtain a.g.c. voltages of correct polarity for both the p.n.p. and the n.p.n. transistors. R.f. from the 3rd i.f. stage is applied, through an emitter follower, to a voltage-doubling rectifier, providing a d.c. control bias for the 1st i.f. An increase in signal strength then will reduce the gain and current in the 1st i.f. transistor. The change in voltage drop incurred thereby across the emitter resistor will produce a positive going voltage for p.n.p. a.g.c., while a negative going voltage for n.p.n. a.g.c. is obtained from across a resistor in the collector circuit. The a.g.c. has a fast attack and a slow release. An r.f. gain control in the a.g.c. rectifier return path varies a positive voltage used as a reference level above which initial a.g.c. bias is developed.

S-meter

The S-meter operates full time. R.f. from the last i.f. is sampled, rectified and applied through a d.c. amplifier to a bridge-type meter circuit. The zero set is obtained by appropriately biasing the detector; sensitivity is controlled by the degree of coupling to the i.f. stage.

Power Supply

Operating voltage for the receiver may be obtained directly from a 12 v.d.c. source for which internal zener-diode regulators are provided for voltage-sensitive circuits. A series-connected diode in the d.c. input line protects the transistors from damage should the polarity of the supply potential be accidentally reversed. A panel switch cuts off the dial lamps to reduce current drain during battery operation. In addition to the zener regulators, a built-in 60-cycle a.c. power supply, which may be connected for 115 or 230-volt use, has a series-connected transistor regulator. A switch transfers the circuitry required for a.c. or d.c. operation.

Frequency Synthesizer

Unfortunately, space does not allow more than a basic description of the frequency synthesizer. Referring to fig. 2, the h.f. oscillator provides 52 separate heterodyning frequencies for the 1st mixer in the receiver. These are in 500 kc steps from 7.25 to 32.75 mc. The oscillator is self-excited and ordinarily could drift or not be tuned to *exact* frequency. However, these possibilities are eliminated by phase locking the oscillator to harmonics of a 500 kc crystal controlled oscillator.

These harmonics are produced in a spectrum generator and each one, when combined with the proper signal selected from the h.f. oscillator, will produce an i.f. of 4.75 mc at the synthesizer-mixer output. This signal is amplified and applied to a phase detector to which a crystal controlled reference signal of 4.75 mc also is fed. If the i.f. signal is not exactly the same as that of the 4.75 mc oscillator, an a.c. voltage beat will appear at the output of the detector. This a.c. component is amplified by a d.c. coupled amplifier and is applied to a varactor (voltage-controlled variable capacitor) in the h.f. oscillator. The varactor capacitance will vary at the a.c. rate and thus will sweep the frequency of the oscillator; however, as soon as the oscillator frequency becomes identical to that of the crystal oscillator (usually before one a.c. cycle is completed), there will be no a.c. output from the detector to further sweep the oscillator.

On the other hand, there will be a d.c. output component of an amplitude and polarity, according to the phase-angle difference between the two signals applied to the phase detector that holds the varactor capacitance at the required value just obtained.

If the h.f. oscillator tends to drift, the phase angle will change and a different d.c. voltage of the correct polarity will alter the varactor capacitance to bring the oscillator back on exact frequency, thus cancelling the initial drift.

The amount of sweep obtainable from the a.c. component output of the detector is limited. Thus, if phase lock control is lost, as may occur during bandswitching, the h.f. oscillator frequency may be too far removed from that required to phase lock with the particularly needed harmonic from the spectrum gen-

erator. A sawtooth sweep generator then comes into play to vary the varactor voltage by a larger amount, thereby providing a wide frequency scan of the h.f. oscillator until a 4.75 mc i.f. signal is again produced to cause phase locking.

During periods when the oscillator is being swept, the output of the sawtooth generator also is used to light a *Phase-Lock* indicator lamp and to produce a muting voltage to the 3rd i.f. that silences the receiver until phase lock is restored. Then the sawtooth generator ceases to operate, the indicator lamp goes out and the receiver is ready for normal operation.

Construction

Unlike most transistorized gear, The HRO-500 is large in size and is built like a battleship. Judging by its sheer weight alone, you'd never think it was all solid state. It has a rugged extruded aluminum panel and a heavy chassis. There are no printed circuit boards. The transistors are mounted in plug-in sockets and all the parts are hand-wired, with most of the components mounted on vertical terminal boards. Considerable gearing is used for coupling to panel controls. Extensive shielding is employed and portions of the frequency synthesizer are mounted above the chassis in individual shielded modules. The set weighs 32 lbs. and measures 7⅝" high, 16½" wide and 12¾" deep.

The famous National PW dial is used to indicate the 1 kc increments on each range. It is operated by a vernier drive with a 5:1 reduction, so that one complete revolution of the tuning knob covers only 10 kc. The beginning of each range is indicated in megacycles by numerals that show up in a window where you'd expect to find a slide-rule scale. The signal frequency is read by adding the kilocycles indicated on the PW dial to the megacycles shown by the window numerals. The preselector dial is calibrated in megacycles and is operated by a 2:1 drive.

Rear Apron Facilities

An SO-239 type coax connector is used for 50 ohm input and phono jacks are provided for unbalanced Hi-Z and Lo-Freq antenna inputs. The versatility of the HRO-500 is enhanced by phono jacks and a power plug that provide receiver functions for use with almost any type accessory, such as other solid-state gear, frequency control for transceive operation with external transmitter, *etc.*

The available circuits are: output from b.f.o., v.f.o., frequency synthesizer, 26 mc oscillator, 230 kc i.f., detector, remote control for receiver muting, standby, r.f. or a.f. gain, b.f.o. on-off; a.f. input; numerous d.c. voltages from +5 to +12, n.p.n. and p.n.p. a.g.c., 12 v.a.c. for external lights and two spare plugs.

The speaker and 600 ohm connections are made to a screw type terminal strip. A two terminal connector is furnished for 12 v.d.c. power source, while a plug-in cheater cord is used for 115 v.a.c. A rocker-type switch sets up the receiver for either a.c. or d.c. use. There also is an S-meter zero adjust and a notch-depth control.

Performance

The *frequency stability* of the HRO-500 from turn-on is rated at no more than 100 c.p.s. change in any 10 minute period including 30° *C.* variation in ambient temperature, or ±20% line voltage shift. At ambients between 70° and 90° *F.*, and with humidity between 50 and 90%, warm-up drift from turn-on averaged no more than 100 c.p.s. the first ten minutes; 100 c.p.s. or less per hour for two hours; less than 25 c.p.s. per hour over longer periods. The frequency remained within ±12 c.p.s. with a.c. line voltage changes of ±25 volts (on any band). Mechanical stability is such that you can bang the set or bounce it on the table without ill effects on the frequency.

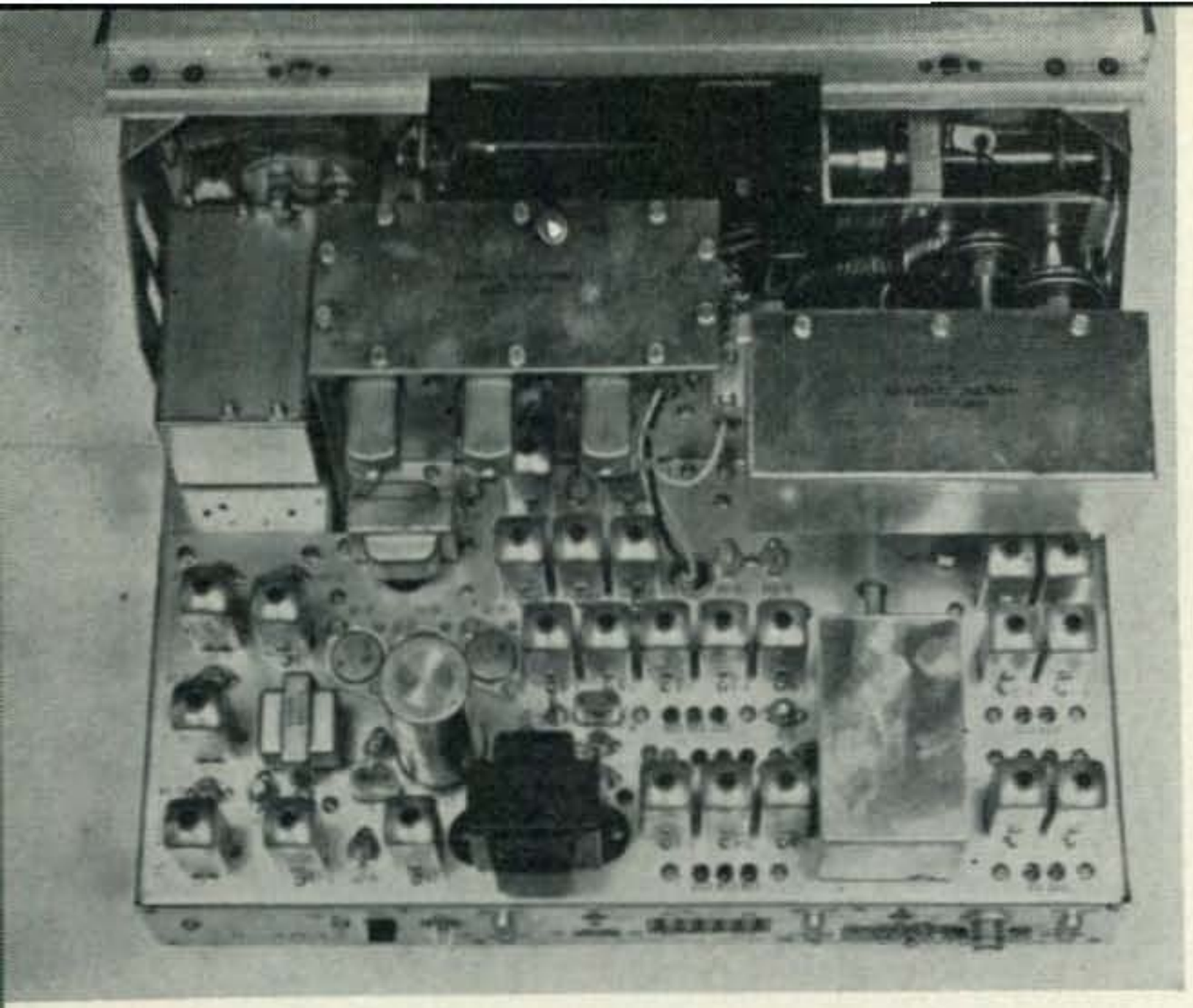
Calibration accuracy was found according to specifications as within 1 kc over the entire tuning range of the v.f.o., and within 250 c.p.s. when zeroed at the nearest 50 kc calibration point. The calibrator signals are applied to the tunable i.f. and thus do not take into account any error that may be due to the synthesizer crystal or the 26 mc oscillator; however, such a possibility can be ascertained by checking a l.f. and a h.f. range against WWV. The 1 kc divisions of the PW dial are 5/16" apart, so you can easily interpolate to less than 1 kc. To further facilitate this, you can pencil in ¼ kc markers between each 1 kc point as we did when making Oscar III Doppler measurements.

The *s.s.b./c.w. sensitivity* for 5 kc-30 mc is rated at better than 1 μ for 10 db S/N. Measurements at each 500 kc interval revealed the following: 500 kc, 0.75 μv; 1-10 mc and 16-30 mc, 0.2-.35 μv; 10.5-15.5, 0.5 μv. Rating for 5-500 kc is not given; with the external low-frequency preselector it is 1 μv.

The a.m. rating is 2 μv for 10 db *S/N* on 500 kc—30 mc; 25-50 μv for 5-500 kc, except 2 μv with preselector. Readings below 500 kc were not taken, but above 500 kc they varied from 0.5 to 1 μv.

Gain figures are not given, but using 500 kc on the 2nd range of band 1 as the zero reference, the relative gain measured as follows (with 1 μv input): .5-1 mc, 0 to −5 db; 1-1.5 mc, +2 to −3 db; 1.5-9 mc, +3.5 to +11 db; 10-19 mc and 20-30 mc, 0 to +12 db. Also, the gain at the h.f. end of each 500 kc segment was 5 db less than at the lower end.

The selectivity for the filters as given earlier is that at the 6 db points, and the shape factor of the 2.5 kc filter is given as 2.5:1. With this filter set at the recommended passband tuning settings, unwanted upper-sideband rejection at 1 kc was 55 db, while on the lower sideband it was 25 db, indicating some lack of symmetry. This probably could be corrected by realigning the filter circuits. Similar observations were made of the 0.5 kc filter. No ringing was found with either filter. The skirts of the 5 and 8 kc circuits slope gradually with shape factors of about 3:1 and 4:1 respectively.



Top view of the HRO-500. The two elevated modules near the center contain portions of the frequency synthesizer and are mounted on a vertical baffle. The can at the upper left contains the 0.5/2.5 kc bandpass tuning circuits and the one at the right foreground covers the preselector capacitors. The v.f.o., not seen, is below the scale drum.

Rejection-tuning insertion loss varied 10-18 db between ±5 kc. The notch depth, rated at 50 db, was 60 db down from the overall residual level and the notch was effective over ±5 kc.

Image rejection is given as 60 db minimum for 500 kc-30 mc and 80 db for 5-500 kc when used with l.f. preselector. The latter was not checked, but the following figures were obtained: .5-20 mc, 70-90 db, except 12-19.5 mc, 50-55 db; 21-28 mc, 60-65 db.

I.f. signal rejection is not given, but we found the following: 230 kc rejection, over 100 db (the limit of our test gear); 2.75-3.25 mc rejection, 70-80 db, except on 2-4 mc, 50 db; 26-30 mc rejection when using up converters for band 1 and 2, 60 db.

Internal spurious responses for 500 kc-30 mc are given as 1 μv equivalent, except two discrete responses at 2.75 and 3.0 mc. This was confirmed with an additional discrete response at 3.24 mc. The 3 mc one was on only the 2.5-3 mc range, not on the 3-3.5 mc range. You'll find most of the low level responses (below 1 μv) on every range at the 0, 250 and 500 kc points of the tuning dial. These are characterized by a "twitter" caused by beats from the 4.75 mc oscillator in the synthesizer. On the 5-500 kc range, discrete responses appeared at 115 and 153 kc.

A.g.c. merit was up to the rating at a little under 10 db a.f. output variation for an r.f. input change of 5-50,000 μv. The a.g.c. time constant is given as 1 second recovery from an S-9 signal, but was found to be 2 seconds.

The *S-meter* is calibrated in db above 1 μv (up to 90 db) and in S-units from 1 to 9. The meter is set so that S-9, or 40 db, is indicated with a 4 mc input signal of 50 μv. In checking out the intermediate points, the S-units varied 3-4 db per S-unit and the actual db changes departed somewhat from that indicated by the meter. In addition, these variations differed over the individual frequency ranges.

Discrepancies were likewise found in respect to the db steps of the a.g.c. threshold, particularly the 10 db step with which the actual level change was 3-15 db, depending on the band range.

What about cross modulation? This is the most commonly asked question concerning the HRO-500.[2] Operationally, no cross-modulation difficulties were found with NSS at the top end of the 4-mc band, as often is the case on the East Coast; while resistance to desensitization from strong nearby signals measured up surprisingly well compared to vacuum tube counterparts of like sensitivity and was much better than with other solid-state gear. In extreme situations such as when the guy down the street opens up, you can crank in the attenuator without having the set go dead for other signals.

The HRO-500 handles nicely and except for a noise limiter, it has all you need for effective reception in all modes. On c.w. you can combine the effects of the 0.5 kc passband tuning and the notch filter to remove almost any QRM; however, due to the insertion loss of the notch filter, you'll have to crank up the a.f. gain.

With s.s.b. passband tuning provides optimum a.f. quality and sideband suppression and of course requires no retuning of the receiver when sidebands are switched. The a.g.c. is exceptionally smooth without heavy pumping and you don't get that hard a.g.c. attack so often experienced on very strong signals, while intelligent use of the a.g.c. threshold smooths out heavy background noises in between times.

The quality of a.m. is excellent and much better than usually obtained with s.s.b./a.m. receivers, even when the 2.5 kc filter is used. In this case the passband tuning can also be helpful against QRM.

If you're located near a number of b.c. stations, you'll need the l.f. preselector to get away from spurious beats when the 5-500 kc range is used, as the antenna goes directly to Band 1 mixer without benefit of any tuned circuits. Even with preselection you're apt to pick up interstation beats caused by mixing in *external* sources such as rusty drain pipes, etc.

Although the receiver is quite complex, you should have little difficulty with servicing, inasmuch as the 60 page manual provides a good deal of functional, alignment and trouble shooting data. You'll also find the number of transistor types held to a minimum and they are inexpensive units.

The HRO-500 is priced at $1295.00 and is produced by National Radio Company, 37 Washington St., Melrose, Mass. ■

[2]Another query has been about the possibility of ruining the input transistor in the presence of r.f. power. This is not likely to occur, since the silicon transistor that is used is tapped at a very low point on the input transformer; in fact, we heard of one case where application of r.f. power burned up the input coil without damage to the transistor.

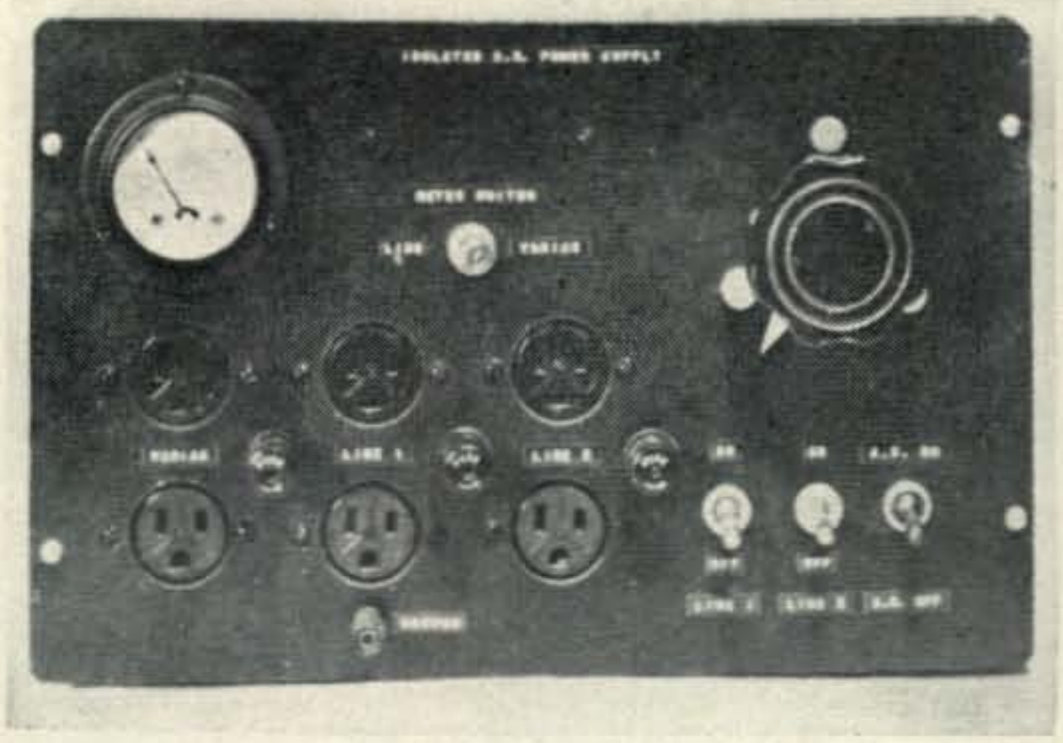


Fig. 1—Front view of the isolated a.c. power supply showing component locations.

An Isolated A.C. Control Center

BY JAMES G. LEE,* W6VAT

THE number of times the average ham exposes himself to accidental electrocution would astonish anyone keeping count. The ham who climbs up a grounded steel tower with an a.c. operated grid-dip meter in hand to check a beam stands right next to the ham who works on a.c./d.c. radios or uses an electric drill while standing on a damp cement garage floor. One side of the a.c line is grounded but how often do we give this a thought while pursuing our hobby? Might as well use an electric shaver while in your morning shower. Most of us are just plain lucky when we use a.c./d.c. equipment or ungrounded tools.

If, instead, you used an isolated a.c. power supply for general bench work and other hazardous jobs, you'd be much safer. For construction purposes it isolates your tools and you from the a.c. line so that shock hazard is essentially eliminated. When troubleshooting equipment it eliminates the chassis-to-chassis shock possibility that comes about with a.c. wiring and plug polarity.

Power Supply

A very useful a.c. power supply can be built around the Triad N-64C isolation transformer. It has four 500 v.a. 110 v.a.c. windings and can be used as an autotransformer or as an isolation unit. Figure 1 shows the front panel layout with Variac, meter, outlets, switches and fuses. The supply is mounted in a 7½" × 8" × 12½" wooden cabinet and has an 8" × 12" × ¼" front panel of hard tempered masonite. A metal cabinet can be used if it is properly grounded, however the wooden cabinet and panel eliminate any possible shock problems and are preferred over a metal cabinet.

The Variac is permanently hooked to one winding and provides a convenient source of variable a.c. for tests, troubleshooting, and comparison. A second winding is permanently wired to two panel mounted sockets through a s.p.s.t. switch and 3 ampere fuse. The third winding is used either to feed two more sockets or is switched in parallel with the fourth winding which is the a.c. input winding. When the two are paralleled, the transformer is capable of supplying 1 kva. The complete schematic of the unit is shown in fig. 2.

The meter can be switched to read either line or Variac voltage and 3 ampere fuses are used in all output lines. Three wire grounded a.c. input is used with the ground brought out to a separate binding post on the panel. A main d.p.s.t. input switch controls the entire unit while the output lines are controlled by individual switches or the Variac.

Construction

Construction is simple and straightforward. The transformer and an 8 terminal barrier strip are mounted on the floor of the wooden cabinet.

[*Continued on page 100*]

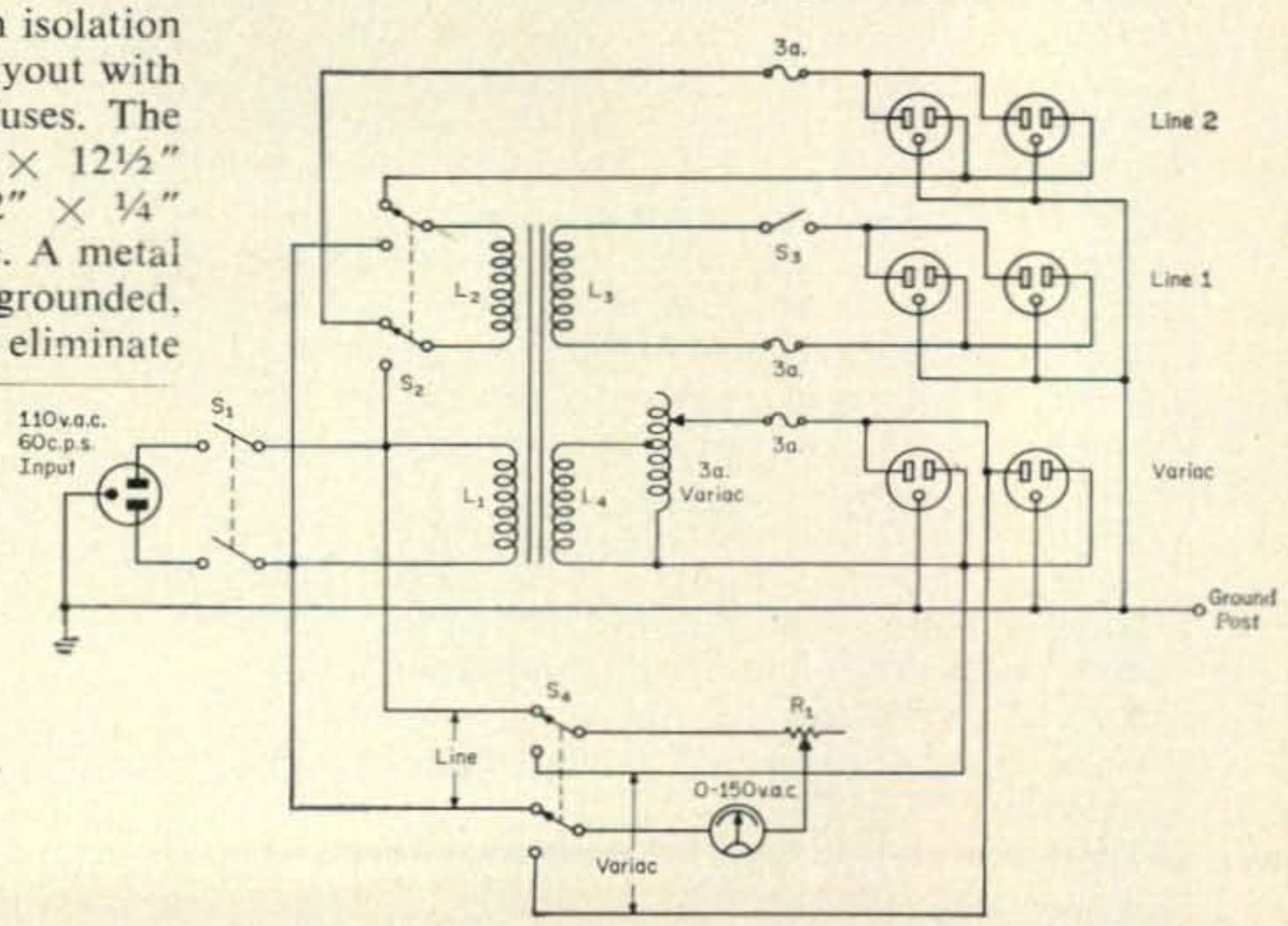
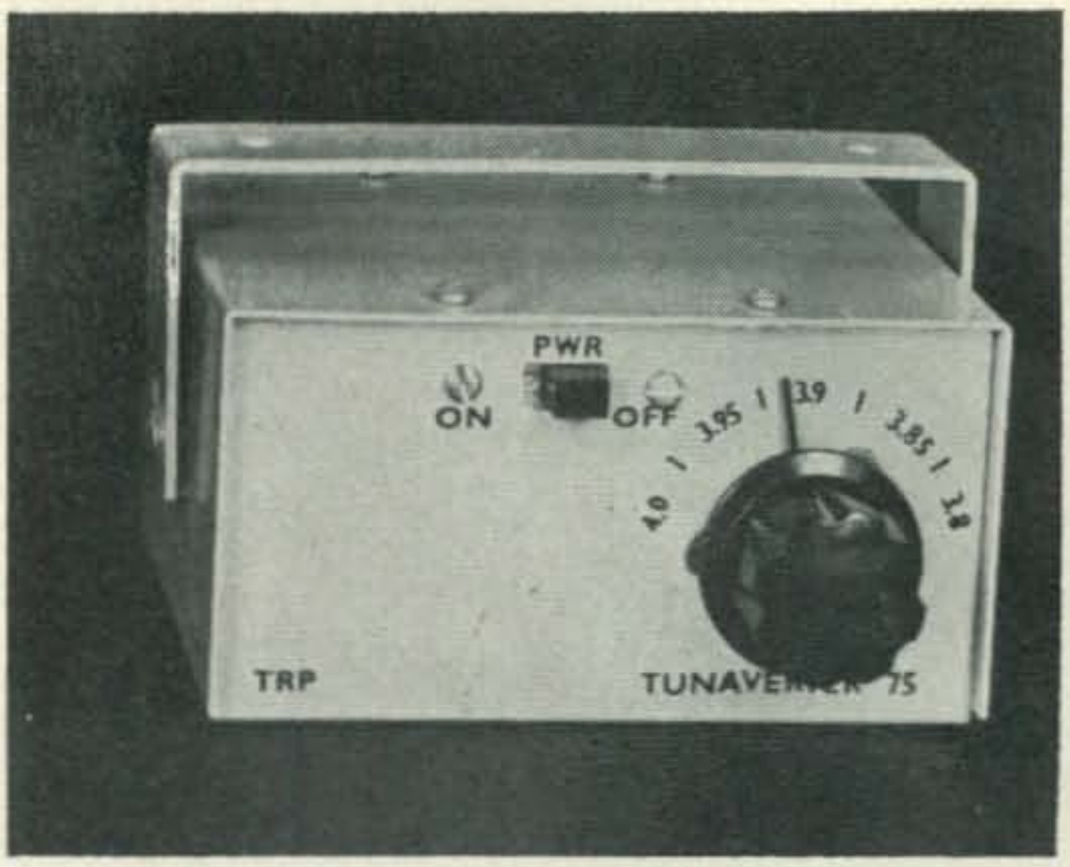


Fig. 2—Circuit of the isolated a.c. power supply.

*Box 357, Cupertino, California.



The 75-meter model of a Tunaverter. Units with a b.f.o. have an additional tuning knob for the b.f.o. on the left side of the panel.

CQ Reviews:

The Tunaverter

BY WILFRED M. SCHERER,* W2AEF

How about a neat little receiving converter tucked out of the way under the dashboard of your car for listening to or operating on your favorite band? The Tunaverters, made by the Tomkins Radio Products, will let you do just that. They are simple transistorized jobs for use in conjunction with your car radio and are available in single-band models for any of the amateur bands 160 through 15 meters.

Operation is not restricted to mobile service, as they may be used for fixed-station work with a broadcast receiver, Q-5'er or other i.f. strips. If your amateur receiver does not cover a particular ham band, such as 160 meters, a Tunaverter fed into a BC set will do the job. C.w. and s.s.b.? Yes, there also are models with a self-contained b.f.o. to match the output i.f.

The Tunaverters are small in size, measuring only 4½" × 3½" × 2¼". A printed-circuit board contains all the circuit elements, except the tuning capacitor and the connectors. A single transistor functions as an oscillator-mixer in an autodyne-converter circuit arrangement with a dual-section variable capacitor that tunes the oscillator and the input of the mixer, the latter function providing uniform gain and sensitivity with a measure of r.f. selectivity too. A 6:1 reduction vernier drive makes tuning smooth and easy.

The oscillator frequency and the mixer output is designed for 550 kc i.f. operation in the 160, 80, 75 meter and marine models. The i.f. output for 40 and 20 meter units is 830 kc, for 15 meters it is 1500 kc. In use, all you do is set your broadcast receiver to the i.f. output frequency of the converter and then operate the Tunaverter tuning control to cover the ham band.

An internal 9-volt battery is used for power which is turned on with a slide switch. The switch also transfers the input of the broadcast set between the Tunaverter output and the BC antenna, as needed. The ham-band antenna always remains connected to the input of the converter.

Three Motorola type jacks for the r.f. circuits are located on the rear of the unit along with two screw-type terminals to which connections may be made for muting the converter by opening the battery circuit with external p.t.t. or relay facilities during transmissions.

The b.f.o. frequency, in models so equipped, is that of the Tunaverter i.f. output, so you don't have to dig into the BC set for installation connections. The b.f.o. is permeability tuned using a panel control for setting to exact frequency or for providing additional vernier tuning.

Performance

The Tunaverter we tested was the 75-meter basic model, without the b.f.o. Its performance was agreeably surprising with a sensitivity of a little better than 1 μv for 10 db s./n. ratio and with excellent stability; in fact, using it with a stable general-coverage receiver having a b.f.o., even s.s.b. signals were easily held on frequency. Since both the Tunaverter and its b.f.o. are operated from a separate internal battery, frequency stability should be no problem as it might be if operation were made using the car battery with fluctuating charging voltages.

In addition, when you're using a b.f.o. equipped unit, you're not dependent on the stability of the BC set. One thing, though, that you'll probably find with b.f.o. operation, is that a.g.c. action may be lost, but this is not necessarily of serious concern, especially considering the performance, simplicity, cost and convenience otherwise realized with the Tunaverter.

The 75-meter model covers only the phone band from 3.8 to 4 mc, but all other models cover the entire ham band with some Mars frequencies too. An 80 meter unit for 3.4-4.1 mc and a marine model for 2-3 mc also are available.

The basic Tunaverter models are priced at $19.95; with b.f.o. they are $24.95. A gimble mount is supplied with each unit for tilt-up or suspension mounting. It is suggested that you write the supplier for further details regarding the available models, as well as for information about some of their other solid-state products. The address is: Herbert Salch & Company, Woodsboro, Texas 78393.—*W2AEF* ■

*Technical Director, *CQ*.

The Case Of

WA2RAU vs. CITY HALL

or

I'll Hold Your Coat, Doc!

BY FRED CAPOSSELA, JR.,* W2IWC

DR. Sam Rosen, WA2RAU, likes to work 20 meters and he gets a kick out of DX. But on 20 meters these days a fellow just can't cut it without a beam. So Doc back in 1962 put up a 3-element wide spaced beam on a 60 foot crank-up tower which cranks down to 22 feet. WA2RAU was in business.

But some of Doc's New Rochelle, New York neighbors didn't feel that a fellow needed a beam on 20. What they really objected to was the tower which held it up, and they decided to do something about it. They got the city to issue a summons to Doc. The City said that the tower was in violation of a zoning ordinance. That was three years ago.

Today, Hams in Doc's home town enjoy legal protection for their towers because WA2RAU took on City Hall—and won! But he also took on some other things he didn't expect, things even a good attorney couldn't overcome. This is what happened when one man decided to fight City Hall:

December 1962—Dr. Sam Rosen was served with a summons indicating that his tower was in violation of a zoning ordinance of the City of New Rochelle. The zoning code prohibited towers over 35 feet in residential areas.

Doc immediately requested assistance of the Communications Club of New Rochelle. It's not that they didn't want to help him, they said, but they had their own towers to think about; if they joined Doc's fight, they would all get involved. He contacted the ARRL. They sent a list of precedents of tower cases from other states, but said that that was as far as they could go. Doc retained private counsel. The case dragged on.

July 1963—The City dropped action against Doc on the basis that his antenna wasn't specifically covered in the zoning code. Doc contended that ham radio as a hobby could be pursued at a man's residence—whether he lived downtown or in a residential area—and that an antenna and tower were normal accessories to his hobby. The fact that his tower, being motor driven, was sometimes 22 feet (below the maximum height) and sometimes 60 feet weakened the City's case and they dropped their action.

January 1964—The City of New Rochelle drafted injunction proceedings against Doc in New York State Supreme Court. Incredibly, in seeking the injunction, the City claimed that Dr. Rosen had the *only ham radio tower in New Rochelle!* The judge commented that he was not interested in tower case precedents from other communities or states.

To prepare that part of his defense, Doc requested the Communications Club of New Rochelle to assist him in securing the number of towers in New Rochelle and Westchester county. The Club declined. Next, he contacted the ARRL to see if they could help in getting the tower figures. They said that they couldn't, that there were a lot of tower cases, but that if he lost in Supreme Court that they might take a hand in the appeal.

Doc hired a photographer and took pictures from the street of 8 towers owned by hams in New Rochelle. He also presented evidence that there were 4320 TV aerials which were in the same category as his own antenna. The case dragged on.

