CQ

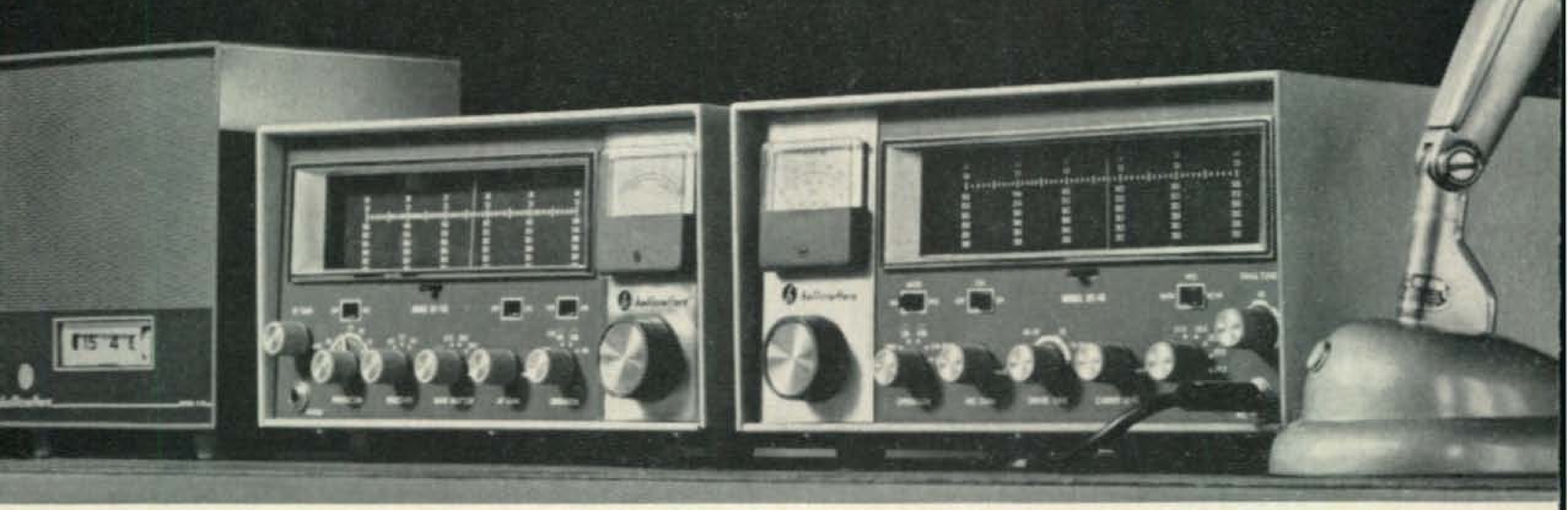
January 1966

75¢

The Radio Amateur's Journal

For further information, check number 1, on page 110

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.

HA-16 Vox Adapter, **$37.95** **Amateur net, $349.95**

R-51 Speaker,

4 x 6 inch oval speaker and attractive 24 hour clock.
amateur net $34.95

"Quality through Craftsmanship"

hallicrafters

Fifth and Kostner Aves., Chicago, Illinois 60624
Export: International Division

Available in Canada from Gould Sales Co.

