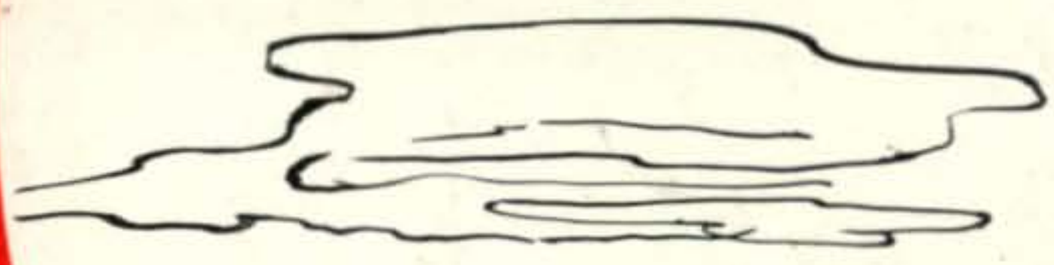
CQ

February 1966
75¢



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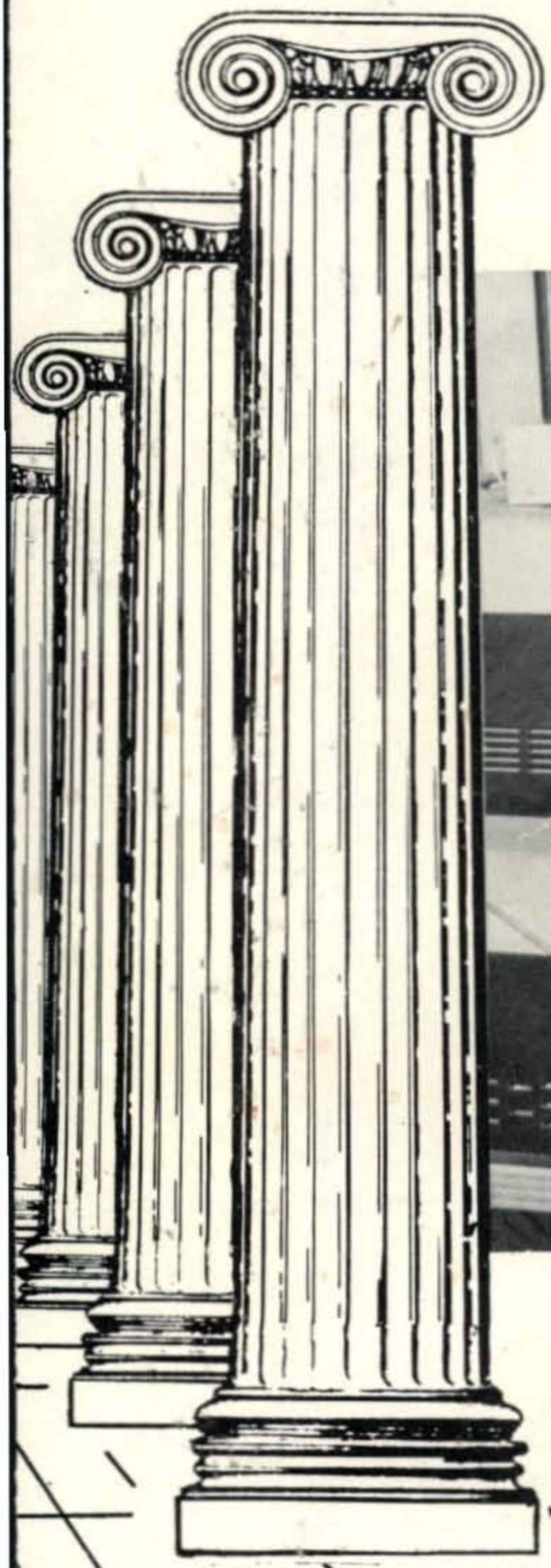
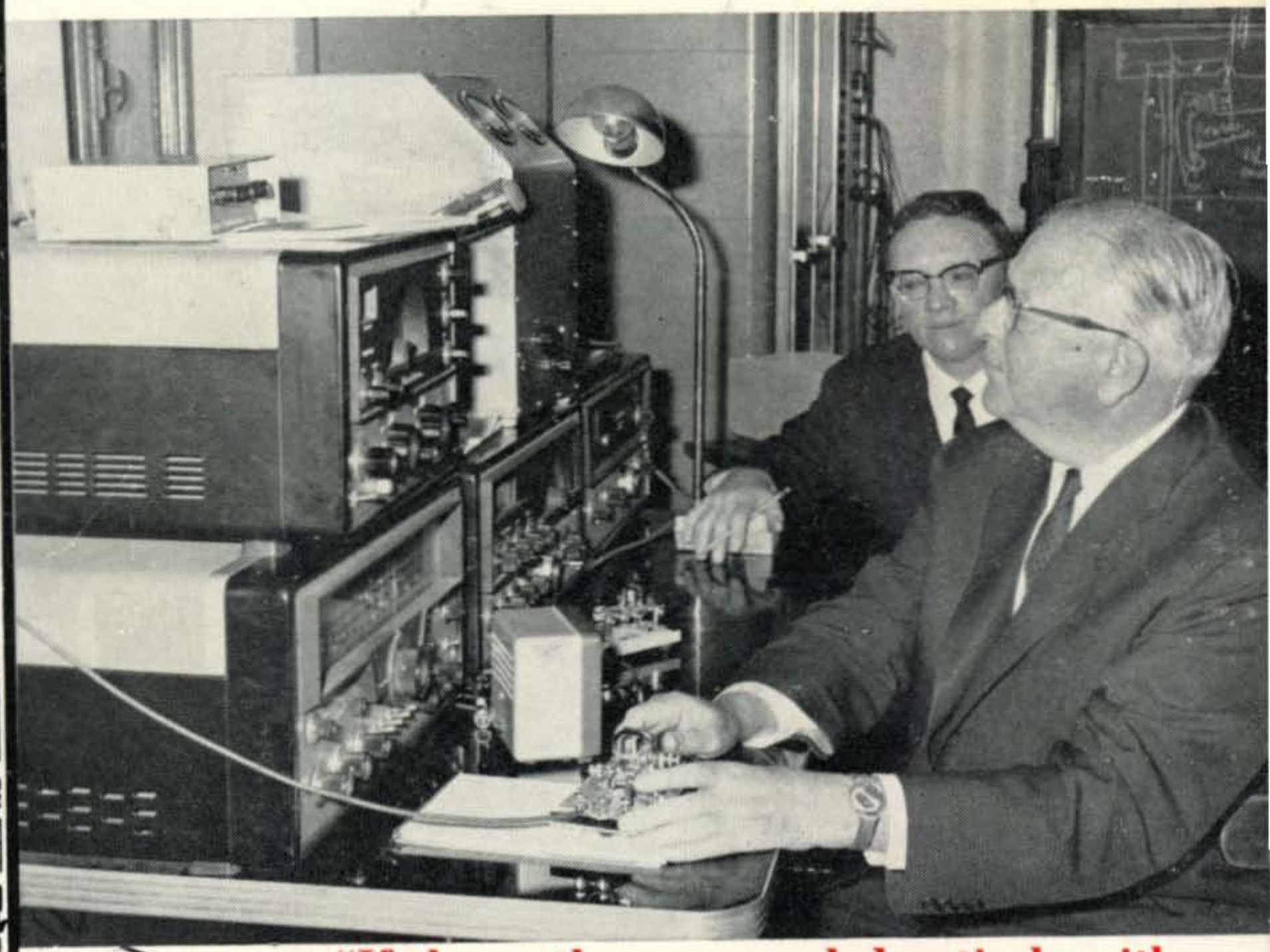


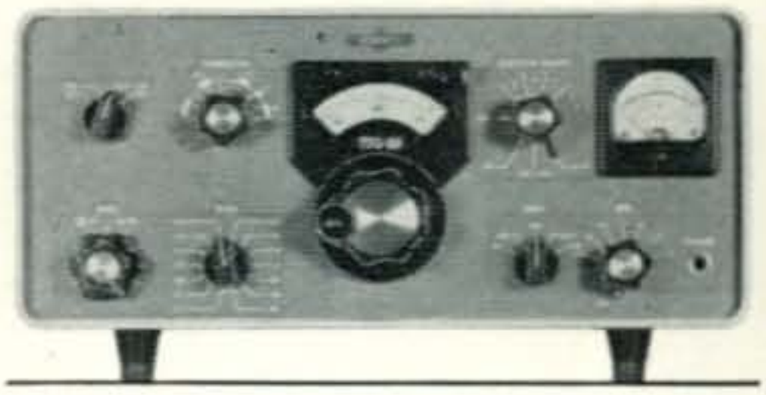


"If the earth were peopled entirely with radio amateurs the road to peace would be as wide as the world."

—W9AC/W4AK

The Radio Amateur's Journal

73, Old Man! No matter what language it comes booming in on, you can work the best with Collins' S/Line. One star of this *complete* fixed station is the 75S-3B, featuring *sharpest selectivity* on SSB, CW and RTTY — optional filters that give you up to three degrees of selectivity in CW/SSB, and with a filter socket for AM-rejection tuning, AGC, and spinner tuning knob. Contact your authorized Collins distributor today. You'll be surprised to find how little it costs to own the finest.



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For further information, check number 1, on page 112

Hallicrafters advanced technology brings you a new breed of amateur equipment

SX-146 Receiver

This is an amateur band receiver of advanced design employing a single conversion signal path and pre-mixed oscillator chain to assure high order frequency stability and freedom from adjacent channel cross-modulation products. The SX-146 employs a high frequency quartz crystal filter and has provision for installation of two more crystal filters. The receiver may also be used from 2 to 30 mc, with the exception of a narrow gap at 9.0 mc, with the connection of auxiliary oscillators. The highly stable conversion oscillator chain may be used for transceiver operation of the matching HT-46 transmitter.

FREQUENCY BANDS: 3.5-4.0; 7.0-7.5; 14.0-14.5; 21.0-21.5; 28.0-28.5; 28.5-29.0; 29.0-29.5; 29.5-30.0 mc (28.0 to 28.5, 29.0 to 30.0 requires extra crystals at users option).

SENSITIVITY: Better than 1 μv for 20 db S/N.

TUBES AND FUNCTIONS: 6JD6 RF amplifier; 12AT7 Signal mixer and cathode follower; 6AU6A 9 mc IF amplifier; 12AT7 AM detector—AVC rectifier—product detector; 12AT7 USB—LSB crystal oscillators; 6GW8 Audio amplifier and audio output; 6BA6 Variable frequency oscillator; 6EA8 Crystal heterodyne oscillator and pre-mixer; Plus diode power supply rectifier, ANL diode and AVC gates diode; *6AU6A—100 kc crystal calibrator oscillator; *Harmonic generator diode.

PHYSICAL DATA: Size: 5⅞" x 13⅛" x 11". Shipping wt., 20 lbs.

FRONT PANEL CONTROLS: Frequency: Power off CW-upper-lower and AM; Audio gain; Band selector—3.5, 7.0, 14, 21.0, 28.0, 28.5, 29.0, 29.5; Selectivity—0.5, 2.1, 5.0 kc (0.5 and 5.0 kc filters optional extra); Pre-selector; RF gain; AVC on-off; Cal. on-off; ANL on-off; Phone set jack; Smiter.

REAR CHASSIS: S-meter zero adjust; Internal-External oscillator switch; Slave oscillator output; External oscillator input; Antenna socket; Speaker, ground and mute terminals; Grounding stud; AC power cord.

POWER REQ.: 105/125 volt—50/60 cycle AC—55 watts.

I-F SELECTIVITY: Uses a 6-pole crystal filter to obtain a nose-to-skirt ratio better than 1 to 1.8.

Amateur net, $269.95

Model HA-19 plug-in, 100-kc quartz calibrator available as accessory. **Amateur net, $19.95**

**Part of HA-19 calibrator.*

HT-46 5-band transmitter

All new from the ground up! Here's the "new breed" transmitter that matches your SX-146 . . . works independently or may be interconnected for transceiver operation.

FEATURES: 180 watts PEP input on SSB; 140 watts on CW; Frequency control independent or slaved to SX-146 receiver; Upper or lower sideband via 9 mc quartz filter; Built-in power supply; Press-to-talk or optional plug-in VOX; grid block for keying for CW.

FREQUENCY COVERAGE: 3.5-4.0, 7.0-7.5, 14.0-14.5, 21.0-21.5 mc and 28-30 mc in four 500-kc steps. Crystal supplied for 28.5-29.0 mc coverage. Other plug-in crystals at user's option.

TUBES: 6BA6 VFO; 6EA8 Heterodyne crystal oscillator and mixer; 12AT7 Carrier oscillator-third audio; 12AT7 Mic amplifier; 6EA8 9 mc I-F amplifier and AALC; 6AH6 Mixer; 12BY7 Driver; 6HF5 Power amplifier; 0A2 Reg.

FRONT PANEL CONTROLS: Frequency Tuning; Operation-Off, Standby, USB, LSB, CW-Tune, Standby LSB USB; Microphone gain; Driver tune; Carrier level; Band selector; Final tune; VFO selector—Transmitter-Receiver; Dial cal.; Calibrate Off-On; Meter MA-RFO.

REAR APRON FUNCTIONS: AC Cord; Ground lug; Fuse; Key jack; VOX accessory socket; Antenna jack; Receiver input (for transceiver); 11 pin control socket; bias adjust.

PHYSICAL DATA: Size: 5⅞" x 13⅛" x 11". Shipping wt., 26½ lbs.

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Export: International Division

Available in Canada from Gould Sales Co.

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CQ

FEBRUARY 1966 VOL. 22, No. 2

The Radio Amateur's Journal

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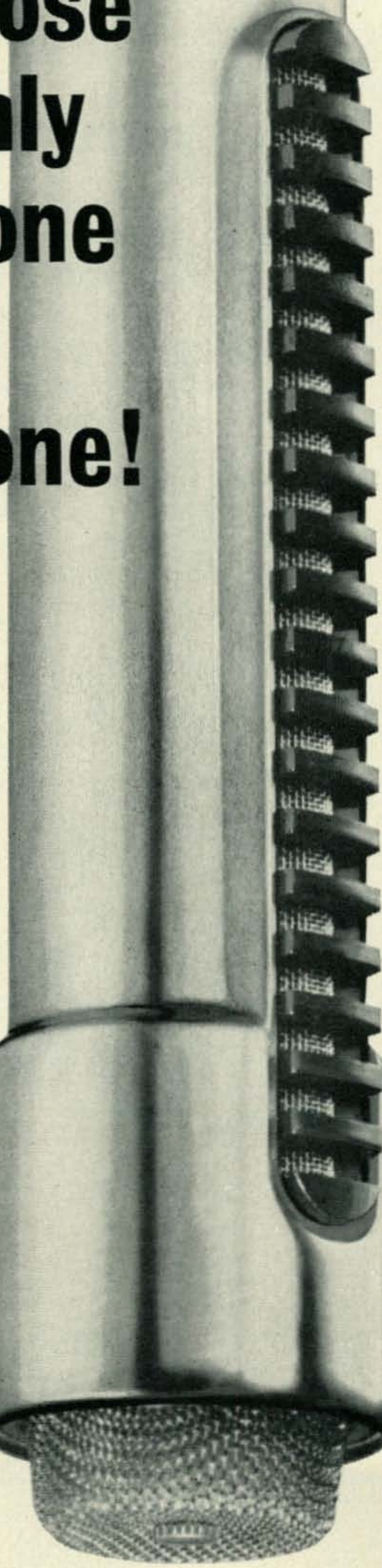
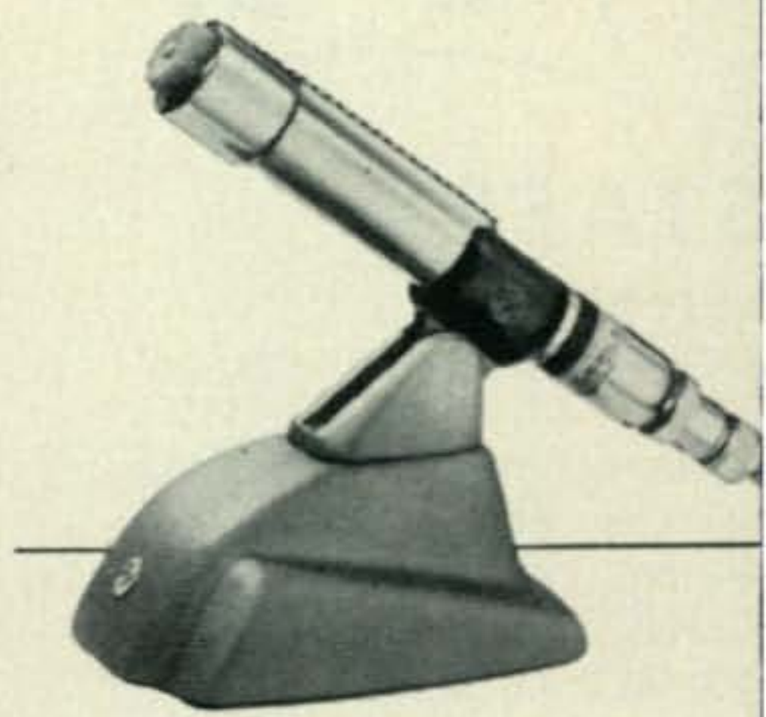
When QRM Gets Tough Choose The Only Microphone With Backbone!





ELECTRO-VOICE
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The backbone of the Electro-Voice Model 676 is no mere decoration. It's visible proof of the most exciting idea in directional microphones—Continuously Variable-D (CV-D)™.

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For further information, check number 4, on page 112

EIMAC introduces 5-500A pentode for retrofit into 1 kW AM transmitters

If you use 400 feet of RG8U coax between transmitter and antenna, your 1 kW AM transmitter using a pair of 4-400A's has to work harder to generate 1200 watts so you'll have 1 kW at the antenna base. That's marginal operation. There's no need for marginal operation with Eimac's new 5-500A power pentodes. Running well within ratings, this inexpensive new 500 watt tube is ideal for retrofit in 1 kW AM transmitters: just change the filament transformer and readjust bias and screen voltage. The 5-500A features a balanced filament which comfortably exceeds FCC hum and noise specifications. As a linear amplifier, the 5-500A will provide a two-tone signal with third order products of −39 db at 450 watts PEP, or −32 db at 600 watts PEP. Write Power Grid Product Manager for details or contact your local EIMAC distributor.

5-500A CHARACTERISTICS CHART

Maximum Ratings Plate Modulated

Radio Frequency Amplifier	
DC Plate Voltage	3200 V
DC Plate Current	340 mA
Typical Operation (Carrier Conditions)	
DC Plate Voltage	2700 V
DC Screen Voltage	475 V
DC Plate Current	280 mA
Carrier Power	600 W

EIMAC
San Carlos, California 94070
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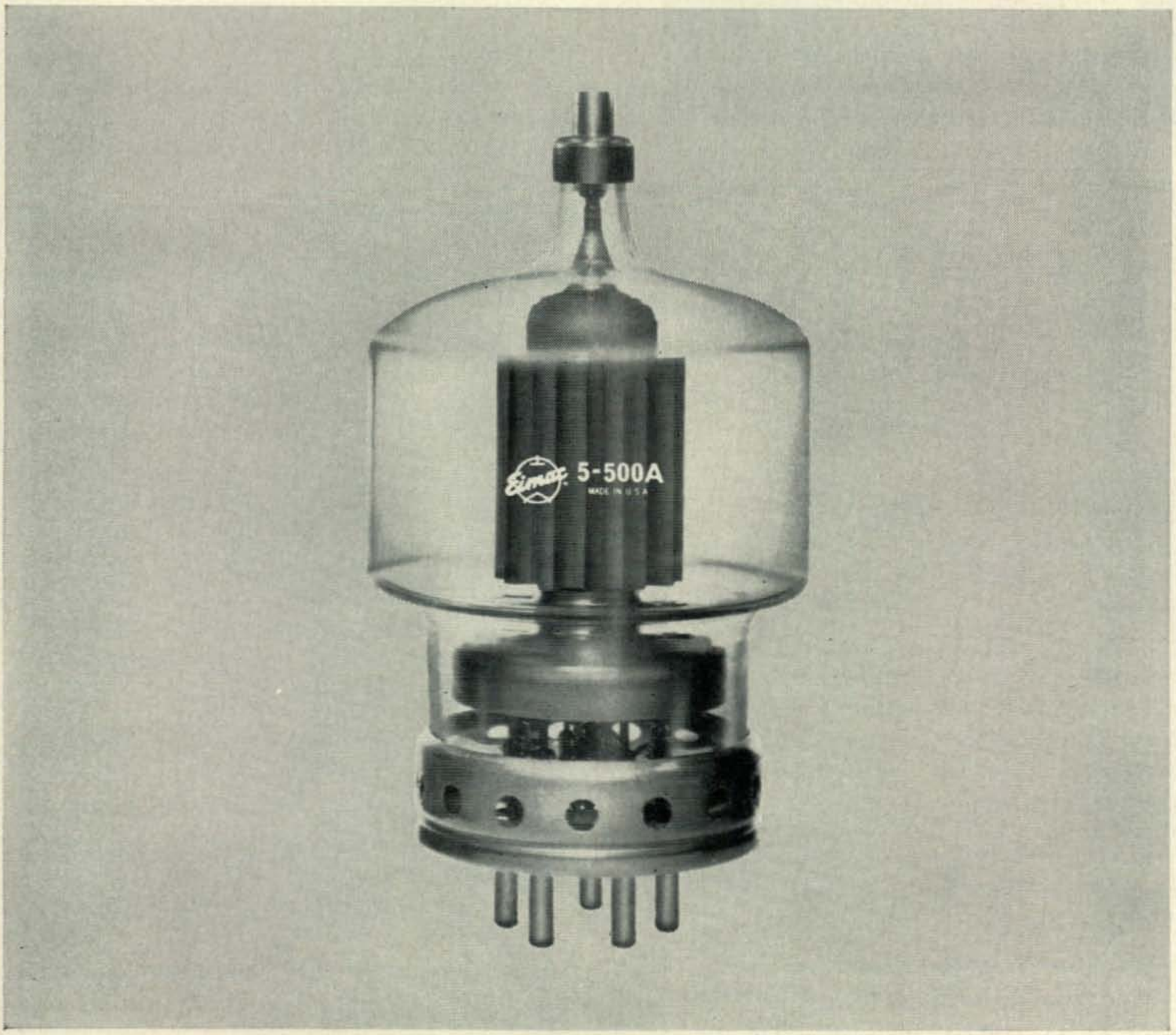
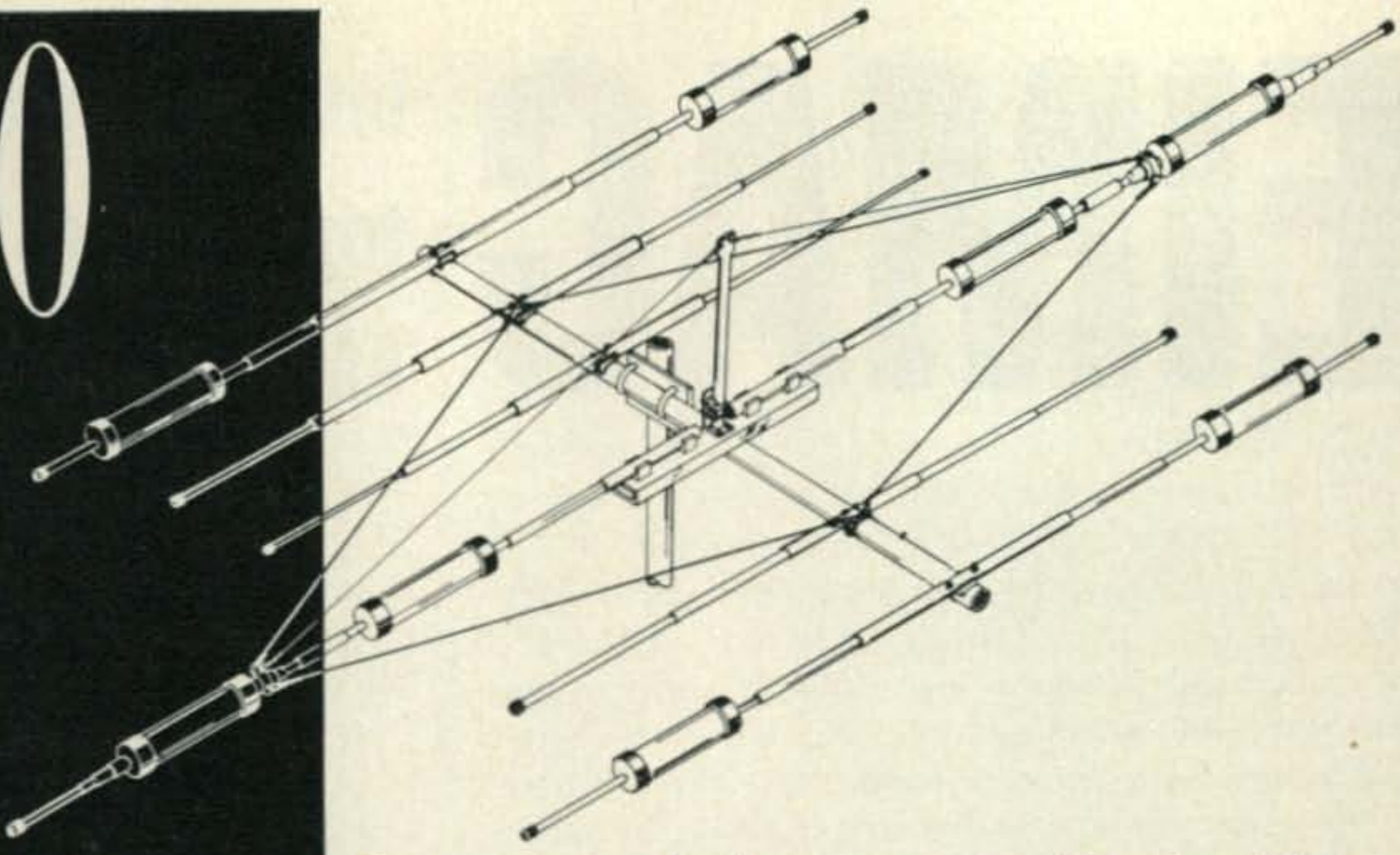


For further information, check number 5, on page 112

TA-3640

for 10 15 20 and 40 meters



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

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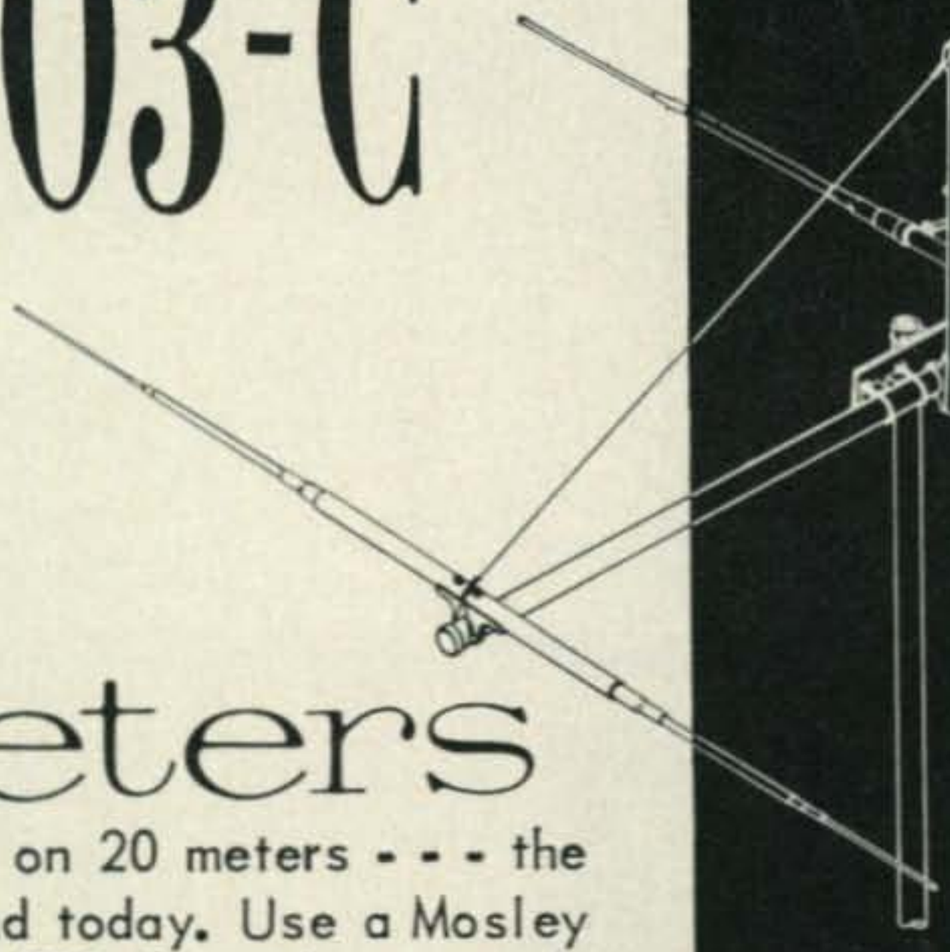
A-203-C

for 20 meters



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

For further information, check number 6, on page 112

ZERO BIAS

I AM pleased to present another side of the DXpedition story this month, in the form of a letter to *CQ* from Don Miller, W9WNV. Don's letter, relayed through W4CCB, tries very valiantly to justify the ill will created by his attitude and operations at Spratly and Cormoran. However, his terribly defensive attitude to some rather mild criticism seems only to reinforce the opinions of many readers that something was not right on these operations; if only in the lack of ham spirit and sportsmanship. Don states that his goals are not necessarily identical to those of amateur radio's most eminent DXers and DXpeditioners. Perhaps this is the soul of the unpleasantness. What are Don's goals?

Self-satisfaction, obviously, is one goal in his operations as it is with any DXpedition, but underlying the two very controversial operations at Spratly and Cormoran is a subtle "public-be-damned" and "tradition-be-damned" attitude which many, if not most, DXers find unpleasant. But as Don says, he's "not running a popularity contest." How true!

At any rate, here's Don's answer to W2DEC's comments, and my own, in January *CQ:*

Dear *CQ* Staff:

I will waste but a few minutes of time which is precious to our DXpedition to reply briefly to the immature, slanderous and unscrupulous charges and comments in the editorial and DX column in the January *CQ* relating to myself and this DXpedition. Indeed, the article in the DX column is the only fairly current information I have seen in this section since I first gazed at a *CQ* 15 years ago.

I never had any intention of following the footsteps of Gus Browning, Danny, or Dick, WØMLY—they have their goals; I have my own. It is commonplace for individuals to set goals for themselves in the sport or hobby or similar venture of their choice—whether to climb a mountain, swim a channel, win a race or even to provide amateurs the opportunity and thrill of communicating with areas of the world not previously available to them (Communist China, "banned" countries, etc.), no principles merit comparison. Just as an expedition can scale Mt. Everest and may be supported by the National Geographic Society or the Smithsonian Institute, our DXpedition is supported by the World Radio Propagation Study Association. All of these organizations are working with voluntary contributions from individuals interested in that particular field. No matter how grateful we may be for this support, we have never entertained the thought of promising anything in return such as a QSO or QSL, although those making this DXpedition possible receive their QSL cards direct and therefore, in many cases, before the rest of the DX gang get theirs from Ack. Since we QSL 100%, we do not feel that this could be called unfair favoritism, particularly because a QSO with any of our stations depends not on whether a ham has contributed financially, but only on his signal, his operating tactics, and conditions. Indeed, many supporters of the DXpedition have not had a QSO with some of our operations. Since I am not afflicted with "honor-roll mania," and have not memorized the standings of that institution, a QSO could hardly depend on how many countries a DXer has to his previous credit.

For the ARRL to recognize for DXCC credit only operations by resident amateurs of a particular country would be even more ridiculous than not recognizing the climbing of Mt. Everest because the climbers were not from Nepal. Just as adventuresome individuals come from all parts of the world to climb Everest, it is not unreasonable that a ham may make a project of his own personal goal in making his way to a rare country, obtaining a permit, and successfully activating amateur activities there. *CQ* might just as well oppose the reciprocal licensing bill.

The advantages of this type of an amateur radio operation are many and obvious—promotion of international understanding, bringing recognition to an area of the world about which little is known, sometimes creating a surge of amateur activity in an area where it was lacking previously, increased DX activity on the bands, added interest among the DXers, improved operating techniques, love of competition, etc., etc., etc.

Understandably, those near the top of the Honor Roll would tend to be the most spastic in seeking new countries, and the temptation to cheat and to use poor operating practices would be much greater to them than to the average DXer, for the thought of missing a new one is far more horrifying to these select few, especially regarding an operation such as 1S9WNV, Spratly Island, in which we were to be on the air only a day. At that, and other QTH's, I have witnessed some most atrocious and rude operating tactics by certain individuals, and, frankly, I do not enjoy communicating with these hams any more than I would invite some rude and discourteous individual with poor manners to my home for dinner. It is every amateur's prerogative to communicate with whom he pleases, and for *CQ* to disallow credit toward their awards because some Honor Rollers were missed is infantile. You are behaving like the 10 year old boy threatening to take his bat and ball home when he finds he is unable to break into a crowded line-up in the first two innings.

The lunacy you attribute to me may exist, but regarding the Spratly and Cormoran operations some DXers behaved like frantic lunatics and I took it upon myself to delay their QSO in the way of a slight hint—apparently some of these DXers were high on the Honor Roll. The lily-white picture you paint of the Honor Roller adds a humorous touch to the article as well as keeping in line with the distortion you present. In the way of added distortion, the glorious flattery used as introduction is misdirected; most of these achievements should be directed to Chuck Swain, K7LMU, and not to myself.

You seem to threaten that you won't count our future operations toward your awards unless we work the amateurs you want us to work. Whereas your *CQ* editorial discusses "falsely created competition," what could be more false than this? I could not care less whether you accept my operations or not; we are not running a popularity contest. I will point out, however, that if any DXer gets missed from any of our stops, it's not because of his Honor Roll standings; it's not because of his inability to contribute financially; it is because either he was not heard, or because when I did hear him he was making a nauseating mess of DX.

The false statements contained in the DX column, particularly such as logging QSO's which did not exist, etc., will be handled in due time by the courts. It will also be interesting to see your DX editor demonstrate that certain stations were "getting through" when the fact remains that they did not "get through" at all. Perhaps this method of distorting second-hand information for the benefit of a few cry-babies is a manifestation of the recent withdrawal of your DX editor from active participation in DX; his recent loss of touch with DX may be deliberate and a reflection of the lesson he may have learned when you dropped Irv and Dorothy's SSB column just at the time it became the most current and informative activities column in your magazine.

There are usually two sides to a story, but in this case there is only one—your magazine presents no side at all, just a sick mess of wild speculations based on erroneous, second-hand information. It would have been decent for you to have first contacted me for the real information before presenting such a slanderous attack on such false grounds.

73's and good DX,
Donald A. Miller, MD, W9WNV
Nieue Island

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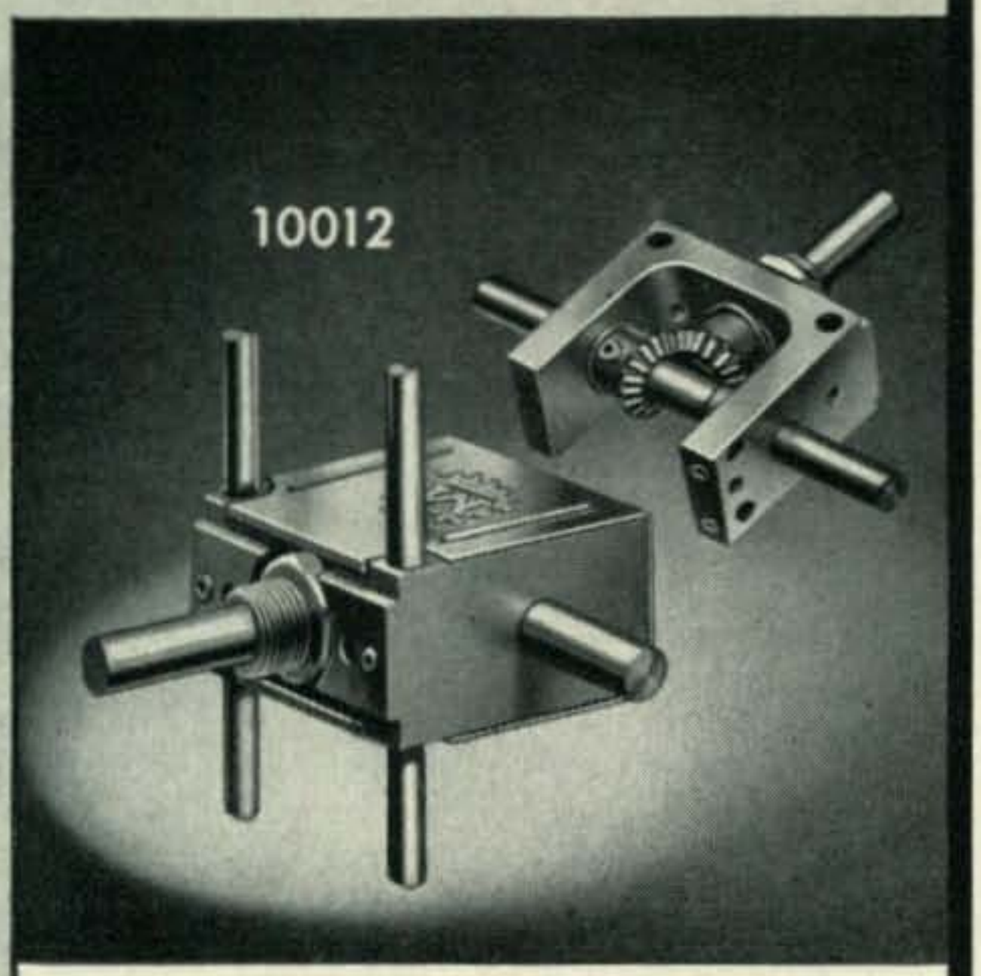
Application



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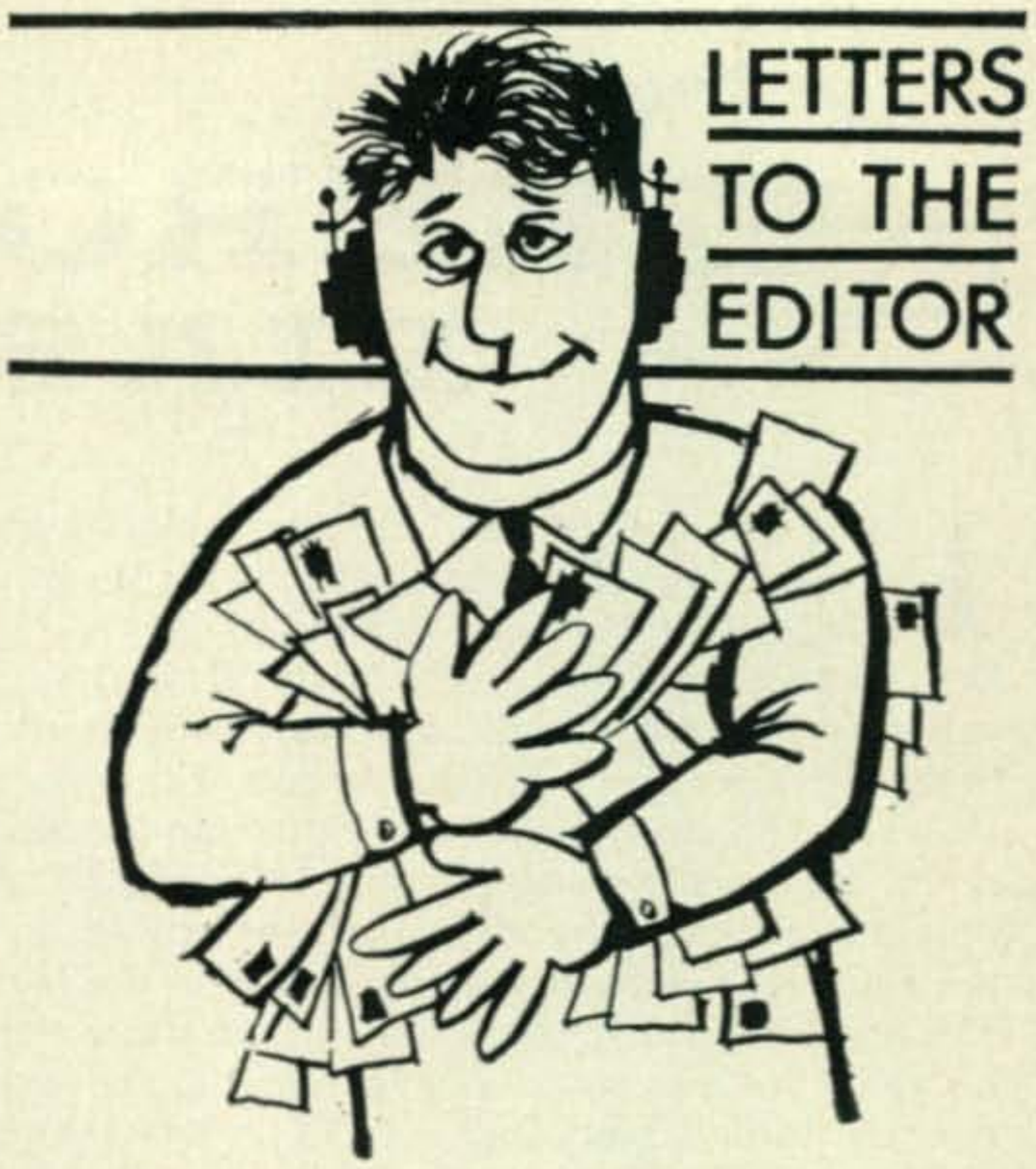


LETTERS TO THE EDITOR

January's Zero Bias

Editor, *CQ*:

An obstreperous HURRAH for a long overdue editorial comment on the deceitful, fraudulent meretricious, adulterated practice of DXpeditioning.

Place equal shame on the contributor as well as the recipient of monies for bogus QSL confirmations. Truly a step rearward for amateur radio.

Ronald Lumachi, WB2CQM
73 Bay 26th Street
Brooklyn, New York 11214

Dear Dick,

This new country business you speak of is no worse than the goal of any other of the popular hobbies, i.e. the big fish for the fisherman, the rare wild game for the hunter, the new heavenly body for the astronomer, etc., and it is not uncommon for these hobbyists to set by the hour waiting for their goal. In fact, we have it much better; we can sit in the comfort of our homes, while others may have to wait in the freezing cold outdoors. There is no other phase of amateur radio that fulfills this particular need or desire. Certainly rag chewing across town or across the state, calling into some net for the sake of calling in, or stateside phone patches, does not do the same thing and we could write books on these subjects.

Now as for DXpeditioners, as you know, there are some countries where there has been no ham activity for some time, and yet, some people do have credit for past activity there. The only way to also contact this country is to hope that 1. some native will start operating and hope that he likes to work DX, and hope that he likes to QSL, or 2. support someone, native or traveler, that *will* work DX and that *will* QSL. The latter makes more sense to me, doesn't it to you? And if you were a rare DX station (native or DXpeditioner), for only a day on the air, you would see it takes money to be rare DX to operate and to QSL. A contribution for each QSL is the least one can do to help for the printing of cards, power costs, and other expenses to give you a new country.

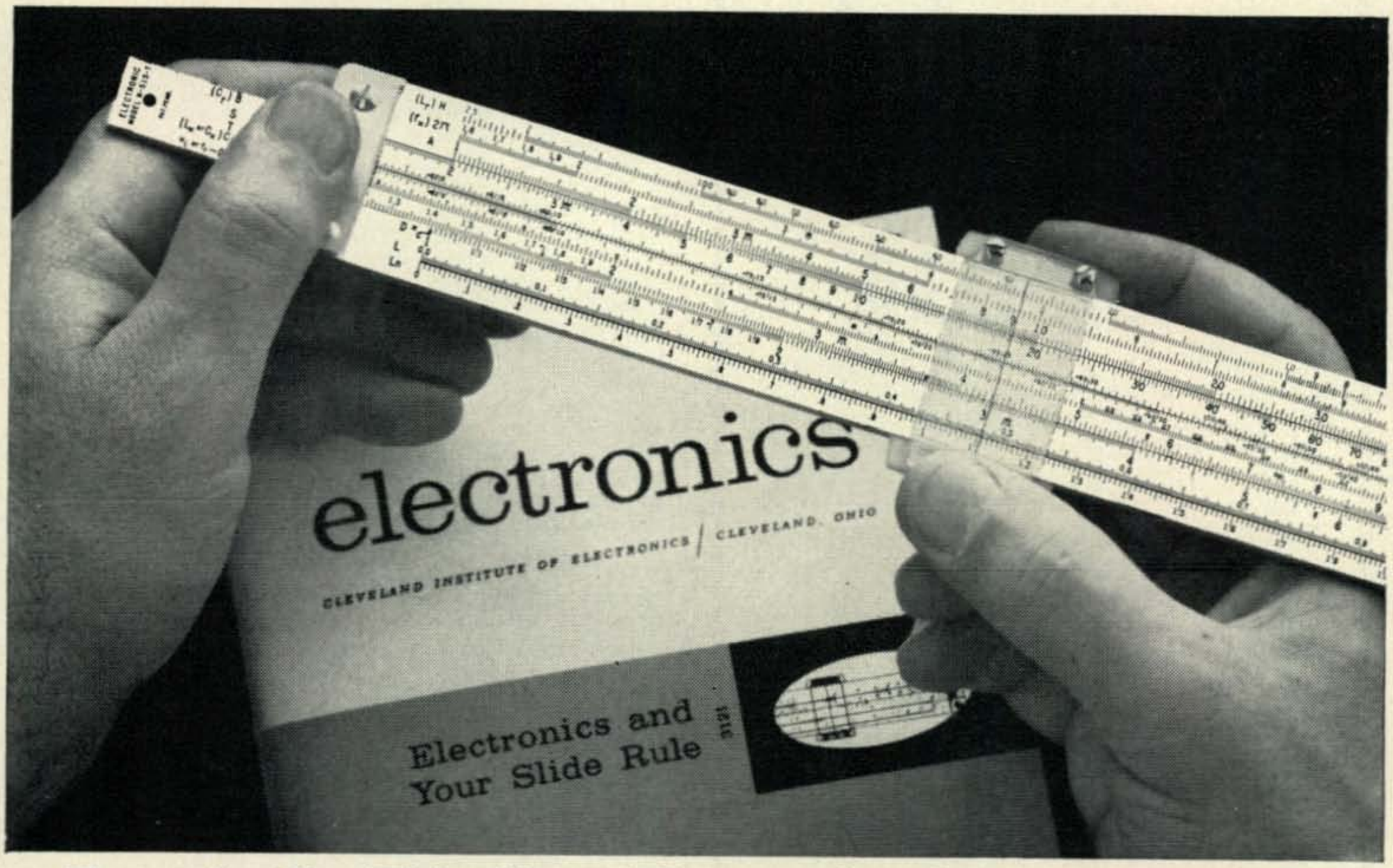
To sum it up, Dick, I feel as if you were "way out" on your editorial and it is obvious that you are not a DXer and probably do not even have DXCC, so you really don't even know what you are talking about. I enjoy *CQ* magazine very much and I hope that us DXers can win you over to our side.

Louis E. Persons, O.D., W4PJG
P.O. Box 1647
Fort Myers, Florida 33902

Dear Dick,

Your fine editorial on "buying DX" in January *CQ* certainly put light into a dark corner of amateur radio—where light was much needed. It is inter-

For further information, check number 8, on page 112



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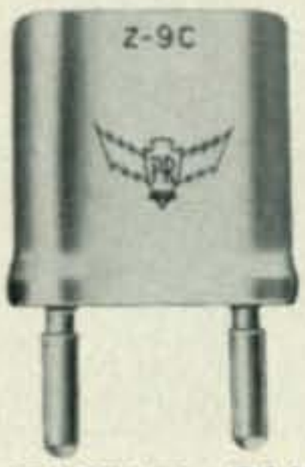
FUNDAMENTAL, PR TYPE Z-9C



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

(All Z-9C Crystals calibrated with a load capacity of 32 mmfd.)

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

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Radio Control, PR Type Z-9R
Calibrated .005% . . . . $2.95 Net
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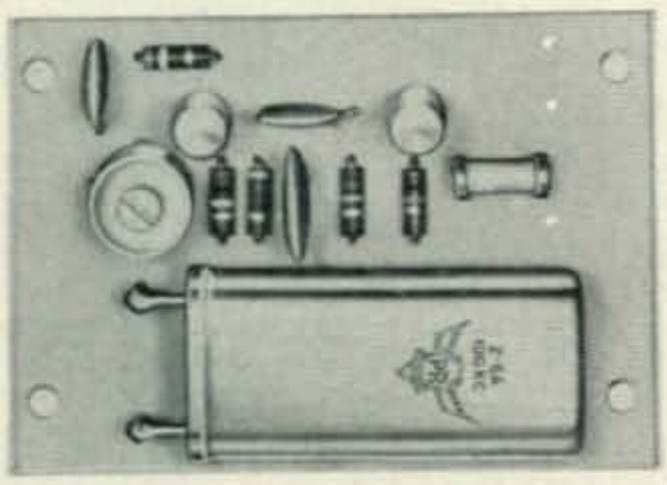

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For further information, check number 10, on page 112

esting that no other nationally circulated ham publication had the courage to blow the whistle!

DX chasing is fun; but let's stick to reality, and get out of the dream world of DXpeditions.

George H. Goldstone, W8MGQ
1010 Burnham Rd.
Bloomfield Hills, Mich. 48013

Dear Dick,

You asked for comments on your last editorial on DXpeditions, and I would like to make a few for what they may or may not be worth. . . .

At my age one doesn't get mad or fly off the handle, at least I don't. I don't entirely disagree with you on the matter of DXpeditions, but I do feel, like taxes, they are here to stay and somebody has got to pay for them, whether they do it by contributions in lump sums, contribute per QSL's, or purchase of equipment from some manufacturer who may be footing the bill—charging a substantial amount off to taxes. The boys who don't have it, must be carried free.

I'm not on the Honor Roll yet, but I will be shortly with two stations, operating both at the same time during the low portion of the sun spot cycle which means 20 and 40 meters only.

If Don has been the cause of some concern to a number of the honor roll members, this would not be the first time it has happened, or the first operator who has done it. I don't believe Don or anyone else has taken any dislike to these fellows because they are high up on the honor roll, but because a number of them, not all, have taken an attitude of tremendous importance, spent a lot of time on the air making a lot of remarks that don't really belong on the air at all, writing letters, and carefully guarding the many deep secret methods of working DX, which they feel they have.

Thank goodness for intelligent people who consider amateur radio only a part of their life, not their whole life. There shouldn't be anything about being on the honor roll to make anyone feel he lives in some kind of ivory tower and is a heck of a lot better than many other men and women on the air.

An intelligent 16 year old kid with a peanut whistle, and a fishing pole could make the Honor Roll during the high portion of the sun spot cycle, if one could be found that could sit still long enough and be taught to listen for DX instead of pounding the key all the time.

In a few words, let's stop all DXpeditions if a way can be found to accomplish it. But as long as we have them, why shouldn't the few Honor Roll holders learn something about good manners and leave off their arrogant attitude that may have made a number of operators not particularly anxious to work them. We are human beings, let's treat each other as such, whether we are on the Honor Roll or not. If the boys are going to pay for a DXpedition, how can someone who participates and has money, be proud of refusing to send in a couple of bucks when he is only letting the other boys pay his bill for him?

T. Frank Smith, W5VA/W5AI
P.O. Box 840
Corpus Christi, Texas

Dear Dick,

You and I are certainly thinking alike! The ZERO BIAS in January *CQ* is very much the same as the ideas I passed on to ARRL last October.

I just couldn't stand the attitude Don and Chuck took during their operation from Spratly Islands and Cormoran Reef and as a long time member of ARRL I wrote to Herb Hoover recommending that DXCC credit be denied for QSO's with 1S9WNV. He replied pointing out that they (ARRL) were much concerned but that it was a knotty problem. He suggested that if I had any ideas on the subject that I pass them on to Ed Handy. I enclose a copy of my letter of Oct. 22, 1965 to Ed. I have also written to him recently drawing his attention to your ZERO BIAS and also Urb's *DX* column in January *CQ*.

It is high time that some definite action be taken on this subject and I am delighted to see that you have started the ball rolling.

Henry R. Pemberton, W3PN
812 Maplewood Rd.
Wayne, Pa. 19087

Editor, *CQ:*

It seems that you have set yourself up as judge and jury. I thought that in America *everyone* was given a chance to prove their innocence. I must have been mistaken,

NOW! A TRI-BAND SSB TRANSCEIVER KIT FOR 189.95

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:**

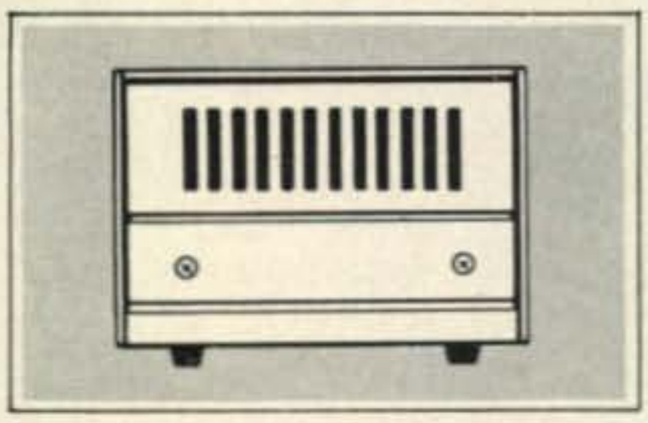
■ Full band coverage on 80, 40 and 20 meters. ■ Receiver offset tuning (up to ±10kc) without altering transmitter frequency. ■ Built-in VOX. ■ Panel selected VOX, PTT & STANDBY. ■ High level dynamic ALC to prevent flat-topping or splatter and permit the use of a linear amplifier. ■ Automatic carrier 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

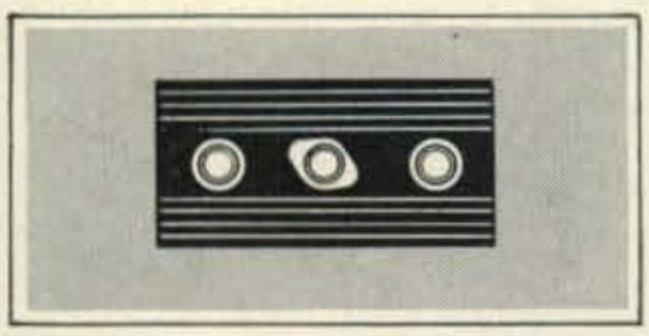
FREQUENCY COVERAGE: 3490-4010kc, 6990-7310kc, 13890-14410kc. SSB EMISSIONS: LSB 80 and 40 meters, USB 20 meters. RF POWER INPUT: 200 watts SSB PEP and CW, 100 watts AM. RF POWER OUTPUT: 120 watts SSB PEP and CW, 30 watts AM. OUTPUT PI NETWORK MATCHING RANGE: 40-80 ohms. SSB GENERATION: 5.2 Mc crystal 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



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For further information, check number 11, on page 112

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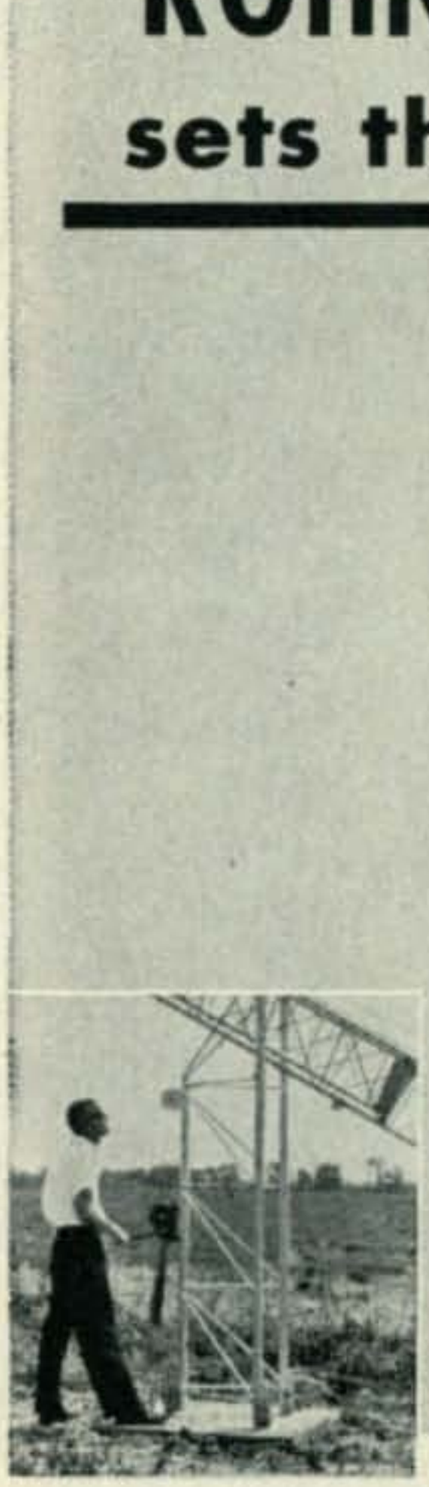

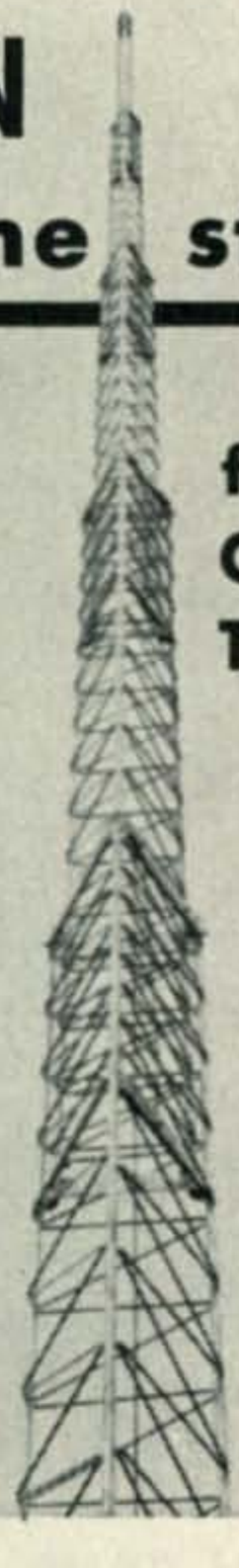

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TWO CATEGORIES TO CHOOSE FROM

Standard Duty Guyed in Heights of 37 - 54 - 88 - 105 and 122 feet

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ROHN has these 6 IMPORTANT POINTS:

Ease of Operation—roller guides between sections assure easy, safe, friction-free raising and lowering. **Strength**—welded tubular steel sections overlap 3 feet at maximum height for extra sturdiness and strength. Unique ROHN raising procedure **raises all sections together**—uniformly with an equal section overlap at **all** heights! **Versatility**—designed to support the largest antennae with complete safety and assurance **at any height desired! Simple Installation**—install it yourself—use either flat base or special tilting base (illustrated above) depending on your needs. **Rated and Tested**—entire line engineered so you can get exactly the **right** size and properly rated tower for **your** antenna. The ROHN line of towers is **complete. Zinc Galvanized**—hot dipped galvanizing a standard—not an extra—with all ROHN towers! Prices start at less than $100.

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"World's Largest EXCLUSIVE Manufacturer of Towers; designers, engineers, and installers of complete communication tower systems."

For further information, check number 12, on page 112

because you and Urb Le Jeune have both sentenced this man without listening to his side. I do not agree with what Don Miller has done, but I will wait to hear what Don has to say before I condemn him.

I also believe that the SSB and DXCC Honor Roll should both be changed so that stations are listed in alphabetical order and no totals be given. This would take the pressure off of the Honor Roll boys to work each and every new one that is on. It would also prevent the blackmailing of the top boys to buy that important new one. I believe that this would also make the XYL's very happy.

Bill Dennis, KØUKN
1618 N. 61st Street
Omaha, Nebraska

See January 1966 *QST*, page 88, for the first step in that direction.

Has anyone "sentenced" W9WNV, or is he simply being indicted by the great majority of DXers, and called upon to explain his "unusual" behavior?—*K2MGA*

Editor, *CQ:*

Your editorial regarding the Don Miller-Chuck Swain DXpedition was one of great interest to me, and your sentiments were, in my opinion, both timely and highly accurate.

I have been fortunate enough, as the result of hard work, to contact this DXpedition from each new location, with one or two exceptions when I was not in touch with my station. When I QSL'ed, I sent a contribution of $1.00 with each new card. I sincerely didn't mind doing this, as I realize it is expensive to travel as they do and I knew I had honestly worked them and was not, as you so nicely put it, trying to "buy a QSL."

However, just before the 1S9 operation, I chanced to hear Don talking around 14,160 kc to Ack, W4EDI. It soon became apparent that this new country was to be for the benefit of the large contributors only. A statement to the effect that this might tend to aggravate a few people brought a reply from Don that "It's our expedition and we'll work whom we wish." I believe everyone knows the outcome of that effort on their parts. The dust has yet to settle and probably won't. Perhaps it is unfair to compare Gus with this group, but I didn't see any of the high pressure tactics being used with Gus.

In my opinion, therefore, Don has violated almost every rule in the book with conduct of this sort. It begins to seem that the whole mess is nothing more than a means to a fast buck. [*not so!*—Editor]

I would rather see the entire expedition ruled ineligible for credit than take a chance that others will be encouraged to employ similar tactics.

Amateur radio has enough problems as it is. We don't need this one.

Edward W. Sleight, K4DJC/4
3267 Creighton Blvd.
Pensacola, Fla.

AHC, NAHC and CHC

Dear Dick,

The December issue of *CQ* just arrived, and I read with great interest the letter of WA2SAZ on page 14. Smitty tells about K6BX's *Newsletter* with the big news that AHC (The Award Hunters' Club) has sued NAHC . . . It's the first time we at AHC know about such, hi! Vice versa. Immediately after hearing about the foundation of the NAHC we contacted the new club and have exchanged a few hearty letters since that. The AHC has —as WA2SAZ wrote in his letter—welcomed the NAHC to the big field of awards, and we have congratulated this new organization for their good start. All this holds good still.

The Award Hunters' Club International, (the full name of our club), is the oldest organization of award hunters in the world. We were founded at the end of 1957. However, we are little known especially in the USA because for well-known reasons that all material to *CQ* concerning AHC was absolutely censored and no publicity was given to us. There was another club to 'go first' as you know. . . . However, we are not bitter about this because our aim is not to grow just in order to have big membership numbers. Our policy has been that everyone who needs a society

[*Continued on page 107*]

Take the 5894 out of the Amperex line of twin tetrodes and what have you got...

what have you got?

You've got the best developed, best manufactured, best proven line of indirectly-heated push-pull tetrodes in the world!

You've got the kind of tube quality, uniformity and applications assistance that only the oldest and biggest producer of vehicular communications types can offer!

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So you've got everything except the 5894. Isn't it lucky you can get that from Amperex, too.

But come to think of it you always could. We developed the 5894 in the first place, you know.

To get the word on Amperex Indirectly-Heated Twin-Tetrodes for your special vehicular communications application, wire or write:

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TYPICAL OPERATING CONDITION

Tube Type	Freq. (Mc.)	Approx. Drive Power (Watts)	Approx. Load Power Output (Watts)
5894	250	6	96
	470	3	33
6252	200	2	67
6360	175	1.0	16
6907	470	3.0	24
6939	470	1.2	6.0
7377	470	1.4	12.5
	960	1.5	5.0
7854	175	3.5	163
8458	175	1.2	30

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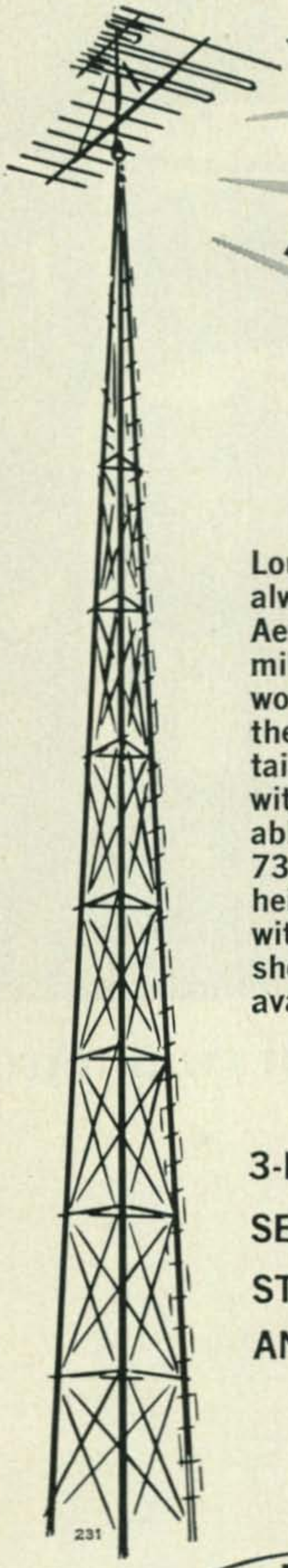
For further information, check number 13, on page 112



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Loud and clear! That's always the way with Aermotor. Eighty-five mile-an-hour winds won't tip, tilt or topple these towers. They sustain 1500 pound loads without guy wires. Available in 20, 33, 47, 60, 73, 87 and 100 foot heights. Type MI-98 with 2-inch pipe top is shown. Other styles available.

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STEEL
ANTENNA TOWERS

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AERMOTOR
Towers
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BROKEN ARROW, OKLAHOMA 74012

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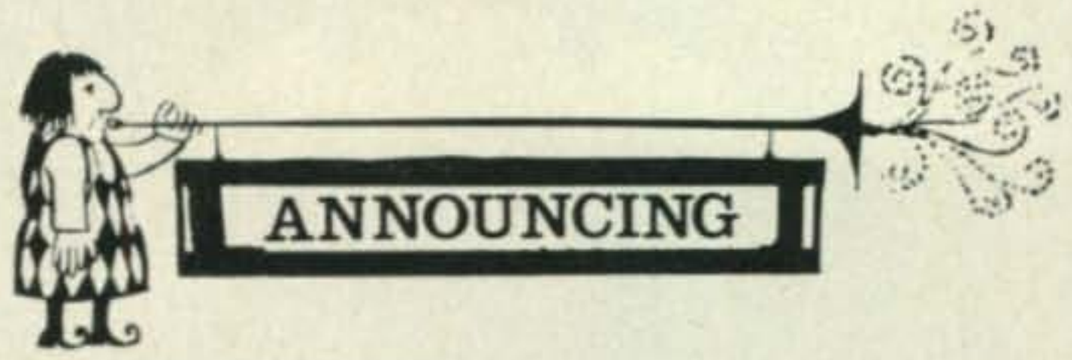

It Kind Of Bugged Him

As a ham radio operator, Philadelphia insurance man Isaac Roach thought the Federal Communications Commission's wit was a bit nit when it assigned to him the call letters WA3DDT. Things are a mite better now, though. The FCC recently changed the Aetna Casualty and Surety Company representative's radio license to W3ABI.

Saddlebrook, New Jersey

February 5, 1966—Saturday, marks the day the East Coast VHF Society will have 2 events from 10 AM to 5 PM—free indoor hamfest with auction, swap tables, displays, prizes and technical sessions.

At 8 PM there will be an annual dinner with speaker of note. Prizes, awards and roast beef dinner. Tickets are $5.00 each. Write to the East Coast VHF Society, P.O. Box 1263, Paterson, New Jersey.

Calling all Teachers

Dick Kesler, K9BTU, is a teacher who is interested in hearing from other hams who are teachers. The object is a teachers ham organization. Anyone interested can contact him by writing: Dick Kesler, 106 Magnolia Dr., Olney, Illinois, 62450.

Correction

In the November issue on page 44 two of the photo captions were reversed. The bottom row of photo's are the ones with the reversed captions. WB6LNS is the operator in the photo on the extreme right.

Toledo, Ohio

The Toledo Mobile Radio Association announces that the Annual Ham Auction will be held Sunday, February 13, 1966, at the Lucas County Recreation Center in Maumee, Ohio. For further information, contact K8LFI, 5030 Janet Ave., Sylvania, Ohio 43560.

Essex County, Vermont

Essex County, Vermont to be activated as Hammarlund DXpedition by John McColly, WB2LZF/W9OIJ and Fred Lehrer, K2RUR for the weekend of 19/20 February during the Vermont QSO Party. All bands will be used with the call W9OIJ/1 mostly CW and perhaps some SSB. QSL's will be handled through Hammarlund Box 7388, GPO, New York, N.Y. 10001. John and Fred were active from Vinton County, Ohio during the Ohio QSO party, Dec. 18 and 19 and QSL's will be handled through the Hammarlund QSL address mentioned.

Newark, England

The Newark Short Wave Club will be putting out an s.s.b. signal on 28.6 mc under the club's call sign (G3UEB/A) and will be beaming at the states operating from the QTH of G3TWV (Secretary). We shall call on the ½ hour for 5 min. and then listen. Calls will be put out between 1030 and 1430 GMT. Short wave listener reports will be welcomed. All information from G3TWV, 93 Balderton Gate, Newark, England.

Chicago, Illinois

The Six Meter Club of Chicago announces their new slate of officers for 1966. They are:

President	Bob Weiss, W9AVB
V. President	Len Lukas, W9FVB
Secretary	Hank Dziekan, K9DKI
Treasurer	Val Hellwig, K9ZWV
Recording Secretary	Greg Urban, WA9IRZ
Members at Large	Ed Porter, K9SZT
	Carl Weiss, WA9BWB
Sergeant at Arms	Jerry Duncan, WA9GVF

W2EYY demands a lot in a mobile antenna...

His *Waters* AUTO-MATCH gives it to him!

The nautically nice Robinsons are blue water sailors. From Penobscot Bay in summer to the Bahamas in winter, Robbie (W2EYY) and XYL Elsa cruise the Atlantic in their 56-foot ketch "Lodestar" . . . virtually always afloat and literally always in contact on 20 meters and 75. Robbie demands a lot in a mobile antenna. He has to! So high on the "Lodestar's" mizzen mast a stock model Waters AUTO-MATCH stands up under the salt-weather beating only year 'round exposure on the Atlantic can give it. And Robbie's AUTO-MATCH (with the mast stays bonded) gives him a signal afloat many hams would welcome ashore. We take such performance in stride at Waters, because we built a plus in AUTO-MATCH for just such severe service. Radiator tip of stainless steel . . . interchangeable coils permanently sealed in low-loss Epoxy . . . mast of aircraft aluminum. If you've mobile antenna problems asea or ashore, could be you'll find the permanent solution in Waters AUTO-MATCH. Costs a mere $38.85 complete on 75—even less on the other bands. And that includes the stronger signal, too!

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MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

WATERS PRODUCTS ARE SOLD ONLY THROUGH WATERS QUALIFIED DISTRIBUTORS

For further information, check number 15, on page 112

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ETCHING, WIRES OR TERMINALS!
Save time and money with
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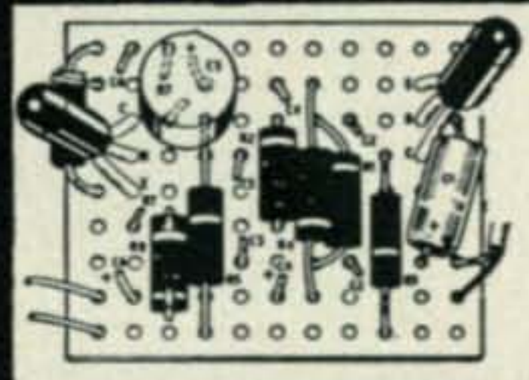
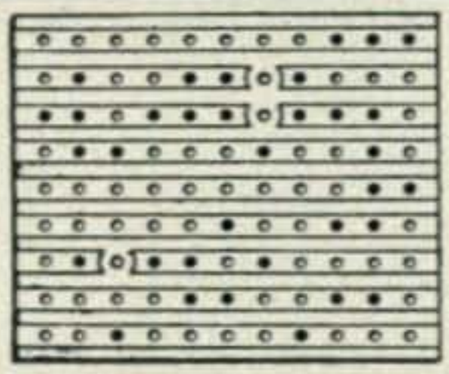
THE ONLY 2 STEP WIRING BOARD AVAILABLE TODAY



Step No. 1—Mount components and solder



Step No. 2—Break copper strip where required

VEROBOARD KITS

PK-5	5 Veroboards & 5 projects to build	$ 1.95
BK-6	6 Veroboards & spot face cutter w/inst.	5.95
VBK-7	Complete laboratory development kit	29.95

VEROBOARDS

No. 6-1	3.3″ x 3.5″ with .2 x .2 grid	.75
No. 6-2	2.5″ x 4″ with .156 x .1 grid	.60
No. 6-3	2.5″ x 6.9″ with .156 x 1 grid	.80
No. 6-4	2.5″ x 6.9″ with .156 x 1 grid	.95
No. 3	4.8″ x 5.8″ with .2 x .2 grid	1.75
No. 20	3″ x 4.5″ with .2 x .1 grid	1.75
No. 25	4.5″ x 6.5″ with .2 x .1 grid	2.65
No. 91	3.6″ x 17″ with .156 x .1 grid	4.05
No. 125	4.7″ x 5.9″ with .1 x .1 grid	2.50

SPOT FACE CUTTERS

No. 2020 for .2″ x .156″ Veroboard	1.50
No. 2021 for .1 Veroboard	2.25

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48 Allen Blvd., Farmingdale, New York

Please send the following order. I am enclosing check for _____ (N.Y.S. residents add Local sales tax)

_____ Kit No. _____ @ _____

_____ Veroboard No. _____ @ _____

_____ Spot Face Cutters @ _____

Name _____

Address _____

For further information, check number 16, on page 112

CLUB FORUM

AL SMITH,* WA2TAQ

NEW clubs are springing up every month. In their quest for survival they are experiencing the usual growing pains associated with any new organization.