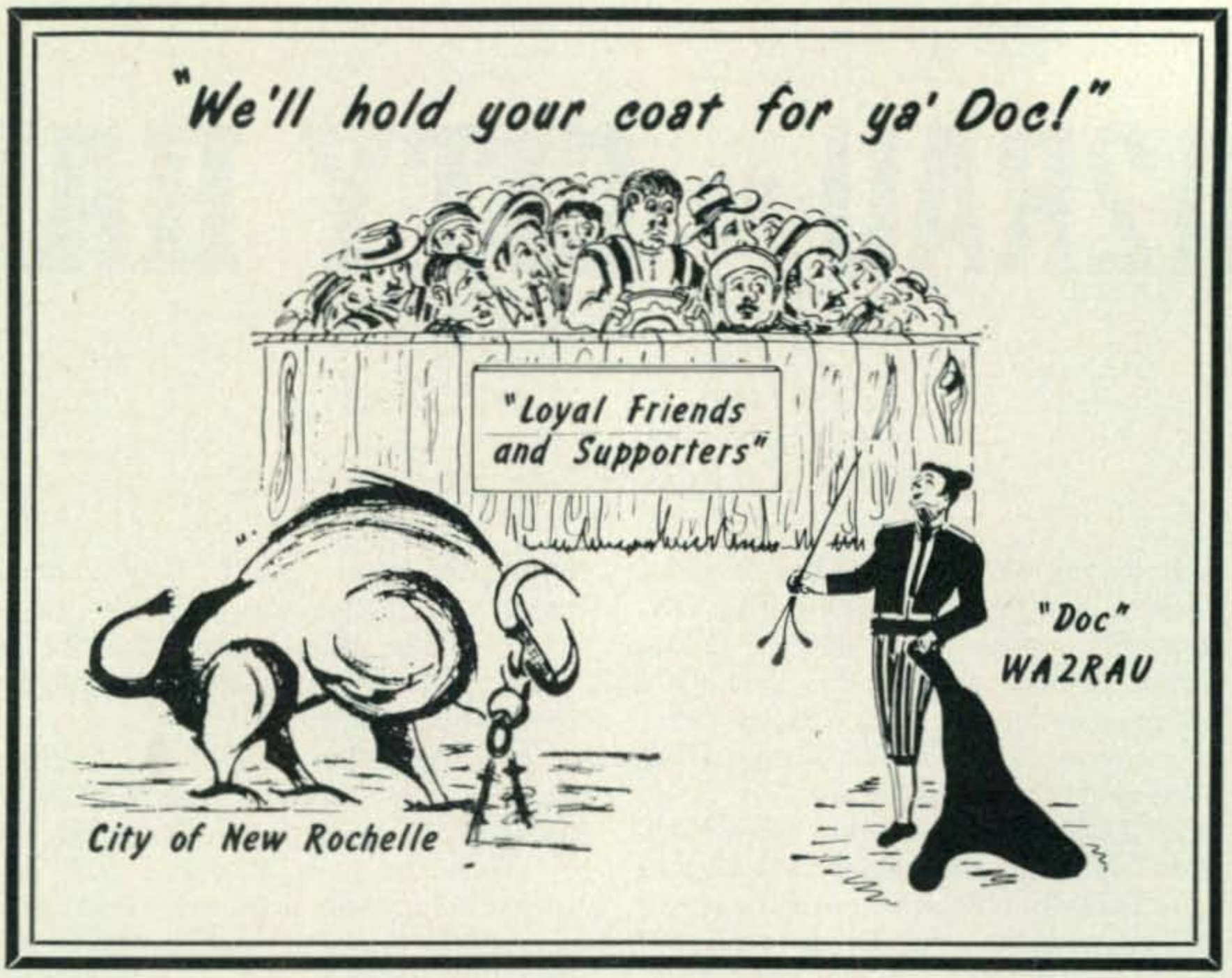
June 1964—The City's injunction was denied. However, the judge ruled that if the City wished, they could continue action and bring Dr. Rosen to full trial.

July 1964—The City notified Doc's attorney and Supreme Court that they would continue action for full trial. The case was put on the Court's calendar.

September 1964—Mr. Donald Froude, President of the Communications Club of New Rochelle, wrote a letter to the local City newspaper praising Doc and decrying the injustices directed toward him. The letter was published. Friends of several Club members wrote similar letters. In less than four years of operation Doc had been cited by the Federal Government, Department of Navy and the Red Cross for his public service activities. His work in securing almost $250,000 worth of drugs for an epidemic which menaced 38,000 people in Brundi and Ruanda and his efforts during the Cuban crisis, the revolt in Panama and the Alaskan earthquake are all well known.

March 1965—During a visit to WA2RAU's shack, New Rochelle's Director of Civil Defense, Arthur Brooke, heard 9U5ID relay a message from a grateful United Nations African High Commissioner for Refugees praising Doc for his help in gathering drugs to combat an epidemic.

* 15 Rose Blvd., Baldwin, N.Y.



Brooke, an acquaintance of Doc's, had dropped over to his shack, and because he had once visited Brundi, his ears perked up when Doc contacted the country. He was even more impressed when he heard the High Commissioner's message.

During the next two months, Brooke visited every branch of the City government to convince them that they should postpone their action in Supreme Court to see how a proposed revision of the zoning ordinance would be received by the City Council at a public hearing. His action took special diplomacy and courage. As Civil Defense Director he was an appointee who served at the pleasure of the City Manager. In other words, if he stepped on the wrong toes, he could be fired summarily. Brooke devoted almost all his spare time to getting Doc his antenna and his work began to pay off.

June 1965—The City Manager directed the City Corporation Counsel, the Building Department, and the Zoning and Planning Board to draw up a proposed revision of the zoning ordinance to permit towers in residential areas.

July 1965—The New Rochelle City Council held a public hearing on the proposed revision. A large contingent of members of the Communications Club of New Rochelle were present to support Doc. The ARRL sent a representative who spoke on the value of the amateur to the community. The City Council voted unanimously to revise the zoning ordinance to permit 75 foot towers in residential areas. They requested their Corporation Counsel to drop their action in Supreme Court "with prejudice" which means that similar action can never again be brought against Dr. Rosen.

August 1965—The Supreme Court of the State of New York records the stipulation that the action between the City of New Rochelle and Dr. Sam Rosen has been dropped.

Naturally, Doc is very happy he won. "Somebody had to fight it," he says. Significantly, the victory sets a legal precedent. Because now more than ever a fellow needs a beam on 20 meters. But zoning codes remain and tomorrow it might be *your* turn to fight City Hall. ■

Measuring The Frequency Response of S.S.B. Transmitters

Fig. 1—To run a frequency response curve on your s.s.b. transceiver all it takes is an audio generator and s.w.r. meter with power output measurement facilities. It is not necessary to take the top and bottom off the transceiver. They were removed here to make adjustments.

BY LOU DEZETTEL,* W9SFW

Described below is a simple method of determining the bandwidth of an s.s.b. transmitter using an audio oscillator and any relative r.f. output indicator.

I WAS setting up to make a carrier frequency adjustment following the instructions given in the Swan manual (fig. 1). It said use an audio generator and adjust the carrier frequency to a point where 300 c.p.s. was 6 db down from the frequency giving maximum response. While rocking the audio generator over its range to find the peak frequency, it occurred to me to plot a curve of its response to *all* audio frequencies. That curve should, then, be the frequency response of the transmitter, *and its selectivity curve.*

It seemed important to know something about the *transmitting* characteristics of the s.s.b. transceiver, and this looked like an easy way to find out. For example, what does the high end look like? If the high end response goes way out, the transmitter is occupying too much bandwidth. On-the-air reports were all OK, but here was a way of knowing what is actually going out on the air. Typically, we want "telephone" response of about 300 to 3000 c.p.s., for an s.s.b. bandwidth of about 2.7 kc.

Wouldn't it be nice to connect an audio *sweep* generator to your transmitter and have some one with a panoramic receiver and a good camera give you a picture of what his scope showed? You can get the equivalent of this picture with just an audio generator and a s.w.r. meter. You've seen selectivity curves drawn for receivers; here's how to do one on your transmitter.

The response curve we are about to make is pertinent to an s.s.b. transceiver for two reasons: First, assuming linear response, the r.f. output is directly proportional to the audio input; second, many of the tuned circuits in the transmitter are common to receiving, and you learn something about the performance of the crystal lattice or mechanical filter, for example, since these are common to both transmitting and receiving. The Swan SW-240 has one i.f. stage and the crystal lattice filter common to both receiving and transmitting. Since most of the i.f. selectivity is in the filter, this curve is a fair approximation of the receiver selectivity response.

*10034 Luella Avenue, Chicago, Illinois 60617.

What You Need

All you need is a variable audio generator, an s.w.r. meter or similar output r.f. indicator and a dummy load. The audio generator must be capable of providing a low level output equivalent to a microphone. The Knight-Kit Audio Generator shown in the photo has an excellent calibrated attenuator for the purpose. The Knight-Kit s.w.r. meter used in the output has a calibrated relative power output scale on it. The dummy load must not be a lamp, as the lamp resistance will vary with current, resulting in a change of load impedance across the audio band.

What You Do

First of all, everything is done on the outside. You don't need to remove the top or bottom covers, unless you want to make some adjust-

Audio Freq. c.p.s.	Relative Pwr. Out	db	Audio Freq. c.p.s.	Relative Pwr. Out	db
200	1	—10.	900	5.5	— 2.58
300	4.5	— 3.5	1000	5.5	— 2.58
400	8.5	— 0.7	1500	8.7	— 0.6
500	9	— 0.45	2000	10.	— 0.
600	8	— 1.0	2500	1.5	— 8.22
700	7	— 1.55	3000	1.	—10.
800	6	— 2.22	4000	0.1	—20.

Fig. 2—Chart used to list the transmitter frequency response of the Swan SW-240 using the set-up shown in fig. 1.

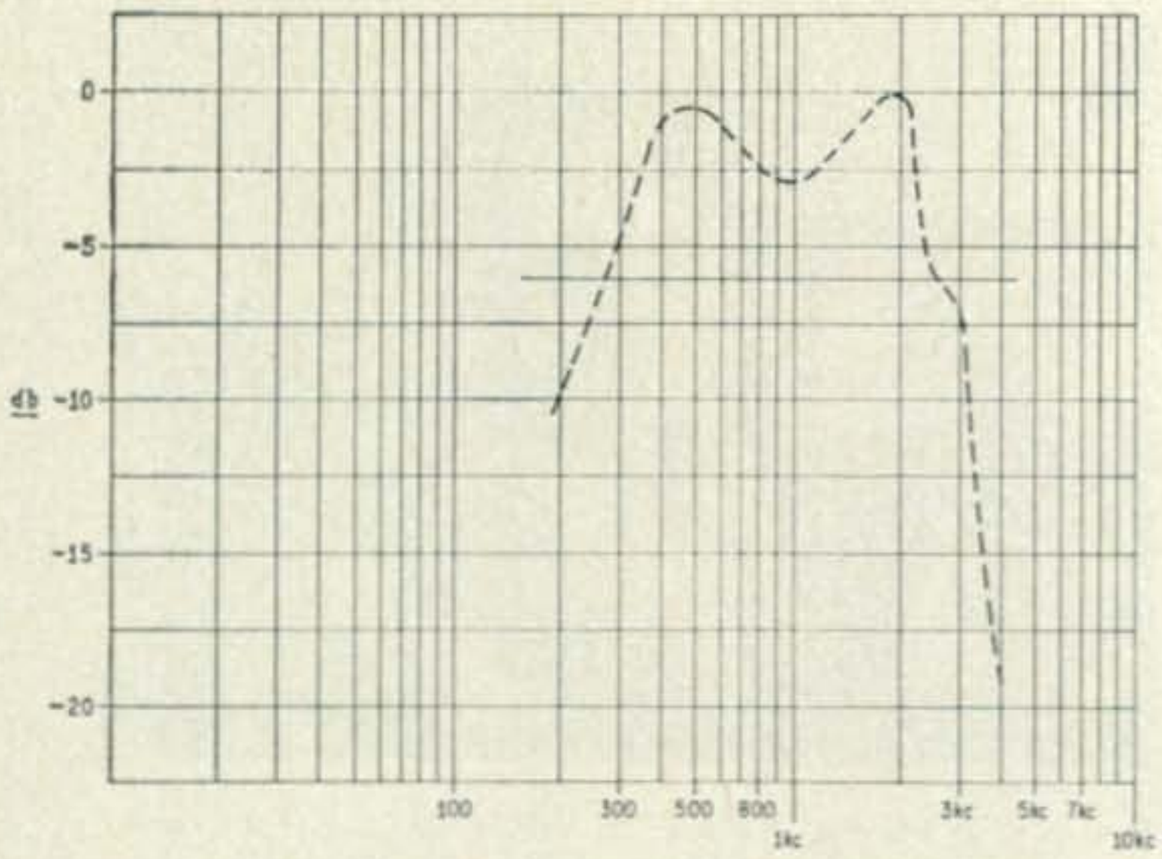


Fig. 3—Curve plotted with the data taken from the chart of fig. 2 shows the response of the Swan transmitter section.

ments at the same time. Connect the output jack of the audio generator to a shielded cable, and on the other end connect a mike plug to fit your transceiver. Plug it in. Your transmitter should be adjusted for normal operation on the band you are going to use for the measurement. Any band should give the same results, except for a little added selectivity (narrower response) on the lower frequency bands as a result of the higher Q of driver and output r.f. circuits.

Set the audio generator to about 2 kc, and turn the gain control on the audio generator up to get full scale deflection on the s.w.r. meter in the FORWARD *switch position and with* SENSITIVITY control up near maximum. By this means you will be putting a minimum signal on the air if you are using your antenna, and keeping final tube dissipation down, regardless of type of load.

Prepare a frequency chart such as shown in fig. 2. Begin by rocking the audio generator frequency control knob and finding the frequency giving the highest output. Adjust the generator gain control for an output of 10 on the s.w.r. meter. It is assumed you have the mike gain control on your transceiver set for the same level as when you use a mike. Now don't change the generator level from this point on. Start with the generator at about 200 c.p.s. and plot relative power output versus frequency on the chart. I hope you find the figures drop out of the picture beyond 3000 c.p.s.

Convert the relative power output figures to db (db is 10 times the log of the power ratio). Conversion is fast and almost direct on a slide rule. The right hand index of scale D will be the figure 10 (the highest relative power figure from your s.w.r. meter). Db is the L scale multiplied by 10 and subtracted from 10 (because zero db is the right hand index of the L scale and all other figures will be minus db's or db's below 0). Convert the db figures to a curve as in fig. 3, using db and frequency as the coordinates.

H-m-m-m. I see from the curve that my transceiver response curve could stand being shifted to the right a little. As long as I have the top and bottom off, I might as well do it. ■

Watch Those Filaments

BY E. H. MARRINER,* W6BLZ

MANY amateurs are now proud owners of either a 4CX250B, 4X250B, or a 4X150A surplus tubes. It should be pointed out the life of these tubes are limited unless strict filament voltages is observed. The filaments of these tubes are rated at plus 5% of 6.0 volts r.m.s. for long life. However, experience has shown that an increase of filament voltage from the 6.0 to 6.5 volts shortens the life of the tube. The increased voltage causes excessive cathode heating and increases the cathode temperature 25 degrees centigrade. The increase in filament temperature results in twice the normal barium loss and effectively reduces the cathode life by one-half.

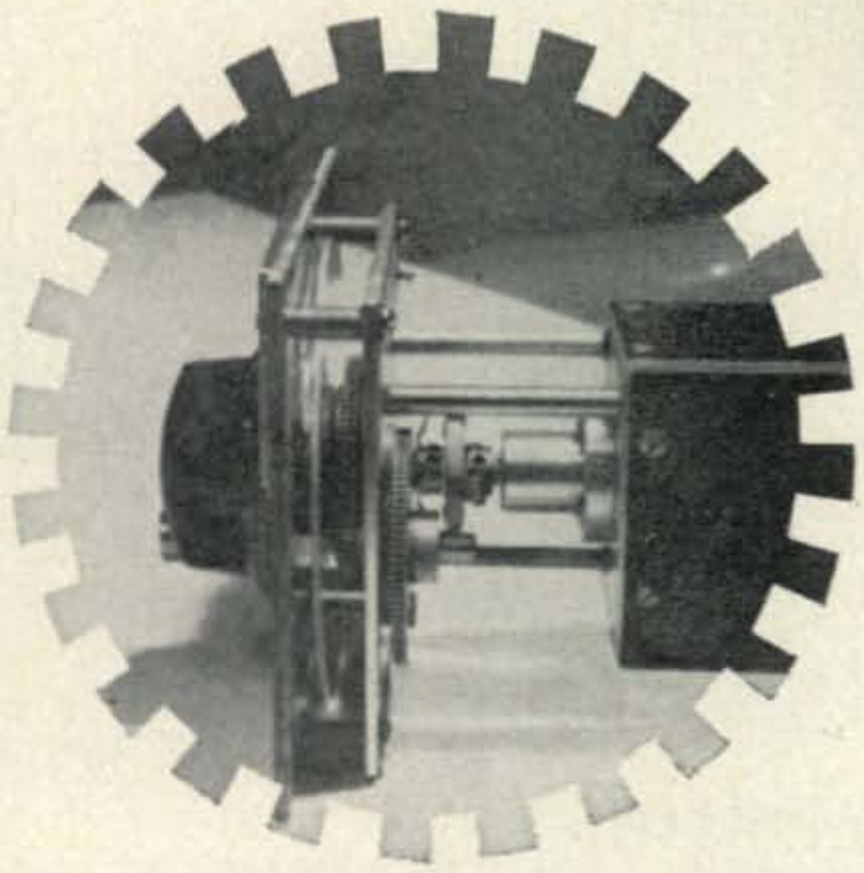
When an indirectly-heated cathode is heated over its normal operating temperature (approximately 825 degrees centigrade) the oxide material is deposited on the cooler surface surrounding the cathode. If this condition persists, sufficient barium will be exaporated to cause loss of emission, high primary control grid and screen grid emission with heater leakage.

This problem shows up in the ham rig as a frequent fuse failure for no apparent reason. The operator will test for shorts and break down of parts and find no trouble; the cause cannot be easily determined. The cause is an initial arcing of the stringers of barium built up on the cathode and then clearing themselves. This blows the fuse and sometimes things seem to be working properly again.

Filament regulation will slow down this process and the installation of a regulated filaments supply is recommended. It is important to have the transmitter panel voltmeter accurately calibrated from a *standard*. A one per cent laboratory instrument of known accuracy, *should be used*.

From experience, the stringers of barium build up after about 200 hours of operations on a non-regulated filament supply or they may not appear until a later time. If you intend to use these tubes this information is something to be kept in mind, or keep a bucket full of fuses handy. ■

*528 Colima Street, La Jolla, California.



A HOMEBREW DIAL DRIVE FOR SLUG TUNED VFO'S

BY HARRY LOWENSTEIN,* W2HWH

This homebrew dial drive assembly is made for slug tuned units where the knob and tuner shaft rotate at the same speed. The indicator dial speed is reduced according to the gear ratios selected.

THERE are several commercially available dial drives for capacitor tuned circuits. All of these work on the basis of the knob turning a slowly rotating shaft projection. The indicator, pointer or dial plate, moves at the same speed as the slowly turning capacitor shaft.

There does not seem to be a commercial dial drive for the slug tuned coil assemblies. These assemblies require a drive where the tuning knob and the slug shaft turn at the same speed and the indicator turns at a slower speed. This is backwards from the capacitor-tune drives. For slug tuning, the shaft projection must turn at a faster rate than the indicator.

After building a slug tuned v.f.o. assembly, I was faced with the problem of how to mount it behind a panel and how to calibrate it. The commercial rigs using p.t.o.'s employ either a string dial drive or a pinch drive disc, with or without additional gearing. This is out of the class of the home workshop, mashed finger, ham builder.

Construction

Fussing with the problem for a few weeks, I wound up with the illustrated drive which is relatively easy to put together and works very smoothly. The slug tuned assembly was mounted on standoffs to an aluminum plate holding the shafts, bearings, and gears. This plate in turn was mounted on standoffs to the back of the panel.

The mechanical arrangement, shown in fig. 1, is simple. A small gear fixed to the knob shaft mates with a larger gear fixed to an idler shaft. A small gear fixed to the idler shaft, mates in turn with a larger gear *rotating freely* on the knob shaft. The indicator disc is fixed to this large gear.

Since the knob is driving the v.f.o. slug shaft directly, the only backlash is that in the v.f.o. itself. The indicator disc is rotating on the same center as the knob. This makes for a compact assembly behind the panel, and with only a knob and window on the front of the panel, as shown in fig. 2, little space is required. No small bonus is the fact that a "commercial looking" bezel is possible.

Although there are four gears, there are only two shafts. Each set of gears, being the same size, have the same center to center distance. The main hole for the knob shaft is necessary whatever drive you use. The other hole for the idler shaft should be located as accurately as possible. Not having a jig boring mill in the

*12 Maplewood Ave., Maplewood, New Jersey.

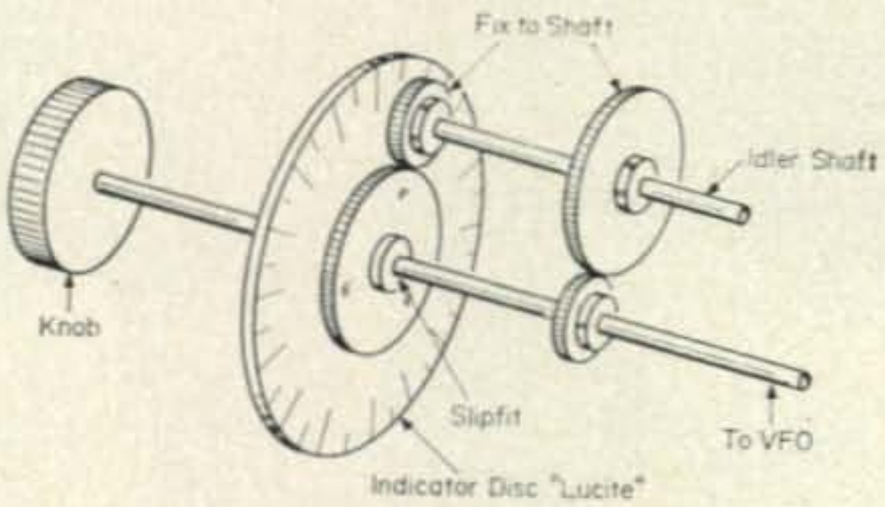


Fig. 1—Mechanical arrangement for the gears and idler shaft. The indicator disc, made of lucite, is secured to the large gear which is slip fitted on the main shaft.

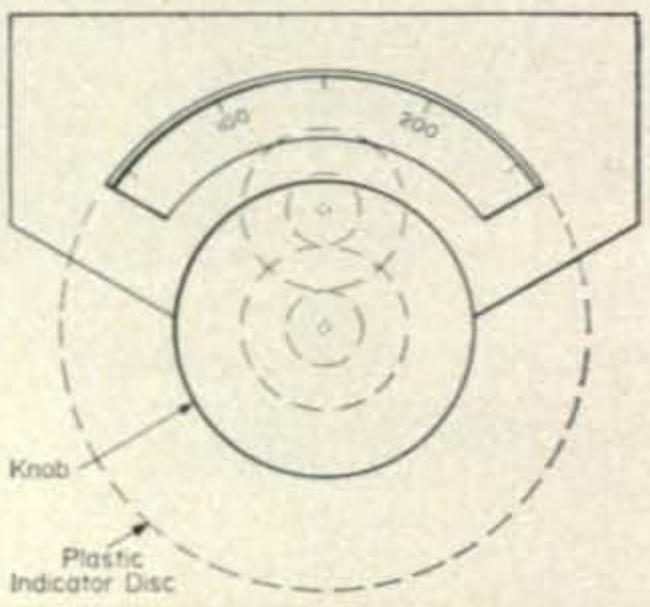


Fig. 2—Shape of front panel bezel is shown above along with a concentric view of the gearing arrangement.

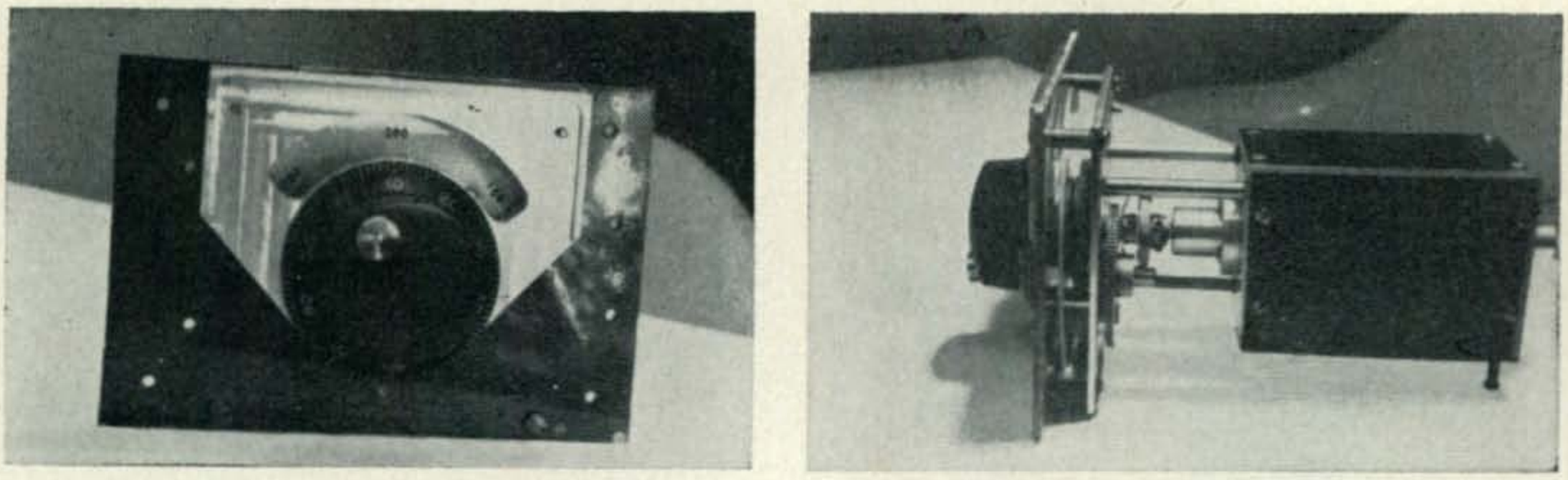


Fig. 3—Dial drive assembly made for a home brew slug tuned v.f.o.

basement, I drilled the hole for the idler shaft through one gear, its mate on the knob shaft, while holding both in close mesh. Then the hole was opened up for the bushing.

Gear Ratios

The ratio of the gears varies with the number of turns the slug shaft must rotate to cover the range. For example, on the unit shown in fig. 3, the slug tunes 25 kc per turn and covers 500 kc in 20 turns. The small gears are 18 tooth (Boston Gear No. Y 4818) and the large gears have 84 teeth (Boston Gear No. Y4884). The ratio of 18 to 84 is 4.66:1. Since $4.66 \times 4.66 = 21.71$, the tuning knob must turn 21+ times to rotate the indicator disc once. Since the indicator disc has a 4" o.d., you have the equivalent of a slide rule dial 12½" long. The five 100 kc points are 2½" apart.

In fig. 4 a Collins oscillator assembly was used, covering 1000 kc in ten turns, 100 kc per turn. Here the gears used had a lower ratio to fill the indicator disc fully. The small gears are 18 tooth (Boston Gear No. Y 4818) and the large gears are 60 tooth (Boston Gear No. Y4860). Now the ratio is 3.33 to one. $3.33 \times 3.33 = 10.8$ turns of the knob shaft to one of the indicator disc. Each 100 kc point is 1½" apart. An additional 0-100 indicator disc was fixed to the knob shaft to readout to 1 kc. A 0-100 skirted knob such as the type used on the ART-13 could be used instead, located on the front panel.

Dial Plates

Lucite (Plexiglass) was used for the indicator discs. A line scratched on this material shows up well when the dial is edgelit with a pilot bulb. The numbering was done with "Datak" transfers. The first panel escutcheon was jigsawed from plastic and painted. Later, a machinist (I helped him with his TV antenna) milled out two from scrap ¼" aluminum plate. Bearings for the mainshaft and the idler shaft are shoulder bushing type (Boston Gear FB 46-2 for ¼" and FB 35-1 for 3/16").

After the assembly was made in each case, a light dose of tooth paste, as lapping compound, was put on the gear teeth and the assembly "run-in" for a few minutes with an electric drill. This took off any tiny high spots and after cleaning and reassembly the action was very smooth.

Several of these drives have been made using various sets of "surplus" gears and the nicest of these is the set from the dial set mechanism of the ART-13.

Home-brew equipment varies with the constructor and the gear ratios will probably be those from parts in the "junk box". If you get the ratios anywhere near a full rotation of the indicator disc, you will have plenty of room for calibration markings. Twelve and a half inches of calibration is more than many commercial rigs can claim.

For those with a well stocked "junk box" this type of indicator and drive can be used with rotary coil assemblies to count turns and might be adapted to calibrating screw thread tuned cavities and the various types of electro-mechanical assemblies so dear to our friends and plumbers on u.h.f. ■

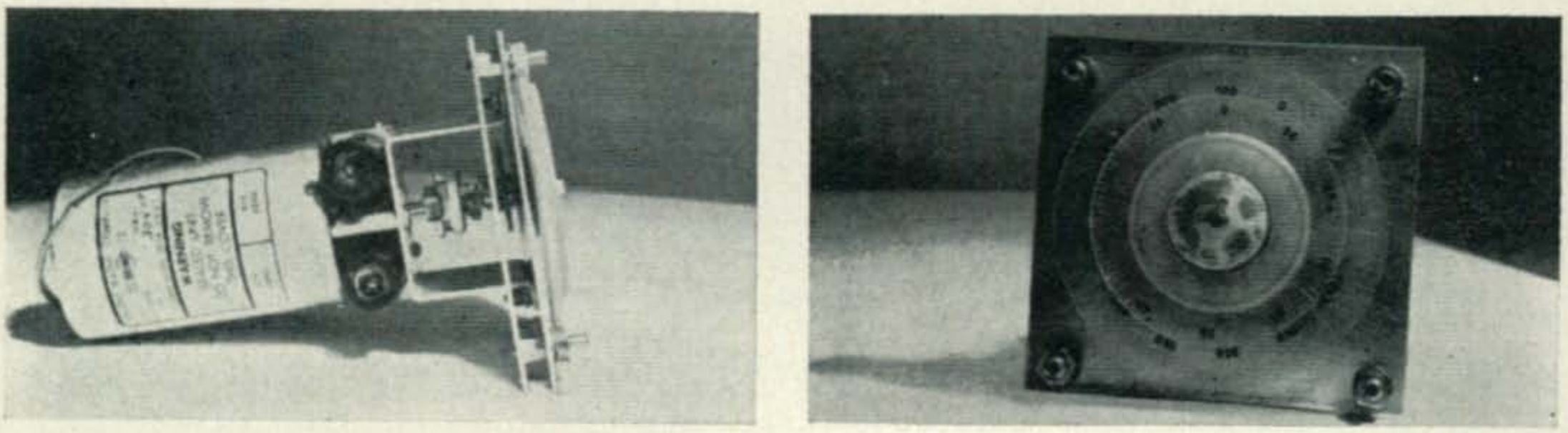
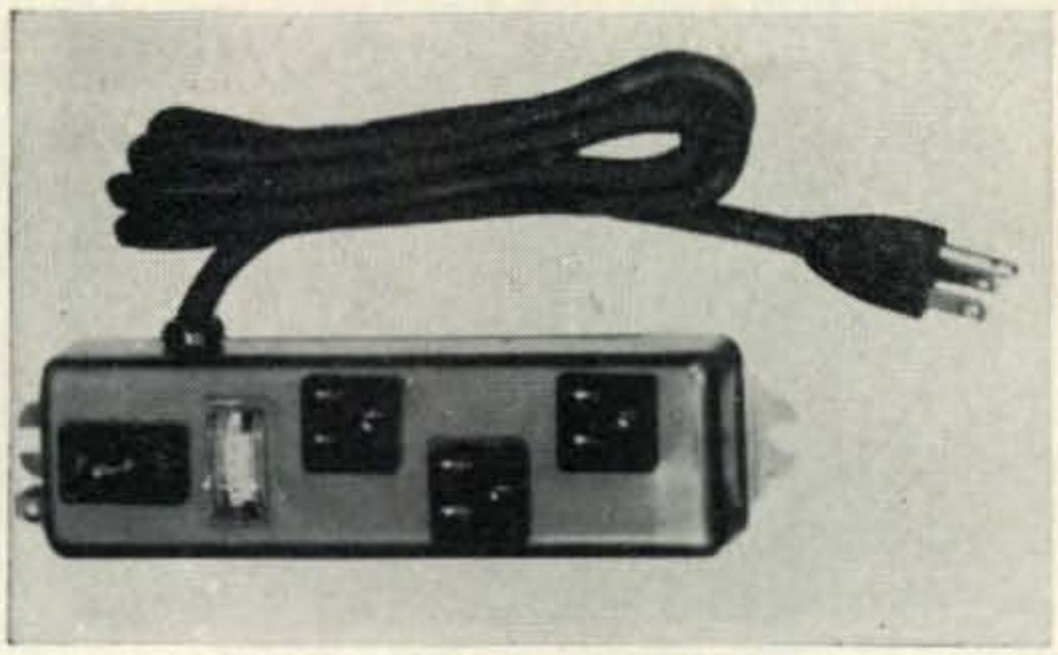


Fig. 4—Front and side views of a dial drive system constructed for a Collins p.t.o. This unit includes a 0-100 scale for reading out to 1 kc.

New Amateur Products

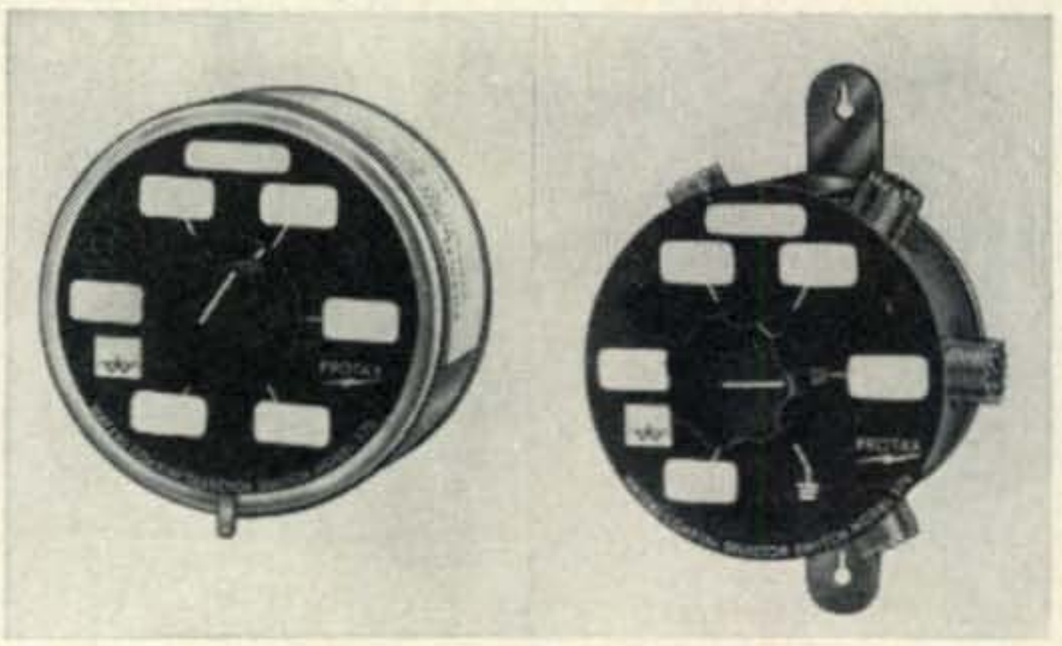


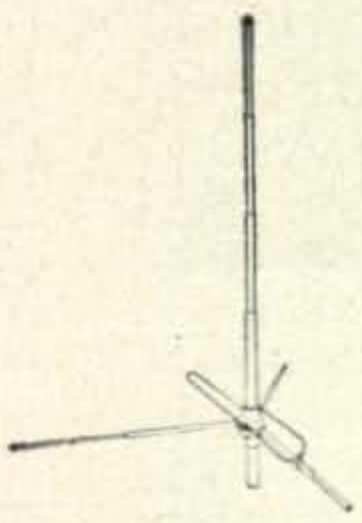
Waber Electronics

An illuminated voltmeter, providing a continuous check of a.c. line voltage, features a new line of outlet boxes developed by Waber Electronics, Inc., Philadelphia. Price ranges from $7.50 to $13.95, depending on the number of outlets. For further information write to: Waber Electronics, 2000 North Second Street, Philadelphia., Pa., or circle 72 on page 110.

Waters Protax Switches

Protax coaxial switches provide automatic grounding of all antennas not in use. Model 375, SP6T ($13.95) is an axial terminal switch, and Model 376 SP5T is a radial terminal switch ($12.50). Power carrying capacity for both units: 1000 watts r.f. up to 150 mc. For further information contact: Waters Mfg., Inc. Wayland, Massachusetts, or circle 73 on page 110.