For further information, check number 2, on page 110

CQ

JANUARY 1966 VOL. 22, No. 1

The Radio Amateur's Journal

TABLE OF CONTENTS

22 SIMPLE R.F. OUTPUT CIRCUITRY DESIGN FOR TRANSISTORS .... *Robert W. Schoening, WØTKX*

26 AMATEUR RADIO ASTRONOMERS TEAM UP TO HELP "APOLLO" PROJECT .... *Kirk Christian*

28 THE VOLT-OHM-MILLIAMMETER .. *Wilfred M. Scherer, W2AEF*

33 RTTY FROM A-Z, PART XVIII .... *Durward J. Tucker, W5VU*

37 A 5 ELEMENT QUAD-YAGI FOR 20 METERS *Ronald Lumachi, WB2CQM*

39 SIMPLE MOBILE POWER SOURCE *Victor H. Ortegren, W6WFR*

40 CQ REVIEWS: THE WATERS NUVERTER MODEL 346 V.H.F. CONVERTER ...... *Wilfred M. Scherer, W2AEF*

42 PUTTING THE NC-183 ON S.S.B. .. *Ken Schouten, W6DDA*

43 SERIES TYPE TRANSISTORIZED REGULATED POWER SUPPLIES .... *Morton H. Burke, K2ENU*

46 LOW PASS FILTERS FOR 5-500 KC RECEIVERS *Wilfred M. Scherer, W2AEF*

48 NUVISTOR CONVERTERS FOR 50, 144, 220, 432, PLUS A PREAMPLIFIER FOR 144 *Frank C. Jones, W6AJF*

53 NEW AMATEUR PRODUCTS

54 THE QSL PRINTER .... *Alex F. Burr, K3NKX*

56 SWEEPSTAKES EXPEDITION TO THE CANAL ZONE *Larry Lekashman, W9IOP*

59 THE CONICAL MONOPOLE . *Lt. Loren A. Stroup, W5WEU/4*

61 THE BEDFORD INCIDENT—A PROGRESS REPORT

63 WPX HONOR ROLL

65 PEOPLE AND PLACES

66 SPECIAL HAM CLINIC FEATURE *Charles J. Schauers, W6QLV*

DEPARTMENTS

14	ANNOUNCEMENTS	79	PROPAGATION
16	CLUB FORUM	85	RTTY
74	CONTEST CALENDAR	88	SPACE
71	DX	82	USA-CA
66	HAM CLINIC	76	VHF
8	LETTERS	93	YL
90	NOVICE	7	ZERO BIAS

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

CQ—(Title registered U. S. Post Office) is published monthly by Cowan Publishing Corp. Second class postage paid at Port Washington and Garden City, New York. Subscription Prices: U. S. A., Canada and Mexico, one year, $5.00; two years, $9.00; three years, $13.00. Pan-American and foreign add one dollar per year.

Please allow six weeks for change of address. Printed in the United States of America.

Short on real estate?

Want maximum multi-band performance on DX as well as short haul communications? Get a

hy-gain HF VERTICAL

5 models to choose from...

The Incomparable HY-TOWER for 10 thru 80 Meters

By any standard of measurement, the Hy-Tower is unquestionably the finest all-band vertical antenna system on the market today. Delivers outstanding omni-directional performance on DX as well as short haul contacts. Takes maximum legal power. Feeds with 52 ohm coax. SWR less than 2:1 on all bands. Positive action automatic band selection is provided by unique stub decoupling system that effectively isolates various sections of the antenna so that an electrical ½ wavelength (or odd multiple of a ¼ wavelength) exists on all bands. Structurally, the self-supporting Hy-Tower is built to last a lifetime...withstands 100 MPH gales. If you want the finest, you'll want a Hy-Tower. Model 18HT .... **$139.50** Net

The New Model 18AVQ. *A high-performance all-band vertical for under $50.00*

You asked for it...Hy-Gain built it. A high-performance automatic band switching all-band vertical at a modest price. Features individually tuned Hy-Q traps that provide peaked performance on each band. Takes maximum legal power. Feeds with 52 ohm coax. SWR less than 2:1 on all bands. Simple to install on ground or rooftop—withstands 100 MPH winds when properly guyed. The biggest value all-band vertical available. Model 18AVQ .... **$49.95** Net

The New Model 14AVQ for 10 thru 40 Meters

Improved successor to Hy-Gain's Model 14AVS...the world's most popular automatic band switching vertical for 10 thru 40 meters. Outstanding omni-directional performance on DX as well as short haul contacts. Features individually tuned Hy-Q traps that provide peaked performance on each band. Takes maximum legal power. Feeds with 52 ohm coax. SWR less than 2:1 on all bands. Easy to install on ground or rooftop—withstands 100 MPH winds when properly guyed. Terrific for portable as well as permanent applications. Model 14AVQ .... **$29.95** Net

Roof Mounting Kit for Model 14AVQ—Includes adjustable roof saddle, guy wires, hardware and complete instructions for installing. Model 14RMQ ..... **$11.95** Net

The New Model 12AVQ for 10, 15, 20 Meters

A new companion antenna to the Model 14AVQ. Outstanding omni-directional performance on 10, 15 and 20 meters. Individually tuned Hy-Q traps provide peaked performance on each band. Takes maximum legal power. Feeds with 52 ohm coax. SWR less than 2:1 on all bands. Easy to install on ground or rooftop—withstands 100 MPH winds when properly guyed. Model 12AVQ .... **$21.95** Net

Roof Mounting Kit for Model 12AVQ—Adjustable roof saddle, guy wires, hardware and complete instructions for installing. Model 12RMQ .... **$9.50** Net

Economy All-Band 18V

A high performance trapless vertical for 10 thru 80 meters. Tunes to any band by simple adjustment of feedpoint on base matching inductor. Feeds with 52 ohm coax. Heavy gauge aluminum construction—mounts on ground, roof or tower. Exceptional portability. Model 18V .... **$16.95** Net