Many, in correspondence received here, have problems and seek information on what to do next. The CLUB FORUM will, as in the past, try to assist these clubs to the best of our ability. It might be suggested that clubs with problems in public relations and new organization refer to CLUB FORUM columns in March, May, and July 1965 issues. Back issues are available from *CQ* Circulation Dept., 14 Vanderventer Ave., Port Washington, N. Y. 11050.

Of course once a club is formed it must stay together. Club officers should investigate every possible avenue to keep members interested in the organization.

No doubt the most important thing that club officers can do is to be sure the meetings have something of interest to offer to their members. Some semblance of order must be had to keep the meeting from resulting in sheer bedlam. Yet at the same time a stuffy, strictly ruled meeting will have an adverse effect too. Use a sort of middle of the road approach. Conduct the business that must be taken care of and an injection of humor here and there will be in order.

It goes without saying that a meeting in which club business is merely conducted will in no time result in a scarcity of members. Coffee and cake will help a great deal and will encourage the eyeball ragchews.

There must be something else between the business and coffee that is some sort of entertainment whether of a fun type or serious nature, depending on the group. A good technical film once in a while should hold interest and a good speaker on any subject pertaining to amateur radio would be in order. There seems to be a problem in finding speakers for many clubs and the CLUB FORUM would welcome any ideas on this subject. Remember that there are many ARRL officials who you could button hole to attend your meeting.

Another important item that has worked wonders in keeping club members on their toes and well informed is a club newspaper. An informed club is a better club in anyone's book. Not only will a small publication hold interest but it will also provide activity for a few of the members.

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

And by the way, won't you include the CLUB FORUM on your publication mailing list so that we can keep informed on your club's progress and pass on to others the things of interest going on in your club. We might extend a vote of thanks to those now sending their club papers. They are all read cover to cover and really enjoyed too.

A growing club that can use additional members is the Eastern Utah Amateur Radio Association. This group is located in Price, Utah. Right now they are in the process of trying to raise funds so that they can get equipment for a club station. One of their fund raising activities was to sell refreshments at the local Rodeo held last summer. They are in search of additional fund raising methods and if any suggestions are available from our readers we'll be glad to pass them along to the EUARC as well as to all our readers.

The CLUB FORUM heard from the Price, Utah club last spring and was glad to offer some suggestions for organizing. At present the club has sixteen members and they are anxious to reach any newcomers in the surrounding area that wish to enter into study for the Novice class license. This club will be good news to county hunters. Before the club was formed, Carbon County, Utah, had a grand total of 4 active hams, now that total will be growing. Earl F. Shafer, Secretary, will be glad to hear from anyone in Carbon County interested in joining the group. Club address is Post Office Box 54, Price, Utah.

An active college amateur radio club is the Tri-C Electronics Club of Cabrillo College, Aptos, California. The club usually numbers around twenty five members. Eddy Pollock, W6KHS is the faculty advisor as well as Trustee for the club station WB6JOD. Eddy is an active amateur being on the Board of Directors of the Santa Cruz Amateur Radio Club and holding down the position of President of the California Council of Electronics Instructors. Some of the clubs activities have been contest operating, classes in Code and Theory, and several field trips to communications and electronics firms in the area.

Another of the group's ambitious undertakings has been to compile a twenty one page list of all the amateur radio clubs in the state of California. The listing includes three major sections: Part I, a general list of radio clubs in alphabetical order; Part II, a list of amateur radio clubs in the junior and senior high schools of California; Part III, a list of the junior college, state college, and university club stations in California. Copies of the list may be obtained for twenty five cents including postage from Eddy Pollock, W6KHS, Cabrillo College, 6500 Soquel Drive; Aptos, California 95003.

The two year Electronic Technology program at Cabrillo College is primarily oriented toward the communications field, with a very rigorous study in solid state and high frequency work.

[*Continued on page 104*]

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It is the RF Communications Model RF-301

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The Model RF-301, SSB Transceiver was designed by RF Communications as a company product without government support. It was designed to be used by military customers in military applications. Now in production, it can be bought in quantities from one unit up with short delivery (averaging 30 to 90 days) at a very modest price. The RF-301 costs about one-third of that normally paid for military transceivers with similar characteristics.

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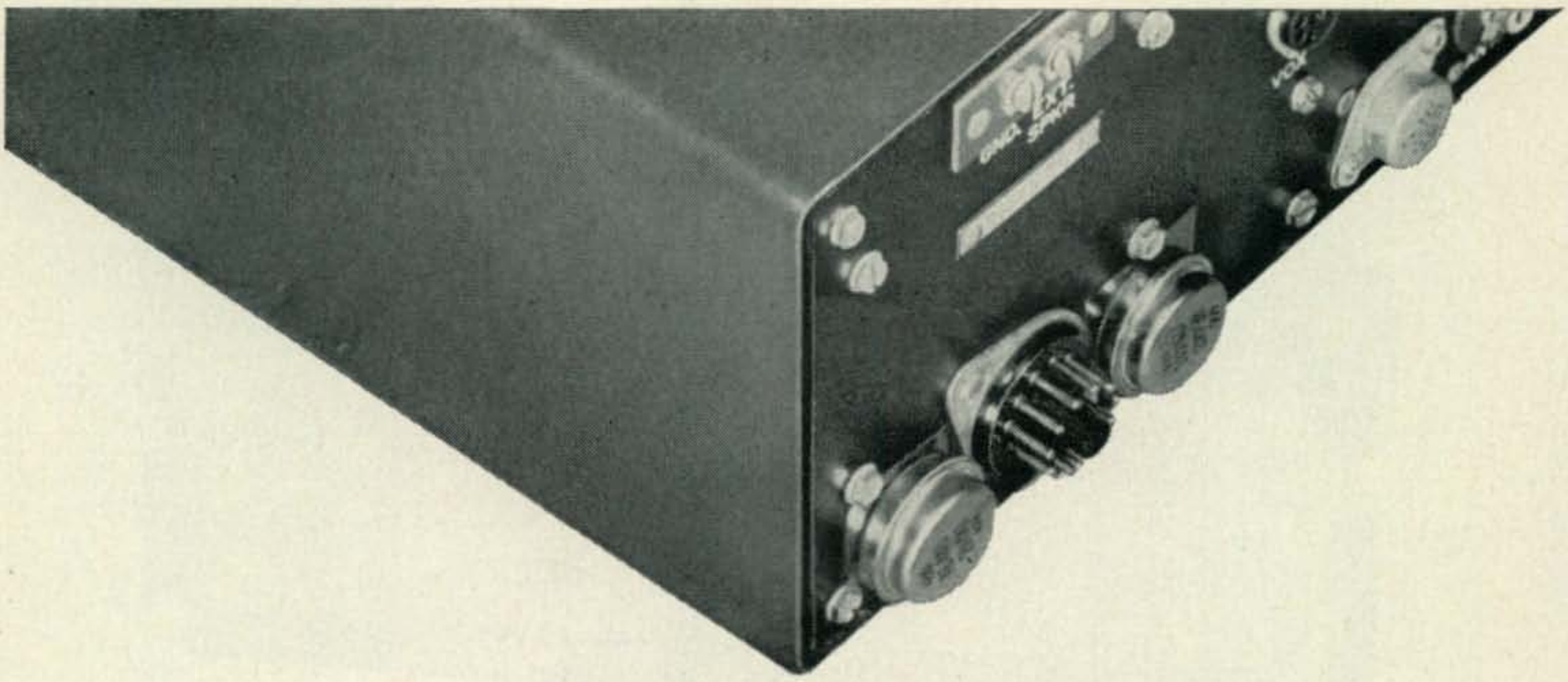

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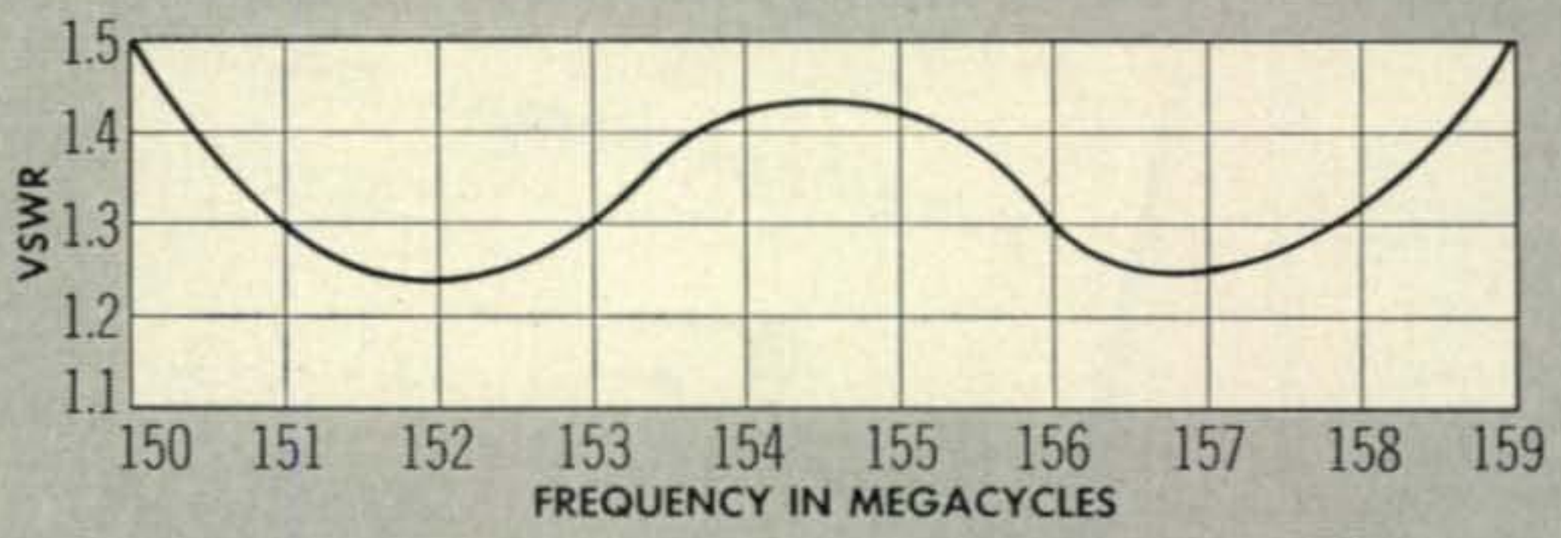
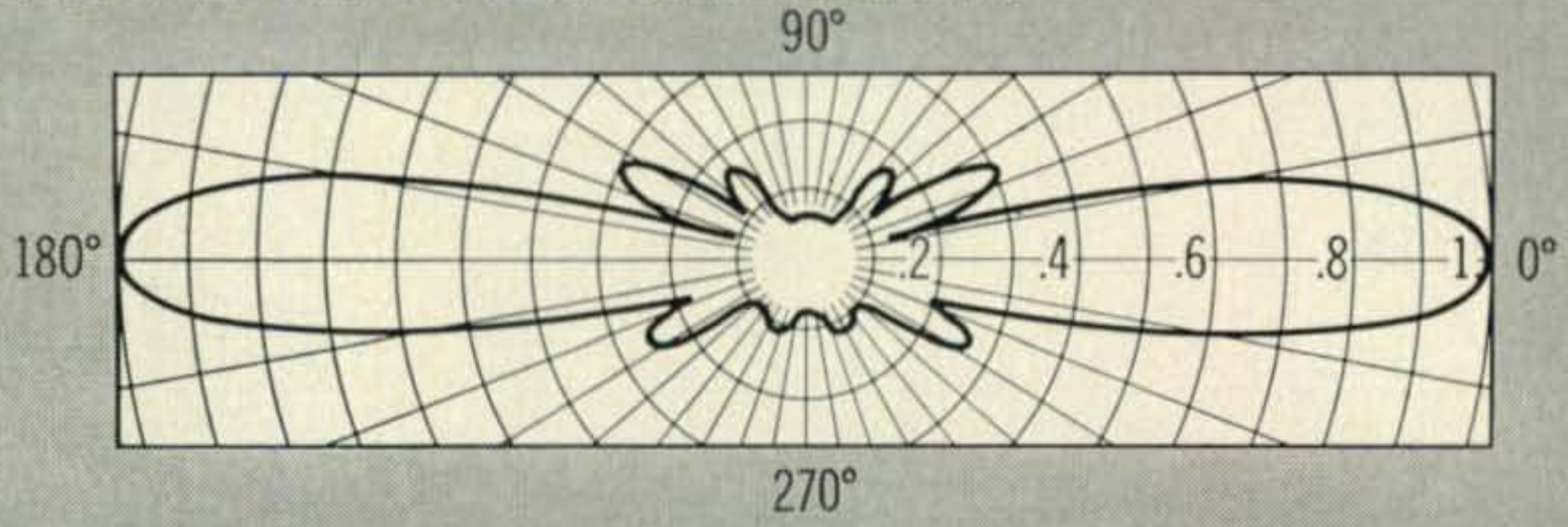
SUPER STATIONMASTER®

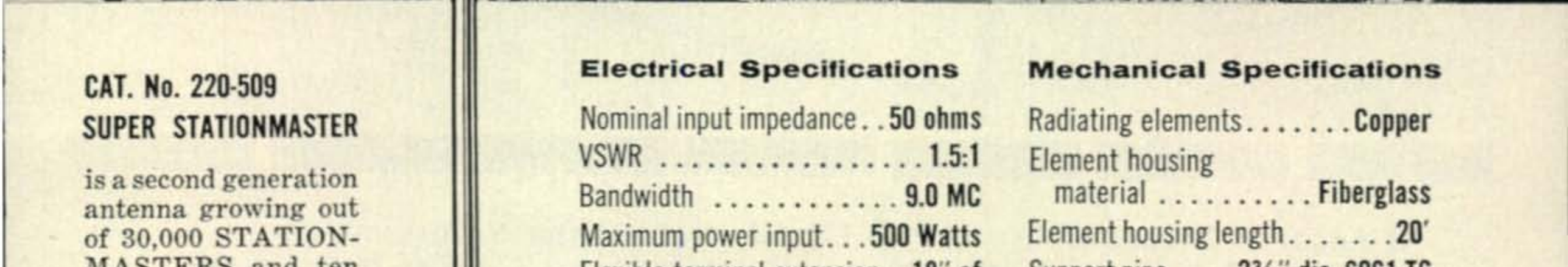
Base Station Antenna



9.0 Mc Bandwidth!



This new CPC antenna has all the qualities of its predecessor, plus new features not now available in any antenna made for the land mobile services



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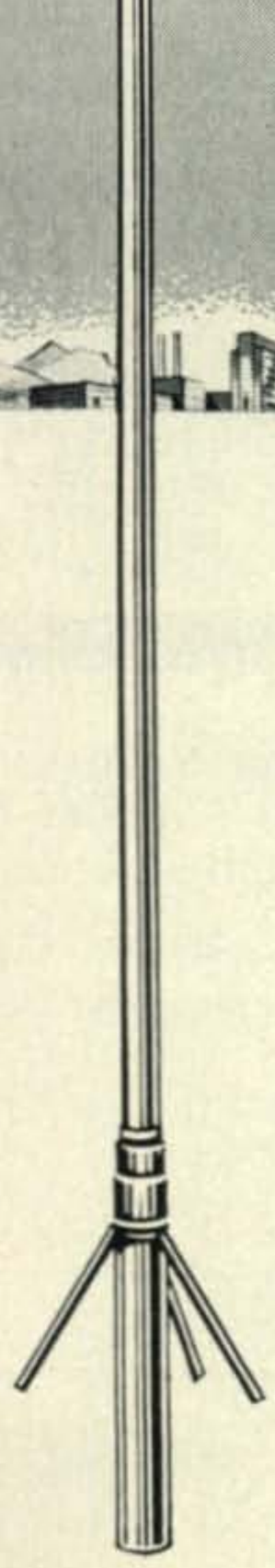

Electrical Specifications

Nominal input impedance	50 ohms
VSWR	1.5:1
Bandwidth	9.0 MC
Maximum power input	500 Watts
Flexible terminal extension	18" of RG 8A/U
Terminations	Type UHF female and Type N male
Vertical beam width (½ power points)	18°
Lightning protection	Direct ground

Mechanical Specifications

Radiating elements	Copper
Element housing material	Fiberglass
Element housing length	20'
Support pipe	2¾" dia. 6061-T6 aluminum pipe
Rated wind velocity	100 MPH
Lateral thrust at rated wind	79 lbs.
Bending moment 1" below ground plane at rated wind	521 ft. lbs.
Weight	30 lbs.

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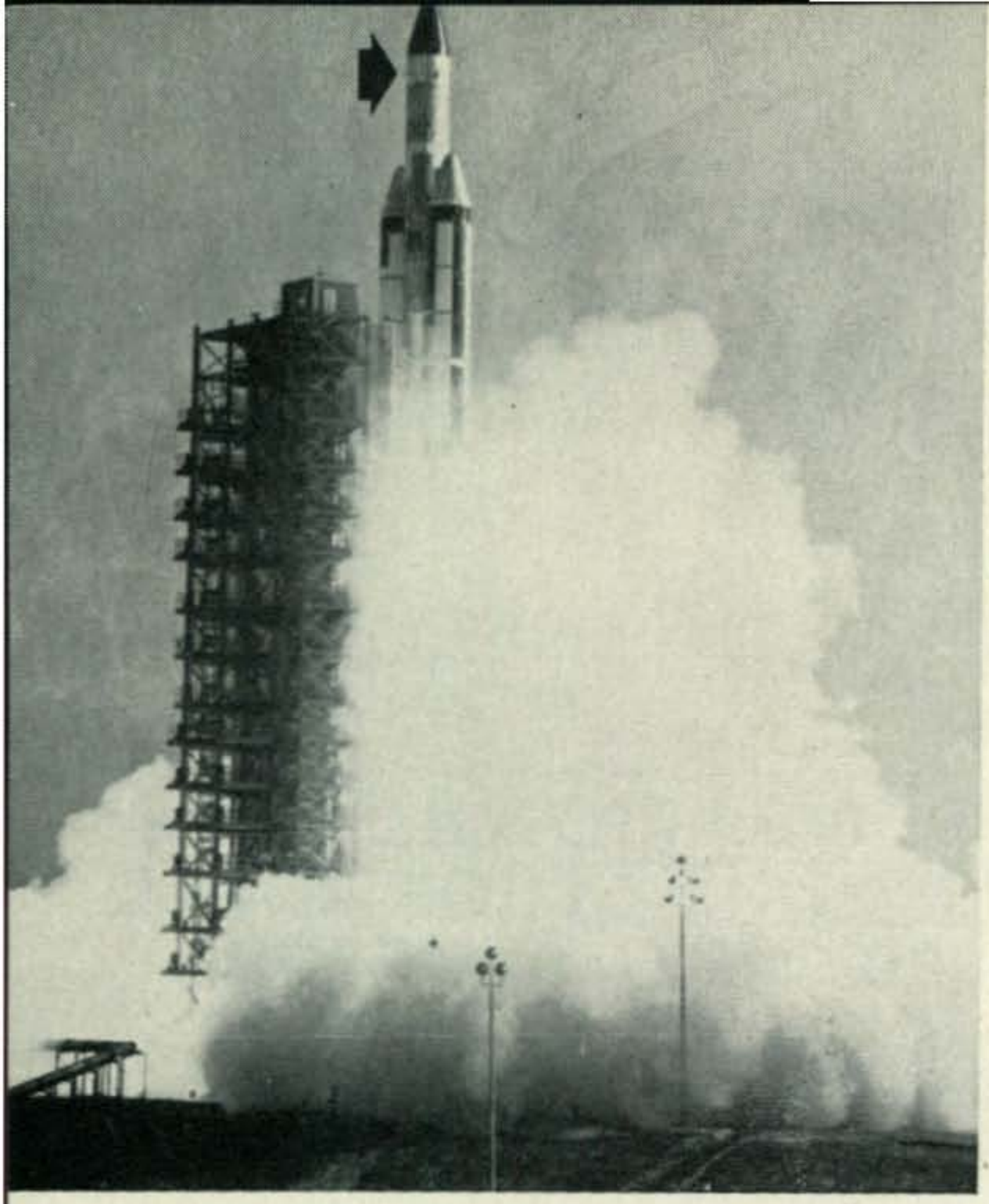


2½ million pounds of thrust launch the Titan III-C booster on its way into space amid a wall of fire and flame. The place—Pad 41, Cape Kennedy, Florida; the time—exactly 1400 GMT, December 21, 1965. The OSCAR IV satellite, built by radio amateurs, sits in the framework of the transtage (arrow), near the booster's nose. *(U.S. Air Force Photo).*

OSCAR IV IN ORBIT!

BY GEORGE JACOBS,* W3ASK

EXACTLY at 1400 GMT, December 21, 1965, OSCAR IV was launched from Cape Kennedy, Florida. The fourth in the series of satellites designed and built by radio amateurs, roared into space aboard America's most powerful booster, a Titan III-C. Although all did not go according to plan, the satellite is in orbit, it is operating as a translator, and several two-way QSOs have taken place through it. OSCAR IV is receiving signals in the radio amateur two meter band, on a frequency of 144.1 mc, and retransmitting them on a frequency of 431.935 mc.

Standing 127-feet high, the enormous triple-barreled Titan III-C booster resembled three giant 10-foot diameter flashlights strapped side-by-side as it stood on the newly-built Pad 41 awaiting launch at Cape Kennedy. Sitting in the framework of the booster's nose (its final stage), waiting to be launched into space was the OSCAR IV satellite, as well as three other satellites.

OSCAR IV's Launch

At exactly 1400 GMT, the giant booster began to lift slowly off Pad 41 with a tremendous roar and an unforgettable blaze of flame and smoke. Everything appeared perfect as a lift-off thrust of 2½ million pounds sped the booster into space. For nearly six hours the Titan III-C perfectly followed its complex flight plan towards what was intended to be a near synchronous orbit 21,000 statute miles above the equator, over the Galapagos Islands. The hefty space vehicle had successfully hoisted its bundle of satellites into a looping orbit ranging between 120 and 20,900 miles above the earth's surface. Firing of the final stage of the booster, called the *transtage,* was all that remained to push the payload of satellites into the final leg of their journey.

The transtage is a 15-foot long spacecraft mounted on the nose of the center stage, or core, of the Titan III-C vehicle. The transtage not only contains the payload, but it also contains the rocket engine for boosting the payload into its final position. The transtage carrying OSCAR IV was supposed to have its engine started by a pre-arranged computer program, and then steer itself through a dog-leg turn that would have brought it directly over the equator, in a near synchronous orbit. At this point it was programmed to release into space OSCAR IV, and three other satellites. Something went wrong! The transtage rocket engine never started. As a result, instead of being ejected into a near synchronous equatorial orbit, OSCAR IV is in a highly eliptical orbit, ranging between 120 and 20,900 miles above the earth's surface. The two satellites ejected before OSCAR IV are in a similar orbit, while the satellite that was ejected after OSCAR appears to have been lost.

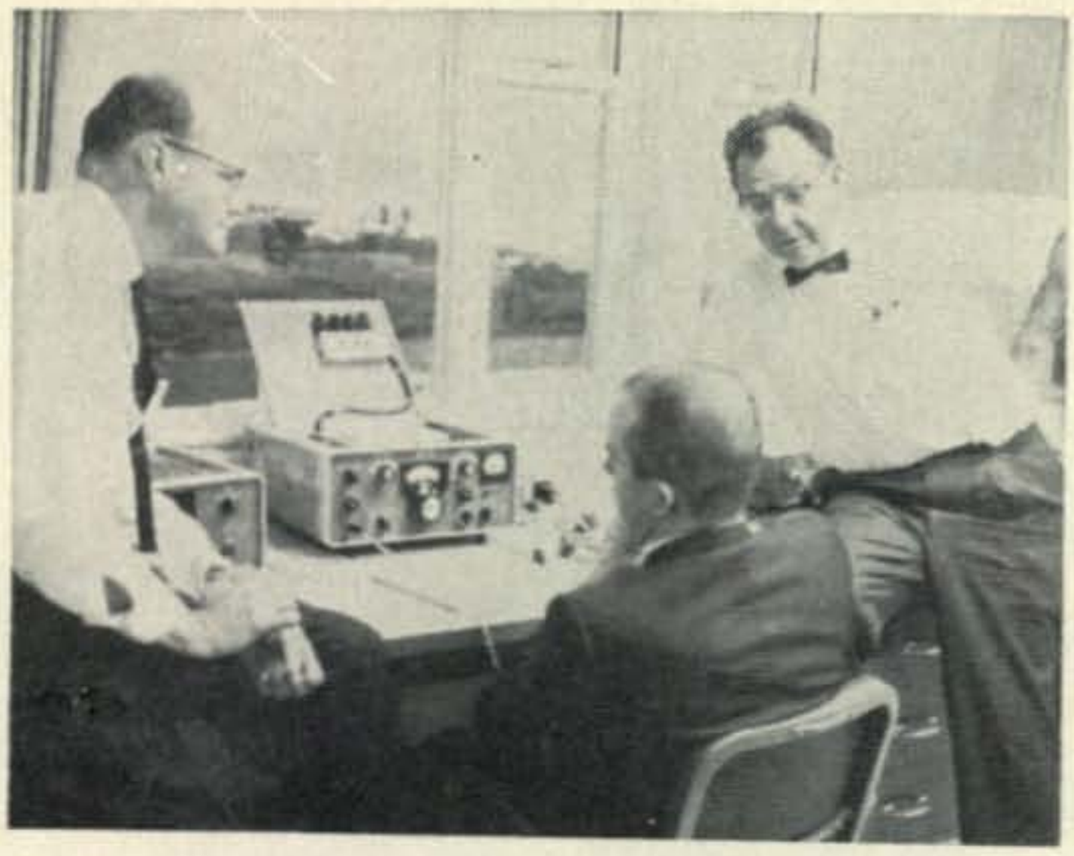
Orbital Parameters

Tracking information received up to four days after OSCAR IV's launch indicates that the satellite has the following basic orbital parameters:

PERIGEE: 120 statute miles
APOGEE: 20,900 statute miles
INCLINATION: 26 degrees
PERIOD: 590.5 minutes

The perigee, or low point of the satellite's orbit, occurs in the case of OSCAR IV just as it crosses the equator going in a northerly direction. This also marks the beginning of a new orbit for the satellite. The apogee, or farthest point from the earth's surface, occurs at the other end of the world, as the satellite crosses the equator going in a southerly direction. On

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



Lance Ginner, K6GSJ of Project OSCAR seen operating W6EE/4 from Cape Kennedy, Florida. The station was on the air December 21-22 to provide launch information and early orbital data direct from the Cape. Lance did an excellent job of describing the launch as it took place, on 14235 kc. Shown with Lance are two other members of Project OSCAR, (left) Bill Orr, W6SAI and (right) Bill Eitel, W6UF. *(Project OSCAR Photo).*

with 12 db gain should be sufficient.

Reception of the 432 mc signal from the satellite will require a receiver with a 4.5 db noise figure and a 3 kilocycle bandwidth, together with a 12 db gain antenna, to achieve a 7 db signal-to-noise ratio for one translator-repeated ground signal. A receiver bandwidth of 500 c.p.s. or less is recommended for c.w. reception, and should produce a better signal-to-noise ratio. While OSCAR IV will translate c.w., s.s.b., a.m., and f.m. signals, it is urged that c.w. be used in order to allow as many signals as possible to go through the limited bandwidth of the translator at the same time.

Since OSCAR IV did not attain its planned near synchronous equatorial orbit, it will be necessary to track the satellite as it travels along its elliptical orbit. OSCAR IV's period is almost ten hours, which is slow enough to track with much less difficulty than was the case with the OSCAR III satellite. While it is desirable to use antennas that can be steered in both the horizontal and vertical planes in order to hold the satellite for as long as possible during its orbit, OSCAR IV will move slow enough that it should be possible to receive its beacon signals or communicate through its translator using antennas that cannot be steered in the vertical plane. The satellite can be tracked by steering the antenna so that the beacon signal is received with maximum strength. For fixed antennas, signals from OSCAR IV will be received as the satellite passes through the main lobes of the antenna's reception pattern.

Range & Lifetime

As OSCAR IV begins each new orbit it is at its point of perigee, 120 statute miles above the earth's surface. At this altitude, the radio range for the satellite is approximately 1500 miles. At its point of apogee, OSCAR IV is 20,900 miles high and has a radio range of approximately 10,000 miles. When the satellite is in the high part of its orbit, it should be possible to communicate through its translator over record-breaking distances for the 432 mc band. Signals from the satellite should be strongest when it is nearest the earth, and weakest when it is at its point of apogee.

Original plans called for an active life period of one year for the OSCAR IV satellite. The equipment aboard the satellite is powered completely by solar cells, which are mounted on all sides.

Initial estimates, based on its present elliptical orbit, point toward an expected life period of at least six months, and possibly a year. There is still time to participate in this history making project.

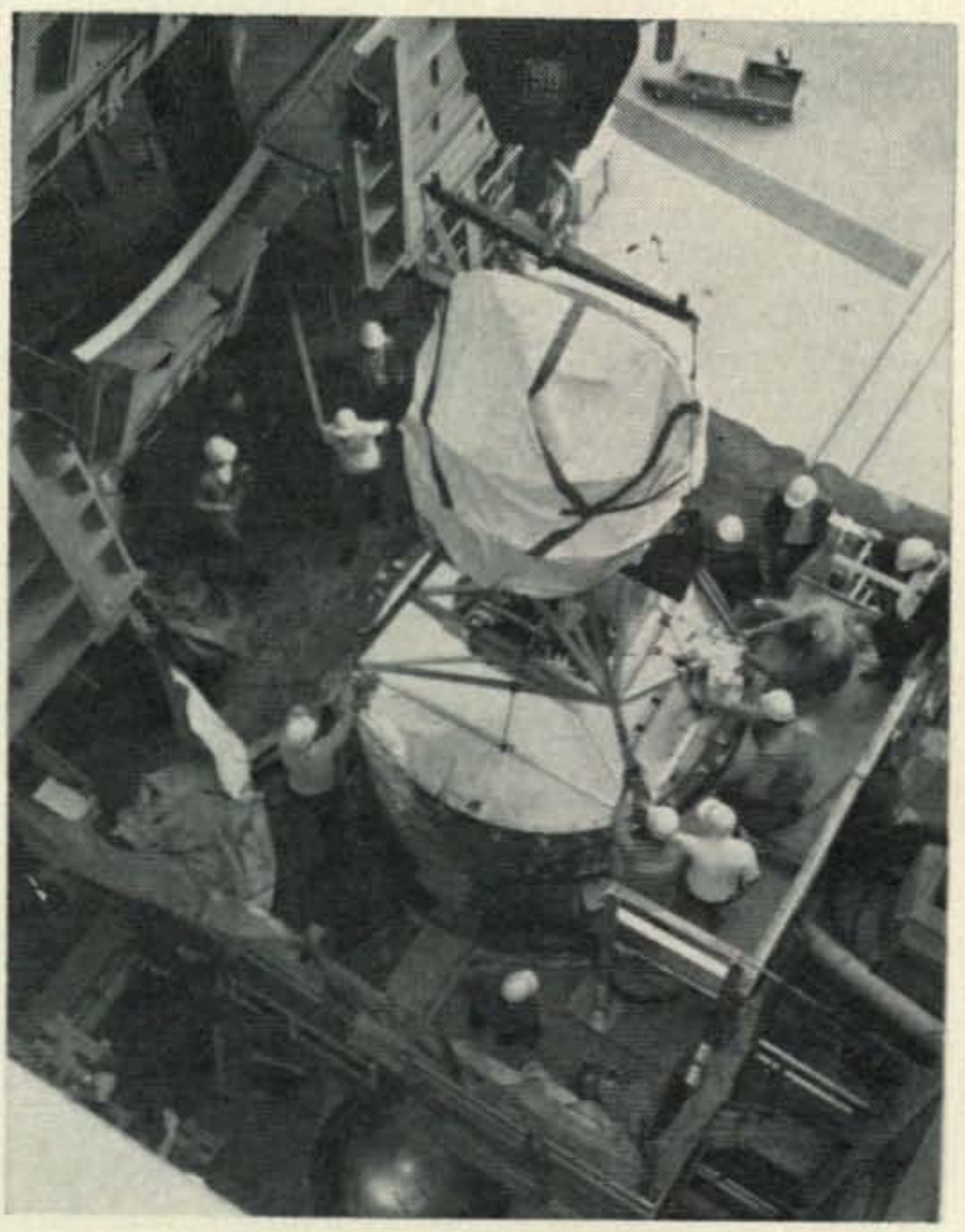
OSCAR News Network

W6EE, located at Project OSCAR Headquarters, Foothill College, Los Altos Hills, California will be on the following frequencies giving latest information concerning the OSCAR IV satellite, including orbital predictions:

S.S.B.	C.W.	RTTY
3935 kc	3507.5 kc	3625.0 kc
7235 kc	7015.0 kc	7040.0 kc
14235 kc	14030.0 kc	14090.0 kc
21335 kc		

W6EE will be most active during the period 0000 to 0800 GMT, but it will be on the air at other times as well.

Orbital prediction data will also be broadcast



The transtage being mated to the Titan III-C booster on Pad 41 at Cape Kennedy. The transtage contains the payloads, as well as the rocket power for firing the payloads into the final stage of a near synchronous equatorial orbit. It was the failure of this stage that prevented OSCAR IV from being placed into its planned orbit. *(U.S. Air Force Photo).*

each successive orbit, OSCAR IV crosses the equator approximately 148° of longitude further to the west.

OSCAR IV's Radio Equipment

The equipment aboard the OSCAR IV satellite is operating, but not entirely as planned.

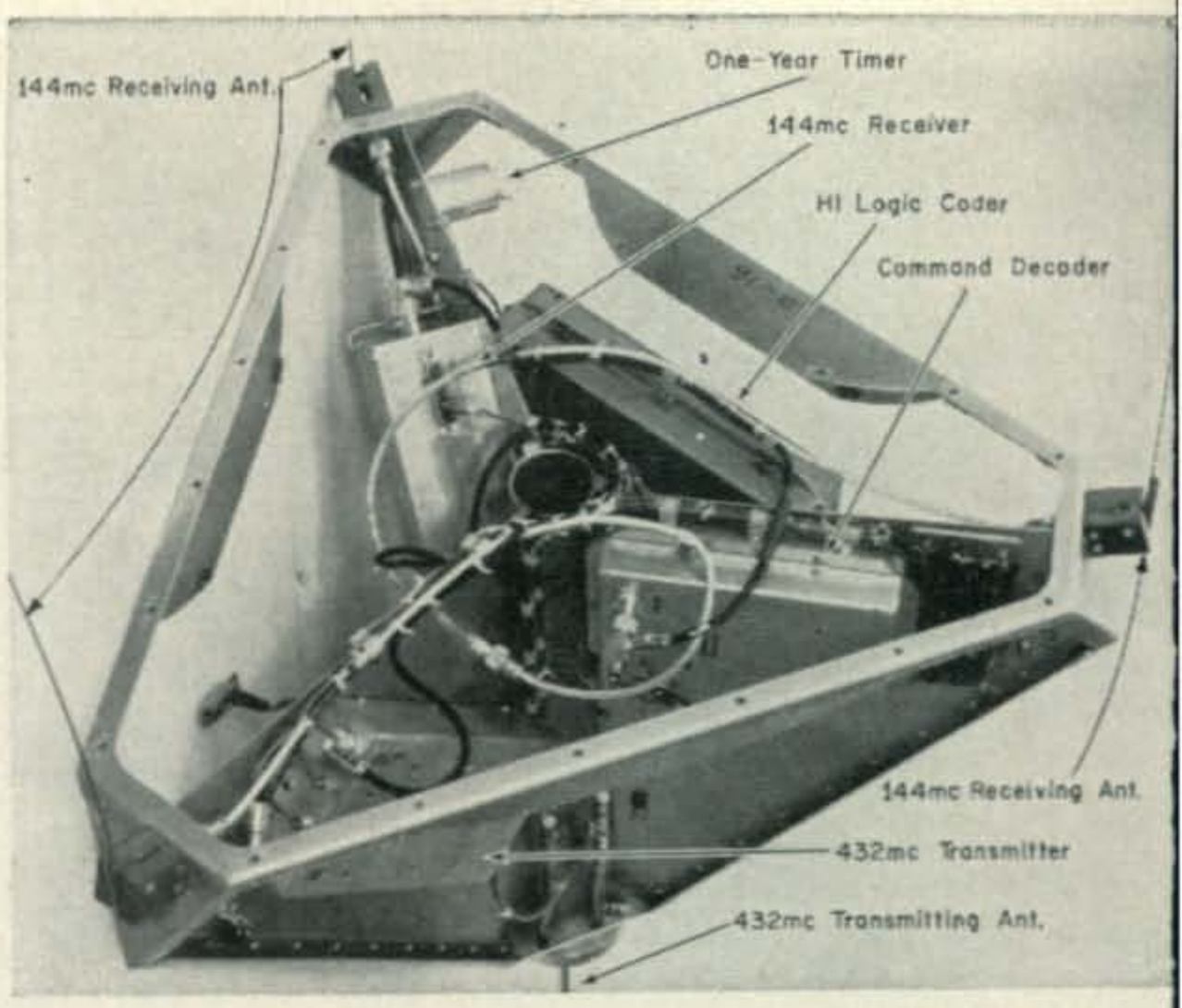
Shortly after the satellite was ejected from the malfunctioning transtage, its translator was turned on. WA6BPZ in San Jose, California was the first radio amateur to report hearing the beacon transmissions on 431.925 mc. He noted, however, that instead of being on for 32 seconds every 10 minutes, the beacon appeared to be transmitting continuously, and blocking the translator's output. This condition apparently cleared partially, and during the first orbit W6YK of Camarillo, California worked W4-AWS of Orlando, Florida for the first two-way contact through OSCAR IV. Both stations used c.w., and reported that the beacon was blocking the translator, but that the translator would clear for 15 seconds to a half minute, every minute or so.

During following orbits, more and more reports were received noting this open-closed action of the translator. Many of the reports attributed this to satellite tumbling, but an initial analysis by Project OSCAR headquarters points to a defect in the timing circuitry for the beacon transmissions.

The first European two-way QSO through the satellite took place on December 22 between DL9AR at Burgdorf, Germany (about 15 miles northwest of Hannover) and DLØVB in the city of Bochum, 120 miles to the southwest. This was also a c.w. contact, and lasted for nearly 1½ hours.

On December 24, the third reported two-way c.w. QSO through OSCAR IV took place between K6HCP and W6GDO in California. This was followed by two-way contacts between W6GDO and K5WXZ in Garland, Texas, and between K2MWA/2 and WA2WEB.

Members of the TRW Amateur Radio Club putting finishing touches to OSCAR IV prior to shipment to Cape Kennedy. Left-to-right, Ray Eastwood, K6MWR; Dave Moore; Herb Gleed, W6ZPX; and Jim McWilliams, W6RTG. John Chambers, W6NLZ, who managed the project, is not shown in the photo. *(Project OSCAR Photo).*



Internal view of the OSCAR IV satellite. The satellite was designed and built by members of the Thompson-Ramo-Woolridge Amateur Radio Club of Redondo Beach, California. The one-year timer which will shut the satellite off after one year's operation, and the command decoder which permits the satellite's transmitter to be turned off or on by ground control, are required in accordance with international agreements. The satellite is tetrahedron in shape, with each leg 27 inches in length. The package weighed in at about 40 pounds at launch time. *(Project OSCAR Photo).*

By Dec. 27, as this is being written, there have been a total of five reported two-way c.w. QSOs through the OSCAR IV translator. In addition, several stations have reported hearing their own signals relayed through the repeater, and more than a dozen stations have been heard through the satellite. Complete information is not available at this time, but W2FZY reports hearing K2MWA/2, K2GUG, K2GUM, K6HAA, K6-HCP, K6TSK, WB6IOM, K9AAJ, W9TGB and W9ZIH. W4WNH reports hearing W4GJO and K2GUG. There'll be a more complete list next month.

The beacon and translator parameters appear to be as follows:

TRANSLATOR INPUT RANGE: 144.005-144.115 mc.

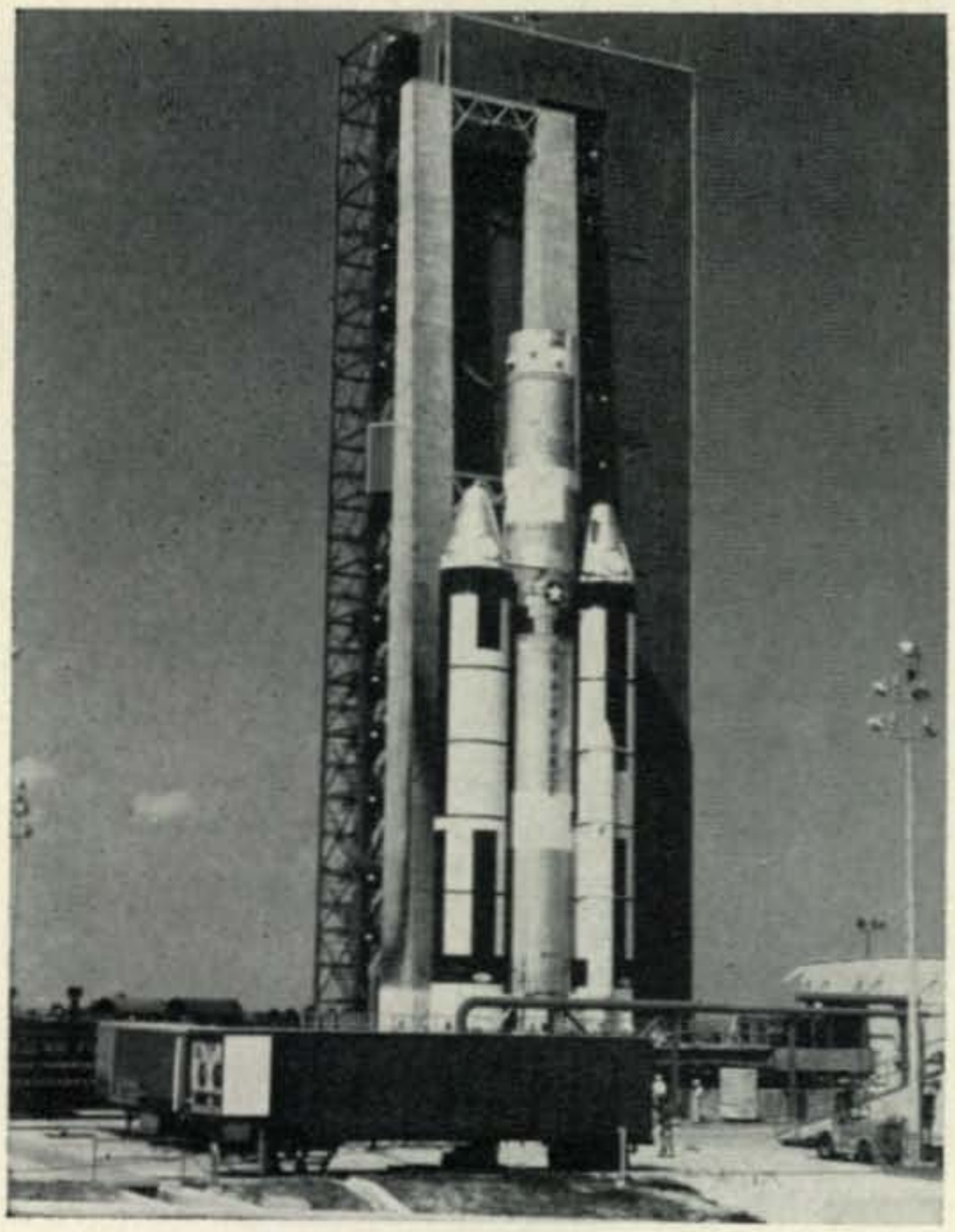
CENTER FREQUENCY: 144.100 mc.

TRANSLATOR OUTPUT RANGE: 431.930-431.940 mc.

CENTER FREQUENCY: 431.935 mc.

BEACON OUTPUT: 431.925 mc.

The beacon signal was designed to transmit automatically for 32 seconds every 10 minutes. It was to gate the translator with 12 seconds of peak c.w. carrier, followed by one "HI" identifier, the whole sequence repeated twice. No telemetry is being used with the OSCAR IV satellite. It appears as if the gating circuit is not working properly, and the beacon transmission is recycling every minute or so, instead of every ten minutes. This means that the translator is open for only very short periods of time between beacon transmissions. There is some possibility that the fault may clear itself as time goes on.



The triple-barreled Titan III-C booster being moved to Pad 41 at Cape Kennedy for a December 21 launch. The booster stands as high as a 12-story building. The "transtage", or third-stage of the center portion of the Titan III-C has not yet been installed. The OSCAR IV satellite, and the other payloads carried into space by Titan III-C were contained in the transtage. *(U.S. Air Force Photo).*

OSCAR IV Circuitry

The Thompson-Ramo-Woolridge Amateur Radio Club of Redondo Beach, California, won its race to complete the translator satellite in time for the December 21 launching.

OSCAR IV was designed to be a spin-stabilized, tetrahedron-shaped package, 27 inches long on each leg, and weighing about 40 pounds. The satellite contains a linear translator constructed by the TRW Radio Club in conjunction with Project OSCAR. It is completely transistorized.

The translator consists of a receiver section, operating on a center frequency of 144.1 mc, and a transmitter section, operating on a frequency of 431.935 mc. The bandwidth of both the receiver and transmitter is 10 kilocycles. The translator's peak power output is about 3 watts. Another small module in the satellite contains the "digital logic" circuitry designed to gate the translator and transmit the beacon signal. It is apparently this circuit that is not operating properly at the present time.

Two additional modules have been built into the satellite to satisfy international regulations. To assure that the satellite can be turned off in the event of interference to other radio services allocated the use of the 432 mc band, OSCAR IV contains a command decoder unit, which permits the translator to be turned on or off by ground control. The satellite also contains a timer which will automatically shut the translator off after an operational period of one-year. All satellites launched are required to contain such equipment, except those that are operated from a battery power supply with a predetermined life period.

Three antennas, mounted on different corners of the OSCAR IV package, provide the 144 mc input signals to the satellite's receiver. A single monopole antenna is used with the 432 mc transmitter. The satellite is powered completely by solar cells mounted on all sides of its outer surface.

John Chambers, W6NLZ was in charge of the OSCAR IV project at the TRW Radio Club. Ray Eastwood, K6MWR, designed the receiver; Herb Gleed, W6ZPX, did much of the final electrical assembly and check-out work; Jim McWilliams, W6RTG, was responsible for the systems engineering work, and Dave Moore did the mechanical design of the package. Members of the TRW Amateur Radio Club assisted with the dozens of other tasks that were required to rush the translator satellite to completion. As was the case with the three previous OSCAR satellites, OSCAR IV was designed and built by radio amateurs.

Ground Equipment

Project OSCAR headquarters estimates that an *effective radiated* c.w. power of approximately 1600 watts is required to activate the OSCAR IV translator. This can be accomplished by many combinations of transmitter output power and antenna gain. A 2 meter transmitter with an output of 100 watts c.w., and using an antenna

OSCAR IV gets a fond farewell embrace from Mrs. Kathleen Licari at the TRW Amateur Radio Club, prior to the satellite's shipment to Cape Kennedy for launch. The 432 mc transmitting antenna is extended at the top of the satellite. Solar cells cover all surfaces of the satellite so that it can receive energy from the sun in any position. *(Project OSCAR Photo).*

over W1AW, the Headquarters station of the American Radio Relay League. W1AW official broadcast schedules may be found in *QST* magazine.

Latest OSCAR information can also be received direct from OSCAR Headquarters by telephone, by calling Area Code 415 941-0112.

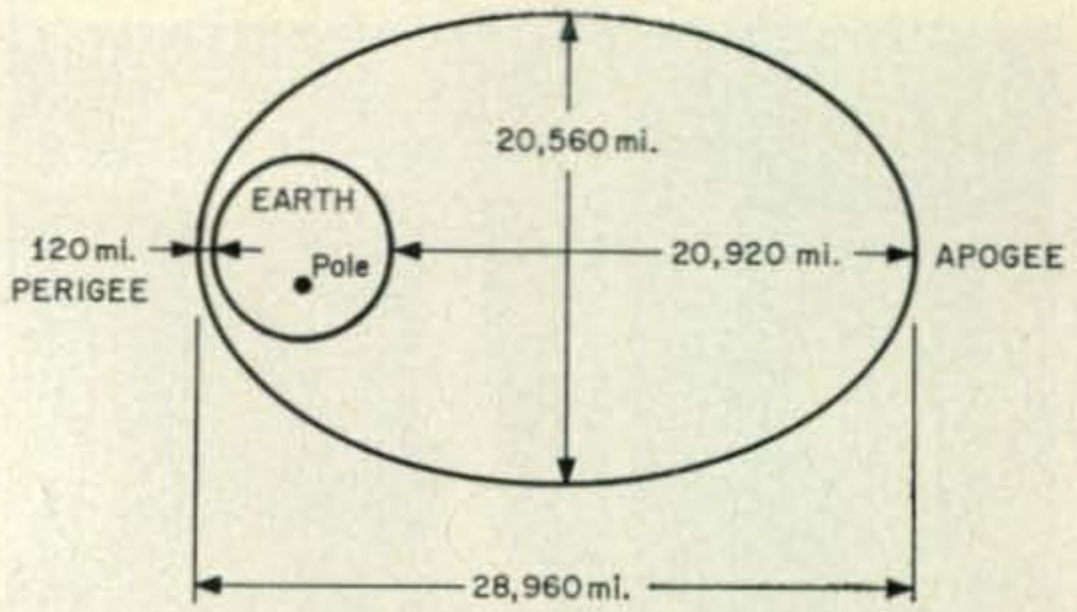
OSCAR IV Reports

Reports of reception, or communication through the OSCAR IV satellite should be reported as soon as possible to OSCAR Headquarters, Foothill College, Los Altos Hills, California.

Reports can also be given on the OSCAR Network. Reports should include as much information as possible concerning tracking or communications. Times should be given in GMT, geographical coordinates of the receiving station should be included, as well as relative signal levels observed, etc.

OSCAR IV was launched as a continuing program to advance the cause of amateur radio. It is speeding along its spatial orbit available for radio amateurs everywhere to use on a free access basis. If all goes well, OSCAR IV is expected to remain in operation for at least six months, and perhaps as long as a year. There is still plenty of time to build the 2 meter and 432 mc equipment required for communicating through the satellite. There is still time to be a part of amateur radio history!

OSCAR IV is not only extending the communication horizon, but it stands as a shining symbol of amateur radio itself. ■



Scaled drawing of Oscar IV's orbit in relation to the earth. The pole is shown off center due to the 26° inclination of the orbit.

Oscalator Notes

SOME time after the launch of OSCAR III we presented the Oscalator,[1] a simply made track for finding the location of the satellite at any time during a particular orbit. The determination of an Oscalator track for the planned orbit of OSCAR IV also would have been a simple matter; however, the unexpected elliptical orbit into which OSCAR IV actually was placed presented a number of problems involving quite a few mathematical calculations. Frankly, we had not as yet completely worked out the simple method for determining Oscalator tracks based on elliptical orbits, but thanks to Bayman McWhan, W2GAX, who made the necessary calculations for us, we are herewith able to provide the required data for plotting OSCAR IV's track.

The track is shown at fig. 1 superimposed on a polar chart (see the original article for the Oscalator concept and for details on making the polar chart). To make the track, first place a piece of tracing paper on top of the polar chart and on the paper use a compass to trace the equatorial circle and the innermost circle (that represents 80° N. Lat.). Also make cross lines through the pole. The circles and the cross are to be used for alignment with the polar chart when the Oscalator is used.

Next, place a dot on the paper at the latitude and longitude for each time interval as given in Table 1. Then draw a curve through these dots and mark the indicated time at each point as shown in fig. 1. The points on the track below the equator and just west of 0° longitude should be marked in *minus* minutes and this portion of the track should be labelled *Southern Part of Previous Orbit*.

At 0° on the equator mark *A* or *Start*. This is the beginning of the orbit and the point of *Perigee*. The *Apogee* may be identified at 256° W. Long. The end of the orbit and the return to perigee is at 148° W. Long. Note that this point corresponds to the shift or the westward progression of each orbit.[2]

To use the Oscalator for OSCAR IV, align the track transparency on the polar chart (or map) with the start of the orbit positioned at the equatorial bearing given in the prediction bulletins. The sub-satellite position (the point on the earth directly below the satellite) then may be found at any given time (in minutes) *after* the *start* of the orbit by referring to the track time and the latitude and longitude over which the track passes at the involved time. Adding the track time to the equatorial-crossing time will give the absolute time. (For the Southern Part of the Previous Orbit the track time is subtracted from the starting time of the regular orbit.)

Also, by referring to Table 1, you can find the satellite's altitude at the marked times. From this you can use a globe and a rule, scaled to miles, to approximate the azimuth, elevation and range angles from your location. To do this, place the scaled rule vertically on the globe at the satellite's position and run a string between your location and the altitude on the rule. The procedure can be facilitated by first tying the string to the rule at the alti-

[1]The Oscalator, *CQ* August '65, page 54.

[2]Mark your own location on the polar chart itself.

Table I—Oscalator Coordinates For OSCAR IV

Time (Min.)	*Longitude* (Deg. W.)	*Latitude* (Deg.)	*Altitude* (Miles)	*Time* (Min.)	*Longitude* (Deg. W.)	*Latitude* (Deg.)	*Altitude* (Miles)
0	0	0	100	554	246	—24	4800
3	339	10	200	566	234.5	—26	3000
6	335	12	300	578	224	—25.5	2200
9	320	18	700	581	188	—18	700
12	284.5	25.5	2200	584	173	—12	300
24	274	26	3000	587	169	—10	200
36	263	24	4800	590	0	0	100
48	254.5	22	6700				
60	252	20.5	8100		*Southern Part of Previous Orbit*		
90	245.5	16.25	11600	0	0	0	100
120	243	12.5	14500	—3	21	—10	200
150	243.5	10	16500	—6	25	—12	300
180	245	7.5	18300	—9	40	—18	700
210	245.5	5	19600	—12	75.5	—25.5	2200
240	248.5	3.5	20400	—24	86	—26	3000
270	251.5	2	20900	—36	97	—24	4800
295	254	0	20900	—48	105.5	—22	6700
320	257	—2.5	20900	—60	108	—20.5	8100
350	260	—3.5	20400	—90	114.5	—16.25	11600
380	263	—5	19600	—120	117	—12.5	14500
410	263.5	—7.5	18300	—150	116.5	—10	16500
440	265	—10	16500	—180	115	—7.5	18300
470	265.5	—12.5	14500	—210	114.5	—5	19600
500	263	—16.25	11600	—240	111.5	—3.5	20400
530	255.5	—20.5	8100	—270	108.5	—2	20900
542	254	—22	6700	—295	106	0	20900

tude point and then supporting the rule with one hand while stretching the string with the other hand. Then note the corresponding angles created between the string and your location. In addition, the satellite will be within view as long as the string does not touch the globe beyond the horizon. The visibility angles *near apogee* also may be approximately found in the table on page 23 of the December '65 issue of *CQ*.

Since the original range scales for the Oscalator were limited to 2000 miles, they will be directly useful in this case only for satellite altitudes up to about 500 miles.

The points given here for OSCAR IV's track are based on the orbital parameters near the end of December '65. Changes in these factors can be expected and should they become significant, we'll provide you with the necessary corrections in return for a self-addressed stamped envelope.—*W2AEF*

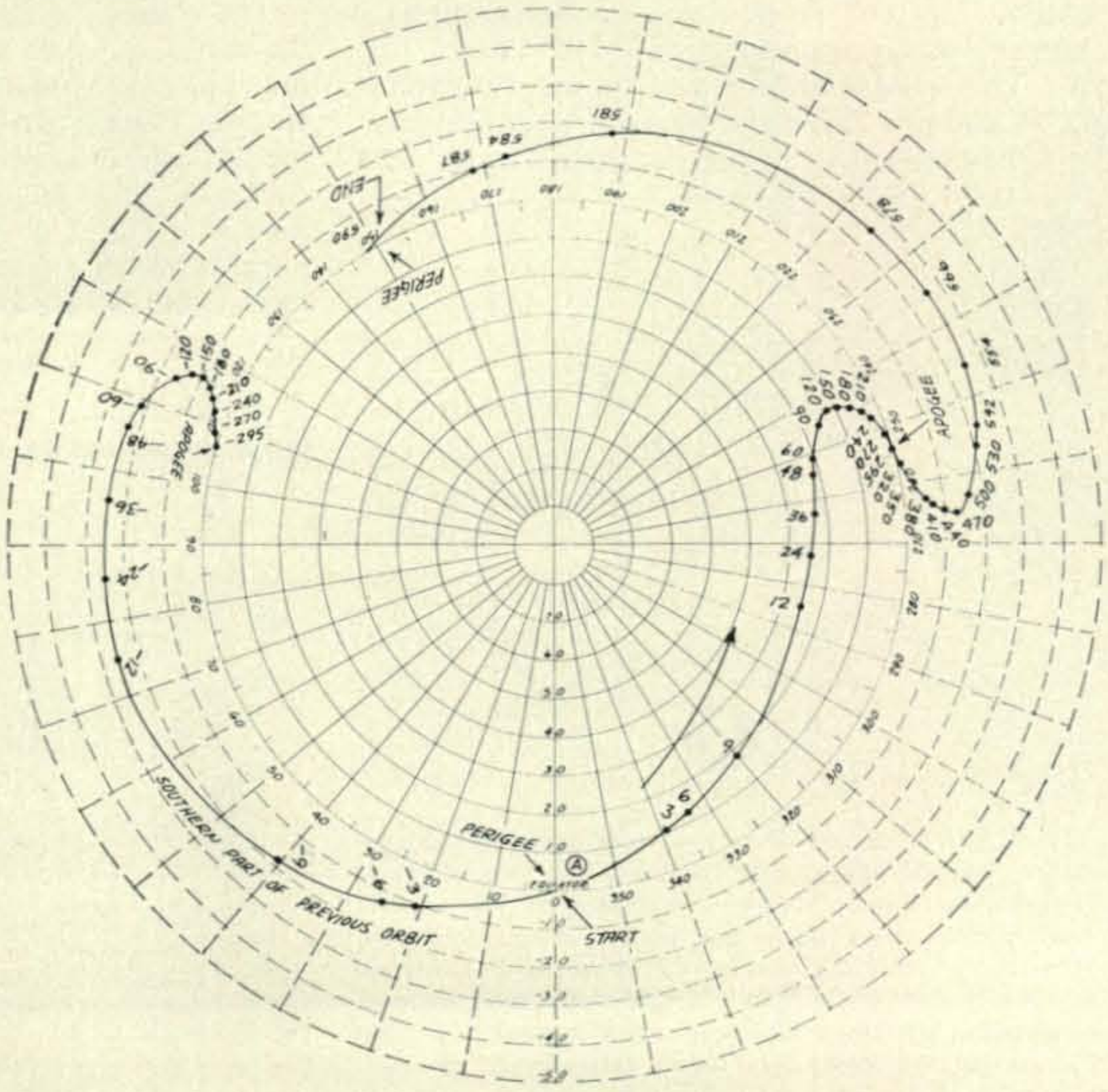


Fig. 1—OSCAR IV sub-satellite Oscalator track shown on polar chart with the start of the orbit at 0° Longitude. The numerals along the track indicate the travelling time before or after the start of the orbit. The satellite's altitude at the various times is obtained from Table I. The perigee slowly moves northeastward and from the known rate at this time it probably will be near the +9 minute point by Feb. 20th.

The Vacuum Tube Voltmeter

BY WILFRED M. SCHERER,* W2AEF

Here is the second in a series of articles relating to the understanding and use of test gear for amateur applications.

LAST month we discussed the basic principles involved in the operation of the volt-ohm-millammeter. This time we'll take a look at the vacuum-tube voltmeter.

The v.t.v.m. is made up of a vacuum-tube amplifier and a microammeter. It takes advantage of the basic principle of a vacuum tube, namely, that the tube can amplify without taking power from the voltage source applied to its grid. This results in a sensitive instrument of extremely high input resistance such as may be required for accurate measurements across high-resistance circuits.

There are many types of v.t.v.m. circuits, but the most commonly used one is the bridge arrangement shown at fig. 1. When no voltage is applied to the grid of V_1, a zero-set control, R_6, is adjusted so that a balance is obtained, between the tube currents and the cathode resistors, that causes equal voltages to appear at the cathode of each tube. This being the case, there can be no difference in voltage across the meter, no current will flow through it, and the meter reads zero.

of V_1, its plate current will increase, raising its cathode current which consequently produces a higher voltage drop across its cathode resistor, R_5. This voltage will be more positive than that at V_2 cathode and there then will be a difference in voltage between the two cathodes of a polarity that will cause a current to flow to make the meter pointer deflect upward.

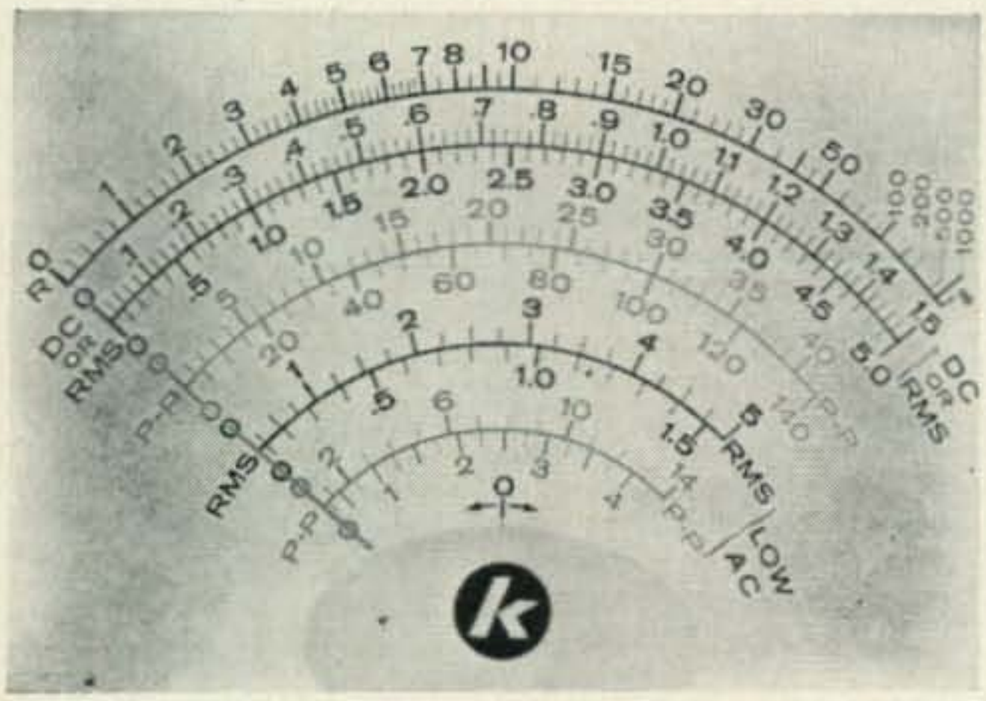
When a *positive* voltage is applied to the grid

On the other hand, a *negative* voltage at the grid of V_1 will cause the current through the tube to decrease and the cathode voltage to drop, thereby again upsetting the balance between the tubes and producing a difference in voltage between the cathodes that will cause a current-flow through the meter; however, this time the cathode of V_1 will be less positive (become negative) in respect to V_2 cathode, so the polarity of the meter has to be reversed to allow the pointer to swing upward. This is handled with a function switch in the v.t.v.m. that reverses the meter connections.

The microammeter functions as a voltmeter to read the difference in cathode potentials which is directly proportional to the voltage applied to V_1 grid. The meter may then be calibrated accordingly and set for a full-scale deflection on the desired range with an adjustable voltmeter-multiplier resistor R_4. In actual practice R_4 (d.c. calibrate) is set for the lowest range of the v.t.v.m.

The circuit constants and the conductivity of the tubes are such that the maximum possible unbalance of cathode voltages will not cause excessive current to flow through the meter; thereby affording protection of the meter against overload with the application of higher than normal voltages at the input of V_1. A.c. components which might be present at the input are filtered out by R_3 and C_1.

*Technical Director, *CQ*.



Typical v.t.v.m. scales. The ohms-scale is at the top and below it is the one used for d.c. and a.c. (r.m.s.) readings for full-scale ranges in multiples of 1.5 and 5. Peak-to-peak a.c. voltages are read on the light-colored (red) center scale. Because of differences in linearity at low a.c. potentials, 1.5 and 5 volt r.m.s. and the corresponding peak-to-peak scales are provided as shown at the lower two scales respectively.

Alternate Circuit

An alternate v.t.v.m. circuit operates on the same principle as the bridge circuit just de-

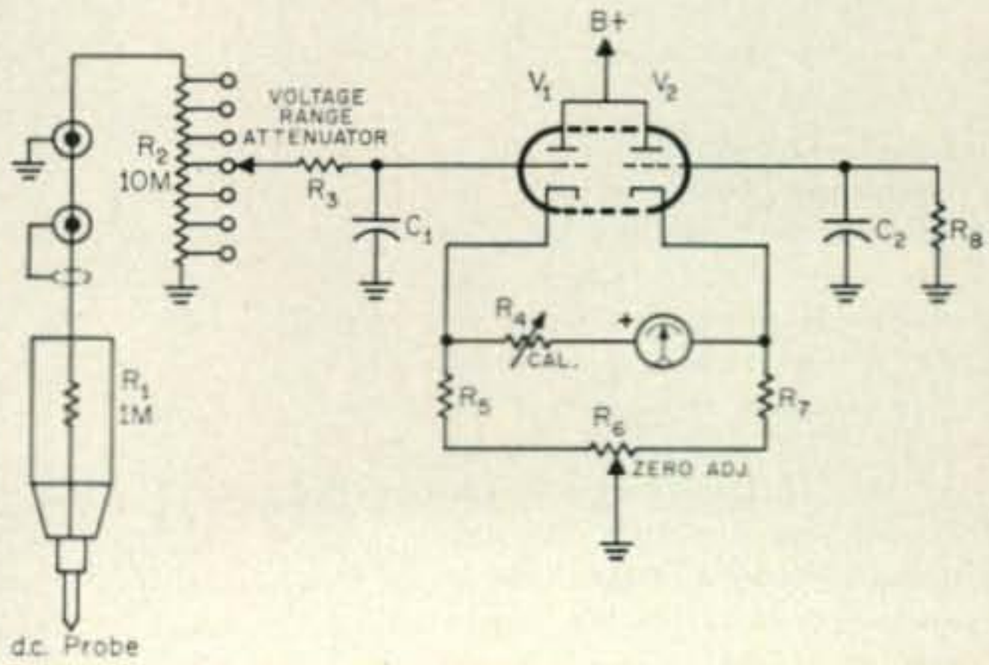
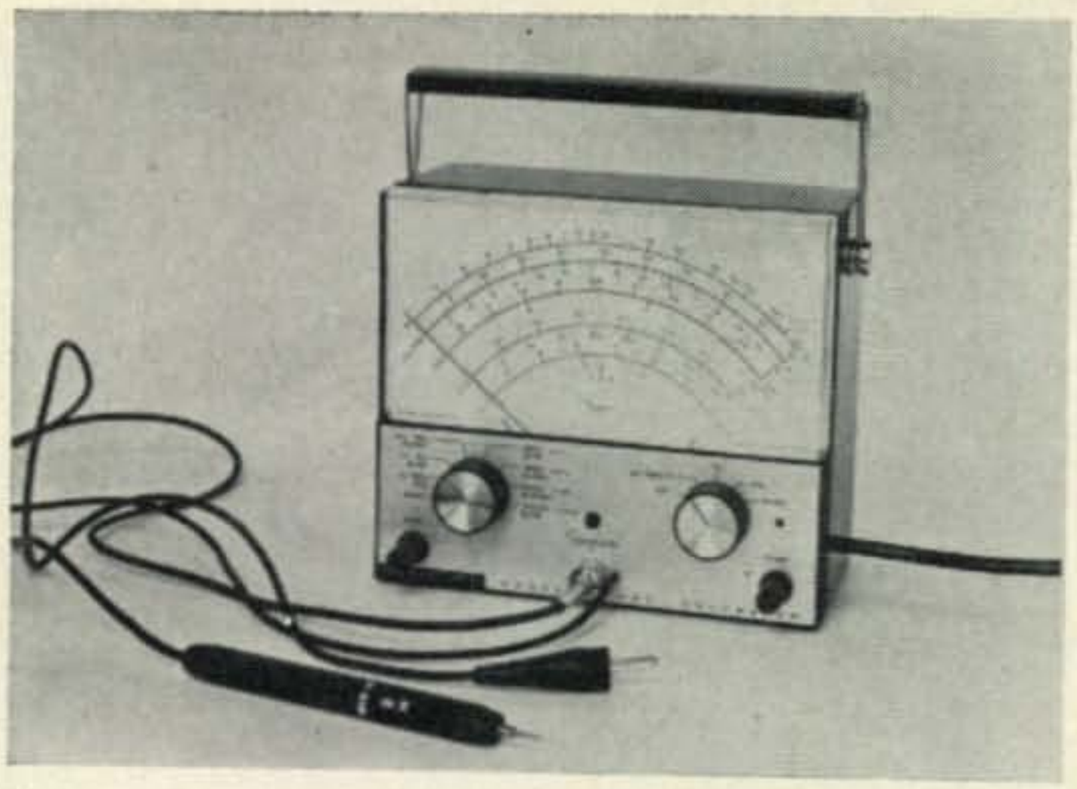


Fig. 1—Basic circuit for v.t.v.m. using a bridge-type configuration.



A v.t.v.m. with a full-view 7" meter. The a.c. scales are calibrated both in r.m.s. and peak-to-peak values. The lead with the clip (at lower center) is the common or ground connection. The probe in the foreground has a tiny switch on it to enable d.c. or a.c./ohms readings to be obtained.

scribed. In this case the meter is connected between the tube plates where voltage differences at these points actuate the meter. Plate resistors in a balancing arrangement are used like that of the cathode network of the previous setup.

The v.t.v.m. usually is arranged for a basic full-scale direct-input reading of 1.5 or 3 volts d.c. For higher ranges a voltage-divider network (attenuator) is used to reduce the input voltage to the required value at V_1 as shown at fig. 1. R_1 is a one-megohm isolating resistor which is located in the d.c. test prod to minimize the capacitive loading effects from the v.t.v.m. and the shielded test lead, so d.c. voltages may be measured on r.f. circuits without adversely affecting operation of the circuit.

The total resistance of the input attenuator generally is 10 megohms which with R_1 adds up to 11 megohms as the d.c. input resistance of the v.t.v.m. This is constant for all ranges and thus permits accurate measurements to be made on high-resistance circuits.

A.C. Measurements

When the v.t.v.m. is used for a.c. measurements, the input voltage is applied to a full-wave voltage-doubler, shown at fig. 2, where it is converted to a d.c. voltage that is proportional to the *peak-to-peak* value of the a.c. voltage.

This is how it works: On the *positive* half of the a.c. cycle diode V_3 conducts and charges C_4 to the positive-peak value of the a.c. potential. On the *negative* cycle the diode ceases to conduct and the voltage stored in C_4, added in series

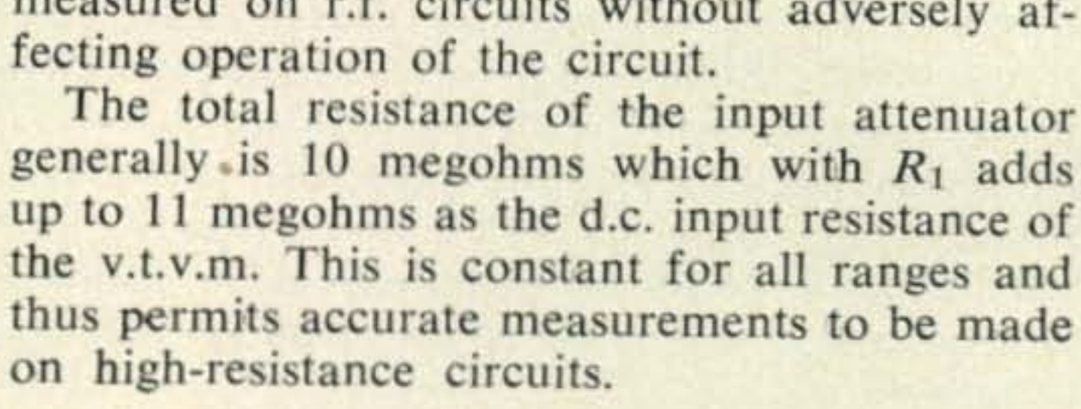


Fig. 2—Full-wave voltage-doubler circuit used in v.t.v.m. for a.c. measurements. The response is to the peak-to-peak values.