Mosley 6 Meter Antenna

Mosley Electronics, Inc., 4610 N. Lindbergh Blvd., Bridgeton, Missouri, announces a 5/8 wave vertical antenna for 6-meters, the Diplomat #6, Model DI-6. Maximum input is 1000 watts. S.w.r. is 1.5/1 or better. Claimed gain is 3.4 db. over ¼ wave ground plane and 5.9 db. compared to isotropic source. A free brochure on antenna is available by writing direct or circling 74 on page 110.

Master Mobile Select-A-Battery

Master Mobile Mounts introduces the New Dual Select-A-Battery control system. The system enables you to select either of two car batteries, both at once, or to turn off all electrical systems in the car. Price $28.95 (less batteries, cables, rack). For further information write to: Master Mobile Mounts, 4125 W. Jefferson Blvd., Los Angeles, California 90016, or circle 75 on page 110.

Waters Attenuator

The new Waters Wide Range Attenuators are accessory devices designed to provide stepped attenuation of signals in receivers, etc. The attenuators provide 0—61 db of attenuation in 1 db steps. Maximum power is ¼ watt. V.s.w.r. is 1.3 maximum d.c. to 225 mc. Price, $27.95. For further information write: Waters Manufacturing, Inc, Wayland, Mass. or circle 76 on page 110.

Front view of the authors RTTY converter which is also made for rack mount. This unit also contains a keyer module which is not described in the text.

A Close Look At Transistorized RTTY!

BY B. C. HILL JR. and B. C. HILL III*

Today's excellent range of transistors offers the circuit designer a fascinating challenge to utilize the special characteristics of these new devices for reliable, low cost, RTTY equipment. The following article describes a tone converter module from a new line of RTTY equipment, together with a short explanation of the design philosophies.

Of greatest interest in amateur RTTY is the ability to copy some of the many frequency-shift transmissions on the air. If the receiver and printer are on hand, what is needed is something to convert the two-tone audio signals from the receiver into d.c. current impulses of a shape and magnitude acceptable to the printer.

Most present-day teleprinter operation, whether land-line or radio, is in the form of two-tone or frequency shift keying as shown in fig. 1A and 1B. One of these tones, *usually* the higher, represents the *mark* signal which is the current-on condition, and holds the printer armature in to the solenoid. The other tone represents the *space* signal and is current-off and armature release. The functions of the converter, then, are to separate the two tones, and provide a gated current according to the presence or absence of the *mark* signal. *All other functions are secondary.*

The base converter is, therefore, a source of direct-current operated by the presence or absence of one tone. With this point firmly in mind, the design discussion will concentrate on the *mark* channels, and later will treat the *space* channel as a mirror-image *mark* channel. Figure 2 shows the block diagram of the basic converter. Since the *mark* channel rectifier should see only the *mark* frequency, a filter, whose response is shown in fig. 3, must be placed in front of the rectifier. Very considerable freedom from noise can be gained by reducing the bandwidth of the filter to the narrowest possible passband.

There is, however, definite limits to the permissable reduction in bandwidth. First, the *mark* signal now under consideration is not a single, discrete frequency. Even if the *mark* frequency generator was crystal-controlled, and most aren't,

*2806 Fairview Road, Camp Hill, Pennsylvania.

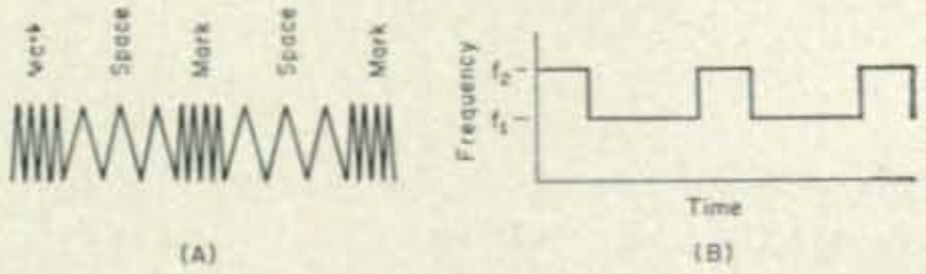


Fig. 2(A)—Frequency shift keying as it would appear on a scope using linear time base. Fig. 2(B) shows the same signal plotted as frequency against time.

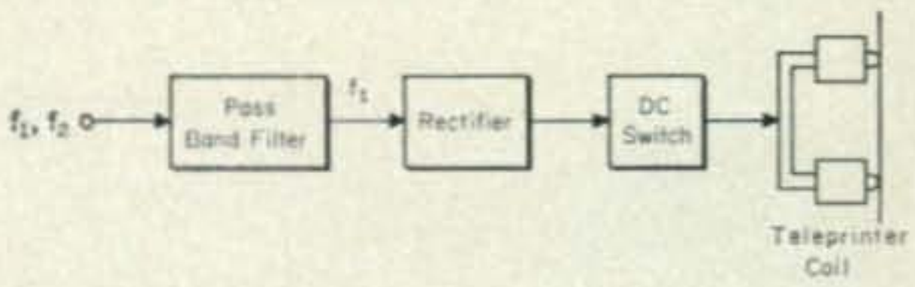


Fig. 1—The block diagram of a basic Tone Converter. Frequencies f_1 and f_2 are fed into the filter but only f_1 emerges. Frequency f_1 is rectified and the d.c. operates a d.c. switch which in turn activates or deactivates the teleprinter coil.

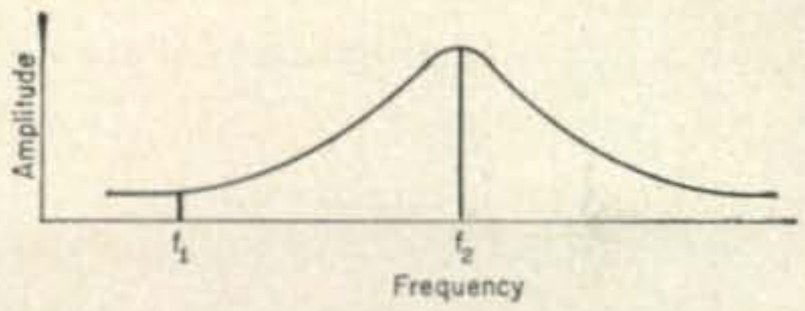


Fig. 3—An amplitude-versus-frequency plot of f_1 and f_2 with the response curve of a low pass filter superimposed. Frequency f_1 (2125 c.p.s., *mark*) will pass while f_2 (2975 c.p.s., *space*) will not.

the tone is being keyed off and on 20 to 40 times per second. This generates sidebands which must be passed by the filter to maintain the shape of the pulse. Figure 4(A) shows *mark* output pulses from an on-off tone generator. Figure 4(B) shows the output from a filter that is too sharp and slightly mistuned. This illustration was made with space pulses present also. Note that in 4(B) there is overshoot on the rise and ring out or slow decay on the end of the pulse. The response between the pulses is the *space* signal.

Rectification

The output of the filter, properly matched to the impedance of the rectifier system, results in a d.c. pulse, approximating the *mark* signal in shape. Filtering the output of the rectifier removes as much of the tone as possible while maintaining sharp rise and fall times. Figure 4C shows the output of a rectifier system from the *mark* signal of fig. 4(A). Figure 5 shows the basic schematic of a suitable rectifier of the voltage doubler type.

Switching

The resulting d.c. pulse now requires only current amplification to a magnitude suitable for solenoid operation. By the use of proper circuitry, the amplifier can take the form of a d.c. switch. The switch makes use of the current amplifying characteristics of transistors, together with their current cut-off and saturation characteristics to produce a switch-like function

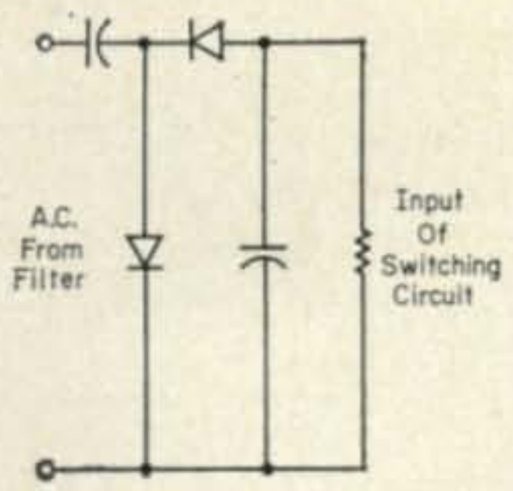


Fig. 5—Basic circuit of a voltage doubler type of rectifier used to convert the *mark* pulses into d.c. pulses for delivery to the switching circuit.

very close to that of a relay. A well designed transistor switch has little residual current in the cut-off condition, has a minimum of voltage drop in the closed or saturated condition, and switches very rapidly. In addition, and in RTTY this is a real bonus, the transistor switch turns off and on at exactly the same point, avoiding the hysterisis effect of the relay.

A single transistor in a switching circuit is shown in fig. 6(A). In the circuit shown, the base bias has been chosen to place the transistor at cut-off with no d.c. input signal. As the d.c. input signal grows more positive the transistor begins to pass collector current. This continues until saturation is reached at which time further increases in input current results in no increase in output current.

A two stage d.c. amplifier shown in fig. 6(C) is similar to that shown in fig. 6(A) but the switching occurs sooner and is much faster. Note, also, the phase reversal.

The d.c. switch used in the author's converter employs three transistors in cascade, insuring that the switch will operate sharply, and on very small current differentials. This is shown in fig. 6(E). The first transistor amplifies the input or base current, but because of the grounded emitter configuration, an increase in base current causes a drop in the base current of the second transis-

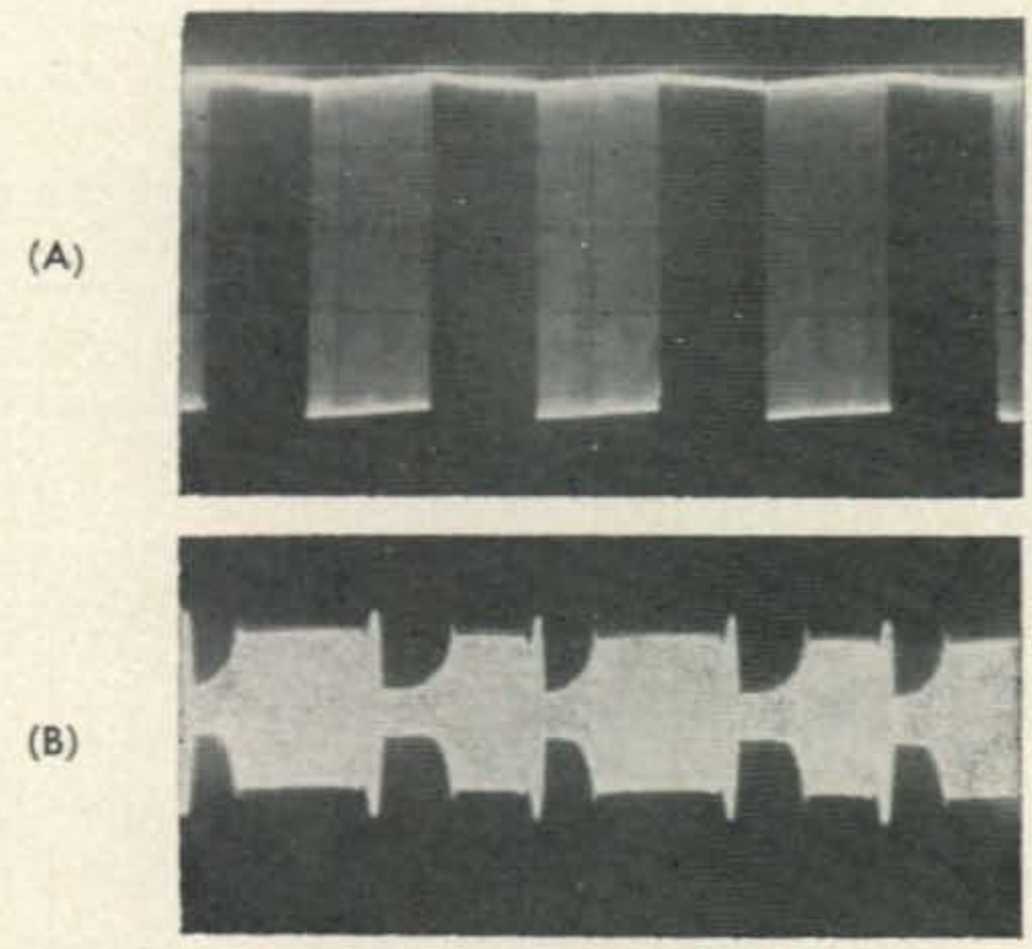


Fig. 4(A)—An oscilloscope trace of *mark* output pulses from an on-off one tone generator. Fig. 4(B)—This trace shows the output of a slightly mistuned filter. Fig. 4(C)—This output contains the same *mark* and *space* pulses as shown in (B) except the filter is properly tuned and has adequate bandwidth. Fig. 4(D)—Filtered output of the mark channel rectifier.

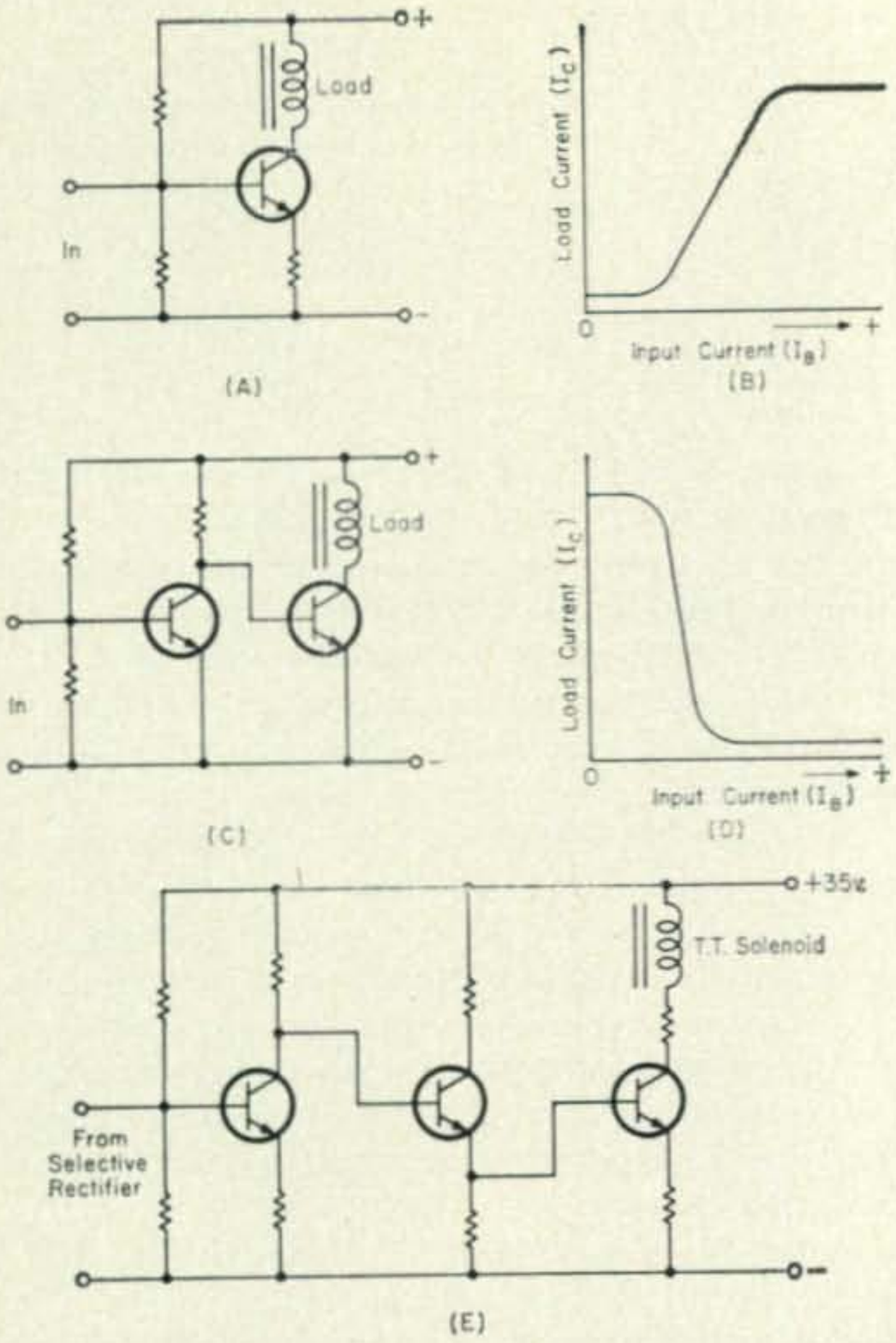


Fig. 6(A)—Single transistor switching circuit and its I_b I_c curve shown in fig. 6(B). A two stage switching circuit, shown in fig. 6(C) is more rapid in action and has a phase reversal as shown in fig. 6(D). A three stage switching amplifier used to drive the printer magnet is shown in fig. 6(E).

tor. In other words, turning the first transistor on turns the second one off. The second transistor is Darlington connected to the third transistor, so that turning the second transistor off also turns the third transistor off. Proper phase *re*-reversal is accomplished by reversing the polarity of the rectifiers preceding the switch. In other words, the *mark* signal produces a negative current to turn the switch on.

The last transistor is chosen to handle the 120 ma necessary for proper operation with the low impedance driving circuit. Figure 7 shows typical keying waveform at 60 words per minute. The high impedance of the opened switch permits proper coil discharge. The spike on the leading edge of the positive going portion is the result of the solenoid field collapse as current is removed. The small nick in the return of the spike is the armature falling away from the pole piece.

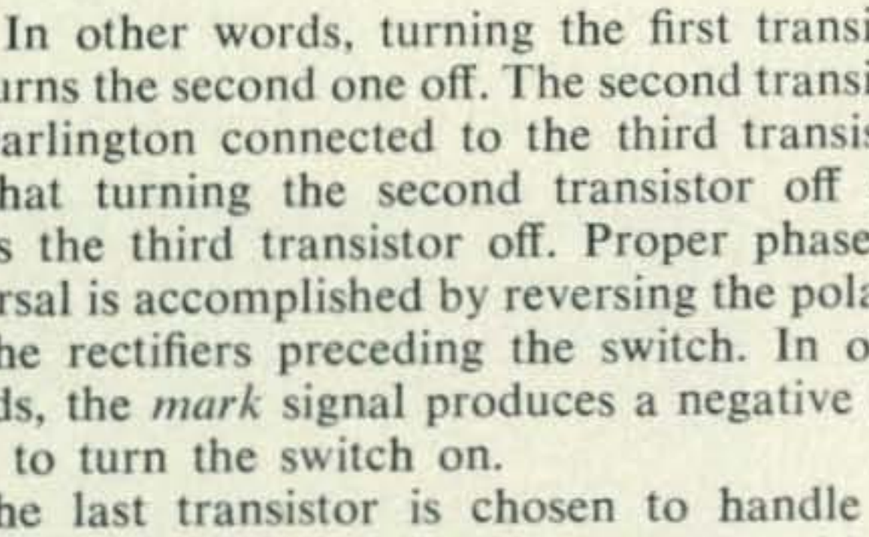


Fig. 7—Scope trace taken from the collector of the output transistor to ground. *Mark* is down.

Converter Improvement

The basic converter described above will work well with steady, clean signals. Assuming that the transmitted signal itself is accurate and stable, there are three hazards to good copy that modifications to the basic converter can help. First, there is selective fading, where initially the *mark* and then the *space* signals fade and return. Then there is major fading, where the whole signal varies widely in strength. Finally, there is noise, whose presence tends to confuse the converter and/or the printer.

The simplest modification is to utilize the second signal transmitted in frequency shift keying, the *space* signal referred to earlier. Remember that *mark on* is key on, and *mark off* is key off. The *space on* is also key off and *space off* is key on. A second filter-rectifier system is added, with the filter tuned to the *space* tone and the rectifier polarity-reversed.

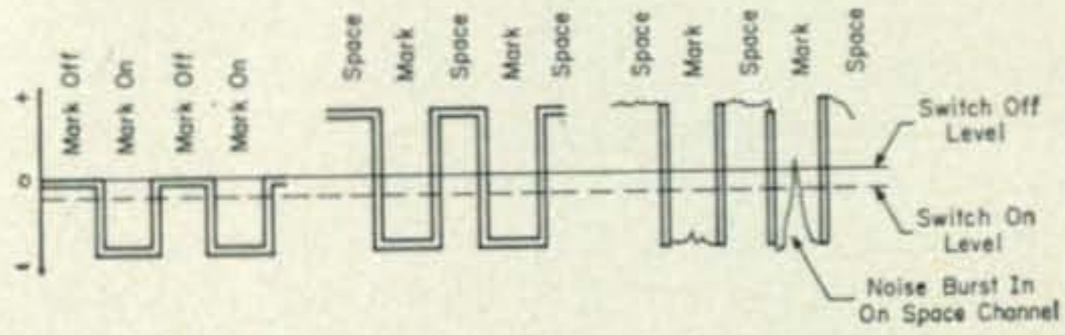


Fig. 8(A)—The *mark* only signal is shown superimposed on the d.c. switch requirements. In fig. 8(B) the combined *mark* and *space* signals are shown superimposed on the switch requirements shown in fig. 8(C) is how noise bursts can leak through the open channel.

Figure 8(A) shows the one-tone converter with the output of the rectifier superimposed on the d.c. switch input requirements. Figure 8(B) shows the addition of the *space* channel. The result is that the *off* has in effect become *off* + *off*, or double *off*, while the *on* condition has not changed. The vulnerability of the *mark* channel has been greatly reduced, since the *mark* channel is "open" to noise during *mark* off. The improvement is not all to the good, since a new "open" channel, *space off* has been added as shown in fig. 8(C).

With the addition of the *space* channel, it now becomes possible to devise a "key on either channel" circuit. Note that the switch in fig. 8(A) is set to "switch off" with no signal input, and to "switch on" with a negative going signal.

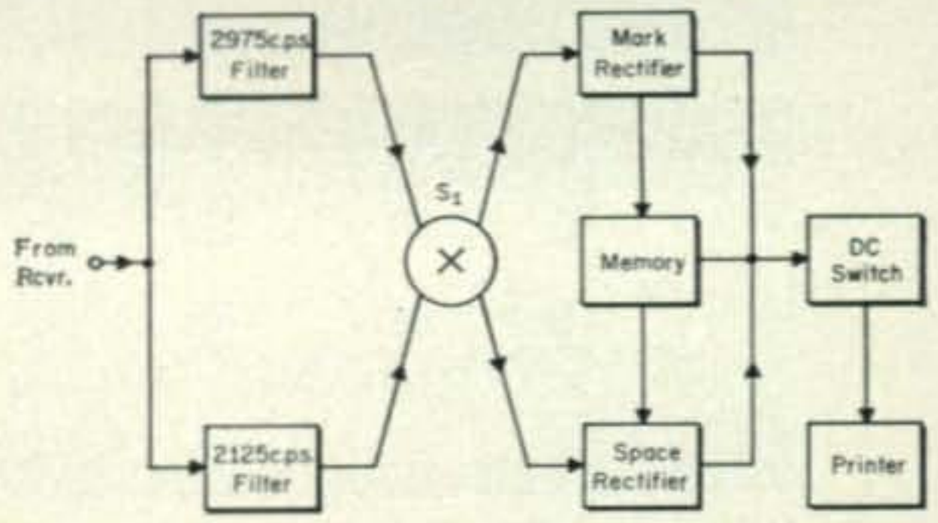


Fig. 9—Block diagram of a converter that can key from *mark* or *space* signals or both. The use of the memory circuit is explained in the text. Switch S_1 is for *mark-space* reverse.

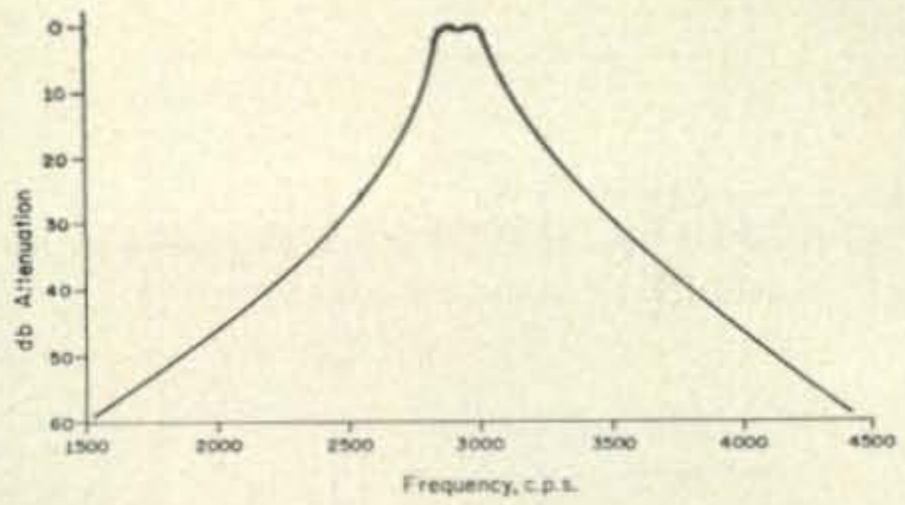


Fig. 10—Response curve of a filter, tuned to the mark frequency, suitable for the elimination of nearby tones (close to 2925 c.p.s.) and white noise.

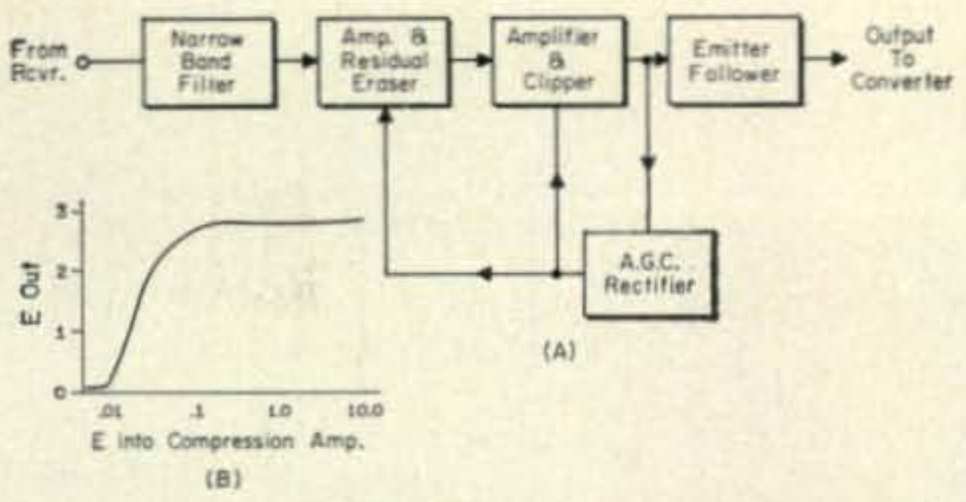


Fig. 11(A)—Block diagram of the preamplifier used to drive the converter. The narrow band filter is tuned to 2125 c.p.s. and is about 200 c.p.s. at the 3 db points. Fig 11(B) shows the input/output characteristics of the preamplifier.

Because of the stability of the transistorized switch, it is possible to place a small bias on the input to the switch in such a manner that keying can be accomplished by either the *mark* or *space* signal, depending on the set of the bias. This characteristic makes it possible to build into the circuit a memory. If this memory is set to remember the last signal into the converter, it will then adjust the bias so that if the opposite signal fails to appear, the memory device will act in place of the missing signal. Thus the converter will key reliably on *mark* or *space*, or both. The block diagram of such a converter is shown in fig. 9. The addition of the "key on either channel" circuitry is an effective measure against selective fading and works well until the other side also fades away.

Noise

The problems of noise can be dealt with most effectively ahead of the rectifiers. One form of noise is unwanted tones nearby, another is general background or white noise. A most helpful measure for both of these noise problems is a more selective channel filter, such as shown in fig. 10. This filter provides a pass band of about 200 c.p.s. with a roll off of about 12 db per octave bandwidth which provides 24 db attentuation at the crossover point of the other channel filter. These characteristics provide near-optimum conditions for relief of white noise and nearby tone interference.

Another serious hazard to good RTTY copy is the occasional sharp noise which, while almost unnoticed by the human ear, rips apart the RTTY operation by upsetting the synchronization of the printer. This causes the next several characters to be in error. Add a continuing series of these spikes, and readable copy is impossible.

The major fading hazard is variations in the level of the audio signal delivered to the converter. These variations are caused by fading, phase shifts, or movement of the reflecting surfaces from which the signals are bouncing. Most of the later model receivers have some form of a.g.c. which is very helpful. For receivers without a.g.c. for the c.w. position, and signal levels in all receivers below a.g.c. operation levels, some form of compression is most desirable.

Preamplifier

The problems described above are relieved by a signal conditioning and selecting preamplifier that has been designed as a separate module. It operates from the converter power supply and accomplishes the following:

a. Preselection of incoming signal.

b. Attentuation of low-level background signals.

c. Limiting action of about 40 db.

The block diagram of the preamplifier is shown in fig. 11(A). Two stages of amplification are used with the second stage driven to saturation and clipping for the elimination of noise spikes. The output of the second stage feeds, in part, a diode rectifier in an a.g.c. configuration.

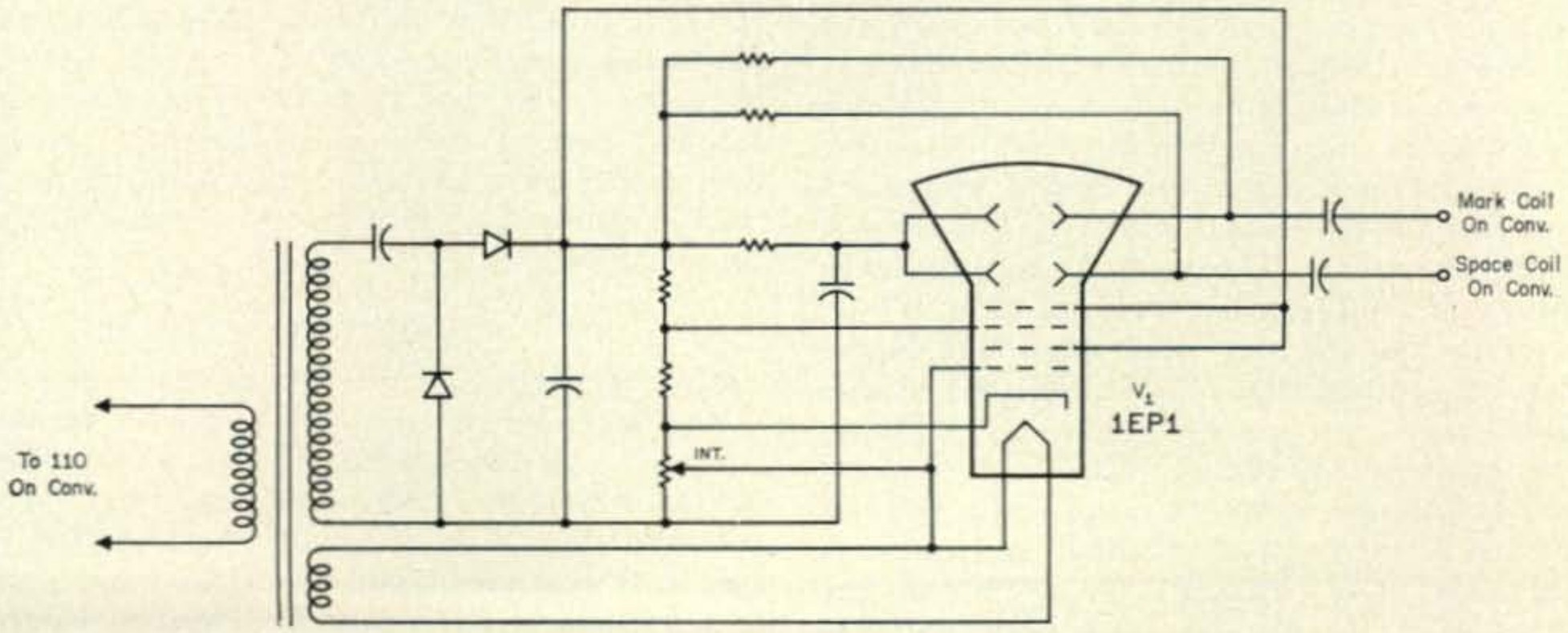


Fig. 12—Simple scope, for tuning and monitoring, makes use of the 1EP1.

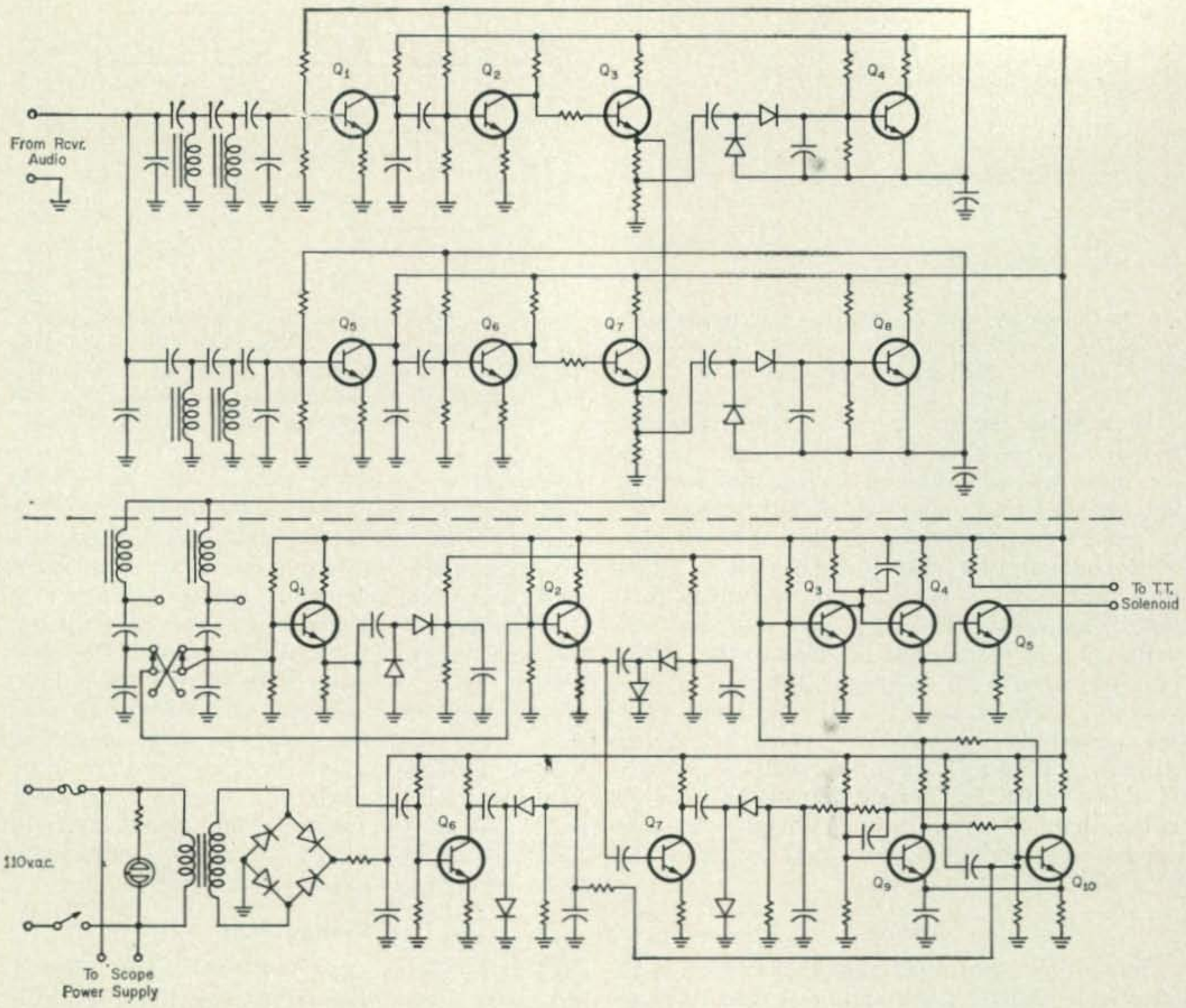


Fig. 13—Simplified diagram of the complete preamplifier and converter modules described in the text.