Available from your Hy-Gain Distributor or Write

HY-GAIN ELECTRONICS CORPORATION

8427 N.E. Highway 6—Lincoln, Nebraska 68501

For further information, check number 4, on page 110

EIMAC

new power amplifier pentode provides excellent linearity

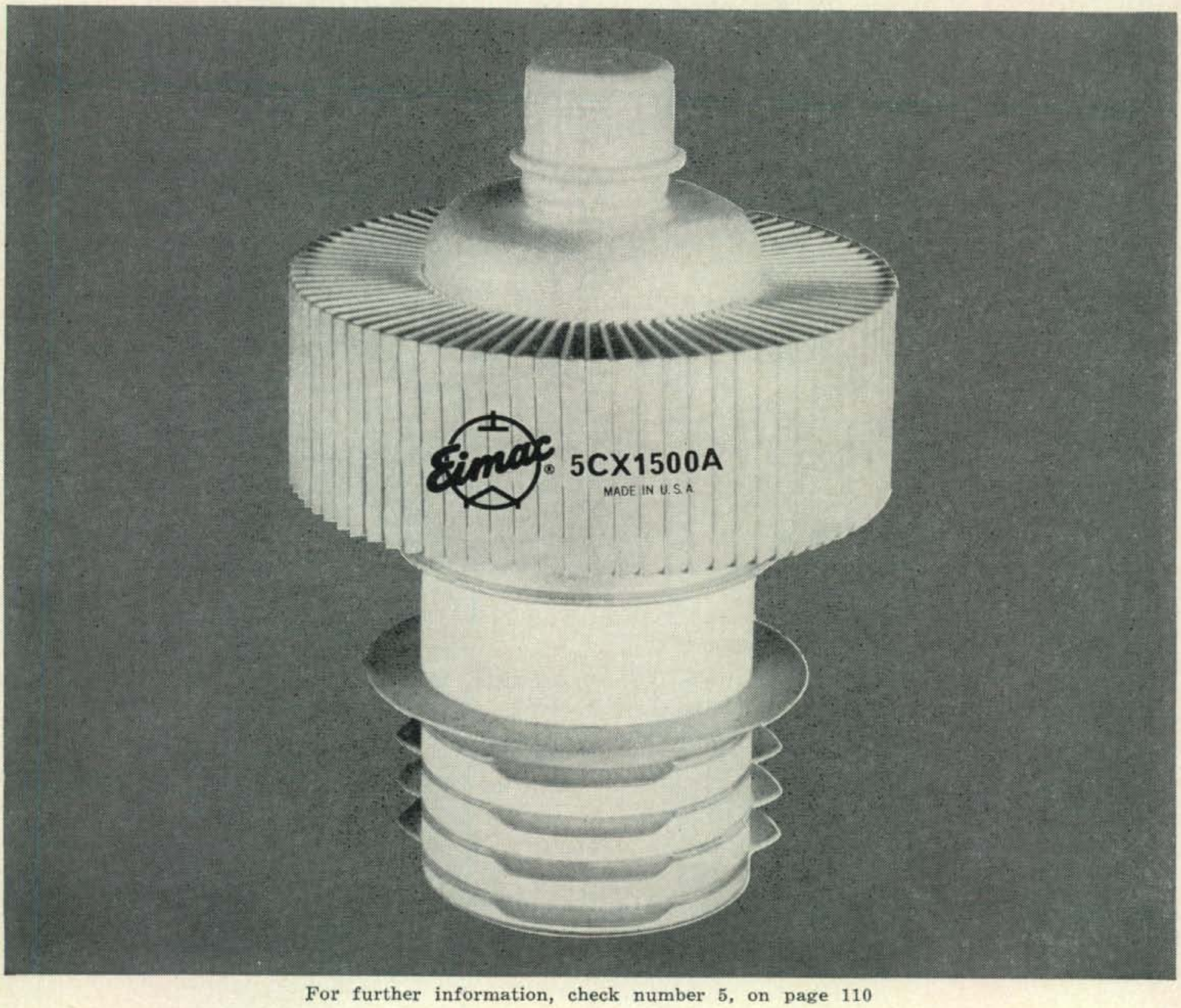
Now you can have reliable power in a new 1500 watt pentode. Eimac's 5CX1500A power amplifier tube is designed for use at the popular 1000-2000 watt peak envelope power range. And it's compact: height, 4⅞", diameter, 3½". Physical configuration is similar to Eimac's well-known 4CX1000A tetrode. The tube carries control and screen grid dissipation ratings of 25 and 75 watts, respectively. The 5CX1500A is ideally suited for Class C operation. In linear service the tube can provide a two-tone signal with third-order products of −39 db at 1000 watts PEP or −35 db at 1700 watts PEP. Write Product Manager, Power Grid Division, for details.