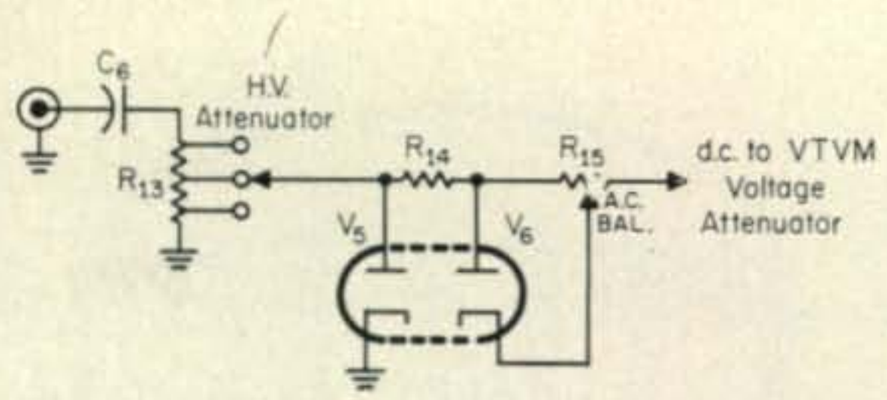


Fig. 3—Alternate a.c. input circuit in the v.t.v.m. uses a half-wave rectifier that responds to the peak value of one-half the a.c. cycle.

with the negative-peak voltage, is applied to diode V_4 which then conducts and charges C_5 to the sum of the positive and negative peak voltages.

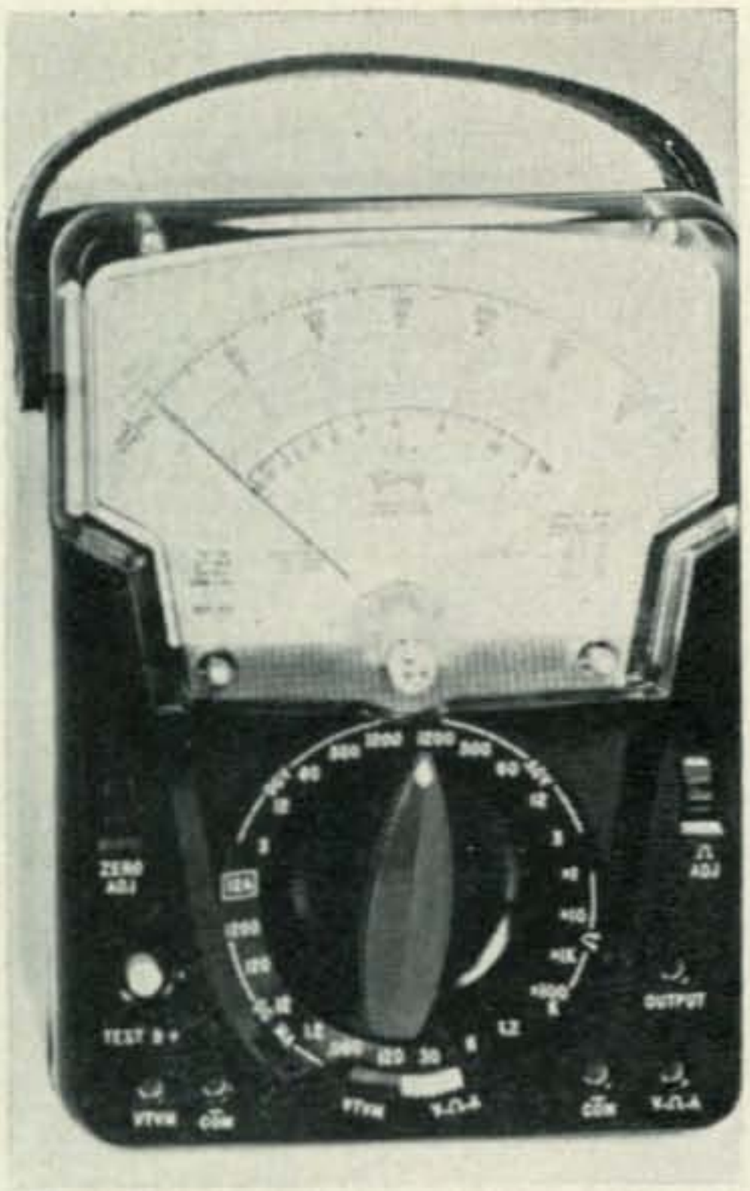
The resulting d.c. potential is then fed to V_1 through its voltage attenuator. For high a.c. voltage ranges an additional attenuator R_9 is used ahead of V_3 and V_4 to drop the applied potential below the maximum rating of the diodes. The input resistance, due to R_9, usually is about 1 megohm for the a.c. ranges.

An A.C. BALANCE control, R_{12}, furnishes a small positive potential from the power supply to cancel out the contact potential, inherent in vacuum-tube diodes, which otherwise would cause a residual meter reading to show up when the low-voltage ranges are used. A separate A.C. CALIBRATE control is used in place of the D.C. CALIBRATE control R_4 in fig. 1.

Many v.t.v.m.'s have scales calibrated both in peak-to-peak and in r.m.s. voltages. The rectifier responds to the peak values for *any* type waveform, so the peak-to-peak calibrations are accurate in most cases; the r.m.s. calibrations are those for a sine-wave only.

Older type v.t.v.m.'s will be found to have only a half-wave rectifier for a.c. measurements. This is shown at fig. 3 where V_5 conducts only during the positive cycle. The contact potential developed in V_6 is used to buck out that of V_5.

A v.t.v.m. which includes a db scale for audio-power readings.



A combination v.o.m. and battery-operated v.t.v.m. The latter measures only voltages up to 120 v.d.c.

The a.c. frequency response with the v.t.v.m. generally is good from about 30 c.p.s. up to a few megacycles. The upper frequency limit is primarily due to the reactive effects (mostly capacitive) of the test lead, of the internal wiring of the instrument and of the rectifier tube; however, accurate voltage readings may be obtained at frequencies up to about 250 mc with the use of an accessory r.f. probe. This utilizes a crystal diode rectifier that has a very low input capacitance and which can be installed directly at the end of the test lead in a shielded probe as shown at fig. 4.

The crystal diode operates in a half-wave shunt-type rectifier circuit to provide a d.c. voltage that can be read on the v.t.v.m. C_7 is a coupling capacitor that blocks any d.c. that may be present on the circuit at which the r.f. measurement is made. This capacitor produces a response to the *peak* value of the positive half of the input cycle, instead of to the average value which would be the case if C_7 were omitted. R_{16} serves both as a multiplier resistor for calibration and as a means for isolating the shielded output cable to prevent loading of the r.f. circuit under test. R_{16} usually is about 5.3 megohms, its exact size being dependent on the require-

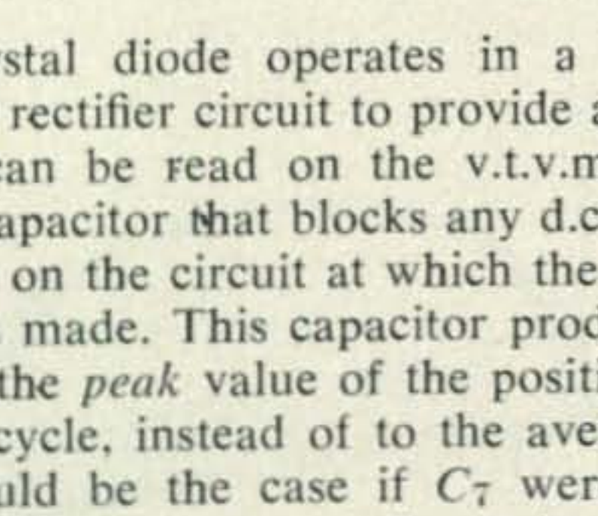
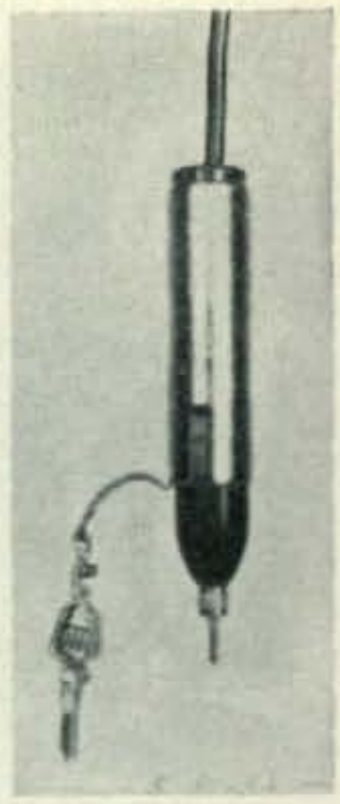


Fig. 4—Basic arrangement of resistance-measuring cir circuit used in the v.t.v.m.



An r.f. probe for use with a v.t.v.m. The lead with the clip is the ground connection. The hot terminal is the pin at the end of the probe. With this particular model, the barrel may be rotated to switch internal connections that permit measurement of d.c. voltages instead of r.f.

ments for the particular v.t.v.m. The crystal diode usually will not safely handle more than 25-30 volts r.m.s., so its use is limited to voltages below this amount.

Resistance Measurements

Resistance measurements are made with the v.t.v.m. using the voltmeter method in an arrangement similar to that described last month in connection with the v.o.m., except in this case the voltage drop measured across the *unknown* resistor, R_x, is compared with the initial reading when terminals *A* and *B* are *open*. See fig. 5. The d.c. voltage attenuator of the v.t.v.m. is not used and terminal *A* goes directly to the grid of V_1 (fig. 1). The voltage reading will be that of the battery, because the input resistance of the v.t.v.m. tube is infinite and no current will be drawn to produce a voltage drop across R_{17}.

When R_x is connected, current will flow through the resistors and the measured voltage drop across R_x will be proportional to the ratio of R_x to R_1 (R_x and R_1 comprise a voltage divider). R_x may be calculated from $R_x = (R_1 \times E_2) \div (E_1 - E_2)$, where E_1 is the reading with *A* and *B* open, E_2 is the reading with R_x connected.

Thus, if R_{17} is 10,000 ohms, the open reading E_1 is 1.5 v. and the reading E_2 with R_x connected is 0.5 volts; then R_x = (10,000 ohms × 0.5 v.) ÷ (1.5 v. −0.5 v.) = 5000 ÷ 1 = 5000 ohms. The total resistance in the circuit then is 15,000 ohms, and the ratio of 5000:15,000 ohms

[*Continued on page 79*]

A v.t.v.m. with an adjustable gimbal mount that allows the instrument to be placed on the bench in a tilted-up position or to be suspended from a shelf.

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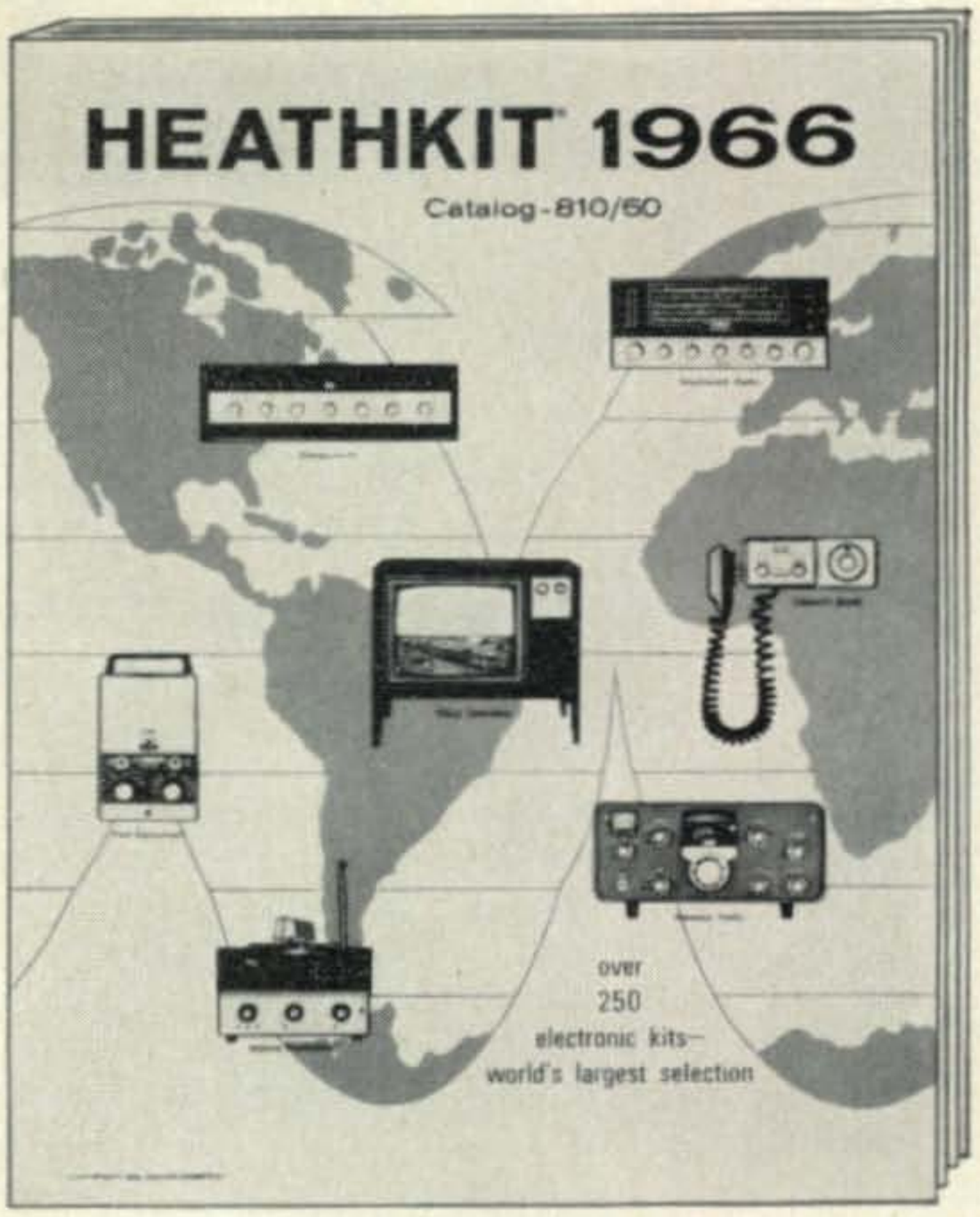

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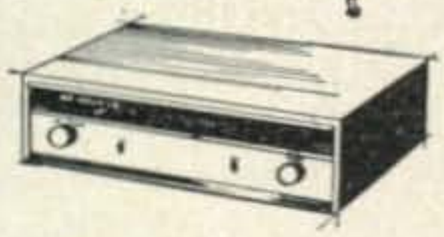

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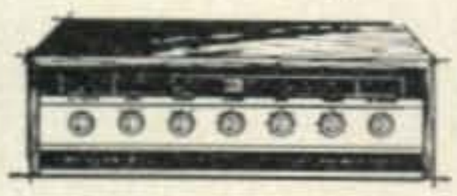

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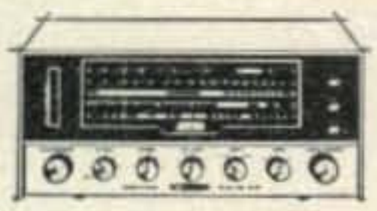

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No-33-34

RTTY From A to Z

BY DURWARD J. TUCKER,* W5VU

It is essential that an RTTY'er have a basic knowledge of the operation of his teletype machines, as well as the servicing requirements. This installment gives some of the basic requirements for the servicing and care of teletype equipment.

ACQUIRING and operating a teletype machine for the first time parallels ones experience in buying a new car. At first, its operation is unfamiliar to us. Gradually, with use, and with the aid of literature on the subject, one gains more understanding of the machine. The following material is designed to give the reader that aid.

Teletype Machine Servicing

It is human nature to try to get the most with the minimum amount of effort put forth on something. The teletype machine is no exception. Many RTTY'ers simply operate their machine with little or no attention until it quits or errors come thick and fast.

A teletypewriter must be given reasonable care and servicing if one is to expect continued trouble-free operation from the machine during its useful life. A good question at this point might be; "What is the length of that useful life?" Naturally, the life of machines varies considerably, depending upon the previous usage (commercial or military) and the treatment it gets in the hands of an amateur. Most of the machines that come through proper channels from Bell companies have many years of life left. More machines become inoperative from neglect than from use and this observation alone should indicate to the reader the importance of giving his teletype machine at least reasonable care.

There are established service organizations available that one can turn to for the servicing of a car or household appliance, but there are very few such places where one can have teletype equipment serviced. Often this involves crating, packing and shipping to some other city. There are no convenient service stations where the machine may be taken for routine inspections, cleaning, greasing, *etc*. You must learn to do basic maintenance your self. This means acquiring a certain amount of "savvy" in regard to teletype equipment. Fortunately, the use of the machine in amateur RTTY is almost nil (with some exceptions) compared to commercial use and it will usually give good service in amateur use, with a bare minimum of attention.

Basically, there are three requirements of servicing that must be satisfied if one is to expect trouble-free operation of a teletype machine. The machine must be periodically *cleaned, lubricated,* and *adjusted*. One is just about as important as the other.

Figure 112 lists a typical set of tools and materials used to service a machine such as the Teletype Model 15. The list gives the identifying numbers, names, description, and in some instances, the purpose of the tool or item. At first glance, one may be discouraged by the sheer number of items. A closer look reveals that many of the items are already on hand, or reasonable substitutes are readily available.

When To Service

A teletype machine that has been in storage or otherwise inoperative for some time may need a certain amount of servicing before it is put back in service. For instance, all oil cups should be checked and filled if necessary. The condition of the clutch on the main drive from the motor should be checked. The clutch should be kept *saturated with fresh oil* at all times; otherwise, the machine may start printing gibberish.

Preventive Maintenance

The teletype machine is an excellent example of where *preventive maintenance* will pay good dividends. Preventive maintenance is designed to *avoid* failures and breakdowns by giving the machine routine servicing at regular intervals. Preventive maintenance should not be done simply for the sake of doing it, or on a hit and miss basis. The manufacturer suggests that there are six basic maintenance operations: Feel, inspect, tighten, clean, adjust and lubricate. These basic maintenance operations are covered in the following sections.

Feel

Feel has to do mainly with the location of above normal temperature of parts. Overheating

*6906 Kingsbury Drive, Dallas 31, Texas.

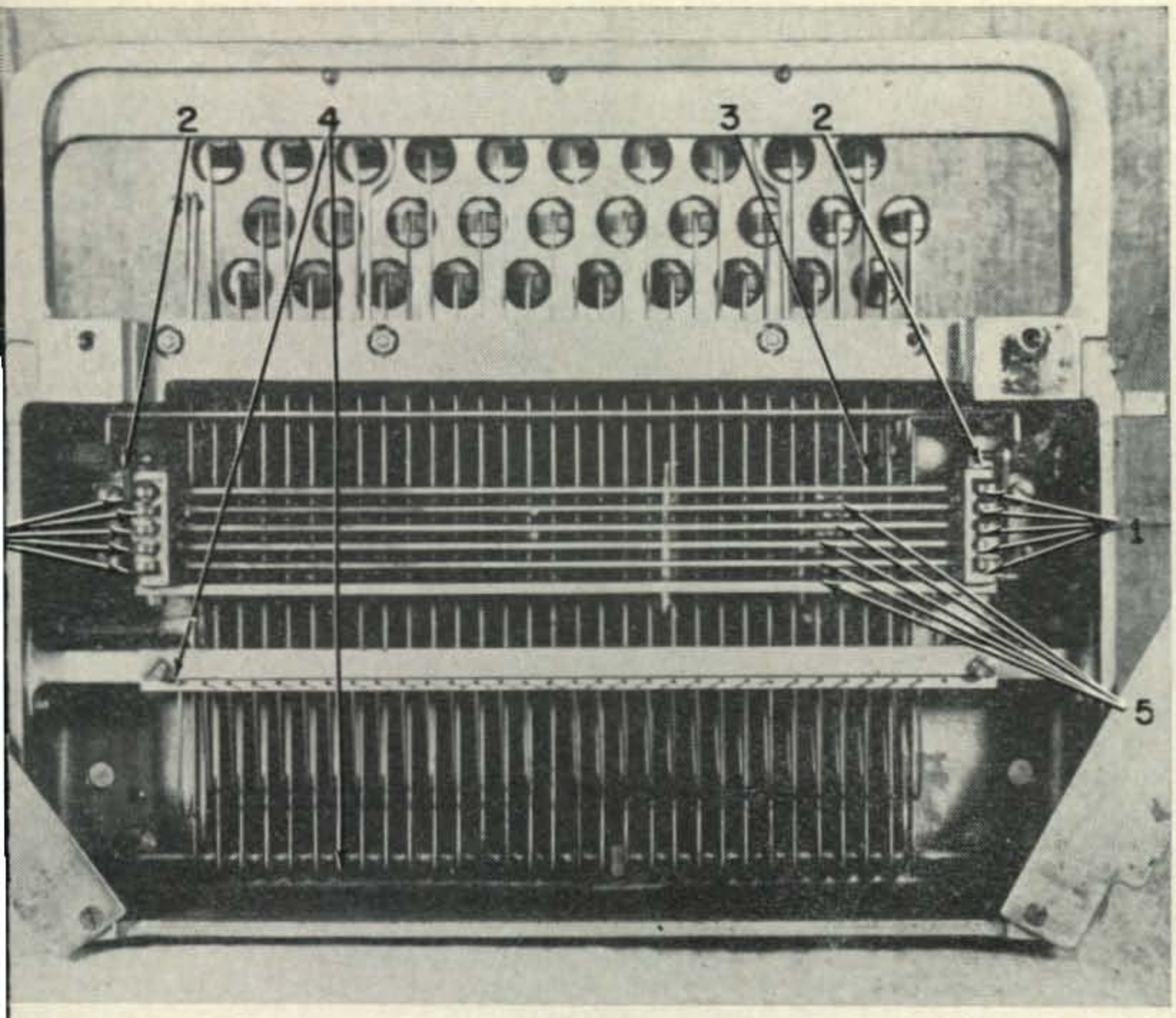


Fig. 113—Bottom view of the Teletype Model 15 keyboard showing the lubrication points. Each point requires 1 or 2 drops of Lubriplate No. 2 or SAE 10.

1. Selector bars in slots and rollers.
2. Universal bar pilot screw on bearings.
3. Trip off pawl link joint.
4. Keylevers on Keylever shaft and in rear comb.
5. Locking levers between pins in selector bars.

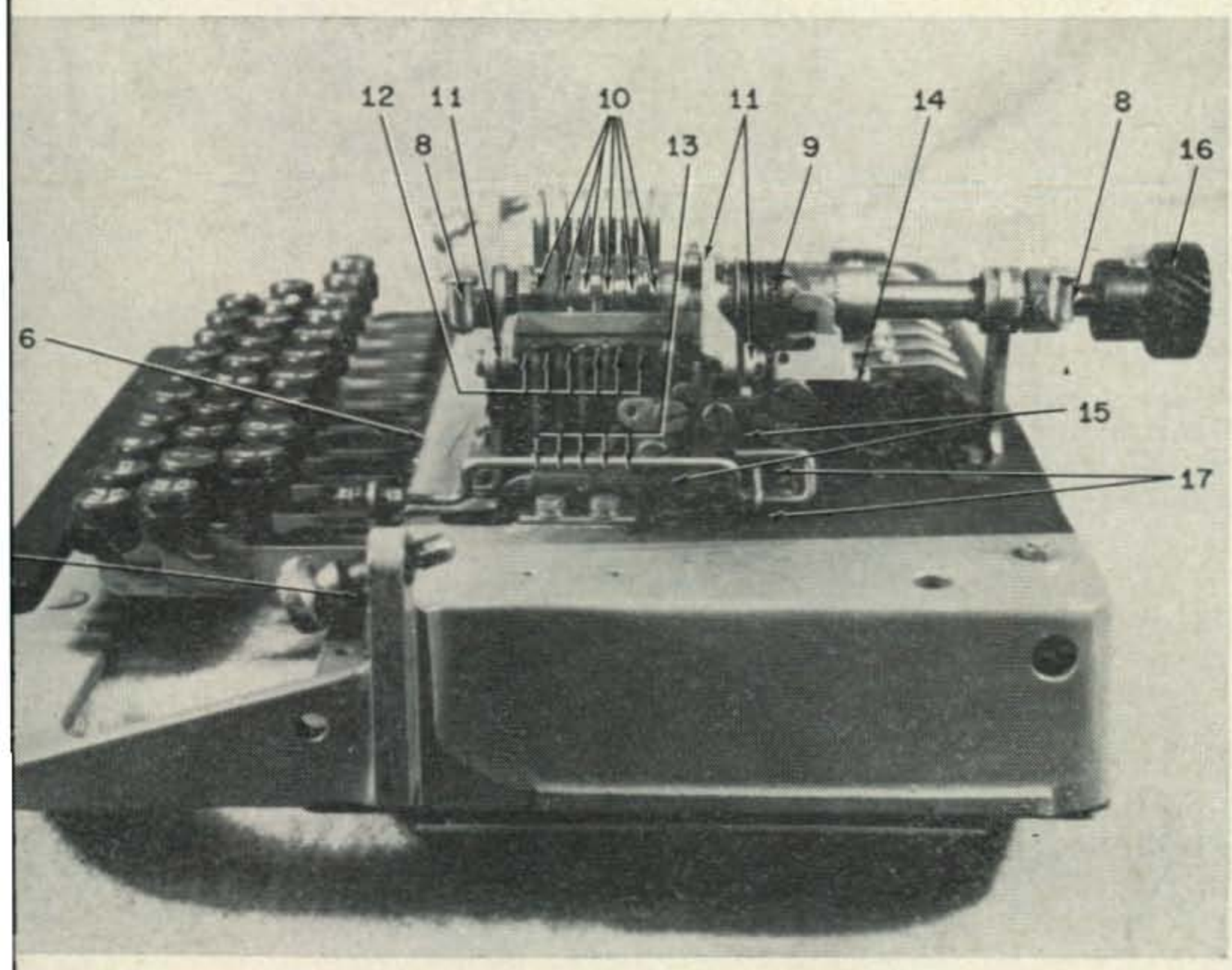


Fig. 114—Top view of the Model 15 keyboard showing the lubrication points. Points marked *A* receive 1 or 2 drops of SAE 10 and those marked *B* receive lubriplate No. 630-AA.

6. Keylevers in front Comb. A
7. Space bar loop on space bar loop shaft. A
8. Keyboard shaft (2 oil cups). A[1]
9. Keyboard clutch-sliding member. A
10. Cams, on surfaces. B[2]
11. Locking loop pilot screw bearings and rollers. A
12. Contact lever pivoting shaft and guiding comb. A
13. Locking levers in locking lever comb. A
14. Clutch throw-out lever bearings. A
15. Trip-off and intermediate lever pawls. A
16. Keyboard transmitter gear. A[3]
17. Repeat space rod on each bearing and points of contact. A

[1]*Fill cups.*
[2]*Light film.*
[3]*Sparingly.*

Gauge: tape.
Gauge: set; wire; 0.006" to 0.025".
Gauge: set; wire; 0.065" to 0.080".
Gauge: set; flat; 0.002" to 0.010".
Pin: gauge.
Guage: perforation of feed wheel.
Gauge: armature locating.
Scale: 32 oz.
Scale: 12 lb.
Hook: spring; pull.
Hook: spring; push.
Paper: cleaning; Bell Seal bond.
Cloth: emery; crocus.
Paper: sand; flint; #000.
Cloth: emery; #0.
Mirror: dental; WECo No. 376A; 6¾" x ¼" overall.
Bender: spring.
Tool: locking bail; finger holding.
Tool: finger bending.
Gun: grease; Teletype No. 88975.
Magnet M-129; bar; steel; 6 × ¾ × ¼".
Test Unit I-236; 5½ × 3¾ × 3¼"; includes neon lamp and target lamp.

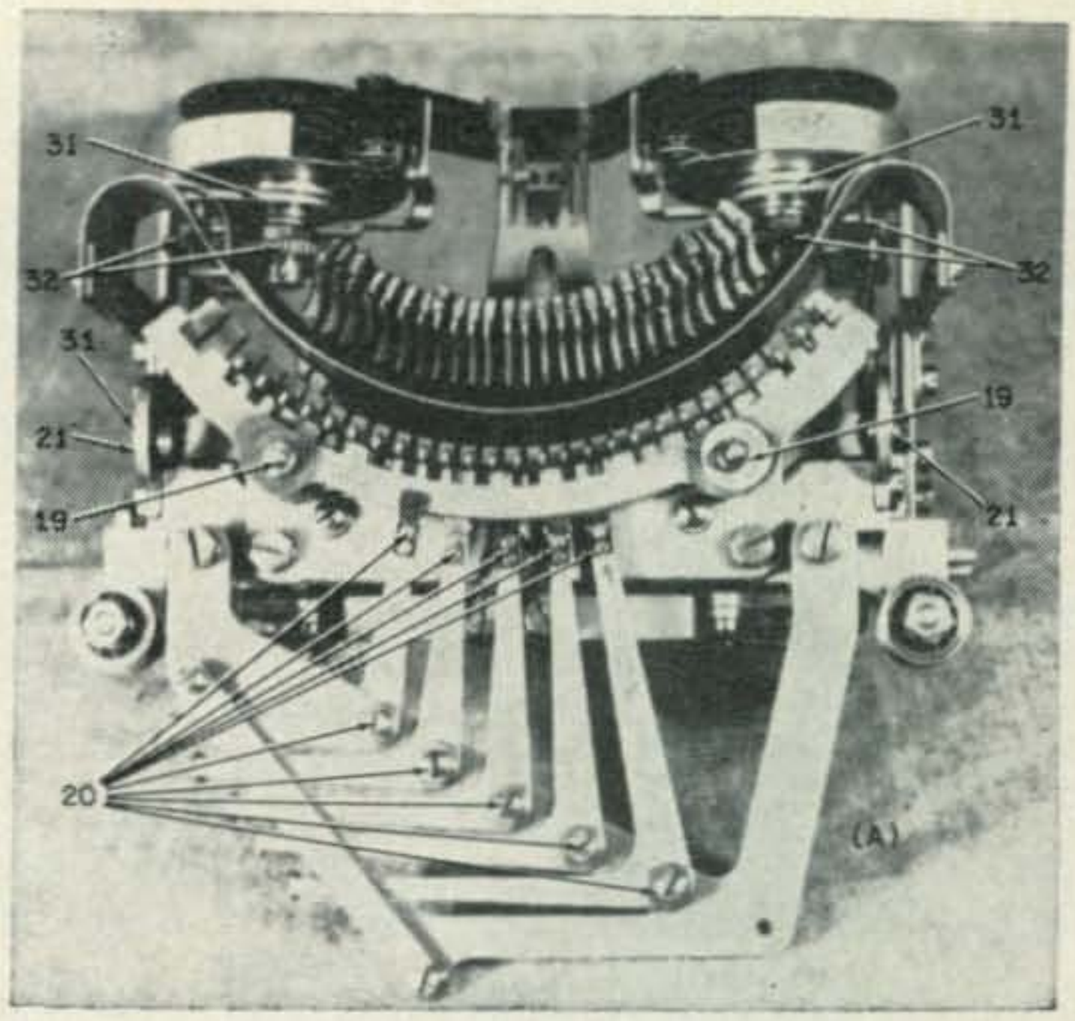
Fig. 112—Listed above are some of the typical tools and materials used to service a teletype machine such the Model 15.

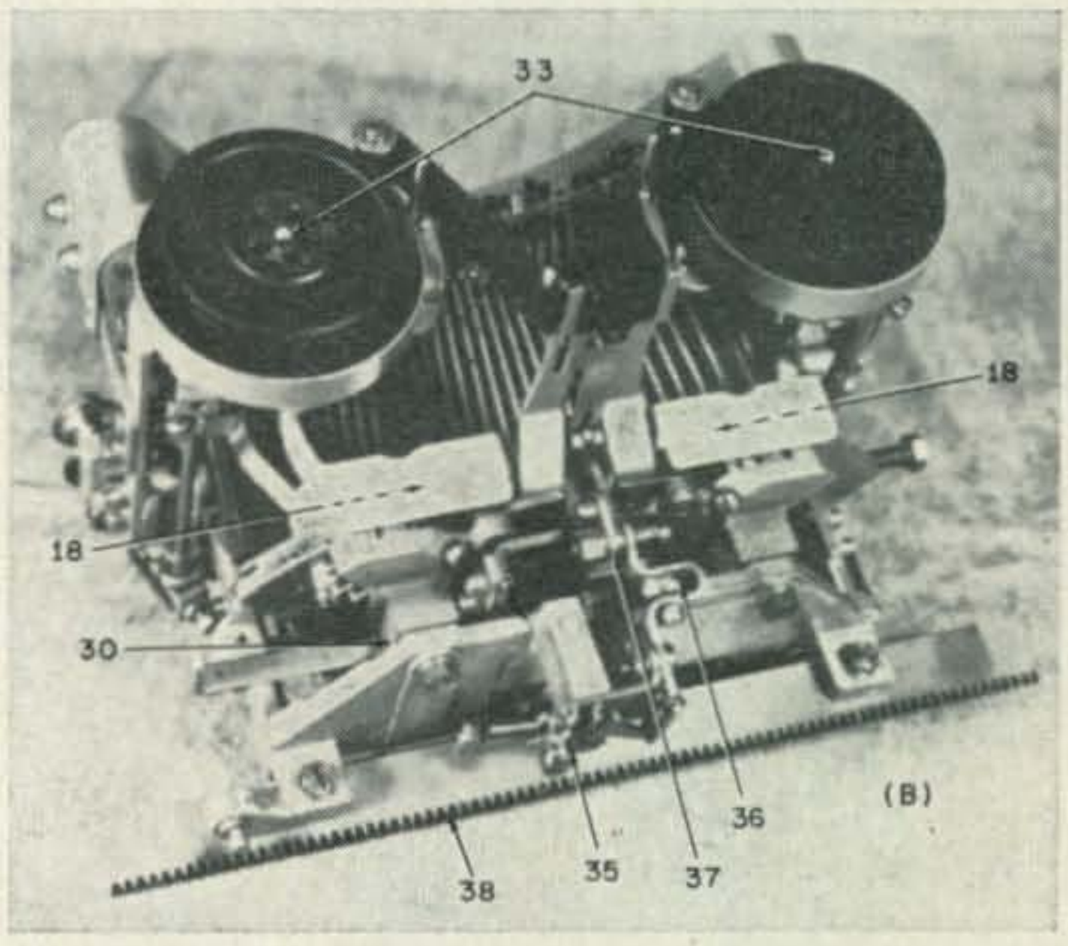
of parts can be due to lack of oil or grease, binding due to an accumulation of gummy substances on moving parts or bearings, or to parts tightened beyond allowable limits. Warped or bent parts can also cause overheating. Operation of the machine in a confined or otherwise unsatisfactory location can also raise the operating temperature. The feel test can also locate loose parts and certain mechanical irregularities. One may be able to locate binding parts or loose parts by feeling and gently prodding around the machine.

Inspection

A careful inspection of a machine should be made before attempting to give the machine preventive maintenance. A careless observer, or one unfamiliar with his machine, may overlook evidences of minor troubles. Unfortunately, many such minor troubles can eventually lead to more serious troubles or breakdowns. Often defects are sufficiently minor so that they do not mar the performance of the equipment for the time being. This makes them more difficult to detect by an inexperienced person. One should make every effort to learn enough about their machine so that they can recognize the normal functions of the machine as well as abnormal functions. After you have become accustomed to the operation and sounds of the machine, you are in a better position to detect anything out of the ordinary, especially if the sound of the operating mechanism changes sufficiently to be noticed. All malfunctions of the machine are *not* accompanied by a change in sound of the moving parts. It may take a thickness or spacing gauge, or a spring tension scale to determine if all is in order with regard to certain functions or operations of the machine.

The inspection of the machine can well be the most important part of preventive maintenance. This raises the question of just what we should look for. The machine should be inspected for cleanliness, whether it is fairly clean or covered with grime and dirt, particularly in the moving parts. One should determine if the machine needs lubricating or has an excess of lubricant. Lubricants, after a long while, or





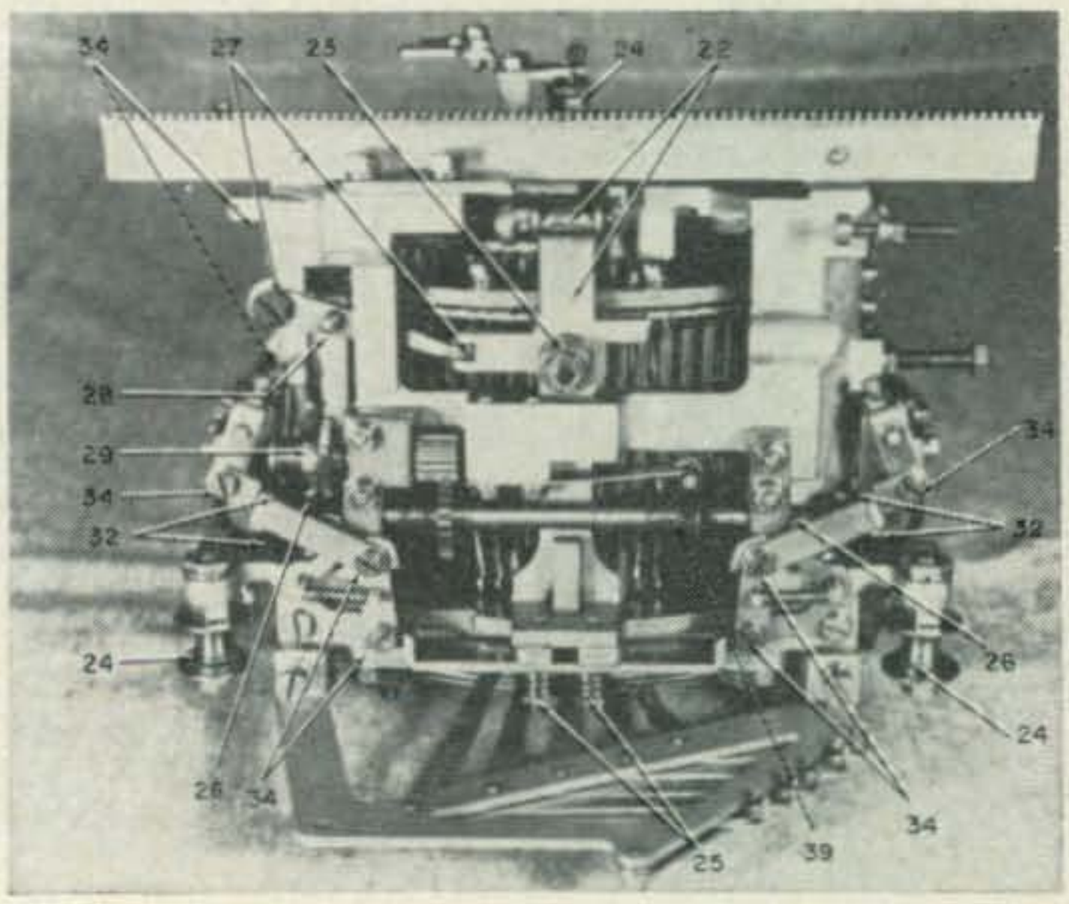


Fig. 115—Front (A), and back (B) and bottom (C) views of the type bar carriage showing lube points as well as general construction. Points marked A receive 1 or 2 drops of SAE 10 and those marked B receive Lubriplate No. 630-AA.

18. Type bars at segment slot. A
19. Code bars at posts. A
20. Code bar bell cranks on wearing surfaces. A
21. Pull bar bail on guide rollers and guide surface. B[1]
22. Plunger surface and rollers. B[1]
23. Plunger roller. B[1]
24. Carriage support rollers. A
25. Ribbon reverse bail. A
26. Ribbon feed shaft bearing. A
27. Ribbon feed pawl operating lever. A
28. Ribbon feed pawl pivot screw. A
29. Ribbon feed ratchet. A
30. Ribbon lockout bar at type bar segment slot. A
31. Ribbon feed shaft, on upper and lower bearings. A
32. Ribbon feed mechanism. A[1]
33. Ribbon spool shafts on bushings (remove spools). A[2]
34. Ribbon reverse shafts, upper and lower bearings, arms, pawls, and levers. A
35. Margin bell pawl. A
36. Ribbon shift lever and roller. A
37. Oscillator lever shoulder screw and carriage casting slot. A
38. Type bar carriage rack, space shaft pinion and travel. A
39. Ribbon feed shaft detent. B[1]

[1] *Sparingly.*
[2] *2 or 3 drops.*

under certain operating conditions, can become hardened and gummy and should be completely removed and replaced with fresh lubricant.

Besides those items already listed, the machine should be inspected for corrosion, moisture accumulation, mildew or fungus growth in tropical or high-humidity locations. One should look for overheating, tension, tightness, wear, placement and adjustment, loose electrical contacts, frayed or deteriorated wiring, arcing, dirty or pitted electrical contacts, as well as broken or warped parts.

Cleaning

The cleaning of a teletypewriter need not be a bothersome chore. If done leisurely and carefully it gives one a chance to observe the many parts and their functions. A lint free, clean, dry cloth should be used to wipe off dust, grime, excessive lubricant and other foreign materials. Naturally, there will be places where even a small strip of cloth will not fit, so it may be necessary to fold a piece of lint-free cloth over a slim screwdriver or other flat object to fit between the function levers, vanes and inside the printing bail, as well as other hard to reach places. Do not force a cloth covered screwdriver between two parts so that they are bent or otherwise damaged. *Do not rush*. Look before you probe and wipe. A small brush can also be used to clean the places more difficult to reach. In fact, it will help to have several small brushes with handles of varying lengths as well as bristles of varying stiffness. The faces of the type bar pallets should be wiped clean with a piece of cheesecloth that has been dampened with a dry cleaning solvent. A typewriter brush will aid in this but be careful not to bend the type bars during this operation. A stiff brush should be used to clean between the key levers and around the transmitting mechanism. Carbon tetrachloride may be used to clean electrical contacts.

Lubrication

A teletype machine should certainly be lubricated, but the lubricant should be used *sparingly*. Too much lubricant on a machine frequently speeds up the accumulation of dust and other foreign materials which works its way into bearings and other meshing and moving surfaces. This provides a cutting compound that causes excessive and unnecessary wear.

Excessive lubricants, together with dust and other foreign materials may eventually harden into a gummy substance that will impede or even prevent certain mechanisms from functioning at all. In addition, excessive amounts of lubricant makes the cleaning job more difficult.

In other words, lubricate your machine, by all means, but use the lubricants sparingly and wisely.

The easiest way to keep from overlubricating a machine is to never try to squirt one or two drops of oil from a can, however small it may be. A better method of applying oil to a lubrication point where only one or two drops are required (a lot of oil for any one spot on a teletype machine) is to use a short piece of #22 wire. Simply dip one end about a half inch into the oil and apply to the lubrication point immediately. One is not always able to put the oil exactly on the right spot. In such instances the misplaced oil should be carefully wiped off.

A teletype machine requires two kinds of lubricant, a grease and an oil. Any good grade of oil equivalent to SAE 10 should be satisfactory. One may use Lubriplate No. 2 oil.[18] The selection of the grease is not quite so simple. Oily or "greasy" types of grease, such as the common "cup grease" should be avoided if possible. Make every effort to obtain a special grease made for this or similar purposes. After all, like oil, the smallest can of grease that you can buy will probably outlast the machine. Another Lubriplate product is useful here, too. Lubriplate No. 630-AA is an off-white colored grease. It sticks well and is not as messy as the general run of cup greases.

Lubrication Points

Up to this point only the Teletype Corporation Model 14, 15 and 19 Teletype machines have been covered since they are in more general use than any of the others. The Teletype Corporation manufactured printer TG-7-A and Teletypewriters TG-7-B and TG-37-B as covered by the War Department Technical Manual TM-11-352. This equipment is the military version of the Teletype Model 15. They are essentially the same; however, there is a variance here and there. Quite a number of these machines are in the hands of the amateur RTTY'ers.

It is beyond the scope of this text to give complete data on every lubrication point for every teletype machine made or even all of those in general use by amateurs. Naturally, these points vary with the type of machine. In addition, there are variations in the same machine when more than one model is involved. A model 15 teletypewriter is shown in figs. 113 to 115 illustrating a portion of the lubrication points of this machine. Other pictures of parts of a dismantled model 15 as well as pictures of the Teletype Model 14, and the Kleinschmidt Model 150 will follow further along in the text.

Space does not permit the inclusion of all of the figures in this month's installment covering all of the lubrication points. These additional illustrations will be included in next month's installment.

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[18]Fiske Brothers Refining Co., Newark, N. J. and Toledo, Ohio.

[*To be continued*]

PLEASE include your ZIP code number on all correspondence.

What Price Honor Roll?

BY DOROTHY STRAUBER,* K2MGE

JIM'S eyes flickered right past the peeling paint and rusty bicycles as his excited glance took in the monster beam shining in the fading glow of the sun.

"There you are, baby," he exalted. "With you and that new final of mine, it should be a snap to work Bob Farmer on that new island. Boy, what would I do without the boys on Channel Z and their alert?"

He bounded up the front stairs and into the house, slamming the door behind him.

"That you, dear?" Mary called from the kitchen.

"Yep, honey, it's me. Say, go ahead with dinner. I got a call that Bob Farmer has shown up from a new country and you know I've got to keep my place on the Honor Roll."

"Well, you won't be too long, will you? I thought you had taken our Christmas Club money to send in a contribution so that you could work him first."

"That's right, honey, contributors first! And it was darn wonderful of you and the kids to give up your presents this year so that I could work this guy without having to scream at him hour after hour as I did before when I didn't have the dough to send in."

"OK, Jim, but please don't be too long. It's Open House at school tonight and you promised the kids you'd go."

By this time, Jim was already down in his shack with the rig warming up. He opened the gain on the 2-meter rig just in time to hear one of the other club members say, "There he is now, 14.105 . . . 5-9 here. This should be a cinch!"

Jim smiled to himself. Most of the other boys had decided not to send in advance donations; it smacked too much of commercialization and was a far cry from the days when, if you worked a guy, all you had to do was send him a card to get one in return. Of course, as more and more Ws became DX-mad, it became a common courtesy to send along IRCs and self-addressed envelopes, but money? Never any call for it among *amateur* radio operators!

"Oh well," Jim thought, "guess those were the good old days. Now you've really got to put a little dough aside if you want to keep up with DX. Stacked arrays. Real hot finals. Advance donations. A dollar a QSL—all this really eats up the savings."

Jim got set to put out his first call. His only call, he believed, since hadn't he been a big contributor?

"QV7KL . . . QV7KL . . . this is W2XXY, over."

"QRZ, QRZ, tuning 200 to 210."

"QV7KL, QV7KL, this is W2XXY, WILLIAM 2 X-RAY X-RAY YOKAHAMA, what say Bobby boy?"

Jim couldn't believe his ears; the guy was 5-9 with a barefoot exciter and a dipole and he wasn't coming back to him. He reached over and opened the audio gain a bit more; that oughta do it for sure!

"QV7KL . . . QV7KL, this is W2XXY. How 'bout it, Bob?"

For the next half hour, he sat there, calling, calling, calling! Bob kept going back to stations all around him, giving them 3-3 reports and they hadn't contributed a dime! Something was wrong! Jim raced up the stairs, past the family finishing up their dinner in the kitchen, and out to the tower. Was the beam heading right? Had the coax snapped? He played a flashlight along the line—everything was perfect! What could be the trouble?

"Daddy, are you ready to leave now? We've got to get to school on time."

"Errr, Johnny, afraid I can't make it tonight, son. You want me to stay on the Honor Roll, don't you?"

"Aw, gee, Dad, you promised you'd come to Open House just once before I graduate!"

"Johnny, I said I was sorry. Not tonight, boy."

By this time, he was back at the rig—his tie off, shirt collar loosened. What was wrong with skip that he couldn't work this guy? Was it just one-way? Bob was still booming through. Well, he better keep trying!

"QSYing now to c.w."

Jim, his fingers all thumbs, quickly tuned up on the preferred frequency which he knew was "five up" and let go a blast. Gosh, there was

"Jim, don't forget the Open House tonight."

*12 Elm Street, Lynbrook, New York.

Bob working all those new WBs and WCs, giving them 449, 439, and not a nod in his direction. Jim suddenly felt like he was having a nightmare —he just wasn't getting OUT! He reached for the 2-meter mike.

"Say, fellows, give me a frequency check and strength report, please. Anybody hearing me calling this guy?"

"Are you kidding, Jim? You were right on the frequency of the last guy he worked and you sound great! Some of us have worked him already—Good Luck!"

Reassured, Jim settled back and let go another call. Still nothing! Another, another, and another! He heard the door opening above; the family must be back and he still hadn't made contact. How could he face them after they had sacrificed so much so that he could get on the preferred list?

"Jim, ready for dinner now? Did you work him OK?"

"Uh, not yet, Mary. He faded out on me!" Jim put the head phones on so that Mary couldn't hear the din of the pile up. His fingers trembling, sweat pouring from his brow, Jim called time after time, first high speed, then low—anything to get this guy's attention. Nothing worked! Finally, after five more exhaustive hours, Bob did fade out and there was nothing for Jim to do but creep upstairs and slip into bed. Not, of course before he had set the alarm for 5 A.M. so that he'd be there first in time for the first "CQ".

When he stumbled back down to the rig, it was still dark and Jim felt like a fool, being up so early when the band was probably still dead. He checked the c.w. frequency—not a sound! He tuned up to the ssb frequency—also dead! He kept on tuning up the band and suddenly froze—there were hundreds of stations calling Bob and those he worked gave him 5-9 reports—in fact, the W4s were telling him that he was 45 over 9—"Watta signal"! Bob spun the dial back down again. "45 over 9" down South? He oughta hear him at least S5! Back and forth, he twisted the dial—nothing—not a sound!

He tuned up the band and heard a buddy in WØ land. "Break, Frank", Jim screamed.

"Hi, there Jim. Did you work Bob? You must have been one of the first to get him."

"Nope, had a little rig trouble, Frank. Say, tell me, what frequency is he on right now? I can't seem to find him."

"Hold on, ole buddy, I'll take a look . . . . . He's down four from last night, back on ssb. Say, you better put the steam on, Jim. He'll only be there another hour or so!"

Another hour? Jim almost fell off the chair. He felt the hairs on the back of his neck start to rise and his head started to ache. Where had he gone wrong? 6-element beam! Full kw! Two receivers to spot the right frequencies! Speech compressor on! Their entire Christmas Club savings, plus the money for the new outside paint job gone for a donation! Where had he gone wrong?

Jim zeroed in on 14.203 and called and called. Even though he couldn't hear the signal at all, maybe there'd be a sudden opening and he'd make it. Gosh, he just had to make it! Without this one, he'd drop way down on the Honor Roll!

In desperation, he tuned up the band and came across a group of other big guns, discussing the operation and comparing notes as to how many hadn't worked Bob. There was Bill, Joe, Andy, Dick—all big signals and top-notch operators! How come they couldn't make it either? Along with Jim, they were usually the first to hear a new station and work him. Something funny-strange was going on!

Wearily, Jim tuned back to Bob's frequency. Suddenly, he heard a weak signal—gosh, that must be him!

"QV7KL . . . . QV7KL . . . this is W2XXY—WILLIAM 2 X-RAY X-RAY YOKAHAMA—WILLIAM 2 X-RAY X-RAY YOKAHAMA . . . over PLEASE Bob . . .

"QRZ"

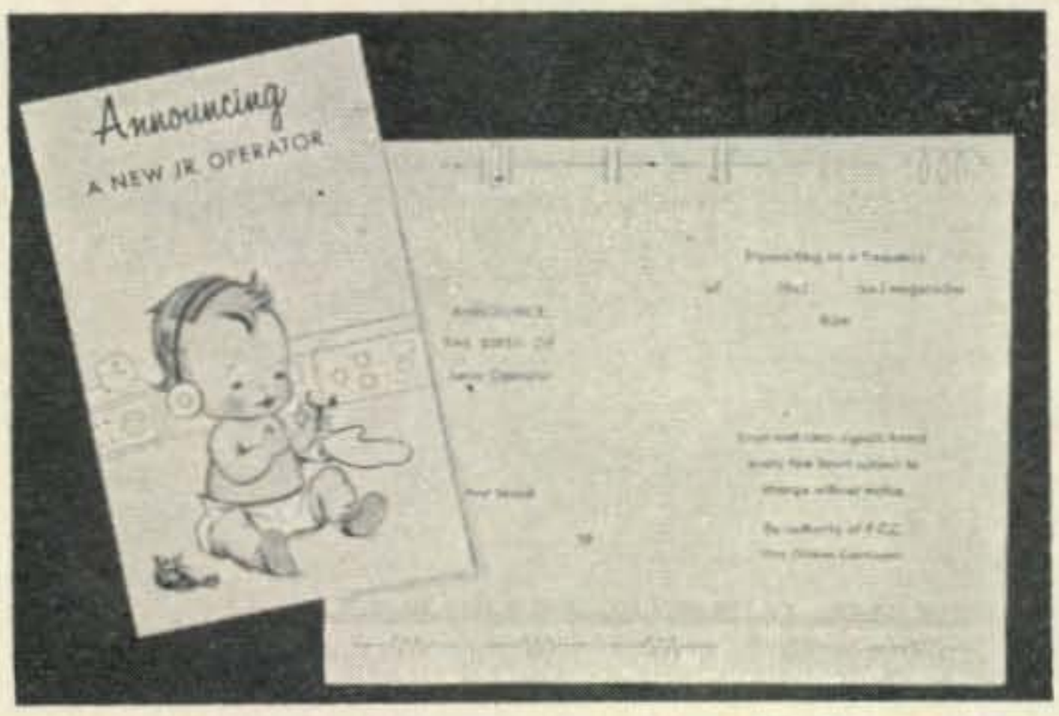
"Hi, Bob, this is W2XXY, W2XXY, W-2-X-X-Y. . . . you're 4 by 3 . . .

"W2XZI, you're 2-2 . . . . QRZ"

Jim tried to keep the hysterics out of his voice. "Not *W2XZI*—W2XXY, W2XXY please correct your . . . . .

"W3XXX, you're 5-9—good to work you again—what's new over there?"

Jim felt himself turning cold—all that time, all that effort, and no contact! Where had he gone wrong? ■



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Now announce your family addition with a colorful new amateur radio design birth-o-gram birth announcement. Printed in four colors, this announcement is suitable for either boy or girl. Ten cards and envelopes $1.00 postpaid. Matching thank-you cards also available 10 for $1.00. For further information write Birth-O-Gram Company, Dept. C, Coral Gables, Florida 33134, or circle 65 on p. 112.

A Broad-Band Balun For A Buck

BY WILLIAM I. ORR,* W6SAI

This article describes the construction of an inexpensive broad-band balun of the lumped constant coaxial variety. It has a 1:1 impedance transformation and will handle a kilowatt without overheating.

A BALUN is a balance-to-unbalance r.f. transformer and an extremely useful device in the field of radio communication. Known for decades in commercial practice, various forms and shapes of baluns are now being used to advantage in radio amateur antenna installations. In many instances it is common practice to connect a coaxial transmission line to a balanced transmission line or antenna system. Conversely, it is not unknown to find unbalanced (coaxial) transmission lines attached directly to the balanced circuits of receivers or transmitters. It is a poor technique to follow and untold difficulties may arise from subterfuges of this type. Such electrical mismatches, or transitions, should not be made directly since the junction between the balanced and unbalanced systems presents an electrical discontinuity in the characteristic impedance of the system. The use of a balun at such a junction permits a proper balance to be achieved and eliminates a sticky problem that can lead to all sorts of weird effects, especially when s.w.r. measurements are made. Trying to make knowledgeable s.w.r. measurements through a balance/unbalance discontinuity in your antenna system is like trying to nail a blob of Jello to the wall. It just can't be done.

*Amateur Service Dept., EIMAC, a Division of Varian Associates, Inc., San Carlos, California.

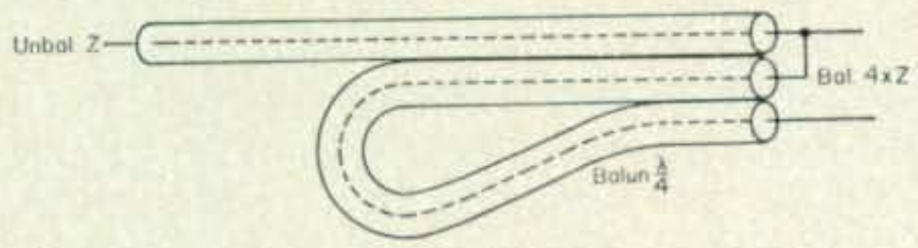


Fig. 1—A simple half-wave coaxial balun provides a 4 to 1 impedance transformation and is extremely frequency-sensitive. Good balance may be achieved over only one amateur band.

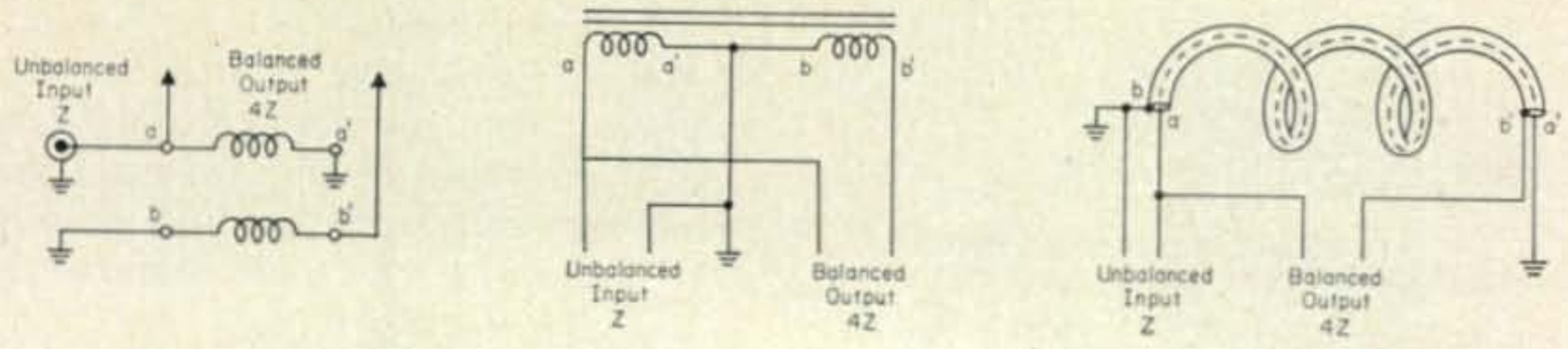
Half-wave Coaxial Baluns and Ferrite Baluns

Simple half-wave coaxial baluns have been used for years by radio amateurs to achieve a continuous junction between unbalanced and balanced systems (fig. 1). These devices may be made of a length of coaxial line and are cheap and easy to build. They are, however, decidedly frequency-sensitive and the balun length becomes quite critical at 50 mc and above. Worst of all, for the amateur wishing to match a low impedance coaxial line to a typical beam antenna (having a *lower* value of impedance than the line) the half-wave balun provides exactly the *opposite* impedance transformation. It is a step-up device rather than a step-down device. In this instance, the perfect balun would provide a balancing action with a step-down impedance ratio that would match a 50 ohm coaxial line to the driven element of a Yagi antenna which is in the neighborhood of 20 ohms or so.

The emergence of the so-called tri-band or duo-band beam in the past decade has imposed a second restriction on the "perfect" balun: it should function over a four octave range (7-29.7 mc). The half-wave balun is too frequency sensitive to do this job. Suitable broad-band baluns to cover this range may be wound on ferrite cores and will accept power levels up to 750 watts or so.[1] Ferrite cores, however, are costly and somewhat fragile and cannot be readily found in the corner radio shop.

An inexpensive and satisfactory substitute for the ferrite variety of broad-band balun is the lumped constant coaxial balun. This article describes such a balun and shows how you may build one in a few minutes for modest cost.

[1]Turrin, R., "Broad-band Balun Transformers," *QST*, August 1964, p. 33.



(A) (B) (C)

Fig. 2—The 4 to 1 balun coil may be visualized as a form of TV "ladder transformer" (A), or as a audio inductor (B) with the input fed to one-half the winding. Balanced output is taken across the complete winding. An equivalent r.f. transformer makes use of a section of coaxial cable (C) which is equivalent to a coaxial winding. The coaxial cable is approximately an electrical quarter wavelength at the center frequency of the balun.

The Broad Band Coaxial Balun

A simple, efficient and effective broad-band balun may be constructed from a length of coaxial line, suitably tapped and wound into a coil. The transformation can be made to be unity (one-to-one), thus providing a balanced 50 ohm termination for a 50 ohm coaxial line, suitable for most tri-band beam antennas. Alternatively, a "Hair-pin" matching device may be used to transform the 50 ohm balanced termination to a lower value.[2]

The broad-band coaxial balun is shown in the drawings and illustrations and consists of a section of 50 ohm coaxial line wound on a 6¾ inch diameter form. The balun acts as a transmission line transformer at the high frequency end of the operating range and as tightly coupled inductors at the low frequency end of the range. The over-all passband is about 6 to 32 mc, and is limited at the low frequency end by the inductance of the windings, and at the high frequency end by transmission line resonances.

Operation of the broad-band coaxial balun may be seen from the analogy shown in fig. 2. This is the sketch of a simple 4:1 coaxial balun. (A). It is also known as a ladder transformer in TV *lingo*. This balun may be compared to a push-pull audio inductor, with the exciting voltage fed to one-half of the winding and the output voltage taken across the complete winding. If both windings have an equal number of turns, the output voltage will be twice the input voltage and will be balanced with respect to ground. As the ratio of the output and input impedances of this device is a function of the square of the ratio of the output to the input voltage, the impedance transformation is 4:1 (step-up).

[2]Orr, W., *Beam Antenna Handbook*, 2nd Edition, Radio Publications, Wilton, Conn.

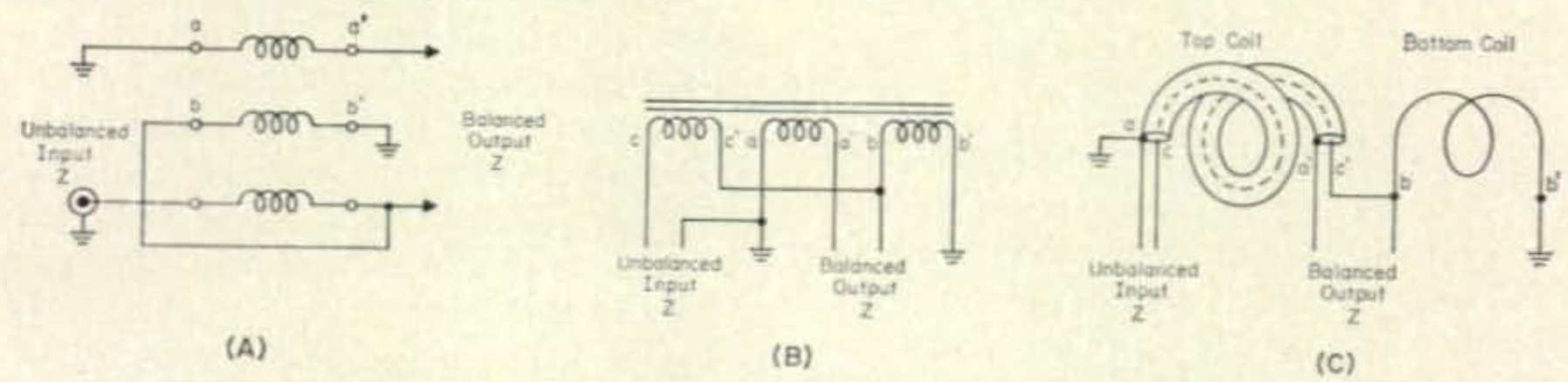
The 1:1 Coaxial Balun

A version of the broad-band coaxial balun is shown in fig. 3 wherein a 1:1 transformation ratio (unity) may be realized. The balun is pictured as having three windings (or two windings, with one winding tapped at the center to obtain a half-voltage point) as shown in the audio inductor analogy.

Each half-winding of this inductor has one-half the input voltage impressed across it. The full input voltage is impressed across both halves of the winding, and one output tap is placed at the center of the winding. The other output tap is taken from the proper end of the "third" winding which has one-half the impressed voltage across it. By proper polarization of the windings the output voltage will be balanced to ground. This version of the coaxial balun provides a 1:1 (unity) transformation from an unbalanced to a balanced state and is a very handy device to have around the amateur station!

Building the 1:1 Coaxial Balun

The 1:1 broad-band balun may be simplified by making the whole device out of a single length of coaxial line as shown in fig. 4 and 5. Symmetry of placement of the various "coils" is thus insured and the cost of the coax is negligible. The "single" winding portion of the balun is made of a shorted section of the coaxial line which, in reality, is merely a continuation of the original "dual" winding. Sounds complicated? Well, it really isn't . . . here's how you do it.



(A) (B) (C)

Fig. 3—The 1 to 1 balun coil has three windings (A) or may be visualized as an audio inductor having three equal coils as in (B). Voltage across each coil is equal and proper polarization of the windings provides output voltage balanced to ground. An equivalent r.f. transformer requires three windings, two of which may be made of a length of coaxial cable. The third winding may be a single section of wire, but is often made of the outer conductor of a coaxial line in order to preserve symmetry as shown in (C). In this case, the outer and inner conductor may be shorted together.

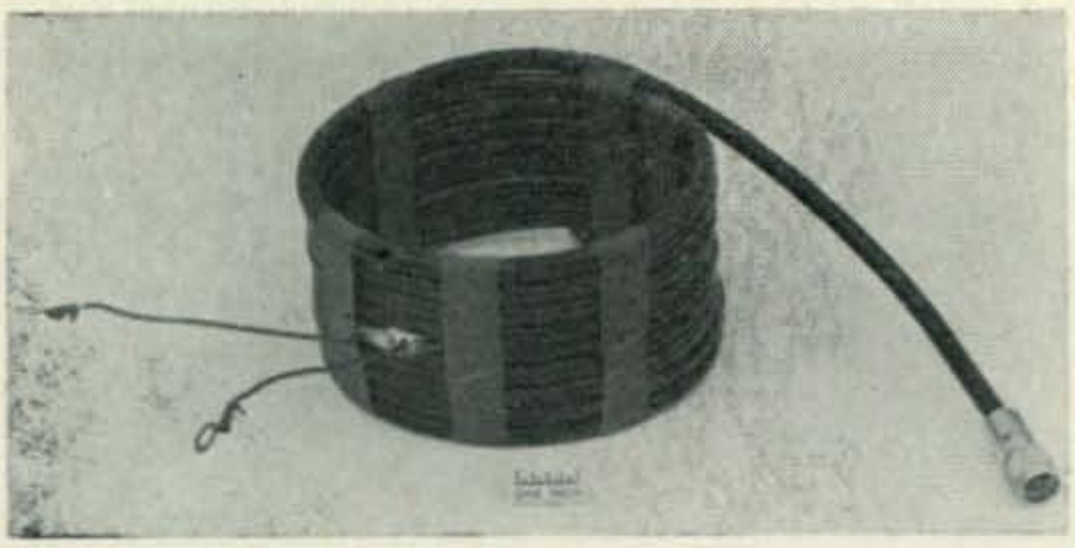


Fig. 4—A coaxial balun made by WA6JSA. A single length of coaxial cable was wound on a suitable form and fixed in position with vinyl tape. The balanced connections at the center of the winding are made by short lengths of #12 wire, and the "top" end of the coil has a PL-259A plug affixed to it for connection to the station transmission line.

The balun is simply a coil of 50 (or 52 ohm) coaxial line. The old favorite RG-8/U or its new noncontaminating cousin RG-8A/U may be used. Alternatively, the new 50 ohm noncontaminating RG-213/U is satisfactory. Any of these cables will produce a sturdy balun that will handle a kilowatt-plus (over two kilowatts p.e.p.) of power without overheating. The new RG-213/U is recommended over the others for reasons that will be discussed later.

A section of coaxial cable 16'6" long is to be wrapped into a coil whose inside diameter is 6¾ inches. This length of line will permit 9 turns to be made, with an inch or two left at each end of the coil for connections. The physical midpoint of the length is found and at this point the outer plastic cover and the outer, flexible shield of the line are broken. The plastic cover is trimmed back for an inch on each side of the break and the copper outer braid is trimmed back and cut about one-half inch each side of the center point to allow the connections shown in fig. 5 to be made. The inner conductor is *not* broken. (To prevent ambiguity, the "shorted" section of line is termed the "bottom" and the unshorted section is termed the "top," as shown in fig. 3.) Wire leads are now soldered to the outer shield at both ends of the "top" section. The shield of the "bottom" section is soldered to the inner conductor at both ends of the line. When this is completed, mark the free end of the "bottom" winding so that it is readily identifiable and securely solder the center joints of the line. Cover this joint with waterproof, vinyl tape, allowing the connecting leads to extend from the taped joint.

Winding the Balun Coil

The next step is to wind the modified coaxial cable into a coil having an inner diameter of 6¾ inches. Your ingenuity will stand you in good stead at this point. It is possible to "air wind" the coil using small wooden strips as braces.[3] After making a few baluns using this technique, using a hand-made form built up of dowel rods pushed into holes drilled in a board, I suddenly discovered a near-perfect coil form of the proper diameter. Gray, *Polyvinyl Chloride (P.V.C.)* plastic pipe of various diameters are available from plumbing supply houses and an eight-inch length of this material makes a nice, permanent coil form that may be bolted directly to the boom of the beam antenna.

Let's assume you have a chunk of the proper diameter P.V.C. plastic pipe. Wind your prepared coaxial line on the form for a trial run, and you'll end up with slightly more than nine turns. Using three hands hold the winding in place and mark the nine-turn end-points on the form with a pencil.

It is necessary to fasten the coaxial coil to the form. The easiest way to do this job is to remove the winding and drill small holes through the wall of the form at each end of the winding (previously marked with pencil) and lash the ends of the coaxial line to the form with heavy twine or lacing cord. Using the pencilled end point marks, it is simple to determine where the holes should be drilled (one on each side of the ends of the cable). The coax may then be rewound on the form and lashed in place. If all went well, the center tap of the coaxial line will be at the center of the coil; that is, there should be exactly 4½ turns each side of the center tap.

The last step is to connect a grounding jumper from the "top" end of the coil braid to the braid at the "bottom" end of the winding. The jumper should have reasonably low inductance. I use a ½ inch wide copper strap for this connection, scrounged from the junk box. Solder the jumper in place at both ends and your balun is completed (The jumper goes from a to b^1 in Fig. 3C: a common ground connection.)

Using the Coaxial Balun

This balun should be mounted on the boom of your beam antenna close to the feed point of the driven element. It is designed to match an unbalanced 50 or 52 ohm coaxial line to the center of a split, driven element and should not be used with such shunt-fed system as gamma matches or the like. The balun may be mounted to the boom by means of a pair of small right-angle brackets. Connections from the center balun terminals to the driven element should be made with short lengths of copper strap or heavy wire. The coaxial transmission line attaches to the input ("top") terminations of the balun, and the ground (outer braid) is grounded to the boom of the antenna and the common ground of the balun coil. That's all there is to it!

In addition to providing a good match for a "tri-band" beam, the coaxial balun works well with a single band beam. The so-called Inducto-match or Hair-pin system may profitably be employed in this instance.[2]

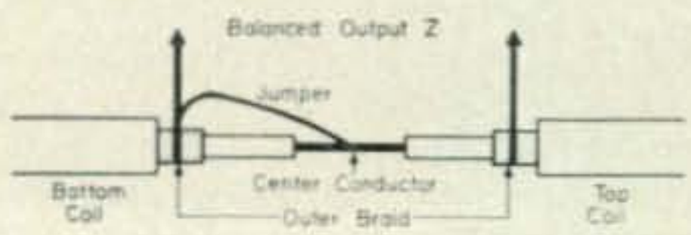


Fig. 5—A sketch of the center junction of the balun coil.

[3]WA6JSA used an empty gallon cider jug for his coil form.