The first stage is biased to provide little gain for very small signals to prevent residual noise from being amplified. Figure 11(B) shows the input-output characteristics of the preamplifier.

Although 850 c.p.s. shift still remains the standard shift, an increasing usage of smaller shifts is occurring, and allowance for this is made in the design of the units. The *mark* and *space* converters are switchable for 850, 600, 400, and 200 c.p.s. shifts.

Bandwidth

Because the susceptibility of the system to noise is a function of the bandwidth of the system, all tuned circuits have been made as sharp as possible for maximum selectivity. However, as in any system where a great deal of selectivity occurs, reasonably exact tuning is a must for optimum operation. The turning required takes the form of adjusting the dial and b.f.o. of the receiver so that the *mark* and *space* signals fall exactly into the passbands of the filters and discriminator.

This can be easily accomplished by the means of an oscilloscope wherein the vertical plates are connected across the *space* channel, and the horizontal plates across the *mark*. Proper tuning has occurred when the vertical and horizontal traces are equal in magnitude, and the vertical trace is at right angles to the horizontal and erect. While almost any model oscilloscope may be used for this purpose, the designers have prepared a special, quite inexpensive, scope module for just this purpose, employing the standard 1EP1 tube. This little scope, mounted with the other modules, makes an important addition to the rig. The circuit is shown in fig. 12.

Figure 13 shows the simplified diagram of the complete converter system with preamplifiers and 'scope.

This article was devoted entirely to the converter because it is easily the most difficult and least understood part of RTTY, especially when the signals are "less" than 599. The converter is the first part of terminal equipment to go into operation, and a very good starting point for the RTTY neophyte, regardless of his skills with the key or phone.

Modules

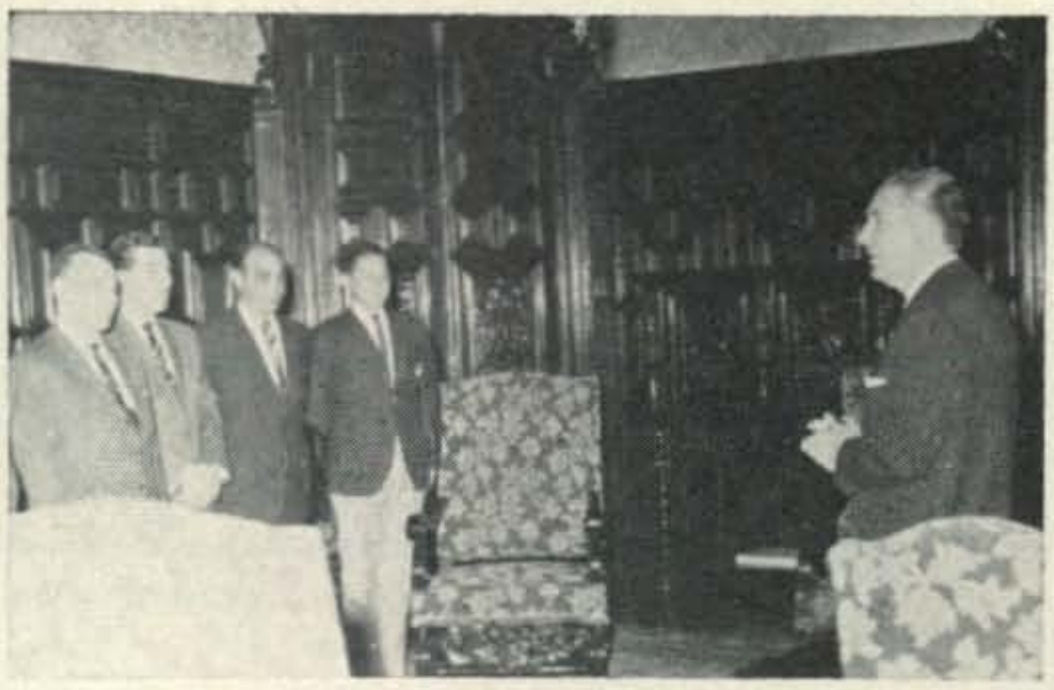
Similar interest on the part of the authors led to the development of a line of RTTY terminal equipment designed with the delicate condition of the amateur's pocketbook in mind. While economy has been a major consideration, no shortcuts were taken, and the design hews largely to the classical approach. The various parts of

(*Continued on Page 104*)

This trailer recently took part in a local "Salute To Safety Week" parade in Bristol, Tenn. Built and manned by the Bristol Amateur Radio Club, (complete with station) the display shows the need to check for faulty home wiring. Bill Lillard, WA4RUT, (Club President) and James Skeen, WA4NEC, are shown operating the mobile station.

The smiling faces of Maurice Margolis (G3NMR) and his charming XYL, Sylvia, seen at Maurice's "fixed rig," at Ilford, Essex, England. Maurice is better known for his extensive interest in mobile amateur radio, and Sylvia for her writing. Several of Sylvia's articles on the lighter side of amateur radio have appeared in CQ during the past few years.

PEOPLE AND PLACES



An eye-ball QSO between distinguished Peruvian radio amateurs. On extreme right, Fernando Belaunde T. (OA4FB), President of the Republic of Peru. In background, from left-to-right. Gustavo Reusens (OA4AV), Vitaly Franco (OA4PD), Natan Sterental (OA4OS) and Benny Sterental (OA4NSO). Also attending the meeting, although not shown in the photograph, was Carlos Tassara (OA4AT), President of the Peruvian Radio Club. The meeting took place recently in President Belaunde's official residence, Lima's "White House."

First of the new "ham" registration plates was recently presented to Father Daniel Linehan, S.J. by Governor Volpe at the State House, of Massachusetts. Father Linehan, Director of the Boston College Weston Observatory and world-famed seismologist has been an active amateur radio operator for over thirty years. Massachusetts is the forty-eighth state to grant this privilege to hams.

Taking time away from 20 meter RTTY, Don Drolgemeyer (DJØDD) on the left watches Sidney Kessler (W3ABA) gulp down a "small one" at the Hofbrauhaus in Munich, Germany. Don shut down recently and will soon be heard with an EL2 call.

DX

BY URB LE JEUNE,* W2DEC

SSB DX HONOR ROLL

TI2HP	303	W3MAC	281	W6YMV	264	W3VSU	235
W2BXA	303	W1LLF	281	W4SSU	263	OZ7FG	233
K4TJL	303	W6UOU	281	G2BVN	263	W4HUE	231
WØQVZ	303	W3KT	281	G3DO	260	W3DJZ	231
W2TP	302	G8KS	279	W4RLS	259	W2PTM	230
W2ZX	301	K4HYL	276	W6WNE	259	WA2EOQ	229
G3AWZ	301	DL1IN	275	PJ2AA	258	W6ZJY	227
5Z4ERR	300	HB9TL	275	KP4CL	256	W3FWD	226
W8PQQ	299	I1AMU	275	K6LGF	250	K1SHN	224
W3NKM	296	PZ1AX	274	W1AOL	250	K2JFV	223
K2MGE	296	W6RKP	273	W4OM	249	K4JEY	221
W2FXN	293	K9EAB	273	W4PAA	249	K1JMV	213
W4OPM	290	W2RGV	272	W4NJF	248	SM5UF	208
W2VCZ	290	W2LV	271	GM3JDR	246	WØQLX	205
K1IXG	288	G3NUG	269	XE1AE	246	K6CYG	203
K8RTW	286	K8ONV	269	YV5AFF	239	W6USG	203
WA2IZS	285	G2PL	265	W7DLR	238	KØUKN	202

Yasme Sails Again!

The *Yasme* sails again. Not actually, but at least in spirit. The Yasme Foundation has been reactivated under its old by-laws and organization with some changes and additions to its officers. Its immediate objective is to sponsor the world-wide DXpedition activities of Iris and Lloyd Colvin. For further *Yasme* news read the West Gulf DX Bulletin, 2153 University Blvd., Houston, Texas. Frank Campbell, W5IGJ, is editor of the West Gulf DX Bulletin. He is also Publicity Director for *Yasme*.

The present officers and directors are:

PRESIDENT: Danny Weil, VP2VB, etc., etc.

VICE PRESIDENT: Hal Sears, K5JLQ

SECRETARY AND QSL MGR.: Bob Vallio, W6RGG

TREASURER: Ed Peck, W6LDD

DIRECTORS: Golden Fuller, W8EWS; Dick Spenceley, KV4AA; Charles Biddle, W6GN; Jack Drudge-Coates, G2DC and Frank Campbell, W5IGJ.

Iris Colvin, KL7DTB/6 and Lloyd Colvin, W6KG, are departing on an extended DXpedition that is hoped to include operation from most of the rare and semi-rare countries of the world. Travel will be primarily by commercial aircraft. The gear includes a Collins 75S-3 receiver, 32S-3 exciter, 30L-1 amplifier and in most cases a Hy Gain triband beam (A 14AVS vertical is available as an alternate). Iris and Lloyd have already visited 96 countries and held 23 different calls and need no further introduction to the DX fraternity.

Written application has been made to operate in approximately 150 countries. Iris and Lloyd say they will go anywhere. If permission to operate can be obtained and you can provide transportation here is your chance to send them to work you from that country you still need, HI! The present operating plan calls for operation from Pacific areas, then the Middle East and then Africa.

Iris and Lloyd left the USA in August. First operation will be in the Pacific areas and has already begun.

To make it easy to remember, Iris and Lloyd will operate on the same frequencies as the Don Miller-Chuck Swain DXpedition which are: 7000-10, 14045-55, 21045-55 kc c.w. and for s.s.b., 7090-100, 14100-110, 21400 kc, listening as directed. Only one QSO per band, per mode is requested. Please s.a.s.e. Contributions as you see fit. Time in GMT. All QSLs answered.

*Box 35, Hazlet, New Jersey 07730.

Here and There

CR3 Portuguese Guinea: CR3AD, Octavia, has

W1BB had two distinguished visitors this summer. On the left (4) is Gary, K1KSH, who operated from several rare spots and has made many 160 meter firsts. On the right is Rolf Rasp who is very famous for his 160 meter s.w.l.ing from Brazil. *(Tnx W1BB).*

The following certificates were issued between the period from August 6th, 1965 to and including September 5th, 1965:

CW-PHONE WAZ

2195	UA1KBA	Radio Club of Leningrad
2196	UA1DI	Vladimir Tarabrin
2197	UW3DR	Vladimir V. Mitt
2198	UA9WS	Valentin B. Wakutjn
2199	OH3XZ	Jorma Saloranta
2200	WB6CFO	Don Cady
2201	W1DGJ	Michael W. Ludkiewicz
2202	DJ9HA	Gunther Bruhl
2203	DLØFT	Club Station Verband der Funkamateure der Deutschen Bundespost
2204	W7JWE	Earl W. Lockwood
2205	WB2HXD	Gerry Offenberg
2206	SM6AMD	Hans-Gunnar Hansson

CW WPX

670	HK4JC	Juan Caballero
671	YU1BCD	Radio-klub M. Pupin
672	UW3DR	Vladimir V. Mitt
673	UA1KBA	Radio Club of Leningrad
674	W8UEX	Robert M. Whitely
675	JA1GC	Keiichi Ishizuki
676		Leif Lindberg
677	KR6JZ	Peter Susko
678	SM6AVD	Hans Svennblad
679	SVØWAA	Everett L. Battey

PHONE WPX

121	I1PRC	Rosario C. Pentimalli
122	DJ5VQ	Karl Kaul

SSB WPX

215	VK5GG	George Angus Gormly
216	VE6ABP	Margaret Tettelaar
217	KL7MF	Harold D. DeVoe

ALL-PHONE WAZ

312	W1DGJ	Michael W. Ludkiewicz
313	W6CHV	Ralph H. Culbertson
314	WØQUU	Jack Fisher
315	DJ2VZ	Herbert Koehna

TWO-WAY SSB WAZ

337	UA1MU	Victor G. Topler
338	VE2WA	Graham G. Williams
339	W9QQN	Norman P. Alexander
340	G2BOZ	John E. Bazley
341	W2QNE	C. M. Heiden

been active on 14089 kc at 0400 GMT. He has a bad chirp and the signal drifts. *(Tnx FEDXP via LIDXA).*

EA6 Balearic Island: EA6BD on 14043 kc at 2300 GMT *(Tnx LIDXA).*

FL8 French Somaliland: FL8RA has been active on 14043 kc about 2000 GMT. *(Tnx NEDXA).*

FR7 Reunion Island: Jan, FR7ZI, on 14090 kc at 1700 GMT. *(Tnx LIDXA).*

KG6I Marcus: Chuck, KG6IF, has a new quad up. He is active on 14270 kc around 0200 GMT. *(Tnx LIDXA).*

KS4 Swan: KS4AB has been operating around 7010 kc at about 0200 GMT. QSL via WA9LCY.

KX6 Marshall Island: Bob, KX6BW, passes along the following: "I am again on the air mostly on 20 phone from about 1130 to 1530 GMT daily at about 14250, for any stations wanting to work the Island of Ennylabegan. We are at present the only station on the Island and we do QSL 100% all cards received. Ennylabegan is 8 miles from Kwajalein. We are also occasionally on 20 at about 0300 GMT but not with any great regularity.

"Next, I noticed in the newest *Callbook* that the Zip Code for Kwajalein, Ennylabegan and Roi Namur Islands is not correct. The correct Zip Code is 96555.

"The address for QSL for KX6BW is Box 65, APO San Francisco, Calif. 96555."

OX Greenland: KG1 stations are no more. They are now OX4 if in Southern Greenland and OX5 if in Northern Greenland. A real good WPX catch is XP1AA who is the former KG1AA. *(Tnx LIDXA).*

PYØ Saint Peter & Saint Paul Rocks: DJ2KS/PYØ operated from this island for one hour and worked very few. Most DXers, including your editor, were sleeping at the switch.

UA1 Franz Josef Land: UA1KED should now now be on s.s.b. *(Tnx LIDXA).*

VK9 Cocos Keeling: KR6IL acts as MC for Eugene, VK9VG, on 14270 at 1300 GMT. After taking calls, VK9VG QSYs to 14110 listening 14260/270. *(Tnx NCDXC).*

VKØ Macquarie Island: VKØTO is QRV around 14175 kc on a.m. phone at 0500 GMT. He will answer s.s.b. in the American phone band. *(Tnx NCDXC).*

VP2S Saint Vincent: Harold, VP2SJ, is active with a new SB-400 Transceiver. Try 14232 around 1900 GMT. QSL via W1MRQ. *(Tnx W1MRQ and LIDXA).*

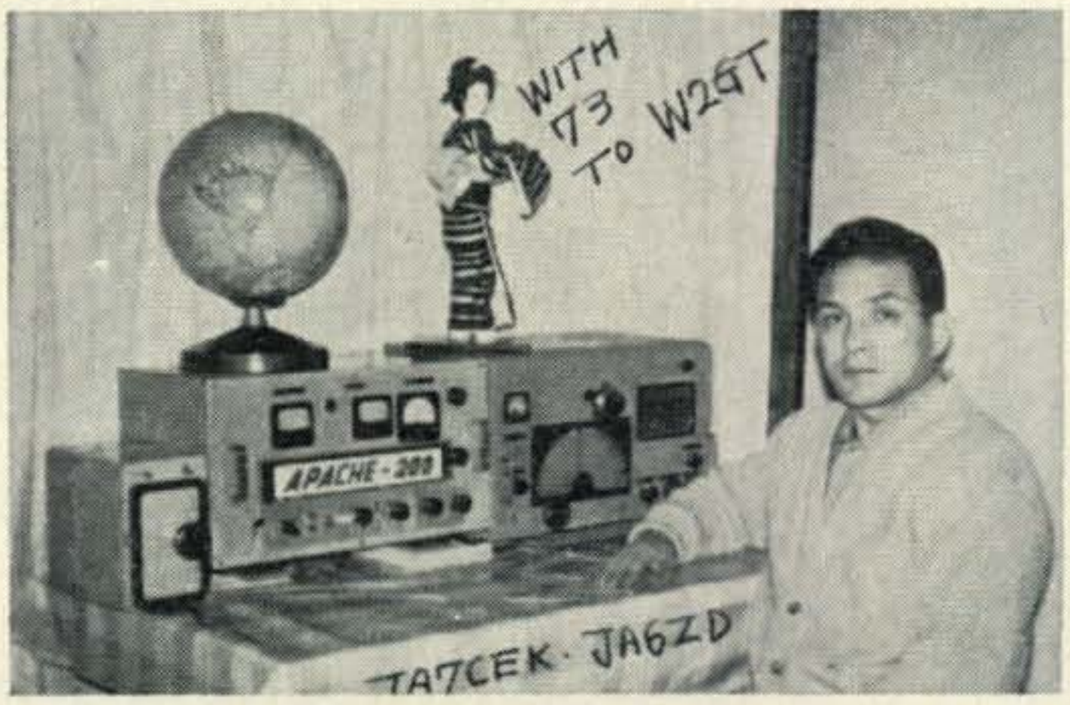
VQ9 Seychelles: John Beck, W6MHB, is currently active on the low end of 14 mc c.w. and 7 mc c.w. *(Tnx NCDXC).*

VR4 Solomon Islands: Arthur, VR4CR, 14089 kc at 1400 GMT. *(Tnx WGDXC).*

VR5 Tongo: George, 5W1AZ, will go to VR5 land sometime after the first of the year with equipment furnished by K6EXO. *(Tnx LIDXA).*

YK Syria: Bob, OD5BZ, was overheard saying that chances of operating from YK have now increased from 10% to 15%. At least the odds are going in the right direction. *(Tnx NCDXC).*

ZD8 Ascension Island: Thanks to Harold, ZD8HL, for the following information: "Thought I'd better let you know that the ZD8 gang is planning an all-out attack on the *CQ* WW DX



Thanks to Ed, W2GT, for this picture of JA7CEK.

This is DLØFT with DL1HA at the controls. DLØFT is the club station of the Frankfurt Radio Club. The rig runs 250 watts. *(Tnx DL1HA).*

Contest, both phone and c.w. We expect to have our new V beam up pointed toward the states, so we should be able to make ourselves heard on 40 and 80 as well. Haven't done too well on these bands until now.

"Will be operating multi-op, multi-transmitter, under the club call ZD8AR. QSLs will be handled via the Hammarlund DXpedition of the Month. Also plan to work the RTTY contest in mid-October with much the same setup. I think ZD8BC has already written you but in case he hasn't, QSLs for our recent VP2AO operation also go via Hammarlund.

"I doubt if anyone still needs ZD8 but the boys here are active daily. ZD8WZ operates mostly 15, s.s.b. and c.w. Bud, ZD8BC, is mostly active chasing DX on 20 c.w. I spend most of my time on 20 s.s.b., 14250 or 14110. We all occasionally operate ten around 28.6. Harold ZD8HL"

ZL Campbell Island: ZL4JF on 14101 at 0300 GMT. *(Tnx WGDXC).*

5R8 Malagasy Republic: 5R8CB on 21080 kc at 1800 GMT. *(Tnx LIDXA).*

3AØ Monaco: Bob Lane, WA6ZIQ/F7BL had to postpone the 3AØ operation until later this year. *(Tnx W2GHK).*

5J3 Colombia: The Radio Club of Colombia will use the call 5J3LR during both portions of the *CQ* WW DX Contest. QSL via W2CTN. *(Tnx HK3RQ).*

9M6 Singapore: 9M6AP, operator Tony Parker RAF—location in Lebuan, a small island off the North Borneo coast, operates between 14250-300 s.s.b. Equipment is KW Viceroy 150 watts d.c.; KW-77 receiver; dipole antenna. QSL direct to Tony Parker, SSB Convoy RAF, Lebuan, BFPO 660, Singapore, or RSGB. The same station being used under call 9M6DH. The operator is Ted, 14000 to 14100 c.w. QSL via RSGB. These stations come through at about 0600 GMT in the States. *(Tnx W6OMR).*

9X5 Rwanda: 9X5CE, Mark, 14255 kc at 1930 GMT. *(Tnx LIDXA).*

160 Meters

1965/1966 Transatlantic DX Tests. Again, reminiscent and symbolic of the first pioneering transatlantic crossings by Marconi, DeLoy, Schnell, Reinartz, Godley, 1901-1924 and continuing a yearly operating activity on 160 established in 1932 and held every year since (except war years), the annual transatlantic and worldwide "Top Band" DX tests will be held on the following Sunday mornings at 0300-0730 GMT Dec. 5th and 19th, Jan. 2nd and 16th, Feb. 6th and 20th. 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 alternate periods thereafter, listening in between. DX will call "CQ DX Test" the 2nd, 4th, 6th five minute periods, etc., listening in between. Adhere this sked except when QSOs in progress.

Use authorized frequencies: W/VEs East, 1800-1825, West, 1975/2000 kc. Europe, 1825-30, VK, 1800-1860. JAs, 1880 (spot). Africa, 1800-1825 mostly. These transatlantic tests are exciting. All hams are reminded to be alert for unusual DX openings anywhere over Darkness Paths, at sunrise or sunset times 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. This is when 160 meter signals peak.

Remember these are tests not contests. They are for pleasure in an unusual operating activity without competition and to develop some propagation information which may make a worthwhile contribution to the art of radio. W/VE stations to send reports of tests to W1BB, Stewart S. Perry, 36 Pleasant St., Winthrop, Mass. USA for logging and reporting immediately after each test. G, GM, GW, GC, etc. send reports to G6QB, Tommy Thomas, DX Editor SWM, 49 Winchelsea Lane, Hastings, Sussex, England. Other DX may send reports to either. The important thing is to send in your reports. W1BB will be glad to arrange special schedules with any station wishing to test out unusual paths and conditions and will send full instructions. Will also sked any station who has not previously QSL'd W land.

Special "First Timer's Tests." This season's transatlantic DX tests will feature special tests when all of those on one side or the other, who have already previously at one time or another crossed the Atlantic or worked real DX on 160 will QRT, *i.e.*, stay off the air entirely on that particular morning to allow the weaker stations who have never crossed before to have a go at it. One morning, the Europeans, except for those who have never crossed before will QRT. The next test, all W/VEs will QRT, except for those who have never crossed before. On the opposite side, everyone, including the "experts" will listen for and try to work the weak ones, the first timers on the opposite side. The "regulars" who are to be QRT to give the weaker boys a chance can either listen or stay in bed for their much needed sleep.

This idea was originally suggested by G8PG then mentioned in W1BB DX Bulletin, then RSGB/SWM/etc. and has been enthusiastically endorsed by many 160 DXers. So, we'll give it

[*Continued on page 97*]

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

October	30-31	VU2/4S7 Dx Phone
October	30-31	New Hampshire QSO Party
November	3-4	YLAP Phone QSO Party
November	6-7	VU2/4S7 DX Phone
November	6-7	RSGB 7 mc C.W.
November	13-14	ARRL SS Phone
November	20-21	ARRL SS C.W.
November	**27-28**	**CQ WW DX C.W.**
December	4-5	OK DX C.W.

VU2/4S7 DX

C.W.—Oct. 30-31. **Phone**—Nov. 6-7.
Starts: 0600 GMT Saturday, Ends: 0600 GMT Sunday in each instance.

Rules for this one were given in last month's CALENDAR.

This year your logs go to: Contest Manager, Glen V. Wickremaratne, 4S7GV, 150/5 Kandy Road, Kurunegala, Ceylon. Deadline November 30th.

YLAP Party-Phone

Starts: 1700 GMT Wednesday, November 3.
Ends: 2300 GMT Thursday, November 4.

A QSO Party open to YLs and XYLs only. Coming during the middle of the week how could it be anything else. The c.w. section has already taken place but you phone gals can still have a go at it. See Louisa Sando, W5RZJ's YL column in the September issue.

Your logs must be in the hands of the contest committee no later than December 10th. They go to Kayla Bloom, WØHJL, 175 So. Jasmine St., Denver, Colorado.

New Hampshire QSO Party

Three operating periods (GMT)
0000 to 0400 Sunday, October 30.
1200 to 1600 Sunday, October 30.
0000 to 0400 Monday, October 31.

This is the sixteenth New Hampshire QSO Party, this year sponsored by the Concord Brasspounders and open to all amateurs. Certificates will be awarded for contest activity and stations may also apply contacts in the party for the WNH (Worked New Hampshire) and the GSA (Granite State Award) certificates.

Exchange: QSO number, signal report and QTH. (County for N.H. stations.)

Scoring: N.H. stations: 1 point for each N.H. contact, 2 points for out of state QSOs. Out of state stations: 2 points for each N.H. contact. Final score for both will be the total QSO points multiplied by the number of N.H. counties worked. (Maximum of 10.) The same station may be worked on more than one band for additional contact credit.

Log Data: Date/time in GMT, QSO number, station worked, signal report and QTH. C.W. and Phone are different categories and separate logs for each mode must be submitted.

Frequencies: All bands 160 thru 10. Suggested spots are: 1815, 3530, 3842, 7030, 7220, 14,100, 14,250, 21,100, 21,350, 28,100 and 28,800.

Awards: Certificates will be issued to all participants reporting, with a special endorsement for the highest scoring stations, both in New Hampshire and out of state, in both c.w. and phone categories. Single operator stations only are eligible for the endorsement.

Logs must be postmarked no later than November 25th and sent to: The Concord Brasspounders, Inc. Att: G. K. Crowell, Box 339, Concord, New Hampshire 03300.

The WNH certificate will be awarded to stations working all 10 N.H. counties during the contest, providing confirming logs are received. Requirements for the WNH, a standing award, may be obtained by writing to the Concord Brasspounders.

The GSA award may likewise be obtained, details from the Nashua Mike and Key Club, Box 94, Nashua, N.H.

ARRL SS

Phone—Nov. 13-14 **C.W.**—Nov. 20-21
Starts: 2100 GMT Saturday. Ends: 0300 GMT Monday in each instance.

Last year's set-up, one week-end for each section, proved very successful. Therefore the same arrangement is being retained and the rules are the same as previous years.

The message exchange will be the QSO number, two digits indicating the year first licensed, section and month and day (not year) of birth. The November issue of *QST* should have all the details.

Requests for log forms and your final product go to the ARRL Communication Department, 225 Main Street, Newington, Connecticut 06111. Deadline for mailing is December 15th.

RSGB 7 mc DX C.W.

Starts: 1800 GMT Saturday, November 6.
Ends: 1800 GMT Sunday, November 7.

It's the world working the British Isles on 40 meter c.w. (the phone section has already taken place).

*14 Sherwood Road, Stamford, Conn. 06905.

Pictured during his recent vacation in Venezuela is W1WY with a few other notables in the DX'ing world: CX2CO, YV5GA and W2GHK.

Scoring is a bit involved, so it is suggested that you check last month's CALENDAR.

Mailing deadline is November 22nd and your logs go to: R.S.G.B. Contest Committee, 28 Little Russell Street, London, W.C.1, England.

OK DX C.W.

Starts: 0000 GMT Sunday, December 5.
Ends: 2400 GMT Sunday, December 5.

This is a world wide type contest so don't confine your operation to working Czech stations only.

1. Use all band, 1.8 thru 28 mc on c.w. only.

2. There are three divisions: A. Single operator, All Band. B. Single operator, One Band. C. Multi-operator, All Band.

3. The number exchange will be five figures, RST report plus two figures indicating the number of years the operator has been active in amateur radio. (*i.e.:* active since 1935, 57930) Multi-operator and club stations will use date station was licensed.

4. Each completed contact counts 1 point, but *3 points* if it's with a Czech station. The same station can be worked once per band and contacts with stations in the same country have no QSO point value but can be worked for multiplier credit.

5. The multiplier is determined by the number of prefixes worked on each band (WPX Award list.)

6. Final score therefore will be the total contact points multiplied by the sum of the prefixes from each band.

7. Use a separate log sheet for each band and show in this order: Date/time in GMT, station worked, number sent, received, contact points and prefix. (First time worked only.)

8. Include a separate summary sheet showing the scoring and other pertinent information and your name and address in BLOCK LETTERS. Also include a signed declaration that all rules and regulations have been observed.

9. Certificates will be awarded to the highest scoring station in each country in each division.

10. Contest contacts may be applied for the 100 OK (worked 100 Czech stations) and the S6S (worked all continents) awards, providing a written application is submitted with your log.

11. Logs go to: The Central Radio Club, Post Box 69, Prague 1, Czechoslovakia. Mailing deadline is January 15, 1966.

CQ WW DX C.W.

Starts: 0000 GMT Saturday, November 27.
Ends: 2400 GMT Sunday, November 28.

The Phone contest is now past history, however the c.w. men are still rushing final plans for the "Big One" at the end of the month.

Information regarding DX-peditions during the contest period is generally received too late for publication, but we do have the following news of interest.

The boys down Colombia way have come up with a new prefix which should create quite a pile-up. The club call is no longer HK3LR, what you heard in the Phone contest and will be hearing in the c.w. week-end is 5J3LR. (Bet you thought you were working a new one over the long path to Asia.)

We are again assured of San Marino activity. W6JFJ hopes to be signing M1N on all bands, 10 thru 80, during the c.w. week-end.

Again we warn you of possible disqualification if your log shows excessive duplicate contacts. It should be thoroughly checked before sending it to us, all duplicates crossed out, taking no credit for them of course, but leave them in the log. And please, PRINT or TYPE your name and address. Some of you are only receiving a certificate because Bobbie took time out to look it up in the *Callbook*.

Once again, the mailing deadline for your phone entries is December 1, 1965 and January 15, 1966 for the c.w. logs. Please indicate on the envelope if the enclosure is a phone or c.w. entry.

Mailing address is: *CQ* WW DX Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

Editor's Notes

How am I going to tell you about our recent visit to Venezuela in the small space allotted to me in this column? Impossible.

It was one continuous series of exciting events for Anne and me from the minute we left the VIASA jet liner at Maiquetia airport to a week later when we left Caracas for home.

We were met at the airport by a large delegation of Club members headed by its president Dr. Rafael Moros, YV5AVW, and an added surprise, Ricardo Sierra, Jr. CX2CO.

The next day we were given an extensive tour of the city, followed by a delightful barbecue lunch at the mile high Club Tachira.

From there it was a dash to the La Rinconada racetrack, arriving just in time to present the Radio Club Venezolano Cup to the winner of the feature race. (A tip, don't bet on horses with American names. Hi.)

[*Continued on page 100*]

Propagation

BY GEORGE JACOBS,* W3ASK

THE c.w. section of the 1965 *CQ* World Wide DX Contest will be held over the weekend of November 27-28. Special DX Propagation Charts for use during the contest period appeared in last month's column. Be sure to check these Charts for a prediction of band openings and other propagation data which should be useful during the c.w. section of the contest. For a day-to-day forecast of general propagation conditions expected during November, including the contest dates, see the "Last Minute Forecast" appearing at the beginning of this column.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use in the continental United States for distances between approximately 50 and 2300 miles. Special prediction charts centered on Hawaii and Alaska are also included. The following are two typical examples, showing how to use the Short-Skip Propagation Chart:

1. What is the best *time* to work between New York City and Denver on 15 meters?

A. Measure the great circle distance between both points on a map or globe. In this case, the distance is approximately 1600 miles.

B. Enter the Short-Skip Propagation Chart for 15 meters, and look under the column headed "1300-2300 miles". The highest quality rating (in this case, 3-4) is found between 11-14 local standard time at the path mid-point.

C. New York City is in the Eastern Time Zone, Denver is in the Mountain Time Zone. The mid-point of the path falls in the Central Time Zone. The optimum time found in "B" is, therefore, 11-14 CST. This corresponds to 12 Noon-3 P.M. EST in New York City, or 10 A.M.-1 P.M. MST in Denver.

2. What is the best *band* for working between Seattle and Los Angeles at 3 p.m. Seattle time.

A. Measure the great circle distance between both points on a map or globe. The distance is found to be approximately 1,100 miles.

B. Enter the Chart under the column headed "750-1300 miles." Since the distance between Seattle and Los Angeles is closer to the upper limit, check the second of the two quality figures appearing in the parenthesis for each band. Since both Seattle and Los Angeles are in the same standard time zone, the time at the path mid-point is also 1500 PST, and no further correction is necessary.

C. A quality figure of (1) is found for 10 meters; (1) for 15 meters; (4) for 20 meters; (2) for 40 meters; and (0) for 80 and 160 meters. Twenty meters is, therefore, the best band between Seattle and Los Angeles at 3 P.M. PST.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for November

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **4, 6, 23, 30**	A	A-B	B-C	C
Normal: **1, 3, 5, 7-10, 15-16, 18-19, 22, 24, 26-28**	A-B	B-C	C-D	D-E
Below Normal: **2, 11, 14, 17, 20-21, 25-29**	C	C-D	D	E
Disturbed: **12-13**	D	D-E	E	E

How To Use These Charts

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

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

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

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

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

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

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

6—These Propagation Charts are valid through Dec. 31, 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.

Sunspot Cycle

The new sunspot cycle, which appears to have begun during October of last year, continues to rise at a slow pace. The Zurich Solar Observa-

[*Continued on page 111*]

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

THE *BIG STORY* for the month is that Cliff Corne, Jr., K9EAB did qualify for #1 USA-3079-CA for *ALL* counties and special Honors Plaque. It would be impossible to list all of the awards, certificates and honors bestowed upon Cliff because it would require one complete issue of *CQ*, and it is almost impossible to keep up with him. Cliff got seriously started on USA-CA back in 1961 and received USA-CA-500 award #1-R in September 1961, and acquired USA-CA-1000 #6 in April 1962 and from then on he was #1 in everything. He received USA-CA-1500 #1 in June 1963, USA-CA-2000 #1 in December 1963, USA-CA-2500 #1 in March 1964, USA-CA-3000 award #1 in December 1964 and #1 USA-3079-CA (*ALL* counties) in August 1965. What a glorious record, what an achievement, and what tremendous obstacles he had to overcome. Back in 1949, Cliff contracted polio and was in the hospital until 1952 and he has remained in an iron lung ever since, as he is totaly paralyzed from the neck down. With the wonderful help of his Mom and Dad, Cliff has enjoyed many hobbies including electric trains, model cars and planes, collecting stamps, pistols, shotguns, rifles, tropical fish and birds. Then his cousin, K9CDC, got him interested in radio and his Dad constructed a wooden bridge over his body and mounted a key on it and the heretofore useless wiggle in his right thumb was just enough to operate the key and at last he was really able to do something for himself. In 1955 he passed the Novice exam and three months later passed the Conditional exam. From then on he has enjoyed all the rewards of amateur radio and he is sure that amateur radio is the ultimate in hobbies with its unlimited outlets. Cliff has enjoyed chasing DX, traffic handling, QSO parties, contests of all kinds, and of course award collecting. He insists that amateur radio is the therapy to keep him going, and he in turn is the kind to make us all proud of amateur radio, yes I am very happy I can call Cliff my friend and fellow amateur. So again *CONGRATULATIONS* Cliff and a great BIG vote of thanks to MOM and DAD (WA9DCQ).

As this column is being prepared, many readers, friends and county hunters are enjoying vacations, but the mail and applications have continued to roll in. Joe, W2JWK received USA-CA-1500 award endorsed All 7 mc, All s.s.b. Bill, K4ISE received USA-CA-1500 award mixed, as well as All 7 mc, All s.s.b. endorsements for his USA-CA-1000 award. Deloris, KØRRO earned USA-CA-500 award All s.s.b. All Phone USA-CA-500 awards went to Walter, W4DPN and Phil, W5LDH/W5LXX, as well as to Richard W5-10353 which was #9 to s.w.l.s and the first from the 5th district. USA-CA-500 awards endorsed mixed went to Ed, W3BWU, Helen, WA5DUL, Lee, WB6IUH and Bill, KØEQF/W5OXM.

New Honor List

The NEW HONOR LIST seems to get the approval of everyone but I still feel the response for *claimed confirmed* counties could be greater. I did get claimed lists from many who did not make the top twenty-five list.