5CX1500A

CLASS C MAXIMUM RATINGS	
DC PLATE VOLTAGE	5000 V
DC PLATE CURRENT	1.0 Amp.
DC SCREEN VOLTAGE	750 V
PLATE DISSIPATION	1500 W
SCREEN DISSIPATION	75 W
GRID DISSIPATION	25 W
SUPPRESSOR DISSIPATION	25 W

TYPICAL CLASS AB, LINEAR AMPLIFIER MEASURED VALUES IN TWO TONE TEST	
DC PLATE VOLTAGE	4000 V
DC PLATE CURRENT (No Signal)	250 mA
DC PLATE CURRENT (Two Tone)	485 mA
DC SCREEN VOLTAGE	500 V
PEAK ENVELOPE POWER OUT	1785 W
THIRD ORDER IN MAXIMUM	−35 db

EIMAC
San Carlos, California 94070
A Division of Varian Associates



For further information, check number 5, on page 110

For further information, check number 6, on page 110

ZERO BIAS

BOUGHT any good DX lately? An awful lot of fellows have—or have at least tried to buy a DX QSO here and there under the guise of financially supporting a DXpedition to an obscure corner of the world. The practice is relatively new to ham radio, but the roots go back several years.

Personally, I think the idea of buying a QSO (or even a QSL, for that matter) is completely revolting.

The blame for the inception of the practice could easily be placed squarely on the shoulders of a fellow like Don Miller, W9WNV, but it would hardly be fair. It would be very easy to say that if a fellow can't afford to finance a DXpedition on his own, he shouldn't put the bite on his fellow DXers. But let's look a little deeper into the situation. Let's look at this entire matter of DXpeditions. Why do they even exist?

First, of course, is the quest for adventure, and who can deny that it is a major driving force. In this age of the Jet-Liner, it takes more than a flight to Europe or South America to satisfy some men's desire for the unusual or the dangerous. It takes a treacherous sea voyage in a leaky, cantankerous old scow to an obscure south sea's island to satisfy some men's hunger. And in satisfying his adventurous needs, he satisfies our own, too.

Second, in forming a DXpedition, a fellow can't help but gratify his own ego. He will be coveted, envied, admired, obeyed, and discussed. In short, he will become the focus of the attention of tens of thousands of people the world over. It does great things for the ego.

Third, the DXpeditioner serves the purposes of that cult-within-a-cult called "DXers." He provides the food that practically keeps some folks alive: the new country.

I can't really fault the first two reasons; they're as human as can be, but what about that third one. Isn't it a ridiculous situation when, to satisfy the status needs of a few hundred fellows, the DXpeditioner must seek out each and every remote dot of land that could be considered a "country" (in DXCC terms) and create havoc on the DX bands for a few days or few hours, just "to give a few of the boys a new one." What useful purpose has been served? What contributions has been made to ham radio? What will be the lasting effect of the operation? The answer to all three questions: None! Even the simple possibility that the DX'ers equipment and operating skill will be put to the test doesn't hold water, for the question "Can I work him?" doesn't even enter the picture! It's a foregone conclusion, and more so if he's well-fixed enough to kick in a saw-buck or two to finance the expedition!

Hasn't DXing reached the point of utter idiocy when in order to stay at the top of the DXCC list a fellow must *pay* for his contacts, or even pay for the QSL he receives? And isn't it even more idiotic for a grown man (DXer) to sacrifice family life, business endeavors and social life all to be able to work some adventurous fellow on a desolate spit of land in the south Pacific? Why? What drives them *The searing desire to remain at the top of the list!* Fine! Competition is a necessary stimulant in any endeavor, but falsely-created competition—competition for something not worth having—is worse than none at all.

In years past, a piece of new DX appeared only when a ham from a more populous country was obliged to take up residence in a remote area for some good reason. The alternative was

[*Continued on page 95*]

Reciprocal Privileges With Great Britain!

A reciprocal operating agreement allowing American and British amateurs to operate from each other's countries was signed in London on Friday, Nov. 26, 1965. Without a doubt, this will have the most far-reaching effect of any of the reciprocal privilege agreements to date, since the two most densely populated nations in the world (ham-wise) are involved.

Also new in the reciprocal licensing basket is an agreement with Colombia, S. A., effective November 28, 1965.

Mr. William C. Armstrong (left), U.S. Minister for Economic Affairs, and Lord Walston, British Parliamentary Under Secretary of State for Foreign Affairs, exchange the new reciprocal operating privileges agreement at the British Foreign Office. (Photo Courtesy US Information Service—London).