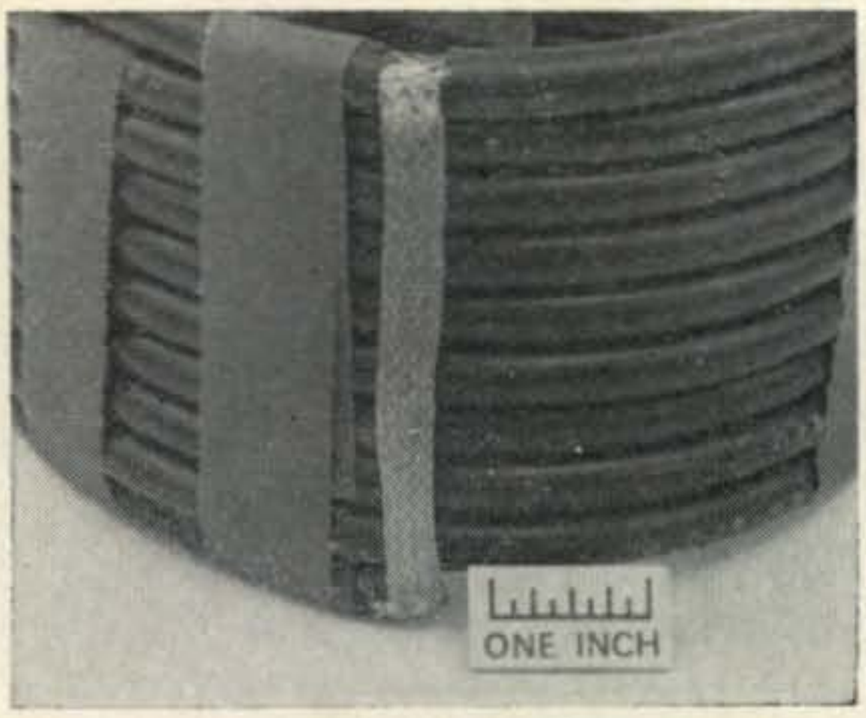


Fig. 6—The outer conductor of the balun coil is jumpered to itself at each end of the coil. This is a common ground point and may be connected to the metal boom of the beam antenna. A short length of copper braid was used in this balun, but a length of copper strap may also be used.

Electrical Characteristics of the Coaxial Balun

A frequency run of a typical coaxial balun is shown in fig. 7, made under laboratory conditions with an *R-X* meter. Using RG-213/U line (a nominal 50 ohms) the balun presented various input impedances when terminated in a 50 ohm non-inductive load. At 7 mc, the input impedance of the balun was about 55.2 ohms. At 14 mc the input impedance had dropped to 53.3 ohms, and was measured as 51.8 ohms at 21 mc. Minimum impedance occurred at about 24 mc and was measured as 51.5 ohms. At 30 mc, the balun input impedance had risen to about 52 ohms. The balun proved to be slightly reactive, having an input capacitance of about 15 mmf above 11 mc. Below 11 mc the capacitance rose gradually and smoothly to 35 mmf at 7 mc.

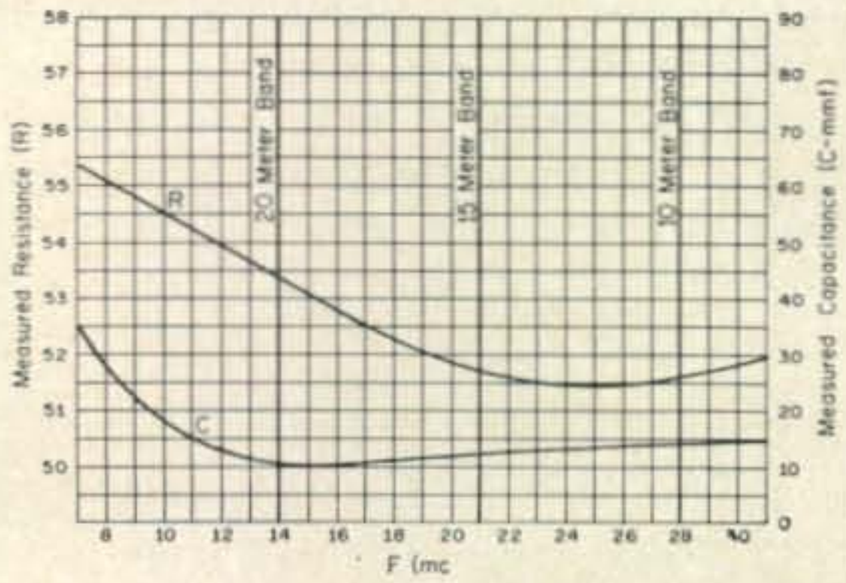


Fig. 7—Frequency run of a typical coaxial balun terminated in a nonreactive load of 50 ohms presents a load to the transmission line that varies between 55.2 ohms at 7 megacycles and 52 ohms at 30 megacycles. The input is very slightly reactive, as seen from the capacitance curve. This performance is several orders of magnitude better than many inexpensive balun devices on the amateur market. Although designed for the 14-30 megacycle range, the balun exhibits excellent characteristics at 7 megacycles. Performance starts to deteriorate above 35 megacycles or so. If the balun is wound of RG-8/U (52 ohm cable), the resistive curve is displaced upwards about 2 ohms, but retains the characteristic shape shown. The actual capacitive reactance at the input terminals of the balun is judged to be somewhat lower than shown by curve (C) as about 5 mmf of residual capacitance was inherent in the measuring device.

The very slight variations in input reactance are "washed out" when the driven element is in place and properly adjusted. Slight adjustments (and by "slight" I mean an inch or so) to the driven element of the beam can reduce the s.w.r. on the transmission line at beam resonance well below the capability of a good s.w.r. meter to detect appreciable flow of reverse current.

It was noticed that when RG-8/U line was used for the coil (a nominal 52 ohms) the resistance measurements of the balun were a consistent one to two ohms higher than when 50 ohm RG-213/U line was used for the coil. As the balun seemed to provide a line termination somewhat higher than the impedance of the line of which it was wound, it was felt that use of the slightly lower impedance line for the coil was justified. The reason for the slight impedance transformation is obscure, but it could be caused by minor imperfections in the coil or by variation in the actual impedance of the particular chunk of coaxial line used for the coil. Practically speaking, either RG-8/U, RG-8A/U or RG-213/U coaxial line may be used with little or no observable effect in operation.

There's no reason why a low power version of this device could not be made out of RG-58/U, or a high power version (heaven forbid!) out of RG-17/U. The only precaution is that the chosen coaxial line should not be coiled less than about ten times the diameter of the line, or else "cold flow" of the plastic dielectric will permit the center conductor to gradually drift with time, eventually causing an internal short in the cable.

Those amateurs who have attempted to run s.w.r curves, or make measurements, on a tri-bander beam directly fed with a coaxial line

[*Continued on page 107*]

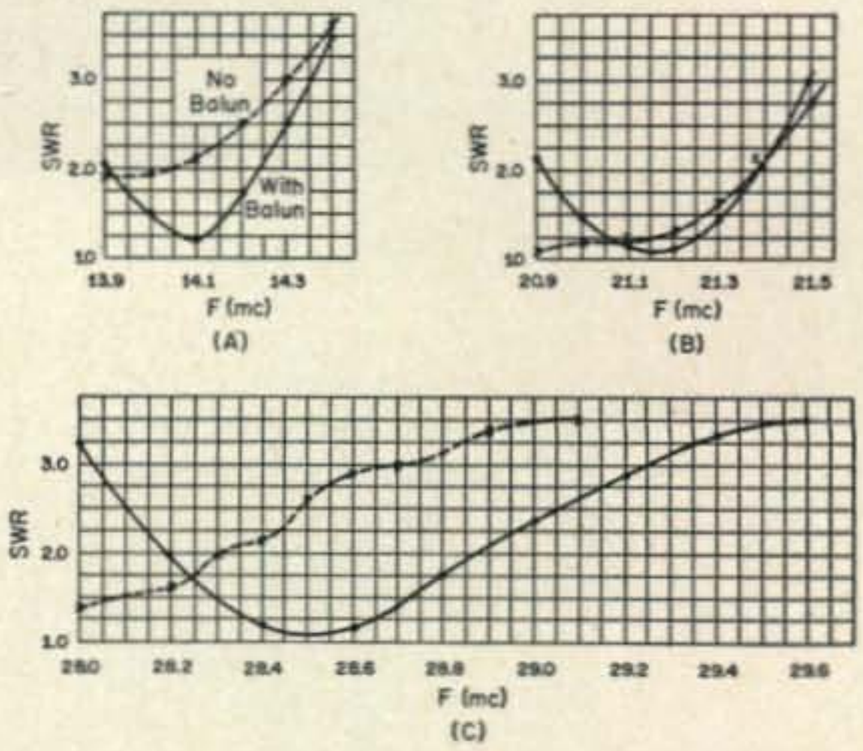
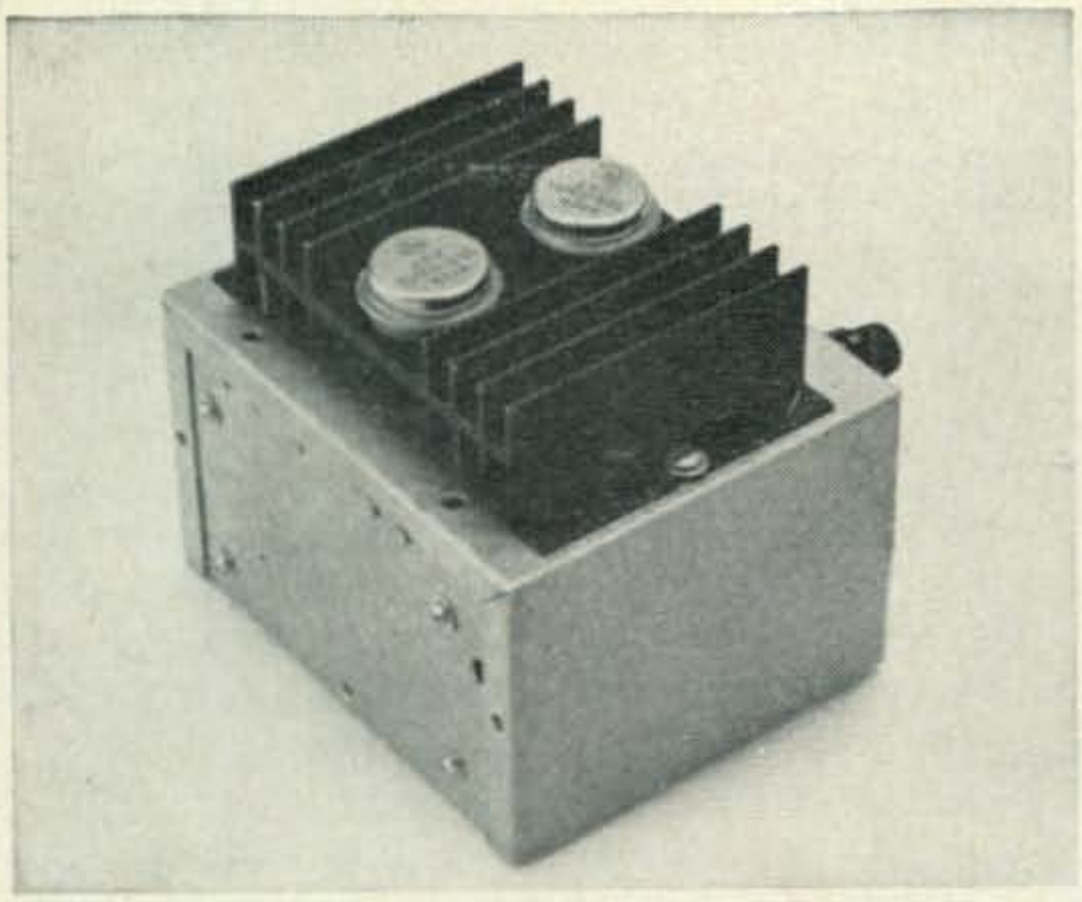


Fig. 8—S.w.r. curves on a "tri-bander" beam antenna with and without the coaxial balun coil. (A) 14 mc: Without the balun (dotted line), the s.w.r. measured worse than 2:1 across the band, with no indication of antenna resonance. The s.w.r. curve could be altered by changing length of line between measuring device and antenna. Balun coil reduced line effect and provided a normal indication of antenna resonance. (B) 21 mc: Resonance curve was emphasized by use of coaxial balun. (C) 28 mc: Without the balun, resonance curve was poorly defined, with s.w.r. running over 3:1 at 29 mc. Use of balun reduced s.w.r. across phone band, with antenna resonance indicated near 28.5 mc.



View of the modulator built in a 3 × 4 × 5 inch metal box. The heat sink is required for high power operation.

A TRANSISTORIZED MODULATOR

BY RAYMOND J. TURNER,*
WB6FIK

This compact modulator can provide an output from 15 to 100 watts, (70 watts with the output transformer specified). The unit includes a low pass filter for elimination of audio frequencies above 2.5 kc and a negative cycle loading circuit for increased talk power.

This compact transistorized modulator runs between 15 and 100 watts output depending on supply voltage. A comparable tube modulator draws at least 15 watts of filament power continuously and another 15 to 30 watts idling power when on transmit. This not only wastes power but also raises equipment operating temperature considerably. This modulator only draws about 10 watts idling and the temperature rise of the heat sink is only a few degrees.

It can be changed from a positive to negative ground simply by connecting either power lead to the chassis. A pre-assembled preamp-driver is used because it not only simplifies construction but costs less than the components necessary to build it. The cost of the modulator is about $20 to $30 depending on the size of your junkbox.

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Operation

Transformer T_1 (fig. 1) matches the high impedance input to the preamp input which is about 5000 ohms. It also allows us to change from positive to negative ground without complications. Transistors Q_1, Q_2 and Q_3 make up the preamp. A 20K pot, R_2, is inserted between Q_1 and Q_2 to adjust the maximum range over which R_1 has control. Terminal J_1 provides a high level input for a carbon mike, *etc.* as shown in fig. 2. Transistors Q_4 and Q_5 are the drivers and are operated in Class B for maximum efficiency. A thermistor is provided to prevent runaway when operating in high ambient temperatures. The output transistors, Q_6 and Q_7, are

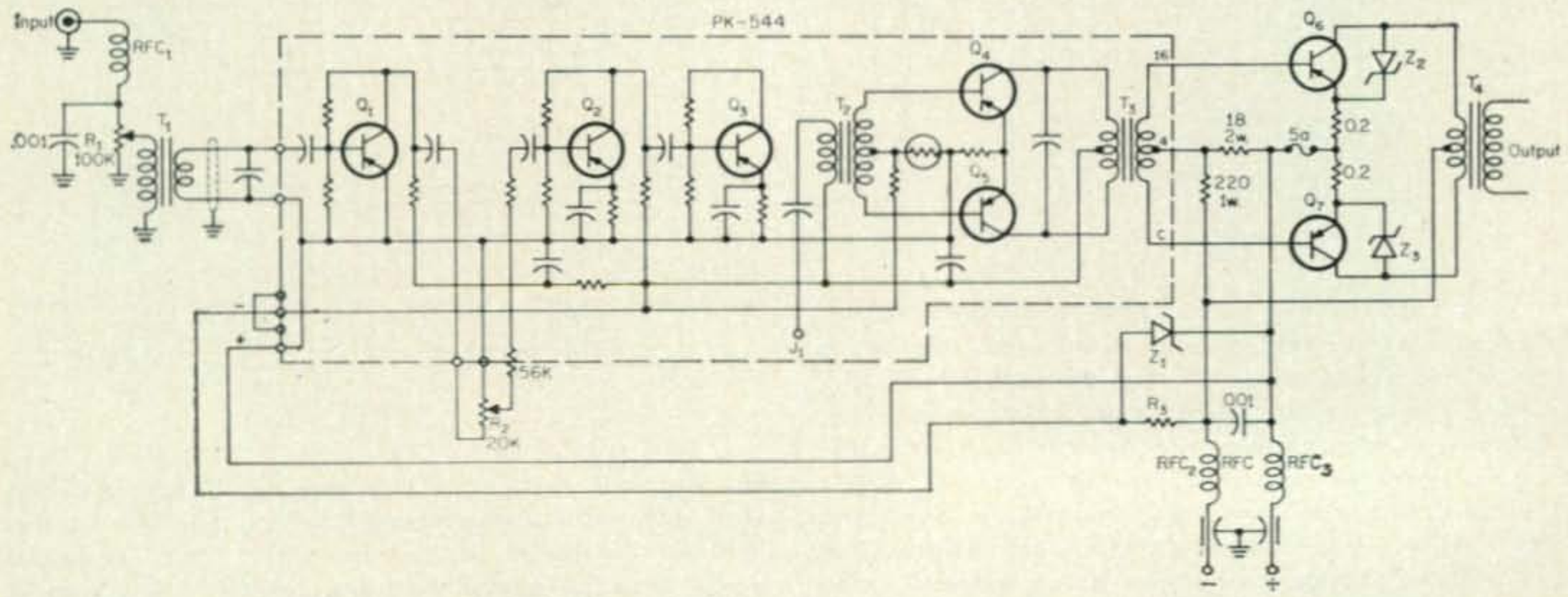


Fig. 1—Schematic of the modulator. Printed board PK-544 is an assembled unit and only T_3 is changed. It is replaced with a Thordarson TR-113 or equivalent.

PK-544—Available from Lafayette or Olson Electronics.
R_3—See text.
RFC_1—100 μh.
RFC_2, RFC_3—25 t #26 e. wound on 1 meg. 1 watt resistors.
T_1—10K pri to 1K sec. Lafayette 99G6126 or equiv.
T_3—400 ohms c.t. to 4 and 16 ohms sec. Thordarson TR-113 or equiv.
T_4—Filament transformer, 117 v.a.c. to 6.3 v.c.t. at 3 a. Stancor P-6466 or equiv.
Z_1—8-10 volt zener diode. See text for power rating.
Z_2, Z_3—See text.

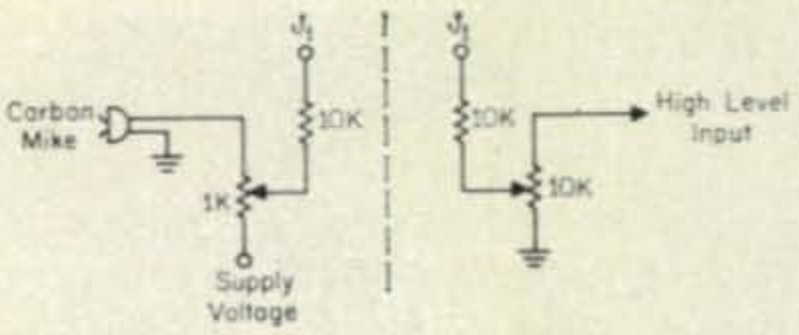


Fig. 2—Circuits for high level inputs.

also operated in Class B for maximum efficiency. A slight forward bias is applied to the output transistors to reduce crossover distortion. The idling current should be about 300-800 ma depending on power output desired and supply voltage. The relationship between the power output and the input supply voltage is plotted in fig. 3.

The output transformer, T_4, is a 6.3 volt filament unit and provides about a 5K output impedance at 30 watts output. However, it will match any impedance from 3K to 7K without any trouble and will handle at least 70 watts. Figure 4 shows how to include a low pass filter with a cutoff around 2.5 kc. This removes the harmonics generated when Q_6 and Q_7 saturate. However, it is not necssary to use a low pass filter unless the modulator is pushed to the point where it starts clipping. The low pass filter inductance value is based on the impedance of the stage being modulated. It may be calculated as follows:

$$L_{hy} = \frac{z}{8000}$$

where Z is the impedance of the stage being modulated. The capacitors are calculated as follows:

$$C_{mf} = \frac{65}{z}$$

Negative Cycle Loading

A word here about negative cycle loading (or negative peak loading) might be in order (fig. 4). This can double your talk power without introducing splatter. Splatter is caused when the final amplifier in the transmitter is cut off during part of the audio cycle (overmodulation). This

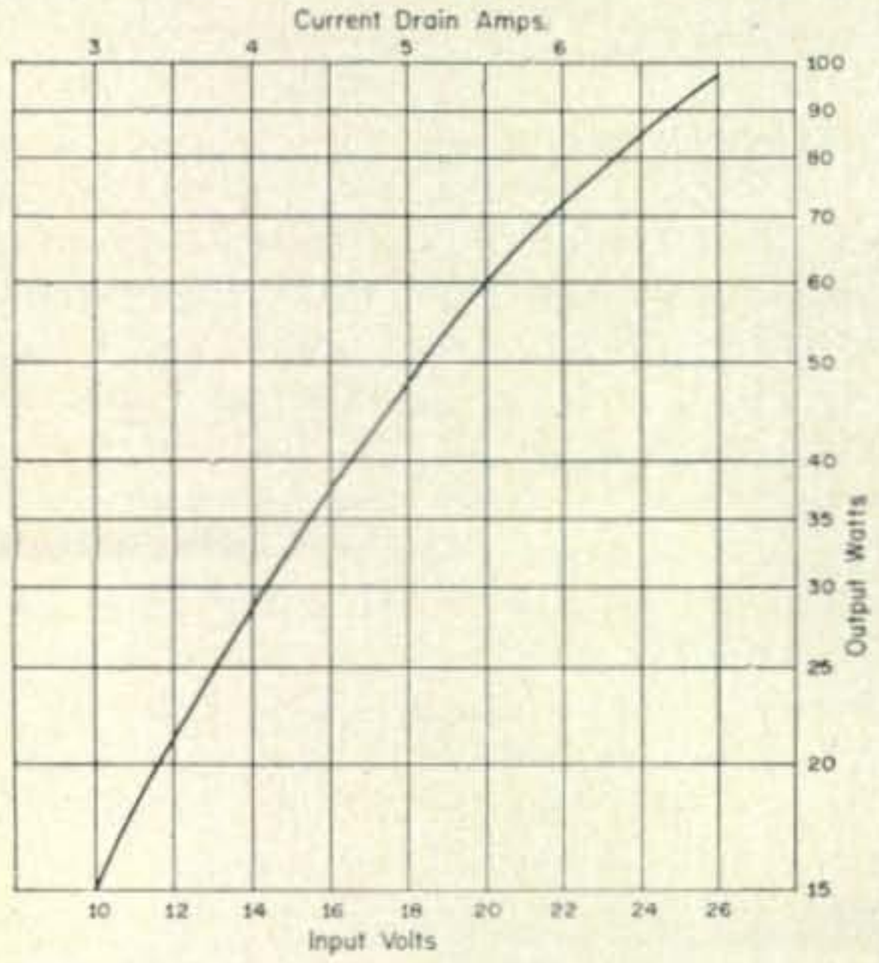


Fig. 3—Power output versus supply voltage and current drain for a 5K load impedance.

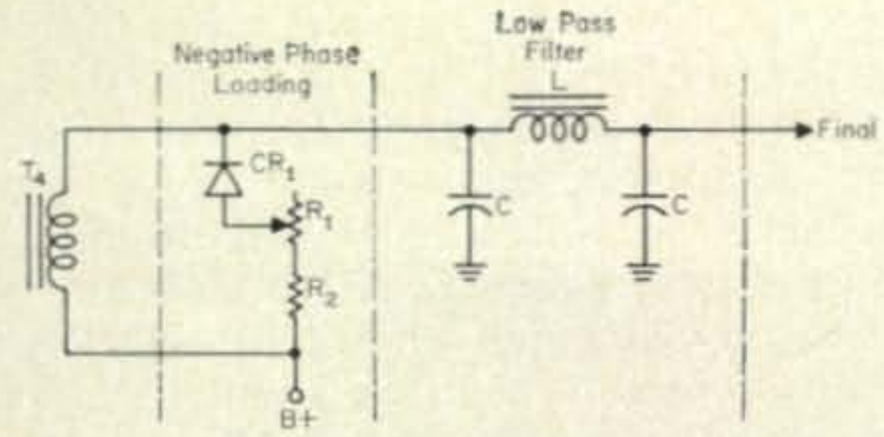


Fig. 4—Optional negative cycle loading and low pass filter circuits. Negative cycle loading is used to increase talk power and the low pass filter should be used if the signal is to be clipped seriously.

occurs when the negative cycle from the modulator exceeds the plate supply voltage on the final and hence the effective plate voltage is zero. The positive cycle from the modulator has nothing to do with causing splatter; it determines the peak power output. By increasing the power output of the modulator to the point where the transmitter would normally be modulated 200% and clipping the negative cycle back down to 100%, the peak transmitter power output is doubled and the average power output is increased 50%. Although the speech waveform is distorted, it is generally agreed that the wave symmetry can be distorted 3:1 before intelligence suffers.

The negative cycle loading component values are also affected by the impedance of the stage being modulated. The resistor R_1 is equal to $2Z$ where Z equals the impedance of the final and $R_2 = R_1/4$. The diode, CR_1, is rated at 500 ma and the p.i.v. rating should be 1.5 times the modulator output voltage.

Construction

Construction is relatively simple and the placement of parts is not critical with one exception. The input end of the preamp must be mounted as far as possible from the output leads and modulation transformer. A shield is used to prevent radiation from the transformer from reaching the preamp, especially T_2.

The value of R_7 can be found by the formula,

$$R_7 = \frac{V_{in\ min} - V_z}{I_{L\ max}}$$

where V_{in}=supply voltage, V_z=Zener voltage and IL_{max}=load current=0.1 amp.

The power rating for Z_1 can be found by

$$P_d = \frac{V_{in\ max} - V_z}{R_7} V_z$$

where P_d=zener diode dissipation. In most cases

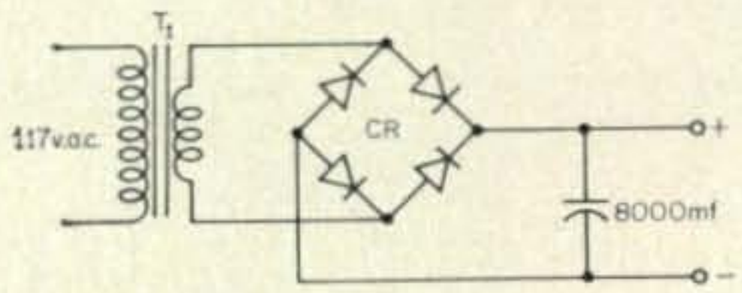


Fig. 5—Simple power supply for the modulator Transformer T_1 should provide a few volts more than needed according to fig. 3. The diodes should be rated at 5 amps each with a 50 volt p.i.v.

a ten watt unit will be adequate. It is mounted with mica washers on the shield around T_4.

R.f. feedback can be quite a problem. For this reason, all power leads should be adequately bypassed. It is also a good idea to filter the input as shown in fig. 1. A few minutes spent here may avoid hours of headaches later.

It was found that, if the input transformer was mounted inside the box, feedback occurred between it and T_4. To prevent this it was necessary to mount T_1 at the mike jack on the transmitter. Don't forget to shield it. It can be mounted in an empty i.f. can or other small metal container.

If the modulator is to deliver 25 watts or less at room temperature, the output transistors can be mounted on the top of the case. If they are to deliver more than 25 watts, they must be mounted on a heat sink and don't skimp on the silicone grease.

Output Transistors

A number of transistor types can be used in the output stage. The following can all be used: 2N173, 2N174, 2N277, 2N278, 2N441, 2N442, 2N443, DS-501, (Delco) ET-7, (Tung-Sol) but the 2N277 and 2N441 should be limited to about 75 watts output because of their lower voltage rating. The others can be used to at least 125 watts and all of them are rated to dissipate 150 watts with adequate heat sinks.

A word of warning: *Don't* use cheap replacement transistors for Q_6, Q_7. A number of types were tried and they all failed, probably because they could not take the transients that are developed on the collector by T_4. Stick to American manufacturers and you won't have any trouble.

Zener diodes Z_2 and Z_3 are optional and provide transient protection when running with heavy clipping or near maximum voltage on the transistors and for protection against accidental operation without a load. The zener voltage should be about 120% of the supply voltage. As with any other power amplifier, *never* operate it without a load of some sort even with Z_2 and Z_3.

Adjustment

The first step is to set the output clipping level, done by changing the power supply voltage. A good approximation can be obtained from fig. 3. The power transformer should be chosen to provide a few more volts than anticipated and the supply voltage can then be adjusted with a series resistor. A typical power supply is shown in fig. 5. Don't worry about poor regulation; the zener (Z_1) will take care of the preamp and

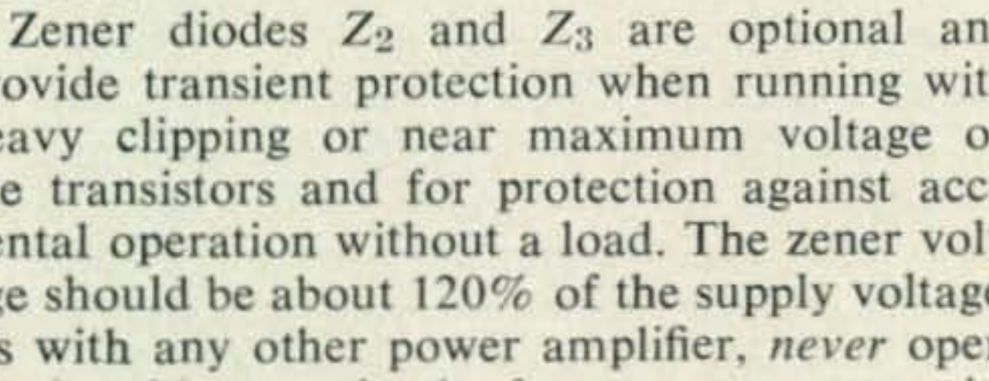
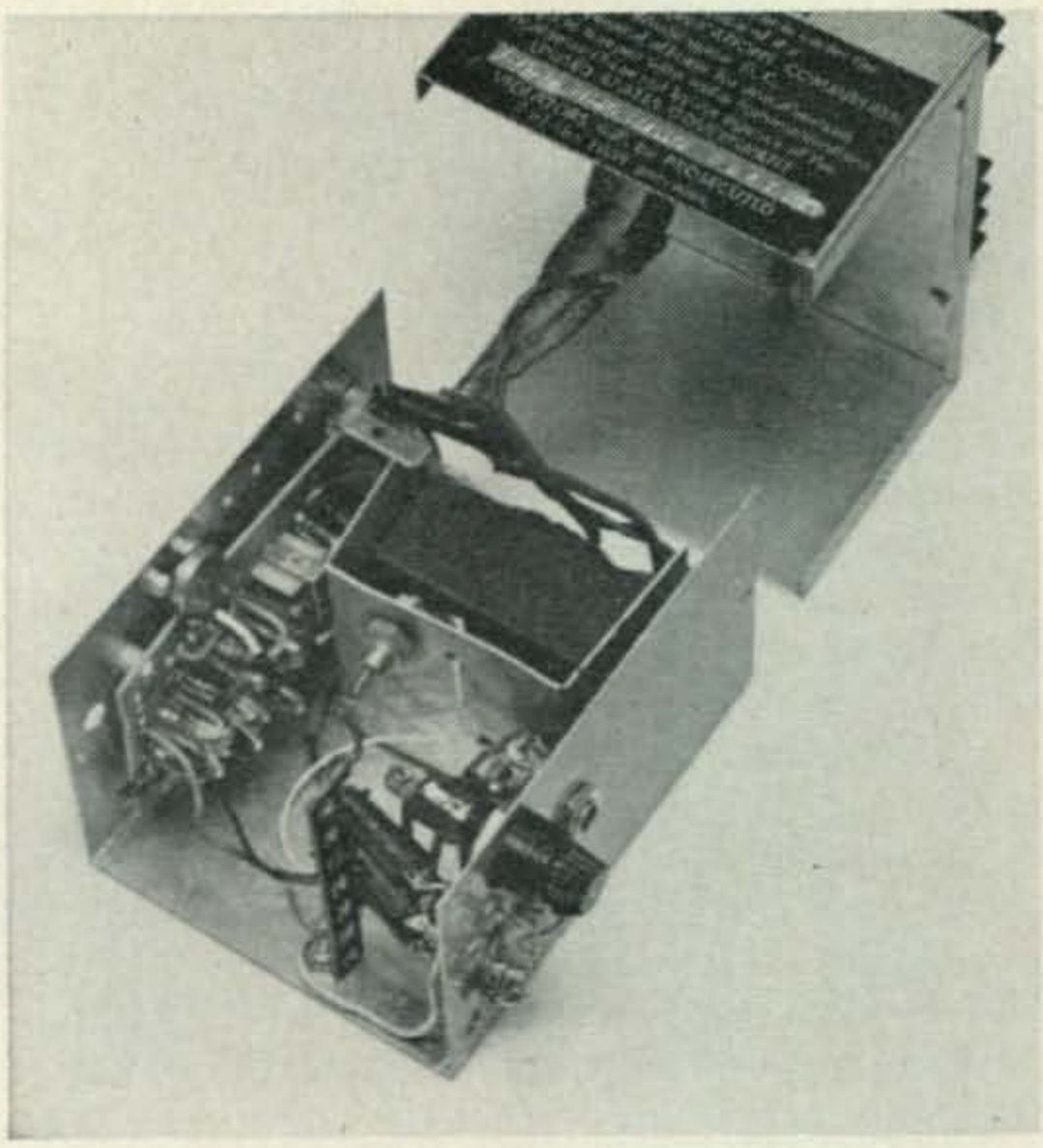


Fig. 6 (A)—Test set-up to measure power output. (B) Test set-up to adjust negative cycle loading.



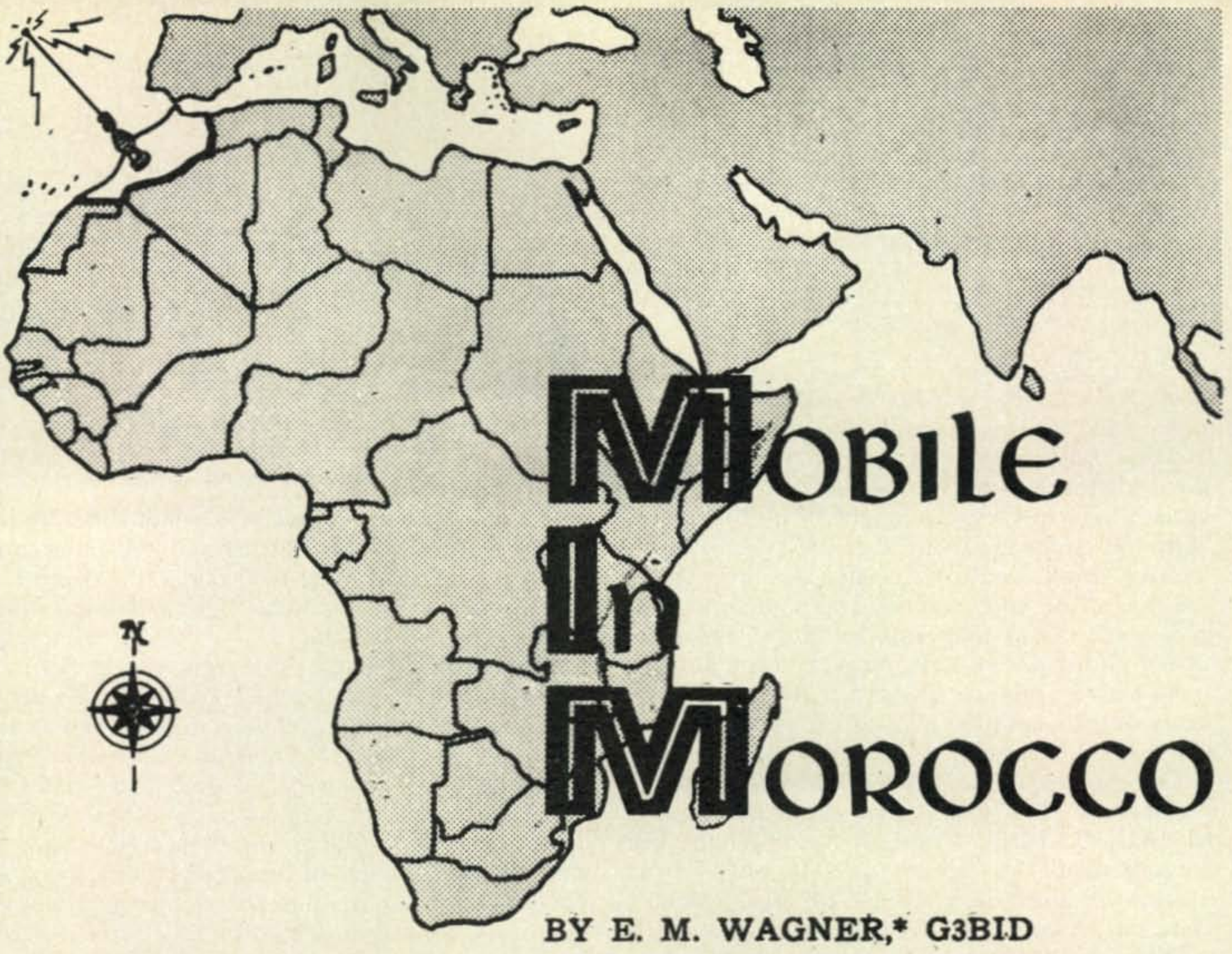
Interior view of the modulator shows parts placement. Control R_2 may be seen just above the PK-544 board. Transformer T_4 is mounted behind the shield and Z_1 is mounted on the shield. The metal mounting strap of T_3 must be insulated from the shield with tape. The jack on the right side is used to measure the collector current of Q_6 and Q_7. Base and collector leads of Q_6 and Q_7 are shielded to prevent radiation and r.f. pickup.

the poor regulation will give a "speech compression" effect to the output transistors.

If you have a monitor scope, simply adjust for 100% modulation. If not, an a.c. voltmeter can be used (fig. 6(A)). Connect a resistor of the same impedance as the final of the transmitter to be modulated. Measure the a.c. voltage across it with a signal (audio gen., whistle, etc.) applied to the input that is just below the clipping level. An ammeter in the power lead or a scope can be used to determine this. It is the point at which a further increase in input no longer gives any increase in output voltage or current drain. Adjust the supply voltage with a series resistor until the r.m.s. voltage output multiplied by 1.414 equals the d.c. supply voltage of the transmitter. This will correspond to 100% modulation.

The negative cycle loading is set in the same way, if a scope is not available. Adjust the power output of the modulator to the amount of upward modulation you want using the test set-up in fig. 6(A). Then, using the set-up in fig. 6(B), adjust R for a deflection equal to the plate supply voltage of the final amp. Diode CR_2 must have a p.i.v. rating at least as high as the peak voltage output of the modulator. A switch in series with the rheostat R can be used to disable the negative phase loading if the power supply voltage is also lowered.

An on-the-air test will serve to check the adjustments. This modulator has been in constant use for almost a year and has never developed any trouble and the small amount of heat it dissipates compared to the old 6L6 modulator is astonishing. ■



Mobile In Morocco

BY E. M. WAGNER,* G3BID

THE nearest African country to Western Europe is Morocco. It is also one of the nearest to North America. Yet, with the exception of those who served on the American bases in Morocco, how few Europeans or North Americans have visited that country.

So it happened that some years ago when motoring in Southern Spain I looked longingly across the Straits of Gibraltar and wondered whether I could get my car across and go motoring in Africa.

One day I saw a boat sailing out with a large cavity at the stern and inquired what it was. It was a car ferry to Africa. In fact there are two services—one from Gibraltar and one from Algeciras running a regular service. So the idea of a motor tour in Africa was born.

Naturally I had had many QSOs with Moroccan stations, and so I ambarked on a trip to Morocco. In my ignorance I had expected to rough it, to find bad roads and poor hotels, but the thrill of the strange different civilization, scenery and people made the idea worth it. We were surprised to find excellent roads and excellent hotels.

The Moroccan amateurs are the acme of hospitality and our visits to Marrakech and Rabat and other places became so delightful with these generous, kind, hospitable people showing us around and entertaining us in a way which we would never have imagined.

Licensing

We ventured, with their encouragement, further and further south and found it ever more interesting On one occasion we visited Tafraoute in the center of Anti-Atlas, a mountain range about 100 miles south of the High Atlas. Here, at a newly built hotel we were 2,500 feet up surrounded by two concentric rings of mountains with peaks of 5,000 and 6,000 feet.

I wondered whether it would be possible to get a signal out of a place like that. We discussed Radio propagation in these parts with the local amateurs, and received some very impressive demonstrations. The Moroccan Government uses radio communications to a very great extent and many mobile stations are used on normal administrative duties in the more remote parts of the High Atlas, Anti-Atlas mountains and the Sahara.

I wondered whether I could possibly get a license to bring my own mobile equipment and try some experiments with propagation conditions. For a Briton to get a license would be very difficult indeed as the British Government had refused to give licenses to foreign amateurs and I felt the request was virtually hopeless. However, my various amateur friends in Morocco discussed the problem and sponsored an application. So it was that I obtained a license to operate as G3BID/CN/Mobile for a month in Morocco. We were started.

Equipment

I had a Drake TR3 (with separate v.f.o.) in my Bentley S.1. I had already had a spare battery fitted with a switch so as to be able to charge

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either battery for the various Belgian Rallies I had attended.

We took several antennas, a Mark Mobile HW3 Tribander for 10, 15 and 20, which I had found to be excellent, a Webster Bandspanner for all bands, a Master Mobile All Bander with capacity hat and Master Mobile Matcher for 80 meters.

Mobile

The roads in Morocco are so good that one problem was the antenna leaning far back at high speed. This we completely solved by fixing a nylon fishing line (25 lb breaking strain) to the radiator mascot of the car and on to the antenna. To provide sufficient flexibility to enable the antenna to bend back when hitting trees, a short length of elastic was inserted in the line at the antenna end. This system worked excellently. QSB and mobile flutter was practically eliminated by this means and the antenna remained upright at speeds of 100 m.p.h. and over, yet the elastic allowed it to bend back when it hit trees.

During just over two weeks we worked all continents, including such exotic DX as—FK8AU, KX6DQ, VE1AJR/SU. Perhaps our greatest thrill was working VE1IE on 80 from Marrakech and also WA2SFP on 80/75 meters. Here the separate v.f.o. is, of course, a necessity.

We had a little trouble with the plate tuning capacitor vibrating off resonance in motion; the frequency control remained magnificently stable. On the last day of the trip we were off the air but this was not a fault in the rig. The coax cable running the full length of the car was too close to the exhaust pipe and began to disintegrate with the high speeds. The coax cable was melted and we had a short circuit but since this was the last day we did not replace it.

We have learned to run the leads on the other side of the car, away from the exhaust pipe. With the slower motoring in Europe we had never experienced this trouble but on the magnificent high speed roads of Morocco precautions must be taken to keep wiring well away from any parts likely to develop great heat at maintained high speeds.

Some readers may be surprised at these references to high speeds as probably only those who have served on the American bases in Morocco realize just how good and fast are the majority of the roads. Over one day, for example, coming north from Essaouira, we covered 136 miles in the first two hours including a fuel stop.

Our trip on this occasion covered only western Morocco with emphasis on the south. The trip was in February, an ideal time to visit the south—later in the year it would get far too hot down there. In February also the almond blossom is in bloom and makes the Anti-Atlas Mountains most beautiful. The whole valley of Tafraoute is carpeted with almond trees.

The North of Morocco can still be cool and wet in February, and so we left such lovely places as Fez, Meknes, Moulay Idris, Xauen, Tetuan, *etc.*, for another visit some other year, and concentrated on Marrakech, that superbly interesting city with the Koutoubia, the beautiful Dar-Si-Said Museum, the Bahia Palace, the fascinating Souks, *etc.*

View of Tifoultoute near Ouarzazate. Also shown is the author's Bentley with the rear mounted Master Mobile antenna.

Besides being entertained right royally by my friends CN8BS and CN8AU a new entertainment awaited us. A newly licensed radio amateur in Marrakech is Roger Ouaknin, CN8CD. His father owns an orange grove and Roger had invited us to picnic on Sunday in the orange grove.

We arrived to find a low table and cushions and carpets arranged in the shade of the eucalyptus trees which surround the orange grove, delightfully cool and quiet. For the picnic Roger had arranged to roast a whole pig in an outdoor earth oven built in the corner of a wall. That's what they call a picnic! The pig was so tender it had fallen into the embers and we feared spoiled. But not at all, it emerged in magnificent form. To follow this superb dish, CN8BS'—XYL had prepared a Quiche Loraine—delicious. For those who were still capable of eating there were dozens and dozens of huge juicy oranges all washed down with sweet mint tea.

Next we crossed the lovely Tizn-Tichka pass of 6700 feet high in the snow of the High Atlas. CN8BS had kindly agreed to accompany us and, as usual, this greatly increased our pleasure.

I had visited Ouarzazate before with CN8BS and dined with M. Paillet, the Headmaster of the local High School where the children, mainly boys, reside in the school. Here about 500 pupils, mainly Berber, receive a very high standard of education. When one remembers that the Berber children first have to learn Arabic and French before their education in any other subject can really begin, one realizes how hard they have to work.

M. Paillet invited us to dinner and here again we experienced Moroccan hospitality. The meal consisted of local dishes, ending, of course, with a Couscous.

Ouarzazate is a beautiful center for touring the Dra and the Dades Valleys and the Date Market at Agdz.

And so we proceeded via the lovely walled city of Tarroudant to the Coast of Agadir. From here South to Tiznit. Though barely 100 years old, Tiznit is a fascinating town where the beautiful jewelry of the South is made. Tiznit

Seated in the back row are Mr. Freestone, CN8BV, CN2BS, CN8BV's XYL and CN8BB. In the foreground are CN8MT and his XYL.

is almost a junction. One road leads down from Agadir and continues on South to Goulimine, the home of the Blue Arabs where we saw hundreds of wonderfully caparisoned horses and camels whose owners had come to greet the King on his visit to Goulimine. The Nomads from the Sahara had come up with their tents and spent days waiting for the King's visit.

From here propagation on 20 meters appeared particularly good and we had long and really solid QSOs with K1YZW and W2PEO as well as dozens of Europeans.

The excellent tarred road on which speeds of over 90 m.p.h. is quite comfortable ends at Goulimine, however, and desert tracks lead on and on through Mauritania to Dakar in Senegal. At Tiznit, in fact, there is a signpost to Dakar. Another road from Tiznit leads East into the Anti-Atlas.

A beautiful tarred road leading at first across a plain gives the driver the false impression that he will reach Tafraoute, a mere 60 miles away very quickly. But here is one of the really strenuous drives as the road turns and twists as it rises and falls over two passes reaching about 4,500 feet on the Kerdous Pass before plunging into a narrow twisting valley full of almond blossom as it goes through the two concentric rings of mountains which surround Tafraoute.

On the Kerdous Pass superb communications were possible across the Atlantic and we held W2PEO all the way up the Pass round all the hairpins and only once did we drop to S4, and when he commented that my signal had dropped I replied that I was not surprised as we had rounded a spur of the mountain and had a huge chunk of mountain between us. Within moments we were 5/7 again.

Throughout the tour we were more interested in holding fairly long QSOs than in working the largest possible number of stations as we were anxious to test the effect of the mountain ranges. In one or two spots we were really in bad locations and once or twice the receiver appeared to go dead. But these were surprisingly few and far between in a country so full of ore bodies as Southern Morocco.

At the top of the Kerdous Pass the road to Tafraoute turns north-east and a track leads on to Foum El Hassane. I would have loved to continue in that direction but that must be for another time.

We spent four days at Tafraoute in the excellent new hotel. Tafraoute's scenery is unforgettable. The two concentric ranges of mountains are such that the inner one is lower than the outer so that both are always visible. At sunset the inner one goes into shadow first while the outer higher one is still picked out in sunlight which gradually goes pink.

Here radio communication looks impossible; but it isn't. It is, however, more difficult. Our reports were lower but to me it was surprising to get out at all. We called into the ex. G. net on Sunday evening and worked W8OYH, although unfortunately net control, W3OQH, could not hear us, though we heard him 5/3.

Yet another road radiates from Tiznit. The track which used to lead to the sea at Sidi Moussa Aglou has been tarred and a hotel is being built there.

Perhaps the most amusing QSOs were those in motion when our contacts, especially in the States, asked whether we used jeeps and had especially large petrol tanks. They found it difficult to believe that we were bowling along beautifully surfaced roads in a Bentley and that the speed at which we travelled was entirely that of our own choice.

As for gas stations, there are plenty: many different oil companies compete for the Moroccan market, including Shell and B.P., Esso, AGIP, Texaco, Total, Beryl and others. Both ordinary and super grades are available at almost all pumps and, above all, the Moroccan Government will sell to tourists reduced price gas coupons.

Languages

There are no problems in touring in Morocco, though a knowledge of Arabic would, of course, be very helpful indeed, and a knowledge of French is undoubtedly an enormous help to the enjoyment of the trip. In fact there are three languages in Morocco—Arabic, Berber and French. Berber and Arabic are the languages of the majority of the inhabitants of Morocco. The Berbers live mainly in the mountains and the south; the Arabs mainly in the plains and the valleys.

Berber is not a written language but can be transliterated in Arabic. And although there is a Berber Broadcast Service, the official language is Arabic. French is still largely spoken in that part that was once French Morocco (Spanish in the small zone that was Spanish Morocco).

Many of the people can and do speak French and it is, of course, a great help to some visitors. There are still Frenchmen in the Administrative Services of Morocco and many of the amateurs are French. In the hotels, shops, banks, restaurants, *etc.*, French is the language in which the European or North American makes himself

[*Continued on page 102*]

The Heathkit HA-14 "Kw Kompact" S.S.B. Linear Amplifier is small enough to permit its placement on top of the SB-400 exciter or on a mobile transceiver such as the Heathkit HW-12.

CQ Reviews:

The Heathkit HA-14 "KW Kompact" Linear Amplifier

BY WILFRED M. SCHERER,* W2AEF

A GALLON in a "pint-size" container! Impossible? Figuratively speaking the answer is no, particularly when it comes to the Heathkit HA-14, a real "KW Kompact" that packs a kilowatt into a case only 3-3/16" high × 12-3/16" wide × 10" deep. Its small size and shape factor are such that make it ideal for mobile installations for which it has been especially designed or for fixed-station use set on top of an exciter.

Other features of the HA-14 include: class B operation with grounded-grid circuitry using two 572B (or T160-L) triodes connected in parallel; bandswitched coverage of all the amateur bands 10 through 75 meters; fix-tuned 50-ohm input circuit; pi network with output impedance fixed for 50-75 ohm loads; built-in s.w.r. bridge metered to read relative forward power or s.w.r.; a.l.c. bias for automatically controlling drive from the exciter; instant automatic switching between exciter and linear amplifier outputs using built-in changeover relay; full 1 kw p.e.p. input with 100 watts drive that produces up to 600 watts output for a power gain of 6, or almost 8 db. External power is used for which there are two separate power supplies. One is a transistorized type for mobile 12 v.d.c. operation, the other is for use with 120/240 v. 60-cycle a.c.

Circuitry

A diagram showing the basic elements of the circuitry is given at fig. 1. R.f. drive is applied to the filaments of the two class-B triodes from a fix-tuned broadband impedance-matching network consisting of L_1 and C_1, the values of which are switched as needed for the various bands.

The output circuit is a pi-network which is tuned to resonance with C_3, while fixed loading capacitors are used at C_5 and C_6. C_4 and C_5 are switched in only for 80-meter operation and L_2 is tapped for the various bands.

The r.f. circuits are switched with a d.p.d.t. antenna-changeover relay which is operated by the v.o.x. relay in the exciter. Operation is as follows: During receive, a bias of —120 volts is applied to the tube grids through the relay coil. The bias cuts off the plate current to eliminate the generation of tube hash which might be heard in the receiver. The relay is not energized, because the exciter-relay contacts are open and the tube grids draw no current through the relay coil. During this condition, the antenna is connected through the normally-closed relay contacts to the r.f. input from the exciter. This allows signals to be received (it is assumed that the exciter is a transceiver, but where a separate receiver and a transmitter are used, it is further assumed that another separate antenna-changeover relay already is in use for switching the antenna between the receiver and the transmitter). During transmit, the contacts on the v.o.x. relay in the exciter ground the bottom end of the relay coil and thus energize the relay from the —120-volt bias source. The normally-open contacts then close, connecting the exciter output to the r.f. input of the linear and transferring the antenna to the linear output.

At the same time, the resistance of the relay coil and R_5 form a voltage divider, with the current drawn through the circuit producing a potential drop of —2 volts across R_5. This voltage is used as operating bias for the class-B tubes.

When the power switch on the HA-14 is turned off, there is no bias voltage to operate the changeover relay, so the antenna remains connected directly to the exciter for normal low-power operation without the linear. The 572-B's have instantaneous-heating filaments, so linear-

*Technical Director, *CQ*.

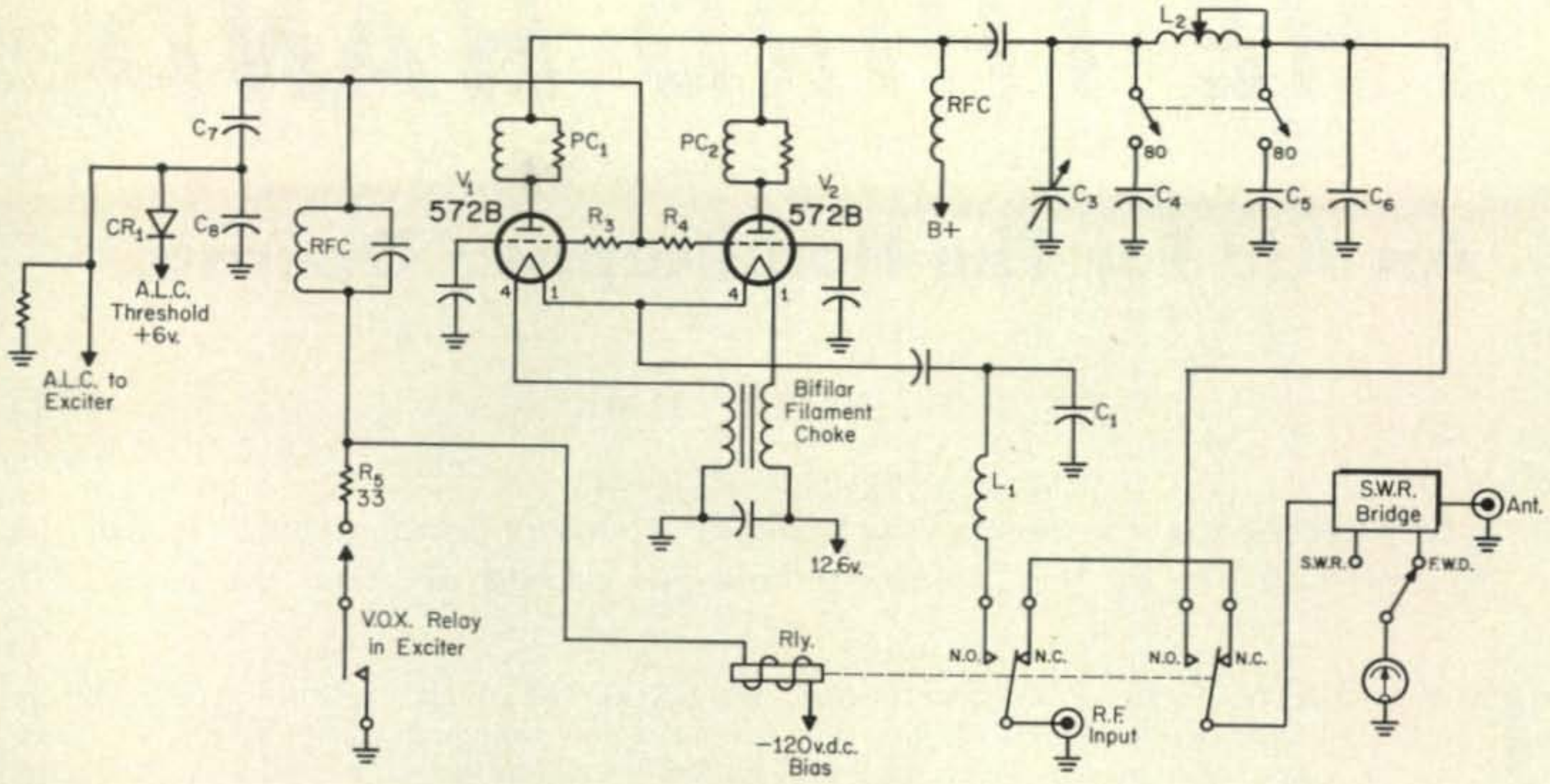
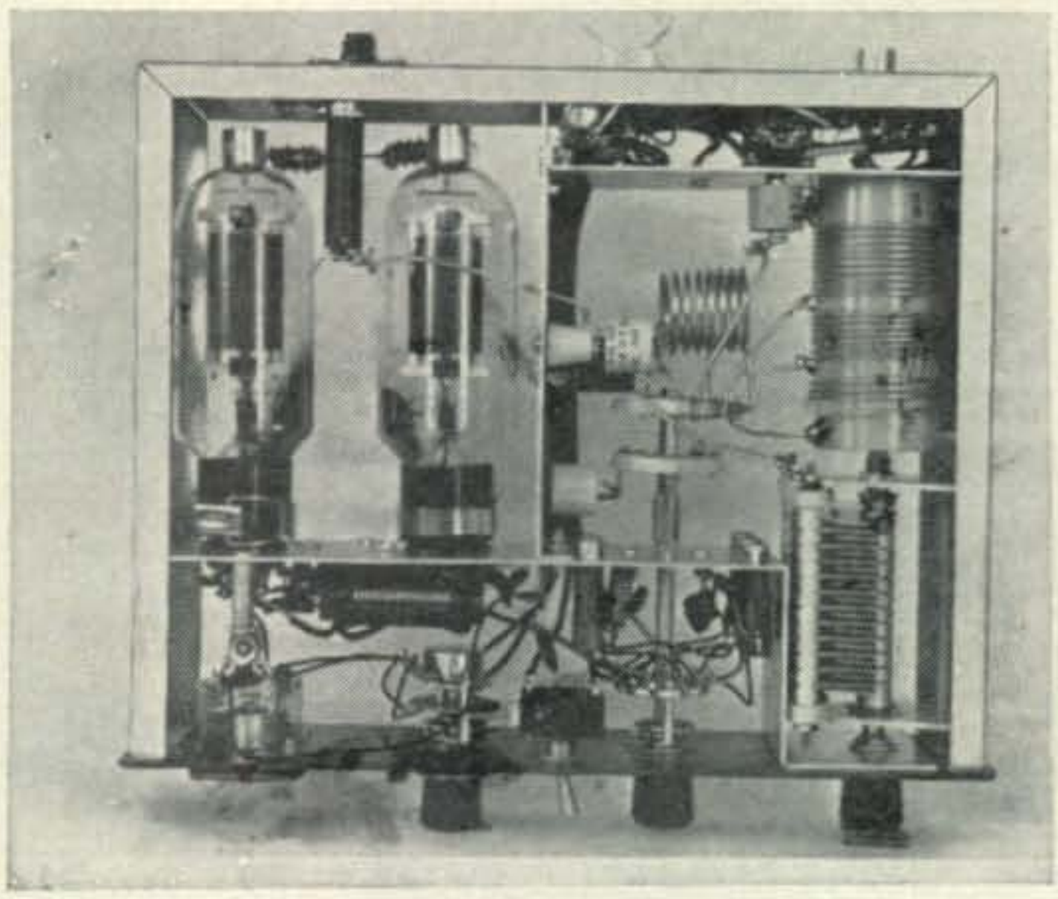


Fig. 1—Basic circuit of the Heathkit HA-14 linear amplifier

amplifier operation may be had as soon as the power switch is turned on, making it possible to immediately switch back and forth between low-power from the exciter or high power from the linear.

A.l.c. is obtained by taking some of the r.f. voltage that appears at the tube grids during modulation and applying it to a diode rectifier from a capacitive voltage divider, C_7-C_8. The rectified r.f. voltage is then fed back as a d.c. control bias to the a.l.c. input of the exciter. This arrangement can be set so that the a.l.c. takes hold *before any* flattopping occurs and is done by fixing a threshold level with a positive d.c. potential of about 6 volts which is obtained from an output-voltage-divider tap in the power supply. This is unlike the usual a.l.c. system in a class AB_1 amplifier wherein some grid-current flow (with attendant flattopping) is required before the a.l.c. operates.



Interior view of the HA-14. Open-frame construction permits good accessibility and excellent ventilation. The bifilar-wound filament choke is below the shelf near the right tube socket.

The s.w.r. bridge is an "in-line" reflectometer-type using a piece of coaxial cable with its shield removed and the two pick-up loops inserted through it.

Construction

Instead of employing the customary chassis-type of construction, the HA-14 is built with an open-frame and shelf arrangement which makes possible the small size and the advantageous shape factor, allows good accessibility to components[1] and provides excellent ventilation which is further enhanced by perforations on all sides of the wrap-around case.

The tubes are securely held in place with ring clamps at their sockets. On the rear apron an SO-239 coax connector is provided for the antenna, a phono-type jack for the r.f. input and a 12-prong Jones connector (with locking clamps) for a.l.c., exciter v.o.x.-relay contacts, and all the power leads except the high-voltage input which is a screw-on type high-voltage terminal.

The unit sent to us for evaluation was already assembled and wired, but after perusing through the assembly manual, we envisioned no difficulties in construction and we've estimated that the work requires 12-15 hours of time.

Power Supplies

Operation of the HA-14 requires 2000 v.d.c. at 500 ma peak, −120 v.d.c. at 60 ma and 12.6 volts a.c. or d.c. at 4 amperes. This power is available from the HP-24 120/240 v.a.c. supply or from the HP-14 12 v.d.c. mobile power unit.

The current drain with 13 v.d.c. input is rated at 25 a. average, 50 a. peak. The latter appears to be low, inasmuch as 1000 watts peak input

[*Continued on page 101*]

[1]Except at the power-plug connections where it's a bit of a tight squeeze.

THE THIRD HAND

An Aid For The Handicapped Operator

BY G. W. HORN,* I1MK

Described below is a device which allows a heavily handicapped person to control a rig by the biological voltages picked up from the body.

THE therapeutic value of amateur radio is beyond discussion. Several rehabilitation services, such as the Veterans Administration, have included our hobby under the vocational activities which helps the ill or disabled patient to regain courage and confidence.[1] Often, hamming proves to the disabled that he can do things not everybody can do. Many of us are acquainted with blind people, amputees, polio victims, *etc.*, who successfully operate a ham station. Many of them cannot be distinguished, on the air, from people who are not disabled.

Disabled hams need, however, some particular aids in order to properly operate the rig. Controls, key, mike, standby-switch, tuning-knob, *etc.*, should be arranged, case by case, for maximum convenience of operation. Several such arrangements have been devised with a great deal of ingenuity. In some instances, however, the disability of the operator is so great that he cannot manage the controls without material help from friends or relatives.

Having in mind a situation of this kind which, unfortunately, is not uncommon among disabled hams, we designed and built some special electronic gear. The voluntary efforts made by the operator, without moving a single finger, are transmitted directly to the servo-system operating the rig. The circuit illustrated in this article was originally designed to couple an externally powered artificial hand to the stump of an amputee.[2] Our prosthetic appliance worked so well that we decided to use the same principle to couple the "will" of a disabled operator to the controls of his rig.

The key to our system is the electrical pulses (the so called EMG or electromyographic signals) developed by the muscles when contracting.[3] The EMG pulses derive from the nerve activity sent along the spinal cord and reaching the muscle when its contraction is called for by the brain. EMG pulses are always present in a stump muscle even when the amputation surgery is many years old. A muscle disabled by polio, paraplegia or dystrophy also produces small EMG pulses, even when the muscle is so weak that it cannot operate against gravity.

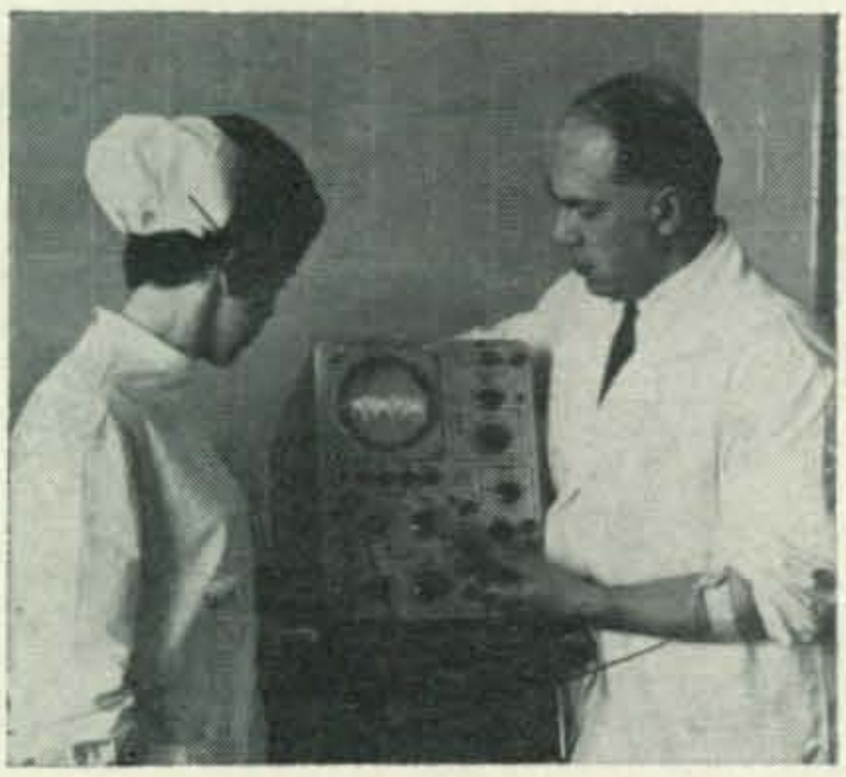
Muscular effort generates the EMG signal without the exercise of a physical force: only mental concentration is primarily required. In the device we designed for the disabled ham, the operator need only think of moving his missing or paralyzed arm, whereupon the servo-operated switch closes electromechanically. After a short period of training, the disabled ham will be able

*80 Via Tripoli, Vercelli, Italy.

[1]Brier, H. S. "Hobby For The Handicapped," *CQ*, Sept., Oct. 1949.

[2]Horn, G. W., "Muscle Voltage Moves Artificial Hand," *Electronics*, Oct. 1963.

[3]Suckling, E. "*Bioelectricity*" McGraw-Hill, 1961.



Professor Horn and a co-worker, Miss Bugada, check the operation of an EMG amplifier on a scope. Note the pick-up electrodes on the author's forearm.

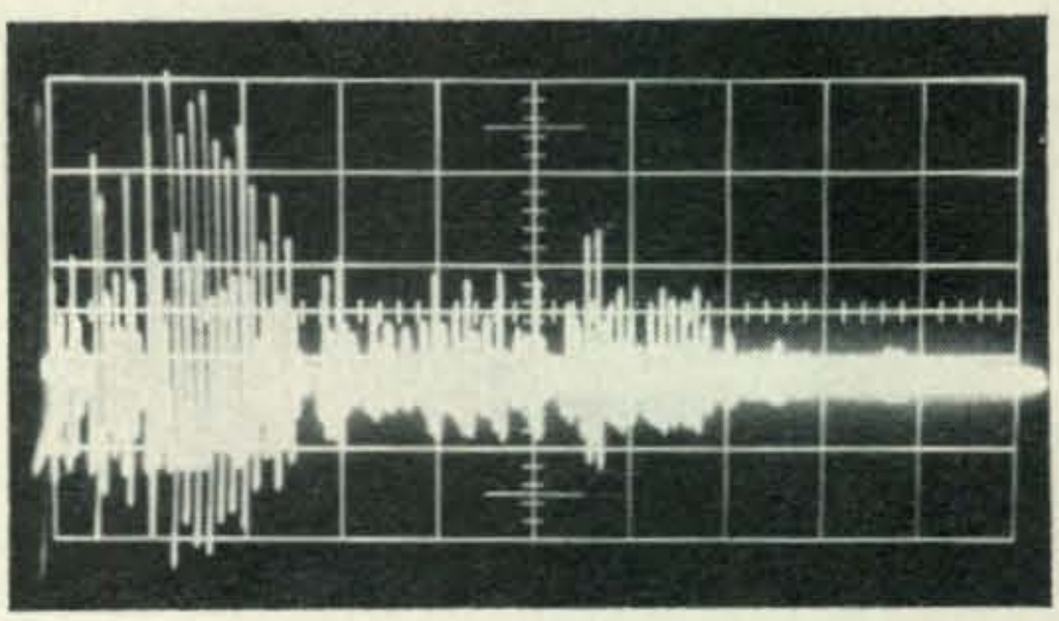


Fig. 1—Typical EMG signal, recorded from the body surface, during a sequence of strong effort, light effort and relaxation.

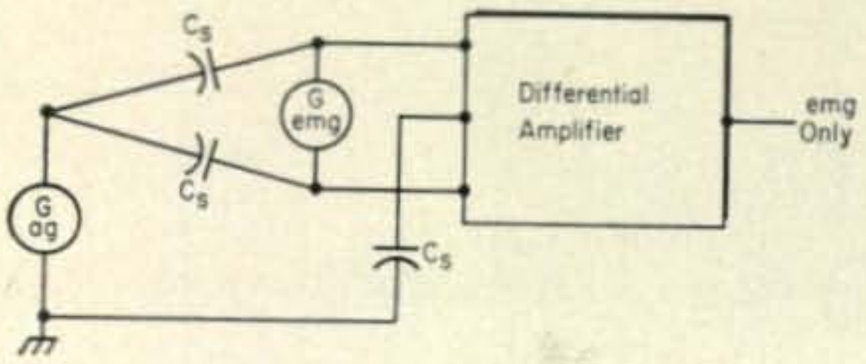


Fig. 2—The action of the differential amplifier for $G_{a.c.}$ signals, picked up through stray capacitances, C_s, is to cancel or reject. Only out-of-phase signals, G_{emg}, are amplified.

to master code at 15 w.p.m., electromyographically.

This kind of mentally operated key is quite fantastic, indeed. The operator remains completely still, no motion is detectable in his limbs or trunk, but the relay keying the rig ticks at normal speed.

Theory of Operation

EMG pulses can be detected, at the surface of the body, using small plane electrodes, the size of a quarter, pressed against the skin covering the desired muscle.[4] The muscle will be selected according to the disability of the operator; radialis or finger-flexor if the hand only is missing or paralyzed, deltoidis, pectoralis major to trapezius if the disability is extended to the whole arm, *etc.*

The total electrical activity, at a given time, is randomly distributed along the muscle mass and only a sample of it is detected by surface electrodes.[5] For that reason, the detected signal is only roughly proportional to the contraction effort; similarly the EMG voltage fluctuates around a mean value, even at constant muscular tension. This situation represents no handicap in our application since the device we wish to actuate (a key, a switch, *etc.*) is of binary nature and requires, therefore, no proportionality between voluntary effort and servomechanical response.

From an electrical point of view, EMG signals are complex pulse potentials having an amplitude of 10./.1000 microvolts and a pulse width of 1./.10 milliseconds, when recorded from the body surface. Individual muscular fibre discharge is about 1 millisecond in duration; however, the pulses overlap in the muscle bundle producing lower frequency components as shown in fig. 1.

The prevalent harmonic components of the EMG signal fall between 50 and 500 c.p.s. Limiting the bandwidth of the amplifier employed in detecting the EMG signal increases the s/n ratio. Preliminary tests showed that beyond 1 kc useful EMG signals were insignificant whereas noise was added. Limitation of the lower cutoff frequency to 100 c.p.s. results in information loss but this condition must be tolerated due to the presence of severe power line interference.

Weak EMG signals are always accompanied by interference arising from stray a.c. and e.m. fields, thermal and biological noise, involuntary contractions, fibrillations and electrode-skin contact instabilities.[6] By designing the input of the amplifier in a differential configuration, spurious signals can be rejected. If the extraneous voltage picked up by the two skin electrodes is in phase and if the amplifier is perfectly symmetrical, no output results. This is illustrated in fig. 2. However, the desired out-of-phase signal is passed to the following amplifier stages. Solid-state amplifiers, free of power-line to ground return, are less subject to spurious signal pick-up than their vacuum-tube counterparts.

Detecting EMG signals from the body surface by solid-state amplifiers is not easy. The contact resistance existing between skin and pick-up electrode is quite high: it lies around 100K when the skin is dry and around 10K when coated with electrode jelly. To detect the EMG pulses from the body surface, without any particular preparation of the skin under the electrodes, the amplifier must present an input impedance of not less than 1 megohm.

The amplifier's input impedance forms a voltage divider together with skin contact resistance as shown in fig. 3(B). Any variation of the contact resistance, which in operation is always possible, causes a change in the amplitude of the signal picked-up by the electrode; that, in turn, degrades the symmetry of the signals at the input of the differential stage and, consequently, the common mode rejection, *i.e.* the rejection of the spurious signals becomes worse.

It is well known that solid-state amplifiers designed to operate from a high impedance source present a high noise figure.[7] Planar transistors of very recent design permit a *NF* of less than 10 db at an input impedance level of several megohms. The technical reliability of an EMG solid-state amplifier working from unprepared skin is very well demonstrated by the circuit illustrated in this article.