Special Achievements

Although not shown in any honor lists, there are several outstanding accomplishments that I would like to mention. "JC", LU1DAB has

*103 Whittman St., Rochelle Park, New Jersey, 07662.

USA-CA HONOR ROLL

ALL 3079
K9EAB 1

3000
WØMCX 2
K8CIR 3

1500
W2JWK 38
K4ISE 39

500
WA5DUL 514
KØEQF/W50XM 515
KØRRO 516
W3BWU 517
WB6IUH 518
W5-10353 519
W4DPN 520
W5LDH/W5LXX 521

SPECIAL USA-CA HONOR ROLL TOP TWENTY-FIVE COUNTY HUNTERS

3079	K5SGJ	W8UPH
K9EAB	K5SGK	K8VSL
3040	WØJWD	K8YGU
WØMCX	VE3-9301	WØVFE
3020	K8IWI	W9CMC
K8CIR	K8KOM	W5NXF
2800	**2050**	**1905**
WA9AJF	K3LXN	W2JWK
2515	**2000**	**1877**
WØKZZ	K9UTI	W9HAS/6
2500	W5EHY	**1780**
K4VOF	WA8EZW	K8BAI

WØMCX, Arthur Jablonsky, holder of #2 USA-CA-3000 Award; #3 USA-CA-2500; #5 USA-CA-2000; #8 USA-CA-1500; #11 USA CA-1000 and #1-C USA-CA-500.

Guernsey County Award

Granite State Award

NARC Award

the only USA-CA-500 award endorsed All 28 mc A-3 and Karl, SM7ID has the only one endorsed All 21 mc A-1. Fred, VE3-9301 has the only USA-CA-1500, 2000, and 2500 awards issued to an s.w.l. Helen, W1HOY has USA-CA-500 award #88 endorsed All 50 mc A-3 and "Smitty", WA2SAZ has USA-CA-500 award #286 endorsed All 50 mc A-3 and he now claims to have 1004 counties confirmed All 50 mc A-3. Willie, W8GDQ has the only USA-CA-500 award issued for All 160 meters. Charles, K8ZNI has the only USA-CA-500 award endorsed All Novice (A-1).

Letters

Space was at a premium last month, so many letters were left out, perhaps I can make up for it this month.

Bill, WA4GAY, writes: "I am located in Wheeler county which has a ham population of 2. I will be happy to sked anyone on 80 or 40. Certainly enjoy reading your column and appreciate the swell job you are doing. Received my certificate and may I say it is really a beautiful award." For schedules, write and send s.a.s.e. to William L. Strickland, WA4GAY, P. O. Box 381, Alamo, Georgia 30411.

Monique & Jean, FG7XL, write: "For so long we wanted to thank you very much for the USA-CA Award which we received several months ago. We are very pleased to get it, it is beautiful and we are proud of it. It was a long hard struggle, but if more Ws would answer our QSLs/IRCs the job would have taken less time and we would now have USA-CA-1000, as we have had about 4,500 QSOs with the states. Not bad? Thanks again and we hope to meet you on the air soon."

K8CIR, Oscar "Otts" Beyer, Jr., holder of USA-CA-3000 Award #3; #2 USA-CA-2500; #2 USA-CA-2000; #5 USA-CA-1500; #19 USA-CA-1000 and #169 USA-CA-500.

Art, WØMCX, writes: "Sorry for my long delay in thanking you for the new USA-CA-3000 Award #2. I can see you are putting a lot of time on the USA-CA program and I know what a job it is just getting the seals and ribbons straight besides keeping all the records straight and answering all the mail. Many thanks for the excellent job you did on my new certificate. . . .

'My *CQ* file dates from Vol. #1, copy #1 (Jan. 1945) to date and with every new issue the first page I look at is, of course, the USA-CA column, next the Editorial." Art and May (XYL) WØMRJ had a most wonderful mobile trip and thus worked many new ones, gave out many new ones and had some extremely wonderful visits with many other county hunters, and as Art said—"Biggest trouble, we just didn't have time to stay and visit as long as we would have liked." Hope the foto he sent turns out ok.

Carl, WØVFE, writes: "Again I want to thank you ever so much for the outstanding job you are doing with the USA-CA program in *CQ*. Sure is such a pleasure to receive the issue every month and read the column. Look forward to it every month.

As for the County Hunder's Honor Roll: I thing it is really a fine thing and believe it will do much for the gang. Just wish we could get a picture once in a while of the top county hunters. This I mentioned to K8CIR and he said something about forwarding the picture album to you for you to use the pictures as you saw fit. He probably thought this over and realized the album would be out of circulation for quite a spell so has other plans. Again thanks ever so much Ed, for the wonderful job and the HONOR ROLL will do much I am sure."

JOE, W2WZB, writes: "Been reading your column in *CQ* the past few months and find it FB. I've been a ham over 25 years and to be frank the last 10 years have been inactive except to get the rig on the air at license renewal time. Again it is time to renew the license but find the USA-CA-500 gives me something to work for. Will probably stay active, this time."

BOB, K1NWE, writes: "Many thanks for the letter informing me of my qualifying for the USA-CA-500. I have looked forward to this

Quetzal Certificate (Guatemala).

The Edison Radio Club Certificate

TTG Certificate (Guatemala).

award for a long time, and have enjoyed participating in the program. The spirit of fairplay and cooperation by the hams in the program, as well as those who just want to help others is certainly gratifying.

Congratulations on the fine way you are administrating the USA-CA program, also enjoy your monthly column in *CQ*."

Gil, W1ZCH, was so kind to offer 5 (Yes FIVE) copies of the 1964 issue of POD #26 as his office requires new ones each year, and he offered to send them to the overseas county hunters in need of them. I've been passing along such addresses to him. I do get such kind offers from time to time, so I am happy to hear about such needs.

Awards

Due to running out of space, some awards were left out last month and some rules got in but not the foto of the award. Everything possible is being tried this month to get caught up. Some of the awards shown in this column were described last month.

SCARA AWARD, issued by the Southern Counties Amateur Radio Association Inc of Southern New Jersey. It is available to amateurs and s.w.l.s, free of charge, for confirmed contacts (or heard for s.w.l.s.) with five (5) members. All bands, all modes, no date limitations, GCR List accepted. Membership list too large to print, so look for stations in Atlantic City, Pleasantville, Northfield, Absecon, Ventnor, Margate City, Egg Harbor, Mays Landing and Somers Point, New Jersey. Custodian: S. J. Knox, WB2MRA, 212 No. Jerome Avenue, Margate City, N.J. 08402. The Club station is K2BR.

The Nittany Amateur Radio Club, Inc. (K3HKK), P. O. Box 60, State College, Pennsylvania 16801 is happy to offer the three awards listed below. These general rules apply:

1. An applicant must have the QSL cards in his possession and may have two licensed amateurs or an official of a national level or affiliated radio club certify to having seen these QSL cards (General Certification Rule). Certification by a Notary or other government official legally entitled to notarize will be acceptable in lieu of the above.

2. AOMB/M (All One Band or All One Mode/or Mixed Modes and Bands) endorsements will be issued as per the specific rules and the 25% rule applies. This means that 25% additional cards will be addition to those cards used for AOMB required in endorsements to obtain Mixed endorsements.

3. All rules of the USA-CA program apply.

4. Send the listings of the stations worked (listed per specific rules) and $1.00 or 10 IRCs for each certificate. All endorsements at the time of initial issuance at no extra cost.

Pennsylvania Counties Award: Issued for working any amateur located in the 67 Pennsylvania counties as follows:

Class AA	67 Pennsylvania Counties (available to DX stations including KL and KH but excluding VE stations)
Class A	67/60 Pennsylvania Counties (Last figure for DX and first figure for VE and US stations)
Class B	60/57 Pennsylvania Counties
Class C	45/40 Pennsylvania Counties
Class D	30/25 Pennsylvania Counties

Include alphabetical listing of counties and stations with application. Initial cost as stated, $1.00, but be sure to include 10¢ or 1 IRC for each higher class endorsement seals or later AOMB/M endorsements, and send to Awards Manager at address listed above. Any contacts made after January 1, 1930 will be acceptable regardless of call or address changes.

73 Sections Award: Issued for working any amateur in the 73 ARRL Sections as follows:

Class A	Work all 73 ARRL Sections.
Class B	Work 65 ARRL Sections.
Class C	Work 50 ARRL Sections.

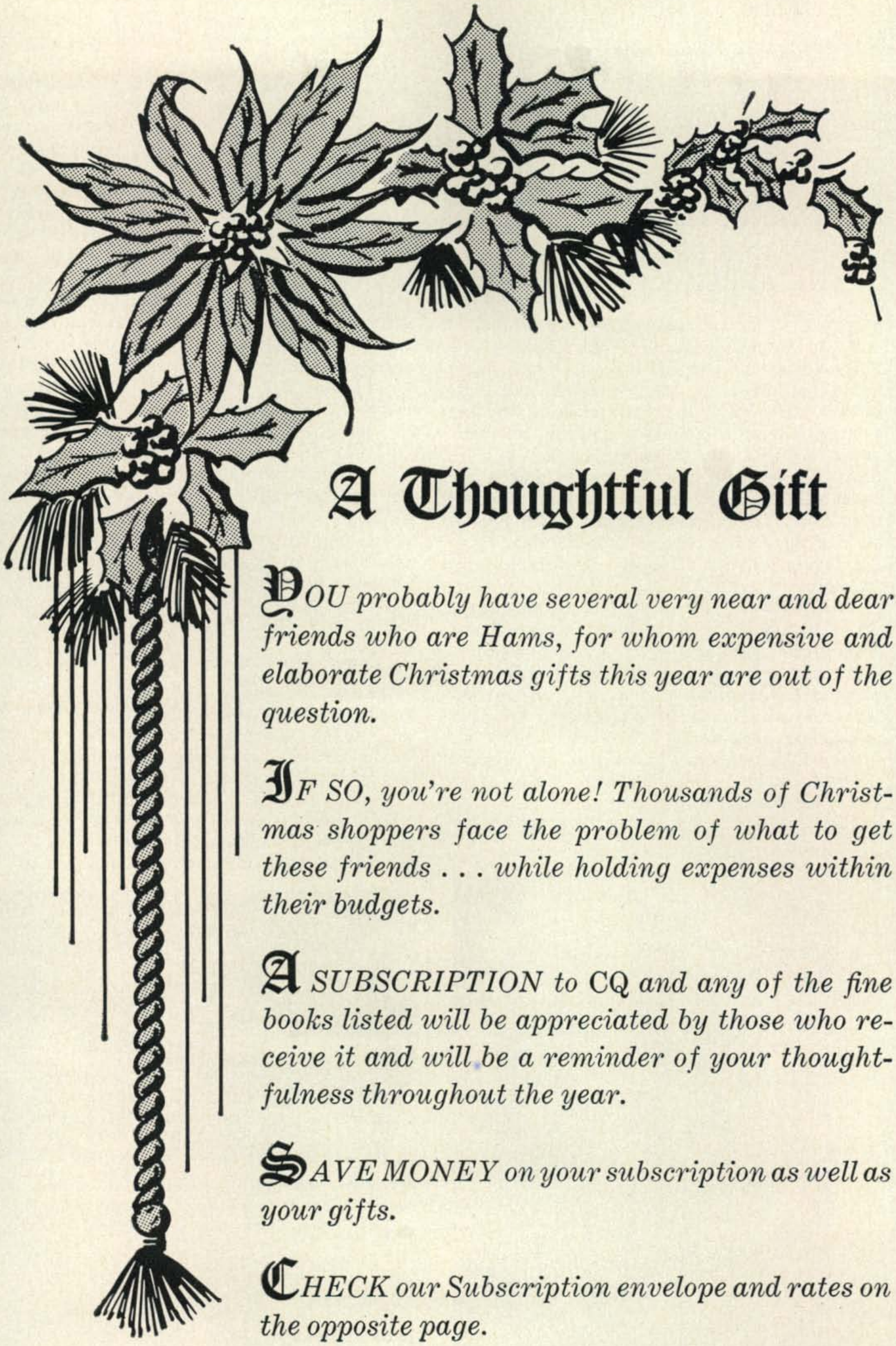
The 73 ARRL Sections are those outlined on page 6 of any issue of QST and they should be listed in that order. VEØ counts as Maritime and VE8, Yukon-Northwest Territory, may count as any one of the required 73 Sections. Initial cost as stated, $1.00, send 10¢ or 1 IRC for higher class endorsement seals. AOMB/M endorsements *only* at the time of issuance of that class of award; AOMB/M endorsements at no extra cost. A separate number will be issued for each class imprinted on the endorsement seals pertaining to that lettered class of award. A copy of the Sections division in the seven states where more than one ARRL Section exists may be obtained by sending a s.a.s.e. or 1 IRC to the Awards Manager.

[*Continued on page 105*]

Pennsylvania Counties Award

SCARA Award

73 Sections Award



A Thoughtful Gift

YOU probably have several very near and dear friends who are Hams, for whom expensive and elaborate Christmas gifts this year are out of the question.

IF SO, you're not alone! Thousands of Christmas shoppers face the problem of what to get these friends . . . while holding expenses within their budgets.

A SUBSCRIPTION to CQ *and any of the fine books listed will be appreciated by those who receive it and will be a reminder of your thoughtfulness throughout the year.*

SAVE MONEY on your subscription as well as your gifts.

CHECK our Subscription envelope and rates on the opposite page.

THE VHF COLUMN

BY BOB BROWN, K2ZSQ
AND ALLEN KATZ, K2UYH*

THE appearance of 432 mc transistorized preamplifiers on the v.h.f. scene a few years back changed the scope of ¾ meter hamming immensely. But the notion that these devices perform in the same class as vacuum tube amplifiers continues to persist in many circles. To illustrate, a few years ago W2VCG's transistor pre-amp for ¾ meters graced the pages of *CQ*, claiming a noise figure of better than 5 db. Today, however, the semiconductor state of the art has changed considerably. Many are saying that the transistor is outperforming the paramp!

The front-end shown in fig. 1 can turn a properly-measured 2.8 db or better noise figure, without exaggeration. More accurate measurements (lower than this) were not possible with existing test equipment, but it is safe to say that 2.8 can almost be guaranteed. W6AJF's parametric presentation recently claimed noise figure of 3 db. From a practical point of view, this transistor pre-amp is one heck of a lot easier to fire up than a paramp.

All, of course, is not roses; transistors do have their problems. Firstly, they are not immune to overload or cross-modulation, although in most areas this shouldn't be of primary concern.

Additionally, they are also quite sensitive to large overdoses of r.f. This *can* be a real problem.

Most coaxial relays, besides being lossy on 432 mc are also leaky. And the transistors aren't by any means cheap—at least those that will provide you with a 2.8 db noise level. So it pays to have a friend who can help you in this dept. Most of the transistors we have seen are unmarked. (It should be mentioned that the RCA 2N2857 or Texas Instruments 2N2998 will also do a nice job in the circuit shown.)

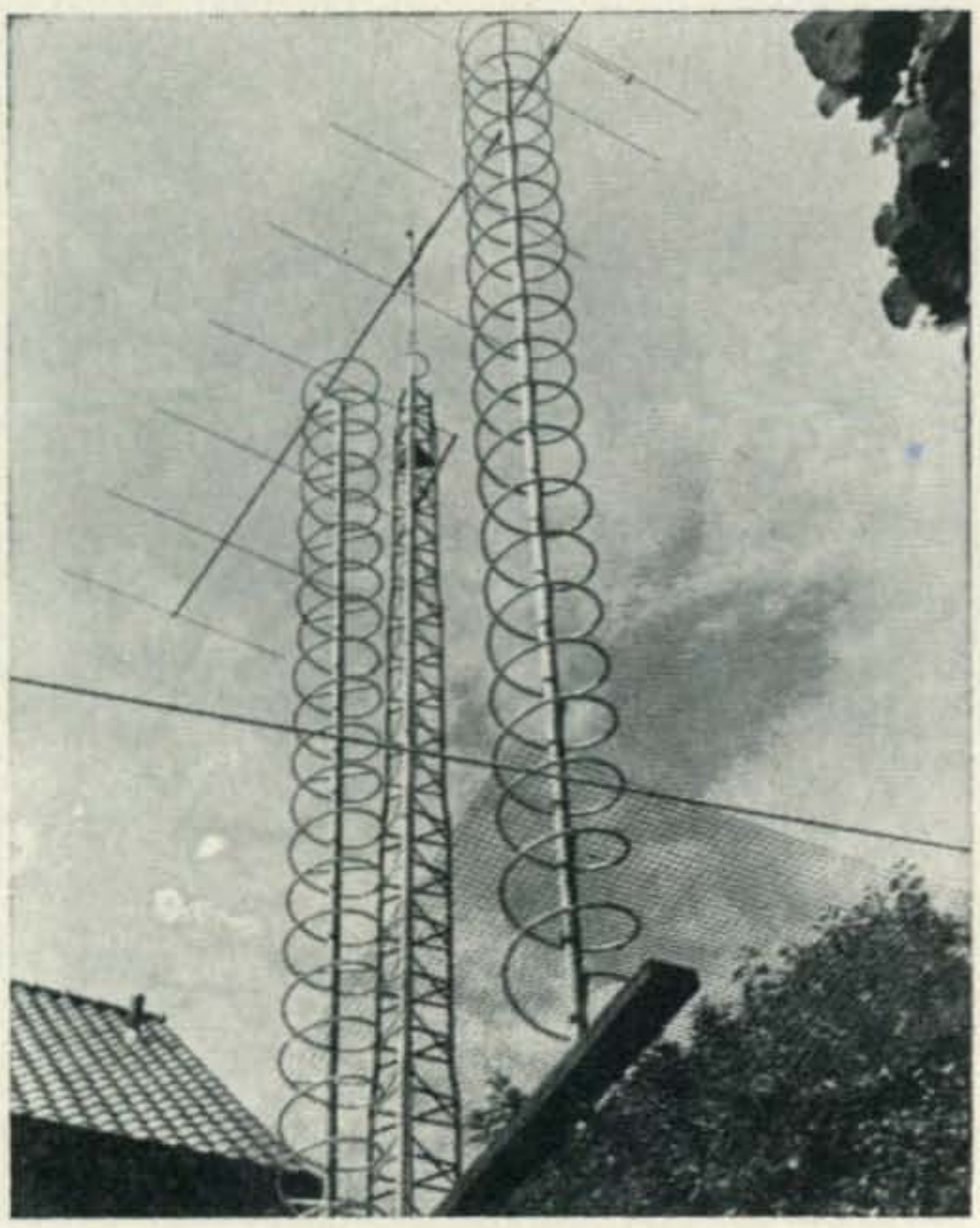
The preamplifier construction is straight-forward and shouldn't present a great deal of problems to the builder. Fig. 1 shows the schematic, and the photograph reveals how WA2FSQ built his (Fred does do a nice job). The transistor is mounted on a protruding screw sticking up from the chassis by soldering a lead from the semiconductor (the one connected to its case) to it. All the tuned circuits are resonant at 432 mc and the taps adjusted for minimum noise figure. WA2FSQ suggests that if your present converter has a poor noise figure (5.5 db or worse), you should build two stages and run them in cascade. The individual amps only provide about 12 db gain. Credit for the circuit goes both to Fred and his OM, WA2DIE.

Commentary: Transceivers, VHF & CB

We can't restrain ourselves any longer. After waiting five years for someone to pick up the ball and get going, it's apparent that the commercial manufacturers of v.h.f. ham gear could care less. So here goes . . .

Although the CB companies have recently merged and consolidated, at one time there were over 300 separate manufacturers making 27 mc transceivers—at an average retail price of

*c/o Allen Katz, K2UYH, 48 Cumberland Avenue, Verona, New Jersey, 07462.



A portable KW? Well at least at contest time. Meet Paul, WA9FAF, who helped man the K9DZK/9 operation a few months back. "Six meters, natch."

This corkscrew belongs to WA2FSQ & OM WA2DIE: a 22 turn helical antenna for 432 mc moonbounce. They're just as handy with antennas as they are with preamps.

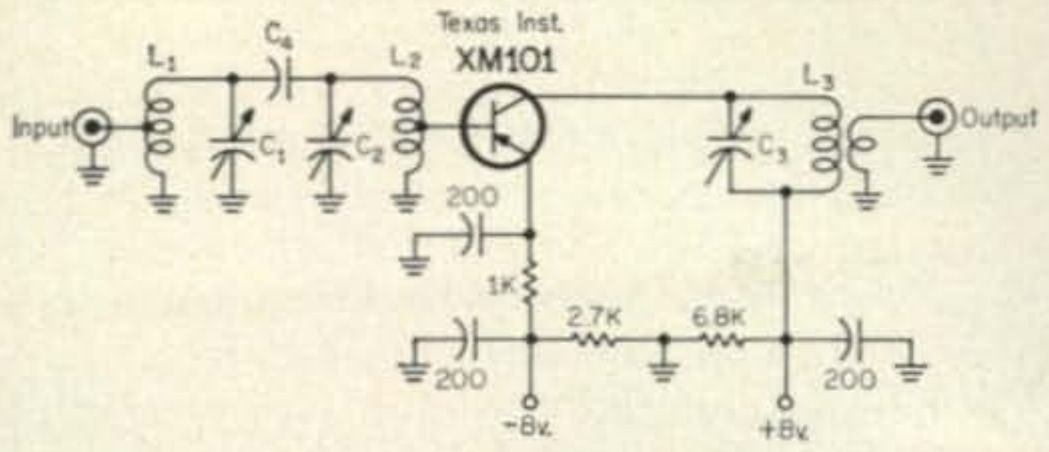
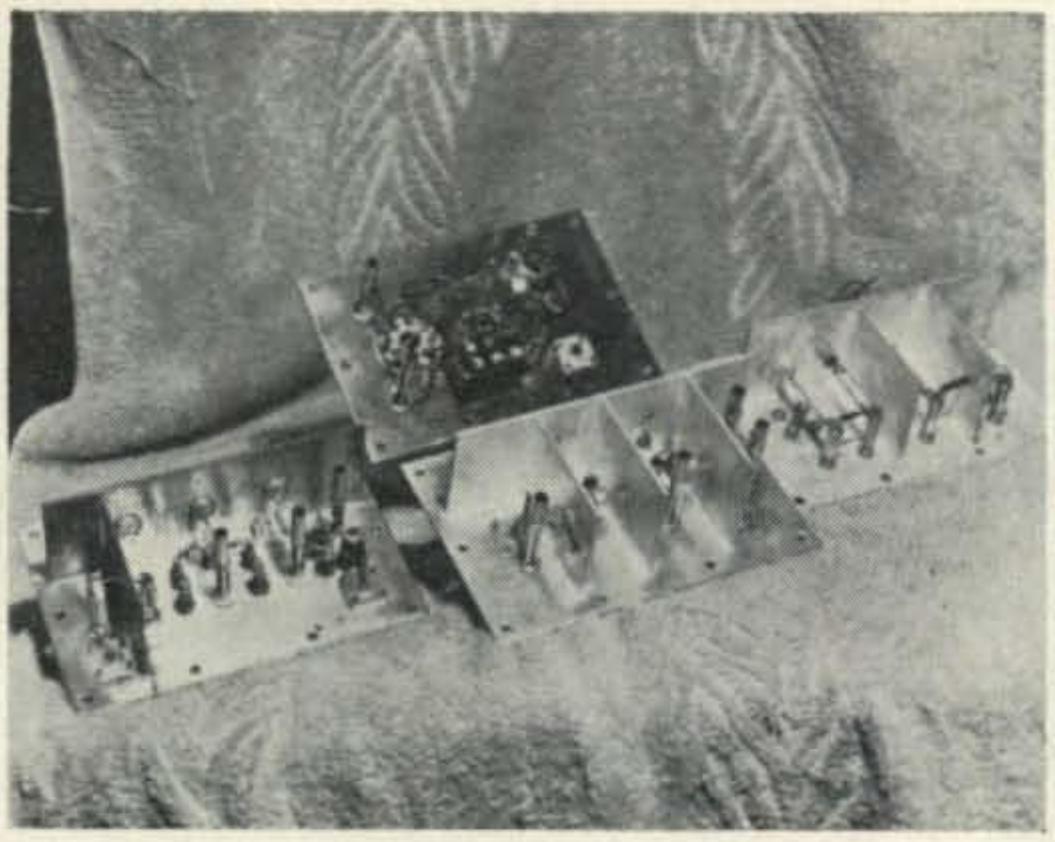


Fig. 1—Schematic diagram of the WA2FSQ/WA2DIE transistorized 432 mc preamplifier. (An RCA 2N2857 or Texas Instruments 2N2998 will also do the job). Measured noise figure: 2.8 db. See text.

$C_{1, 2, 3}$—1-20 mmf JFD piston capacitors.
C_4—Gimmick, 2 insulated wires coming together for ¾".
$L_{1, 2, 3}$—1½ × ¼" copper strap, mounted across piston capacitor, tapped approximately ¼" from cold end.



Here's how WA2FSQ & WA2DIE employed the 432 mc preamp shown in fig. 1. With this chain set-up, exceptionally good ¾ meter moonbounce reception has resulted.

$100.00. Try to get a good six meter version for that price.

Item two: With the ever-increasing complaints of "what has happened to six meter c.w.?," why doesn't someone sell a piece of gear that is so equipped? How many commercially-made six meter (or even two meter, for that matter) transceivers even come with a b.f.o.? To our knowledge, *none*.

How many rigs are sold with a built-in c.w. monitor? Again the answer is clearly "none."

It is common knowledge that few companies make equipment specifically for ham v.h.f. purposes. Generally we have found it to have been restyled with a few modifications (darned few) from government military specifications. Or, in the transceiver area, from CB. The intent is to capitalize on the "enormous" ham market with a product that is something less than adequate.

Okay. We have nothing against someone legitimately desiring to make money out of ham radio. All we ask is that there be an honest attempt at designing v.h.f. products to match the audience they're shooting for.

Hams are nobody's fool; they won't buy unless they are confident that they are obtaining the very best value in exchange for dollars spent. The sad truth, however, is that the equipment is in most cases so badly conceived that the v.h.f. enthusiast must resort to surplus receivers, separate converters, second-hand transmitters and an ARC-5 v.f.o.

The manufacturers cry that they don't move enough merchandise in the v.h.f. field to make it worth their while. What they overlook is the fact that most of them don't have a product worth buying.

Taking a rough estimate, we'd wager that there is a good $4 million to be made in the ham v.h.f. transceiver area annually. Unfortunately for the companies, that four million is now being spent elsewhere, since few sales managers bother to examine the powerful economic potential that exists in v.h.f. ham radio.

If our mail is any yardstick, here is what most readers find sorely lacking on today's marketplace *that they would be willing to buy* were it available:

1. Six meter transceivers in the $200-and-down area with the following features: 50 to 51 mc *only* range, key jack for c.w., c.w. monitor built-in, b.f.o., headset jack, built-in mobile d.c./a.c. power supply, built-in v.f.o., and finally —better audio.

Surprises: Most of our readers are not overly concerned about power input; they would be willing to sacrifice a few watts for the above features. Many even ask for 1-watt rigs. Secondly, transistorized power supplies could be passed up in lieu of vibrators. Lastly, chrome styling could be abandoned for more functional design.

2. Two meter transceivers in the $250-and-down price range with the same features as above, only retaining full band coverage (144 to 148 mc).

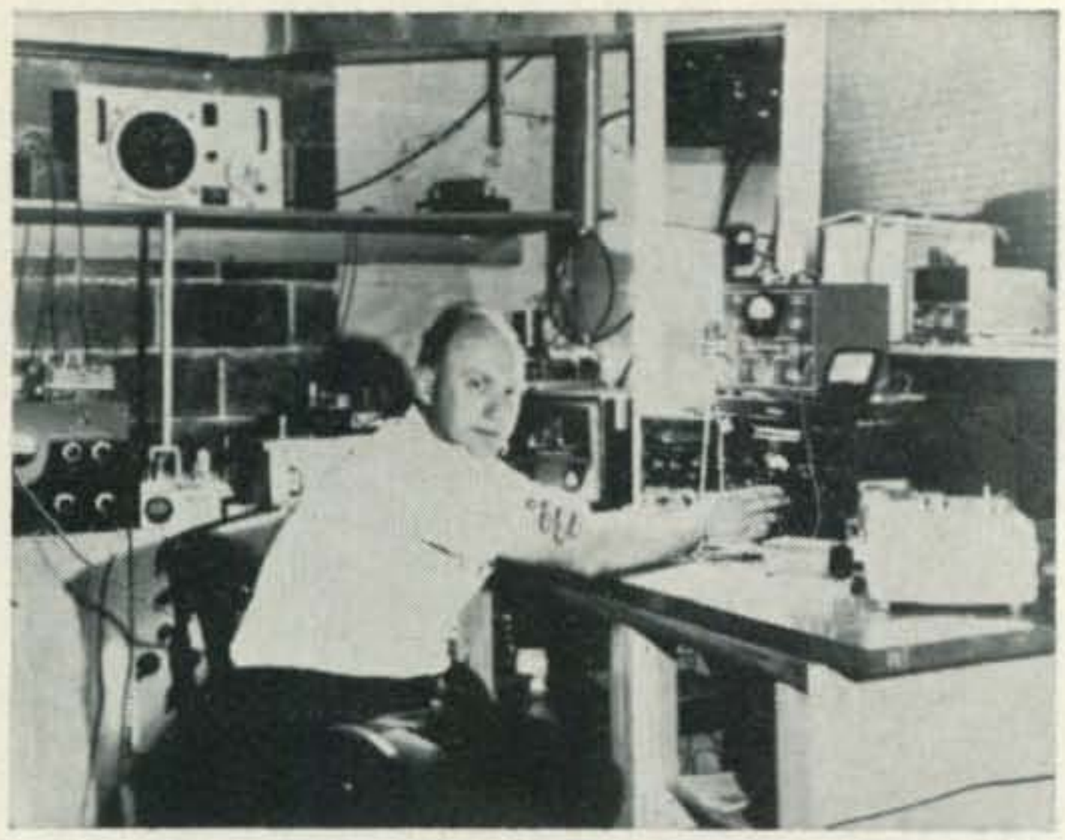
3. "High-powered" v.h.f. transceivers in the $900-and-down area with the following: built-in 6 and 2 meter receiver with good selectivity, solid-state front end, b.f.o., built-in 6 and 2 meter transmitter offering 100 watts or more at 50 mc with c.w. monitor, built-in v.f.o. that doesn't track with the receiver, and a switching configuration that would allow duplex (50 mc transmitting, and 144 mc receiving at the same time).

Surprises: S.s.b. not a major concern of most readers looking for a "big" transceiver. Mobile supply not really necessary, unless optional. Transistorization not imperative unless it would lower manufacturing costs. Overall cry for more ruggedization for portable and contest purposes.

4. A test package in the $45-and-down category including a built-in in-line s.w.r. bridge and reflected power meter, a power output read-out device showing actual wattage from final stage, and any suitable form of modulation monitor.

5. A panoramic adapter with ±100 kc coverage that could work in conjunction with existing equipment. Present problem: i.f. frequencies of 5 to 10 mc prevent use of most available 455 kc panadapters. Price $135-and-down.

6. A 220 *and* 432 mc u.h.f. transceiver. Suggestions are vague here, but the consensus of opinion is that *someone* ought to have something substantial available above 144 mc. Ideally, of



In case you're wondering who mans that impressive moonbounce array that appeared last month on p. 78, meet W3SDZ. By now, 1296 operation should be complete.

course, the unit would have most of the features incorporated into our $900-and-down six and two unit described above.

These ideas represent only what we have observed in our reader mail. Heaven knows what design engineers and market research men could learn if they ever bothered to conduct a survey of v.h.f. operators in this country.

The CB industry accounts for its booming success thusly: variety of merchandise due to competition, *increased demands* by the CB'er for more sophisticated equipment, and just plain good product orientation. (Another interesting observation: CB transceivers are now taking a turn for the inexpensive, with each major manufacturer offering a transceiver in the $99-and-down price range in addition to their more complex sets. Many anticipate complete units selling in the $39 to $69 range for 1966! Bear in mind that they *all* run the legal 5 watts input and generally offer the same receiver/transmitter frequency range coverage.

To the moaning v.h.f. manufacturers, we would suggest they give some serious thought to the CB situation before they jump into the manufacture of more useless ham gear. With incentive licensing lying just around the corner, the v.h.f. marketplace may well wind up far more profitable for the ambitious company than the present tri-band s.s.b. transceiver business—*provided* the equipment is a great deal better than what is being offered us today.

From The Mailbag

Rick Cruickshank, WA4LTS, with a new award idea: "Some column you both have! I really enjoy it and all I can say is, keep up the good work.

"Just had to comment on your July 'tit-tat' on v.h.f. contests! These things might be true in your area, but WA2SAZ seems to do okay during the summer contests." *So who said anything about Smitty?* "Which reminds me, I've been talking quite regularly with Smitty up there in Forest Hills (L.I.) and I told him I'm out for his neck on this next one! . . . "By the way, I run 1 k.w. here with a pair of 4CX300A's in the final. Antenna on six meters is 11 element Spiralray up 81 feet. Shortly we'll have a pair of 4X250B's on 144 mc. Antenna there is 20 elements up 103 feet. Receiver is a modified SX-43 with pair of 6AK5's precluded by 6CW4 on 6 meters and W2AZL 417A's on two precluded by a homebrew 416B preamp. 432 is in the mill.

'I think there should be some recognition for outstanding performance on v.h.f. each year. I have in mind one boy in Greenville, S.C., who has to date 38 states confirmed since March of this year. Not bad—he's only running a Clegg 99'er. Larry Pace is the lad, WA4ZLQ, and he is a real go-getter! Thinking now about a pair of 4-400's on six. How's that for enthusiasm on the bands?"

Rather like your idea of annual v.h.f. awards, Rich. Perhaps they could be worked up into different categories: Special Recognition—Operating, Special Recognition—Building, etc.

How about hearing from the readership on this one? If we get encouraging response, we'll design a handsome certificate and try to get the program underway immediately to include the year 1965.

If you are behind WA4LTS, drop a QSL in the mail with "Annual Recognition Award" written on the back and address it simply to: K2ZSQ, CQ, 14 Vanderventer Ave., Port Washington, L.I., N.Y. The sooner we hear from you, the sooner we can get the program underway. (If you like, include categorical suggestions on your QSL).

Ronnie Alberson, WA4MWC, Pelzer, S.C.: "I'd like to say that I enjoy your v.h.f. column very much and feel it is the best in the field.

"Here around Greenville we have been trying for years to increase the activity on 2 meters and have succeeded in getting a few stations on the air. If anyone else in our area is interested, have them contact me or WA4SRJ and we'll be glad to help wherever possible. Ideally we'd like to start a traffic net.

'My station on two at the present time consists of the Heath HR-10 receiver and converter, plus three transmitters. One's a Tecraft running 20 watts, and the others are homebrew running 30 and 5 watts. Antenna system is an 8-element yagi, 16 element collinear, and ground plane up 30 feet."

Thanks for the letter, Ron, and for S.C. prospectives, you can reach him by writing: WA4-MWC, Route 2, Pelzer.

FLASH: The Stanford Research Institute Radio Club, WA6LET, worked K2MWA, W9HGE, W3SDZ, W2CCY and G3LTF on 432 mc moonbounce the evening of September 25th, using the Stanford University 150' parabolic reflector—about 48 db (compared with Arecibo's 60 db)—and a 600-watt output transmitter on c.w. and s.s.b. W2CCY (Morristown, N.J.) reported WA6LET's signals as between 20 and 25 db below those of KP4BPZ.

(*Continued on Page 111*)

HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV

HAM CLINIC's correspondence is not all devoted to the technical, for example we often receive letters like this one: "Tell me, why do *some* hams continually berate the FCC as a 'do nothing agency' and call it everything under the sun but efficient? It seems to me that they are badly informed or just do not know how the FCC operates. I can well imagine the kinds of letters received by the FCC if the conversations I hear on the air from *some* hams are similar.