LETTERS TO THE EDITOR

Certificates

Editor, *CQ:*

As KZ5JW is a CHC'er (with more than 50 certificates, including USA-CA), we have noted the small investment in certificates. For the majority of the certificates, a fee of up to $1.00 is required for the cost of the certificate, handling, and mailing; and, in some instances, more money is required, for seals, etc.

We believe that it would not be unreasonable to suggest that sponsoring organizations should finance the production and dispatch of their own certificates. The Canal Zone Amateur Radio Association does not charge a fee for its certificates but only requires log-data application, not necessarily confirmed by GCR.

We know that various means of raising funds are available to radio clubs as well as other organizations. Some of the fund-raising activities are: membership dues, surplus ham gear auction sales, and "bake" sales. We believe that organizational financing of their own certificates would promote good will, especially with DX stations.

We, also, believe that QRM would be alleviated if an operator, before calling CQ or testing, would require, "Is anybody using this frequency?" By this means, a listener in QSO could have an opportunity to reply that the frequency is being used and his QSO or traffic-handling would not be seriously interrupted, assuming that the caller would QSY to a clear frequency.

Gloria M. Spears, KZ5GS/WA3EQA
Operator of KZ5JW
Box 522
Balboa, Canal Zone

Homebrew Meter Scales

Editor, *CQ:*

I read with interest the article "Homebrew Your Meter Scales," written by Gary L. Erland, which appeared in the November issue of *CQ*.

I think your readers would be interested to know that the meter scale sheets only are available from Datak and a few parts jobbers at $2.00 per set of four meter scale sheets.

Of course, we're somewhat prejudiced, but we think an even better job can be accomplished with less effort and minimum expense by using these sheets. The sheet number in question, by the way, is K19/1 black.

In any case, we are glad to see Instant Lettering dry transfers put to such good use and we are enclosing a Meter and Dial sheet which we would appreciate your forwarding to Mr. Erland.

Thanks very much.

Barry David Brown
The Datak Corporation
63 71st Street
Guttenberg, New Jersey 07093

← For further information, check number 8, on page 110

NOW! A TRI-BAND SSB TRANSCEIVER KIT FOR 179.95

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

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

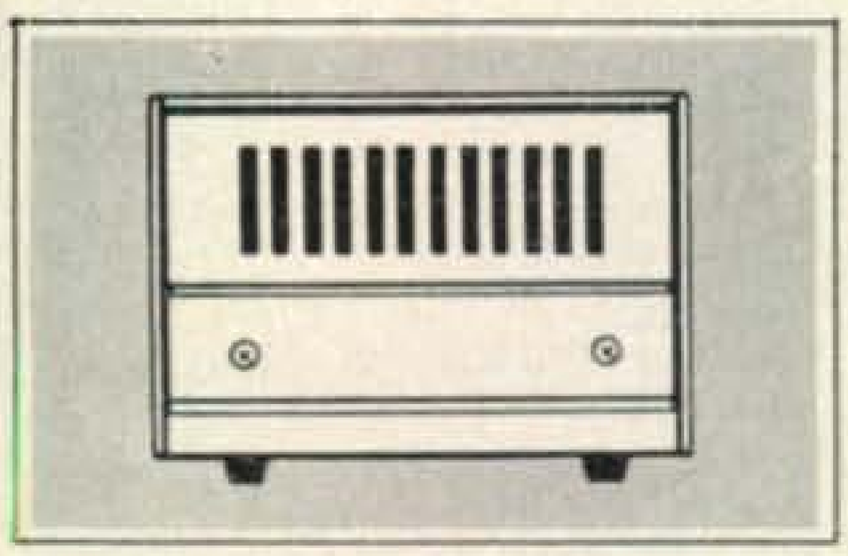
■ Full band coverage on 80, 40 and 20 meters. ■ Receiver offset tuning (up to ±10kc) without altering transmitter frequency. ■ Built-in VOX. ■ Panel selected VOX, PTT & STANDBY. ■ High level dynamic ALC to prevent flat-topping or splatter and permit the use of a linear amplifier. ■ Automatic carrier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