The Circuit

The schematic diagram of our EMG amplifier, well suited to servo-control purposes, is shown

[4]Horn, G. W., "Muscle Voltage Moves Artificial Hand" *IEEE*, Professional Technical Group Bio-Medical Engineering, April 1964.
[5]Horn, G. W., "Muscle Voltage Operates Artificial Hand," *Radio, Television and Hobbies*, February 1964.
[6]Horn, G. W., "Interferences in EMG-detection Systems" *IEEE Technical Group on Electromagnetic Compatibility*, December 1963.
[7]Blaser, L., "High Input Impedance Transistor Amplifiers" *BAS* 14/2 *S.G.S.*, Milano.

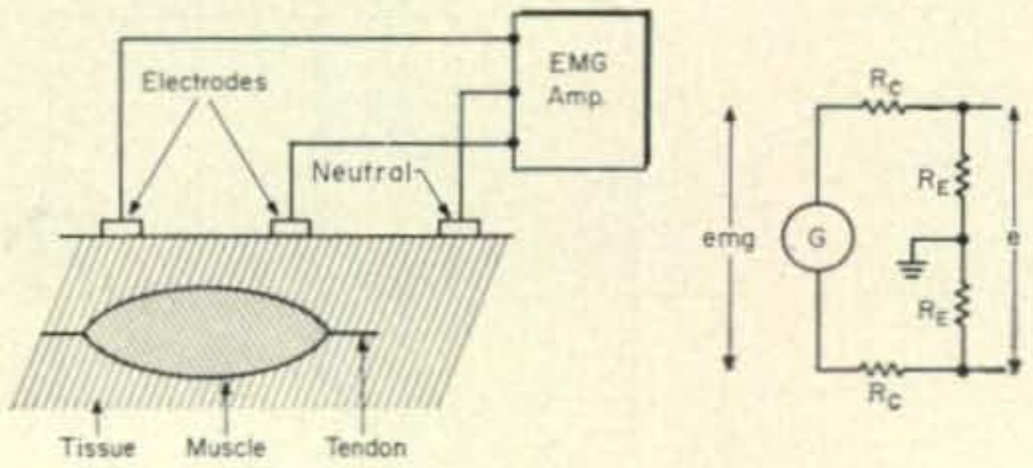


Fig. 3(A)—EMG detection from body surface employs two signal electrodes and one neutral. (B) Equivalent circuit of the pickup electrodes shows how the contact resistance, R_c, and the input resistance, R_e, form a voltage divider.

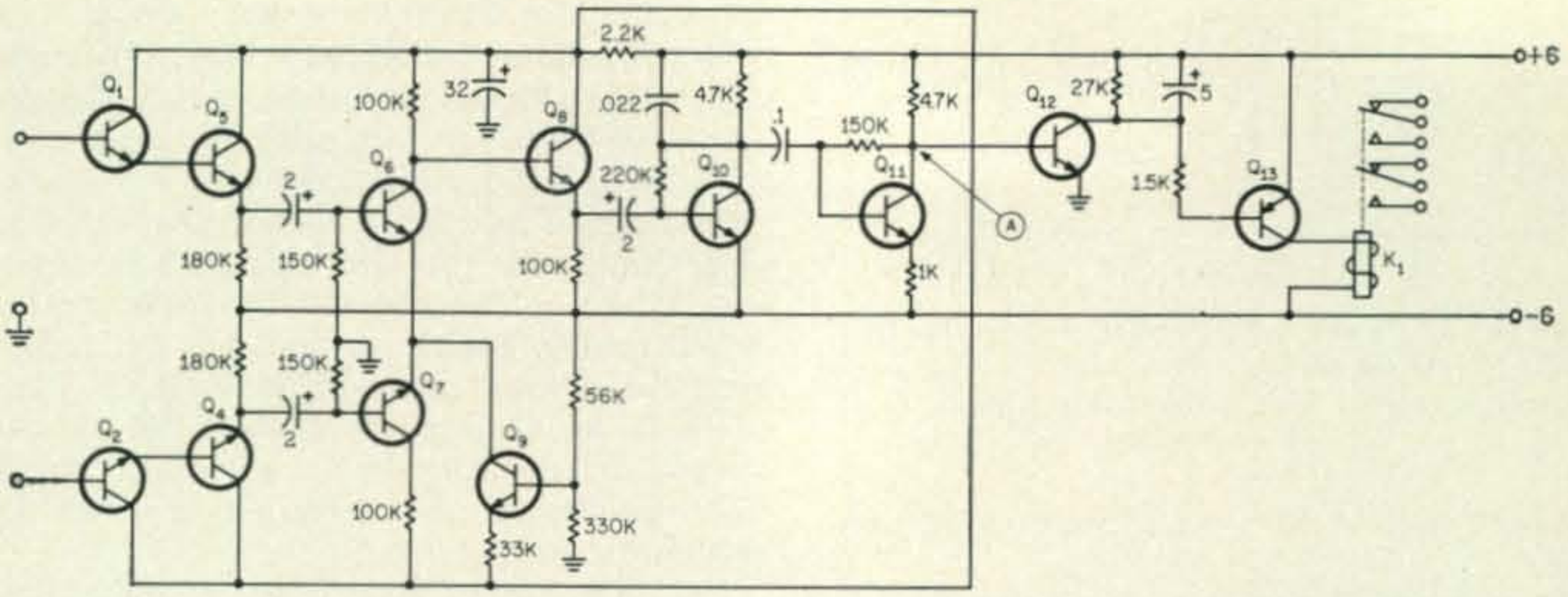


Fig. 4—Circuit of an EMG amplifier suitable for on-off operation. All resistors are ¼ watt and all capacitors are in mf. Relay K_1 is a Sigma SIL 2500 or equivalent. Q_9-Q_{12}—2N708; Q_{13}—2N398.

in fig. 4. The amplifier consists of three main sections: a front-end low-noise impedance transformer feeding a differential amplifier, a conventional two stage high-gain amplifier, a detector followed by a d.c. amplifier operating the output relay.

The pick-up arrangement consists of two main electrodes, which should be positioned in correspondence to the selected muscle, and a neutral one connected to the amplifier's ground. This should be applied to the skin in some position (not critical at all) about 3″ apart from signal electrodes. The electrodes are thin silver plates arranged on a leather strip.[8]

The high input impedance is transformed to a much lower value by two cascaded emitter-followers; these, in turn, drive the differential amplifier. Its common mode rejection is largely improved by the high dynamic resistance presented by transistor Q_9 which acts as a common load in the emitter return of the differential stage.

The output impedance of the differential amplifier is quite high. In order to couple that stage to the following, without degrading its performance, a further emitter-follower has been employed.

The second section, the high gain amplifier, consists of two cascaded common-emitter stages showing an overall gain of about 80 db. Its output feeds a detector consisting of Q_{12} acting as an integrator. The time constant of integrator-network has been selected so that the single muscle potential pulses fuse together in a smooth transient-free rectified output voltage. Detector output actuates, through a single stage d.c. amplifier, the output relay.

Connecting the output relay to the device to be controlled electromyologically is an easy job: the actual configuration of this part of the circuit depends on the disability to be overcome. As previously mentioned, a keying-relay can be operated at a considerable speed without undue difficulty on the part of the handicapped ham.

To operate more than a single control electromyologically, several EMG channels may be installed. Coordinated simultaneous control of many EMG channels can be achieved after a short period of training. In general, three channels per side can be controlled simultaneously without difficulty.

Proportional Control

EMG control can also be operated as a proportional device. A system of this kind will allow one, for instance, to control, continuously, the angular position of a tuning knob.

If a rectified EMG voltage is used as input signal of a position servo, then the angular position of its output shaft will be made proportional, at any instant, to the effort exerted

[8]Don't try to use other metals, because they polarize in contact with the skin; electrodes polarization shifts input stage operation-point, blocking the amplifier.

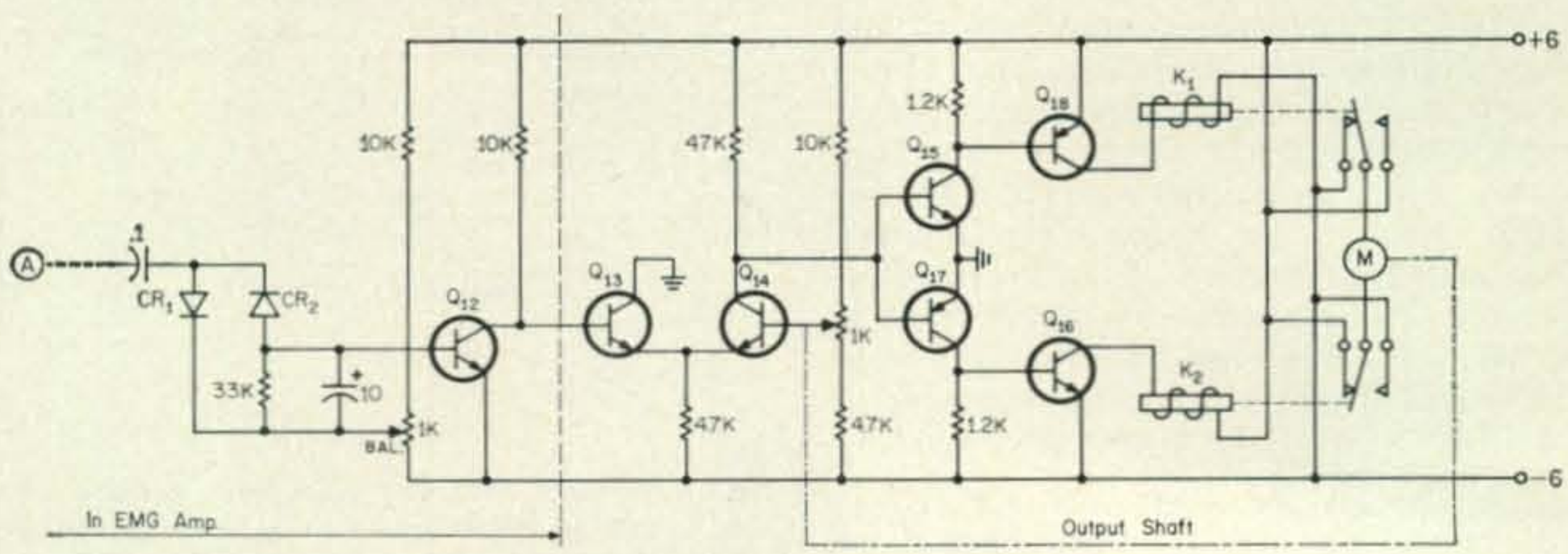
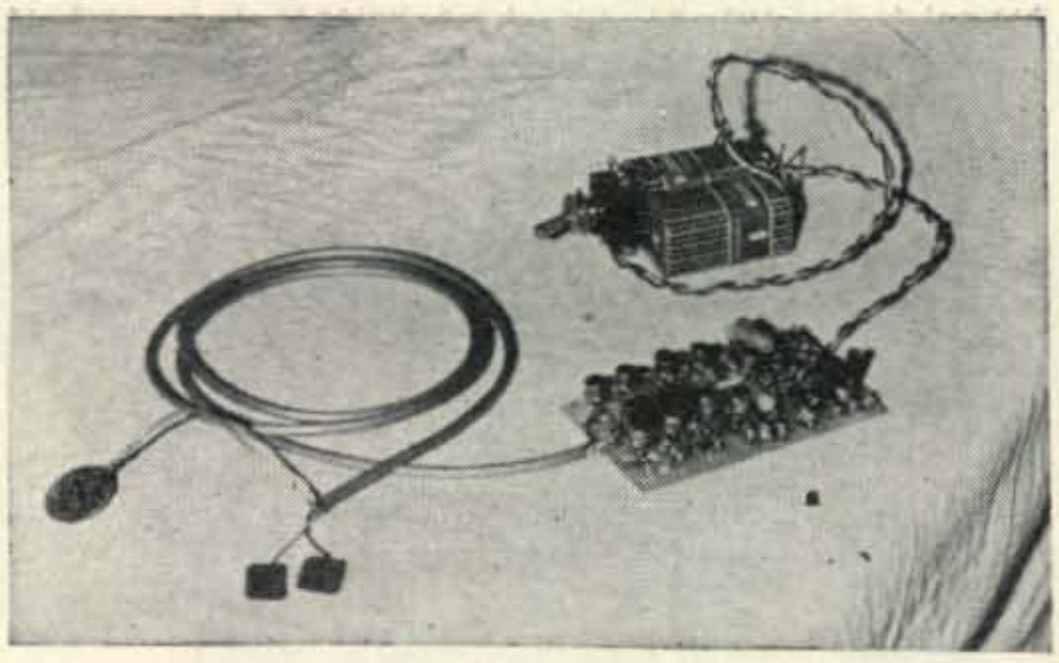


Fig. 5—Circuit of an EMG amplifier suitable for proportional control. Point (A) is connected to a similarly marked point in fig. 4. Q_{12}-Q_{15}, 2N708; Q_{16}, BFY56; Q_{17}, 2N398; Q_{18}, BFY64.



View of the prototype model. The round pick up plate is the neutral.

Miniaturized version of the EMG amplifier.

by the operator. A stronger effort will result in a larger rotation of the shaft; relaxing the muscle (*i.e.*, the mental concentration) will cause the shaft to return to its zero-position.

The schematic of an EMG-controlled position servo, with which we experimented successfully, is shown in fig. 5. For that appliance we changed the detector-stage circuitry; a pair of diodes in a voltage doubler arrangement supplies a smooth d.c. signal to transistor Q_{12}, which acts as a d.c. amplifier. Its operation point has been made adjustable in order to balance the servo system when at rest.

The shaft to be controlled is operated by the p.m. motor M which, in turn, is activated by relay K_1 (clockwise rotation) and relay K_2 (counterclockwise rotation); at rest, the rotor of the motor is shortcircuited in order to prevent any shaft oscillation due to system overshoot.

The current activating $K_{1,2}$ is supplied by a couple of complementary transistors Q_{16}, Q_{18}, driven by Q_{15}, Q_{17}. This stage, in turn, is driven by a differential amplifier (Q_{13}, Q_{14}) the inputs of which are supplied by the EMG control-signal and by the follow-up potentiometer ganged to the output shaft. Transistors Q_{13}, Q_{14} are biased so that zero voltage appears at Q_{15}, Q_{17} bases when the system is at balance.

Conclusion

As previously mentioned, the circuits briefly described in the present article have been originally designed to control electromyologically the active movements of a motor-driven artificial hand or arm.

From a theoretical point of view, EMG signals represent a means for coupling, directly, the will of a person to some external work. Having that conclusion in mind, we devised to employ the EMG-technique as a method allowing a heavily disabled ham to operate his station without physical motion.

Here is a new field of application for electronics. Electronics and ham-radio, by their nature being a constructive science, it is time to extend their blessing to all disabled people of the world, who need technical aids. ■

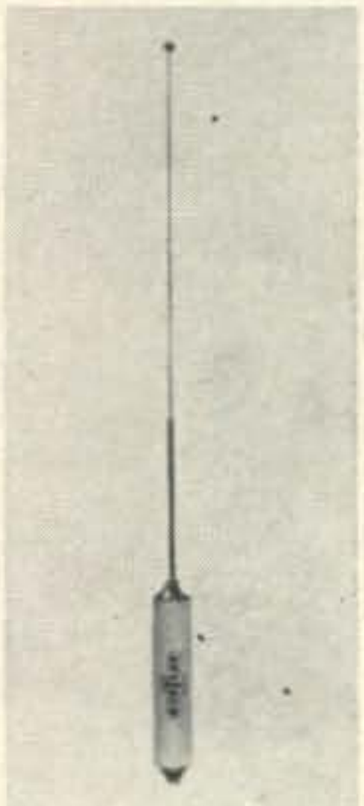
New Amateur Products

Lafayette HA-250

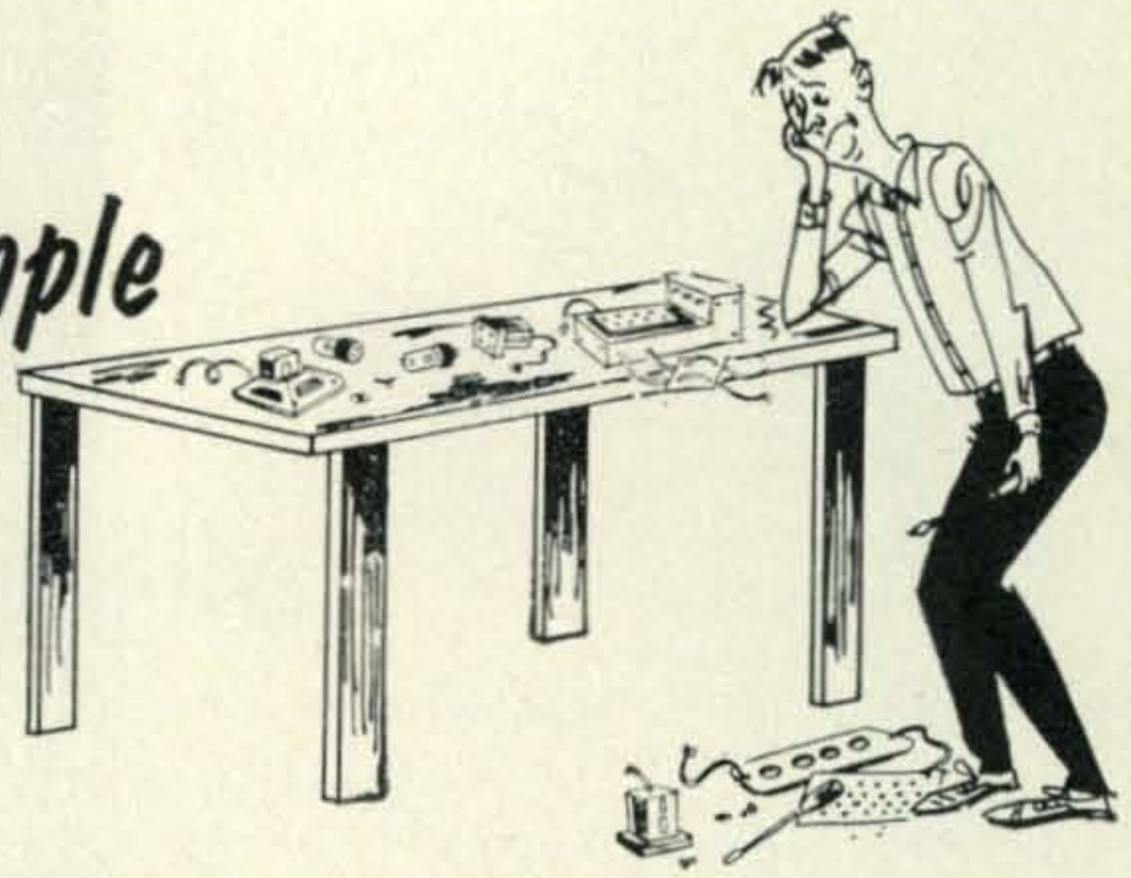
THE Model HA-250 Linear Amplifier can be used on 6, 10 or 15 meters to boost transmitter output to a full 100 watts p.e.p. power. The linear amplifier features an r.f. sampling circuit which automatically switches the linear. No extra switching or wiring is required. Other features include a 12-volt d.c. solid-state power supply, over-sized heat sinks, and illuminated tuning meter. Size: 7× 9 × 2", price: $79.95. For further details write to Lafayette Radio, 111 Jericho Turnpike, Syosset, L.I., N.Y. or circle 66 on page 112.

New-Tronics Corporation

NEW antenna resonators for 10, 15, 20, 40 and 75 meter mobile amateur operation are announced by the New-Tronics Corporation. Called the Super Hustler, the unit reputedly can handle the maximum legal limit on s.s.b. Designed for the widest bandwidths, they maintain minimum s.w.r. over 40, 20, 15, and 10 meters and also 60 kc wide at 2 to 1 s.w.r. on 75. Base impedance is a nominal 52 ohms at resonance without specific feedline lengths or matching devices. For information, write New-Tronics Corporation, 3455 Vega Avenue, Cleveland, Ohio 44113, or circle 67 on page 112.



A Cheap and Simple C.W. Monitor



BY NORTHE K. OSBRINK,* WA6ZEM

I had not been using c.w. very regularly during the past year and as a result my fist was terrible. The easiest way to improve a fist is to hear one's mistakes by monitoring the sending and so a c.w. monitor became a priority project here. I read the article by WØMQB in *CQ*[1] and decided to follow his lead and build a simple, self-powered unit.

After a little experimenting, this unit was built and serves my purposes admirably. The version here is built on a small hardware cloth chassis and as the parts were so common, scrounging reduced the cost to nothing. It is always ready for operation, requires no external power, needs no tuning or adjustment and with the addition of a flashlight cell can serve as a code practice oscillator.

In most transmitters, closing the hand key causes a current to flow to some sort of keying circuit. If a resistor is connected in series with the key, when characters are being formed, a voltage drop will appear across it, which can be used to power a small audio oscillator. The few ohms required will usually cause no ill effects to the keying of the average transmitter.

Resistor R_1 is connected in series with the key and the value can be determined by the formula $R=E/I$, where R is the required resistance, E is any value between 2 and 3 volts and I is the current through the key (in Amperes). My DX-40 uses cathode keying and has a current of 110 ma through the key circuit, so a 25 ohm resistor for R_1 served to produce about 2.6 volts under the oscillator's small load. The 25 ohms does not noticeably affect the keying characteristics or the cathode current of the rig.

Transistor Q_1 can be any pnp audio unit such as a CK722; inductor T_1 can be almost any audio output transformer primary (miniature or otherwise) and the value of R_3 may be varied to provide a pleasing tone or eliminated altogether. (I used 15K.)

The parts can be laid out in any desired configuration since the lead placement and length make no real difference, and could even be built into the transmitter.

To use the monitor, plug P_1 into the station receiver audio output jack, high impedance magnetic phones into J_1 and connect R_1 in series with the code key. Since most c.w. ops use phones anyway, the lack of a speaker presents no real problem.

If loudspeaker operation is desired, a plug should be made up to plug into J_1 with a 28K resistor across the terminals and the hot lead of a small amplifier going to the center terminal and the ground lead going to the minus side of R_1. I have used a 3-transistor amplifier which cost only $4.00 and it provides room-filling volume.

To use the unit as a c.p.o. connect a flashlight cell in place of R_1 and connect the key in series with the high impedance phones plugged into J_1. ■

*4506 Lowell Avenue, Los Angeles, California 90032.

[1]Wrench, O., "Self Powered C.W. Monitor," *CQ* August 1965, p. 37.

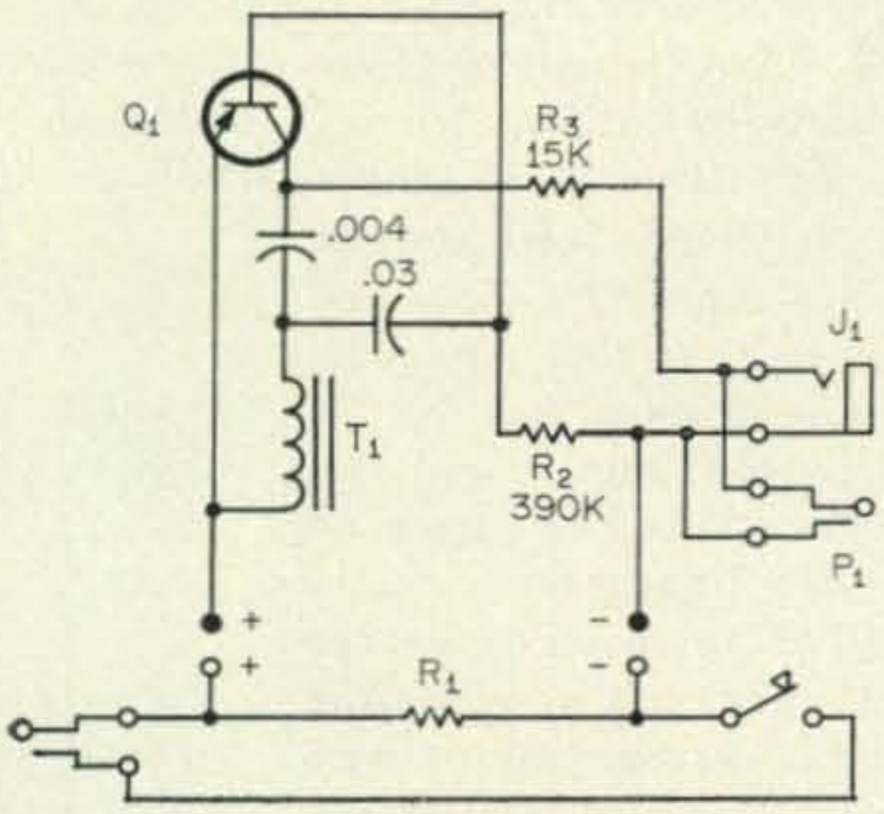


Fig. 1—Circuit of a simple code monitor that is powered by the current in a cathode keyed circuit. The transistor can be any audio pnp type (CK722) and T_1 the primary of any output transformer. The value of R1 is discussed in the text.

ADJUSTABLE SELECTIVITY FOR THE LAFAYETTE HA-350 RECEIVER

BY GEORGE P. OBERTO,* K4GRY

A previous issue of *CQ*[1] fully described the Lafayette HA-350 communications receiver. Several modifications were suggested to further improve its overall performance. However, the main drawback encountered with a.m. operating was that the selectivity, (2.1 kc) of the mechanical filter was much too sharp for good copy. The problem was solved very easily by installing a three position selectivity switch.

Figures 1 and 2 show how the switch is wired across the mechanical filter. Position 1 of the single pole three position switch, is the 2.1 kc selectivity, position 2 is about 3.1 kc and position 3 about 10 kc.

Positions 1 and 2 of the selectivity switch give a sharp peak. However, the broad selectivity characteristics of position 3 results in a double humped resonance curve. This double characteristics curve is somewhat similar to those obtained with the old high quality broadcast receivers designed before World War II, and its selectivity is similar to many of the older a.m. communications receivers. For receiving with v.h.f. converters this broad position really does the job, and for all around use we have our choice of more selectivity.

The same changes for adjustable selectivity can be incorporated when installing the Lafayette mechanical filter into other communication receivers resulting in the best overall performance possible. ■

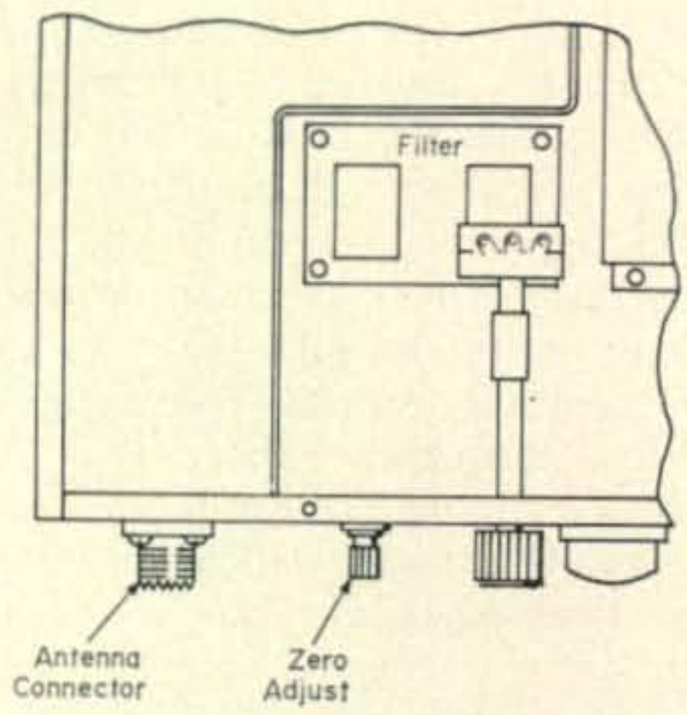


Fig. 2—Location of the bandwidth switch. The switch is located close to the filter and a shaft extension is brought out to the rear.

*6731 Patterson Ave. Richmond, Va. 23226.

[1] Scherer, W. M., "The Lafayette HA-350 Receiver," *CQ*, Feb. 1965, p. 60.

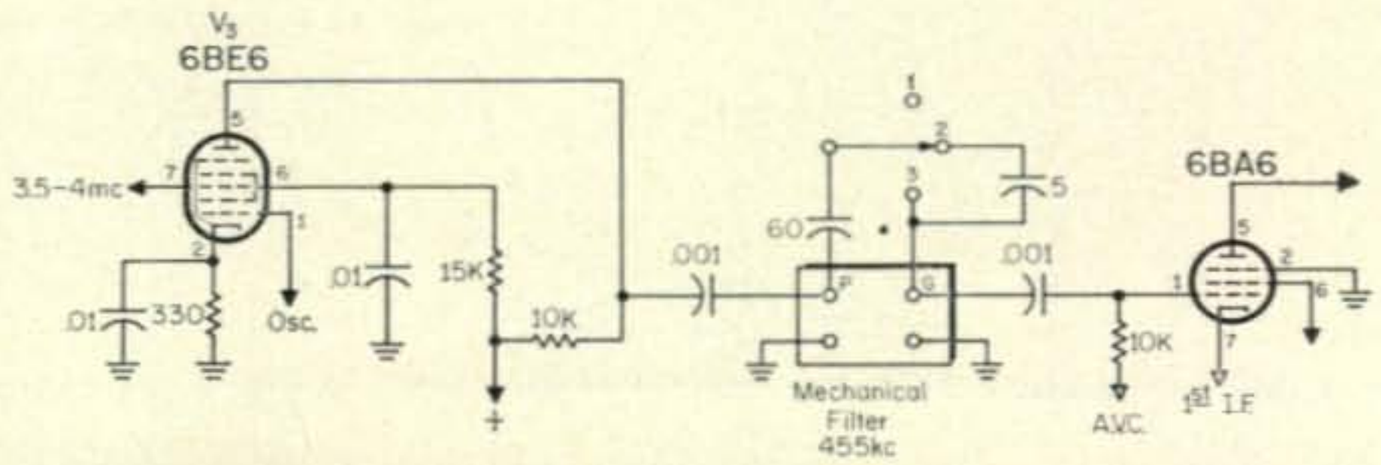
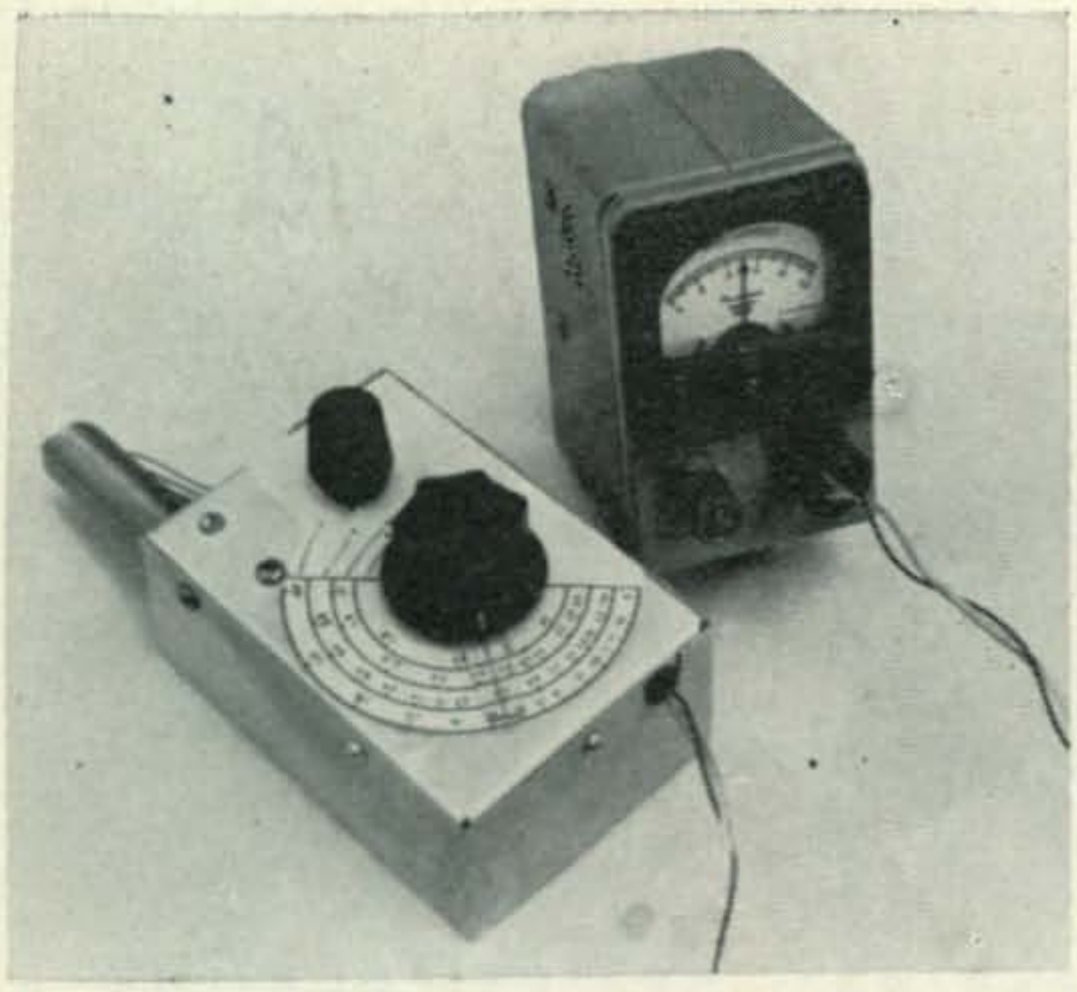


Fig. 1—Circuit showing how variable selectivity can be obtained with a s.p.t.t. rotary switch. The 5 and 60 mmf capacitors added are ceramic types. Position 1 provides a bandwidth of 2.1 kc, 2-3.1 kc and 3-10 kc.



The bandswitched grid dip meter is built in two sections. The unit on the right contains the battery, a d.c. amplifier and the meter. The r.f. head on the left contains the oscillator and tuned circuits. The range is from 1.7 to 36 mc in four bands.

A BANDSWITCHING GRID-DIP METER

BY FREDERICK W. BROWN,* W6HPH

This versatile instrument not only performs the usual work-horse grid-dip meter jobs, but is also useful as an indicating wavemeter and transistor tester.

THE first grid-dip meter, described in 1926, used plug-in coils. For some reason grid-dip meters are still encumbered with plug-in coils despite the obvious advantages and almost universal adoption of bandswitching in communications receivers, transmitters, signal generators, *etc*. This dip-meter, while by no means an ultimate design, does, at any rate, prove the feasibility of bandswitching over at least a 30 to 1 frequency range.

No space will be wasted on detailed construction data since the reader will probably have his own ideas. This particular model was built in two parts; the meter, battery, and d.c. amplifier are mounted in a separate box since I plan additional r.f. heads for v.h.f. and u.h.f. coverage. The r.f. head described here covers 1.2 to 36 mc in four ranges.

*Pine Cove, Idyllwild, Calif.

Circuit

As can be seen from fig. 1, the dipper uses two transistors: a 2N711 in a bandswitching Hartley oscillator circuit, and a 2N44 as a direct current amplifier. The r.f. signal is rectified by a 1N276 diode, capacitively coupled to the oscillator emitter. The resulting d.c. is applied to the current amplifier which drives a 500 micro-

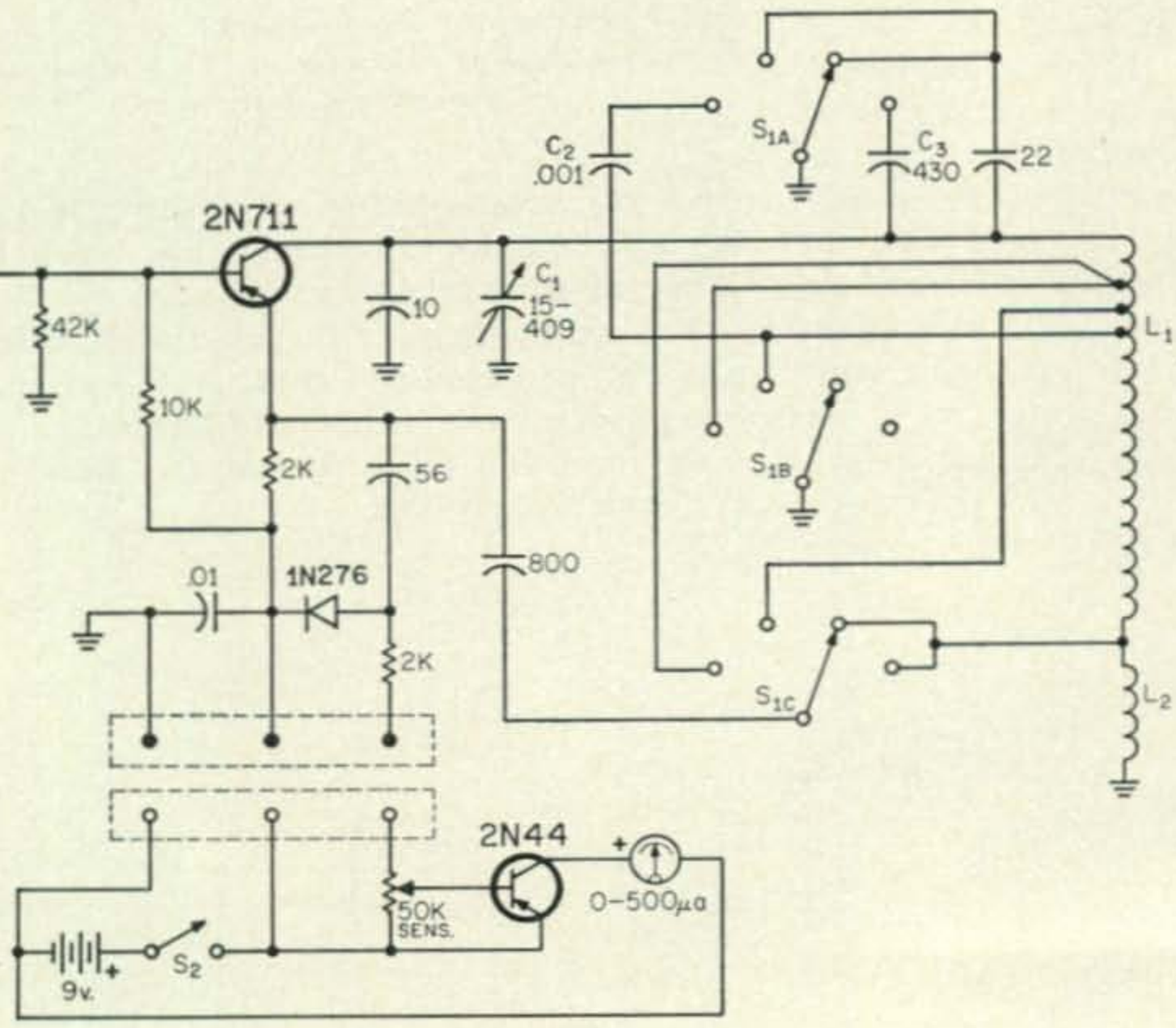


Fig. 1—Circuit of the transistorized bandswitched grid dip oscillator. Except as indicated all capacitances are in mmf and all resistors are ¼ watt.

C_1—15 to 409 mmf variable. Allied #13U524 or equiv.

L_1—63 t #24, ⅝" dia., 2" long, Air Dux 523T or equiv., tapped 4½" 16½ and 18½ t down from the top.

L_2—10 t #24 d.c.c. ½" dia. closewound at the base of L_1.

S_1—3 pole 4 position miniature rotary switch.

S_2—S.p.s.t. mounted on 50K sensitivity control.

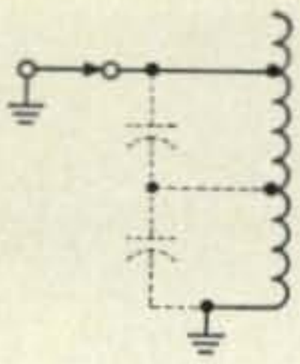


Fig. 2—How sections of a coil can be parallel resonant even though grounded at both ends.

amp meter (0-1 ma. would also be o.k.). Practically any old p.n.p. will do for the d.c. amplifier. I used the 2N44 only because it happened to be handy. A high frequency type is required for the oscillator, of course; the 2N711 seems about as cheap and plentiful as hundreds of types that will do the job.

Bandswitching System

Some words of explanation are in order about the bandswitching system. The center portion of the bandswitch (S_{1B}) changes the tuning range of the tank circuit by shorting out lower parts of the coil. The entire coil is used on the lowest two bands. On the lowest band (1.2-1.7 mc), a 430 mmf capacitor (C_3) is switched in shunt with the tuning capacitor by S_{1A}. This is a simple and rather ineffective way of extending the tuning range downward. It is ineffective because the tuning ratio is so drastically reduced, from about 2.7 to 1 to about 1.4 to 1. On the other hand, whereas switching in another section of inductance would have extended the frequency limit much lower, it would also have invited Gremlins on the higher ranges. This is because all sections of the coil are inductively coupled together, and even though the lower section is shorted out on the upper ranges, it is still possible for false-dip causing resonances to occur. The reason is illustrated in fig. 2. Although both ends of the coil are grounded, the distributed capacity between the center and either end forms a parallel resonant circuit.

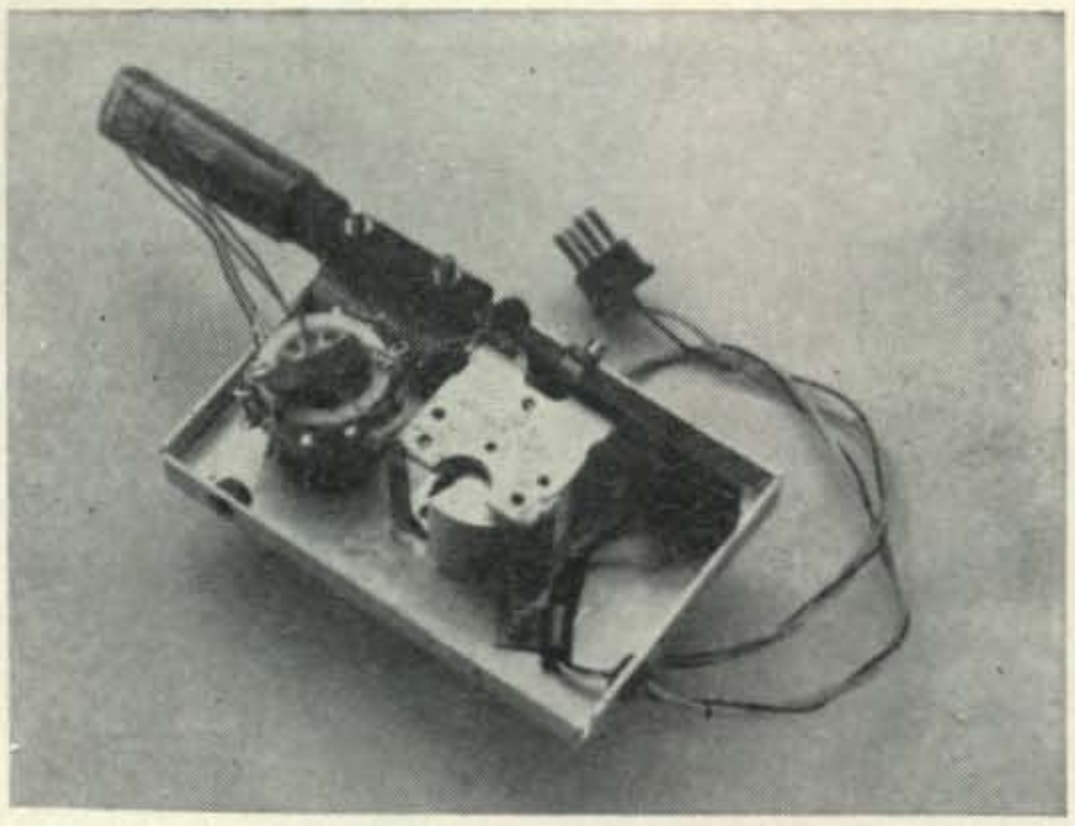
On the highest range it was necessary to ground the next lowest tap through C_2 to get rid of a false dip. The purpose of C_2 is simply to tune out some of the lead reactance. Notice that the emitter is connected to the same tap that is grounded on the highest range. At first it might appear that the emitter is shorted to ground on this range, but feedback results from the inductance of the common lead that runs between the coil tap and S_{1B}. This wire is about 2½ inches long and, in conjunction with the switch inductance, provides plenty of feedback.

Improvements

This design can certainly be improved. For one thing, the coil taps are not in precisely the right spots for equal percentage coverage on each range. The ranges ended up about as follows:

1.2—1.7 mc
1.7—4.5 mc
3.7—10.0 mc
10.0—36 mc

A better tuning capacitor might be one of the miniature two-section BC superhet types, using



Interior view of the r.f. head. The coil is mounted on a ½" dowel so that it's clear of the housing. Note the use of a miniature bandswitch.

both sections in parallel on the lower ranges, and the small section alone on the top range. A high C to L ratio has the advantage of producing very stable T9 signals without the usual transistor "burble" when using the dipper as a signal source. On the other hand, a large ratio results in high circulating currents which magnify the effects of any resistance in the tank circuit. A tiny bit of dirt in the tuning capacitor bearings can result in erratic operation on the highest band. Keep the bearings clean by covering with masking tape during construction.

A shorting type switch that would automatically ground all the lower unused coil taps might possibly be better than the conventional type used here.

Other Uses

I would strongly recommend use of a socket for the oscillator transistor with an access hole in the box for its easy removal. The socket makes possible two additional applications of the instrument. One is as an indicating wavemeter to which the dipper can easily be converted by simply removing the oscillator transistor.

An even more valuable use of the dipper is as a transistor tester. Practically any p.n.p. transistor can be plugged into the socket and its approximate cutoff frequency determined by watching the meter while tuning throughout the range of the dipper. In fact, after using this device for the last few months, it's hard to say whether it has been more useful as a g.d.o. or as a transistor tester. ■

"He's not taking any chances since he fell down the chimney yesterday."

Celebrating his honorary membership in the REF, the French amateur radio society, Bill Halligan, W9AC/W4AK, (right) discusses international radio with (left) Robert Brochut, F9VR, President, REF and (center) Herve De Rolland, President, Teleradio-Paris, during Bill's recent visit to France.

W9AC/W4AK, (left), with Gerald C. Gross, W3GG, Secretary-General of the International Telecommunication Union, in Geneva where Bill received the ITU Commemoratory Medal for his contributions to international radio communications.

W9AC Honored on European Good Will Tour

IF THE earth were peopled entirely with radio amateurs, the road to peace would be as wide as the world"—these are the words of Bill Halligan, W9AC/W4AK and this was the motive behind his special trip to Europe in November to activate HV1CN, the Vatican Radio Station, during the *CQ* World Wide DX C.W. Contest. With his abiding interest in the cause of peace through understanding and understanding through communication, Bill felt that such a contest is an ideal method of encouraging wider contacts among the radio amateurs of the world by providing a planned period of effort. Even though the contacts must necessarily be brief, they afford a wonderful opportunity for all participants to realize their full potential and to be encouraged to repeat and amplify similar contacts at the end of the contest period.

Because of the heavy responsibilities to the Vatican of chief operator, Domenico Petti, especially during the closing sessions of the Ecumenical Council, it did not appear likely that Dom could devote an entire weekend to participating in this Contest. Therefore, aware of the continuing demand for HV1CN contacts, Bill relinquished his Thanksgiving Day celebration with his family and invited two of America's top c.w. operators, Larry LeKashman, W9IOP, and Al Kahn, W8DUS, to participate with him in working as many stations as possible from Vatican City during the Contest. Among the three of them, they provided 1800 contacts among sixty-two countries and eighteen zones during the 48-hour period!

In recognition of countless similar contributions by him to operational and technical advancements, Bill Halligan became the first amateur to be consecutively honored by three of the world's leading amateur radio organizations, ARI, the Italian amateur radio society; REF, the French amateur radio society; and IARC, the International Amateur Radio Club (headquarters at the ITU in Geneva), during his visit to Europe.

On November 25, a banquet was held in Rome to which top officials of the Italian and Roman

Bill Halligan, W9AC/W4AK, receives the membership pin of the Italian Radio Society from its President, Dr. R. Sesia, I1FA, after Bill was inducted as an honorary member of the A.R.I.

Contest operators gather at HV1CN before the CQ World Wide C.W. Contest, Nov. 27-28. L. to r. Larry Lekashman, W9IOP; Domenico Petti, Chief Operator, HV1CN; Neal Latorraca, WB2NAD; Al Kahn, W8DUS; Bill Halligan, W9AC/W4AK; and Fr. Lars, SM5BOE.

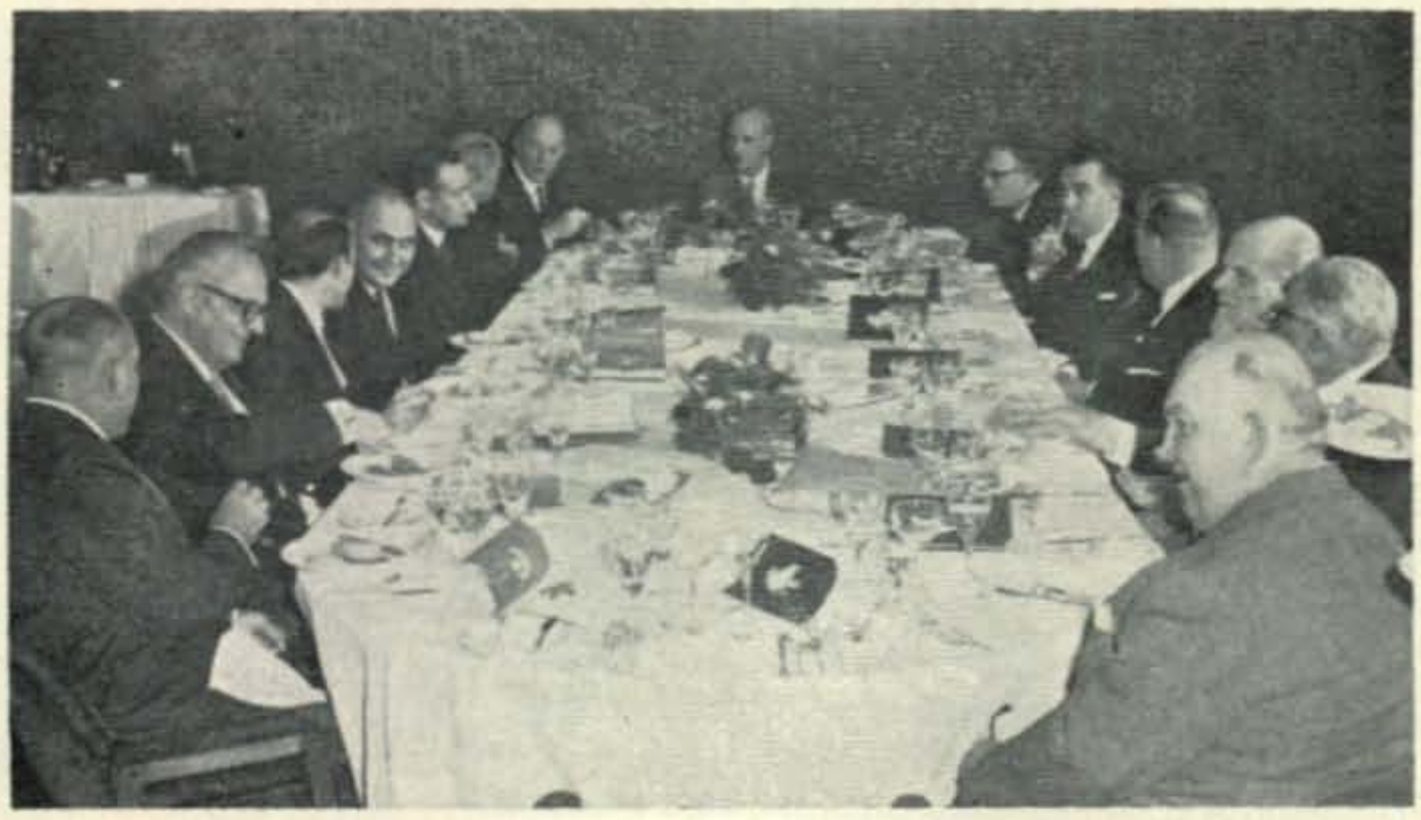
societies came from hundreds of miles to pay tribute to this outstanding American radio amateur by granting him honorary memberships in both organizations. Among those present were Dr. Robert Sesia, I1FA, President of the ARI; Dr. Spartaco Zuanelli, President of the Amateur Radio Club of Rome; Mr. Sergio Pesce, Secretary of the ARI; Domenico Petti, chief operator, of The Vatican; Dr. Bernardo Doleatto, I1XU; Dr. Loris Castaldi, I1CL; Commander Mario Berardi I1MB; Dr. Carlo Polli, I1NQ; Mino Cuzzoni, I1BAF; Victor Wilson, I1MS; Commander Pizzinato; and Bill's fellow contest operators, Larry LeKashman, W9IOP; Al Kahn, W8DUS; and Neal LaTorraca, WB2NAD.

Following the festivities in Rome, Bill went to Geneva where on November 30, at a reception in his honor, he was awarded the ITU Commemoratory Medal "in recognition of his many contributions to amateur radio and to the International Amateur Radio Club." After the presentation ceremonies, an announcement was made by John Gayer, Honorary President of the IARC, of the inauguration of "The International Amateur Radio Hall of Fame" in 1966, in cooperation with The Hallicrafters Company. This program is designed to provide the first permanent recognition of contributions to communications made by the radio amateurs of the world. Each year, five amateurs will be chosen by a board of judges from among thousands of nominations submitted by fellow amateurs. The top five nominees will have their names inscribed on a plaque to be installed at the IARC station, 4U1ITU, through the courtesy of The Hallicrafters Company, and each winner will be presented with an engraved replica of "The Hall of Fame" plaque.

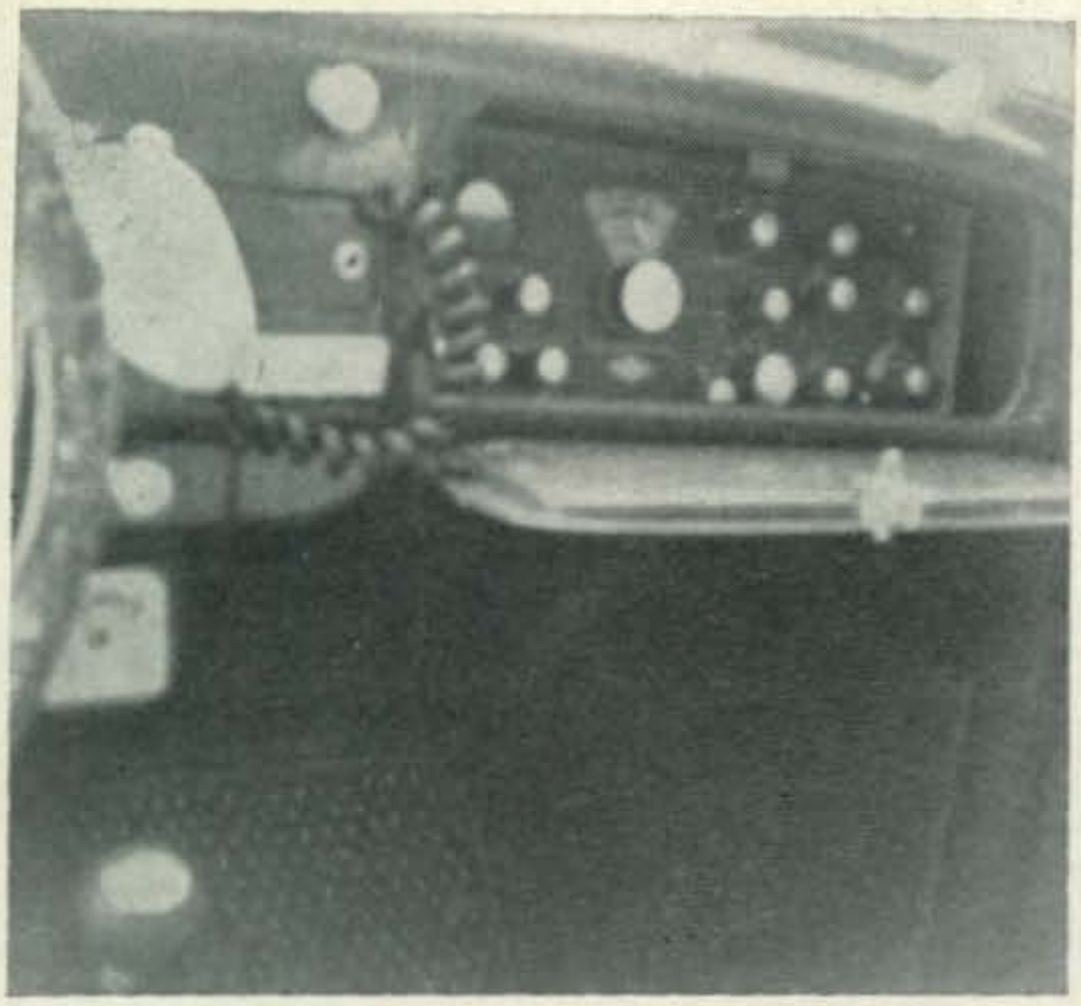
Further honors awaited Bill in Paris where, on December 2, officials of REF, led by its President, Robert Brochut, F9VR, inducted Bill into honorary membership in that organization at special ceremonies planned for the occasion.

Bill's European trip ended with visits to London where he was feted by a large group of British hams and to Ireland where Henry Wilson, EI2W, initiated plans for Bill to be given his own EI call.

Throughout Bill's European trip, he had the opportunity to meet many of the local amateurs and, with them, he exchanged ideas about the future of international communications and equipment. Always a radio amateur at heart, he has never let his position as Chairman of the Board of The Hallicrafters Company keep him from mingling with "the boys" and it has always been this attitude and this interest that has made Bill Halligan a moving force in the vital exchange of ideas and friendship among the radio amateurs of the world. ■



Notable Italian and American radio amateurs gather in Rome at a banquet honoring Bill Halligan, W9AC/W4AK, who was inducted as an honorary member of the A.R.I., Italian Amateur Radio Society.



Car look familiar? This is Irwin Wittner's, W9EXZ, answer to a tricky mobile installation. Irwin used the glove compartment space of this VW to install a G-76. A second battery located under the rear seat provides power to a 12 V alternator and in turn powers the d.c. supply. Good idea Irwin, lots of DX and safe driving this winter.

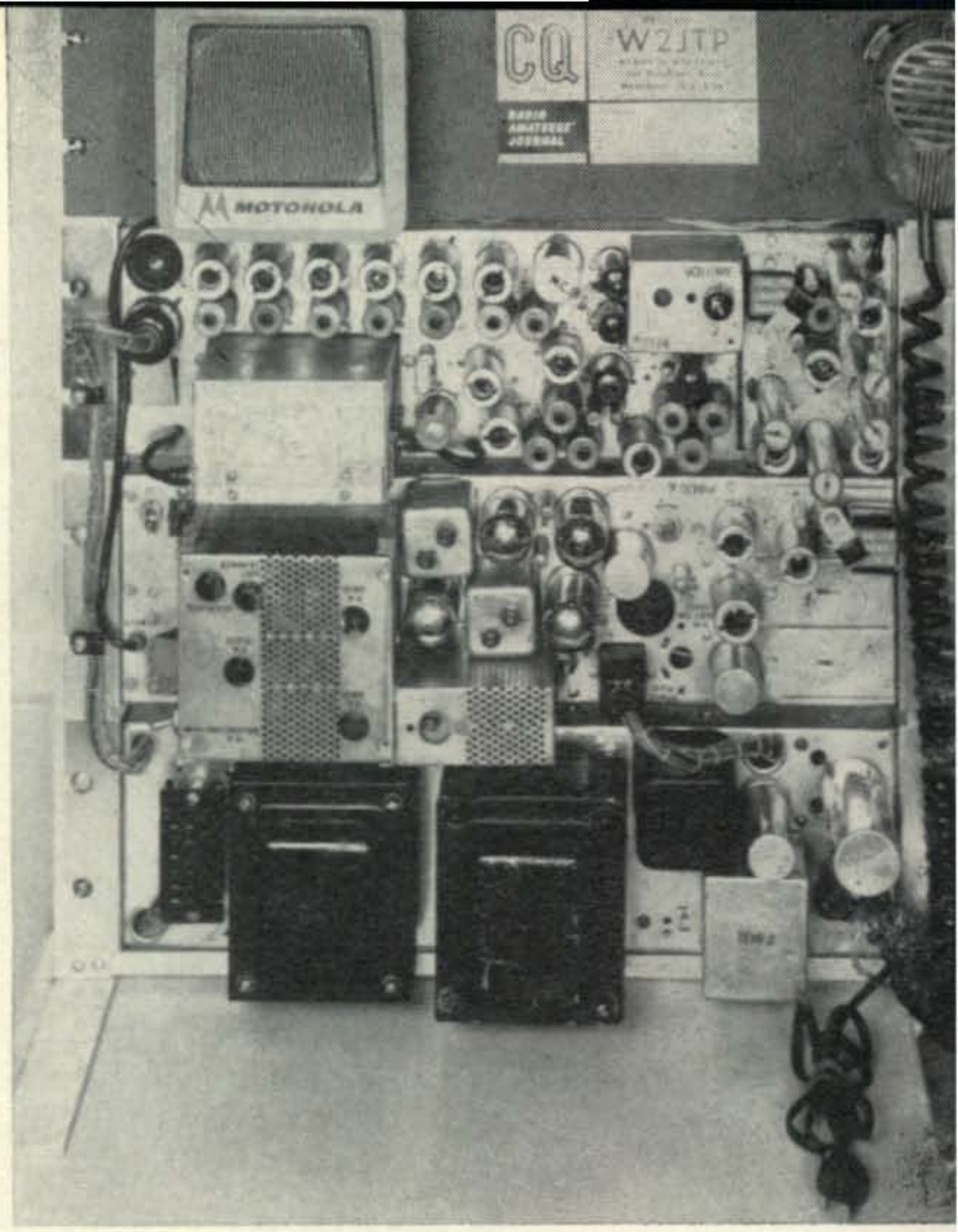
Here is Ed Daly, WA2CZG, operating the station at the Century Theater, Roosevelt Field, L.I., during the showing of "The Bedford Incident." Ed operated the rig on three consecutive evenings and made 32 contacts plus handling 13 pieces of traffic along with a tremendous public relations job.

PEOPLE AND PLACES

Jess Daughtrey, K2EEM, is shown deeply engrossed in operating his station at the Bronxville Theater in Bronxville, New York. On two Sunday afternoons both Jess and Perce, W2KN, (not shown) handled traffic and informed onlookers about amateur radio. Jess and Perce took part in the "Bedford Incident" program as members of the Westchester Amateur Radio Association.

Shown l. to r. are: Ruth Christian, WA4HED, Albert Henderson, WA4NFM, Henry Navalany, WA4FND, and Walter Edwards, W4MSC, all members of the Broward Amateur Radio Club in Ft. Lauderdale, Fla. Operating under the call W4AB/4 the club accepted and relayed messages at the Gateway Theater in Ft. Lauderdale. Eight of their members were Navy MARS members.

This is the well equipped station of John Wegimont, FG7XT. John operates from Pointe-A-Pitre, on the French West Indian island of Guadeloupe. He is active on c.w., a.m., s.s.b. and RTTY, as well as conducting propagation experiments on 6 meters.



Motorola FMTRU-80D on 2-Meters, mounted on a small open rack. From top to bottom: blank panel to hold speaker; 17-tube sensicon fixed-frequency f.m. receiver; 30-watt (output) f.m. transmitter, with just one oscillator deck; and, a.c. power supply built on the d.c. power supply chassis. An octal socket, for external connections, is mounted in place of the vibrator socket.

Putting the Motorola FMTRU-80D On 2 Meter F. M.

Part I

BY BYRON KRETZMAN,* W2JTP

Presented below, in Part I, is a combined conversion and information article. Described is the conversion technique for the high frequency (150-170 mc) Motorola FMTRU-80D unit. Also covered are the procedures, frequencies and standards for this type of f.m. operation.

THIS is not a "conversion" article in the ordinary sense of the word, but rather is two-fold, an information and a construction article. We will attempt to give you all the information required to put into operation on 2-meters, from your home station, one of those commercial surplus "two-way ex-taxicab or police f.m. sets which are now appearing on the market. Although both "low-band" (40-50 mc) and "high-band" (150-170 mc) sets are available we will confine this article to the high-band variety and specifically to the Motorola FMTRU-80D, which seems to be the model most available from eastern and from midwestern sources at extremely reasonable prices.

There are some basic facts about this kind of operation which should be understood before rushing out to buy one of these sets.[1] First of all, f.m. is not for the "appliance operator." Somewhat like RTTY, f.m. takes a little effort to get going. Since the -80D is a vehicular radio, most likely for 6 volts d.c., an a.c. power supply must be built. (This we will detail in Part II.) Secondly, the f.m. mode is quite likely unfamiliar to the usual amateur; and, the 18 tube double conversion receiver supplied is, at first, quite fearsome to the newcomer. (This fear is overcome as you dig in.)

Standards for Amateur F.M.

The FMTRU-80D sets, like most of those available, were designed for ± 15 kc deviation, and the transmitter is rated at 30 watts *output*. The receiver has a sensitivity in the order of 0.6 to 0.8 microvolts. Although the sets are about 10 years old, these fundamental parameters are still considered very satisfactory today. Converting one to a.m. would be sheer idiocy. They were *designed* as f.m. sets, and when used that way we take advantage of all the years and money the manufacturer invested to make them outperform almost anything you could possibly buy or lash up for a.m. And, because these sets have receivers with squelch circuits that keep speakers muted until a carrier is received, we can continuously monitor a channel without any annoying noise. This is ideal for keeping a listening watch on a channel where occasional mobile or RTTY activity is expected.

Frequencies of operation for f.m. are usually up on the high end of the 2 or 6 meter band. Since amateur f.m. is predominently a specialized local operation, the low end is left to the DX-

*431 Woodbury Road, Huntington, Long Island, N.Y.
[1]Kretzman, B. H., "A New VHF Operation: FM," *CQ*, August 1963, p. 74.

chasers and the middle is left to the a.m. appliance operators with gooney boxes. QRM in most areas is thus avoided. In as much as this f.m. operation utilizes fixed frequency crystal controlled transmitters *and* receivers, there is no tuning around, and it is general practice to receive on the frequency transmitted. By national agreement, frequencies, or rather *channels,* have been set up on a 60 kc separation basis. Also by agreement, the primary calling (and working, where activity is low) channel has been set up as 146.94 for phone and 146.70 for RTTY. In high density metropolitan areas secondary working channels have been set up within 720 kc of the primary channel. This is so that only crystals, or crystal oscillators, need be switched to get two-channel facility.[2]

Phone operation on f.m. is on a press-to-talk basis, and long transmissions tying up a channel are frowned upon. Seldom is there a transmission longer than 10 *seconds,* and identification is made only once in any 10 minute period, as required by the FCC. It is inconsiderate to jam up an f.m. channel with needless repetition of calls. In crowded metropolitan areas 10-signals, such as used by law enforcement agencies, are frequently used to keep transmissions as short as possible.

The FMTRU-80D

The FMTRU-80D is a mobile set, with three separate chassis; receiver, transmitter, and power supply. For operation on a.c. from your home station it is most desirable to separate the chassis from the end plates which hold them together in the drawer-type mobile case. (This makes them easier to work on.) Most f.m. operators then rack-mount the chassis by adding simple L-brackets to each end. Figure 1 shows such an end bracket. Note that it permits reversing so that the rack rail lip of the bracket can be either flush with the bottom or the top of the chassis. Rack cabinets, if used, should have their panel-mounting tapped rails on the *inside* side walls,

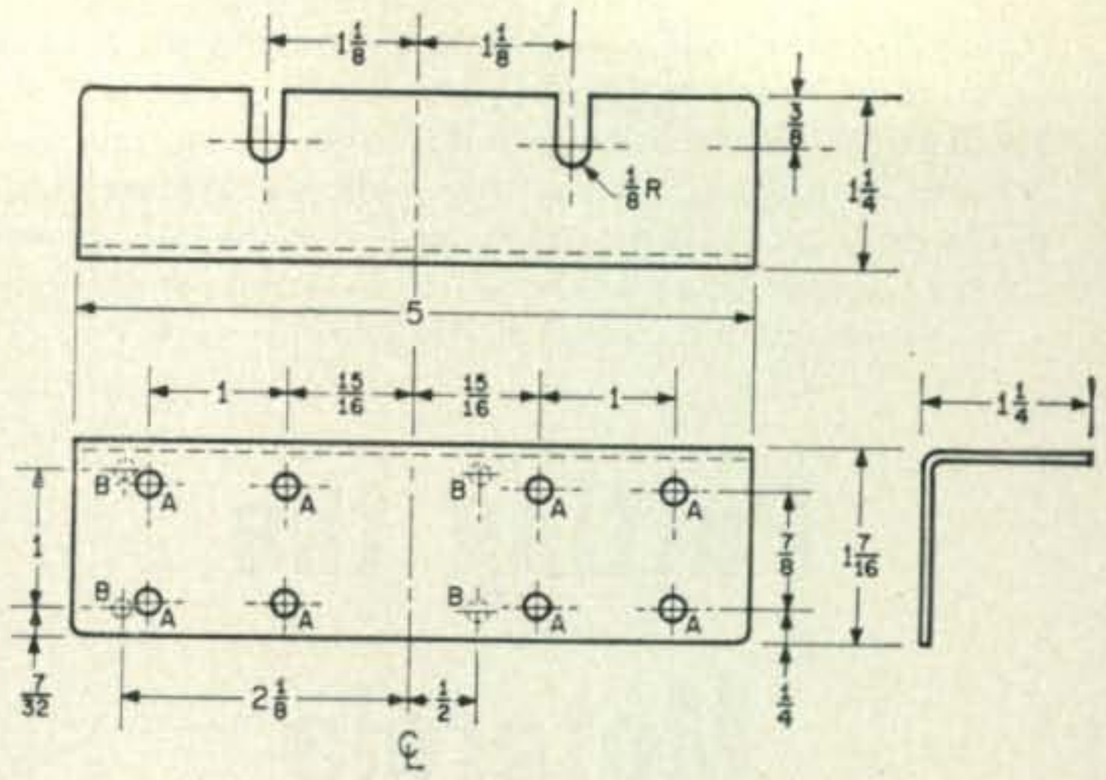


Fig. 1—End bracket mechanical details for mounting the Motorola FMTRU-80D chassis. Holes marked A are 11/64". These are basic holes for the sensicon chassis. These marked B are additional 5/32" holes for the unichannel chassis. Brackets should be fabricated from #16 gauge steel or 1/16" aluminum.

like Western Electric terminal equipment cabinets, for example.

The d.c. power supply chassis most likely will have on it a dynamotor for the transmitter and a vibrator supply for the receiver. If it is desired to buiid an a.c. power supply from scratch this chassis can be used. It should be prepared by removing the dynamotor and the heavy contactor on the top. The Jones plug wired to the contactor can also be discarded. Do *not* disconnect the 18-pin Jones socket for the control cable, nor remove the transmit-receive relay under the square metal cover on the top of the chassis. After the dynamotor is removed it will be discovered that a semicircular bottom plate is underneath. This can be separated from the chassis itself by drilling out the spot welds with a 3/16" drill. Be *very* careful to move out of the way the cables underneath so that you don't drill into them. Remove and discard the power transformer, the vibrator socket and its retainer ring. The latter is probably soldered to the chassis, but comes off very fast with the aid of a sharp cold chisel. Don't be afraid to whack it. The filter capacitor and the filter choke should be left in place. Be careful not to damage them or the two wire-wound resistors underneath. (It is suggested that the two resistors be temporarily

[2]On 6 meters, channels have been set up on a 40 kc separation basis, with the primary calling (and working, where activity is low) channel 52.525 for phone and 52.60 for RTTY. Secondary channels should be within 300 kc on this band.

Table I—Receivers Used With The Model -80D

Receiver Type	*Chassis No.*	*Chan. Freq.*	*Htr. Volts*	*Filter Unit*	*2nd I.F. kc*	*1st I.F mc*	*I.F. Xtal kc*	*I.F. Xtal No.*	*Control Xtal No.*		*Control Xtal Freq. in kc*	
									Black	*Gold*	*146.94*	*146.70*
Sensicon	PA-8433	1	6	K8436	455	5.5	5955	A04	D01	RM16	28288	28240
Sensicon	PA-8438	1	12	K8436	455	5.5	5955	A04	D01	RM16	28288	28240
Sensicon	PA-8476	2	6	K8436	455	5.5	5955	A04	E01	ZM16	28288	28240
Unichan.	PA-9033	1	6	K9035	455	5.5	5955	A04	D07	R07	28288	28240
Unichan.	PA-9073	2	6	K9035	455	5.5	5955	A04	E03	Z03	28288	28240
Unichan.	PA-9033A	1	6	K9035A	457	8.0	8457	A07	D15	R15	27788	27740
Unichan.	PA-9073A	2	6	K9035A	457	8.0	8457	A07	E05	Z05	27788	27740
Unichan.	PA-9243	1	6	K9241	455	8.0	8457	A09	D21	R21	27788	27740
Unichan.	PA-9243-12V.	1	12	K9241	455	8.0	8457	A09	D21	R21	27788	27740

removed while preparing the power supply chassis.) If the chassis you have are dirty, greasy, and perhaps coated with carbon dynamotor brush dust, you should get as much off as possible with the aid of a rag and a small brush moistened with carbon tetrachloride (Carbona).