"Don't you think that the image of the amateur radio enthusiast (in the eyes of everyone including the FCC) should be improved rather than run down by a minority of hams who feel maligned and treated unfairly?

"What are your thoughts on the subject, and what should one put in a letter to the FCC relative to pending dockets etc.?"

Well, let's face it, the people who comprise the FCC *are* human, do try their best and have, over the years done a remarkable job with low funding and personnel shortages.

Yes, there are some hams who berate the FCC and they do very little good I can tell you.

If those who write irate letters to the FCC or rate it as a failure on their "report cards"—especially when they would like the FCC to carefully consider *their* side of *any* argument—think they are doing amateur radio a favor they are of course badly mistaken.

What would you think if you were an FCC official who received a nasty letter full of venom from someone? Would you, (because he *is* nasty) feel that he is right and should receive careful and unbiased consideration? I don't think you would!

In the U.S. today we do have *some* blow-hard hams who if given the ball or offered responsibility would drop both like a hot potato. These people make a lot of noise but when called upon to "put up or shut up" they continue to bleat on.

It is true that some of the decisions made by the FCC have been unpopular among some hams and some CB'ers, but so are many of the decisions made by members of the Boards of many U.S. Corporations . . . and our own Congress.

The FCC is not in a popularity contest, and one can honestly say that it is trying to do the very best it can with what it has. Certainly, they are under political pressure—and so is every other governmental agency.

You show me another agency like the FCC in any other country of the world who calls upon interested parties for their comment prior to putting new regulations into effect! Show me another country (any country) that has as many radio stations in operation as does the United States, and show me an agency that has as much to worry about as our own FCC. Let's be fair!

On *my* "report card" the FCC rates an A+. Perhaps it can be rated "slow" in getting around to some things but it IS doing *something*. During its existence it has accomplished an awful lot.

The FCC will cater to majority desires *if* these desires (in spite of anything else) are in the public interest. People have found out that they cannot lobby with the FCC, and this is as it should be. Sure there have been some rotten apples in the FCC as there have been in any other organization, but you can bet on the whole, the *people* in the FCC are a dedicated, loyal and considerate group devoted to doing their jobs properly in the interests of public service.

We want the FCC on the radio amateurs' side. Through our actions, letters and other means we want them to see us as a serious, responsible, worthwhile, public service minded and oriented, group. We want them to continue to feel that the majority of U.S. hams are worthy to be called on for communications assistance in peace or in war. We want them to know that we realize it is not humanly possible for them to please everyone.

When you write to the FCC be *brief*, be *factual*. Don't accuse or opinionate and do not try to play the prophet by declaring: "why if you do this now, (why) such and such will happen." Remember that the people you are writing to *do* want suggestions and *constructive* argument, they have little time to consider long-winded rambling complaints not germane to the issues at hand.

Tact and courtesy do pay off with anyone, including the FCC. Remember that the letter you write contributes to the overall image of the radio amateur at large.

Questions

Galaxy III and V Operational Hints—"I am one of a number of hams who have acquired a Galaxy III for my car and a Galaxy V for my shack. The sets are second hand and I do not receive service bulletins from the manufacturer. Both sets work beautifully, but I was wondering if you could supply me (and others) with any late operations or service information that may be useful. Can you?"

Yes. Galaxy is one of the manufacturers who *do* think of their customers and who offer full factory service if it is needed. To registered owners they do send bulletins from time to time as all manufacturers should. You should register with them. My thanks to Owen L. Meyerson, General Manager of Galaxy for the following information which will prove helpful to all Galaxy owners.

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

Bias Adjustment

It is recommended that the Galaxy III and V bias be adjusted by placing the function switch in the CW position, with the mike gain control full counter clockwise (off position) and the side band selector switch in SB-1. The bias should be adjusted midway between 4 and 5 on the meter scale. This adjustment should be checked periodically and readjusted if necessary. This new setting will give better p.a. tube linearity and the audio quality should be much better.

Meter Adjustment

Occasionally the meter movement will appear to stick or hang momentarily. This can normally be corrected by carefully removing the snap-on plastic face of the meter and adjusting the meter bearing mount assembly. This should be done with care and any slight adjustments made should be re-checked for freedom of needle movement. If bearings of the movement are set too tight the needle will hang.

VOX Hang-up

The 6-35 VOX has been modified to include a heat sink on the output transistor to prevent hang-up. Many owners have already received this production change. Galaxy will continue to make this modification when requested for the small handling charge of $1.00.

S-Meter Adjustment

Many inquiries indicates some confusion exists in making proper adjustment of the S meter. Proper adjustment of the S meter should *be* made prior to tune up adjustments of the transceiver. After approximately 10 minutes warm-up time, remove the antenna and place the function switch to PTT *position*. RF gain control must be fully clockwise. Adjustment of R_2 control (inside on left front of chassis, adjacent to the v.f.o. dial light) for a zero reading (left edge of S meter scale) will provide meter accuracy.

Factory Service

Do query the factory before sending your set to Galaxy so that they may schedule your unit for service. As far as I know, Galaxy is the only company currently offering complete alignment and an on-the-air check for $10.00 plus two-way transportation cost. They charge a reasonable $5.00 per hour for major repair work and only net cost of parts used.

SR-150 lower sideband operation—"I have had no trouble with my SR-150 transceiver since buying it over 18 months ago. Now however, when I go to lower sideband on 40 or 80 meters the receiver sounds as if I have just cut in a crystal selectivity filter and the signals sound unnatural. What do I look for?"

I had this trouble with mine too, and found the crystal was bad. Before replacing the crystal I made a small aluminum shield out of a strip of the material and shaped it in the form of a "U". This was placed around the crystal to keep the heat away from it generated by the tube V_6. A friend of mine also had the trouble but his crystal was okeh and he found R_{84} (100K) resistor had changed value; replacement cured this effect. Do check alignment in any case.

Reciprocal Operations—"I am stationed overseas. I approached the U.S. Embassy here and found out that they knew little about PL-88-313. They now know all about it and are negotiating. Tell me how long does all the red tape take to enable one to operate, and what do you suggest?"

Sometimes the time involved is relatively short because the radio amateurs within a country (as represented by a National ham society) get together with their own officials and request that *they* go along with the U.S. On the other hand, it may take months and months. The State Department will not of course ask for reciprocal operating privileges if there are no interested U.S. hams in a country or they do not know there are U.S. hams there interested in reciprocal operations. You must advise the U.S. Embassy concerned. Also, foreign hams within the U.S. should contact their own embassies and request the privilege—notification works both ways. Good luck!

Transmission impedance line matching—"Would you please tell me what the several methods are for impedance matching of transmission lines? What in general governs specific selection of a method?"

Here are the main ones: utilize a tapered transmission line as an impedance matching transformer; use a lumped reactance of proper sign and value in place of a stub-line but electrically equivalent to it; design the load and lines to have equal impedances so that they will be self-matching; try tapped transmission lines beyond a short circuit; employ a coupled section of line in parallel with the main feeder and of proper length to reflect the proper amount of reactance into the main feeder at the correct point so that you will obtain the impedance match desired; an impedance matching transformer use a series section of transmission line of proper length and characteristic impedance; use either an open-circuited or short-circuited stub section of line as a reactance in parallel with the feeder at the correctly chosen point to make the impedance at this specific point equal to its characteristic impedance.

Choosing any one of these methods involves a number of considerations among these being: frequency, currents, potentials, amount of initial mismatch, feeder configuration and whether or not feeders are balanced or unbalanced, bandwith desired, mechanical problems, availability of space, money available etc.

Increasing dipole gain on 144 mcs—"I understand that I can increase the gain of a dipole antenna used on 144 mc simply by placing a reflector behind it. How much gain can I realize in one direction by doing this?"

The gain depends on the spacing of the dipole from the *solid* reflector. Generally, gains of up to about 7 db. can be realized by using a reflector. A parallel line reflector of the same length as the dipole can also be used but the gain will be about half as much as with a solid reflector about ½ wavelength away.

7360 sheet beam tube stability—"I used a 7360

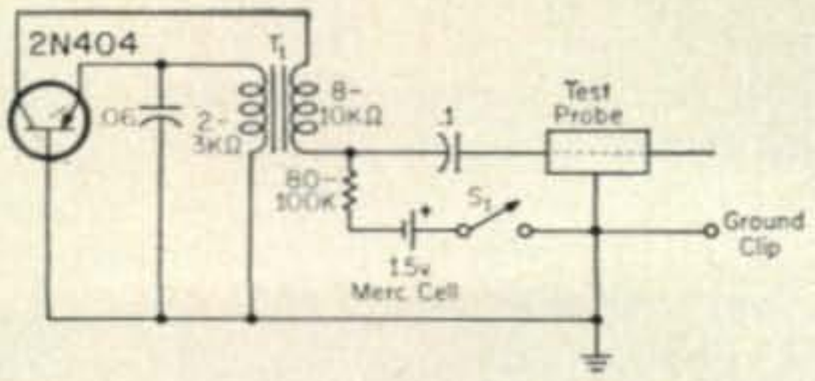


Fig. 1—A tracing oscillator. The whole unit can be built in the probe itself. Observe transformer T_1 winding connections for proper feedback to sustain oscillation. T_1 can be an Argonne No. AR-108 or 109, available from Lafayette Radio.

sheet beam tube as a balanced modulator in a s.s.b. rig I just finished constructing, but I am having problems with stability. Any suggestions?"

Yes. First of all make sure that the tube is operated at the voltage ratings stipulated by the manufacturer. Next, I do not recommend using the tube in a steel cabinet for the tube is influenced by external magnetic fields. Try Mu-shielding, if this does not work I suggest you switch to a solid state ring-type modulator. Perhaps someone else has some better suggestions, if so, send them in and we'll print them.

BC-610 to s.s.b.—"As you can see, I live in Spain where it is not too easy to obtain parts. I acquired an old BC-610 transmitter and want to know what you think about my converting it for s.s.b. operation?"

The old BC-610 was a good workhorse in its day. It has a heavy power supply and can be made to operate on s.s.b. without too much fuss or muss. In fact I know a couple of hams who converted theirs for s.s.b. operation using the SB-10 Heath exciter.

In *QST* for November 1955 an article by W5DWT shows you how to convert this rig for s.s.b. operation.

Generally, the final tubes in the BC-610 lend themselves well for grounded-grid operation and with a good exciter having 100 to 150 watts output you can nearly drive them to the full d.c. input rating.

For information on modifying the BC-610 tank coils for ham band operation see *CQ* for September 1949.

Increasing Bandspread of the SCR-274—"How can I increase the bandspread on the SCR-274 surplus receiver?"

See the article in *CQ* for June 1948. This article tells you how to remove plates from the main tuning capacitor to give you the spread you desire.

Motorola conversion information—"Did *CQ* ever publish an article on converting Motorola surplus police radio equipment? If so, what issue?"

CQ May 1955.

500-1000 Cycle tracing oscillator—"Can you give me a diagram for a simple one transistor oscillator that has a frequency output of between 500 and 1000 cps and which I can use for circuit tracing and troubleshooting of receivers and amplifiers?"

Sure. See fig. 1. This simple little gadget can be built into a miniature aluminum box and used as a probe. Its output will approach 1 volt peak across a load of 25,000 ohms or so.

Nickel-cadmium batteries—"What happens when nickel-cadmium batteries are discharged while connected in series?"

Nothing if the discharge is not allowed to go past a certain point. If discharged in series to a point where one or more cells are reverse polarized then the life of the batteries can be reduced. The recommended charge rate of NC batteries should never be exceeded and they should never be installed backwards. Depending upon temperature, storage time varies. For example at 70° F. a fully charged cell will lose 25% of its full charge in one month, 50% in three months and 85% in five months. At higher temperatures the discharge rate will be higher.

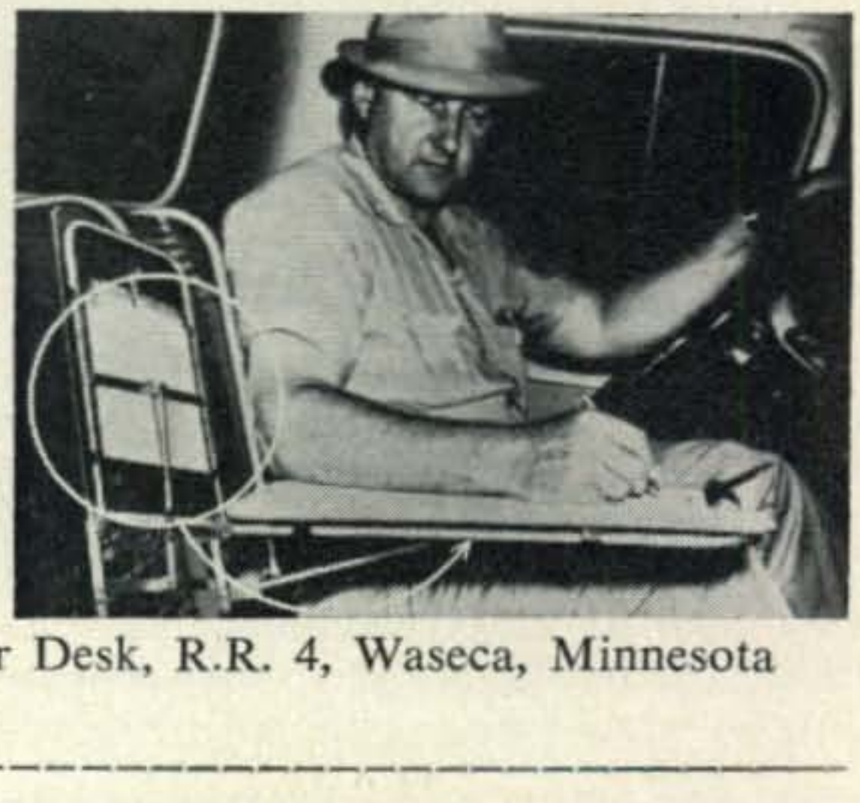
Thirty

We wish to extend our warmest Thanksgiving season greetings to all of our faithful HAM CLINIC readers, and we hope that your table will be full on Thanksgiving day as well as every day that will follow.

Drop us a line. 73 and 75 Chuck & Elfriede

New Amateur Product

Mishek Car Desk



THE new Mishek Car Desk is easily installed in any car, station wagon or truck without tools. The writing surface of plastic measures 12 × 20 inches and comes equipped with a hold down clip. The entire board lifts away from the frame to make a conventional clip board. A storage compartment under the board is ideal for holding log books, paper, pencils and QSL's, etc. The desk folds back when not in use. Regular price is $15.95 plus postage, they say if you mention *CQ* they will cut the price to $12.95 postpaid. For more information write Mishek Car Desk, R.R. 4, Waseca, Minnesota or circle 70 on page 110.

NOVICE

WALTER G. BURDINE,* W8ZCV

WELL I have found out that you're not the only person getting a lot of interesting ideas out of this column. It seems that many more than just the newcomer is reading it and following the trend of the times with the newcomer. I must thank the fifteen or more oldtimers that have taken the time to sit down and write me interesting letters about the QSL card's history. I have heard from both living holders of the call 8UX and W8UX and have been sent more history on the person responsible for the first QSL. He was Don Hoffman and when he left this life he was using the call W8FRY from Youngstown, Ohio. I will show more of the old time QSL some time in our column. I wish I had a good picture of the first QSL. The oldest QSL sent was dated October 24, 1920 and it has been photographed and the original sent back to Carl J. Schuller, W8EJP.

Letters came in from coast to coast and border to border. It was very interesting reading. Thanks to all who wrote and sent cards.

Sad News

It is with a heavy heart that I report the death of Daniel C. McCoy, W8DG, ex W8CBI, of 7546 Normandy Lane, Centerville, Ohio. Dan was 70 years old and died Aug. 30 of a heart attack at home. He made his first radio contact in 1906 and I saw the oldest license issued in 1912 framed and hung over his desk at home. There is nothing to say except that Dan was one of the greatest men that I have ever known and one of the people that is responsible for my being a ham. He has earned a gold plated kilowatt to operate on the other shore by his many kind deeds to all amateur radio. He personally introduced me to many of radio's greats including Paul Godley and John Reinartz. It will take a great man to even look at his shoes to be filled.

Questions and their Answers

The following was omitted last month due to space limitations. It should be a continuation under the **Questions and their Answers** heading.

Replacing a tube involves more than just pulling out the tube from a socket and plugging another one in the empty socket. Literally hundreds of tubes can be plugged into an octal socket. Each circuit in your radio set or transmitter was designed for a *particular* type of tube and will only work right if that socket has a good tube of the right type in the socket. This does not mean that no other tube of similar type and construction will not work in that socket. The pins of the tube must connect to the right base pins as shown in the tube manual. The filament voltages must be the same if the tube is in a parallel connected filament circuit. The amount of current drawn by a series connected must be the same for all tubes in the string. It can be different for parallel connected filament circuits. The voltage of a seried connected filament circuit may be of different voltages. It must add up to the supply voltage or be dropped by a resistor in series with the series string. Usually if all of the tubes have the same voltage rating, the receiver has a parallel connected filament circuit. If the tubes have different voltages for some of the tubes, the filament circuit is series connected. Both transmitters and receivers use series and parallel and circuits for filament circuits. Transmitters using series filament wiring are usually of the small portable type and run low-power. Most of the small communication and entertainment type receivers use series connected filament circuits to conserve space and weight. Use your handbook, check type, filament voltages and current, check pin connection, plate and screen grid voltages and current. You may be able to keep the station working over the weekend by using this information. Changing the oscillator tube in the receivers used on the higher frequency bands may change the frequency of the oscillator requiring the circuit to be realigned. *Always* put the same tube back in the oscillator socket if it checks good, then check the dial calibration. Most tube testers used in drugstores are not the best kind to use, some are of little use in determining the quality of the tube being checked. It is always best to ask the help of your local serviceman after the emergency has passed. You can learn best by doing, but be careful if you 'mess around' with your good equipment.

My favorite girl friend, Doris Kuhnert, 4230 Shroyer Road, Kettering, Ohio now has the call WN8PZR. Doris is a junior at Graceland College, Lamoni, Iowa and will likely be heard talking to dad and mom, Bob and Betty at home in Kettering. Bob is K3BRE/8, Capt. USAF, Dayton, Ohio.

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

Letters to the Editor

I have waited about three years to print this letter. I was invited to have supper at the home of Captain Robert Kuhnert, K3BRE and his 16 year old daughter told me she was very much interested in becoming a ham and she promised me a picture and letter for the column when she received her call. Congratulations Doris, let's work on Betty to make it an all-ham family.

"Dear Uncle Walt: A long time ago you said if and when I got my license you would put my picture in *CQ*, Remember? Well get set to 'pay off'. I received my novice license recently and you may now call me WN8PZR. Of course, if we are still—after that public kiss—you may still call me Doris. Hi, hi. *(ed note—only my way of congratulating good looking YL ops.)*

'I thought you might be interested to hear about our college amateur radio club. Graceland College, Lamoni, Iowa, has had a club call—WØYO—since 1917. Through the years there has been a varying amount of activity from 'the hill' as it is known. During my first year (1963-64) there were 6 members in the club and I was the only girl.

'In my second year I was the only returning member. We had a total of 13 members and a new sponsor—Physics professor Ron Carter, WAØLEV. We elected officers in accordance with the existing constitution. I was elected President, V.P. was Ray Dickensheets, WAØEVV of Independence, Missouri, Secretary was Goldia Strong of Des Moines, Iowa and Treasurer was Trudie West of Sacramento, California. Both girls are working for their tickets.

'Several members of the club studied under Mr. Carter and took the Novice test. During the summer I learned that the following have received their calls: Mike Wintermeyer, WNØMFS, Independence, Missouri, Doug Bidwell, WN1EFS, Lexington, Massachusetts and of course My call WN8PZR. We hope others have or will get their calls.

'I haven't seen many letters from college amateur radio clubs in your column and thought you'd like to hear about ours. We'd be interested to hear from other college amateur radio clubs. We hope your many friends will listen for WØYO and all the Graceland 'Yellow-jackets.'

'I am sending you a picture of me at the rig of K3BRE/8, my dad, and one of Mr. Carter at WØYO's new Heathkit s.s.b. station. 73, Doris. WN8PZR."

Doris lives at 4230 Shroyer Road, Kettering, Ohio when she is home from college. I was her first QSO and she made the rag-chewers club. When she gets the General she gets to call me Aunt Walt and her dad, Bob. I hope Mom, Betty, will be the next amateur in the group.

Members of the Graceland Radio Club, Lamoni, Iowa will likely be heard operating from WØYO this winter as they have now gone back to college. Front L. to R. Doug Bidwell, WN1EFS, Ray Dickensheets, WAØEVV, Mike Wintermeyer, WNØMFS. Rear L. to R. Trudy West, Ron Carter. WAØLEV and Doris Kuhner. WN8PZR.

Carlos A. Lizarraga, OA1NA, Box 73, Sullana, Peru is one of our constant readers and is badly in need of a book telling hou to tune up his Gordon 10-20 meter antenna. If you have a book how about copying the tuning instructions and helping Carlos. He has a beautiful QSL.

Doris sent pictures of the radio club and I am printing that picture so that I will have more Novice news in the column and we still have a picture of Mr. Carter. I think this club is doing a very fine job of educating new amateurs and at the same time giving them an excellent hobby. Thanks Graceland and Mr. Carter.

"Dear Walt: I haven't seen a letter from Maine *(can't print em if I don't get em)* in your column so I thought I'd start the ball rolling. The rig here is an HT-40 transmitter running 75 watts to a Hy-Gain 80/40 meter trap doublet. I am also experimenting with different antennas for 15 meters. The receiver is a National NC-140.

'I spend most of my time on 40, but I also look for DX on 15 and ragchew with the VE's on 80. Right now I'm busy building a console for my shack and studying for my General. If anyone (especially DX) needs Maine I'll be glad to give them a sked on 80, 40 or 15 meters.

'My score is 17 states and Canada so far and still trying.

'Well, I guess that's all for now but I'll send a picture when I get the console built. I hope to hear you on and have a QSO. 73, David."

That is the way to see a letter from your state, just write and it will appear soon. David P. Robbins, WN1DTZ, R.F.D. #3, Belfast, Maine took time to write and there is Maine in the column, why don't you do the same? I'll be looking for that picture, David.

Help Wanted

Carlos A. Lizarraga, OA1NA, Box 73, Sullana, Peru could use some help locating a manual for tuning instruction for his Gordon Specialties 10-20 meter Beam Antenna. If you have or can get a manual let him know. Thank you.

The weather is too hot for studying radio theory this summer and therefore no one needs help right now. But, it will cool down soon and then you can write that card or letter to Walter G. Burdine, W8ZCV, R.F.D. #3, Waynesville, Ohio and get listed in *CQ* for a little help from our good amateur fraternity.

We have just run out of space. 73, Walt, W8ZCV

SPACE COMMUNICATIONS

BY GEORGE JACOBS,* W3ASK

OSCAR IV To Fly Next Month

JUST as this issue was going to press, word was received that OSCAR IV is expected to be launched sometime during December, 1965. Although final arrangements have not yet been completed, it is hoped to launch OSCAR IV into a near stationary orbit, piggyback aboard a Titan-3C booster from Cape Kennedy.

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

In all probability, OSCAR IV *will not* be a translator communication satellite like OSCAR III. Present plans are to equip OSCAR IV with at least two, and possibly three beacon transmitters. One beacon would operate in the 2 meter band between 145 and 146 mc, the other in the 432 mc band, and possibly a third on 1296 mc. It is hoped that the beacon transmitters will create a greater space communications interest among radio amateurs in the v.h.f. and u.h.f. bands, as a prelude to launching future OSCAR satellites with transponders in these bands.

If all goes according to plan, OSCAR IV will be placed in a near stationary orbit nearly 18,000 miles above the surface of the earth. From this great altitude, the satellite will "see" nearly one-third of the earth's surface at any one time. In such an orbit, the satellite's signals should be receivable on the ground for long periods of time with a minimum of tracking equipment.

[*Continued on page 96*]

Table I—List Of Frequencies On Which Satellites Can Be Heard (As Of September 15, 1965)

Freq. (Mc)	*Satellite Name and Country*	*Date Launched*	*Period* (Minutes)	*Inclination* (Degrees)	*Remarks*
1.500	EXPLORER 20—USA	25 Aug. 1964	104	80	Ionospheric sounder, on command
2.000	"	"	"	"	"
2.850	"	"	"	"	"
3.720	"	"	"	"	"
5.470	"	"	"	"	"
7.220	"	"	"	"	"
19.430	ELECTRON 2—USSR	30 Jan. 1964	1356	59	Command telemetry and c.w. beacon
19.540	"	"	"	"	"
19.775	COSMOS 63—USSR	15 Mar. 1965	104	56	"
19.800	COSMOS 71-75—USSR	16 Jul. 1965	96	56	"
19.918	PROTON 1—USSR	16 Jul. 1965	91.4	63.5	"
20.000	EXPLORER 27—USA	29 Apr. 1965	108	41	Command transmission, c.w. tone modulated
20.005	ELECTRON 1—USSR	30 Jan. 1964	169	61	Command telemetry and c.w. beacon
20.005	COSMOS 53—USSR	30 Jan. 1965	97.3	49	"
20.005	EXPLORER 22—USA	10 Oct. 1964	105	80	Command transmission, c.w. tone modulated
20.035	COSMOS 55—USSR	21 Feb. 1965	105	56	Command telemetry and c.w. beacon
20.084	COSMOS 61—USSR	15 Mar. 1965	105	56	"
20.084	COSMOS 71-75—USSR	16 Jul. 1965	95.3	56	"
30.008	ELECTRON 1—USSR	30 Jan. 1964	169	61	"
40.000	EXPLORER 27—USA	29 Apr. 1965	108	41	Command transmission, c.w. tone modulated
40.010	EXPLORER 22—USA	10 Oct. 1964	105	80	"
41.000	EXPLORER 27—USA	29 Apr. 1965	108	41	"
41.010	EXPLORER 22—USA	10 Oct. 1964	105	80	"
54.000	TRANSIT 4A—USA	29 Jun. 1961	104	67	"
89.100	COSMOS 71-75—USSR	16 Jul. 1965	96	56	Command telemetry and c.w. beacon
90.022	COSMOS 53—USSR	30 Jan. 1965	97.3	49	"
90.023	COSMOS 44—USSR	29 Aug. 1964	100	65	"
90.158	COSMOS 56—USSR	21 Feb. 1965	104	56	"
90.225	ELECTRON 2—USSR	30 Jan. 1964	1356	59	"
90.378	COSMOS 71-75—USSR	16 Jul. 1965	96	56	"
136.019	ECHO 2—USA	25 Jan. 1964	108	81.5	Continuous c.w. and telemetry
136.078	ALOUETTE—USA/CAN	29 Sep. 1962	105.5	80.5	Command telemetry
136.078	EXPLORER 23—USA	6 Nov. 1964	99	52	"
136.125	EXPLORER 28—USA	29 May 1965	8559	40	Continuous c.w. and telemetry
136.140	RELAY 1—USA	13 Dec. 1962	185	47.5	Command telemetry
136.142	RELAY 2—USA	21 Jan. 1964	195	46.4	"
136.147	EXPLORER 21—USA	4 Oct. 1964	2080	34	Continuous c.w. and telemetry
136.170	ECHO 2—USA	21 Jan. 1964	108	81.5	Continuous c.w. and telemetry
136.171	EXPLORER 22—USA	10 Oct. 1964	105	80	Continuous c.w. and command telemetry
136.200	OGO 1—USA	5 Sep. 1964	3842	40	Command telemetry and c.w. beacon
136.231	TIROS 8—USA	21 Dec. 1963	99.4	59	"
136.232	TIROS 10—USA	2 Jul. 1965	101	99	"
136.233	TIROS 7—USA	19 Jun. 1963	97.4	58	"

Table I—List Of Frequencies On Which Satellites Can Be Heard (As Of September 15, 1965)

Freq. (Mc)	*Satellite Name and Country*	*Date Launched*	*Period* (Minutes)	*Inclination* (Degrees)	*Remarks*
136.234	TIROS 9—USA	22 Jan. 1965	119	96.4	"
136.273	EXPLORER 26—USA	21 Dec. 1964	455	20.2	Continuous c.w. and telemetry
136.292	EXPLORER 25—USA	21 Nov. 1964	116	81.4	Continuous c.w. and command telemetry
136.326	EXPLORER 20—USA	25 Aug. 1964	104	80	Command telemetry and c.w. beacon
136.350	EXPLORER 20—USA	"	"	"	"
136.405	ARIEL 1—USA/UK	26 Apr. 1962	100	54	Continuous c.w. and command telemetry
136.410	PEGASUS 1—USA	16 Feb. 1965	97	32	Command telemetry and c.w. beacon
136.410	PEGASUS 2—USA	25 May 1965	97	32	"
136.410	PEGASUS 3—USA	30 Jul. 1965	95	29	"
136.440	EARLY BIRD—USA	6 Apr. 1965	1437	0.13	Continuous c.w. and command telemetry
136.467	SYNCOM 2—USA	26 Jul. 1963	1436	31.8	"
136.470	SYNCOM 3—USA	19 Aug. 1964	1436	0.10	Command telemetry and c.w. beacon
136.557	ARIEL 2—USA/UK	27 Mar. 1964	100	52	Continuous c.w. and command telemetry
136.590	PEGASUS 3—USA	30 Jul. 1965	95	29	Command transmission
136.591	ALOUETTE—USA/CAN	29 Sep. 1962	105.5	80.5	"
136.620	RELAY 2—USA	21 Jan. 1964	195	46.4	Continuous c.w. and command telemetry
136.621	RELAY 1—USA	13 Dec. 1962	185	47.5	Continuous c.w. and command telemetry
136.650	1964-83C—USA	13 Dec. 1964	106	90	Continuous c.w. beacon
136.653	1963-38C—USA	28 Sep. 1963	107	90	Command telemetry and c.w. beacon
136.680	EXPLORER 20—USA	25 Aug. 1965	104	80	Continuous c.w. and command telemetry
136.709	EXPLORER 24—USA	21 Nov. 1964	116	81.4	Continuous c.w. beacon
136.713	OSO 2—USA	3 Feb. 1965	96.5	33	Continuous c.w. and telemetry
136.740	EXPLORER 27—USA	29 Apr. 1965	108	41	Command telemetry and c.w. beacon
136.766	GRAVITY GRADIENT 3—USA	9 Mar. 1965	103.5	70	Continuous c.w. beacon and telemetry
136.768	1965-58C—USA	20 Jul. 1965	2611	34.4	"
136.800	SOLAR RAD—USA	9 Mar. 1965	103.5	70	"
136.805	EGRS-1—USA	11 Jan. 1964	103.4	70	"
136.840	EGRS-3—USA	9 Mar. 1965	103.5	70	"
136.860	EXPLORER 25—USA	21 Nov. 1964	116	81.4	Command telemetry
136.861	EXPLORER 23—USA	6 Nov. 1964	99	52	Command telemetry and c.w. beacon
136.886	SOLAR RAD—USA	11 Jan. 1964	103.5	70	Continuous c.w. and telemetry
136.889	PEGASUS 2—USA	25 May 1965	97	31.8	Continuous c.w. beacon
136.890	PEGASUS 1—USA	16 Feb. 1965	97	31.8	"
136.918	TIROS 9—USA	22 Jan. 1965	119	96.4	Command transmission
136.924	TIROS 7—USA	19 Jun. 1963	97.4	58	"
136.924	TIROS 8—USA	21 Dec. 1963	99.4	58.5	Command transmission
136.924	TIROS 10—USA	2 Jul. 1965	101	98.6	"
136.980	SYNCOM 2—USA	26 Jul. 1963	1436	31.8	"
136.980	SYNCOM 3—USA	19 Aug. 1964	1436	0.10	Continuous c.w. and command telemetry
136.980	EARLY BIRD—USA	6 Apr. 1965	1437	0.13	Command c.w. beacon and telemetry
150	TRANSIT 4A—USA	29 Jun. 1961	104	67	Command tone-modulated c.w.
150	1963-22A—USA	16 Jun. 1963	100	90	Command tone-modulated c.w. and telemetry
150	1963-49B—USA	5 Dec. 1963	107	90	"
150	1964-26A—USA	4 May 1964	103	90.5	"
150	1964-83D—USA	13 Dec. 1964	106	90	"
162	ANNA 1B—USA	31 Oct. 1962	108	50	Command tone-modulated c.w.
162	1963-38C—USA	28 Sep. 1963	107	90	Command tone-modulated c.w. and telemetry
162	EXPLORER 22—USA	10 Oct. 1964	105	80	Command tone-modulated c.w.
162	1964-83C—USA	13 Dec. 1964	106	90	Command tone-modulated c.w. and telemetry
162	EXPLORER 27—USA	29 Apr. 1965	108	41.2	Command tone-modulated c.w.
320	1964-83C—USA	13 Dec. 1964	106	90	Command transmission
324	TRANSIT 4A—USA	29 Jun. 1961	104	67	Command tone-modulated c.w.
324	ANNA 1B—USA	31 Oct. 1962	108	50	"
324	1963-38C—USA	28 Sep. 1963	107	90	Command transmission
324	EXPLORER 22—USA	10 Oct. 1964	105	80	Command tone-modulated c.w.
324	EXPLORER 27—USA	29 Apr. 1965	108	41.2	"
360	"	"	"	"	Command transmission
360.090	EXPLORER 22—USA	10 Oct. 1964	105	80	Command tone-modulated c.w.
400	TRANSIT 4A—USA	29 Jun. 1961	104	67	"
400	1963-22A—USA	16 Jun. 1963	100	90	Command c.w. beacon and telemetry
400	1963-49B—USA	5 Dec. 1963	107	90	Command tone-modulated c.w. and telemetry
400	1964-26A—USA	4 May 1964	103	90.5	Command tone-modulated c.w.
400	1964-83D—USA	13 Dec. 1964	106	90	Command transmission
400.250	*OGO 1—USA*	5 Sep. 1964	3842	39.7	Command c.w. beacon and telemetry
400.850	OGO 1—USA	5 Sep. 1964	"	"	"

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

RADIOTELETYPE frequently has been called a rich man's hobby by the "unwashed multitude," as the late WØBP used to call 'em. Nothing could be further from the truth. The RTTYer, more often than not, has considerably less hard cash tied up in ham gear than the average s.s.b. operator. The RTTYer (more often than the single sidebander) builds his own transmitter, too. Terminal equipment is also usually built, that is, unless a surplus converter can be found at a reasonable price.

A recent ad in another radio magazine displayed a new RTTY converter with a price tag of over $500, less tuning indicator! It's no wonder that people get the idea that RTTY is a rich man's hobby. As we have said so often, RTTY is *not* expensive. A perfectly good machine can be bought for as little as $55 (*CQ*, June 1965, page 90) and a simple converter can be built for about $35. (The *RTTY Handbook*, page 92) The most excellent surplus AN/FGC-1 that we have been describing in a series which began with the July '65 RTTY Column can be bought for $50 to $125. Build a TU or convert an AN/FGC-1 and we will guarantee one thing: you will *learn* something. Remember, amateur radio is not just a hobby to while away leisure time; it is a *service*, and the basis and purpose stated in the FCC Rules very plainly indicates that we should be learning something.

The AN/FGC-1, Part V

The Frequency Indicator and Metering Circuits

One of the most interesting and useful features of the AN/FGC-1 is the extensive provision of test and patching jacks, not only on every unit but primarily concentrated on a jack strip immediately above the REC RELAY panel and on the Frequency Indicator panel just above.

Meter Circuit

Figure 1 (A) is the schematic diagram of the meter circuit which, mounted on the Frequency Indicator panel, makes it very convenient for line-up and maintenance of the AN/FGC-1. No extra portable test set is required. From this position the meter can be connected by means of patch cords to jacks for testing purposes. For some tests no patching is necessary as the frequency indicator circuit is normally connected to the meter.

Either a.c. (audio frequency) or d.c. may be measured as a switch inserts a copper oxide rectifier when a.c. measurements are made. The meter has a zero-center scale, reading 100 divisions to either side of center.