ADDITIONAL SPECIFICATIONS

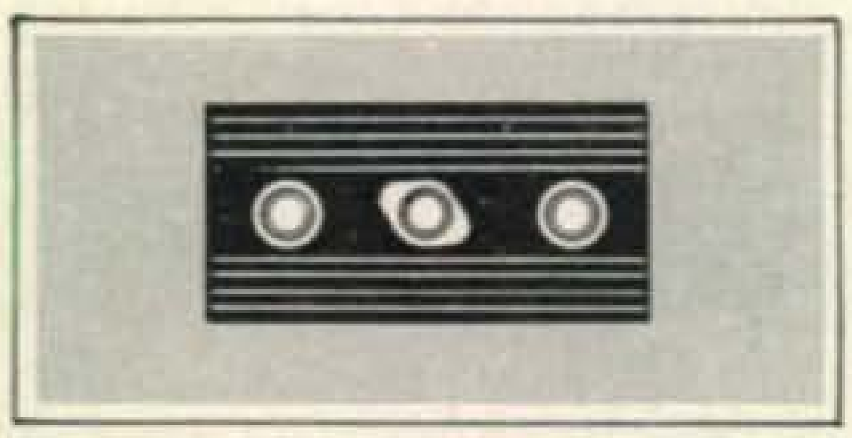
FREQUENCY COVERAGE: 3490-4010kc, 6990-7310kc, 13890-14410kc. SSB EMISSIONS: LSB 80 and 40 meters, USB 20 meters. RF POWER INPUT: 200 watts SSB PEP and CW, 100 watts AM. RF POWER OUTPUT: 120 watts SSB PEP and CW, 30 watts AM. OUTPUT PI NETWORK MATCHING RANGE: 40-80 ohms. SSB GENERATION: 5.2 Mc crystal lattice filter; bandwidth 2.7kc at 6db. STABILITY: 400 cps after warm-up. SUPPRESSION: Carrier-50db; unwanted sideband-40db. RECEIVER: Sensitivity 1uv for 10db S/N ratio: selectivity 2.7kc at 6db; audio output over 2 watts (3.2 ohms). PANEL CONTROLS & CONNECTORS: Tuning, Band Selector, AF Gain, RF Gain, MIC Gain with calibrator switch at extreme CCW rotation, Hairline Set (capped), Mode (SSB, AM, CW, Tune), Function (Off, Standby, PTT, VOX), Carrier Balance, Exciter Tune, PA Tune, PA Load, Receiver Offset Tune, MIC input, phone jack. REAR CONTROLS & CONNECTORS: VOX Threshold, VOX delay, VOX sensitivity, Anti-VOX sensitivity, PA Bias adjust, S-Meter zero adjust, power socket, external relay, antenna connector, key jack, accessory calibrator socket. METERING: PA cathode on transmit, S-Meter on receive. SIZE (HWD): 5 13/16" x 14 1/4" x 11 1/4". POWER REQUIREMENTS: 750 VDC at 300 ma, 250 VDC at 170 ma, -100 VDC at 5 ma, 12.6 VAC at 3.8 amps.

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

Power Supplies Tailored for Optimum Performance of the 753.



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



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

EICO For FREE Catalog and 753 Spec. Sheet write to EICO Dept. CQ-1, 131-01 39th Ave., Flushing, N. Y. 11352

For further information, check numebr 9, on page 110

Stereo QSO's

Editor, *CQ:*

Writing to editors is not one of my hobbies but I guess even the strongest break down at some stage.

The thing that has triggered me off is the letter from HR1RP/W5ZRP in the September issue. Man, I congratulate you on speaking your mind. These stereo-typed QSO's give me the screaming jitters and as for auto CQ senders, may the powers-to-be legislate for capital punishment to any one using the things.

CQ is looked forward to every month even though it is usually six to eight weeks behind by the time it arrives. I don't know how they work these things out but until a couple of months ago (when it was priced at US 50¢) we were paying a particular fee but since the price increase of 50%, we now pay approximately 70% more—this being ten shillings our currency—so some one sure is catching up on the round abouts!

Now, may I sign off with another grizzle? I was going through the paste boards 'tother day just to see if I could qualify for ONE of the CA awards. I wouldn't take or guess at how many W/K cards are there, but of them all, only six named their county. Now I ask you, how the blazes can DX stations qualify for any of them without obtaining county maps? These things take a lot of postage to send out to VK and wouldn't be necessary if the QSL's made mention of the county locations.

After all that, you'll probably hope I never write to an editor again. However, please don't think I am sore at anyone. Just getting a few things off my puny chest.

Best to you all at *CQ*.

Barry S. Clarke, VK5BS
18 Cornish Street
Glenelg North, S. Australia

Mixer Spurious Frequencies

Editor, *CQ:*

A procedure such as that described by Mr. Lee in his article, "Mixer Spurious Frequency Analysis," is essential when designing heterodyne receivers and transmitters. However, an example used in the article is misleading and may cause the charts to be mis-interpreted.

It can be shown that a spurious harmonic will be produced *exactly* at the mixer output frequency when $F_2/F_1=n/m$, where m and n are integers. A harmonic is then generated exactly at the mixer output frequency when a mixer frequency line crosses a $F_2/F_1=n/m$ line figure 1. A combination of mixer frequencies that only approach a line will not cause a birdie at the output frequency. A harmonic is still present, however, and it may well fall within the output passband.