The Transmitter of the -80D

Look underneath for the chassis identification number stamped in black on one side. Most 6 volt single-frequency versions will be stamped *PA-8461*. A letter and perhaps a number following indicate a slightly different version. An early version of this transmitter had a microphone transformer (for a mobile-type carbon microphone) while most later models have a resistance network to provide button current. The majority of sets will have just one oscillator deck; however, there is space for two more such modules to permit two or three frequency operation. The oscillator is a 6AK6 and the crystal is of the fundamental type, subsequently multiplied 24 times. (See Addendum I for crystal calculation data.)

The final is a pair of 2E26 tubes with long-lines in the plate circuit. The driver-doubler is also a 2E26. Loctal base tubes are used in the other multiplier stages, and these in particular will be found to have a very long life. A 6AL5 is used, with a 12AX7 (or 12AT7), in a speech amplifier and clipper circuit, called *Instantaneous Deviation Control* (IDC for short). Some transmitters will be found to have been modified in the field to add a 3000-cycle cut-off low pass filter, too. The gain control is a screw-driver-adjust pot on the top of the chassis near the filter capacitor.

Modification of the -80D transmitter to permit operation in the 2 meter band consists merely of padding six coils and the p.a. grid circuit with mica or ceramic capacitors. We used 3.3 mmf, however 2 or even 5 mmf is satisfactory. (These were of the Erie "Ceramicon" type.) Slug-tuned coils, L_1 and L_2 in one can, and L_3 and L_4 in another can, have their terminals accessible underneath the chassis. The plate terminal on L_1 or L_3 is readily identified by the short wire to the plate pin (2) of the associated tube socket.

In like manner the grid terminal is identified by the wire going to the grid pin (6). The padding capacitors for these coils are then connected from each plate and grid terminal, respectively, to the chassis or ground terminal at each can. Coils L_5 and L_6 are also slug tuned but are in the open underneath the chassis. The padding capacitors for L_5 and L_6 are connected directly across each of these coils. Leads should be short. The long-lines grid circuit of the p.a. is padded by connecting the capacitor across the lines, near the grid pins (5) on the 2E26 tube sockets.

Voltages required by the -80D are: 400 volts at 200 ma for the final and doubler/driver stages, and 250 volts at 80 ma for the oscillator and multiplier stages. The filament drain, at 6.3 volts, is 4.95 amperes, less crystal oven current. If a black bakelite oven is used, it will add 0.8 amperes, and if the golden metal oven is used, about 1.25 amperes will be added. Non-oven crystals can be used if the set is located in a regular room of the house; however, if the set is located in an unheated remote shack, oven crystals should be used. It doesn't make much difference which oven is used, except that the crystal must be ordered for the particular type you plan to use. (See Addendum I and Table I) Figure 2(A) shows the connections to the power plug on the transmitter chassis. The mating female connector, on a short cable coming from the power supply chassis, is a Cinch-Jones type S-312-CCT.

The Receivers of the -80D

The -80D may be supplied with either of two general types of high band receivers, the "sensicon" or the "unichannel." The sensicon is constructed on a 5-inch wide chassis and is quickly identified by the silver plated pipes or coaxial cavities used as the front-end circuits. One version of the sensicon has 5 pipes and the other has 6 pipes. The 5-pipe job is the better as it has an extra r.f. amplifier stage. As with the transmitters, the particular receiver is identified by the chassis number stamped underneath, on one side. The unichannel receiver is constructed on a 3¼-inch chassis and, for the -80D, is provided with an adaptor chassis *K-9021* that widens and lengthens the assembly so that it is mechanically and electrically interchangeable with the sensicon chassis. No pipes are used; the front-end coils are in cans identical to the i.f. cans. Table I lists the most common -80D re-

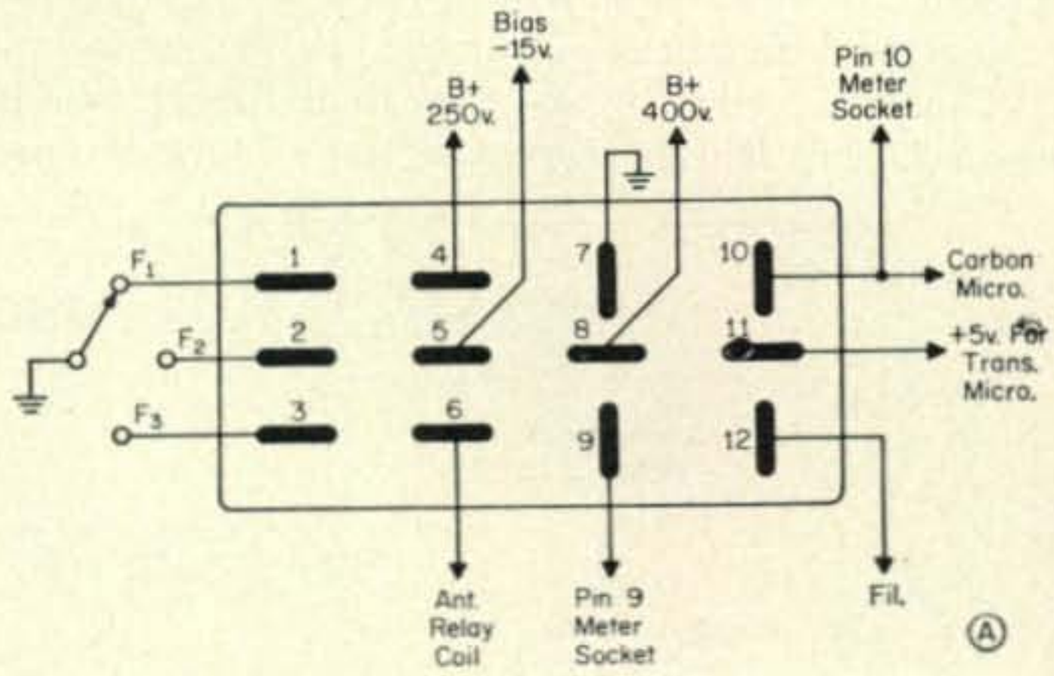


Fig. 2A—Transmitter power plug connections for the -80D. Note that pin #1 is grounded for single frequency operation. B—Receiver power plug connections. There are no connections to pins 9 and 10 in single frequency units. Also, the remote volume control is provided in a few particular versions only.

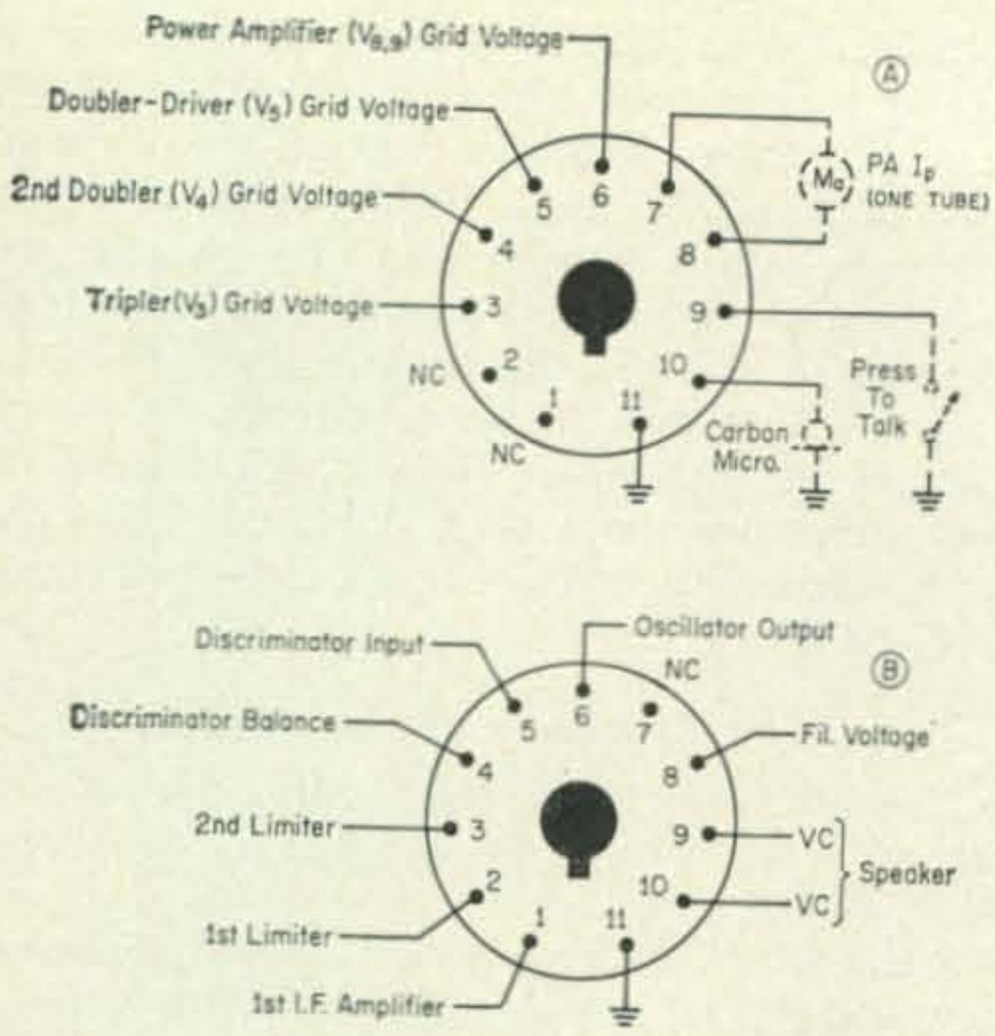


Fig. 3A—Transmitter metering socket. *Caution:* high voltage is present on pins 7 and 8. B—Receiver metering socket for the Model -80D.

ceivers by chassis number showing the i.f. frequencies and the 2nd conversion crystal frequencies. Corresponding crystal frequencies are also given for the 146.94 and 146.70 channels.

Modification of the -80D receivers depends upon which receiver you have. Since sets usually come without accessories such as control heads it is desirable to add a 10,000 ohm squelch control on the little subpanel that mounts the volume control on either receiver. (The hole is already there.) It connects between pin 3 on the power connector and chassis ground. On the sensicon, and on some versions of the unichannel, a 0.02 mf capacitor is used to bypass the a.f. power amplifier plate to ground. This should be changed to 0.01 mf, particularly if you are going to use the set on RTTY where the *space* tone is 2975 cycles.

The unichannel receiver front-end coils should be padded, like the transmitter, with 2 to 5 mmf ceramic capacitors. The oscillator multiplier coil *202* is padded in like manner. It should be noted that the antenna coil padder connects between the hot end of the coil and the antenna connector—not to ground. The sensicon receiver front-end pipes will reach 146 mc without padding, but the screws will be either partly out or out so far that the dust caps will not go on. If this disturbs you, each pipe can be padded with 2 to 3.3 mmf.

Figure 2(B) shows the connections to the chassis-mounted 11-prong power plug. The mating female connector, on a short cable coming from the power supply chassis, is an Amphenol 86-PF11. Note that the plate voltage supplied to the sensicon receiver should be 180 volts while for the unichannel receiver it should be 200 volts. Total plate current drain is in the order of 65 ma for the sensicon and 60 ma for the unichannel, at the above voltages.

Metering

Both the transmitter and the receiver of the -80D were designed to permit metering from a test set, the *P-8501*, which can be plugged into an 11 pin metering socket provided in both units. Basically, the test set is a 50 microampere meter, with a series resistor, that connects between each test point and the chassis; *except*, in the case of the transmitter it connects across a 10 ohm resistor in the plate circuit of the final via pins 7 and 8. *Caution!* High voltage is present on these

Table II—Typical Meter Readings On The Model -80D

Receiver Circuits	*Test Set*	*Sock. Pin*	*Ant. Input*	*Approx. Range Microamperes*
2nd I.F. Grid	1	1	Noise	2-5
1st Limiter Grid	2	2	Noise	15-30
2nd Limiter Grid	3	3	Noise	30-50
Discriminator Balance	±4	4	Noise	0-±2
Discriminator Input	5	5	Noise	15-25
Oscillator Output	6	6	Noise	15-30
2nd I.F. Grid	1	1	0.5-0.8 μv*	5-10

*for 20 db of quieting, db meter on speaker leads.

Transmitter Circuit	*Test Set*	*Sock. Pin*	*Microamperes*
7C5 Tripler (V_3) Grid	3	3	20
7C5 2nd Doubler (V_4) Grid	—4	4	20
2E26 Doubler-Driver (V_5) Grid	5	5	20
2E26 Power Amplifier (V_8, V_9) Grid	6	6	25 min.
2E26 Power Amplifier (V_8, V_9) Plate	PA	7-8	40 max.*
Fil. voltage, transmitter unkeyed	8	9	—

*80 ma max., with 0-100 ma meter connected between pins 7 and 8; instead of test set in socket.

pins and your meter will be damaged if you forget that you have one side of the meter connected to the chassis. The safest, and most convenient, thing to do is to build yourself a test set.[3] Figure 3(A) shows the metering socket connections for the transmitter and Figure 3(B) shows the connections for the receiver. It is nice to know that no matter which particular version you have, the metering as well as the power connections will be the same. Table II shows typical readings, in terms of microamperes, that you can expect.

Diagrams, etc.

We just don't have enough space in *CQ* to be able to give you the complete schematic of either the transmitter or the receiver of the -80D. Some dealers[4] in this kind of surplus can supply a reprint of certain versions. If you can't get a schematic in this manner, we suggest you obtain (for $1.75) a copy of the publication, *Wide-band FM for the Amateur*, by Jim Aagaard K90JV and John DuBois K9YHQ. Only a few versions are given, but even this should be of great help because of the similarity in circuitry between versions.

Part II of this article, to follow in a subsequent issue, will detail the construction of an a.c. power supply to power both the transmitter and the receiver of the -80D, and will give step-by-step instructions for the tune-up of both units.

Addendum I

Transmitter crystals for the -80D should be of the fundamental type and are 1/24th of the operating frequency. The frequency trimmer capacitor provided on the *P-8465* oscillator deck permits moving the center frequency about plus and minus 10 kc on 2 meters; however, unless the correct crystal is ordered you still will not be able to put the transmitter on frequency. This means that it is a good idea to order commercial

[3]Kretzman, B. H., A Test Set for FM, *CQ*, November 1963, p. 74.
[4]FM Surplus Company, 1100 Tremont Street, Roxbury 20, Mass.

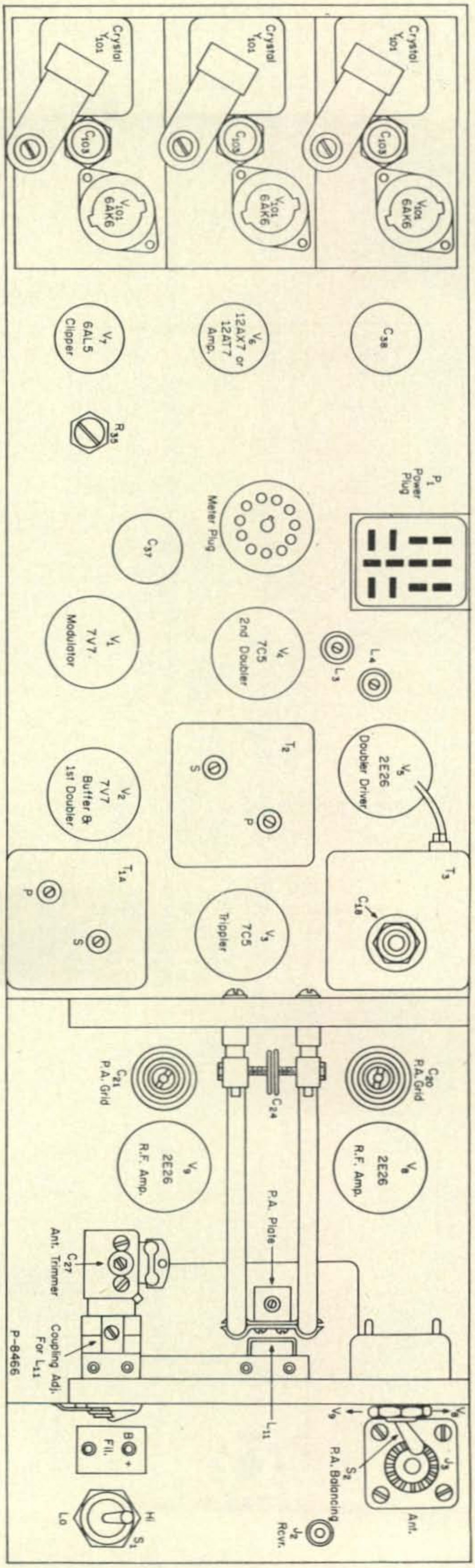


Fig. 4—Chassis layout of the transmitter section of the Motorola FMTRU-80D.

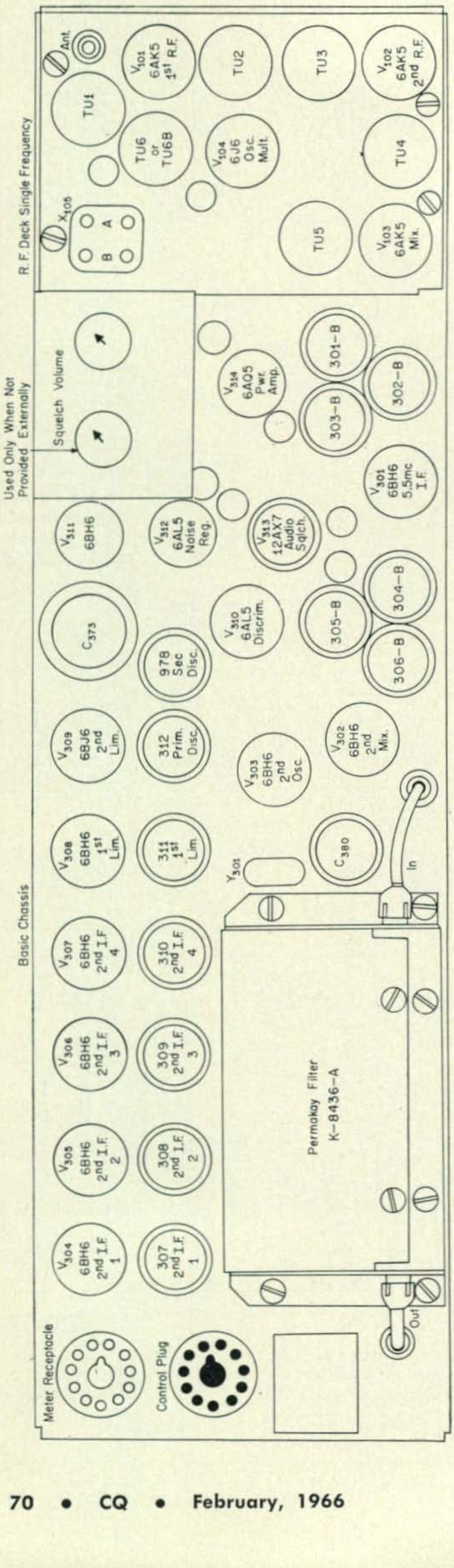


Fig. 5—Chassis layout of the Sensicon receiver of the Motorola FMTRU-80D.

grade crystals from a reliable supplier.[5] Admittedly, this is costly, but it is the sure way. In adidtion to giving the crystal frequency when ordering, you stipulate oven or non-oven operation. If oven operation is desired, specify the Motorola crystal number (from Table I). It is also a good idea to supply the transmitter chassis number.

If you order an ordinary "amateur" crystal, such as the International Type FA-9, you will *not* be able to get on frequency. Now, if you can operate without an oven you can finagle on-channel operation with an FA-9 crystal by padding, from the screen-grid side of the crystal to *ground*, with a 25 or 30 mmf mica or ceramic capacitor. It is recommended, though, that you order the commercial grade crystal correlated to the oscillator of the -80D.

Receiver crystals for the -80D should be of the 3rd mode type and are ⅓ of the 1st oscillator injection frequency, which is on the low side of the incoming signal. A slug-tuned coil in the crystal circuit permits swinging the injection frequency roughly plus and minus 5 kc to permit adjusting the receiver exactly to the channel center. As with the transmitter, it is recommended that commercial grade crystals be ordered. If oven operation is desired, give the Motorola crystal number (from Table I), and also give the receiver chassis number.

If you order an ordinary "amateur" crystal, such as the FA-9 type previously mentioned, you might be able to get almost on frequency. As you move the oscillator trimmer slug to approach the frequency, the oscillator output will fall off considerably, causing the receiver to lose sensitivity. As before, if you don't need oven control, you can finagle operation with an F-9 crystal. Just order the crystal 1 kc *lower* than calculated. Again, following this procedure is at your own risk, and the recommendation is to order the correct commercial crystal.

[*To be continued*]

[5]American Crystal Company, PO Box 2366, Kansas City 6, Missouri; International Crystal Mfg. Co., 18 N. Lee, Oklahoma City, Oklahoma.

Last year the International Telecommunication Union celebrated its 100th birthday. To mark the occasion, the Editor of the Telecommunication Journal, *the official publication of the ITU, invited leading telecommunication officials throughout the world to write a series of articles on "Telecommunications, Yesterday, Today and Tomorrow." George Jacobs, W3ASK, was invited to write about the Amateur Radio Service. The following is a reprint of the original article as it appeared in the July 1965 issue of the* Journal.

Amateur Radio

BY GEORGE JACOBS,* W3ASK

WITH twenty years of professional experience in telecommunications, mainly with the broadcast service, one might question why I am writing a Centenary Year article on the subject of "amateur" radio.

The word "amateur" is often associated with the words as "beginner," "non-professional," or "unskillful." In the case of amateur radio, such interpretations are unfortunate, since they are far from the truth. The very nature of amateur radio is such that right from the beginning it has not only kept pace with the development of other radio services, but it has often been well in the vanguard. Actually, "amateur," in the radio sense, simply denotes lack of pecuniary interest, but not a lack of technical competence. The great contributions of amateur radio to technology and humanity are well established.

Amateur radio has been a part of me for almost as long as I can remember. I have been licensed since 1941 and presently hold the call sign W3ASK. I credit amateur radio for first introducing me to the wonders of radio communication and for kindling my enthusiasm to pursue this field professionally. Through the years amateur radio has brought me friendships throughout the world, friendships that vault political, social and economic barriers, and are as fraternal, warm and sincere as any I have made in my lifetime. Amateur radio is not only a radio service, but it is also a spirit, indeed, almost a way of life. I am indeed grateful for this opportunity to write briefly about it.

The Radio Regulations, Geneva, 1959, define the amateur service as follows:

"A service of self-training, intercommunication and technical investigations carried on by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest."

How did amateur radio begin? In the latter years of the 19th century there already existed a keen interest in a new marvel—electricity. Amateur experimenters, mainly in Europe and North America, were making small electromagnets, motors, dry calls, static machines, erecting neighborhood telegraph lines and building numerous other experimental electrical devices.

George Jacobs, W3ASK, CQ's Radio Propagation and Space Communications Editor, shown at his own station in Silver Spring, Maryland. George's main interest is in handling emergency overseas traffic, and you can find him doing this just about every morning, or weekend afternoons on 15 or 20 meters.

It was not until the very end of 1901, however, that an event took place that fired the imagination of these experimenters still further—Marconi's bridging of the Atlantic with radio signals. The press of the world was filled with jubilation, disbelief and triumph at this accomplishment. "Wireless" was on everyone's tongue. Large numbers of amateur electrical experimenters turned away from their electromagnets, motors and dry calls and began to explore the realm of radio communications. Amateur radio was born!

During the first decade of this century, amateur experimentation with radio was a difficult task, since technical and constructional material were scarce. A typical amateur station of those days consisted of an induction coil, a condenser and a spark gap for transmitting and a simple coherer-decoherer or galena crystal, and a single head telephone for receiving. It was not unusual for early radio amateurs to communicate with each other using such equipment, over distances of 80 to 160 kilometers.

International regulations were non-existent at the time, since there was no radio law. Everyone had an equal right to the air, and during the first decade of this century the number of

[*Continued on page 97*]

*11307 Clara St., Silver Spring, Md.

DX

BY URB LE JEUNE,* W2DEC

Here and There

CEØ Easter Island: CEØAC on 14065 at 0300 GMT. *(Tnx LIDXA).*

CR7 Mozambique: Ken, K3HQJ, relays the following: "I have not received any logs from CR7IZ since December, 1964; therefore, I regret that I must return all QSL cards as I have decided I am no longer his QSL manager. Try QSLing direct to: Rutilio F. Graca, C. P. 95, Porto Amelia, Mozambique, Africa."

EA9 Spanish Morocco: EA9AZ can be found daily on 21360 at 1630 GMT for a sked with KP4CL or on 14260 if 15 is out. *(Tnx LIDXA).*

FR7 Reunion Island: FR7ZD on 14235 at 1800 GMT. *(Tnx LIDXA).*

FS7 Saint-Martin: The following letter is from Reg, FS7RT. "Since about August 22-24, 1965, some character operating on 20 meter c.w. using my FS7RT call and also a FS7RF call. This operator even told many stations that W2CTN was 'his QSL Manager'. Jack, W2CTN, advises he knows nothing of this.

"Although I cannot prove that the alleged FS7RF was not on French Saint-Martin, as far as I can determine he was not and it is positive that the call letters FS7RF have not been assigned by the French Government. The fact of the 'phony' information of W2CTN being his QSL Manager would further prove FS7RF was indeed a bootlegger.

"As to his use of FS7RT, I can advise that this station has not been operated by me or anyone else since March, 1963. Although my authorization to operate from the French Foreign Minister is still perfectly valid, the local Posts and Telegraphs Inspector asked me not to continue until reciprocity was established between France and America. When in effect, I can resume operation. Actually, this request not to operate has not meant much since I have been on Saint-Martin very little in the last two years as travels have taken me on extensive trips to South America and other places.

"This character is a pain-in-the-neck to those who thought they had a rare new country. Also, it has cost me a considerable sum in QSLs sent to Saint-Martin and forwarded back airmail here. Forwarding postage has to be paid by me on any forwardings. Such bootleg operation could cause me much trouble with the authorities when my call is used. I have taken the trouble to reply to each and every QSL sender advising of the above—that it was not FS7RT and most likely not FS7RF, at least on Saint-Martin."

FU8 New Hebrides: FU8AG on 14026 at 0900 GMT. *(Tnx K9CAA).*

KG6I Marcus: Floyd, KG6IF, on 14243 at 0000 GMT. *(Tnx LIDXA).*

LZ Bulgaria: LZ1BZ daily between 1300 and 1500 GMT on 14225 kc. *(Tnx WGDXC).*

MP4B Bahrain Island: MP4BCC, Bob, is often heard around 14240 kc s.s.b. from 1330 GMT and receives his QSLs c/o State Police Headquarters, Bahrain, Persian Gulf.

TN8 Congo Republic: TN8AF on 21060 kc c.w. at 1900 GMT. *(Tnx LIDXA).*

TT8 Chad: TT8BS on 21050 kc at 1630 GMT. *(Tnx NCDXC).*

TY3 Dahomey Republic: Jack, TY3ATB, on 21400 kc at 1300 GMT. *(Tnx LIDXA).*

UA1 Franz-Josef Land: UA1KED is now active on s.s.b. with a 500 watt p.e.p. rig and a beam. Xtal frequencies are 14121, 14127, 14133 and 14203. *(Tnx DX-MB).*

VK9 Papua: Jim, VK9PL, is active on 15 and 20 meters, mostly weekends. Best times are 1100 to 1300 GMT on 20 (14130-135) and 2100 to 0200 GMT on 15 (21380-90). *(Tnx LIDXA).*

VKØ Macquarie Island: Trevor, VKØTO is active on 14230 a.m. around 0700 GMT several times a week. *(Tnx VERON).*

VQ8 Mauritius: "I am licensed since the 15th of November. Am very active on phone and c.w. 14 mc. I use a Viking Ranger I Transmitter and the receivers are a Marconi CR-150 and a Heathkit RA-1. The antenna, a home-made ground plane. I especially look for the USA on c.w. every evening around 1600 GMT on 14,040-14,060." Thanks to Jean, VQ8BJ, for the above letter.

VR2 Fiji Islands: Warren, VR2CC, on 14242 at 2200 GMT. *(Tnx LIDXA).*

VU2 Laccadives: VU2AK reports, via the PR DXer, that he and Raju, VU2NR, may try this spot again in the near future now that transportation facilities have been improved.

YK1 Syria: Bohous, ex-YK1AT, is now in Czechoslovakia and offers to fill in any missing QSLs. Send them via OK2QR at the address shown in the QTH section. Rasheed, YK1AA, continues quite active around 14235/45 from

*Box 35, Hazlet, New Jersey 07730.

SSB HONOR ROLL

TI2HP	305	W3MAC	282	G2BVN	264	W3VSU	235
WØQVZ	305	W1LLF	282	G3DO	260	OZ7FG	234
K4TJL	305	W6UOU	282	W4RLS	260	W4HUE	231
W2TP	305	W3KT	282	W6WNE	260	W3DJZ	231
W2BXA	304	I1AMU	282	PJ2AA	258	W2PTM	231
G3AWZ	303	W2RGV	279	KP4CL	256	WA2EOQ	229
W2ZX	302	K4HYL	277	K6CYG	252	W6ZJY	228
5Z4ERR	301	DL1IN	276	K6LGF	251	W3FWD	226
W8PQQ	300	HB9TL	276	W1AOL	250	K1SHN	224
G8KS	298	PZ1AX	275	W4OM	249	K2JFV	223
K2MGE	297	W4SSU	274	W4PAA	249	K4JEY	221
W3NKM	296	W6RKP	274	W4NJF	248	W2MJ	215
W2FXN	294	K9EAB	274	GM3JDR	247	SM5UF	209
W4OPM	291	W2LV	271	XE1AE	247	WØQLX	206
W2VCZ	291	G3NUG	270	W7CMO	246	W5KC	206
K1IXG	289	K8ONV	270	YV5AFF	240	W6USG	204
K8RTW	288	G2PL	266	W7DLR	239	KØUKN	202
WA2IZS	288	W6YMV	265	K1JMV	236	ZS6YQ	202
						G3HDA	200

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

CW WAZ

2122	W2FXE	William Tucker
2123	W6BCT	Stanley Wernick
2124	W6TYM	Donald McDougall
2125	WA6VAT	Robert Suerstedt

ALL-PHONE WAZ

318	W2FXE	William Tucker
319	K4JEY	Johnny Wood
320	PY3AHJ	Dr. Thelmo E. Snel
321	W6KUT	E. A. Andress
322	WA6KNE	John W. Renshaw

TWO-WAY SSB WAZ

353	W2FXE	William Tucker
354	WØAIH	Rev. Paul E. Bittner
355	SM5ANH	Lars Norell
356	K4JEY	Johnny Wood
357	PY3AHJ	Dr. Thelmo E. Snel
358	JA1ADN	Noboru Ihara
359	W6KUT	E. A. Andress
360	W8IRN	R. F. Johnston
361	JA2ADH	Hideo Wantanabe
362	WA6KNE	John W. Renshaw
363	DL8DX	Heinrich Gesing

CW WPX

693	YO3FF	Petre Cesar
694	DJ3CI	Walter Schilling
695	VE3BLU	Richard Matsumoto
696	ZL1QW	Alec G. Binnie
697	W4JO	Forrest D. Pilgrim
698	OK3HM	Jozo Horsky

PHONE WPX

125	UB5UN	Serge G. Bunimovich

SSB WPX

221	ZL3NS	T. Ositis
222	PAØGMU	W. Mulder
223	W5QKZ	A. M. Sprague
224	F9MS	Claude Ronsiaux
225	WA9AVV	Julian Horstman
226	DJ8OT	Eberhard Warnecke

MIXED WPX

114	W1BFA	Ernest L. Bracy
115	K6KII	Clifford G. Moore
116	K4RZK	John F. Berryman

200 TWO-WAY SSB

130	K9PPX	Scott Millick

100 TWO-WAY SSB

480	F3II	Paul LeBlan

1230 GMT. He QSLs direct upon receipt of SAE and IRCs. *(Tnx WGDXC).*

ZC4 Cyprus: ZC4's AK, BY, GT, MO, PC, TJ, and TX are all RAF Club Stations active periodically and all receiving QSLs via Box 216, Faragusta, Cyprus or via RSGB. *(Tnx WGDXC).*

ZD3 Gambia: VP3CW has taken a job with the United Nations in Gambia. Shortly he will be operating on s.s.b. from there using ZD3C. *(Tnx VERON).*

ZD5 Swaziland: Archie, ZD5R, on 14118 at 1800 GMT. *(Tnx LIDXA).*

ZD7 Saint Helena: ZD7RH, has been reported active on 14016 kc c.w. around 2300 GMT. *(Tnx WGDXC).*

ZL Campbell Island: Peter, ZL4CH, is the replacement for ZL4JF, Kip, on Campbell Island. *(Tnx LIDXA).*

S7 Ceylon: Ian, 4S7IW, 14220 kc at 1200 GMT. *(Tnx LIDXA).*

5T5 Mauritania: Alban, 5T5AD, on 21155 at 1600 GMT. *(Tnx LIDXA).*

QTHs and QSL Managers

DU	QSL Bureau, Box 4083, Manila, Philippines.
DU1OR	via W2CTN.
EA4URE	Box 220, Madrid, Spain.
FU8AG	Box 104, Santos, New Hebrides.
GB2USA	via G3UKI.
HV1CN	(Contest QSOs) via K9BPO.
LA5CI/P	via LA1NG.
M1N	via W6JFJ.
OD5EG	Box 4848, Beirut, Lebanon.
PJ5BC	via KØGZN.
PY7ACQ	Box 842, Recife, Pe, Brazil.
ex-SVØWBB	now WA8IMC/5 Route #1, Box 115A, New Boston, Texas.
TZ5H	via Hammarlund.
VE1AED/SU	via Base Post Office 5049, Beirut, Lebanon.
VP2AA	via VE3ACD.
VP2GTA	via W2CQA.
VP5BB	via W4RC.
VQ8BFA	via G8KS.
VQ8BJ	Jean Lagesse, Cere Street, Curepipe Road, Mauritius.
XF5L	via W2SAW.
XTØH	via Hammarlund.
YA1AW	via K5GOT.
ex-YK1AT	via OK2QR, Rudolf Staigl, Napajedla, Czechoslovakia.
ZB2AK	c/o Cable Company, Gibraltar.
ZD7RH	via G2IO.
ZS8G	Box 379, Maseru, Basutoland.
5T5H	via W2GHK, POB 7388, General Post Office, N.Y., N.Y. 10001.
5U7H	via Hammarlund.
5VZ8CM	s.s.b. via W1YDO, c.w. via Hammarlund, GPO, Box 7388, N.Y., N.Y. 10001.
7Q7BN	Box 51, Blantyre, Malawi.
7X2SX	M. Yacoubi, Lot. Is. Serrier, Birmandreis, Algiers, Algeria.
9H1R	via W2CTN.
9J2AB	via W6BAF, 301 E. Buffington St., Upland, Calif.

73, Urb, W2DEC

"Yeah, Hal, and next payday I'll get one for your time zone."

HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV

OF the many letters we receive from HAM CLINIC readers, a very large number are devoted to questions relative to transistors and transistor circuitry. You can bet that some of the requests for information are "way out" and these we usually cannot answer (even with the help of a "high powered" transistor engineer), for *some* hams expect too much of the present state-of-the-art.

There are few tasks that a transistor cannot now do better than a vacuum tube. Progress in transistor design has been so rapid during the last 3 years that we predict some startling breakthroughs during the next 2 years.

As we predicted some years ago, transistors would be used more and more in r.f. applications and the day would come (it has) when one could buy a complete transceiver 98% transistorized that could be carried with one hand by a 9 year old boy.

As time marches on, we will be using more new transistors for ham radio work than ever before. If you are a home-constructor you can look forward to many pleasant hours at your ham-lab workbench experimenting with some mighty exotic semi-conductors.

Using Field Effect Transistors

When field effect transistors (FET's) were mentioned briefly in the April 1965 HAM CLINIC column, we received a great number of letters pleading with us for more practical information. Unfortunately, our requests to then-known manufacturers for experimental samples were either refused or we received no answers at all. Although our files were full of articles (from 1956 on) on FET design and applications, they contained little information in which the ham would be interested, for the technical level was a bit too high.

Now that usable information is becoming available to hams, there is a lot of interest in the FET.

Why the FET?

The FET is a transistor that acts like a pentode vacuum tube and can be used to increase circuit impedance and Q, increase current sensitivity and reduce the requirement for a large number of circuit components with equal or improved performance. Further, its input impedance is much higher than the usual bipolar transistor, and it has a much lower noise factor.

The elements of the FET are now labeled *G*ate, *D*rain and *S*ource instead of emitter, collector and base, or grid, cathode and anode as in earlier models.

As we know, vacuum tubes are designed around the voltage node and bipolar transistors are designed around the current node. Well, with FET's you go back to designing around the voltage node.

FET's can be of the MOS or junction types and each has its advantages and disadvantages as well as specific applications.

The FET can now be obtained with tetrode structures having dual gate control, these are dandy for a.g.c. circuitry.

FET Circuits from Siliconix

Thanks to Siliconix Inc., 1140 West Evelyn Ave., Sunnyvale, California, makers of the unipolar FET's (UNIFET's) we present here a few circuits that are of interest to the ham experimenter.

Fig. 1 shows a practical a.g.c. circuit that has a range of 60db. It can be used in transistorized receivers or even to control some types of vacuum tubes used as r.f. or i.f. amplifiers.

An amplifier for a crystal mike is shown in fig. 2. This amplifier has a maximum output r.m.s. voltage of 6, has an input impedance of 22 megohms and an output of about 30k ohms. Its frequency response is from 10 cps to 90 kc ± 1 db.

An oscillator designed for 160 mc but which can be modified easily for -44 mc operation is shown in fig. 3. The circuit uses the Siliconix U89 tetrode FET.

KMC r.f. Amplifier with IGFET

Thanks to KMC Semiconductor Corp. Parker Road RD 2, Long Valley, N. J., we have the circuit of a 200 mc r.f. amplifier using their insulated gate field effect transistor (IGFET). It is shown in fig. 4.

By changing the circuit values it could be made to operate at 144 mc. Maximum available gain with this circuit is around 13 db, this being achieved with a gm (amplification factor) of 5000, as compared to the gm of 9500 for the 6CS4 nuvistor, with a gain of 18 db; or a gm of 47000 for the u.h.f. transistor (2N2857) and

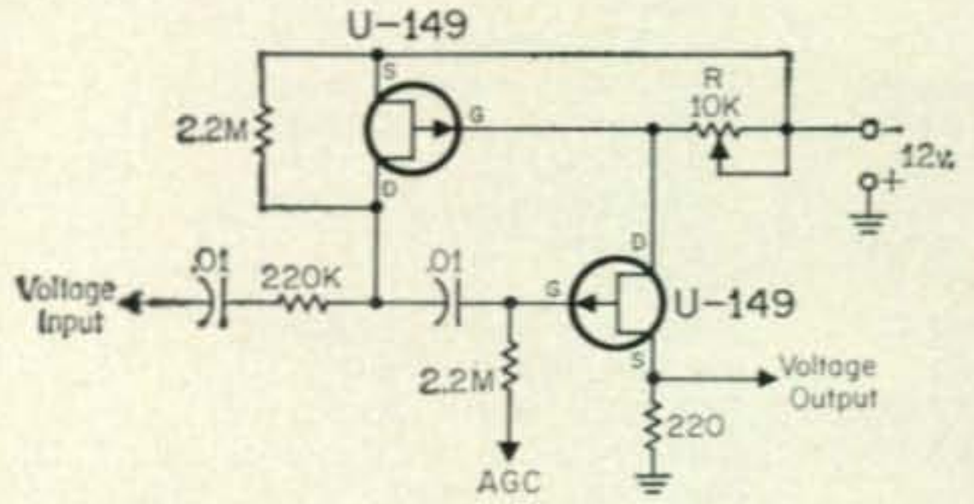


Fig. 1—A practical a.g.c. circuit having a range of 60 db. By adjusting control *R* to the minimum value, maximum output voltage is produced when the a.g.c. voltage is zero.

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

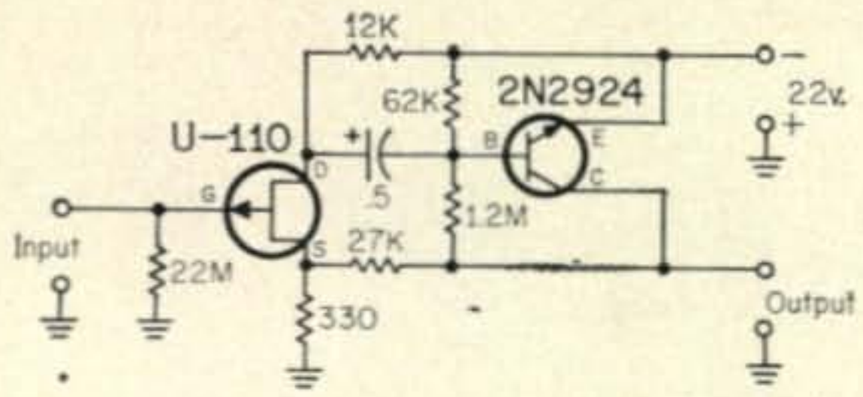


Fig. 2—A crystal mike amplifier using an FET to obtain a high input impedance. This may be increased to 1000 megohms by bootstrapping Gate to Source.

its gain of 22 db. The noise factor for the IGFET is 3 compared to 4.2 for the 6CW4 and 3 for the 2N2857.

Some General Considerations

In designing circuits using FET's it is important to keep in mind that you are dealing with a high impedance device. When used as amplifiers, careful shielding of input and output circuits to prevent oscillation should be considered.

Low loss components should be used for v.h.f. and u.h.f. work as with vacuum tubes.

The IGFET can be used in front-end r.f. amplifier design of receivers to get away from much of the cross modulation experienced with ordinary transistors. In fact, if the proper FET's are chosen for the r.f. and i.f. stages of a receiver it is possible with proper FET a.g.c. circuitry to lessen the effects of strong signal overloading, which of course now necessitates the constant use of r.f. and a.f. gain controls in the *ordinary* diode derived a.g.c. circuit scheme.

The FET may of course be biased either positively or negatively, but it is wise to observe the manufacturer's recommendations relative to power dissipation and not to exceed the recommended gate to source and gate to drain voltage ratings.

For those who have asked how the gm (Y_{21}) of an IGFET can be checked without expensive laboratory instruments, a circuit for the purpose is shown in fig. 5. An r.f. voltmeter is used to measure voltages at points V_A and V_B and the gm is obtained by using the formula: $gm = \frac{V_B}{50\ V_A}$.

(Circuit courtesy of KMC Semiconductor Corp.) Note that the IGFET has a sub-strate connection (SS).

Because circuits using FET's can essentially be handled as are vacuum tube circuits they are easy to work with.

If you obtain a few FET's or IGFET's and come up with some circuits of interest to hams, send them to us for publication. The FET and IGFET transistors in my estimation, have a great future.

QUESTIONS

Tape Recorders and r.f.—"I acquired a well-known transistorized tape recorder which does about everything I want it to except record my on-the-air transmissions. When I play back a transmission it sounds like a feed-back signal has been introduced into the recorder and the speech is barely intelligible. The input cable to the recorder is shielded and I have connected it in parallel with the mike input connection of my transceiver. What do I do?"

I believe that some r.f. is getting back into the recorder as you transmit—especially if the recorder is housed in a plastic case. Before you do anything, try a 2½ mh r.f. choke in series with your recorder input cable and bypass the input end with a .001 mf ceramic capacitor. If this does not do the job, make an aluminum shield for the *whole* recorder out of aluminum foil and ground it to the transceiver. This may work. If not, try different lengths of shielded input cable to your recorder and make sure that the recorder is grounded as well as the shield that goes to the transmitter.

What could be happening is that your recorder is receiving two signals, one directly from your mike connected to the transmitter and another from *rectified* r.f. The rectified r.f. can come from any of the low-level stages of the recorder. If all else fails, try some small r.f. chokes in series with the emitters or collectors of the transistors in the recorder used as low-level amplifiers. If these do not work try the same in the final output stage of the recorder. I hope you are not trying to monitor your on-the-air recording using a headphone that no doubt comes with the recorder for the purpose. The unshielded cord could pick up r.f.

Hot Antenna Tower—"I have an antenna tower on which is mounted my 3 element beam (10, 15 and 20 meters). On 15 meters I can light a neon bulb at the base of the tower, on 10 and 20 there is no r.f. The tower is mounted in concrete blocks and bolted to these. What's happening?"

You could have an oxidized joint or joints in that tower somewhere thus insulating a portion of it that is "semi-resonant" at 15 meters. I think your trouble though is the ground. Install a good ground near the tower and ground the tower.

Speaker Cone Alignment—"I bought a well-known transceiver and after a few days the speech from the loudspeaker was scratchy, low in volume and distorted. I had the set checked at the shop without my power supply (which contains the speaker), and it checked out okeh. I brought the set home and it still is scratchy. Voltages and signal reports are good. The receiver works fine. What do I look for?"

Check the loudspeaker, bet the cone is not aligned. Suggest you take the whole supply back

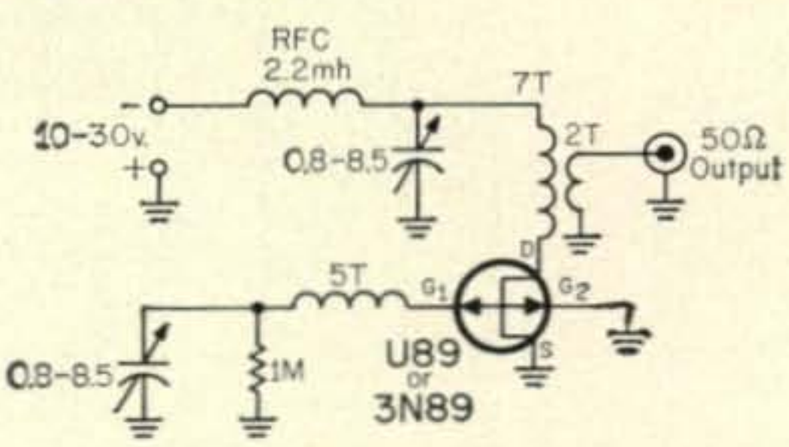


Fig. 3—An oscillator with a tetrode FET for 160 mc. Part values can be scaled down for 144 mc. All coils are ½" i.d., #18 bare copper, spaced 1:1. The U89 takes 20 v.d.c. and the 3N89 uses 30 v.d.c.

to your dealer and ask for another with a *good* speaker, or ask him to install another speaker. Modern day speakers used in such sets do not have an adjustable speaker spider for adjusting cone alignment.

Top Loaded Mobile Antenna—"I have heard that the top loaded mobile antenna is best. Is this true? Why?

If the antenna is mounted on the rear bumper (as it usually is), the top loaded mobile vertical is best because the r.f. is "placed" above the car body metal mass, better radiation takes place.

Sub-zero Transistor Operation—"We all know that excessive heat, ambient or otherwise, will affect transistor operation. But tell me, how about sub-zero temperatures?"

Extremely low temperatures do affect transistor operation, depending on the type used. The information I have indicates that silicon transistors are less likely to be affected than germanium.

Receiver i.f. Differences—"Why is it that most receivers have different i.f.'s? It seems to me that there is *one* best i.f. and all manufacturers should use it. Can you enlighten me?"

Your answer of course is that the overall design of most receivers is different. That is to say, that mixer oscillator schemes, band width desired, selectivity desired for various bands etc., all depend more or less on the i.f. chosen. I.f. gain must also be considered. Some receivers' mixing systems permit bc signal leak-through in some areas because the signals are so strong; the same sets in other areas are not bothered. The predominant i.f.s are of course 455 kc for bc operation and some other bands; 110 kc for long-wave work and 1600 kc or higher for sw work.

The lower the i.f. the more difficult it becomes to suppress image interference. A high i.f. cuts selectivity and gain. A very low i.f. results in increased selectivity but side-band splitting. The i.f. should not be close to or in the range of frequencies that are to be received. I.f.'s that are too high make tracking difficult between signal and oscillator circuits.

The number of stages of i.f. (and the frequencies used) must be a compromise between selectivity and gain desired and the cost—the latter being of much importance to the manufacturer catering to a mass market.

SX-115—"I own an SX-115 that has been giving

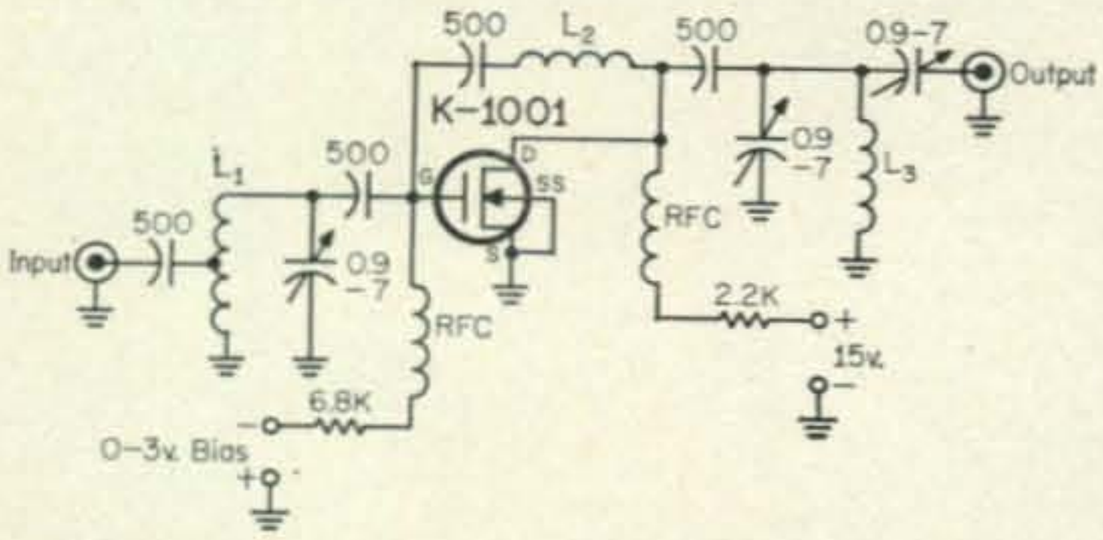


Fig. 4—A 200 mc IGFET amplifier using the KMC type K-1001 transistor. The noise figure is 3 db at 200 mc. L_1 and L_3 are 5 t. 20 b.c.w., ⅝" × ½". L_2 is a Miller 20A107RB1 or equiv. (0.125—0.079 μh).

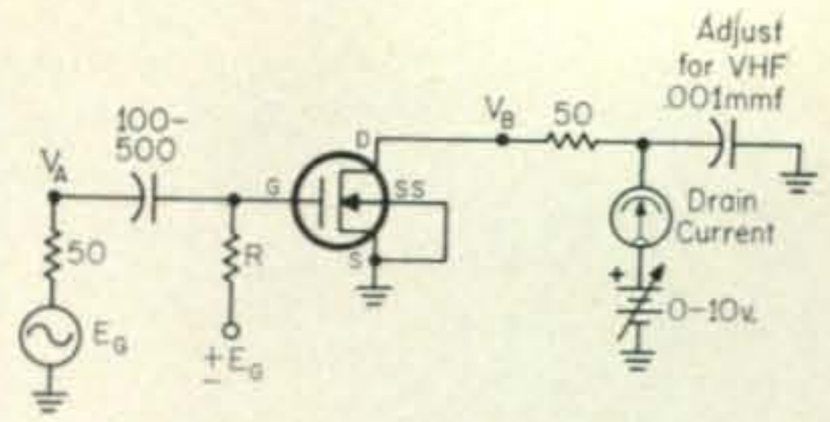


Fig. 5—A circuit for measuring gm (Y_{21}) of IGFET transistor. Adjust R for transistor (2-10K).

me good service. I recently moved and took the set with me. After connecting it up nothing came from the speaker, but I note that the S meter works. What could be wrong?"

Shorted or defective speaker or output transformer; shorted speaker output terminals; defective tubes V15, V16 or/and V17.

SP-600-VLF-31 Conversion—"Any way to convert a Hammarlund Sp-600-VLF-31 very low frequency receiver for use on the ham bands? What I am thinking about is a practical approach."

No, not practically. You could of course use out-board converters but this is mighty expensive.

Shawnee 6 Meter Transceiver r.f. Output Indicator—"I recently bought a third-hand Heath Shawnee transceiver through an ad in one of the magazines. The guy I bought it from told me that he had never been able to get the meter to indicate r.f. output and I'm stuck with the problem. I have no instruction book. What do I do? The set works fine otherwise."

First write Heath for an instruction book ($3.00). If you will look on page 130 of the book you'll find that if the meter does not indicate r.f. output the following *could* be the matter: diode reversed in r.f. "sniffer" circuit; PA switch incorrectly wired; antenna relay not wired correctly; keying circuit incorrectly wired; leads not connected at FT-14; AM-CW switch incorrectly wired and improper control setting. But these hints are for the guy who built the set. I'm inclined to think that the diode is bad (too much heat when soldered in) or installed improperly When installing any semi-conductor, *heat-sink* the leads.

Warrior Linear on 6 Meters—"I have heard that the Heath Warrior linear amplifier has been modified for use on 6 meters. Do you have any concrete information (step-by-step) on this? If not, what do you suggest?"

With some work the Warrior could be made to operate on 6 meters. This does not mean that one would merely remove turns from the final 10 meter coil, because for efficiency the ratio of tuning capacitance to inductance would have to be changed. Further, the r.f. chokes used in the amplifier are fine down to 10 meters but more than likely would not be efficient for 6 meter operation. Problems of instability may arise too with the 811's. The parasitic chokes in the plate circuits of the 811's must be changed.

[*Continued on page 100*]

Propagation

BY GEORGE JACOBS,* W3ASK

THE sunspot cycle is increasing slowly, and the 10 meter band is beginning to come to life again. Many good north-south openings took place during the late fall and early winter months, and some east-west openings from the United States to Europe and to the Far East have also been reported. Some 10 meter DX openings are forecast for February, especially on days when propagation conditions are above normal. Good 15 meter conditions to almost all areas of the world are expected during February. The band should open an hour or two after sunrise, and remain open through the late afternoon and early evening hours. Good world-wide DX openings are also predicted for 20 meters from shortly after dawn, through the early evening hours. To some areas of the world, 20 meters may remain open all night. When propagation conditions are normal, 20 meters should be the best band for world-wide DX during the hours of daylight. When conditions are above normal, 15 meters is likely to turn out to be the best DX band.

Forty meters is expected to be the best band for DX during the hours of darkness, with openings predicted to many areas of the world. Fairly good 80 meter openings are also predicted during the hours of darkness, and some 160 DX openings are also likely to occur to some areas of the world between sunset and sunrise. (The annual 160 meter DX Tests will be conducted on February 3 and 20 from Midnight to 2:30 a.m. EST. See December's PROPAGATION Column for more details.)

VHF Ionospheric Openings

An increase in the occurrence of auroral displays usually take place during February and the early spring months. During such displays there is a tendency for ionospheric disturbances, or radio storms, to take place. While DX conditions on the high frequency bands may become poor, or blackout entirely during such storms, unusual short-skip openings for distances up to approximately 1300 miles may be possible on 10, 6 and 2 meters. These openings occur by way of reflection from the ionization produced by the auroral display. Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are likely to be "disturbed" or "below normal" during February.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for February

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **1, 15, 21, 26, 28**	A	A-B	B-C	C
Normal: **2, 4-5, 8-9, 12-14, 18-20, 22, 25, 27**	A-B	B-C	C-D	D-E
Below Normal: **3, 7, 10, 16, 24**	C	C-D	D	E
Disturbed: **6, 11, 17, 23**	D	D-E	E	E

How To Use These Charts

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

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

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

3—With the forecast rating noted above, start with the numbers in 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 reception conditions (signal quality, noise and less than 4). The letter symbols (A-E) describe fading levels) expected for each day of the month and have the following meanings: A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's DX Propagation Charts are based upon a transmitter power of 250 watts c.w.; 500 watts s.s.b., or 1000 watts d.s.b. into a dipole antenna a quarter-wave above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

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

6—The Eastern USA chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9 and Ø areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid through March 31, 1965, and are prepared from basic propaganda data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

No significant meteor showers are expected during the month.

Sunspot Cycle

The Zurich Solar Observatory reports a monthly sunspot number of 15.5 for November, 1965. This results in a 12-month running smoothed sunspot number of 15 centered on May 1965. A smoothed sunspot number of 29 is predicted for February 1966, as the solar cycle continues to rise slowly.

This month's *Propagation Charts* contain predictions for major DX paths for February and March. A short-skip propagation forecast for February appeared in last month's column.

PROPAGATION

CQ DX Propagation Charts

FEBRUARY AND MARCH, 1966

Time Zone: EST (24-hour Time)

Eastern USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe & North Africa	10-12 (1)* 08-09 (1) 09-11 (2) 11-12 (3) 12-13 (2) 13-14 (1)	06-07 (1) 07-08 (3) 08-11 (2) 11-12 (3) 12-14 (4) 14-15 (3) 15-17 (2) 17-19 (1)	17-19 (1) 19-20 (2) 20-01 (3) 01-02 (2) 02-03 (1)	18-20 (1) 20-23 (3) 23-01 (2) 01-03 (1) 20-23 (1)† 23-01 (2)† 01-02 (1)†
European USSR & Eastern Europe	08-12 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-16 (1)	18-02 (1)	20-00 (1) 21-23 (1)†
Eastern Mediterranean	08-09 (1) 09-10 (2) 10-12 (1)	04-07 (1) 07-09 (2) 09-12 (1) 12-16 (2) 16-19 (1)	18-20 (1) 20-21 (2) 21-23 (1)	19-23 (1) 20-22 (1)†
East & West Africa	10-13 (1)* 07-10 (1) 10-12 (3) 12-14 (4) 14-16 (2) 16-17 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (2)	18-19 (1) 19-22 (2) 22-01 (1)	19-22 (1) 20-22 (1)†
Central & South Africa	10-13 (1)* 07-10 (1) 10-13 (2) 13-15 (3) 15-17 (2) 17-18 (1)	18-20 (1) 07-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-22 (1)	23-01 (1)	23-01 (1) 23-01 (1)†
Central Asia	07-09 (1)	06-07 (1) 07-09 (2) 09-11 (1) 20-23 (1)	05-07 (1) 18-21 (1)	*Nil*
Southeast	07-09 (1) 18-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 19-21 (1)	06-08 (1) 17-20 (1)	*Nil*
Far East	16-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-18 (1) 18-20 (2) 20-21 (1)	05-08 (1)	06-07 (1)
Pacific Islands & New Zealand	14-17 (1)* 12-17 (1) 17-19 (2) 19-21 (1)	07-09 (2) 09-20 (1) 20-23 (2) 23-07 (1)	00-02 (1) 02-06 (3) 06-07 (2) 07-08 (1)	02-03 (1) 03-05 (2) 05-07 (1) 02-06 (1)†
Australasia	12-17 (1) 17-19 (2) 19-21 (1)	06-07 (1) 07-09 (2) 09-15 (1) 20-23 (1)	03-05 (1) 05-07 (2) 07-09 (1)	04-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)†
North & Central South America	11-14 (1)* 14-16 (2)* 16-17 (1)* 07-08 (1) 08-09 (2) 09-11 (4) 11-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	00-06 (1) 06-07 (2) 07-10 (3) 10-15 (2) 15-17 (3) 17-19 (4) 19-22 (3) 22-00 (2)	18-19 (1) 19-20 (2) 20-03 (3) 03-05 (2) 05-07 (1)	19-21 (1) 21-02 (2) 02-06 (1) 00-04 (1)†
Southern Brazil, Argentina, Chile & Uruguay	13-14 (1)* 14-15 (2)* 15-16 (1)* 07-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-10 (2) 10-14 (1) 14-16 (2) 16-18 (3) 18-20 (4) 20-22 (2) 22-03 (1)	19-21 (1) 21-03 (2) 03-07 (1)	21-06 (1) 01-04 (1)†
McMurdo Sound, Antarctica	15-17 (1) 17-19 (2) 19-21 (1)	17-19 (1) 19-22 (2) 22-00 (1) 06-07 (1) 07-09 (2) (1) 01-60	23-05 (1)	*Nil*

*Predicted 10 meter openings, all others in column are 15 meter openings.
†Predicted 160 meter openings, all others in column are 80 meter openings.

Time Zones: CST and MST (24-hour Time)

Central USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe & North Africa	09-11 (1)* 08-10 (1) 10-13 (2) 13-14 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-18 (1)	17-19 (1) 19-22 (2) 22-02 (1)	19-20 (1) 20-22 (2) 22-00 (1) 20-00 (1)†
Eastern Europe & European USSR	08-12 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-13 (2) 13-15 (1)	19-01 (1)	20-23 (1)
Eastern Mediterranean	09-12 (1)	07-12 (1) 12-14 (2) 14-17 (1)	19-23 (1)	20-22 (1)
East & West Africa	10-12 (1)* 07-09 (1) 09-11 (2) 11-13 (3) 13-15 (2) 15-16 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-13 (2) 13-16 (2) 16-18 (2) 18-19 (1)	18-19 (1) 19-21 (2) 21-00 (1)	19-22 (1) 20-22 (1)†
Central & South Africa	09-12 (1)* 08-10 (1) 10-12 (2) 12-14 (3) 14-16 (2) 16-18 (1)	07-14 (1) 14-15 (2) 15-16 (3) 16-18 (2) 18-20 (1)	20-23 (1)	21-23 (1) 21-23 (1)†
Central Asia	07-10 (1) 18-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 19-21 (1)	06-08 (1) 19-21 (1)	*Nil*
Southeast	10-14 (1) 17-20 (1)	06-07 (1) 07-09 (2) 09-12 (1) 19-21 (1)	06-08 (1) 17-19 (1)	*Nil*
Far East	16-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-21 (2) 21-23 (1)	02-05 (1) 05-07 (2) 07-09 (1)	05-07 (1)
Guam & Pacific Islands	14-17 (1)* 11-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-21 (1)	07-09 (2) 09-18 (1) 18-20 (2) 20-22 (3) 22-00 (2) 00-07 (1)	22-01 (1) 01-06 (3) 06-07 (2) 07-09 (1)	00-03 (1) 03-06 (2) 06-07 (1) 03-07 (1)†
Australasia	15-17 (1)* 13-17 (1) 17-19 (2) 19-22 (1)	06-07 (1) 07-09 (2) 09-14 (1) 17-19 (1) 19-21 (2) 21-01 (1)	02-04 (1) 04-07 (2) 07-09 (1)	04-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)†
North & Central South America	10-13 (1)* 13-15 (2)* 15-16 (1)* 07-08 (1) 08-10 (2) 10-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-19 (1)	00-06 (1) 06-07 (2) 07-09 (3) 09-14 (2) 14-16 (3) 16-18 (4) 18-21 (3) 21-00 (2)	18-19 (1) 19-20 (2) 20-02 (3) 02-04 (2) 04-06 (1)	20-21 (1) 21-02 (2) 02-06 (1) 00-03 (1)†
Southern Brazil, Argentina, Chile & Uruguay	12-13 (1)* 13-14 (2)* 14-16 (1)* 07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-20 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-21 (2) 21-02 (1)	19-22 (1) 21-03 (2) 03-06 (1)	21-05 (1) 01-04 (1)†
McMurdo Sound, Antarctica	13-16 (1) 16-18 (2) 18-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-19 (1) 19-22 (2) 22-01 (1)	00-06 (1)	*Nil*

Time Zone: PST (24-hour Time)
WESTERN USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe & North Africa	08-12 (1)	22-00 (1) 06-08 (1) 08-13 (2) 13-16 (1)	18-00 (1)	19-22 (1)† 19-21 (1)
North-Europe & European USSR	07-10 (1)	23-01 (1) 06-07 (1) 07-09 (2) 09-12 (1)	19-23 (1)	20-23 (1)
Eastern Mediterranean & East Africa	08-11 (1)*	13-15 (1) 22-00 (1)	18-21 (1)	*Nil*
West & Central Africa	08-11 (1)* 06-08 (1) 08-10 (2) 10-12 (3) 12-14 (2) 14-16 (1)	02-10 (1) 10-14 (2) 14-16 (3) 16-18 (2) 18-20 (1)	18-22 (1)	19-21 (1)† 19-21 (1)
South Africa	08-10 (1) 07-10 (1) 10-13 (2) 13-15 (1)	05-14 (1) 14-17 (2) 17-18 (1) 23-01 (1)	19-22 (1)	20-21 (1)
Central Asia	07-09 (1) 17-19 (1)	07-09 (1) 16-18 (1) 18-20 (2) 20-22 (1)	05-08 (1)	*Nil*
Southeast	17-19 (1)* 15-17 (1) 17-19 (2) 19-22 (1)	07-09 (1) 09-11 (2) 11-13 (1) 20-22 (1) 22-01 (2) 01-03 (1)	02-05 (1) 05-07 (2) 07-09 (1)	05-07 (1)
Far East	12-14 (1) 14-18 (2) 18-20 (1)	09-11 (1) 11-13 (2) 13-16 (1)	22-01 (1) 01-04 (2) 04-06 (3)	00-02 (1) 02-05 (2) 05-07 (1)
		16-18 (2) 18-19 (3) 19-21 (4) 21-22 (3) 22-00 (2) 00-01 (1)	06-09 (1)	03-06 (1)†
Guam & Pacific Islands	15-17 (1)* 10-14 (1) 14-16 (2) 16-18 (2) 18-20 (2) 20-22 (1)	07-08 (1) 08-10 (2) 10-17 (1) 17-19 (2) 19-22 (4) 22-00 (3) 00-02 (2) 02-04 (1)	21-22 (1) 22-05 (3) 05-07 (2) 07-09 (1)	22-00 (1) 00-05 (2) 05-07 (1) 02-06 (1)†
Australasia	15-17 (1)* 13-17 (1) 17-19 (3) 19-20 (1)	07-08 (1) 08-10 (2) 10-17 (1) 17-18 (2) 18-21 (3) 21-01 (2) 01-04 (1)	00-03 (1) 03-05 (3) 05-07 (2) 07-08 (1)	02-03 (1) 03-05 (2) 05-07 (1) 04-06 (1)†
North & Central South America	09-13 (1)* 13-15 (2)* 15-16 (1)* 06-08 (1) 08-10 (2) 10-12 (1) 12-14 (3) 14-15 (2) 15-17 (1)	06-07 (1) 07-09 (2) 09-15 (1) 15-17 (2) 17-19 (4) 19-20 (3) 20-22 (2) 22-00 (1)	18-20 (1) 20-00 (3) 00-03 (2) 03-05 (1)	20-21 (1) 21-01 (2) 01-04 (1) 23-02 (1)
Southern Brazil, Argentina, Chile & Uruguay	10-12 (1)* 12-14 (2)* 14-16 (1)* 06-08 (1) 08-10 (2) 10-12 (1) 12-13 (2) 13-16 (3) 16-17 (2) 17-19 (1)	05-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-22 (2) 22-00 (1)	20-00 (1) 00-04 (2) 04-05 (1)	00-04 (1)
McMurdo Sound, Antarctica	12-15 (1) 15-18 (2) 18-20 (1)	05-06 (1) 06-08 (2) 08-11 (1) 16-19 (1) 19-22 (2) 22-02 (1)	00-06 (1)	*Nil*

Test Equipment [*from page 32*]

is the same as 0.5:1.5 volts. The meter then can be calibrated according to the ratios.

In practice, a separate OHMS-ADJUST control is used in place of R_4 (fig. 1) to set the meter for an initial full-scale reading when terminals *A* and *B* are open. The meter scale is calibrated in terms of ohms up to 1000 as shown on the v.t.v.m. scale in the photo. Various size ratio resistors are selected for R_{17} and are proportioned so that the calibrations may be multiplied by 1, 10, 100, etc., for the different ranges. Thanks to the infinite resistance of the v.t.v.m. input tube, resistances up to 1000 megohms may be measured.

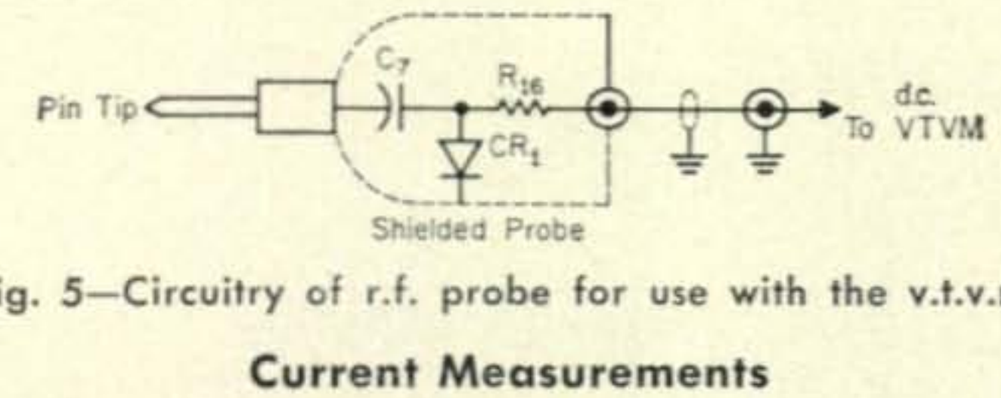


Fig. 5—Circuitry of r.f. probe for use with the v.t.v.m.

Current Measurements

The v.t.v.m. customarily does not include a means for directly measuring current such as can be done with the v.o.m.; nevertheless, indirect methods can be used as will be discussed in connection with applications of the instrument in a subsequent installment.

Facilities of the V.T.V.M.

Four controls generally are found on the v.t.v.m., namely: a FUNCTION switch which turns on the power and sets up the circuitry for the type of measurement to be made (a.c., —d.c., +d.c. or ohms); a RANGE-SELECTOR switch; a ZERO-ADJUST and an OHMS-ADJUST. On some instruments three test-lead terminals are provided; one each for a common or ground lead, a d.c. lead and an a.c./ohms lead.

In other cases a phone-type jack or a screw-on type connector will be found with a common ground lead that has a clip at one end of it and with a shielded lead on the end of which is an insulated probe equipped with a means for switching a pin-type tip for d.c. or a.c./ohms measurements. Operating voltages for the v.t.v.m. are obtained from a built-in 120 volt a.c. powered supply.

The entire instrument is housed in a shielded metal cabinet. The common ground lead is connected to the case. Under certain conditions this can present a shock hazard, so a coming trend is the use of a plastic case instead, with a 3-prong 120-volt plug that grounds the instrument when it is plugged into a wall socket. Although this minimizes the danger, it does not completely eliminate it as we'll see later on.

A carrying handle is furnished on the case, but sometimes a gimbal mount is provided to enable the v.t.v.m. to be placed on the workbench in an adjustable tilted-up position or to allow it to be mounted on a wall or be suspended from the bottom of a shelf above the bench.

Next time we'll talk about using the v.o.m. and the v.t.v.m. ■

THE VHF COLUMN

BY BOB BROWN, K2ZSQ
AND ALLEN KATZ, K2UYH*

Two Meters – Wide Open!

FEW amateurs ever get an opportunity to hear the two meter band when it opens, much less make long-haul DX contacts. But on November 16th it happened: a combination of tropo inversion and meteor shower resulted in ideal DX conditions that would have resulted in record-breaking QSO's if enough operators had been on the air.

One fortunate team was on—K2LNS and WA2FGK from Somerville, N.J. Although the call WA2FGK was used, Andy hastens to point out that the major construction work (150 hours matching and phasing the antenna and 50 hours working on the kw linear) was chiefly the result of K2LNS's craftsmanship in the months prior.

Aft 0705 EST on the 16th WA2FGK wrapped up his shower sked with W4WNH in Kentucky (the previous day's efforts had only resulted in 2 pings) and prepared to close down the station.

Then Herb (LNS) heard K5WXZ near Dallas, Texas calling CQ. They called him, and to their complete astonishment, he came back, with signals varying between a solid S5 via tropo and peaks of S9 via meteor bursts. This 1350-miler made state no. 20 for the team.

A few minutes later W5UGO in Tulsa, Oklahoma, was heard and QSO'd for state no. 21. Strictly meteor scatter.

State no. 22 followed with a call from W4AWS in Orlando, Florida, and a solid contact.

Which left only Georgia to complete the east coast states. K4SJF was heard in QSO with W8YIO, but contact wasn't made.

The fish that got away, was a Waco, Texas station (WA2FGK didn't mention his call) who was called, but didn't reply. It would have made 1400 miles, nearly the 2 meter land record.