When using the meter circuit to measure direct currents or voltage, the knob marked METER is turned to DC and the meter jack marked DC is patched to the proper jack according to the following table:

Measurement	Jack	Full Scale
Detector output or REC relay	REC REL	50 ma
Receiving loop	LOOP	50 ma
Suppressor current	SUPPR A or B	20 ma
Plate voltage	PTL V TST	200 v.
Power supply (telegraph) voltage	TLG V	200 v.

When measuring a.c. (audio frequency) levels, turn the METER knob to AC and patch the AC jack to the jack carrying the signal to be measured. The approximate dbm level corresponding

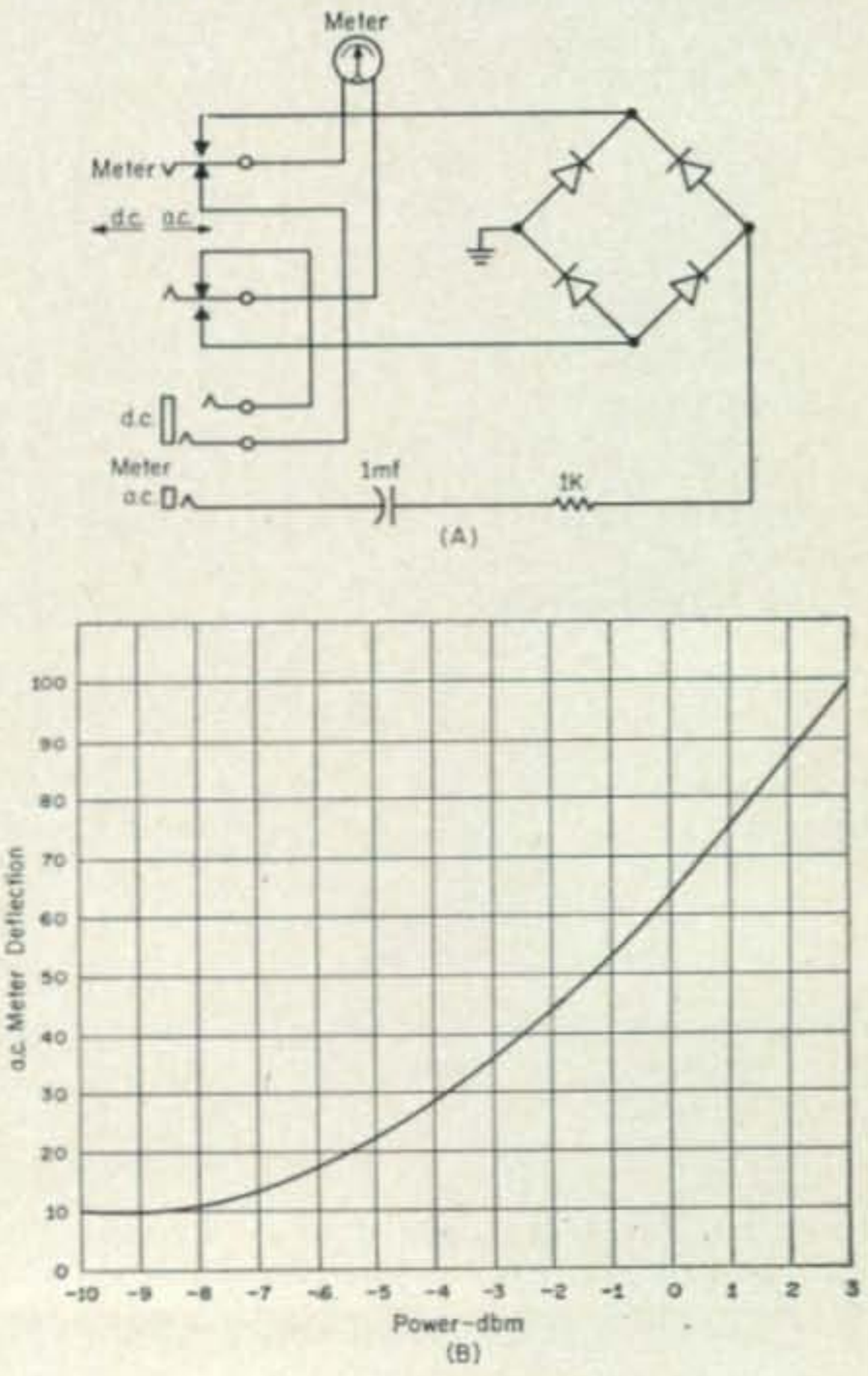


Fig. 1—(A) Meter Circuit, (B) Meter Calibration on A.C.

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

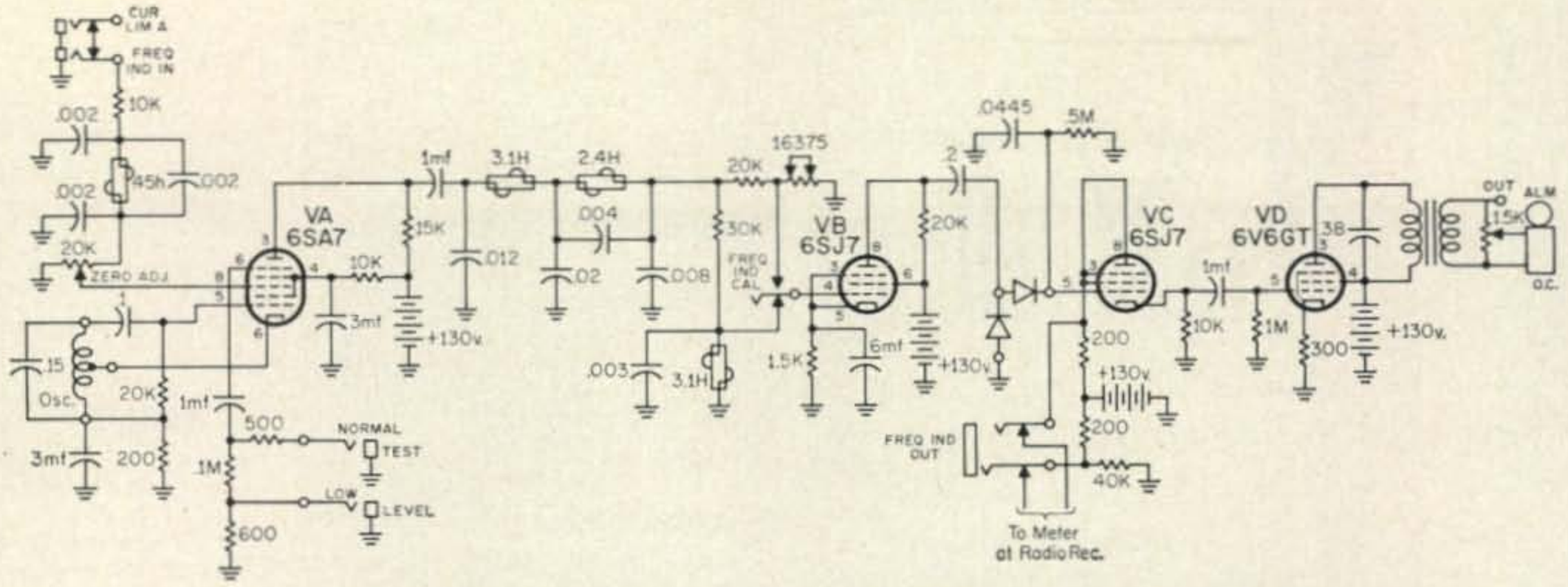


Fig. 2—Simplified Schematic Diagram of the Frequency Indicator Panel.

to various deflections when the meter is terminated in 600 ohms is shown in Figure 1 (B). Values may vary ±2 db depending upon the age and temperature of the meter rectifier. The a.c. range is also used for measurement of frequency when used with the frequency indicator circuit. Full scale reading in this case is ±300 cycles.

Patch cords used for a.c. measurements are equipped with WE 347A two-conductor plugs (similar to PL-55) making tip and sleeve connections. When connecting the DC METER jack to another jack for measuring d.c. voltage or current, a patch cord equipped with WE 310 type plugs is used. These are 3-conductor plugs making tip, ring, and sleeve connections.

Frequency Indicator Circuit

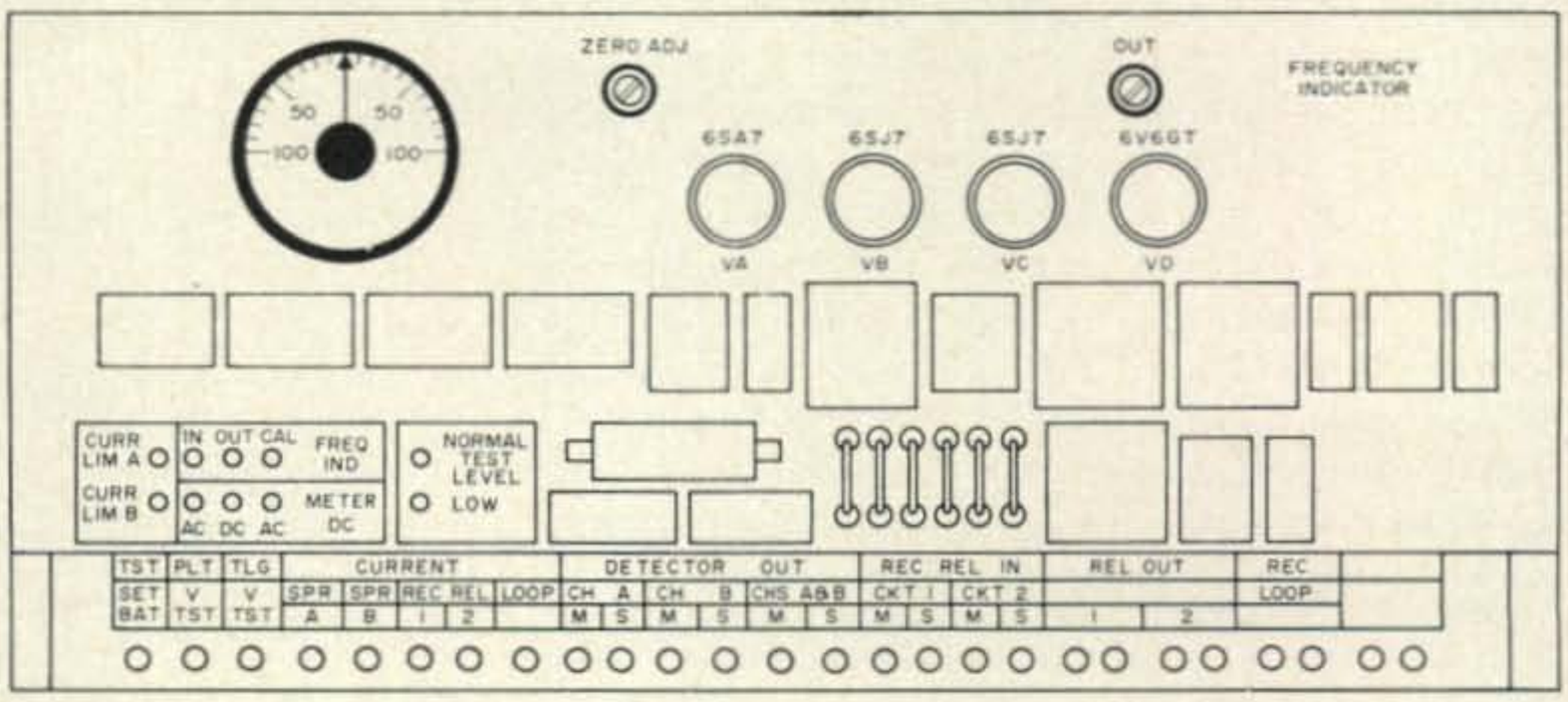
Figure 2 is a simplified schematic diagram of the frequency indicator panel. The 2125 cycle *mark* or the 2975 cycle *space* frequency from the Channel A limiter is mixed with a 2550 cycle local oscillator. The 425 cycle difference is separated from other products by a filter and passed through a tuned circuit in the grid circuit of mixer/oscillator tube VB, the voltage drop across which is proportional to the frequency. This voltage is amplified by tube VB and rectified in the grid circuit of tube VC, resulting in a d.c. which is proportional to the frequency, and the indication of a d.c. meter in the path of this current is a measure of the frequency. If the *mark* and *space* frequencies are correct, the zero-center meter will indicate zero. If they are symetrically located about 2550 cycles and differ by less than 850 cycles, the meter deflection will be steady but negative; if the frequency shift is greater than 850 cycles, the deflection will be positive. If the frequencies are not symetrically located, the meter indications will be unsteady. Of course, the radio receiver is tuned to make the meter steady.

The oscillator coil OSC is adjusted to 2550 cycles at the factory by approximately 0.15 mfd. Two test output voltages at 2550 cycles is provided for making tests and adjustments. The NORMAL TEST LEVEL jack gives approximately —6 dbm and the LOW TEST LEVEL jack gives —50 dbm when either is connected across 600 ohms.

Output from the mixer tube VA passes through tube VB, actually to the tuned circuit through a low pass filter with about a 1000 cycle cut-off 30k-ohms. The impedance of the resistor is large compared to that of the tuned circuit, so the current will be substantially independent of frequency. The tuned circuit acts as a discriminator, since the voltage drop across it will be directly proportional to the frequency. Because of signal limiting, the mixer output will be constant in amplitude; therefore, the voltage drop across the discriminator is directly proportional to frequency and may be used as a measure of frequency change. This voltage is applied to the control grid of tube VB.

Depressing the CAL button connects the grid of tube VB to a potentiometer which is in parallel with the discriminator; the voltage across the pot does not vary with frequency. This pot is adjusted at the factory so that the voltage applied to the grid is the same as that across the discriminator coil for 425 cycles, and so causes the frequency indicator meter to read zero. The process

[*Continued on page 101*]



Front view of the test jack or patch panel (lower), and the Frequency Indicator panel as they are installed in the AN/FGC-1. The Meter Circuit has its own jacks in the lower left of the Frequency Indicator panel.

YL

LOUISA B. SANDO,* W5RZJ

CONGRATULATIONS to these YLs who are the newly elected officers of the Young Ladies Radio League for 1966: President, Kayla Bloom, WØHJL; vice president, K1EKO, Edie McCracken; secretary, WA6AOE, Maxine Hanberry; receiving treasurer, K1OLM, Joyce Garlick; disbursing treasurer, Barbie Houston, K5YIB. These YLs are already well known to most: Kayla has been serving as V.P. of YLRL during 1965 (see write-up in Dec. '64 *CQ*); Edie has been editor of *YL Harmonics* for the last three years (see write-up in *CQ* Dec. '62); Maxine has been 1965 YLRL D/C for the 6th District. Both Joyce and Barbie have been serving YLRL in their respective positions. Continuing in her post as publicity chairman is KØEPE, Marte Wessel, whose new QTH, by the way, is Liberal, Kans. Taking over as editor of *YL Harmonics* is Peg Harnois, K1GSF.

Serving as YLRL's District Chairmen for 1966 will be these YLs: W1YPH, Leona Peacor; WB2PYI, Camille Hedges (ex-W3TSC); W3CDQ, Elizabeth Zandonini; W4BAV, Cathy Seeds; K5OPT, Ruth Jank; K6UTO, Betty Kuegeman; K7PEE, Edith Bennett; WA8ARJ, Roberta Lemon; K9ZLB, Mildred Bovee; WØUMO, Alyce Hanney; KH6BTX, Gladys Stickle; VE7BBB, Eva Green.

With YLRL secretary Fran, K7MRX, hospitalized for many weeks and unable to handle the ballots, we are grateful to her OM, Doc, K7LDK, for tabulating the results, and to Marty, K7KCU, and her OM, W7EQN, for certifying them. A speedy recovery to you, Fran!

K1GSF

Peg, new editor of *YL Harmonics*, came up with K1GSF in 1958 after being encouraged to join the hobby by her Dad, who is a ham. He thought it would be a good way for her to meet people without leaving home, but Peg has found since being a ham she has been more places and met more people than she ever did before. They have just built a new room for their shack. Peg says she usually uses an SB-33, but they have a DX-100, an HQ-160, a Clegg 99er (that her Mom won at the YLRL convention in Ohio) and a Heath Twoer (which Peg put together). K1GSF is a member of the Yankee Lassie Net, the Boston Region and Maine Post Office Nets and MARS (Army), and is scrapbook custodian for WRONE. Her most prized awards are WAS, YLCC, and Worked All Maine. For other activities Peg is secretary of the Maine Paraplegia Assn. and Wheelchair Confined, Inc.

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

YL NETS

Day	*Time (EST)*	*Freq. (mc)*	*Name*	*NCS or Mgr*
Daily	1300	14.230 a.m. 14.340 ssb	CHC/FHC World-wide Service Net	CHC YL Chap. 4
Daily	1300	14.331	YL Int. SSBers	Rotates
Mon.	0830	3.900	Buckeye Belles Phone	K8MZT
	0900	3.920	U.P. Mich. YL	Rotates
	0900	7.225	Floridora	K4JZX
	1100	7.235	Loaded Clothes Line	WØESD
	1300	50.4	IMPS	K9YIC
	1400	3.870	LARK	Rotates
	1430	3.737	Buckeye Belles c.w.	K8TFG
	1800	3.890	Honeybee	W7HHH
1st & 3rd T.	0800	50.25	Puget Sound YL	Rotates
Tues.	0830	3.900	Blue Ridge	K4CZP
	0830	3.940	Jayhawker	KØHEU
	0900	51.3	Buckeye Belles	Rotates
	0900	3.933	Floridora YL SSB	Rotates
	0930	Tune Band, 2-Meter Net		K8NOK & K8TVX
	1000	50.33	Floridora YL Southern	K4ACF
	1300	7.179	Buckeye Belles c.w.	WN8DZL
	1300	50.4	IMPS	K9YIC
	2130	50.5	Colorado YLs	WAØBBR KØWZN
	2130	3.825	GAYLARK	Rotates
	....	3.915	LARK (after North Central phone net)	Rotates
Wed.	0830	3.900	Yankee Lassie, WRONE	K1LCI
	0930	50.25	Hawk Roost	K9MZV
	0900	3.900	YL Welcome	K8LHF Alt. W8ATB
	1100	7.100	Loaded Clothesline c.w.	KØEVG
	1300	50.0	IMPS	K9YIC
	1300	50.65	WRONE	W1HOY
	1400	14.288	YL Open House	K6KCI & WA4FJF
	2100	50.7	Chix on Six Akron	Rotates
	2100	50.3	Suncoast YL	K4EAC
	2100	50.7	Chix on Six Cleveland	Rotates
	2200	146.1	L.A. YLRC	K6BUS
Thurs.	0900	7.270	Friendly Forty	W3UUG
	0900	3.880	TYLRUN	K5IOJ
	1130	7.235	TYLRUN	K5IOJ
	1300	14.265	Tangle Net Open to both a.m. and s.s.b.	KØEPE
	1300	14.277	Floridora Int'l Upper SB DX	KP4CL
	1300	50.4	IMPS	K9YIC
	1430	7.185	Floridora Novice	WA4FJF
	1900	50.64	Buckeye Belles Columbus	W8LGY-K8CEN
	2300	28.8	10-Mtr. Chirps-W6	Rotates
Fri.	0830	3.600	WRONE c.w.	K1IJV
	1200	3.880	Northwest YL (Minow)	K7RAM
	1230	7.250	40 Mtr. Round-table-W6	Rotates
	1300	50.4	IMPS	K9YIC
	Late eve.	14.3531	YL Int. SSBers	ZL2ZO & ZL2WS
	2300	3.900	YL Round-up	K4YAK & WA4FEY
Sat.	1400	3.910	Hawks Roost	WA6LIZ
	1300	3.845	BAYLARC Mermaid	K9ILK
Sun.	0900	7.225	Floridora Business Girls	K4UIZ
	1700	3.940	Jayhawker	W9JUV

If there are any changes or additions to this net listing, please notify W5RZJ.

Two national League presidents photographed July 4, 1965 at the National Convention at San Jose, Calif.: ARRL President Herbert Hoover, Jr., W6ZH, and YLRL President Martha Edwards, W6QYL. Photo by W6DEY.

WØHJL, Kayla Bloom, president of YLRL for 1966.

YLRL A.P.

Just a reminder of YLRL's Anniversary Party: CW—Oct. 20-21; Phone—Nov. 3-4. Remember that logs must be postmarked by Nov. 24 and received by WØHJL by Dec. 10. Full rules were in Sept. *CQ*.

Follow-Up

After the feature item about Sister Mary Cletus, WAØJIE, appeared in August *CQ*, we had this note from W7VFR, Bob, at Richland, Wash.: "I believe we, the Western Country Cousins, deserve a measure of credit for Sister Mary's many enterprises. I am Sunday night NCS of the Country Cousin Club and it was through me that Sister Mary got the Swan 240 (via a letter to the production boss of Swan Corp.). The Country Cousin Net is an organization of amateur radio operators dedicated to help and serve our fellow men. The Country Cousins have been selling those bows. I have sent in orders for several gross, as have others in the Northwest." . . . (Re: the package bows, Boy Scout Troop 611 of our church here in Alb. has recently completed selling 1,000 of them!) . . . And while we're giving credit, we should have added thanks to K7PVG, Frieda, who first sent your editor a clipping about the fine work of Sister Cletus, WAØJIE.

Anny Jenk, HB9YL, at the station built by her OM HB9TT. In addition to DXCC-200 and CHC, Anny has earned WAZ on c.w.-phone, only the 29th YL to make WAZ.

DX Awards

Congradulations to these YL recipients of WAZ earned on c.w.-phone: HB9YL, Anny Jenk (29th among the YLs to earn it), and WA6OET, Jessie Billon (30th YL to earn WAZ). Both have been written up here earlier.

Albuquerque Directory

A directory of all amateurs in Albuquerque, N.M. has been compiled by K5WZA, Irene Henderson. Not only are the hams listed by call with name and QTH, but there is an alphabetical listing by name. There also are special sections listing all the YLs, members of the Albuquerque Radio Club, Caravan Club and VHF Club (with QTH and phone), together with information on certificates available. Contact K5WZA if you'd like a copy (QTH: 120½—10th St., NW, Albuq.; locals phone 242-4403). The directory will be available in December at $1 a copy, but it would help her plan for number of copies if you contact her now. 33—W5RZJ

Space (*from page 90*)

Unfortunately, the exact frequencies upon which the satellite's transmitters will operate, orbital information, and other details are not available at this time. Be sure to see next month's column for complete information concerning OSCAR IV. Meanwhile, get your v.h.f. and u.h.f. gear into shape, and ready to go on short notice. It will not be possible to give much advance warning before OSCAR IV is launched, and the satellite may be rocketed into orbit as soon as the end of the first week of next month!

Euro-OSCAR

On Sunday, September 19 an Euro-OSCAR meeting was held in Geneva, Switzerland. Among those attending the meeting were Bill Orr, W6SAI of Project OSCAR headquarters; Hans Raetz, HB9RF, and Dr. Hans Lauber, HB9RG, of OSCAR and moonbounce fame; Edgar Brockmann, DJ1SB, OSCAR Co-ordinator for Germany, and Karl Meinzer, DJ4ZC, of OSCAR III fame. Karl brought with him the 2 meter translator and beacon package that he had built, and which had been launched successfully in a meteorological balloon to an altitude of 80,000 feet off the Dutch coast during August.

Karl's package was carefully examined by the group, and it was found to be of first class quality, and of high enough standards to meet requirements for a space launch. It is now planned to build a satellite around Karl's 2 meter transponder and beacon transmitter. The satellite would be very similar to OSCAR III, and may contain a second beacon transmitter in addition to the one already designed by DJ4ZC. It is planned to complete the satellite, and ship it to Project OSCAR headquarters for a hoped for launch by next spring. If all goes according to plans, the Euro-OSCAR satellite may become the fifth in the OSCAR series to be launched into space, and the second to contain a transponder.

Transmitting Satellites

As of September 15, 1965, no fewer than 56 satellites were in orbit transmitting radio signals back to earth on 110 different h.f. and v.h.f. frequencies. Many of the signals in the h.f. range can be heard well on relatively inexpensive shortwave receivers, while the v.h.f. signals can often be received with relatively simple frequency converters. Table I contains those frequencies in which orbiting satellites were transmitting as of September 15, 1965. Many of these satellites are expected to continue to transmit radio signals during 1966.

The satellites which should be heard with the least difficulty are those which transmit a continuous c.w. signal. These signals, which are often used as tracking beacons, can usually be identified by their steady tone when the receiver's beat frequency oscillator (b.f.o.) is in the ON position. Telemetry signals are often somewhat more difficult to receive, since in most cases telemetry data is transmitted for only brief periods upon command from the ground. Telemetry signals usually consist of two or more musical tones being transmitted at the same time, or in the case of the Russian COSMOS satellites, of a series of dots and dashes of different length.

Inclination and period data are included in the listing as a further aid in identifying satellites from which signals can be received. The inclination is the angle that the satellite's orbit makes with the equator. If a directional antenna is being used to receive satellite signals, the inclination data can be used for determining the direction from which the satellite's signal should be heard first. The satellite's period is the time it takes, in minutes, for the satellite to complete an orbit. By timing reception on successive orbits, it is often possible to identify the satellite.

73, George, W3ASK

DX (*from page 74*)

a try and here's betting that all of the boys will cooperate 100%. Pass the word around so that these special tests and procedures will be well known to all. We will all be happy to help some brother 160 DXers make their first crossing and have the real thrill that goes with it. It will also be interesting to see who can work the most of these first timers. The dates for the first timers test are as follows:

European/African First Timers: Dec. 19th and Feb. 6th between 0500 and 0730 GMT (all others QRT).

W/VE North American: Jan. 9th and March 7th (all others QRT).

Times will be same for transatlantic DX tests. Those on the opposite side of the First Timers should QRX and listen intently until a call to answer is heard. A special request to W/VE/NAs is to stay below 1820 kc so as not to QRM the sector 1820-25 where many Europeans operate. Suggested weak European/Africans use 1823-27 kc as best frequencies. Note that the W/VE/NA first timers are dates in between the regular transatlantics whereas the EU/African first timers dates are on the regular transatlantic test dates. All of those selected dates are times when conditions can be good for weak signal. *(Tnx W1BB).*

SSB Honor Roll Notes

John, WA2IZS moves to 285 this month with CR8BH, CEØXA, AC3H and AP2MI. W6YMV added 29 and advanced to 264 with such goodies as AC3H, AP2MI, CEØ's AG and XA, UH8BO, VP8HO, YK1AA, ZS8MI and ZL3VB.

QTH's and QSL Managers

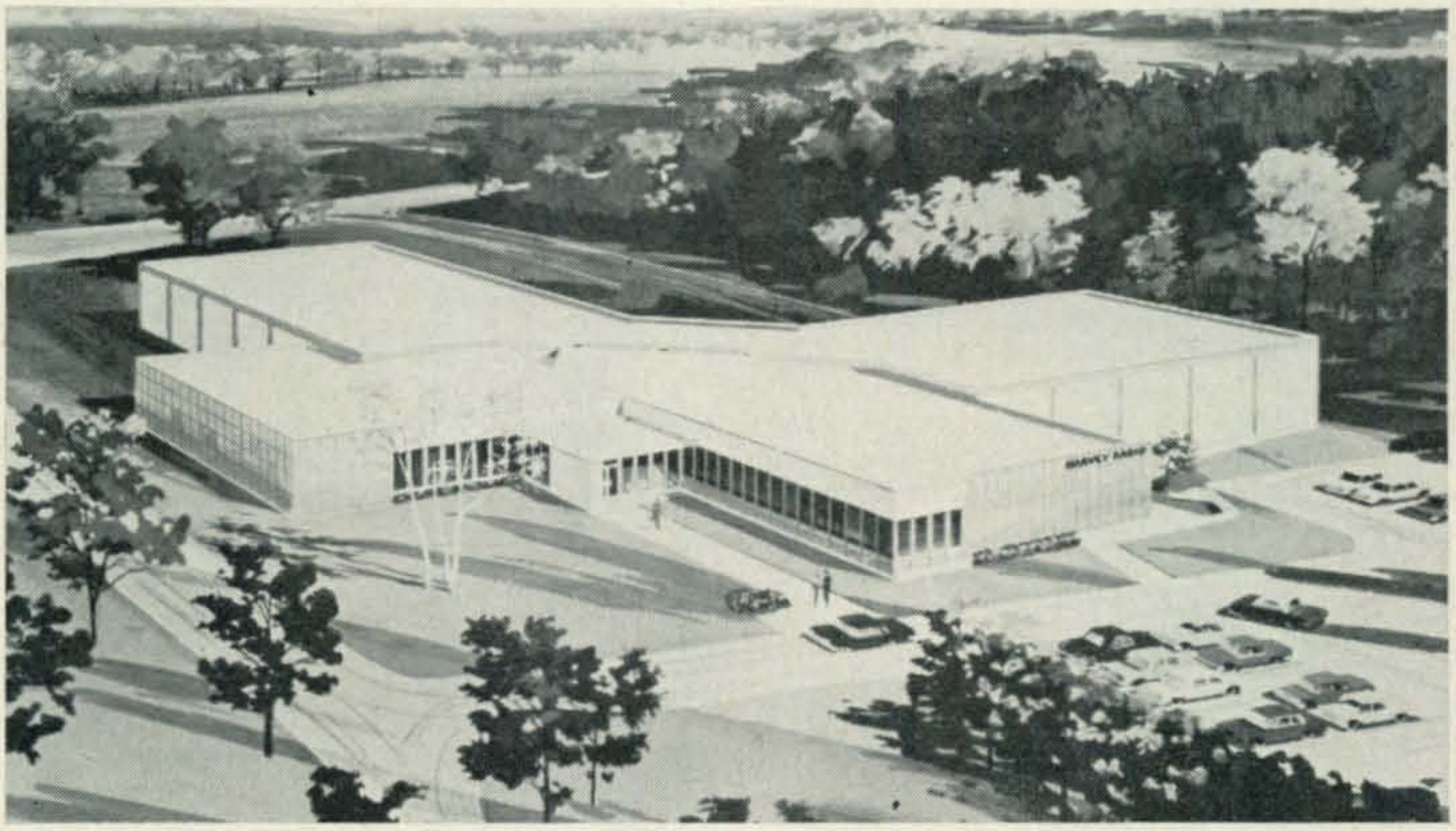
George, CR6GO, who handles the CR6 Bureau, would like to mention that cards for any other CR area (CR5, CR8, etc.) should go to the REP Lisbon.

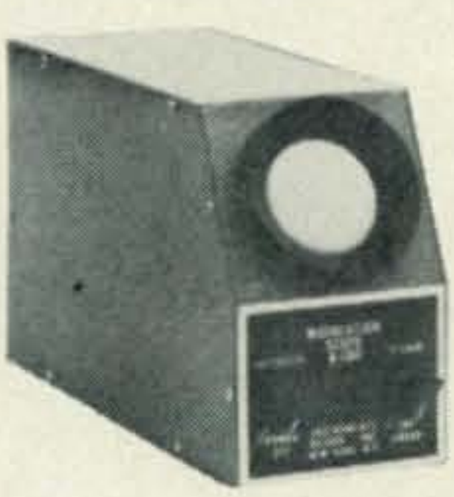
BY4SK via W4ECI.
CO2JB Box 6996, Havana, Cuba.

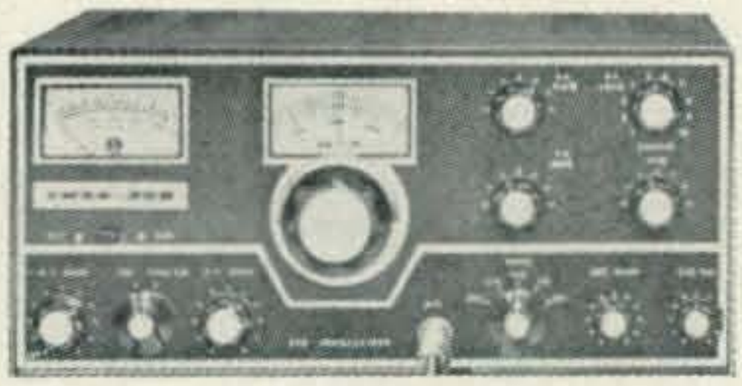
CR3AD Box 205, Bissau, Portuguese Guinea.
CR6FW Box 980, Benguela, Angola.
DI2DR (W only via DJ2KS—s.s.b. only via DL6XP).
F7BL via DXpedition of the Month.
HR1CGT via WA5CNP.
KG6IF Charley Brown, APO, San Francisco, Calif. 96315.
KS4AB via WA9LCY.
KX6BW Bob Tache, Box 65, APO, San Francisco, Calif. 96555.
LU6FA Box 263, Losario, Argentina.
MP4DAN via DJ4AB.
OA4MF via W2CTN.
OH0FZ via DJ4SO.
ON8VB via F7CR.
PY2BZD/PYØ via K2HLB.
VP2SJ via W1MRQ.
VP3AA Box 337, Georgetown, British Guiana.
VP3MV via W2UOX.
VP5GC via K4RCS.
VP8HJ via W2CTN.
VQ9J via K4IXC.
W9TQL/KV4 via W9TQL.
W9WNV/8F3 via W4ECI.
WB6TFE/KS6 c/o E. T. V. Pago Pago, American Samoa.
XZ2TZ via W4ECI.
3AØDL via ON4FU.
4W2AA via HB9AET.
4X4QL via W2IWP.
4X4SO via W2IWP.
4X4SK via W2IWP.
4X4UL via W2IWP.
4X4VL via W2IWP.
5J3LR via W2CTN.
5W1AD via W4ECI.
9M2OV via DJ1AK.
9Q5NT Box 2498, Leopoldville, Congo Rep.
9Q5QR Tony Jeuken, Box 10101, Aeroport Leopoldville, Rep. of Congo.
9Q5RD Box 1196, Elizabethville, Congo Republic.
9U5ID via W8HBI.

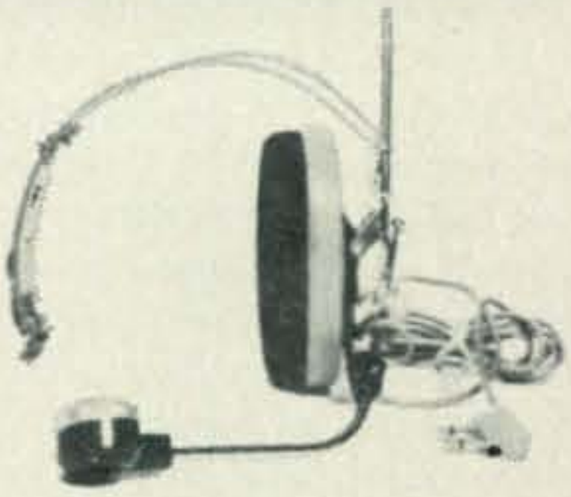
73, Urb, W2DEC

HARVEY RADIO's new Syosset, L.I., ham headquarters opens its doors to you.









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73, Elliot WA2HDP

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– Elliot Berelson, WA2HDP

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A.C. Control Center [*from page 57*]

The isolation transformer leads are brought out to the barrier strip for joining with wiring from the panel. The Variac, meter, sockets, switches and other components are mounted on the panel and all wiring is done point-to-point. Zip-cord is used for most of the wiring but certain connections use single conductors. Make sure you use at least #14 gauge wire in all cases.

Testing

When the wiring is complete, a check must be made to assure proper phasing of L_2 when it is paralleled with L_1. Attach a 10 v.a.c. meter to L_3, set S_2 to ON and apply 6.3 v.a.c. to L_1. Now switch S_2 to OFF and observe the a.c. voltmeter. If the meter reading drops to zero, L_2 is phased wrong and its leads must be reversed at the barrier strip. When properly phased, the voltmeter reading will not change when S_2 is switched to OFF.

The unit shown used a meter which required an external resistor, R_1. The a.c. meter you use may not require this resistor, but if it does, simply set R_1 for the correct reading as verified by other meters plugged into the line. Remember to disconnect the line cord before you make a change in the slider on R_1. ■

Contest Calendar [*from page 76*]

Then the night of the big event, the presentation of the *CQ* Trophies and other awards at the fabulous Circulo Militar, the Country Club Hotel of the military. (Incidently this was our hotel during our stay, as well as Stu Meyers, W2GHK and Ricardo, CX2CO.)