Consider the example used of a 5 mc v.f.o. and a 9 mc s.s.b. generator. $F_2/F_1=3/5$ when $F_2=5.40$ mc, not 5.35 mc. The 8th order harmonics are then found to occur at $4F_1-4F_2=14.4$ mc and $6F_2-2F_1=14.4$ mc, which is also the output frequency $F_1+F_2=14.4$ mc.

When $F_1=5.35$ mc, a combination which is near the 3/5 line but not exactly on it, the output is at $F_1+F_2=14.35$ mc, and the harmonics are at $4F_1-4F_2=14.60$ mc and $6F_2-2F_1=14.10$ mc. The spurious responses move farther from the operating frequency (and hence are reduced in amplitude) as the mixer frequency combination moves away from the 3/5 line. At $F_1=5.0$ mc the output frequency is 14.0 mc, and the spurious responses are at $4F_1-4F_2=16.0$ mc and $6F_2-2F_1=12.0$ mc.

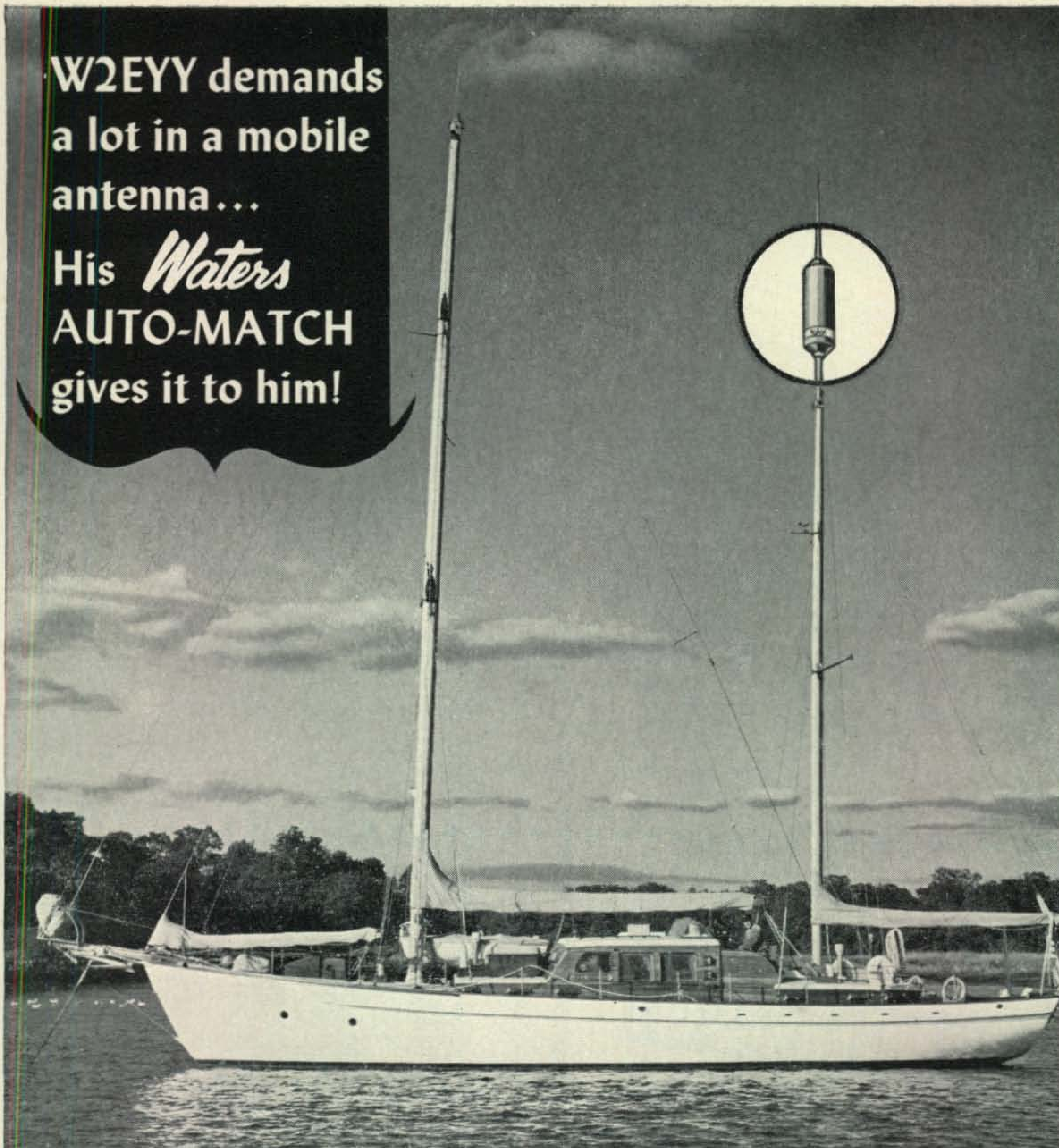
The point is then that one must not only guard against crossing a line, but must also guard against approaching a line close enough to put a birdie in the output passband.