But perhaps the most enlightening part of the entire affair was the absence of more two meter c.w. activity. Had it been there—especially in the New England area—November 16th would have gone down in v.h.f. history books.

The equipment at WA2FGK consists of a Clegg Zeus driving a 4600A at 1 kw; receiver is a 417A converter into an SX-101 and an 80 element Telrex antenna system.

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

A note for the future: WA2FGK will have a 48-foot 21 element 2 meter antenna up in time for May moonbounce schedules. (Also in the works is a sked with Bob, WØENC, in Rapid City, S.D. for a distance of 1600 miles.)

A Good Idea, But . . .

Apparently few people were interested in WA4LTS's suggestion in the November column for an annual recognition award. At least judging by the response we received.

Only one card arrived, from the team of WA8IIE and WA8NEH.

Any other ideas?

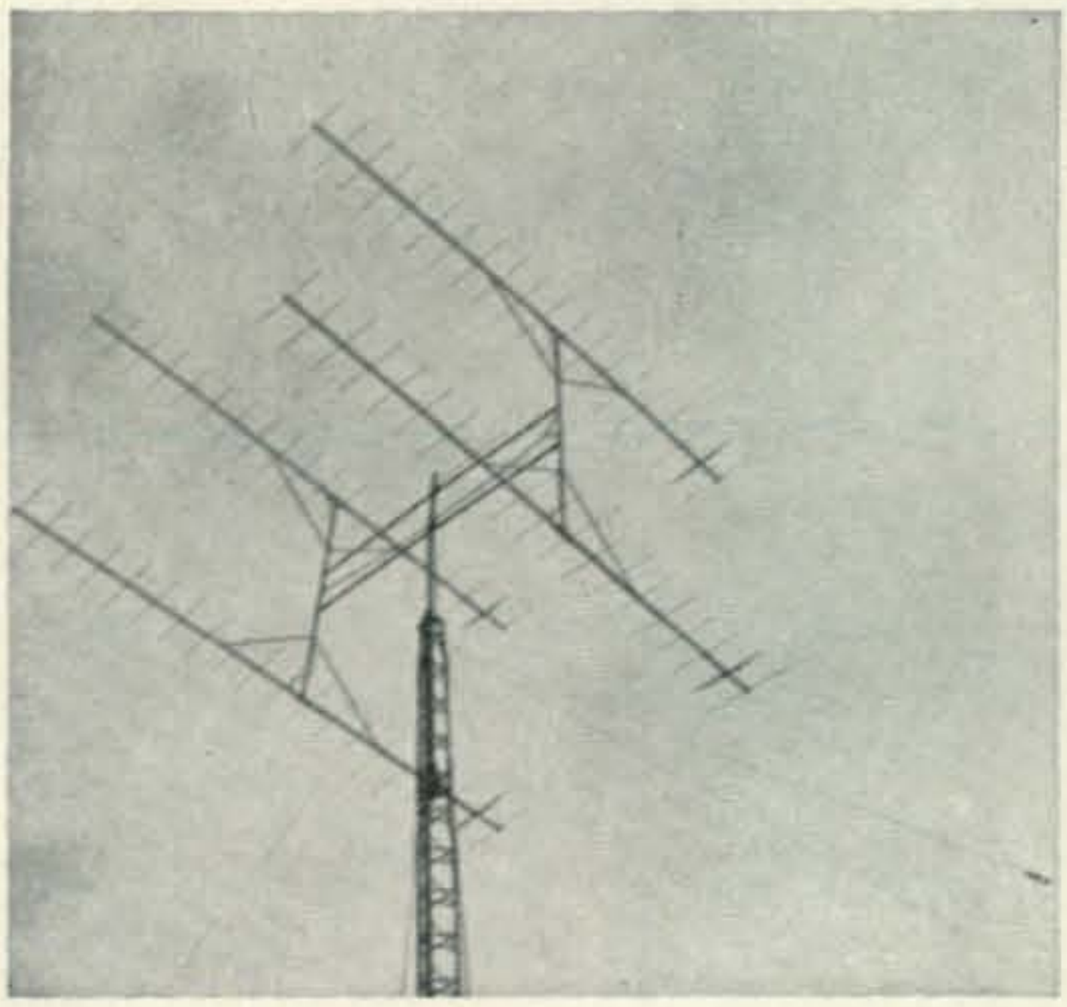
On The Ham TV Front

Would appreciate hearing from a few more amateur TV'ers; mail is slowing down a bit in this department.

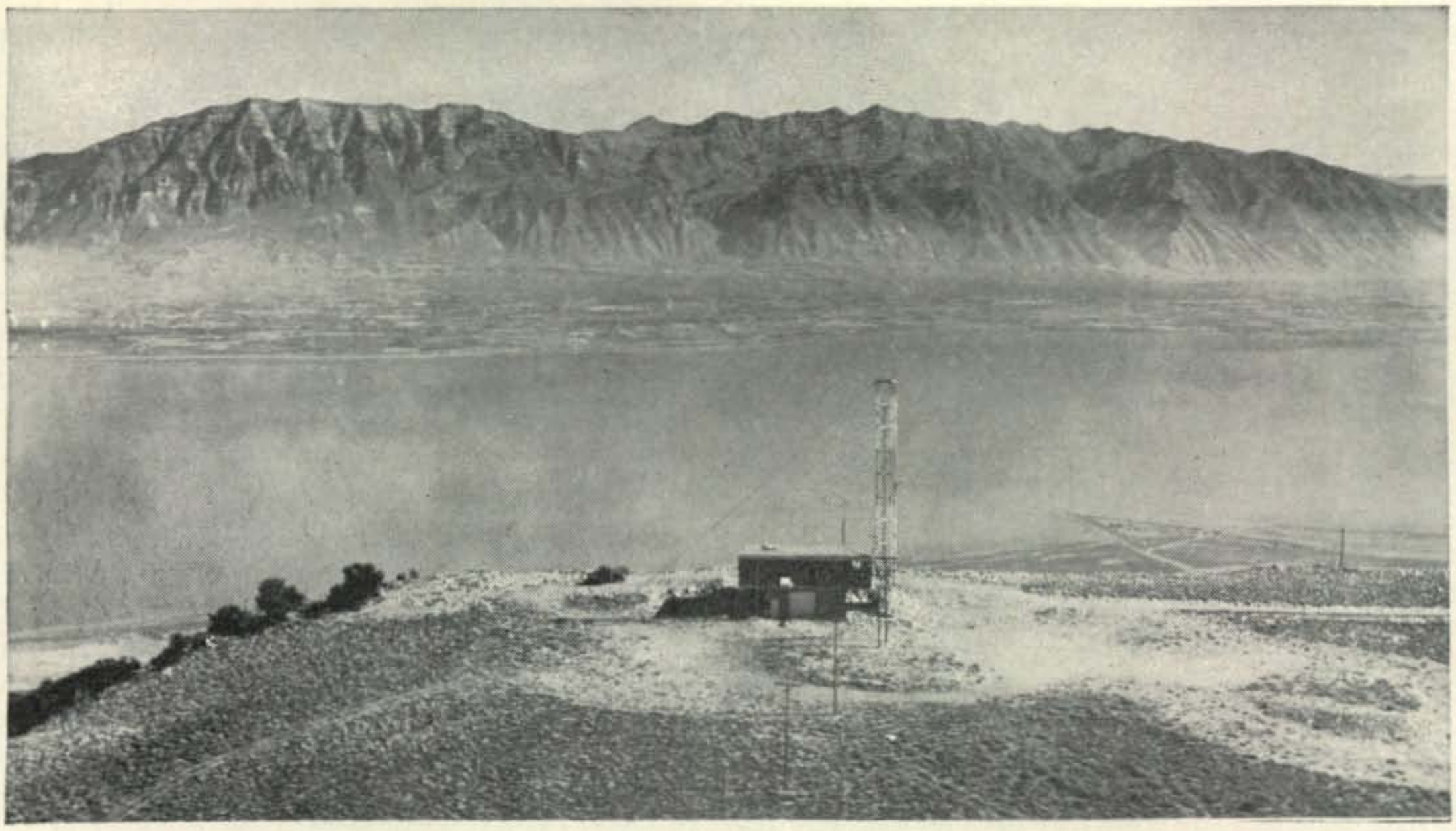
Al, K7VQL, Tucson Arizona: "Not too much to report except that K7DWN and company went up to Mt. Bigelow on a QSO party for a few days. Their Twoer came in like a KW here. Understand the boys also built a tree-house up there for diversion." *Should make for some interesting ATV shots.*

Jim Parson, K5ROV, San Angelo, Texas (if you don't recognize the call, try these on for size: Ex—DL4NC, DL4GK, KA2JP, K4FEO, K5-FBB, W1RLA): "ATV bug has really caught on here in San Angelo. Only problem is the location—we are almost on an island on the west Texas plains with no really large city nearby. However, we are hoping that some of the boys in Midland and other cities within a hundred or so miles will get active and try for some ATV DX." *Good luck!*

"Navy Chief Jess Lee, W5GCJ, is on with a live vidicon camera, a 40-watt video transmitter terminated in a 5894, crystal controlled. He is using interlace scanning and will soon have sub-carrier audio.



A glimpse at the WA2FGK/K2LNS 80 element 2 meter array used in the November 16th opening. Mounted 72 feet above ground, Herb & Andy by themselves carried the entire quad by hand up the tower (which is not a tilt-over, crank-up job)! Each boom is twenty two feet long, stacked twelve feet apart.



This peaceful scene is the site of the Utah Relay Club's two meter repeater station near Orem, Utah. It is the result of over a year of hard work by the ten charter members of the club. See W7QAG's letter.

"Chuck, W5SBI, is presently set up for receiving and is now building a power supply for an RCA ATI TV camera.

"As for myself, I have a homebrew vidicon camera and have just completed a 40-watt video transmitter using a 5894 in the final. Next project is the interlace generator. Like Jess, I'll soon be transferring from the 11-element beam to a colinear array."

Varactor Innovation

Although there have been many articles on varactor multipliers in radio amateur publications, a careful glance will show all circuits to be almost identical. The reasons for this similarity are two-fold. First of all it is desirable to secure one side of the varactor directly to chassis. The varactor gains its advantage over the vacuum tube as a multiplier by using a reactive (voltage sensitive capacitor) nonlinearity which does not dissipate power to generate harmonics. However no capacitor is perfectly free of series resistance. It is this small series resistance which limits the efficiency of the varactor by transforming r.f. power to heat. With direct contact, the chassis can act as a heat sink allowing the varactor to operate at a higher power level, but also the circuit is limited to what is called a shut configuration.

Secondly, the varactor is not just efficient at generating one harmonic, but many harmonics. Since amateurs in general are only interested in operating on one frequency, the unwanted harmonics must be eliminated. To do this, it has been found that just one tuned circuit is not adequate, and that double-tuned circuits must be used to obtain the needed attenuation. Double-tuned circuits, however, are nasty to adjust. This fact, coupled with the varactor's own capacitive variations, can lead to real tuning trouble.

It is precisely because of the above problem that our interest perked when an Amperex Applications Report S-124 by R. J. Bosselaers described a varactor tripler using series single tuned circuits crossed our desk. The idea is to use a sharp filter after the multiplier to get rid of the undesirable frequency products. This approach makes a great deal of sense, since a tuned filter between the multiplier and a power meter is a necessity during the initial tune-up procedure.

Fig. 1 shows the circuit of a 144-to-432 mc tripler we have constructed using the above idea. It is completely housed in a minibox and appears to be much easier to tune than the standard design. We have tried several different types of filters after it and all worked well. Fig. 2 shows an easy-to-construct filter. It was built in a separate minibox, and should always be used between the varactor multiplier and antenna or driver amplifier.

A Word on CCC

During 1965 the long-running CCC awards took an abrupt change of course, probably due to esteemed associate editor K2EEK's aversion to publicizing certficates he has not won. After a rather heated discussion with esteemed assistant editor Dorhoffer, however, he pledged to afford more publicity during the coming year to the program if he received an award. Bowing to the powers-that-be, we have prepared a rules box to run in future columns (and a *blank* certificate for the front office).

On u.h.f., the 220 and 432 mc Century Club divisions need more participation. Only a handful were processed last year, indicative of the amount of work necessary to achieve such status. So, *for the next fifty applications*, only 25 QSL's will be required for 220 membership.

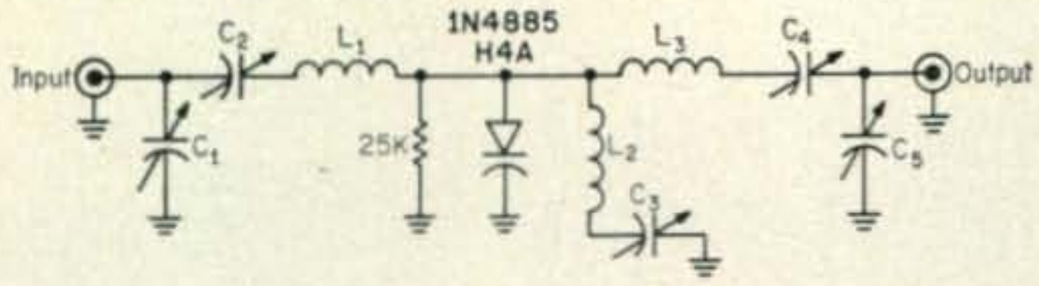


Fig. 1—A 144-to-432 mc varactor tripler as constructed by K2UYH. It is built into a minibox and is a great deal easier to tune than the more conventional designs. Several types of filters have been used at the output, all quite successfully.

C_1—25-100 mmf trimmer.
$C_{2, 3, 4}$—10 mf variable.
C_5—50-20 mmf trimmer.
L_1—6t. #16 tinned.
L_2—2t. #16 tinned.
L_3—¾ × ¼" copper strap.

From the Mailbag

Roger DeWitte, WB2PZB, Paramus, N.J.: "In the November *CQ* you stated that to the best of your knowledge there isn't a v.h.f. transceiver with c.w. provision.—To *my* knowledge both the Heathkit Shawnee for 6 meters and the Heath Pawnee for 2 have c.w. provision. I might also add that the pitch of the c.w. note of both of these models is variable." *(We stand corrected, Roger. Our apologies to Heath; there should be more alert manufacturers.)*

Dennis Haarsager, WAØKKR, Beresford, S.D.: "In your commentary on v.h.f. transceivers in the latest issue of *CQ* you said that to your knowledge there was no 6 meter transceiver made which is capable of c.w. operation." *Oh, no. Another one?*

"Well I just bought one, the Utica 650-A. It also has many features you mentioned later as being desirable in a v.h.f. transceiver such as c.w. reception, good audio, built-in a.c./d.c. power supply and v.f.o." *Well it looks like at least two companies are waking up.*

Gustav Kuether, TI2GK, Honduras, Central America: "Just a short note to tell you of my interest in your VHF column. I have been a v.h.f.'er for several years, but since coming to Latin America I have found myself all alone.

"I have recently aroused the interest of one other and a possible second ham. That means we may be putting Honduras on the 6 or 2 meter map in the near future." *Be looking for you, Gus.*

"Have written Project Oscar expressing my hope that they will go UP but that they will do so slowly so that some of us down here can try to catch up. I have very little funds for amateur use and there are no surplus houses down here. Makes it a little rough with 6146's at $11.00-each. But we will get there." *How about some stateside club sending Gus some 6 meter gear? Address is: Mission Evangelica, Apartado 17, San Pedro Sula, Honduras, C.A.*

Alfred Lilly, KZ5BV/K3SRT, Cristobal, Canal Zone: "Although 'ham' radio in the Canal Zone is very active here, to the best of my knowledge no one has attempted to work the states on six meters (about 1400 miles airline to Miami).

"CB'ers, though, are very active illegally working up into the Carolinas, Texas and in some instances New York and New England. Do you think the same can be accomplished with a Heath Shawnee or Hallicrafters SR-46 on 6 meters?" *No, Al, not the same. But I do think you'll be able to work into the U.S. via Sporadic-E skip around May or so when the band begins to open. It was done successfully several years back with even less power. Matter of fact, there should be pile-ups on your frequency!*

"I would appreciate your opinion also on what type antenna I would need." *Most any yagi will do the job, Al. The best rule of thumb is the bigger the better. When the band opens, though, even a 3-element antenna will work wonders. Stay away from vertical arrays.*

Jack Ross, K4NTD, Oakland, Florida: "Don't often see much anymore about 1296 activity in the magazines so I thought I would tell of the experiences WA4GHK in Palm Bay and I have had the last few weeks on the band." *Good idea.*

"Jim and I have been holding skeds 5 to 6 nites a week for the last 5 weeks or so and he has not failed to copy my c.w. signal over this 75 miles path all those nites.

"Rig here at K4NTD is a K6AXN (ARRL Handbook) converter using a 1N21C diode mixer with a 144 mc i.f. Transmitter is a MA 4060C varactor tripler (*ARRL VHF Handbook*) running 3 to 4 watts output to a modified 7 foot u.h.f. TV parabolic dish up 35 feet and fed with 40 feet of RG/8 of all things. Eight to ten watts of 432 drives tripler.

"WA4GHK is using a rig very similar and a 4 foot dish antenna. He also has a 2C39 rig for phone that runs about 2 watts output. His varactor triple also runs about 2 watts out.

"Horace, WA4NKN in North Orlando, is on but so far we haven't been able to hear each other. Lou, WA4BYR, 120 miles south of me in Englewood is now on with s.s.b. and c.w. but so far we haven't had a chance to try this path. Dave, W4UWH is building a s.s.b. rig and also think Grid, W4GJO will start soon. So this band looks real promising."

[*Continued on page 104*]

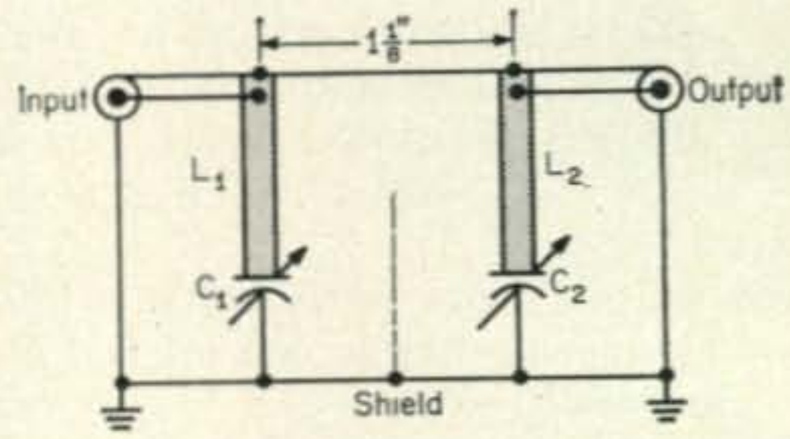
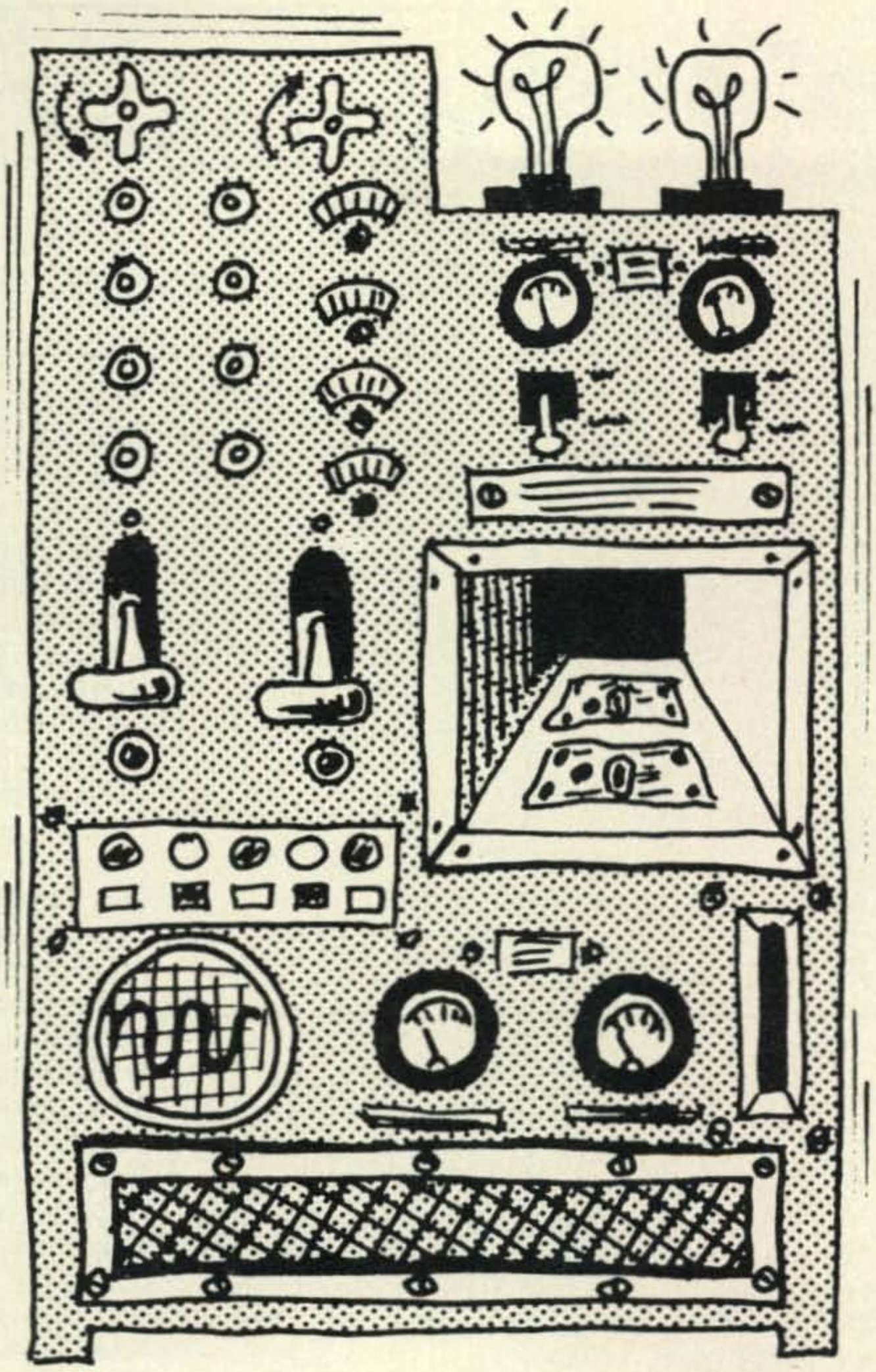


Fig. 2—An easy-to-construct filter for a varactor tripler that will work well with the design shown in fig. 1. It should be built into a separate minibox and employed between the tripler and antenna.

$C_{1, 2}$—8 mmf JFD piston trimmer.
$L_{1, 2}$—1½ × ¼" copper strap, mounted edge-to-edge, 1⅛" apart.

HOW TO MAKE MONEY!



Use this money-making machine? A good idea, but Uncle Sam holds the patent ! ! Discouraged? Don't be . . . Try this—

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Contest Calendar

BY FRANK ANZALONE,* W1WY

CALENDAR OF EVENTS

January	**29-30**	**CQ WW DX 160**
January	29-30	Louisiana QSO Party
January	29-30	R E F C.W.
February	5-6	Tenn. QSO Party
February	12-13	ARRL DX Phone
February	12-14	NYC-LI QSO Party
February	18-20	QCWA QSO Party
February	19-20	Vermont QSO Party
February	19-21	YL/OM Phone
February	26-27	ARRL DX C.W.
February	26-27	R E F Phone
March	5-7	YL/OM C.W.
March	12-13	ARRL DX Phone
March	19-20	RSGB BERU
March	26-27	ARRL DX C.W.
April	2-3	Florida QSO Party
April	1-15	Goose Bay QSO Party
April	**16-17**	**CQ WW DX SSB**

CQ WW DX 160

Starts: 0200 GMT Saturday, January 29
9 P.M. EST Friday, January 28
Ends: 1400 GMT Sunday, January 30
9 A.M. EST Sunday, January 30

Just a reminder, mailing deadline for your log is February 28th and they go to *CQ*, Att: 160 Contest, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050

Louisiana QSO Party

Starts: 1400 GMT Saturday, January 29
Ends: 2200 GMT Sunday, January 30

Mailing deadline for this one is also Feb. 28th. Logs go to: Louisiana QSO Party, c/o Bill Allen, W5NQR, 155 Karen Drive, Lafayette, Louisiana 70503

R. E. F.

C.W.—Jan. 29-30. **Phone**—Feb. 26-27.
Starts: 1400 GMT Saturday. Ends: 2100 GMT Sunday in each instance.

Rules and information where to send your applications for the many French awards appeared in last month's CALENDAR.

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

Tennessee QSO Party

Starts: 0000 GMT Sunday, February 6
Ends: 2400 GMT Sunday, February 6

All amateurs are invited to participate in the third annual Tennessee QSO Party, sponsored by the Radio Amateur Transmitting Society. Tennessee stations are urged to work as many out of state stations as possible to permit others to earn credits for the King Cotton, Chattanooga Choo Choo, Metro Nashville and USA-CA awards.

The same stations may be worked on different bands and modes, there are no power or time limitations and c.w. and phone are separate contests, therefore requiring separate logs.

Exchange: QSO number, RS/RST report and QTH; county for Tennessee stations; state, province or country for all others.

Scoring: One point per contact. Tenn. stations multiply total contacts by the number of states, provinces, countries and Tenn. counties worked. Out of state stations will use the number of Tenn. counties worked for their multiplier (a maximum of 95).

Awards: Certificates to the first three places per state, province and country, and to the first five places in Tennessee. All stations contacting 10 different Tenn. stations during the contest will be awarded a Certificate of Achievement.

Frequencies: 3530, 3900, 7030, 7250, 14070, 14275, 21050, 21325, 28300, 28900. (Keep off any Tenn. traffic net, you may be disqualified.)

Logs must be in the hands of the committee no later than March 5th. They go to: Club Station WA4NZE, 612 Hogan Road, Nashville, Tenn. 37220.

ARRL DX

Phone: February 12-13 and March 12-13.
C.W.: February 26-27 and March 26-27.

We gave you a brief run-down on the rules in last month's CALENDAR but if you need more details, and we don't know why you should since this one has been around for 32 years, you will find them in the January issue of *QST*.

Requests for official log forms and the finished product should be sent to the ARRL Communications Dept., 225 Main Street, Newington, Conn. 06111

NYC-LI QSO Party

Starts: 2300 GMT Saturday, February 12
Ends: 0500 GMT Monday, February 14

This year's NYC-LI QSO Party is sponsored by the South Shore Amateur Wireless Association. The same station may be worked once on each band and each mode. There is no time limit or power restrictions.

Exchange: QSO number, RS/RST report and QTH. County for NYC-LI stations, ARRL section for all others.

Scoring: Outside NYC-LI: 2 points per QSO

*14 Sherwood Road, Stamford, Conn. 06905.

multiplied by the number of NYC-LI counties worked. (Maximum of 7) NYC-LI stations: 1 point for in section QSOs, 2 points for out of section QSOs; multiplied by the number of ARRL sections worked.

Awards: Certificates to high scorers in each county for NYC-LI, each ARRL section for all others and also Novice awards. There will be an endorsement for national standing.

Frequencies: Suggested spots are: 3560, 3900, 7030, 7250, 14080, 14250, 21050, 28010, 29000, 50.4 and 144.5. Also Novice frequencies.

Mailing deadline is February 28th and logs go to: The SSAWA QSO Party, 116 Locust Street, Valley Stream, New York 11581.

QCWA QSO Party

Starts: 2200 GMT Friday, February 18
5 P.M. EST Friday, February 18
Ends: 2200 GMT Sunday, February 20
5 P.M. EST Sunday, February 20

This year's party is sponsored by the Oklahoma Chapter of the QCWA. Only members are eligible for the QCWA Plaque and certificates presented by the National Headquarters. Only contacts with other members will count toward these awards.

There are no point scoring or multiplier involved, this is primarily a party to renew old acquaintances, and see how many members can be contacted over the week-end.

The judging committee requests that your log should show in this order: Date and time in GMT, Contact number sent and received, station worked, RS/RST report, band, QTH of station worked, first name and QCWA number.

The activity will be found on these frequencies; plus or minus 5 kc.

C.W. - 3540, 3566, 3790, 7005, 7030, 7100, 14100, 21110, 28110.

"Eva" Irmgard Hof, DJ3YL took over when the "boy friend" DJ2YA was not able to participate in this year's Phone Contest. You may have been one of the lucky ones to work her on 21 mc. She promises to be back next year. What happens if they have to share the same rig?

A.M. - 3810, 3950, 7230, 14240, 21340, 28900.
S.S.B./L.S.B. - 3805, 3995, 7205, 7295.
S.S.B./U.S.B.—14315, 21410, 21440, 28690.
RTTY—7105, 21140.

Your logs should be in the mail before March 15th, and sent to: QSO Party Chairman, Mr. Orin Gambill, W5WI, 3710 East 36th Street, Tulsa, Oklahoma 74135.

Vermont QSO Party

Starts: 2300 GMT Saturday, February 19.
Ends: 0300 GMT Monday, February 21.

All amateurs are invited to participate in the Vermont QSO Party sponsored by the Central Vermont Amateur Radio Club. Vermonters are urged to work as many out-of-state stations as possible so that those interested can earn credit toward WAS, WANE, W-VT and USA-CA awards.

The same station may be worked on different bands and modes for contact credit, and there are no time limits or power restrictions.

Exchange: QSO number, RS/RST report and QTH. County for Vermont stations, ARRL section for all others.

Scoring: Vermont stations: 1 point per contact and multiply total by the number of ARRL sections and foreign countries worked. Outside stations: 3 points per Vermont station worked and multiply total by the number of Vermont counties worked (maximum of 14).

Awards: Certificates to the high scorers in each ARRL section and 2nd, 3rd and 4th highest in Vermont.

A trophy will be awarded to the top station in Vermont and to the overall out-of-state winner.

The W-VT certificate will be awarded to stations working 13 out of the 14 Vermont counties.

Frequencies: Suggested spots are: 3685, 3855, 3909, 7030, 7240, 7290, 14040, 14225, 14290, 21050, 21300, 28100, 28600, 50.250, 50.360, 144 thru 144.5, 145.8 and Novice frequencies.

Logs postmarked no later than March 31st should be sent to: CVARC QSO Party, c/o E. Reg. Murray, K1MPN, 3 Hillcrest Drive, Montpelier, Vermont 05601

YL/OM QSO Party

Phone—Feb. 19-21. **C.W.**—March 5-7.
Starts: 1800 GMT (1300 EST) Saturday.
Ends: 0500 GMT (2400 EST Sun.) Monday.

When you fellows run out of QCWA and Vermont contacts you can QSY to the YL fre-

[*Continued on page 101*]

Claimed Scores
CQ W.W. CW DX 1965

Single Operator
All Band

WØAIH	397,590
W9IOP	312,666
W3MSR	289,800
W6WX	271,064
K1HVV	238,896
K4EZ	190,518
CR7IZ	183,750
EL8AF	156,653
W3AYD	104,850
W3QQL	103.597

28 mc

WA4WIP	408

21 mc

K8VDV	40,392
KE1TG	37,760
WA4GCS	22,620
W6PQW	22,098
DJ1ZG	21,158
DL8ML	20,026

14 mc

W1TYH	172,900
W3AFM	165,510
JA8AA	147,680
KH6IJ	121,095
K9CSW	93,834
5X5IU	84,304
K7ADL	71,094
K4PDV	68,688
ZE1BL	61,918
W6KNE	59,363

7 mc

KZ5TW	156,456
W5WZQ	81,408
W1WAI	54,990
K4YFQ	25,025
DL1KS	20,770
OH5UQ	20,148

3.5 mc

W1WKK	20,212

1.8 mc

W1BB/1	2520
VE2UQ	2275
W2EQS	451
OE1KU	378
W6JTB	99

Multi-Operator
Single Transmitter

EL2AE	740,691
HV1CN	382,700
WØEZO	315,099
IØFGM	312,800
WA6HRS	304,060
W4ZYQ	151,709

Multi-Operator
Multi-Transmitter

W4KXV	1,202,685

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

An interesting and informative story about K5SGJ and K5SGK, but first the information on awards issued. USA-CA-2500 award went to Carl, WØKZZ and he received endorsements of all 2X s.s.b. for his USA-CA-2000 and all mobile for his USA-CA-1500 award. Adger, K4MSS received USA-CA-2000, USA-CA-1500 and USA-CA-1000 awards. Joe, W2JWK earned a USA-CA-2000 award. George, K8QYG received a USA-CA-1000 award and all A-1 endorsement for his USA-CA-500 award. John, WA5ALB won a USA-CA-1000 award and all 7 mc 2X s.s.b. endorsement for his USA-CA-500 award. Jim, W8BZY went-to-town with a USA-CA-1000 award and a USA-CA-500 award endorsed mixed, all A-1 and all 7 mc. Mixed USA-CA-500 awards went to Alfred, K1WQU, Dale, K4GSX, and Mildred, W4ZDK. Luis, KP4BBN earned a USA-CA-500 award and thus received #2 USA-CA award going to KP4.

K5SGJ And K5SGK And Family

The wonderful family of "Arcy" and Mabel includes four sons. The oldest, Bob and wife—also named Mabel—have two children Bobby 6 and Cathy 4. Bob, whose home call is K5ODD is in the State Department and he and his family just finished a two months home leave after spending two years in Monrovia, Liberia where he was active as EL2AC. Bob and family are now in Beirut, Lebanon for two years and it is hoped that he can add an OD5 call to his growing list of calls. The second son, Dick is 21 and working in New Orleans for an office supply house and expects a call from Uncle Sam any day. Number three son, Buddy is 18 and an engineering student at LSU (New Orleans). The youngest son, Tommy is 13 and an 8th grade student. Mabel, K5SGJ and Arcy, K5SGK have been hams since 1958 when Bob was in the Air Force in Tripoli, Libya with the call 5A4TH. Bob started scheduling a "local" back home so he could talk to his folks. They bought a receiver in order to listen to him at home, and from that start they got their own ham licenses, and have been having a *ball* ever since.

At the moment Mabel and Arcy are having a friendly race with Charley, WØJWD and Ken, K4VOF to see who will be first to get a USA-CA-3000 award. They need a few of the more rare counties in Texas and might just take a little trip to catch them and give out some rare ones to the folks on the net.

Arcy loves to tell the story of some years back while he was on 40 meters when some chap from Lafayette, Louisiana broke in saying he wanted a contact with Arcy for Jefferson parish for the USA-CA award. After the QSO, while filling out the QSL card, Arcy decided to read about the USA-CA Program in *CQ* and when he saw there were 3079 counties in the USA, he thought the chap must have eaten too many crawfish dinners and had gone out of his mind. Arcy says he still thinks the chap was nuts, but now after more than 2900 counties confirmed, he must say he's never had so much fun going nuts as he has had hunting and giving out counties.

For example, last winter they covered 46 Louisiana parishes (counties) going from the Mississippi border across the state to the gulf,

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

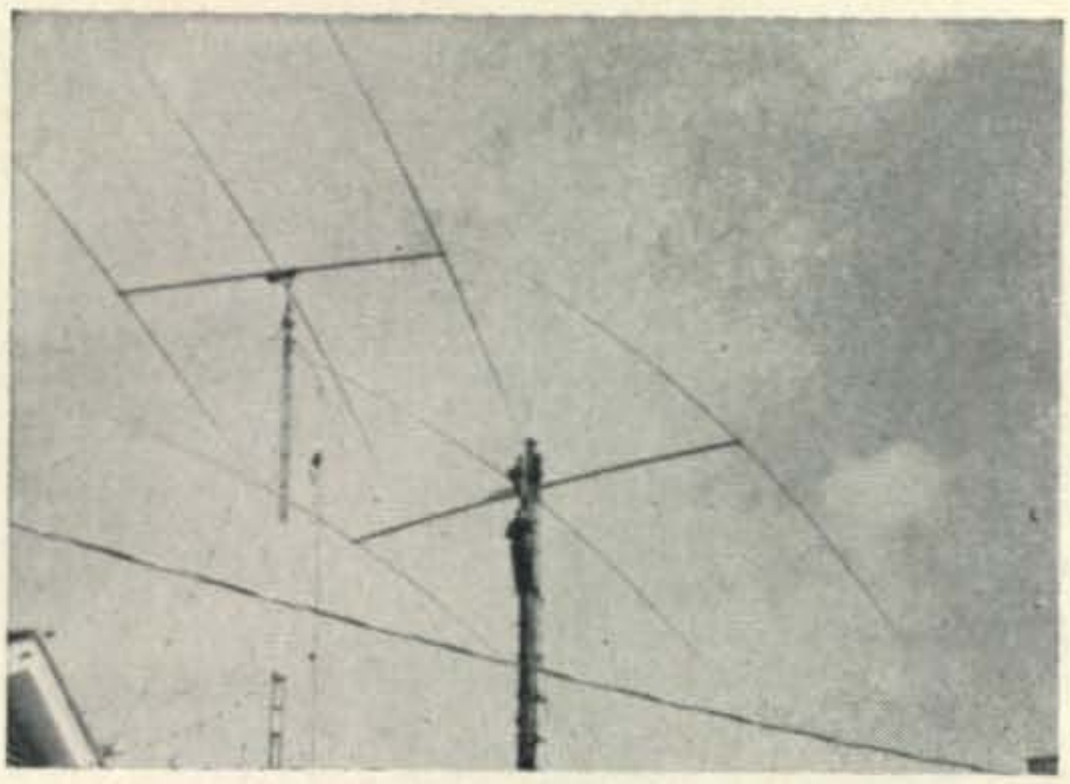
USA-CA HONOR ROLL

2500		1000		500	
WØKZZ	12	K4MSS	87	K4GSX	534
2000		K8QYG	88	W4ZDK	535
K4MSS	22	WA5ALB	89	KP4BBN	536
W2JWK	23	W8BZY	90	K1WQU	537
1500				W8BZY	538
K4MSS	43				

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

3079	**2679**	**2080**
K9EAB	VE3-9301	W5NXF
WØMCX	**2538**	**2050**
3058	WØKZZ	W2JWK
K8CIR	**2520**	K3LXN
2954	K4VOF	**2000**
K5SGJ	**2500**	K9UTI
K5SGK	K8KOM	W5EHY
2950	**2410**	WA8EZW
WØJWD	WØVFE	K8VSL
2900	**2335**	K8YGU
WA9AJF	W8UPH	**1877**
2780	**2280**	W9HAS/6
K8IWI	W9CMC	**1787**
		K4BAI

K5SGJ, Mabel, holder of #5 USA-CA-2500 Award; #7 USA-CA-2000; #14 USA-CA-1500; #38 USA-CA-1000 and #374 USA-CA-500 Award. Arcy, K5SGK, holder of #6 USA-CA-2500 Award; #8 USA-CA-2000; #13 USA-CA-1500; #44 USA-CA-1000 and #359 USA-CA-500 Award.



20 meter and 40 meter beams of K5SGJ/K5SGK (Pre Hurricane "Betsy"). Those little specs on the 40 meter beams are not birds but people.

then back across again and again until they had covered the 46 parishes. Who would have thought they would have become such rabid county hunters as to drive all the way to Dayton, Ohio and back, to meet a bunch of county hunters. They were a wonderful bunch of guys and gals and it is hoped the trip can be made this year to again meet the many county hunters and also renew old friendships.

Now to the sad part of the story. Hurricane "Betsy" did about one billion dollars worth of damage in that area, and about 70 people lost their lives.

Their 40 meter beam was on a 67 foot pole and well tied down, the 20 meter beam was on a crank-up tower which was lowered. After Betsy, both antennas were a total loss and the 40 meter rotator was damaged. A new Telrex 10-15-20 meter beam was put on the crank-up tower but the 40 meter beam has been missed, but by the time this is in print, a new 40 meter beam should be up and K5SGJ and K5SGK should be heard loud and clear once again on 40 meters.

Looking to the future, after the 3079 mark, they wonder what *CQ* can come up with, for them, that can equal USA-CA.

QSO Parties

The Louisiana QSO Party starts at 1400 GMT Saturday 29th of January and ends at 2200 GMT Sunday 30th of January.

The Tennessee QSO Party starts at 0000 GMT Sunday 6th of February and ends at 2400 GMT Sunday 6th of February.

The New York City-Long Island QSO Party starts at 2300 GMT Saturday 12th of February and ends at 0500 GMT Monday 14th of February.

The Vermont QSO Party starts at 2300 GMT Saturday 19th of February and ends at 0300 GMT Monday 21st of February.

See full details in CONTEST CALENDAR by Frank Anzalone, W1WY. Note—Louisiana has 64 parishes (counties), Tennessee has 95 counties, N.Y.C.-L.I. have 7 counties and Vermont has 14 counties. During these QSO parties, many rare counties get on the air, so this helps you add counties for your USA-CA Award *AND* the many different city and state awards.

Letters

"Pappy", WA9AJF, writes: "You may make my total counties 2900 if you wish for your column. I've been having a battle with that old man with the scythe and just out of bed again. Am hoping to make that 3000 before we tangle horns again."

Luis, KP4BBN, comments: "Hardest counties to get seem to be those in New Mexico and Delaware. I have many many QSOs with those states but all seem to be in the same county."

Fred, VE3-9301, writes: "Certainly agree with all the recent published comments re the fun of the USA-CA program . . . the excellence of your monthly column (the first thing I read when the mailman brings *CQ* . . . but then, it is the only thing of interest to the s.w.l. Perhaps we should hit *CQ* publishers for a s.w.l. column ??) . . . and the eye-catching appeal of the USA-CA certificate. It occupies a place of honor in my s.w.l. shack! As you may know, I work for CFPL-TV here in London, and when my original USA-CA certificate arrived a couple of years ago, I took it to work with me to have a frame and plastic cover made for it . . . to protect it on the wall. As I was making the frame, the Director of our News Department stumbled upon me . . . questioned me re: the award . . . and promptly sent me home with a cameraman who proceeded to "shoot" a story on myself, my hobby, my shack, and your fine award as center of attention. So . . . USA-CA made the TV air-waves here in Southern Ontario . . . as well as the ham air-waves.

"One final comment re: vacations last summer . . . spent in company with Garry, VE3GCO (ex-VE3-7554 and a USA-CA holder also) . . . on a 7000 mile auto tour of the southern US and most points in Mexico. Had occasion to visit many hams en route through the States, as well as Mexico . . . and found them all to be most friendly and hospitable. One of the highlights was an evening in New Orleans with Mabel and Arcy K5SGJ and K5SGK . . . both holders of USA-CA-2500 . . . and you can well imagine, the main topic of conversation that night was county hunting, and our assorted experiences with members of the old County Hunter's Net on 40 meter s.s.b. After seeing the 40 meter beam there, I can well appreciate the reason behind the potent signal that Mabel and Arcy generate on 7 mc."

Art, WØMCX, writes: "When the County Award USA-CA was first announced, I was sure *no one* would ever work all of them and now find myself with #2. After 20 years of active hamming I only had 565 counties confirmed and then in the last few years with County Hunters Net it was possible to get all 3079.

Once again, many thanks for all the work you are doing with the USA-CA program and although I no longer can collect counties, I still get a great pleasure out of giving them out on the nets. My total counties that

Worked All Counties West Va.

S C M—73

Scout Radio Award

International Friendship Award "ROAR"

Old Dominion Award

I have given out is 403 since my recent trip across the state to Bates County, Missouri."

Awards

The Old Dominion Award is issued by the Roanoke Valley Amateur Radio Club, Inc., for contacts with the counties of Virginia, the Old Dominion State. It is also issued to short wave listeners on the basis of confirmed reception reports. The award is issued in three classes, with requirements being based upon the applicant's location.

CLASS	East of Miss. River Including VO, VE1, 2, 3.	West of Miss. River Including VE4, 5, 6, 7, 8.	DX Station Including XE, KP4, KH6, KL7 & /MM.
1	96 counties	96 counties	96 counties
2	75 counties	60 counties	50 counties
3	50 counties	35 counties	25 counties

The original certificate is issued for Class 3, and will be endorsed with seals for Class 1 and 2. Endorsement will also be made when all contacts were made on one band and/or one mode. Due to the independent status of cities in Virginia, such cities may be counted for one and only one of the counties with which they share a common border. Confirmations for contacts with mobile stations are to be considered only if the location of the mobile station at the time of contact is specified. In the case of contacts with counties which have been party to mergers with other counties or with cities, such contacts may be counted only before the date of merge. Send certified list (GCR) in alphabetical order by counties, and 50¢ or 5 IRCs to Roanoke Valley Amateur Radio Club, P.O. Box 2002, Roanoke, Virginia.

The Worked All Counties West Virginia Award is sponsored by the Mountaineer Amateur Radio Association, Box 909, Fairmont, West Virginia. All contacts must be made after July 1, 1946. Any amateur band or mode and certificate will be marked for the mode, if requested. Contacts must be made with West Virginia amateurs and in the case of mobiles, operator must be a West Virginia amateur or have held a former West Virginia call and mobile operators must mail the QSL from the county of contact. All 55 contacts must be made from one location (moving 20 miles, etc . . . ok) and using the same call. Send the 55 cards and alphabetical list (by county, not calls) and $1.00 to MARA, Box 909, Fairmont, West Virginia. (Ed—Yes this is a real challenge!).

Scout Radio Award: Requirements–U S Stations contact K3WQW Club Station and *two* members; foreign stations contact Club Station and *one* member. The Boy Scouts of Coplay Amateur Radio Club (Coplay, Pa. Lehigh County) announces its first *International QSO Party* for the beautiful Scout Radio Award. The aim is to bring Scout radio operators together. Starts 1000 GMT Saturday 5th February and ends at 0500 GMT Monday 7th February. Frequencies: 20-40-80 meter bands c.w., phone and s.s.b. Call for this 44 hour contest: On c.w. CQ C and on phone CQ Coplay. All contacts with Coplay Radio Club members count also towards Pennsylvania's Keystone Award which requires 100 QSOs with Pennsylvania stations. And don't forget Lehigh County for USA-CA. Send log data and $1.00 for award (if earned) to K3WQW, Post Office, Coplay, Pa. 18037 by March 1, 1966. All QSOs will be acknowledged with a special QSL card. The president of the Club is WA3-BYH, and the Communications Manager is K3VWH.

S C M–73 Award is issued for contacting SCMs of ARRL Sections after January 1, 1960, and issued in 6 Classes as follows: Expert Class—73 SCMs (72 Sections and W1AW); Class 1—65 SCMs; Class 2—55 SCMs; Class 3—40 SCMs; Class 4—30 SCMs and Class 5—15 SCMs. Application: QSLs with return postage in U.S. stamps to cover return of QSLs. Foreign stations IRCs to cover. A certified list (GCR) will also be accepted. Comments: As there is no SCM for Yukon, a contact with W1AW is required for Expert Class. Each class is a separate certificate and all applications for any classes should list total SCMs contacted to date of application. Endorsement for all phone is available. Contact with past SCMs count if contact made while an SCM. Send to Custodian: B. W. Southwell, W6OJW, 200 South 7th St., Dixon, California 95620.

International Friendship Award: sponsored by Rotarians of Amateur Radio, to encourage international friendship and understanding through short wave radio conversation (as opposed to merely brief contacts with minimum exchange of greetings or run-of-the-mill information such as signal reports). Rotarians of Amateur Radio (R.O.A.R.), a group of radio amateurs who are members of Rotary Clubs. Initiated in 1958, (R.O.A.R.), now has almost 500 call listings in over 32 countries. Award Records and Applications Custodian: J. Foy Guin, Jr., W4RLS, Box 26,

[*Continued on page 106*]

NOVICE

WALTER G. BURDINE,* W8ZCV

ABOUT a year and a half ago I received a letter from Hijame Suzuki of Tokyo, Japan and printed it in our column. The results of that letter has brought many letters about his receiver and his record of stations confirmed. I have received 37 letters about his letter and many of them wanted to know more about Hijame's receivers and location. I wrote to Hijame for more dope on his wonderful little receivers and about amateur radio operators and the license examinations in Japan. The following is part of a condensation of the letters from Hijame. I'm sure you will enjoy them as much as I did. By the way I might also do some other columns like this if you like to know more of amateur radio in other countries.

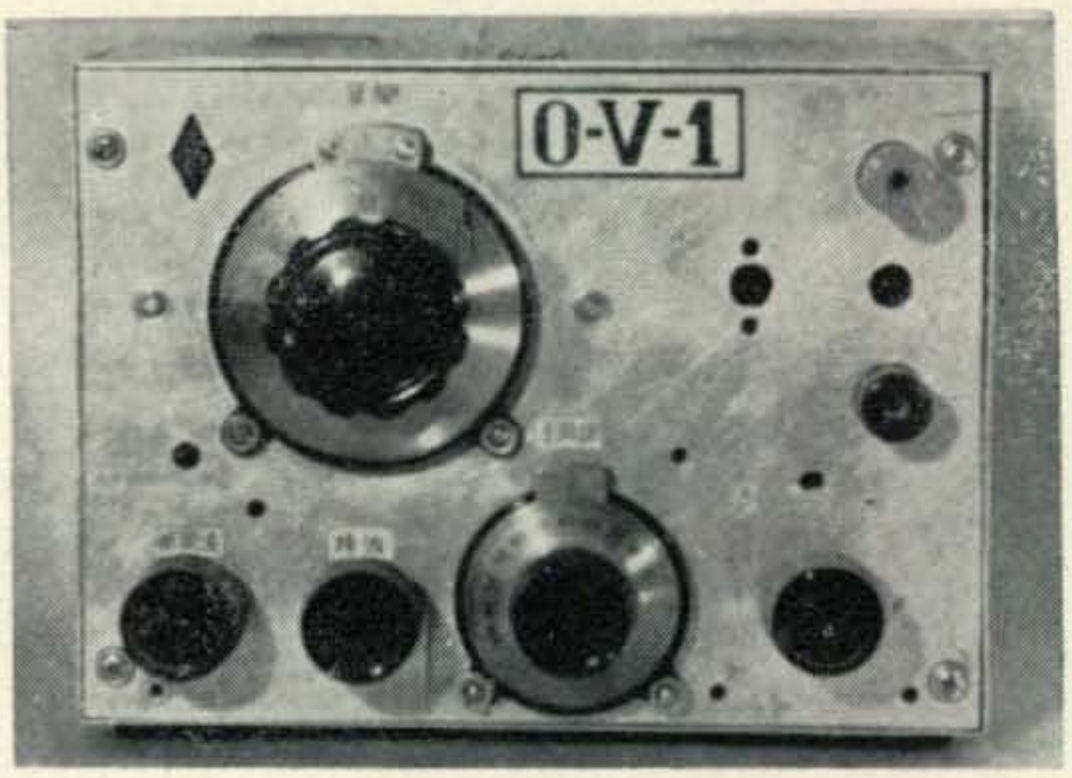
Right after the story of Hijame's appeared in *CQ* (Dec. 1964) he sent me a diagram of his receivers and a nice long 24 page letter. Here is part of one paragraph. "I'm very happy to see my letter and photo to you has been printed in your and "our" *CQ*. I have received 5 letters concerning the receiver asking for circuit diagram and one of them is asking me to sell him my receiver to him. But I don't want to sell my radio to anyone, I want to confirm 200 countries, using with my peanut sets. I will send to you a diagram of my receiving sets so that your friends may build them if they want.

"Some people ask me for a circuit diagram of my receiver, they almost never ask me nothing other than a circuit diagram. But could they make a good regenerative receiver as I did? They can not make a good one just by looking at the diagram, I hold. The simpler a receiver, the more difficult to build it. The number of turns of my coils are not theoretical ones but experimental ones with or without a signal generator (200 kc to 30 mc). I made the 3.5, 7.0 and 14.0 mc coils first without an r.f. generator. From the first time I intended to make surely solid-state coils, so I used 1 mm d.c.c. wire for the 7.0 and 14.0 mc coils. This is very important because the coils are the heart of the simple short-wave receivers. So I have 6 or 7 hearts for my receiver. I tried but 50 mc is not so sensitive. 50 mc is a v.h.f. band and we can soon realize that it is difficult to make a sensitive and stable circuit for v.h.f. with low frequency techniques. The 50 mc coils are rather sensitive for a simple circuit.

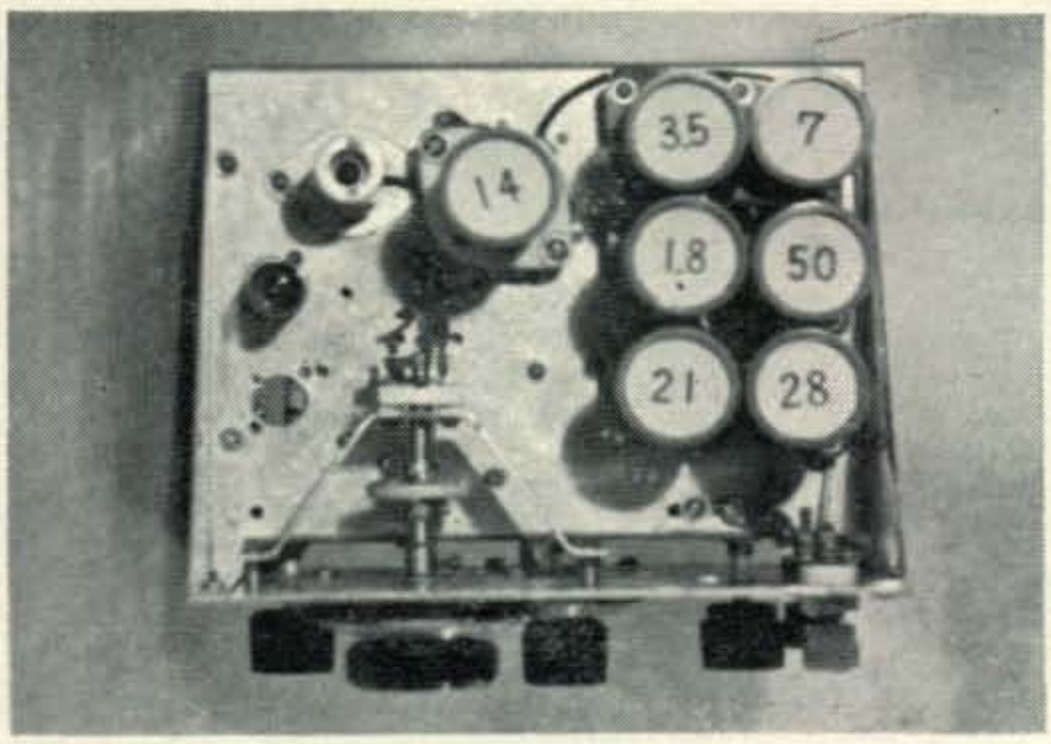
"Thinking simply I can get a voltage amplification of 140 times (47.6 db) with the 7.0 mc coil so I could hear 127 countries on this band. I have now heard 202 countries. I made the 202 country mark last month with 176 confirmations. I think this is a new world's record with a simple receiver according to one of the top Japanese DXers. I am very happy to report to you that I have now finished my main aim as an s.w.l. I used 50 months for this goal and spent about

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

The receiving position of Hijmae Suzuki, Tokyo Japan and some of his QSL collection. All pictures were taken by Hijame with a simple box camera.



Front view of receiver, dials may be bought from any radio supply house.



Top view of receiver.

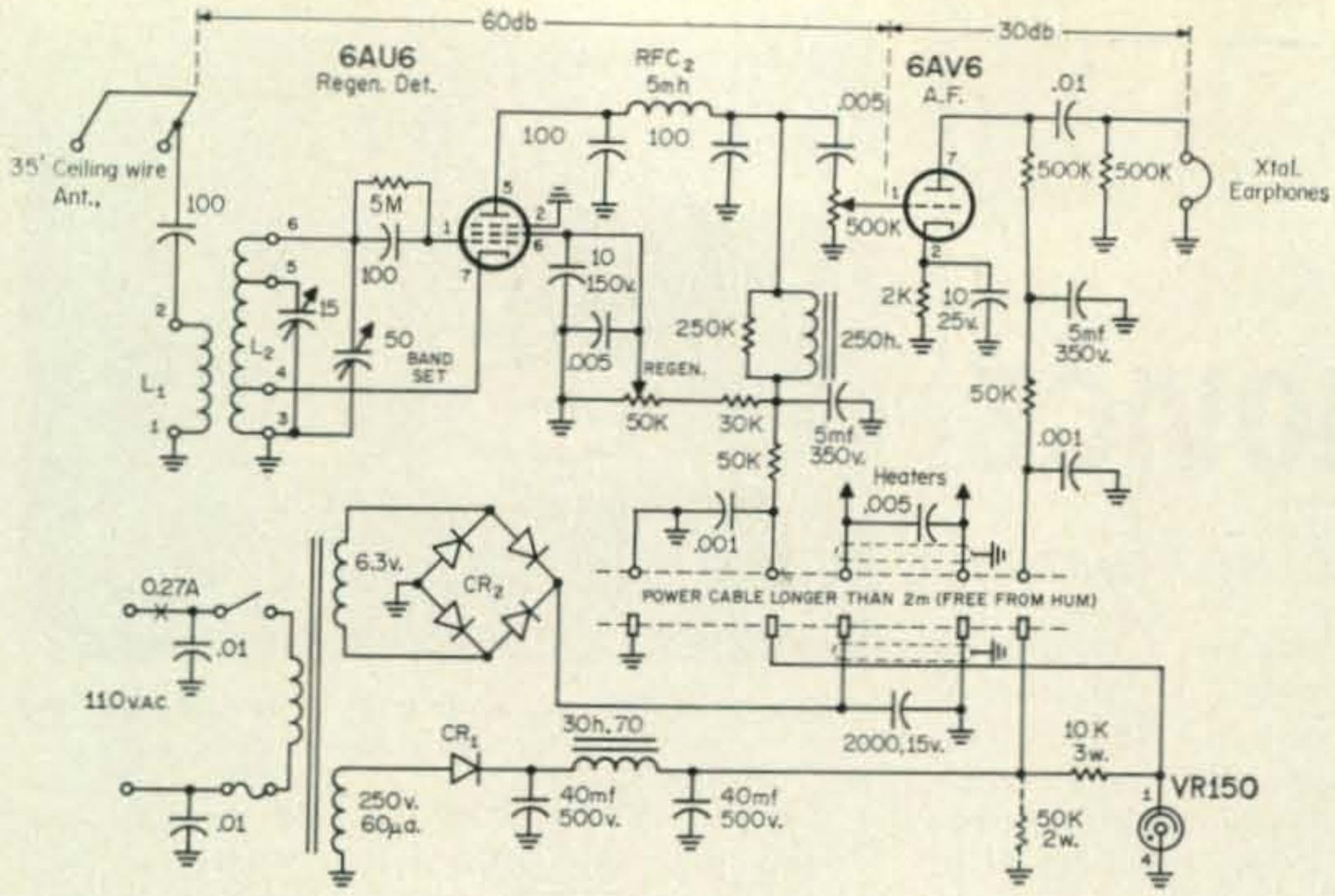


Fig. 1—Circuit of the regenerative receiver.

$42.00 to collect QSL cards from 176 countries. If I will not stop s.w.l.ing, I'll probably be able to confirm 200 countries with my simple 2 tube regenerative receiver fed by a 10 meter antenna. I need not a big thousand dollar receiver at present, my simple receiver will do.

"My pen-pal G3LHJ had worked 234 countries with 201 confirmations with 50 watts and a quad as of last December. JA6PA worked 130 countries with only 8 watts and JA2LC worked about 120 countries with an 807 and a three tube regenerative set (one rectifying tube) five or six years ago, getting a DXCC certificate. This JA2LC's attractive results with a homemade regenerative receiver was one of the main inspirations for me and I got started to listen to the DX with a simple regenerative receiver with my own modifications and ideas.

"I have heard 40 zones with 38 zones confirmed. I need zones 2 and 33 for completion of confirmed all zones. I have heard 66 countries on s.s.b. with 31 confirmed. I do not have a QSL card from W1. I have heard 2 countries on 160 meters, 25 on 80, 127 on 40 meters, 170 on 20, 41 on 15, 2 on 10, 2 on 6 and 1 on 2 meters. We do not have the 220 mc band and I have heard no one on 432. I have heard 158 stations on 6 meters and have been awarded the '50 MC 100' award of the JARL. The sunspot activity is at its worst at this time and I'm sure that I could have done better in 1957-58. I am doing very well with my simple receiver and am glad to know that my results are believed by you and many others.

"I have learned much of my English through s.w.l.ing and made many friends. Walt, I have learned another thing by "s.w.l.ing". Of course the technical approach of radio engineering is very important, but what amateur radio stations have as their goal is the world-wide friendship. I have a theory that the so-called DX country type of ham is not a real ham. Of course there are time limitations but the local QSOs are important, in other words, the DXCC is not so important as the deep philosophical point of view. I believe that friendship is more important than DXCC."

In his February letter, Hijame tells me that

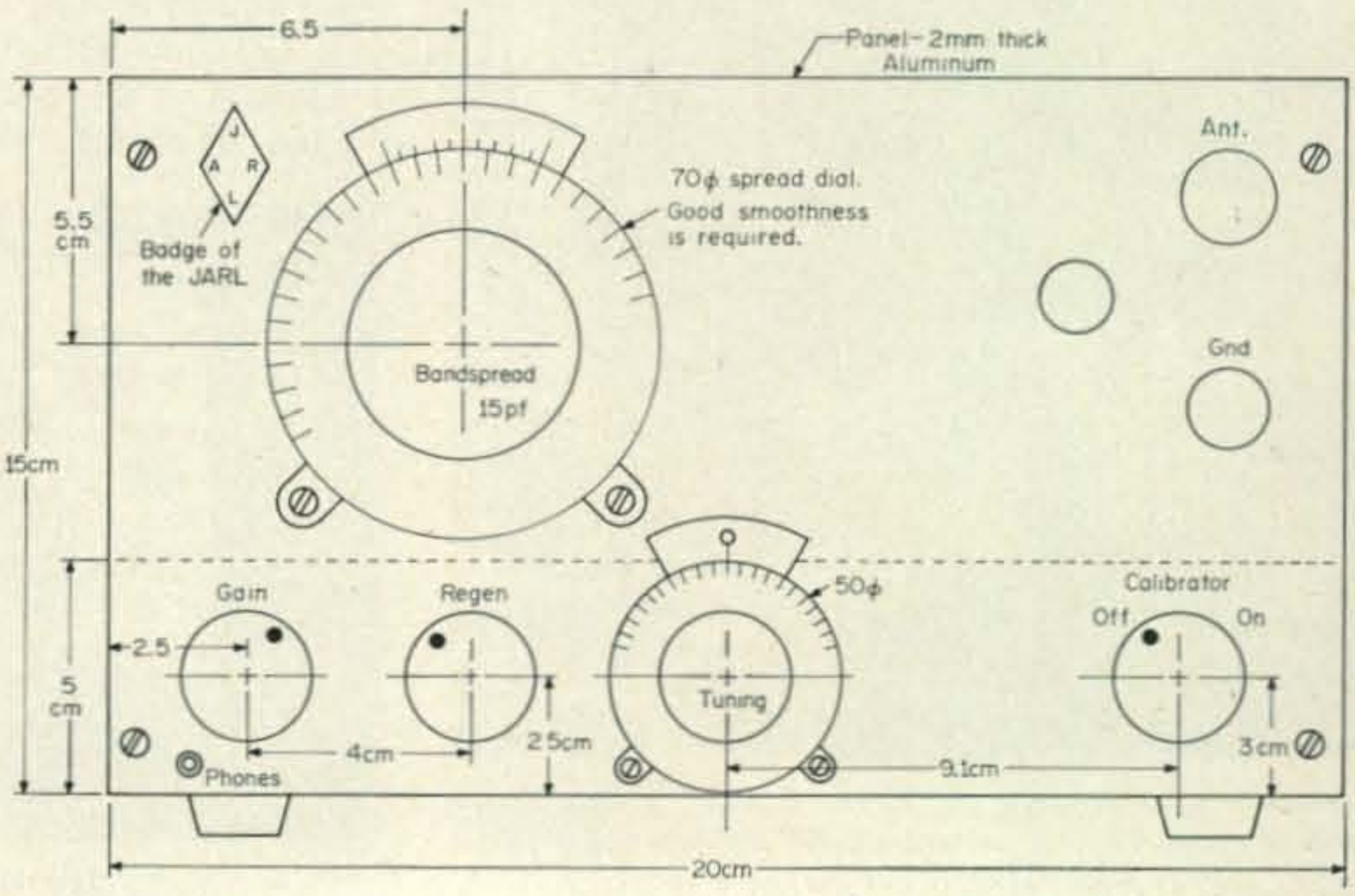


Fig. 2—Front panel layout.

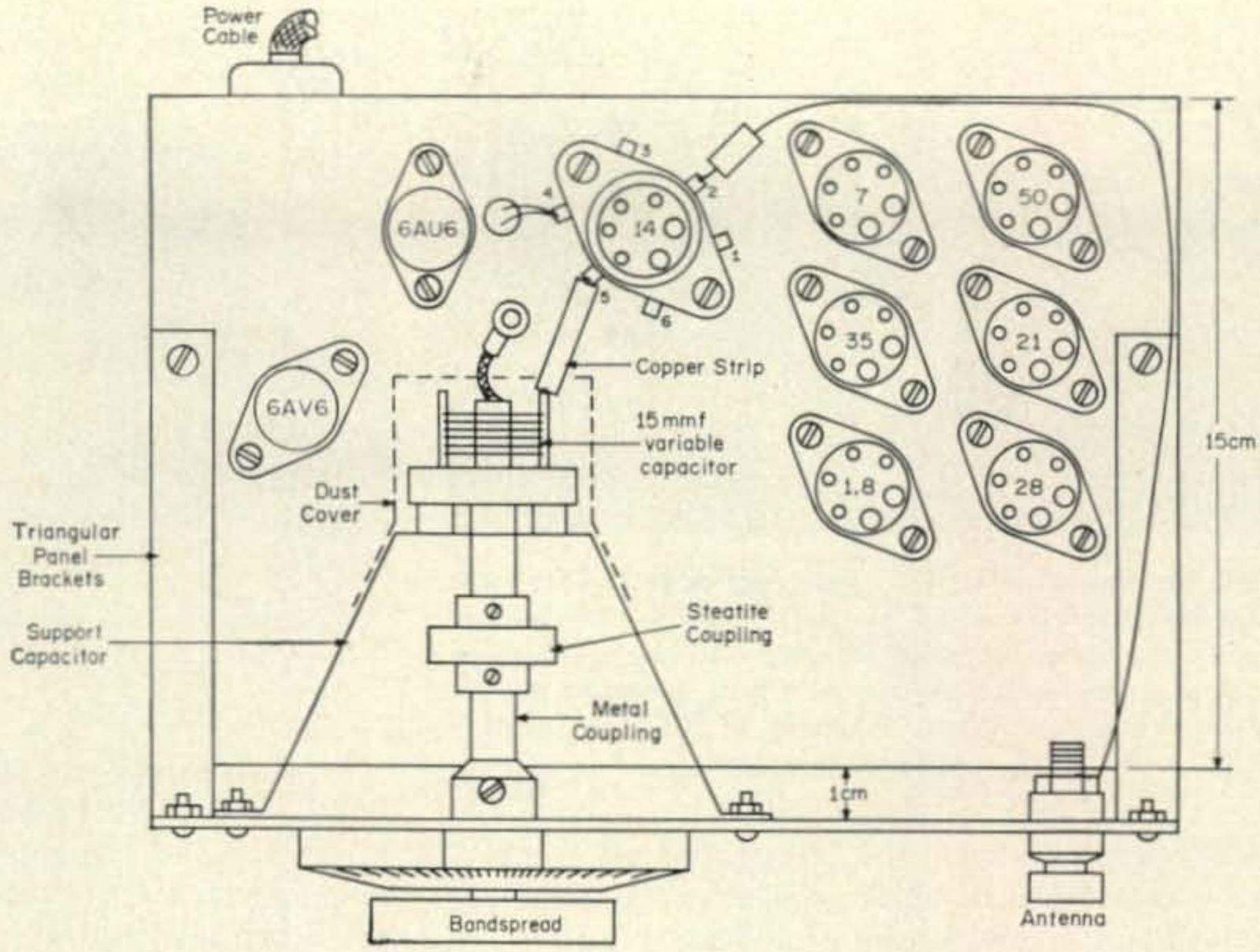


Fig. 3—Top view of the receiver.

he is 24½ years of age and is studying to be a radio engineer. He says, "I am going to finish my student time with one more studying year at my institute till March 31, 1966. I would like to remain a student always in my heart till death.

"I live in a small house made of wood and have never tried the receiver in a concrete or steel house. My location is bad, noise-wise. My closest neighbors are only 50 feet away from my room and my house is surrounding many other houses. My family has only a very small backyard here. The antenna is a 10 meter wire under the roof of my house, at ceiling high. I use this antenna because the antenna vibration caused by the wind affects the stability of my receiver. I have a ground plane for 2 meters, 30 feet high and even this affects the indoor antenna. With this ceiling antenna and my simple receiver I heard and confirmed UA4KED on 7 mc s.s.b. and heard the rare M1ZG on 3.5 mc A1. The receiver is very sensitive but is bothered by local man made noises caused by motors, fluorescent lamps, T.V. sets, radio sets, automobiles and other electrical appliances. I always unplug the BC set when I want to really get the DX. I use d.c. on the filaments. The radiation from TV sets is the worst."

I am building one of these receivers and expect to be listening in on you quite a lot soon. I will also be on 40 c.w. looking for you as soon as the antenna is up at my home. I will be running low power, using a long-wire. When I first started, I used a receiver nearly like this. My receiver used a 6D6 regenerative detector with a 6C5 and a 41 audio amplifier.