The presentation ceremonies were preceded by a reception and dinner and followed by a gala Victory Ball that lasted into the wee hours of the morning. (I am still trying to find out what time Stu and Ricardo got to bed, but that's another story.)

The next day another luncheon, this time a buffet, at the headquarters of the Comandante General de la Aviacion, General Francisco Miliani, YV5GA. What a spread.

Stu Meyers treated us to a showing of slides of several Hammerlund DX-peditions that night, following a dinner at the Macuto Sheraton Hotel.

Then there was the delightful day spent with the club secretary, Tony Gomez, YV5AGD, an avid contest man. Tony took us over the mountain through the mile high jungle in the Pittier National Park and many other points of interest.

An exciting afternoon was spent with Armando Aldrey, YV5BPJ and George Gugig, YV5BBU and his YL. This was a breath-taking trip by cable car to the top of Pico Avila. 4000 ft. above the city. It was bright and sunny when we started, but within minutes we were in the clouds and in a torrential downpour.

These are only the highlights of our visit with the YV5 boys. I couldn't begin to tell you of all the other delightful incidents during our week in Caracas. Meeting Ricardo, CX2CO, sharing the festivities with Stu Meyers, the pleasant few hours spent with the YV5AKU crew, the

visit with Raul and his XYL at YV5BIG, Gus YV5AMW's assistance in transportation problems, meeting all the fellows at the club house, etc.

The Radio Club Venezolano is a social as well as a radio club. The club building is open daily for its members and visitors, so we stopped in almost daily to meet the boys and use their station YV5AJ for state-side contacts and patches.

In closing I must once again express my gratitude to the Club and all its members for making this wonderful week possible, and the honorary awards presented me. Especially its president Dr. Moros, Tony Gomez and his XYL Waldina, Luis Rotundo and particularly Eddie Cabrera, YV5AXU in charge of public relations.

Also Mr. Jose Pygna of VIASA, General Francisco Miliani for making our stay at the Circulo Militar possible and Col. Ruben Navas for his hospitality while we were at the Circulo.

A grand bunch of fellows and gals, all of them, those mentioned here and all those which space has not permitted to name.

73 for now, Frank, W1WY

RTTY (*from page 93*)

of calibration then consists in depressing the CAL button and adjusting the ZERO ADJ pot until the meter indicates zero.

Output of amplifier tube V8 (425 cycles) is rectified by a copperoxide rectifier and the d.c. is amplified by tube V9. The plate circuit forms one arm of a Wheatstone bridge, the other arms consisting of resistances of 40K, 200, and 200 ohms, and the meter is connected across

one diagonal. In the calibration process the circuit has been adjusted to balance this bridge at 425 cycles; if the frequency is low, the bridge is unbalanced and the meter reads negative; if the frequency is high, the meter reads positive. The deflections are nearly proportional to the departure from 425 cycles and are full scale for a departure of 300 cycles. Connections are provided for a remote meter at the radio receivers. Frequencies may be measured at the AN/FGC-1 bay by patching the DC METER jack to FREQ IND OUT and turning the METER knob to DC.

A very interesting alarm circuit is provided as part of the Frequency Indicator panel. Its purpose was to alert the receiver station operator in case either the receivers or the distant transmitter drifted off frequency. The cathode of tube VC is connected to the control grid of tube VD through a 1 mfd capacitor. As long as the voltages from the discriminator, developed from *mark* and *space* signals are alike, they do not affect tube VD. When they differ, an impulse passes through the capacitor to the control grid of VD at each transition. Tube VD amplifies these impulses which cause the ALM bell to sound when the frequency difference exceeds the allowable limit. The output pot OUT can be adjusted so that the bell sounds at any desired departure from the correct frequency.

Next month we will detail the automatic Frequency Control panel. This is the unit which can feed back a signal to the receiver(s) to *correct* for drift. The result is really "hands-off" painless copy. 73, Byron, W2JTP

Perfect Dummy (*from page 50*)

be sure that C_1 is set for minimum reflected power. Repeat so you are sure you cannot adjust dummy load any better. Mark down dial setting and do not touch C_1 again. There should be no indication of any reflected power on meter with the s.w.r. bridge in the reflected position so adjust the reflected power pickup and/or diode for a zero reflected power reading. Turn the sensitivity towards maximum, or increase power, but not so much that meter deflects backwards. If you cannot get zero reflected power reading then parts values are wrong and/or you have harmonics in the transmitter output. After adjustment of the reflected power pickup do not touch it again.

Disconnect the bridge from the dummy load and set the sensitivity about halfway. Leave everything else as it is and feed just enough r.f. into the bridge to get a ¾ to full deflection on the meter in the reflected position. Switch to forward power and adjust the forward power pickup and/or diode for exactly the same meter reading. The idea here is that with no load the forward and reflected power must be the same. Make the bridge adjustments with the r.f. power off; meters and diodes cost money.

Adjusting the dummy load for zero reflected power on the different bands will give you a perfect non-reactive load for the selected frequencies. This dummy load is practically a necessity for setting up the Coax Phase Detec-

tor,[1] a must for any amateur interested in antennae. On transmitters with fixed outputs (HT-37 *etc.*) this load is the only type suited for comparing output readings on the different bands and getting useable results. As a matter of fact, with this dummy load, a calibrated s.w.r. bridge and a coax phase detector, there is not much you cannot find out about your coax feedline. But be careful with the interpretation of the meter indications. The purists may say the r.f. resistance is not the same, as the d.c. resistance (skin effect, *etc.*) and the bridge is not calibrated in the usual manner by connecting it backwards, but then practice is not theory. Try it and see how a real dummy load tunes and loads. ■

[1]Geiser, David T., *"Building and using the coax phase detector," CQ*, Jan., 1962, P. 24.

Transistorized Rtty *(from page 70)*

the terminal equipment are modular in form and are constructed on 4½" × 6" printed circuit boards. These modules may be mounted as desired, for example in the printer case or two housings, desk or rack-panel.

The basic module is the converter, which has its own power supply, and powers all other modules except the scope. The converter drives the 60 ma coil directly, and will drive to 100 w.p.m. all properly equipped serial printers such as the 14, 15, 19, 28, *etc.* Polar relays are not required, due to the design of the circuitry. All modules are silicon solid state circuitry except for the c.r.t. and the converters are available on four models.

Model C101—The basic converter, keying ON on signal, tuned to *mark* frequency of 2925, tunable to *space* with external trim capacitor for reverse keying. Single tone converter.

Model C102—Same as C101 above with the addition of second tuned circuit for *space*. Keys ON and double OFF. Discriminator polarity reversable for reversed keyer. Accessory switch assembly available for adidtional shifts of 600, 400, and 200 c.p.s.

Model C103—Same as C102 above with the addition of memory circuit as described in article for key on *mark* and/or *space*. Reversable.

Model CPA3—Same as C103 above, except addition of two preamplifier channels for additional limiting and selectivity. The preamplifiers are on a separate 4½" × 6" board.

It should be noted that all the above converters use the same printed circuit board, and may be returned for upgrading at a later date for a small additional charge. The basic converter module, C101, is priced at $49.50. Further information on the system, literature, and prices may be obtained from Tuck Electronics, 2331 Chestnut Street, Camp Hill, Pa. ■

USA—CA *(from page 80)*

NARC Award: Issued for working the club station, K3HKK and/or club members as follows:

Centre County Amateurs: work 10 club members or 7 club members and K3HKK

All other amateurs: work 5 club members or 3 club members and K3HKK

Send alphabetical listing of the stations worked with application. Stations must be a member during the calendar year in which worked. Initial cost as stated, $1.00, later endorsements are 10¢ or 1 IRC each. All contacts must be made after January 1, 1960 and QSL cards received for such contacts. All contacts acceptable regardless of call or address changes. A list of the qualified club members may be obtained from the Secretary, Nittany Amateur Radio Club, Inc., P.O. Box 60, State College, Pennsylvania 16801, by sending a s.a.s.e. or 1 IRC.

Zone Five Award

ments are: Low frequency stations within 50 miles of Edison, N.J. work 4 members; outside 50 miles work 3 members. V.h.f. stations within 50 miles of Edison, N.J. work 8 members; outside 50 miles work 5 members. No date limitations. Send GCR List and $1.00 to CUSTODIAN, Ken Porsolt, WA2FNN, 26 Chestnut St., Edison, N.J. 08817. For any additional data and membership list, send s.a.s.e.

GUERNSEY COUNTY AWARD is sponsored and issued by The Guernsey County Amateur Radio Club, Box 422, Cambridge, Ohio 43725. To be eligible for this award, any amateur or s.w.l. must have worked or logged 5 amateur radio stations located in Guernsey County, Ohio, on 160 to 10 meters. Three (3) stations are required on 6 or 2 meters. Send list of stations worked or logged to the above address.

The mail this month has been most wonderful, thanks, hope I did answer all your questions and for those of you who did not find time to write, how was your month?

73, Ed., W2GT.

Homebrew Meter Sales *(from page 49)*

transfer type very easy and efficient to use. Not having a set of meter decals, I used the "I's" for this, from a regular marking set. Large ones for the numbered points and small ones for inbetween calibration. Line these up with the pivot point of the meter when applying.

Under the 0.5 ma, 0.35 ma, 0.21 ma, 0 and the full scale point, place a large marker. Place a small marker under the 0.45 ma point. Looking at the graph in the ARRL Handbook again, we find the curve almost linear between 1 to 1 and

1.5 to 1. Likewise, the curve is fairly linear between 1.5 to 1 and 2 to 1. Now, divide each of these sections into five equal segments and mark lightly with a pencil. For those who wish closer calibration, estimate the curve. Using the described method, you will have excellent calibration. Place the small transfer markers at these points. (See fig. 1B.)

Now, using numerals, mark the 1, 1.5, 2 and 3 s.w.r. points. At full scale, label this point "Set". Place any extra wording on the meter face at this time.

Reassembly

Before reassembling the meter, clean the inside of the meter case and wipe all finger prints off the glass. Reassemble, using care. Don't forget the pointer stops or grounding strap.

Only one example was given but the same process will work in many different arrangements. (See fig. 1(C).) An "S" meter may be calibrated for the characteristics of your receiver. The results will probably be more accurate than a commercial unit if care is taken. The pride and satisfaction gained is more than worth the time spent. Good luck and happy homebrewing. ■

APX-6 (*from page 48*)

We have never seen an APX-6 receiver that didn't work the first time. If you have another APX-6, you can listen to its signal. If not, you should be able to detect the harmonic of a two meter carrier at close proximity. Bear in mind, however, that the TR cavity must be peaked on the receiver frequency for unusually weak signals.

Conclusion

The Project Oscar Association has announced recently the possibility of a beacon signal in the 1296 mc band in future orbiting satellites. If you are a true u.h.f. addict, you'll want to use your APX-6 with a rotatable antenna to copy the "HI" 's.

Regardless of how you employ your APX-6, the v.h.f. editors would like to hear from you. If problems crop up that cannot be answered by double-checking against the steps outlined here, send us a self-addressed stamped envelope with your query and we'll try to help. ■

RTTY A-Z (*from page 39*)

the adjustments, except perhaps the feedback GAIN control, should require further attention. Increasing the GAIN control, R_1, up and beyond the point at which the neon lamps fire will increase the required positive input voltage necessary to trigger V_{1A}. This is desirable, under certain circumstances, and is why this control was placed on the front panel of the test set.

Next month's installment will cover the use of the test set, in conjunction with an oscilloscope, to measure the bias distortion of a polar relay.

[*To be continued*]

Ham Shop

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Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

EMBOSSED QSL Cards. Free Samples. Ace Printing Service, 3298 Fulton Road, Cleveland, Ohio 44109.

"GOLDEN CALL" QSLs, samples 10¢. Samco, Box 203-G Wynantskill, N. Y. 12198.

QSLs 2 & 3 colors 100 $2.00, samples dime. Bob Garra, Leighton, Penna.

QSLs. 3-color glossy. Samples 10¢. Gates Pring Shop, 317-11th Avenue, Juaniata, Altoona, Penna. 16601.

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.

CREATIVE QSL CARDS free, new catalog and samples. Personal attention given. Wilkins Creative Printing. P.O. Box 787-2, Atascadero, California.

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.

QSL's 3-color glossy. 100 $4.50. Rutgers Vari-typing Service. Free Samples, Thomas Street, Riegel Ridge, Milford, N.J.

QSLs Samples 25¢. Rubber Stamps; Name Call, Address, $1.55. Harry Sims, 3227 Missouri Avenue, St. Louis, Mo. 63118.

QSL's . . . 18 samples 10¢ . . . Filmcrafters . . . Martins Ferry, Ohio.

QSL's WSL's XYL-OM's (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 BROWNIE—W3CJI . . . 3111 Lehigh, Allentown, Pa. Samples 10¢ with catalogue 25¢.

QSL's CB, WPE Samples 10¢ Nicholas & Son Printery P.O. Box 11184, Phoenix, Arizona 85017.

QSL CARDS—100 3-color, glossy $3.00. World globe in silver; report form on reverse side; Free samples. RUSPRINT, Box 7575 Kansas City, Missouri, 64116.

HUNDRED QSL's: $1. Samples, dime. Meininger, Jesup, Iowa.

QSL's—Ham and CB, related products. Free Samples. April Sign Co. 56290 Van Dyke, Washington, Michigan.

QSLs. Large Selection, including photos, rainbows, glossy stocks, cuts, etc. Fast Service. Samples, dime. Ray, K7HLR, Box 1176 Twin Falls, Idaho, 83301.

QSLs $2.00 per 100 postpaid. Free sample. Hobby Print Shop, Umatilla, Fla. 32784.

QSL—Special—100 two color—$1.65. Quality. Free samples. Kanuck, Box 461, Dayton, Ohio.

QSLS?? WPES?? SWLS?? Samples 25¢. (refunded). Sackers, W8DED, Holland, Mich.

DON'T Buy QSL cards until you see my free samples. Bolles, Box 9363, Austin, Texas.

QSLs. Samples, dime. Print Shop, Corwith, Iowa.

ELECTRONIC CHASSIS PUNCHING and drilling service, Panels cut, etc. Build that magazine article! Send chassis or request estimate. Hole (16ths) diameters to ½", 5¢; to 1½", 25¢; to 4", 50¢; sq., 5¢ perimeter inch in aluminum to 3/16. Steel 20 ga. add 50%. Mark sizes and centers, allow clearances. Payment with material, minimum $2.00, under 2 lbs returned postpaid. Metalwerk, P.O. Box 1372, Cedar Rapids, Iowa 52401.

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.

PRINTED CIRCUIT BOARDS Hams, Experiments. Many different projects. Catalog 10¢ P/M Electronics, Box 6288 Seattle, Washington 98188.

TOOOOOBES: 6CW4-$1.40. 614B-$4.75, 6360-$3.45, 5894-$15.00, 417A-$3.95. New. Boxed. Guaranteed. No pulls, seconds or JAN. Free catalog of hundreds mort. VANBAR dist., Box 444Y, Stirling, N.J. 07980.

WANTED—Laboratory test equipment. Electronicraft, Box 13, Binghamton, N.Y. 13902.

For further information, check number 42, on page 110

For further information, check number 43, on page 110

SUB CARRIER DETECTOR

Add programs of commercial-free music thru your FM tuner. Detector, self-powered, plugs into multiplex output of tuner or easily wired into discriminator and permits reception of famous background music programs now transmitted as hidden programs on the FM broadcast band from coast to coast. Use with ANY FM tuner.

WIRED UNIT $75.00
KIT, with pretuned coils, no alignment necessary $49.50
crystal-controlled receivers available

MUSIC ASSOCIATED
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Upper Montclair, New Jersey
phone 744-3387 area code 201

For furtter information, check number 45, on page 110

NOW! A SSB TRIBAND TCVR KIT FOR ONLY $179.95

NEW EICO 753
IN STOCK AT
MAC'S RADIO SUPPLY
8320-22 Long Beach Blvd. South Gate, Calif.

QCWA

Quarter Century Wireless Association, Inc.

Licensed amateurs who held an amateur license 25 or more years ago are eligible for membership.
Entry Fee $3.00 3 Years Dues $5.00

Applications may be obtained from
A. J. Gironda, W2JE, Executive Secretary
1417 Stonybrook Avenue, Mamaroneck, N.Y.

FREE

GIANT NEW CATALOG

100's OF BIG PAGES CRAMMED WITH SAVINGS

BURSTEIN-APPLEBEE CO.

Dept. CQ, 1012 McGee, Kansas City, Mo. 64106

☐ Rush me FREE 1966 B-A Catalog.

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Address .....

City ..... State .....

Please be sure to show your Zip No. .....

SEND FOR IT TODAY

FREE

For further information, check number 46, on page 110

WHOLESALE ELECTRONICS, Resistors 3¢, Multimeters $9.95, speakers 49¢, electrolytics 10¢. Hundreds of items. Catalog 25¢. Refundable. ROYAL Box 2591, El Cajon, California 92021.

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. Bcx 406—Canal St. Station, New York N.Y. 10013.

CASH, SONY TRANSISTOR TV's etc. swapped for G-R, H-P, L & N, etc. Equipment, special tubes, manuals, military electronics. Engineering Associates. 436 Patterson Road, Dayton, Ohio. 45419.

HIGHLY EFFECTIVE HOME STUDY REVIEW for FCC commercial phone exam preparation. Free literature. COOK'S SCHOOL OF ELECTRONICS. Box 747, Riverhead, New York 11902.

RTTY GEAR for sale. List changes Monthly—Write for information—Elliot Buchanan, W-6-VPC, 1067 Mandana Blvd., Oakland, California 94610.

Ruby Laser Rods. Single crystal ruby rods are now available for the university student and amateur experimenter from one of the nation's leading fabricators of sophisticated optical elements. Rods are ¼" diameter, 3" long; finely polished, and with flat and parallel ends silver coated for immediate installation, $75.00 per unit plus $1.00 postage and handling. All rods guaranteed to last. Moneyback if returned unharmed in 10 days. Valpey Corporation, Department 510, Holliston, Massachusetts.

CRYSTAL BARGAINS. Free list. Nat Stinnette, W4AYV, Umatilla, Fla. 32784.

FINE NEW BOOK—4000 words German-English for Hams and SWL's. Send $1.25 or 11 IRCs for your copy to Christian Zangerl, OE9CZI, Dornbirn, Nachbeurstrasse 28, Austria.

FREE! Giant bargain catalog on transistors, diodes rectifiers, components; Poly Paks, P.O. Box 942P, Lynnfield, Mass.

THIS COMPANY is looking for Ham & CB cartoon artists and ideas. $10.00 per idea IF ACCEPTED. For information, write AMBRU PRODUCTIONS, 10 Burbank Street, Yonkers, New York 10710.

Technical Manuals—lowest prices USA, teletypewriters, receivers, transmitters, text equipment and etc. Large lists. Send 10¢ coin-stamps. Quaker Electronics, Hunlock Creek, Pa.

CRAZY . . . NOT QUITE. LET'S DEAL. . . . We want to become Nevada's largest ham store! Look! . . . Swan, Transcom, Galaxy, Hallicrafter, Hammarlund. . . . No honest deal refused. Write: Sierra Electronics, P.O. Box 212/ Sparks, Nevada.

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.

ANTENNA, MULTI-BAND Doublet, 80, 40, and 15 Meters, 1KW, S.W.R. less than 2:1. Complete with insulators, coax and instructions on how you could use it in an attic or small city lot or apartment. No R.F. sponges (traps or coils) used. $5.00. Adiabatic Enterprises, Box 151 Albany, California.

CRYSTALS—LOW FREQUENCY 16.00000kc HC-17U hermetically sealed holder, only $2.50 each postpaid. No charge matched pairs. Also 700,000 other crystals in stock—lists available. Quaker Electronics, Hunlock Creek, Pa.

JOIN OUR AMATEUR THRIFT CLUB. Pay cash and save. Write for details. Joe Dimare, Box 20672 Dallas, Texas 75220.

CLOSE-OUT, Full size three element 20 meter beams, new, 1" and ⅞" Aluminum tubing. All hardware complete $22, Express collect. GOTHAM, 1807 Purdy, Miami Beach, Fla.

WANTED: Commercial or Military, Airborne or Ground . . . Equipment and Testsets, Collins, Bendix, others. We pay Freight. . . . RITCO, POB 156, Annandale, Virginia.

CRYSTALS, Transformers, pyranol condensers, etc., top quality surplus. Write for Bulletin No. 865. R & M Electronics, Box 5234, Knoxville, Tennessee 37918.

DISTRIBUTOR WANTED. No Competition. To service and set up new accounts in exclusive territory. Investment secured by fast moving inventory of amazing plastic coating used on all types of surfaces interior or exterior. Eliminates waxing when applied to any type of floor. Tliminates all painting when applied to wood, metal or concrete surfaces. Minimum Investment—$500/Maximum Investment $12,000. For details write or call: Phone-314 AX-1-1500, PENGUIN PLASTICS CORP., 3411 North Lindberg Blvd., St. Ann, Missouri 63074.

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.

REMOTE CONTROL UNIT, brand new $5.00. Postpaid. (Cost Navy $125.00) MDC, 923 W. Schiller, Phila. 40.

ANTENNA tuning unit, brand new $3.00 postpaid (cost Navy $85.00). MDC, 923 W. Schiller, Phila. 40, Pa.

ANTENNA: 3 element, 10, 15, 20m. Hornet TB-500. Repaired. $25. H. W. Johnson, Box 81, Norris, Tenn.

10% discount from WRL's Blue Book Prices on quality used gear without trade-in. HT37—$275; Communicator III (2 or 6)—$169; Communicator IV (2 or 6) $219; SX101A—$219; SX117 $269; PSA 63 250 watt Universal P.S. $19; Mosely CM1 $95; NC300 $175; NC303 $269; SBE33 $249; Galaxy 300—$219; CE200V $429; Valiant $199. Free Catalog. We buy for cash—Inquire. Write: Leo WØGFQ, Box 919, Council Bluffs, Iowa.

TV CAMERAS. Model 400 complete with good vidicon and lens. Used as demonstrators. Only $200 F.O.B. Vanguard, 190-49 99th Ave., Hollis, N.Y. 11423.

SELL: Elimac 4x250B tubes. Guaranteed good. $6.50 each, $10.00 pair. Prepaid in U.S.A. Send check or money order. Everett Stidham, Jr., W5JLQ, 722 South 30th, Muskogee, Oklahoma.

INTERESTING OFFERS GALORE in the new "Equipment Exchange —Ham Trader"! Rush $1 for next 12 issues. Brand, WA9MBJ, Sycamore, Illinois.

RME 6900 Receiver and RME DB23 Preselector both excellent condition for first $200. W2DNG, 89 Van Horn, Demarest, N.J.

DX-40, VF-1, MR 1 w/power supply. Pick up $80.00. Package deal. K9ONT.

ART-13 with high and low solid state power supplies. Calibration and manual included. Pick up $80.00. K9ONT.

FOR SALE, Collins 51-J3 receiver, good condition. $250.00. Will ship. K5ZPJ, 1222 Gretchen La., Bossier City, La.

FOR SALE: HT-32A $300; SX101 MKIII $170. Both in excellent condition for $450. Used infrequently. Also newly purchased but unused equipment includes Hallicrafter HA-I TO keyer $75; Vibro-keyer $15; Hallicrafter R48-A Speaker $15; Johnson Low-pass filter $10; Turner SSB Ceramic Mike $10; SWR Bridge, Knight, $15; Dow Key Ant Relay DK60-G2C $13; Hygain Lightening Arrestor LA-1 $15; Johnson Standard Key $2; Mosley RV-4 vertical ant. $25; with roof mount kit RV4K $10; Heathkit Cantenna Dummy Load $5; 100 ft. RG8U Foam Core Cable $5; Will take $650 for entire station. Cash and F.O.B. Neena. Dr. O. E. Larson, K9LWG, 449 Edgewood Court, Neena, Wis. Tel. 414-PA 5-5227.

FOR SALE: Globe Scout 65A and Heathkit VFO w/pwr supply. Work all bands 50 watts fone and 65 watts cw. $50. Contact Gearson May, W4HOE, 301 Wildwood Drive, Jasper, Ala. 35501.

Need any band coils fitting HRO-7 and components or unit for ART-13 AC power supply. G. Evans, W4WVS, 803 Rosselle St., Jacksonville, Fla.

VHF—6 and 2 meter Heathkit Seneca phone cw transmitter built in vfo. Excellent condition $135.00 plus shipping. Robert Wolfe, W3HDT, 19 Virginia Ave., Baltimore, Md. 21236.

COLLINS STATION, like new, original cartons. KWM-2 $750, PM-2 Power Supply $110, CC-2 Case $55, SM1 mike $24, 312B-3 speaker $21. All fob Santa Ana. First check for $940 for lot. I pay shipping. W6AHC.

Wanted: constructional details of W 9 T O keyer which has appeared in some issues of Radio Handbook. G2DFX.

I need and will pay top price for a CRL Paragon plus Amplifigon for my antique radio collection. Same also applies to GREBE, KENNEDY, MARCONI, WIRELESS SPECIALTY and similar material. Worcester, R.D. 1, Frankfort, N.Y.

CANADIANS: Ideal first or mobile rig. Heath Cheyenne Commanche. Used two years. New tubes. VE2BQA, 4984 Circle Road, Montreal, Quebec.

WANTED: A few RK-65 or 304 TL xmitting tubes for high-power final and spares. Write card stating quantity condition and price. All replies answered. John Mayes, W4VJA, Route 13, Knoxville, Tenn. 37918.

FOR SALE: Collins KW-1. Excellent shape with spare tubes and modulation transformer. Best offer over 1800 dollars. Diagrams for SSB conversion included. Henry Galbraith, 1214 South Alvord Blvd., Evansville, Indiana 47714.

STAMP COLLECTORS: Will swap stamps (your choice) for amateur and military radio equipment, supplies, tech manuals, etc. John Reilly, 35-19 167th Street, Flushing, New York 11358.

LEARN CODE the V method, money back trial, guided sending, records, tapes, write. Page Electronics Institute 90037.

IDEAL MOBILE—same type #3012 (152-162 M.C.) and (40-50 M.C.) tuners for sale. Receive highway patrol, police, fire, secret service, taxi, mobile, telephone, etc. Also, Federal "DIRECTOR" Electronic Siren-PA, 12 volts all transistorized. 4 lbs. 150 watts siren, 125 watts audio output w/two speakers. Richard M. Jacobs WAØAIY, 1015 Glenside Place, University City, Missouri 63130.

COLLINS 75A-4 OWNERS: Don't trade up! Investigate our conversion that makes the 75A-4 a real dream. W2VCZ—30 Pitcairn Ave., Ho-Ho-Kus, N.J. 201-652-8494.

Wanted: Complete set, preferabiy bound volumes, CQ for 1945 through 1963. Must be in excellent condition. Write Charles Miller, W4AXV, 2875th GEEIA Squadron, Box 460, APO San Francisco 96323.

FOR SALE: NC 303 brand new, in original carton plus extras $300. EZ Way 400 foot tower with ground post, CDR Ham rotor and Hy-Gain 4 element Tri-Bander beam antenna $300.00, or Package Deal $450. McCormack 35a Edgewater Pl. Edgewater, N.J. 07020.

"S & H" GREEN STAMPS. Needed for Missionary Ham Station. Have your friends help too. Father Jude, WA2YNO, St. Paul's Abbey, Newton, New Jersey 07860.

Please . . .

When writing to *CQ* for any reason, be sure to include your **ZIP code.** It will soon be a postal regulation and may effect delivery of *CQ* to your door each month.

READER SERVICE

NAME_____ CALL_____
(Please Print)

ADDRESS_____

CITY_____

STATE_____ ZIP CODE_____

Please send me more information on your ads in the Nov. 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				☐

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Propagation (*from Page 77*)

tory reports a monthly sunspot number of 8.6 for August, 1965.

This results in a smoothed running number, upon which the sunspot cycle is based, of 12.2 centered on February, 1965. A smoothed sunspot number of 25 is predicted for November, 1965.

V.h.f. Ionospheric Openings

The *Leonids* meteor shower is expected to occur during the middle of November. This should result in some meteor-type ionospheric openings on the v.h.f. bands.

Some auroral-type v.h.f. ionospheric openings are likely to occur during the month, especially when ionospheric conditions on the h.f. bands are below normal or disturbed. Check the "Last Minute Forecast" at the beginning of this column for the days that are most likely to be in these categories during November.

73, George, W3ASK

CQ Short-Skip Propagation Chart

NOVEMBER & DECEMBER, 1965

At Path Mid-Point

(24-Hour Time System)

Band Openings Given In Local Standard Time

Band (Meters)	*50-250 Miles*	*250-750 Miles*	*750-1300 Miles*	*1300-2300 Miles*
10	*Nil*	*Nil*	10-16 (0-1)	09-10 (0-1) 10-14 (1-2) 14-16 (1)
15	*Nil*	*Nil*	09-11 (0-1) 11-14 (1-3) 14-17 (0-1)	08-09 (0-1) 09-11 (1-3) 11-14 (3-4) 14-16 (1-3) 16-17 (1-2) 17-19 (0-1)
20	*Nil*	09-11 (0-1) 11-14 (0-3) 14-16 (0-2) 16-18 (0-1)	07-09 (0-1) 09-11 (1-4) 11-14 (3-4) 14-16 (2-4) 16-18 (1-2) 18-20 (0-1)	06-07 (0-1) 07-09 (1-3) 09-16 (4) 16-18 (2) 18-20 (1)
40	07-09 (0-1) 09-12 (2-4) 12-14 (3-4) 14-16 (2-4) 16-18 (1-2) 18-20 (0-1)	07-09 (1-3) 09-14 (4-2) 14-16 (4) 16-18 (2-4) 18-20 (1-3) 20-00 (0-2) 00-07 (0-1)	07-09 (3) 09-14 (2-1) 14-16 (4-2) 16-18 (4) 18-20 (3-4) 20-22 (2-4) 22-00 (2-3) 00-03 (1-2) 03-07 (1-3)	07-08 (3-2) 08-09 (3-1) 09-14 (1-0) 14-16 (2-1) 16-17 (4-2) 17-18 (4-3) 18-22 (4) 22-00 (3) 00-03 (2-3) 03-07 (3)
80	08-17 (4) 17-20 (2-4) 20-22 (1-3) 22-07 (1-2) 07-08 (2-3)	08-09 (4-2) 09-16 (4-1) 16-18 (4-2) 18-20 (4) 20-22 (3-4) 22-07 (2-4) 07-08 (3)	08-09 (2-1) 09-16 (1-0) 16-18 (2) 18-06 (4) 06-07 (4-2) 07-08 (3-1)	08-09 (1-0) 09-16 (0) 16-18 (2-0) 18-20 (4-3) 20-04 (4) 04-06 (4-2) 06-07 (2-1) 07-08 (1)
160	09-17 (1-0) 17-19 (3-2) 19-07 (4) 07-09 (3-2) 09-11 (1-0)	17-19 (2-1) 19-05 (4) 05-07 (4-3) 07-09 (2-1)	17-19 (1-0) 19-21 (4-2) 21-04 (4) 04-05 (4-2) 05-07 (3-1) 07-09 (1-0)	19-21 (2-1) 21-04 (4-3) 04-05 (2) 05-07 (1-0)

*Indicates possible 10 meter openings.
†Indicates possible 160 meter openings.
‡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 time zone between Skagway and 141° west longitude, etc.

Hawaii

Openings Given In Hawaiian Standard Time‡

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

Alaska

Openings Given In GMT§

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

VHF (*from Page 84*)

Thirty

Would appreciate hearing from readers who are making the APX-6 conversion currently running in *CQ*. We've had loads of fun with these little black boxes on 1296, using everything from dipoles through corner reflectors, to parabolas. APX-6 nets have formed in several regions that have been quite successful in years past; perhaps now more will spring up throughout the country.

K2UYH will be in attendance at the Syracuse Roundup by the time this gets typeset, so will try to have a report on doings for December.

73, Bob, K2ZSQ & Al, K2UYH.

PLEASE include your ZIP code number on all correspondence.

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the catalog every ham uses
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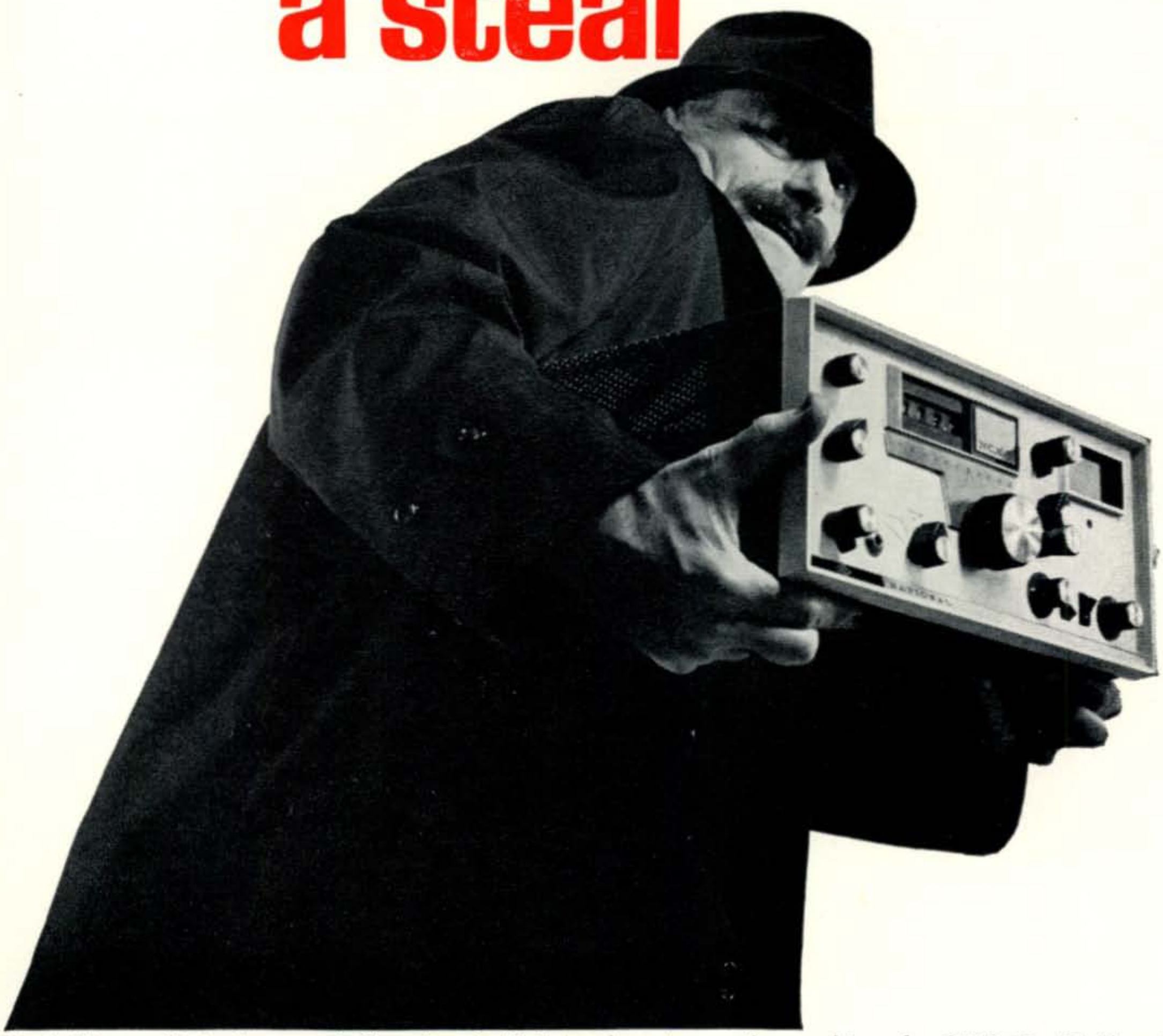
a steal



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