To use this receiver with a speaker, this unit will need another stage of audio, such as a 6AQ5 or similar amplifier tube. I will give you

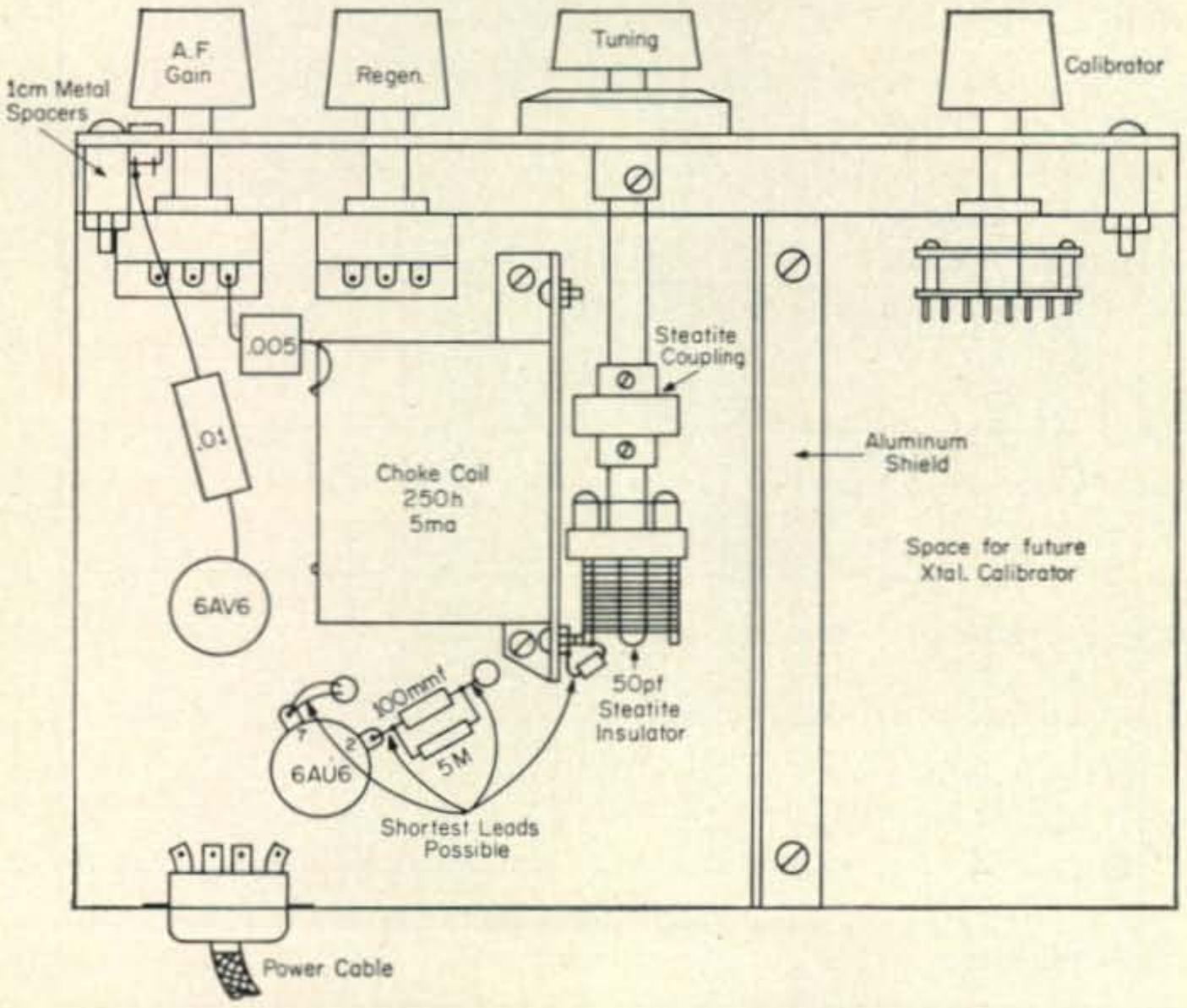
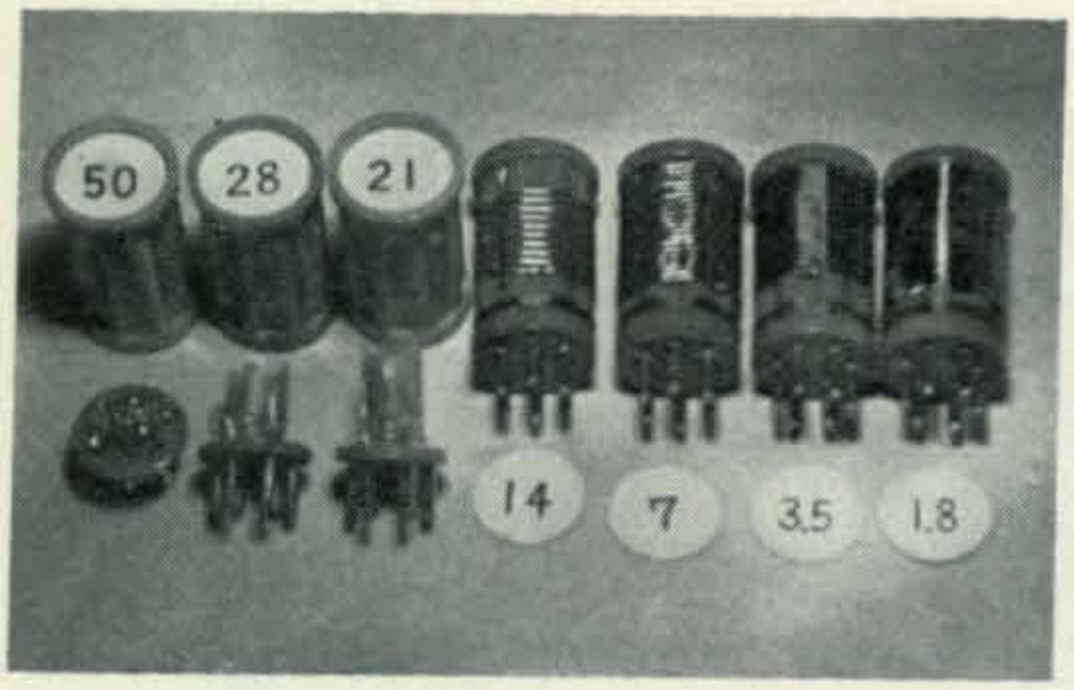
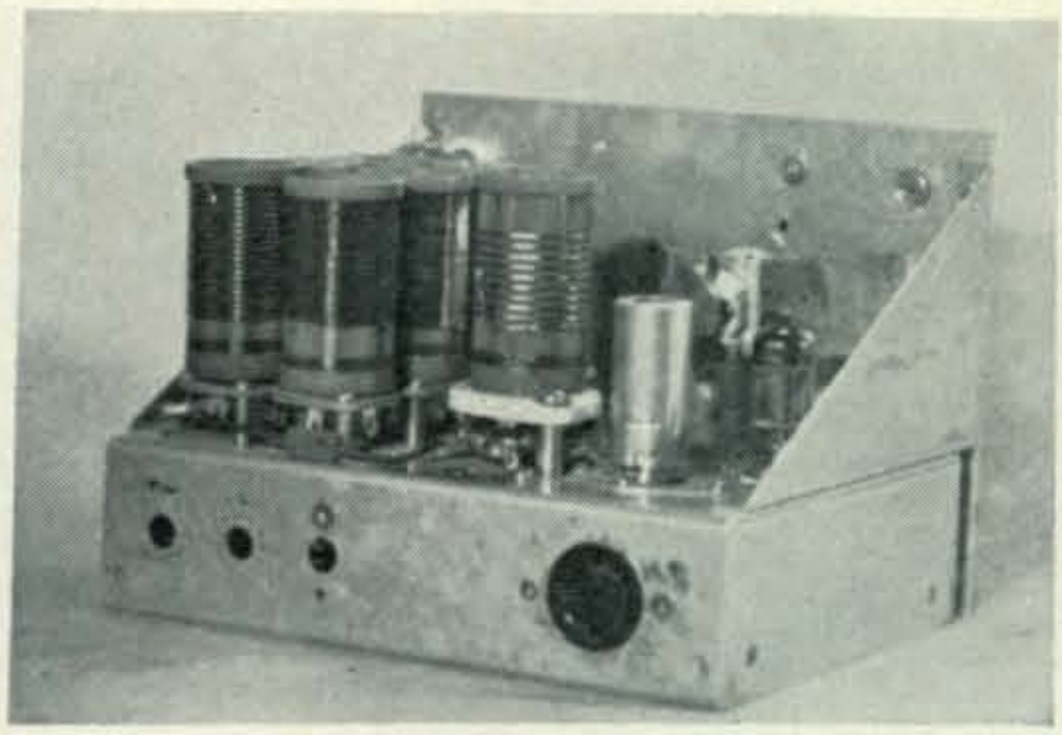


Fig. 4—Bottom view of the receiver.



Coils for the receiver. The three higher frequency coils may be carefully wired in the socket or the bottom cut off the form, the coils installed and the form glued back in place. Adjust all cathode taps so to get the set to regenerate at about ½ setting of the regeneration potentiometer.



Rear View of the receiver. 20 meter coil in socket.

more information on the use of this receiver. By the way almost all of the parts for this receiver including the power supply and extra audio can be built from the parts in any old television set that you have laying around.

Don't spoof at the little set, you might be like the fellow that I was listening to the other night. He was running 30 watts and the fellow that he was talking to was kidding him about his low power. The QRP fellow asked him if he had ever tried low-power, and said he was having a bushel of fun working the bands with his peanut whistle. I have always believed that if they can get here with low power I would be ashamed to admit that I couldn't do the same. Try low-power and a good antenna, see what you are missing.

I must extend my thanks to Hijame Suzuki, JARL-JA1-3477, Inokashira 2-33-12 Mitaka-Shi, Japan for the information for this column. He tells me that *CQ* cost him 300 yen before the price increase and it is always two months later than we get it. He is copying code at 20 w.p.m. and the Japanese code at 18 w.p.m. Student activities keeps him too busy but he will be on the air this summer. He graduates March 31, 1966. I'll be looking for you on the air, Hijame.

As an afterthought: the choke used in the plate circuit of the 6AU6 is an article that may be hard to get so in an emergency use the primary of an audio transformer. A single plate to grid unit may be used.

Next month we will show the Japanese licensing procedures & regulations along with Hijame's plans for 6, 2, 432 mc super regenerative detectors.

73, Walt, W8ZCV

TABLE I—COIL DATA FOR THE HIJAME SUZUKI RECEIVER

Freq. (Mc)	L_1	L_2	*Cathode Tap†*	*Band Spread Tap†*
1.8 (1.74-3.25)	4¼ t. #26e. 5mm from L_2	72½ t. #24e. close wound	1 t.	None
3.5 (3.05-4.95)	4¼ t. #26e. 1-10 mm from L_2	36⅝ t. #24e. 1mm pitch	¼ t.	None
7.0 (6.81-12.2)	4 t. #24e. 6mm from L_2	20¼ t. #18e. 2mm pitch	⅜ t.	12½ t.
14 (12.0-22.4)	4 t. #23e. 1mm pitch. 9mm from L_2	9½ t. #18e. pitch 3mm	⅜ t.	5 t.
21 (17.4-30.1)	2½ t. #20 tinned, 1.5mm pitch, 4mm from L_2 *	10½ t. #20 tinned, 1.5mm pitch *	½ t.	6¼ t.
28 (21.6-40.5)	2-1/12 t. #20 tinned, 1.5mm pitch, 4mm from L_2 *	7½ t. #20 tinned, 1.5mm pitch *	½ t.	4¼ t.
50 (36-66)	2 t. #20 tinned, 2mm pitch, 2.5mm from L_2 *	6 t. #20 tinned, 2mm pitch, 10mm dia. *	1½ t.	3¼ t.

*Can be Airdux or equiv.
†Turns from cold (ground) end of coil. 1 inch = 22.4 mm (approx 3/64" = 1 mm)
All coils wound on 1¼" dia. 6 prong coil forms except where coil stock is used.

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

OLD timers bemoan the fact that most newly-licensed radio amateurs have and need little technical inquisitiveness (all that is needed is money to buy the chrome-plated transceivers now flooding the market) in order to get on the air and yak about nonessentials. As you might expect, those without the money frequently have the technical interest and soon develop the ability. Those are the ones we hear from, asking intelligent questions about the use of inexpensive surplus radioteletype gear such as the AN/FGC-1, which we have been describing in detail these past few months. It makes us feel good; makes us feel that it is really worth while, anyway.

As we promised, last month, we will now give you a brief run-down on the line-up adjustments on the AN/FGC-1. Once made, they should not have to be made again, barring loss of a tube. Incidentally, when you *do* have a tube burn out, it is a good idea to run through the procedure again to make sure everything is set up properly. Before starting, read over Part V, on the metering circuits, which appeared in the November 1965 RTTY Column, noting in particular the locations of circuits as labeled on the test jack or patching panel pictured on page 93.

AN/FGC-1 Line-Up

First of all, never let one end of a patch cord hang loose; it might have high voltage on it which can either cause a shock or hit the chassis, causing a fuse to blow and set off the alarm buzzer. Make no patches unless you know *exactly* what you are patching. Remember, the cords with the 3-conductor plugs are used for d.c. patching; those with 2-conductor plugs for a.c. (audio); and, the cords with twin 2-conductor plugs for d.c. signal patching on the jack strip. Always insert *both* of these plugs with the knurled edge to the left to prevent an inadvertent turn-over.

Power Supply Adjustment: To set up the correct output of the tube rectifier, turn the meter knob to the d.c. position and patch the DC METER jack to the PLT V TST jack on the jack panel. (Be sure to use the cord with the 3-conductor plugs.) Adjust the control *R*, through the hole in the cover, until the meter reads 65. This is 130 volts as full scale is 200 volts; as per the table in the November '65 RTTY Column. Recheck after 20 minutes. If you have also the disc rectifier, patch the DC METER to TLG V TST and adjust the COARSE and FINE knobs on this unit to get a reading of 65, ± 2 (130 volts ± 4 volts).

Current Limiter Adjustment: Turn the meter knob to the a.c. position and patch the NORMAL TEST LEVEL (on the frequency indicator panel) to the AC METER jack, using a cord with 2-conductor plugs. Note and record the meter reading; then remove the patch. Now, patch the NORMAL TEST LEVEL to the channel *B* INP FILT IN jack, using a cord with 2-conductor plugs. Then, patch the channel *B* CURR LIM OUT jack to the AC METER, using a cord with 2-conductor plugs. Adjust the control OUT on the current limiter *B* panel to obtain the same reading as noted and recorded above. That sets up channel *B*. Repeat the same procedure for channel *A*.

Detector Adjustment: Begin by inserting open circuit 'phone plugs into the CURR LIM OUT jacks of current limiter *A* and current limiter *B*. Now, concentrating on channel *A*, patch the NORMAL TEST LEVEL to the PAD IN jack, and the PAD OUT jack to the M DET IN jack. Turn the ADJ M REC GAIN control of channel *A* maximum clockwise. Switch the meter switch to d.c. and patch the CURRENT REC REL 1 jack to the DC METER jack. Note and record the meter reading, which should be plus and between 20 and 40. The next step is to press and hold in the ADJ REC GAIN button of channel *A* and turn the ADJ M REC GAIN counterclockwise until the meter reading is one-half that noted immediately above. Next, patch the PAD OUT jack to the S DET IN jack and turn the ADJ S REC GAIN control of channel *A* maximum clockwise. Note and record the meter reading, which should be *minus* and between 20 and 40. Press and hold in again the ADJ REC GAIN button of channel *A* and turn the ADJ S REC GAIN control counterclockwise until the meter reading is one-half that noted directly above. Repeat the whole procedure, as detailed, for channel *B* this time.

Frequency Indicator Adjustment: Feed in to the INPUT FILT IN jack on current limiter *A* (open circuit plug in channel *B*) the output from an a.f.s.k. oscillator *known* to be reasonably accurate on 2125 cycles. Turn the METER switch to the d.c. position and patch the DC METER jack to the FREQ IND OUT jack, using the d.c. patch cord with 3-conductor plugs. Now, depress and hold in the FREQ IND CAL button. Adjust the ZERO ADJ control to obtain a zero meter reading. Release the button and remove the patch cord, the open circuit plug, and the input feed.

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

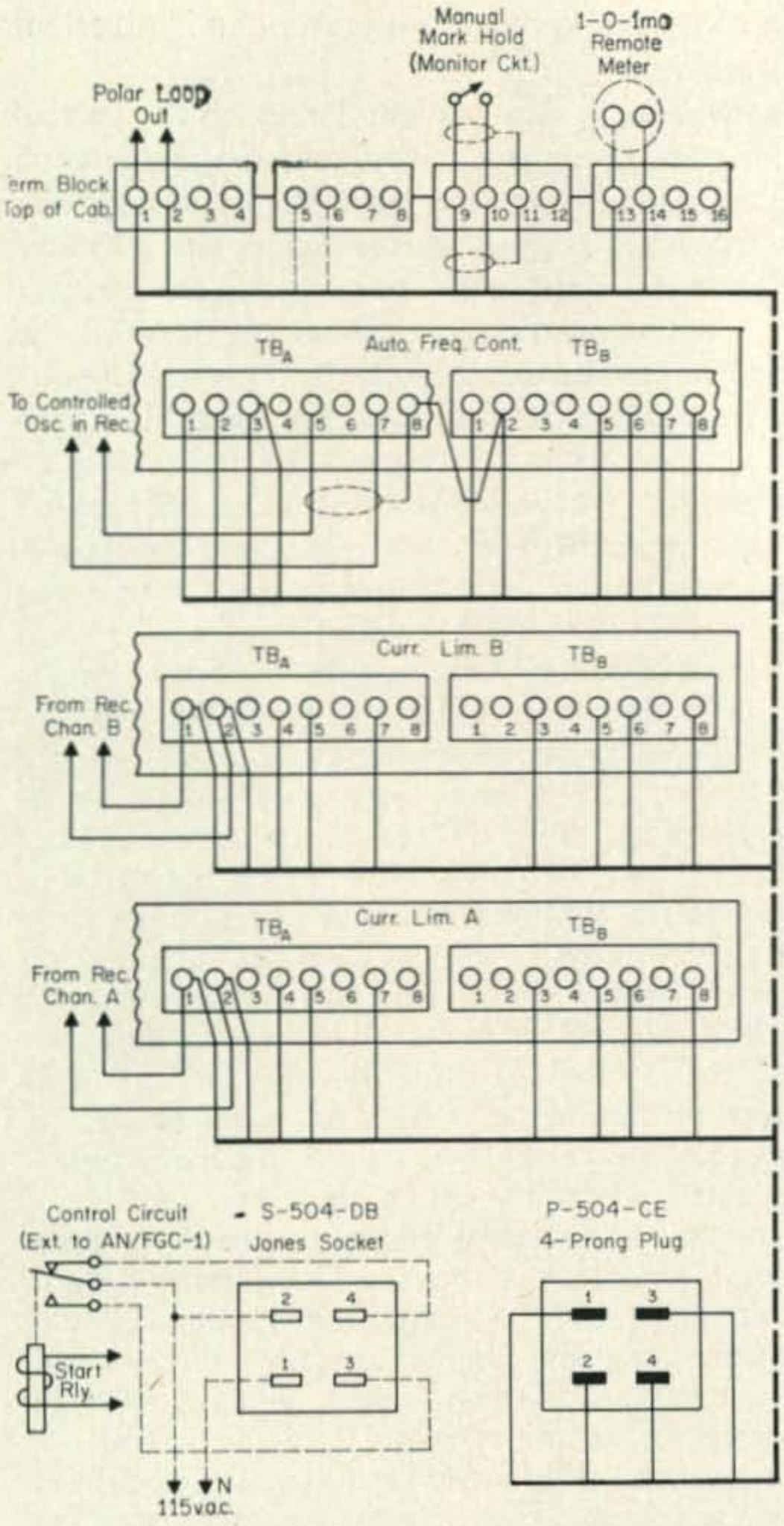


Fig. 1—External connections to the AN/FGC-1. The internal cabling shown is for only those units, or terminal blocks, to which external connections are made.

There is provision for the use of a remote meter at the radio receivers, and since the AN/FGC-1 is often located away from the receivers, this can be extremely useful. The meter required is a 1-0-1 ma meter. Connection is made at terminals 13 and 14 on the terminal block at the top of the cabinet. These connect, via cabinet wiring, to terminals 5 and 6 on terminal board *A* on the frequency indicator panel. Inserting a patch cord into the FREQ IND OUT jack automatically disconnects the remote meter.

If the AN/FGC-1 is fed from only one receiver, the audio input terminals are 1 and 2 on terminal board *A* on both limiter panels and they can be tied in parallel. Using the meter as a turning indicator, the receiver is tuned to an RTTY signal, sending tape preferably, until the meter is most nearly steady. The point of minimum fluctuation will be at *O* if the station being copied is using the correct shift (850 cps). If the *steady* reading is to the right of zero, the shift is too wide, and if to the left, the shift is short. Six times the steady meter reading gives the departure, in cps, from the correct shift.

AFC Unit Adjustment: As was suggested for the frequency indicator adjustment, feed in an *accurate* 2125 cps signal. Turn the METER switch to the d.c. position and patch the DC METER to the FREQ IND OUT jack, using a patch cord with 3-conductor plugs. Turn the AFC switch to OFF, press and release the AFC DISCHG button. (The meter should read zero.) Turn the AFC switch to the ON position and allow about half a minute for conditions to stabilize, then adjust the FREQ ADJ control on the a.f.c. panel to set the meter back on zero. Remove the test signal and feed in the receivers. It is suggested that all receiver tuning be done with the AFC switch OFF, switching it back on as soon as the signal has been tuned for minimum fluctuation.

External Connections

Figure 1 is a partial cabling diagram of the AN/FGC-1 cabinet. Shown only are those terminals to which external connections are made. Note, too, that many of these cabinets are supplied without the automatic frequency control unit. The manual mark hold or monitoring circuit, terminals 9 and 10 on the terminal block at the top, was explained in Part IV (Oct. '65), and the frequency meter circuits in Part V (Nov. '65). The dotted lines to terminals 5 and 6 on the block at the top of the cabinet indicates wiring that may be added to connect with the "back contacts" on the REL OUT 2 jacks so that a second polar output circuit may be obtained when the AN/FGC-1 is used in non-diversity as separate terminal units. (More about this at another time.)

The a.c. input control circuit shown is similar to that found in the AN/FRR-3 receiver bay, usually associated with the AN/FGC-1. The "start" relay is used to control the heat lamps in the base of the AN/FGC-1. You don't need that king-size 4-prong plug and socket (even if you had the socket!), of course. If you don't mind the heat lamps (50-watts, each) being on with the TU, simply tie the wires that went to plug terminals 2, 3, and 4 together and connect to the hot side of the a.c. line, perhaps through a switch. The wire went to terminal 1 on the plug then connects to the grounded neutral side of the a.c. line.

Comments

We regret that space is a little short this month so the "On the Bauds" section was omitted. Stay tuned in, like next month, and find out who is on what in *your* area.

Lately we have been getting many requests for information on where to find those commercial surplus (retired police and taxi) f.m. sets that have been enjoying increasing popularity on 6 and 2 meters. Recent word is that these sets, GE, Bendix, Link, and Motorola, are now available at the Suffolk Radio Corporation, Island Industrial Park, 225 West Main Street, Patchogue, N.Y. Write them for a list. They are open Saturdays between 10 a.m. and 2 p.m., too.

73, Byron, W2JTP

YL

LOUISA B. SANDO,* W5RZJ

THOUGH they are not great in number, the YLs of India have been receiving quite a bit of publicity recently—with a YL issue of the Bangalore Radio Club magazine *SIRAN*, in *QST*, and now *CQ*. With their fine spirit and working under the handicaps they do, we are glad to give them special recognition.

At this writing (Nov. '65) there are six YL hams in India: VU2's LA, EV, LD, YL, QFZ, LYZ (the last two being Grade II-Novice- license holders). VU2YL (originally held by Mrs. B. M. Chakravarti, YF of VU2BU) is now held by Mrs. Audry King, YF of Col. Lesley King, VU2AK, at Jabbalpore. She uses her OM's rig.

VU2QFZ, the 2nd YL ham, is Miss Sipra Banerjee, a student at the Indian Institute of Technology at Kharapur. Third YL ham is Miss S. Lalitha, VU2LA, who so kindly sent most of this information on the VU2 YLs. The fourth is Miss K. R. Shantha, VU2EV, YL Editor of *SIRAN*. She is an engineer in the R & D Dept. of M/S Bharat Electronics Ltd., the leading electronic industry of India. She is active on the 7 mc band mostly working VUs with her QRP rig.

The fifth YL ham is Miss Ranjanbala R. Desai. VU2LYZ, and OM G. V. Sulu, Editor of *SIRAN*, tells us she is 18 years old, the youngest YL in India. She became interested while studying for the 10th standard in the Bai Avabai High School at Bulsar, through the school club station VU2HS. Currently Miss Desai is in her final year working on her Bachelor of Science degree with mathematics as her major and statistics and physics as additional subjects, and of course is QRL with her studies. After completing her B.Sc. she plans to take a post graduate science course.

The sixth YL is Mrs. Lakshmi Durvasula, VU2LD, who also works as an engineer in M/S Bharat Electronics Ltd. in their Measuring Instruments Div. She plans to go to England for higher studies in electronics and if time permits she plans to take a G ticket also.

Miss Lalitha adds that Miss Kasthuri Bhavani of the Bangalore YL group, another engineer with M/S B.E.L., has passed the qualifying test and will have her ticket soon, to become YL number seven. Another six YLs were planning to take the qualifying test in December. Three received their training from Miss Lalitha and the rest from VU2EV.

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

It was Miss Lalitha who founded the first YL Group in India, as part of the Bangalore Radio Club. For this and her very active part in teaching the YLs, and for other services rendered by her to the club Miss Lalitha, VU2LA, was chosen as "Bangalore Ham of the Year" for 1964 and received a Citation for her contributions to the club and to the YL ham movement in India.

Miss Lalitha is 24. She holds a diploma in radio engineering and after working for a time in the local electronic and radar development company she took up teaching. She got her license with the help of VU2BZ and received her call, VU2LA, in '64. Her gear consists of a BC-348 receiver, 18-watt transmitter, with 6L6 final, and long wire antenna. Operation is mostly on 7 Mc, but she is working on a 40-watt rig with 807 final and with it and a better antenna she is looking forward to working W/K land.

As for the handicaps facing YLs in India, Miss Lalitha explains that hamming is not yet popular in India. Getting good equipment is a big problem. The existing ham activity in India is largely due to availability of WW II surplus gear, and this is nearly exhausted. What is available is expensive; for instance, a used BC-348 receiver costs about Rs 400/-($80), about a month's salary for a new electronics engineer. And due to the acute shortage of foreign exchange they cannot import ham gear.

She adds that the traditional conservative attitude of the people also makes hamming a bit difficult for their YLs and if one fails the qualifying test on the first attempt she gives up the hobby itself. Despite this Miss Lalitha and her YL Group look forward optimistically to popularizing this hobby among the women of India. And in this, may we wish you most success!

ET3USA Achievement Award

You may have read in W2GT's column of the newly available ET3USA Achievement Award. It is presented by the Kagnew Station ARC, Asmara, Ethiopia, to amateurs and SWLs for work-

Some members of the YL Group at Bangalore, India. L. to r., VU2LA, Miss S. Lalitha, organizer of the group; VU2EV, Miss K. R. Shantha, YL Editor of the magazine SIRAN; Miss Jamuna and Miss Ramamani (the latter two are awaiting their licenses).

VU2LYZ, Miss Ranjanbala Desai, pictured at school club station VU2HS. At 18 Miss Desai is the youngest YL in India.

Mrs. Lakshmi Durvasula, VU2LD.

ing or logging different Ethiopian stations (ET3, 9E3 or 9F3 prefixes) and/or different operators of Ethiopian club station ET3USA/9E3USA/9F3USA. (Check W2GT column for full rules.) Custodian is Al Kemmesies, K1QHP/1, former president of Kagnew ARC, ET3USA.

Al tells us the first two ET3USA awards have been made to YLs: No. 1 to DJ9SB, Renny Krause, whose award is endorsed as 1st for Germany, Europe and worldwide; 1st all c.w. and 1st to YL. No. 2 went to PY2SO, Sonia Rotenberg, whose award is endorsed as 1st to YL in PY and South America and 1st on all 14 mc c.w. Al feels there are probably many more YLs eligible for the ET3USA award.

Our thanks to Al, K1QHP/1 for the info and pix.

Here and There

A P.S. to our report in Jan. *C.Q.* of G2YL's travels in the U.S. Nell just missed the Northeast "blackout" (visiting across the river in New Jersey). In New York she met W2EEO, W2OWL, W2JZX and others when the N.Y.C. YLRL held a luncheon for her on Nov. 13 with 14 YLs attending. On the 16th Nell flew back to England.

The Portland Roses began their 11th year as a club by electing these officers: Pres., W7GRC, Lill; V.P., W7QKU, Donna; secy., K7BED, Bettie; treas., W7NOK, Pat, and P/C, W7REU, Dorthie.

It is constantly being brought home to us what interesting people most ham operators are. If you don't think so, read the *SSB'ERS VOICE*, edited by K4ICA, V. Mayree. In the October '65 issue we were especially impressed by the work and words of Fr. David Reddy, O.F.M., K2BUI (FP8DR), as Priest, teacher, student, Scoutmaster and ham operator.

Congratulations to you, V. Mayree, for the very fine calibre of your publication and the interesting material you share with all. YL International SSB'ERS, Inc. membership includes more than five thousand Hams in 220 countries, all States, all Continents and all 40 Zones.

YLRL

Word from YLRL President WØHJL, Kayla, that the receiving treasurer for 1965, K1OLM, Joyce Garlick, has resigned. Temporarily the receiving treasurer's duties will be handled by the President's Advisory Committee. Send your YLRL dues to Blanche Randles, K1IZT, 62 Linda Ave., Framingham, Mass.

On a flying trip down to Albuquerque, Kayla also brought us results of the Howdy Days contest: First place was a tie between VE3BII and K4RNS with 94 points each. Others included: K5YIB 71, WA8FSX 28, W6DXI 26, K6KCI 20, WA8ARJ 20, W1ZEN 19, K8VCB 15, WA6UBU 12. To the other 80 plus YLs who participated, where were your logs?

Kayla has appointed WA4BMC, Berath Farr Eggert, as YLRL Sunshine Chairman. It seems Bertha has for some time been sending birthday and anniversary greetings to the YLs when she had the proper dates. She volunteered to continue, so Kayla has made it "official." If your birthday and/or anniversary did not appear in the last YLRL Directory, Kayla suggests you send a card to Bertha with this information, and adds, "Your OM may forget, but Bertha will remember!"

33—W5RZJ

DJ9SB, Renny, in her shack at Mannheim. She is a member of CHC, NAHC, RCC, GAARC, HSC (only YL in Europe), Int. SSB'ERS. She won first place Europe in YL/OM contests in '64 and '65, and holds #1 YL certificates from YO DX Club, WHSC and ET3USA. Renny loves cw operation, travel, eyeball QSOs, music, painting, photography, languages, gardening and correspondence. Her OM is DJ4SB. (Photo by Al, K1QHP/1.)

Amateur Radio [*from page 71*]

amateur radio stations on the air greatly exceeded the number of coastal and ship stations—a fact that should qualify amateur radio as the "dean" of the radio services.

Pioneer Spirit

From the very beginning, the radio amateur has been a pioneer. He "tinkers" and "toys," he "tries this" and then "tries that," always with the purpose of extending the range of communication or increasing operator efficiency.

Space limitations will not permit a detailed review of all the contributions made by the amateur radio service to the field of radio communications. Radio amateurs were, however, the first to demonstrate the enormous usefulness of short waves, and they also pioneered the use of the v.h.f. and u.h.f. regions of the radio spectrum. They were among the first to devise practical transmitting and receiving equipment using vacuum tubes, and they have contributed much to radio propagation research. Amateur radio was the first service to completely outlaw spark transmissions and among the first to utilize c.w. Amateurs have also led the field in devising techniques to reduce interference so that greater use can be made of the radio spectrum. Suffice to say that since its birth, amateur radio has been a clearinghouse for ideas, and a "proving ground" for almost every major technical and operational development in the field of radio communications.

Emergency Work

From the early days, amateur radio has earned an outstanding reputation for providing communications during emergencies, when other means of communication fail or are overloaded. The annals of amateur radio contain an impressive record of countless emergencies, natural catastrophies, epidemics, etc., in which radio amateurs, with skill and devotion, and frequently at personal sacrifice, have served their communities and brought speedy relief to victims of suffering and need. Many thousands of lives, an untold amount of human misery and millions of dollars in property have been saved by their efforts. Radio amateurs consider such assistance not a duty, but an opportunity to serve humanity.

Training Ground

Amateur radio, with the world as its classroom, is a great training school for the entire field of electronics. What better way is there to learn about radio communications, than by participating in it? Through amateur radio, one can train oneself and acquire skill and practical experience in a complex field. From the ranks of amateur radio over the years has come an army of trained technicians, operators and instructors.

Amateur radio also provides a spark that can set the inquisitive mind afire. Many of the world's leading telecommunication officials and communication engineers can trace their first interest in these fields to participation in amateur radio. Many of the young radio amateurs of today will be the professional engineers and scientists of tomorrow.

Space Exploration

Space exploration opened a new era for amateur radio, as indeed it did for all communication services. Amateur radio entered the space age on December 12, 1961, with the successful launching of the OSCAR I satellite (*O*rbiting *S*atellite *C*arrying *A*mateur *R*adio). Built entirely by radio amateurs, and containing a beacon transmitter operating in the 2 meter amateur band, observers in thirty countries tracked the satellite as it orbited for a three-week period. This was followed by the successful launching of a second OSCAR beacon satellite in June, 1962. Now, almost at this moment, radio amateurs are standing by throughout the world awaiting the imminent launch of OSCAR III.[1] This will be an active communication satellite capable of receiving and relaying signals in a portion of the 2-meter band.

Frequency Congestion

The amateur service, perhaps more so than any other radio service, is feeling the pinch caused by the congestion in the short-wave bands. There are more stations operating per kilocycle in the amateur bands than in those allocated to other services. To make efficient operation possible under such conditions, over the years the amateur service has adhered to a technical development program stressing the use of narrow band emission techniques, reductions in receiver bandwidths, use of directional antennas and transferring operations to the v.h.f. and u.h.f. bands wherever this is technically possible. Many of the techniques developed by the amateur service to reduce congestion have set the example for other services.

Amateur radio is dynamic and its future looks even more exciting than its past. From its beginning at the turn of the century, amateur radio has grown to where there are now approximately 400,000 duly authorized persons participating in this service. Radio amateurs are now located in nearly every country of the world, with the greatest concentration in North America and Europe. It is estimated that the number will rise to above the 650,000 mark by the end of this decade.

In the years ahead, amateur radio looks toward increased technical assistance to "new and developing countries." Its long history shows that radio amateurs comprise a reservoir of trained operating and technical personnel. By encouraging and assisting in the development of amateur radio in these countries, it is hoped to provide a source of trained communication

[*Continued on page 107*]

[1]Since this article was written, OSCAR III was successfully launched and more than 200 two-way contacts were made through the satellite, during the period March 9-24, 1965. OSCAR IV, another active communications satellite, was launched on Dec. 21, 1965, and is now in operation, although somewhat erratically.

Surplus Sidelights

BY GORDON ELIOT WHITE*

THIS is the opening effort in a column on news of surplus electronics. It will not pick up precisely where Ken Grayson, W2HDM, left off in March, 1961, but it will accept Ken's view that surplus, military and commercial, is one of the greatest sources of high-quality material for the ham shack.

Surplus is big business; the General Services Administration and private corporations sell hundreds of millions of dollars a year worth of electronic equipment at a few cents on the dollar of the original list cost. Top-quality aircraft receivers costing $7,500 new, go for well under $100. Teletype Corporation machines sell for $50 to $100 compared to their original $3,000 cost, and most are probably given away for hauling costs.

Rather than deal in specific conversions of popular military sets, worked out in detail, as Ken did them from 1958 through 1961, we will attempt to tell you what's available, give a few of the vital statistics on some surplus components, and leave the wiring changes up to the individual ham. We suspect that everyone has his own ideas on conversions to suit his own aims, and has no need of point-to-point instructions in the manner of the electronic kit builder.

Being located in Washington, D.C., we have unusually good access to tech manual libraries in the Pentagon, BuShips, BuPers, the Commerce Department, and the Library of Congress. We have clearances which allow us, on special application, to see Signal Corps and Naval Operations files, and the National Archives.

We have dug through files at the Air Force University at Maxwell Air Force Base, through the Air Force Museum at Wright-Patterson AFB, and have corresponded with Signal Corps, Navy, and Air Force radio engineers around the world. All this gives us some insight into surplus electronics from World War I through the current unpleasantness in Viet Nam. We hope to make some of this available to the amateur ranks through this column.

We do not plan to make this a letters column, but we do welcome any questions or suggestions, particularly data, on specific items of gear likely to find their way into the hands of amateurs. If there is demand for information on one set or another we will run it in the column as space permits.

*5716 N. King's Highway, Alexandria, Virginia, 22303.

To start off, we want to mention a very fine Collins transmitter-receiver set which will be turning up in surplus stocks in the next few years, the AN/ARC-58. One or two are carried in almost every B-52 jet bomber or KC-135 jet tanker, and as the bomber force is cut back AN/ARC-58 sets will be appearing in reasonable numbers. So far the units are relatively rare, consisting of early or experimental models, damaged sets, or other odd items.

The AN/ARC-58 is a crystal-synthesis set covering 2-30 megacycles in 1 kc steps (28,000 channels). It has a design stability at 30 mc of less than 30 cycles drift per month! Compare that to your better amateur equipment which may be guaranteed to drift no more than 100 cycles in a half hour. Consider too that the AN/ARC-58 was used in aircraft under wide temperature, altitude, and vibration fluctuations. It uses a crystal oven, of course, and automatic frequency-corrective circuits. Single sideband sensitivity is rated at 1 microvolt for 10 db signal plus noise to noise ratio. A.m. sensitivity is better than two microvolts.

With upper and lower sideband, a.m. and FSK modes, the AN/ARC-58 is a most versatile performer. It is quite complex however, and should not be considered in the Command Set category for ease of maintenance.

Nominal transmitter output is 1 kw, at the above-mentioned stability.

Components include the R-761 and R-1149 receivers, the T-605 transmitter, a power supply, antenna tuner, cooling air blower, and control box, C-1939. For amateur use the correct control head is almost a necessity, as tuning is done by servo motors through a highly complex network of switches in the frequency-selector control. The two receivers are virtually identical, but the R-1149 has a clock indicating total time in use.

The AN/ARC-58 requires 28 volts for the tube filaments, and the input of the d.c. to d.c. converter which supplies B+ power. It needs a rather light 400 cycle a.c. supply to drive the servos, but the current could easily be supplied by a small 28 volt inverter.

The transmitter and receiver are built in identical 10¼" wide ATR cases, 25" deep and 7" high, weighing about 48 pounds apiece.

The AN/ARC-58 has the same specs as the Collins commercial 618-T set, but the commercial modei is contained in a single case.

The tech manuals for the AN/ARC-58 are Air Force Technical Orders 12R2-2ARC58-2, -2H and -2J. They are not widely available on the surplus market, but may be ordered from Warner-Robins Air Material Area for $7.00 (checks should be written to the Treasurer of the United States. Send two copies of your order to the Accounting and Finance Office, (CA), c/o WRNST, Robins AFB, Georgia)

Incidentally, the 55-pin connectors are scarce too. Better try to find them with the receiver and transmitter units if you can.

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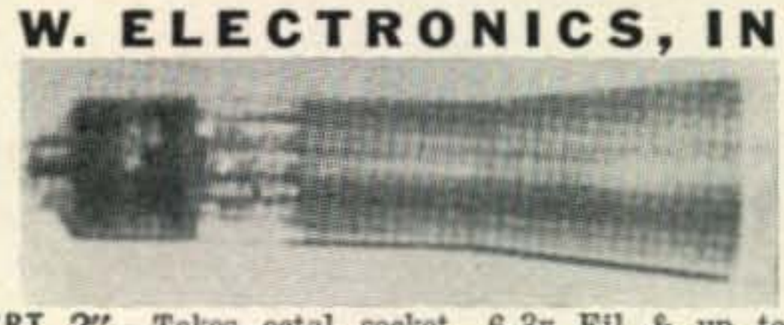

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National Guard field, you might be able, as we were, to get your set checked out, at least to see if it works, since they will have the big Collins test bench. We find that the greatest single time saver in surplus work is finding out if the unit operates *before* we dig into it.

The AN/ARC-58 is approximately identical to the Marine Corps AN/TRC-75, which is a jeep-mounted version.
goes on the military aircraft market at from $200 to $900. You might be able to pick one up cheaply in a government sale, through MARS or CAP, but not, just yet, through your friendly surplus dealer. This beautiful set is in demand by countries who get U.S. military gear in foreign

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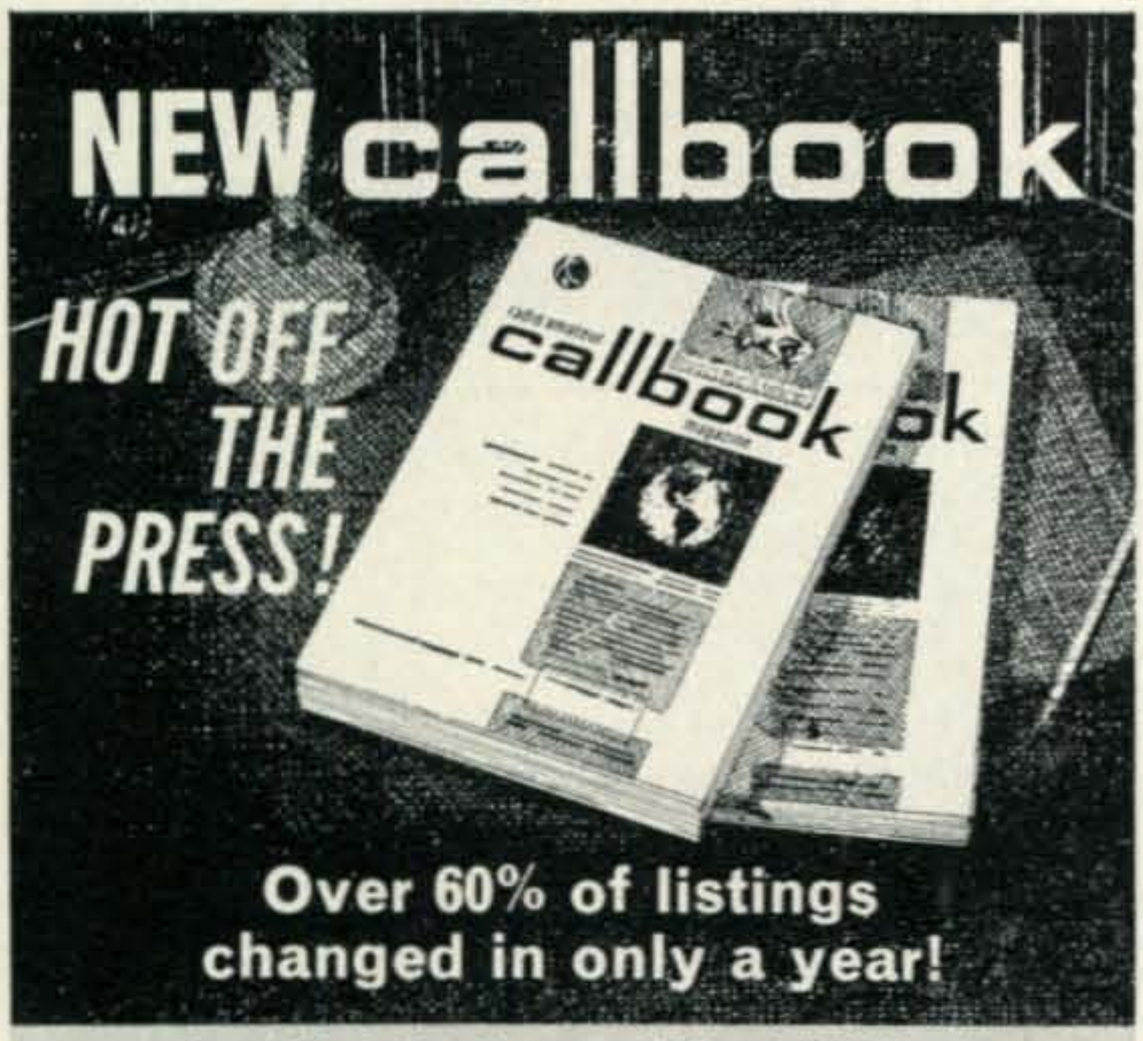

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aid and buy spare parts from U.S. export dealers.

Another, slightly less glamorous surplus item is the AN/ART-28, one of several we have had queries about recently. This is used by Navy Radar "Connies" on ocean patrol as an extension of the land-based warning net.

The AN/ART-28 is primarily designed to send radar information from an early warning radar set in the aircraft to a receiving station on shore. It transmits the map-like plan position indicator (PPI) image back home, or may act as a relay for another plane farther from shore.

The AN/ART-28 could also be used aboard radar picket ships in some circumstances. It operates with AN/APS-20 and AN/ARR-27 radar and radio equipment, the latter designed to look at the other side's radar emissions.

The AN/ART-28 covers 460-510 mc, normally in crystal-controlled channels at 464.87, 477.43, and 502.56 mc. Its carrier is pulse-modulated at 300 cycles per second in complex coded form. An unmodulated output of 20 watts rises to 400 watts at peak synchronized output.

Power required is 115 volts a.c. at at least 320 cycles at 2.5 amps, plus 6 amps at 28 volts d.c.

The transmitter section is the T-271 and the power supply nomenclature is PP-615. The transmitter weighs 43 pounds and is about 11" wide, 8" high and 20" deep. It has plate meters on the front panel and all controls, being designed for local operation.

The tech manual is AN 16-30ART28-1, -2. The set was built by Westinghouse in the early 1950's and ought to be pretty cheap in surplus. It might make a fair ham TV transmitter, properly converted. 73, Gordan

Ham Clinic [*from page 76*]

I do not recommend tearing up this fine set to go on 6 meters. If someone owning a Warrior has converted it to 6 meters and it works well, we'd like to publish the details here.

Thirty

HAM CLINIC is the only column in the ham radio-world that offers a technical service to its readers without fee; because of this, we do receive piles of mail. It is true that we do not have the answers to all questions but we try our level best to give you the information you seek on equipment trouble-shooting, surplus gear, transistors, etc., and even on non-technical problems.

Catching up on our mail in the spare-time available occupies a number of hours each month, but as long as we are contributing something to amateur radio by doing it we feel that the time is well spent.

Although we try to answer letters as quickly as we can we usually have a back-log. We ask only that you enclose 2 IRC's for airmail postage when you write to us at our present overseas address. (4 Lutzelmatt Str. Luzern, Switzerland.) Please be patient. If time means nothing to you then direct your letters to us at *CQ* Headquarters.

We always welcome technical tips to pass on to our readers. When your item appears it is read by thousands of readers and *you* help those interested in the same fine hobby as yourself—amateur radio.

Until next month then, our Valentine greetings to you. 73 and 75 Chuck, W6QLV

Contest Calendar [*from page 85*]

quencies and give the gals a few contacts.

W5RZJ, Louisa gave all the details in her column last month.

B E R U

Starts: 0001 GMT Saturday, March 19.
Ends: 2359 GMT Sunday, March 20.

This activity in its 29th year is sponsored by the RSGB and is open to stations in the British Commonwealth only. This announcement therefore is directed to our Canadian friends and other British areas.

You can write to me for a copy of the rules. Log sheets and rules are available from the RSGB on request.

Contest entries must be postmarked no later than April 12th and they go to: RSGB Contest Committee, 28 Little Russell Street, London, W.C.1, England.

Editors Notes

Conditions for the c.w. section of our contest were somewhat disappointing. Although WWV was sending N6 most of the week-end the MUF evidently did not reach 28 mc. Unlike the phone week-end when we had some surprisingly good openings on 10, the band was absolutely dead on c.w.

As in the past the 20 meter band carried most of the load, with 15 doing its share the short time the band was open to Europe. After that it was hunting around for additional multipliers. The lower frequency bands 40, 80 and even 160 showed their share of activity during the favorable hours to the respective bands.

This year I decided to give all bands a go so as to get a better picture of what was going on, and W1WY finally worked his first JA on 40, at 7 A.M. local time. A telrex inverted V did the trick.

We are happy to see many new calls and first timers in the incoming logs. Most of the old stand-bys were in there, especially in the multi-operator divisions where there was some keen competition.

Also heard were the usual "muscle-flexers" and "I'm only looking for new countries" guys, who never have the courtesy of sending in a report. It has always been a revelation to us to receive logs with only a handful of contacts from stations in far away Japan but nothing from our own W/K stations whom we know made scores of contest contacts.

I wonder if all that activity and those "rare new ones" would be there to work if it was not for the activity created by the contest.

73 for now, Frank, W1WY

Heathkit HA-14 linear [*from page 53*]

would require about 1200 watts (assuming 90% efficiency), or approximately 90 a. at 13 volts; however, the basic theory of what takes place here is that the switching transistors tend to cease operation when the current reaches 50 amperes. The additional peak-current requirements are then supplied by the voltage to which the high-capacitance filter which is charged when the current demand is low and the voltage is high, which occurs during the time between s.s.b. modulation peaks.

In any event, a husky alternator-type battery-charging system is recommended with a 50-ampere battery for mobile operation where the additional current drain of the exciter also must be considered. Then too, don't forget that it may be necessary to use the headlights or other car accessories at the same time!

Performance

We were quite surprised to see how well this little package really performed. Using the a.c. power supply with 120 volts input under full load, 100 watts of steady drive produced a d.c. input to the linear of one kilowatt with an output of 600-550 watts, depending on the band used. With s.s.b. modulation the p.e.p. ran to a little under 1200 watts input and to 700 watts output (slightly less on 15 and 10 meters).

Due to low filament voltage (during full load) from the original HP-24 a.c. power supply which was furnished with the amplifier, it was not possible to realize the aforementioned power capabilities. A drop of .25 volts in each filament-supply lead in the 10-foot cable to the power supply also contributed to inadequate filament voltage. The power transformer deficiency has since been corrected by the manufacturer, but in any event, it is recommended that the leads to the power supply be made no longer than absolutely necessary.

Due to the current-limiting action that takes place in the 12 v.d.c. supply during use as mentioned earlier, the amplifier cannot be driven to a steady d.c. input of more than 400-500 watts and reliance must be made on the filter capacitors to supply the 1 kw peak s.s.b. power. The rated peak power actually was obtainable with normal voice modulation, as measured during our tests while using the mobile supply; however, excess use of a.l.c. either at the exciter or from the linear will hold down the peak power, inasmuch as the filter capacitors then cannot charge up sufficiently due to the greater average power demand.

The Heathkit HA-14 "KW Kompact" Linear Amplifier is a little package with a mighty wallop at a cost of $99.95 for the kit. The HP-24 a.c. power supply kit is $49.95 and the HP-14 12. v.d.c. model is $89.95. They are products of the Heath Company, Benton Harbor, Michigan.—W2AEF

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For further information, check number 30, on page 112

Mobile in Morocco [*from page 51*]

understood without any difficulty, unless he can speak Arabic.

Back North

So we returned on splendid roads back towards the North, passed Agadir so sadly destroyed by the earthquake, and now being rebuilt, to Essaouira, that lovely old Portuguese fortified Port.

Between Agadir and Essaouira we made a mobile QSO with 9M4MF in Singapore to complete WAC Mobile from Morocco. I'm not sure who was more thrilled, he or I. He, because it was his first Mobile in Morocco, and I, because it made my WAC/Mobile.

Here once again CN8BS met us and we spent the night at a wonderful hotel on the coast. Then North again on superbly fast roads to Rabat, where we met many more of our friends. The amateurs of Rabat had made the trip memorable. CN8BB, Roger, who has just moved from Marrakech to Rabat had entertained us at a memorable dinner.

Now, on the way back we were greeted by Pierre (CN8BV) and Hamid (CN8MT) who invited us to dine next day at Hamid's house where all the Rabat amateurs assembled—CN8MT and XYL, and her sister: CN8BB and XYL: CN8BV and XYL: CN8MZ and XYL, who is licensed in her own right as CN8CC: CN2BS: my two friends Mr. & Mrs. Freestone; and G3BID.

In particular, our thanks are due to—CN2BS, CN8BV, CN8MT, CN8BS, CN8AU, CN8AW, CN8AI and CN8BC who made our trip so memorable, and especially to CN2BS and CN8-BV who managed to get us the license; to CN8BS who accompanied us far to the South and entertained us right royally for days on end, and to CN8MT who entertained us in his lovely home in Rabat with one of the most sumptuous and delicious Moroccan meals imaginable.

On the radio side the following are samples of the contacts made: From Marrakech we worked KX6DQ; FK8AU; a number of Gs, Fs and WØBJV; W3MSK; WØQUU; W8ECA; W8NGO; KA1RR; ZS1TP; VE3OFG; 7Q7PBD.

From Ouarzazate we worked EI8H; PZ1AX; ET3DR; 9GICC; 7Q7GS; ZS6AZD; FG7XL; ZS6OS.

En route from Ouarzazate via Agdz to Tazenakhte we worked—OE1FF; I1TWA; HB9-KB; HB9AFM; K1YZW; W2PEO; W1BU; W2LEC; W3HYH; etc.

En route from Taliouine to Taroudant we worked—W9HSP; K9YLG.

En route from Agadir to Tiznit, we worked—UWØIN; YV3CN; K2SAO; W2PEO; W2FWZ.

En route from Tiznit to Tafraoute we worked—LA9LE; 5A1TT (with whom we held a long QSO); SVØWGG; W3TOO; W2LV; W2BXA; K1YZW; W9JOV; W4MVB; W9VSO.

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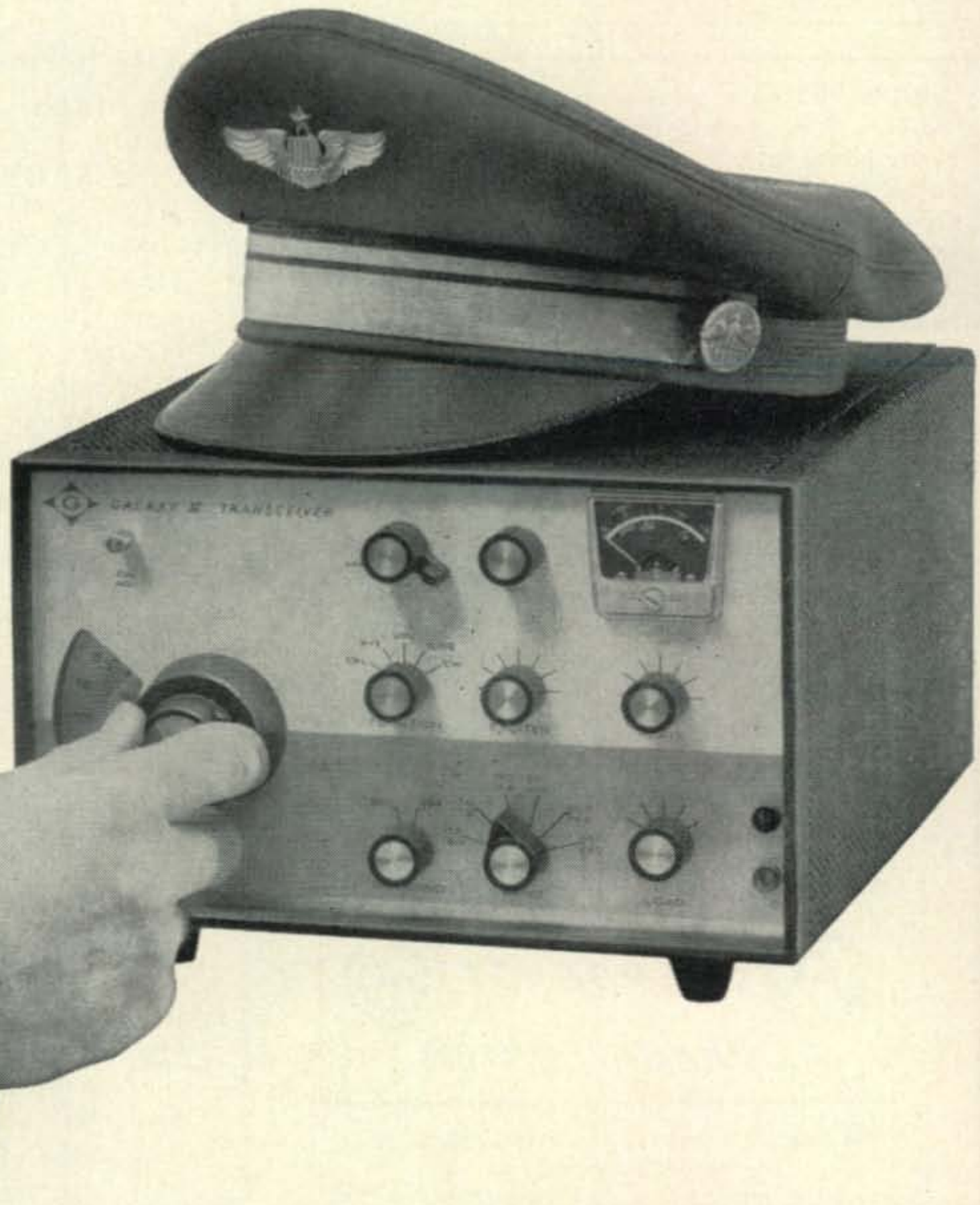

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For further information, check number 33, on page 112

mountains, we worked—VE3CFG; 7Q7PBD; VE5VL; VE2BLT; VE2IK; F9VK; F3LL/P; F2KP/P; W8HQO; 9G1DY; 9L1JR; W8LUZ.

From Goulimine in the very South, we worked —K1YZW; W2OKM; W2AWU; W8GMF; WA2CYQ.

On the return route up the coast from Tiznit via Agadir, Essaouira to Rabat, we worked—9M4MF; W2BXA; W4OM; SM6BDI; VE3BWY; WA2TAQ; ZD5R; KP4BCL; W2JSX; WA2SFP; SL6BH; 5A1TT; W1BFA; SZ4AA; SM5RQ/M (Mobile to Mobile) as well as many Gs and other Europeans. ■

Club Forum [*from page 17*]

The fall semester boasts eighty electronic majors. Its good to know that such highly knowledgeable people have an interest in amateur radio. It will give our image a shot in the arm. Incidentally a state wide junior college amateur radio network is in the offering and the CLUB FORUM will keep those California hams that are interested informed as to time day and frequency when the info is available. 73, A1, WA2TAQ

VHF [*from page 82*]

Vic Michael, W3SDZ, Milton, Pennsylvania: "In case you haven't heard, the results of the test from K2MWA/2 were as follows: W1BU operated by W1HIV made the only actual two way contact. The system at K2MWA was working extremely well, and they were hearing their own echoes better than anything I've ever heard, outside of KP4BPZ's s.s.b. echoes at Arecibo. They copied signals from W9HGE and W3SRZ that were Q5 copy at K2MWA, but both W9HGE and W3SDZ could not get Q5 copy of the K2MWA signal. This was due to both lower power output a K2MWA and poorer receiving front ends at our stations." *Vic has recently taken on the writing of a moonbounce column for the VHFER magazine, an endeavor in which we wish him much good luck. The VHFER is a fine small magazine published by Loren Parks, K7AAD, of Parks Laboratories, Beaverton, Oregon, and is certainly worth looking into.*

Robert Brickey, W7QAC, Orem, Utah: "After many hours of hard work and considerable expense, the Utah Relay Club now has an operating two-meter repeater atop 7700-ft. Lake Mountain in Utah. *Congratulations!*

"The repeater is u.h.f. controlled from three different remote-control locations in Utah Valley. The repeater is installed at the location of an old television transmitter, in facilities which are now owned by Lake Mountain Industries, Incorporated. The site is an excellent location for v.h.f. operation and provides coverage over a wdie area in Utah and parts of Southern Idaho."

Correction

In the Century Club rules box on page 76 last month, the number of cards required for 432 and 220 mc were incorrect. It should have read: 25 QSL cards on 220 mc and 25 QSL's on 432. Our apologies for the error.

CQ TECHNICAL BOOKS

CQ ANTHOLOGY I

We've looked back through the years 1945-1952 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out and are unavailable.

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212 pages of everything the Amateur must have to get his license and progress toward the general class ticket. Plus many additional pages of vital information for the ham operator.

ANTENNA ROUNDUP

A common denominator for all ham stations is the antenna. Here at last is the cream of antenna information packed into a 160 page book. Forty-seven information-packed articles that will dispel much of the mystery surrounding antennas.

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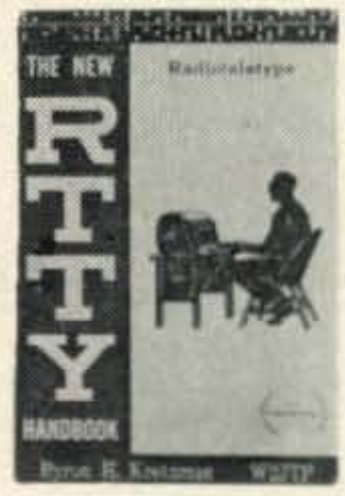

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MOBILE HANDBOOK

This new Mobile Handbook by Bill Orr, W6SAI, has been getting raves from top experienced mobile operators. Written for advanced, as well as beginning mobile operators, much of this information cannot be found anywhere else. This is NOT a collection of reprints.

SIDEBAND HANDBOOK

Written by Don Stoner, W6TNS, who was almost one full year in the preparation of this terrific volume. This is **not a technical** book. It explains sideband, showing you how to get along with it . . . how to keep your rig working right . . . how to know when it isn't . . . and lots of how to build-it stuff gadgets, receiving adaptors, exciters, amplifiers.

VHF FOR THE RADIO AMATEUR

If you are, or are planning to be a VHF operator, you can't afford to be without this dynamic new handbook written especially for you. Filled from cover to cover with all new and original construction material presented so you can understand it. Written by Frank C. Jones, W6AJF, nationally acclaimed for his VHF pioneering.

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For further information, check number 35, on page 112

Thirty

Would like to hear from more six and two meter boys on their plans for the Spring. And also send along photographs. We can always use them. Drop a card for K2UYH's *Moonbounce Newsletter,* copies available now.

73, Bob, K2ZSQ and Allen, K2UYH

USA-CA [*from page 88*]

Russellville, Alabama 35653. Any duly licensed radio amateur anywhere is eligible and at no charge. Requirements: The single requirement is to complete 100 international "rag chews" and ARRL DXCC countries list will control all questions regarding a QSO being international, except that KH6 and KL7 count as part of the USA. The award is granted in one class only, no special band or mode or other endorsements, except a seal will be awarded for each additional 100 rag chews. For the seal, repeat QSOs with the stations and countries in the first or prior 100 rag chews are permissible. A rag chew is defined as a QSO lasting 15 minutes on phone with readability reports both ways of at least 4 and on c.w. at least 30 minutes and also readability reports of 4 minimum both ways. Double credits will be given for rag chews held entirely in a language considered foreign to the nation in which the applying station is licensed. (But applicants may not count their own native tongue as foreign). All rag chews must have taken place after December 1, 1964.

The same foreign station and same foreign country may be worked and counted repeatedly, but the application must show a minimum of 50 different foreign stations worked in at least 25 different countries.

QSL cards need not be submitted, nor is it required that the rag chews be confirmed by QSL cards. It is sufficient for the applicant to list his rag chews in column form, showing left to right, Call sign of station worked, country, date, time QSO began, time ended (both in GMT), mode (phone or c.w.), report sent, report received. If double credit is claimed, simply show on the next line of the application the name of the foreign language used. Show at the bottom the total number of different stations and number of different countries, followed by the applicant's certification that the application is correct. The sponsor assumes that anyone interested in this type of award is unlikely to be anything other than honorable. Therefore, the applications will be on the honor system and the Custodian's decision on all disputes shall be final.

Yes, I ran out of space again but I do want to say I'm sorry that W6KG was left out of the December *CQ* Awards Honor Roll. Fortunately Lloyd and wife Iris are on a world wide DX-pedition and by the time his December *CQ* catches up with him, I will be able to explain that I apologized in February *CQ*. Again thanks to you all for your wonderful help, letters and cards, keep it up, please. How was your month?

73, Ed., W2GT

Letters [*from page 12*]

of award hunters is looking for his way to go; one of the ways open is AHC. We have continental sections, and our Section-NA (North America) is taken care of by K2TGH. I can tell you that our oldest U.S. members have joined us as early as January 1958, and we now have 87 members alone in N. America.

We have some modest activities, but as I have given W2GT more information about these, it's useless to repeat them here.

By the way, it may be of interest to you that K6BX used to be AHC member since May 19th 1959, *i.e.*, long before he founded his CHC. Clif resigned from AHC a couple of years ago, although his membership principally is life-long according to our rules.

John Velamo, OH2YV
AHC International Co-ordinator
and Sect. Eur. Hon. Sec'y
The Award Hunters' Club International
Isokaari 4-B-30
Lauttasaari, Finland

A Rebel Speaks Out

Editor, *CQ:*

Dictatorship has no place in the USA and especially in ham radio. But a dictator has risen in the ranks of our wonderful hobby. He will not allow the members of his organization to participate in any program that does not meet with his approval. He instructs his members with whom they may talk and may not talk to on the air. If he hates someone or some organization, then all his members must also hate the same. The only alternatives are to either be fired or to quit in disgust, which many of us have done.

We all earned our membership and paid the fee, which gives us a lifetime membership, but this is in theory only. You may not quit; you cannot quit. He refuses to take your name off the membership rolls. But if he wishes, he may fire you, even though you earned and paid for your membership. The members have no vote. He makes all the decisions. All matters must be referred to him before any action may be taken. The cardinal sin in this organization is the ability to think for yourself, and then to express these thoughts, on the ham bands or in print.

We, who are against any kind of dictatorship of any kind of a "one man rule," have formed a rebel club. We will fight against this dictatorship in our USA until we have freed ham radio from this blight upon its wonderful name and tradition.

The organization under discussion is the Certificate Hunters Club and the dictator is K6 Bad Xample.

Bertha Farr Eggert, WA4BMC
Rebel #2 Ex-CHC #683
1510—17th Ave., North
Lake Worth, Florida 33460

The Bedford Incident

Editor, *CQ:*

It was with great sympathy I read K2AGZ's letter regarding motion picture interference (*CQ*, December '65 p. 12). In order to prevent just such happenings when the Catamount Radio Club operates in public places we use very low power, and make transmissions to the homes of several club members who receipt for the messages, and then re-transmit them at higher power on the various net frequencies nationally and internationally.

We have used both c.w. and fone for these low power transmissions. Thus we have enough gear on display and in use to "impress" the public. The message originator sees his radiogram sent out, and we have discharged our responsibility of getting the message out.

The local stations who relay the messages are then free to do so at a time of day or night when conditions are favorable, and the message load is divided equally among the participating club members. In the past, we have never failed to get a message off the hook in time for delivery before the deadline.

Use of low power (eight to ten watts) obviates TV interference to nearby radio, hi-fi and TV showrooms, and we have never gotten into the sound system of Bennington's only movie house.

It is too bad that the movie-goers in K2AGZ's case received this impression of ham radio, and this letter is too late to prevent anything now, but in the future, those who consider this type of operation might find that the Catamount solution is practically fool-proof.

Arthur W. Rogerson, W1UXK
President, Catamount Radio Club
247 Grandview Street
Bennington, Vermont 05201

Amateur Radio [*from page 97*]

experts who in would be able to operate the various radio services of the countries concerned.

The Spirit of Amateur Radio

Not all the 400,000 radio amateurs in the world today are interested solely in technical matters. Indeed, a large number participate in amateur radio simply for the sheer enjoyment and pleasure of speaking to each other by voice, c.w., teletype, or whatever type of emission might be used. Amateurs, as a rule, chat freely with each other about their equipment, their families, their work and their leisure interests. Radio waves do not recognize frontiers or political, economic or social barriers. Personal radio contacts between radio amateurs of different origins, nationalities and cultures, foster—more than one may realize—a spirit of union and friendship, of peace and understanding. This aura of commonness which unites radio amateurs throughout the world is a bright symbol of hope for the future. This is the real spirit of amateur radio and one that sets it apart from all other radio services.

Amateur radio doesn't measure its success by volume of traffic, gross revenue, or audience—but simply by how well it has served humanity. ■

Broad-Band Balun [*from page 45*]

without benefit of a balancing device will discover that this "cheap-and-dirty" balun will produce very sanitary results. Shown in fig. 8 are s.w.r. curves run on a typical tri-bander with and without the coaxial balun. When the balun is not used, the curves bear no relation to the customary beam s.w.r. resonance curve. Placing the coaxial balun at the beam permits excellent curves to be observed which provide the observer with a truer picture of antenna performance. It is now easy to make adjustments to the antenna and to observe the results of the adjustments. Without the balun, the antenna characteristics are obscured by transmission line effects due to line discontinuity and unbalance, and the results of antenna adjustments made to such a system would be anybody's guess!

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To make a 70 ohm balun for RG-11/U transmission line, it is only necessary that the coil be wound of RG-11/U line. All dimensions remain the same. For QRP artists, RG-59/U line may be used. Those experimenters who may wish to extend the range of the balun to 3.5 mc or even 1.8 mc may try making the coil larger in diameter, and with more turns. An eleven inch diameter coil having thirteen turns is suggested as a starter, and will work down to 1.5 mc or so. ■

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QSL's—Ham and CB, related products. Free Samples. April Sign Co. 56290 Van Dyke, Washington, Michigan.

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FOR SALE: Clegg Zeus and 11 ele 6m Beam. Contact WB2CUO 201-756-8340.

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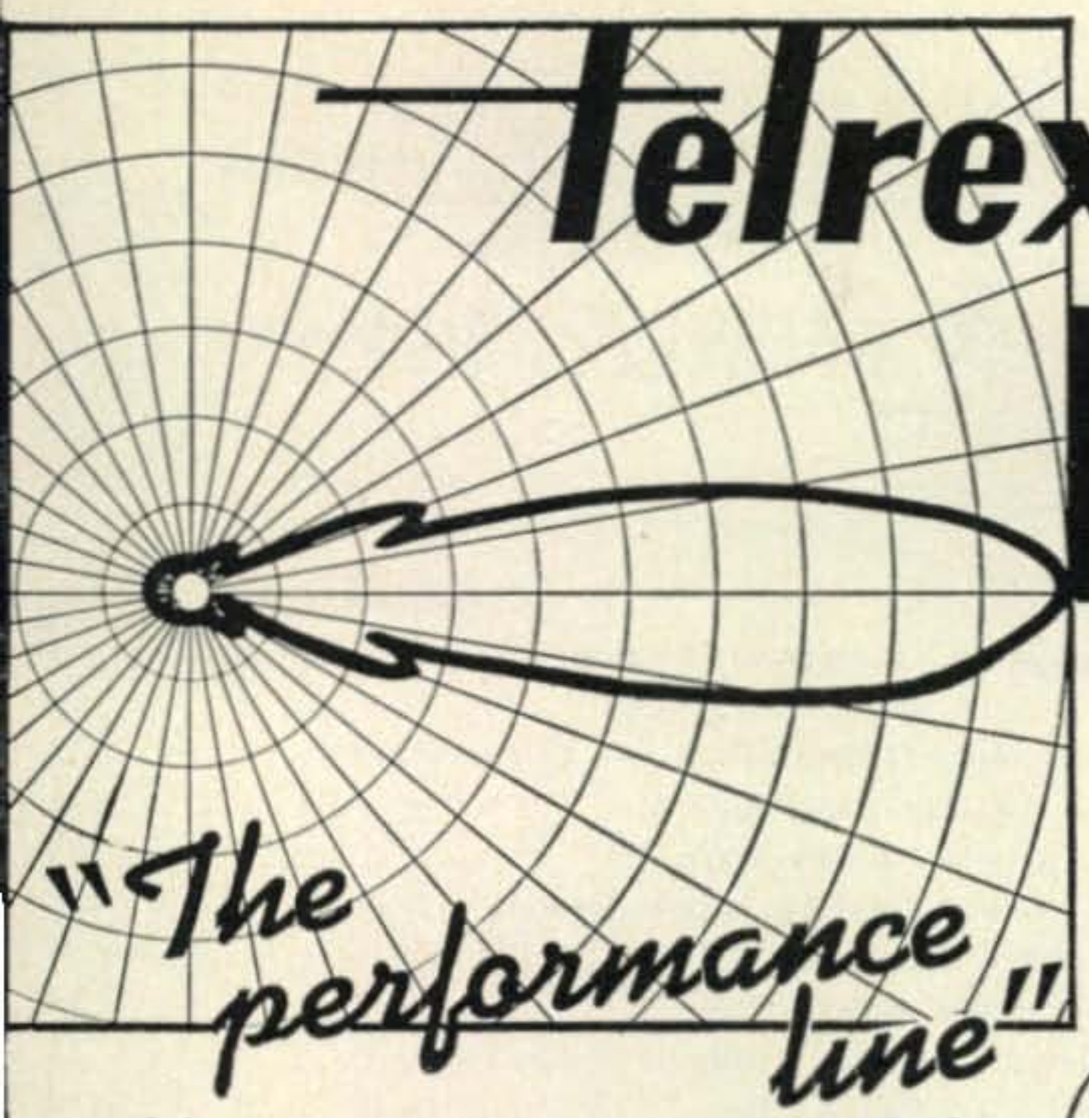

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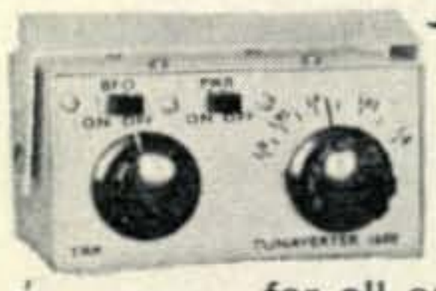

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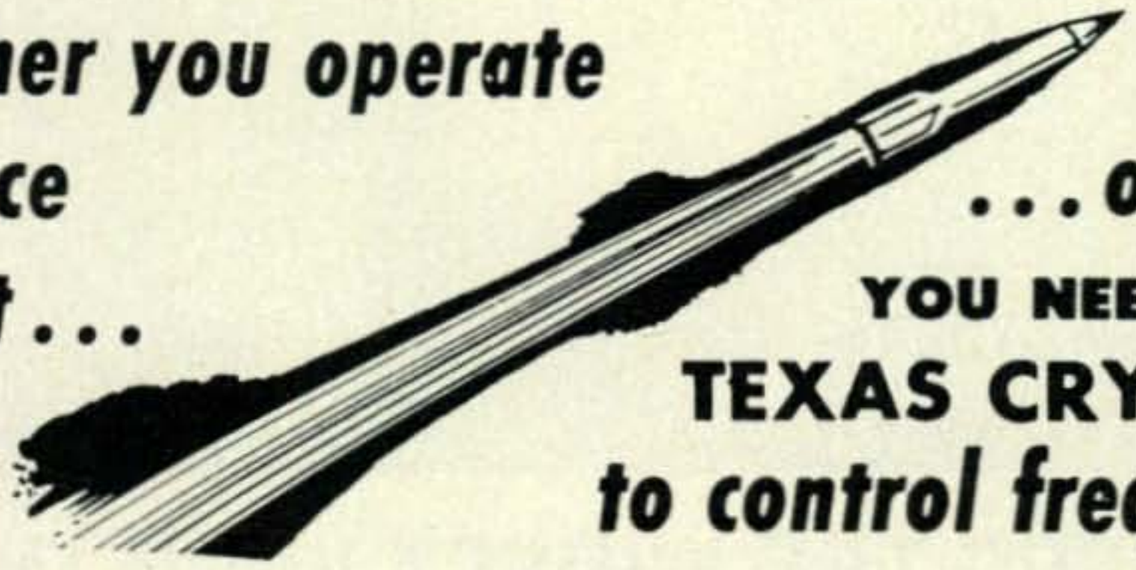

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in a pint size container

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