Ronald C. Barrett, W2ANY
Apt. 362A, Matawan Village
Matawan, New Jersey

Ignition Noise

Editor, *CQ:*

In the September issue of *CQ*, John Harvey Chase, DL5DU/WA4TPF, raised the question of why did European autos cause less ignition noise to 20 meter reception than US autos. The answer is simple. The European autos are better suppressed than the average US auto after it has been overseas for a year or two. Germany, France and the United Kingdom have government decrees and standards in force which establish radiation



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!

WATERS
MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

WATERS PRODUCTS ARE SOLD ONLY THROUGH WATERS QUALIFIED DISTRIBUTORS

For further information, check number 11, on page 110

limits from autos. In France you can even get a traffic ticket for using an auto whose ignition causes interference. On the other hand, the US autos in Europe are generally exempt from these standards, and in addition, ignition suppression has likely been removed when the engine was tuned up.

Most US autos are delivered from the factory with pretty good ignition suppression. The ignition wires are generally the radio resistor type, the distributor cap generally has a built-in resistor, and a capacitor or two may also be installed. When the average mechanic tunes up the engine he may disconnect the capacitors and if he replaces the ignition wires he will use ordinary spark plug wires. The mechanic feels that suppression devices make the ignition less reliable. Actually, properly installed suppression cable generally makes starting easier.

A poor quality auto ignition system can invade the privacy of hundreds of homes in a single evening, and can cause serious problems to essential radio services. It can also cause irreparable damage to a military or scientific installation. Many of these locations will not admit autos if their ignition system's noise trips an alarm device at the gate. Ignition noise needs to be better controlled, and it will take anti-nuisance laws to do it.

Chester P. Wilkes
Registered Professional Engineer
7214 Harkavy Drive
San Antonio, Texas

Be Kind To FCC

Editor, *CQ:*

I certainly agree with Chuck Schauers' W6QLV article [Nov. '65 Ham Clinic] on the way some hams continually berate the FCC. It is a very fine article and I enjoy his column "Ham Clinic" also.

Bob Tuttle, WA6IJN
522 N. Progress Place
Los Angeles, Calif.

LICENSE EXPIRATION NOTICE SERVICE

Available To Anyone Anyplace In The World.

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

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

Joan Machinchick, K3KBI
Lake Drive, Cape St. Clair
R.F.D., Annapolis, Md. 21401

PLEASE include your
ZIP code number on
all correspondence.

SAVE $40.00 **EXCLUSIVE SPECIAL PURCHASE**

B-A's MOST EXCITING SHORTWAVE RECEIVER BUY IN HISTORY

SINCE 1927

REGULAR NET WAS $139.95

B-A SPECIAL

$99.95

NATIONAL NC-121

LOADED WITH FEATURES FOR THE AMATEUR, THE SHORTWAVE LISTENER AND HI-FI LISTENER

B-A PURCHASED ENTIRE FACTORY INVENTORY TO SELL AT A GIANT $40.00 SAVING

NATIONAL ONE YEAR GUARANTEE

1 YEAR GUARANTEE

Defective parts replaced without charge if returned to B-A within 1 year from date of purchase.

TUNES 4 BANDS: **SHORTWAVE 1.6 TO 30 MC STANDARD BROADCAST 550 TO 1600 KC**

HAS TUNER OUTPUT FOR HIGH FIDELITY SYSTEMS

YOU'LL BE PROUD TO OWN AND OPERATE THIS HANDSOME RECEIVER...

Has exceptional appearance, the look of fine quality, which it is.

. . . AND JUST LOOK AT THIS RANGE OF FEATURES: Modern circuitry for AM and SSB phone and CW with separate product detector, illuminated S-meter operating in all modes, peaking Q-multiplier, full time KVC for all modes, automatic series gate noise limiter, full wave transformer-operated power supply.

Has built-in speaker, headphone jack on panel, and tuner output for Hi-Fi systems.

Cabinet size 7⅝" H. x 13½" W. x 9" D. Wt. 28 lbs.

B-A SINCE 1927 ***RUSH YOUR ORDER NOW!***

BURSTEIN-APPLEBEE CO.
1012-14 McGee St., Kansas City, Mo. 64106

☐ I enclose $99.95 plus $2.25 for shipping for National NC-121 Receiver.
☐ Please ship COD National NC-121 Receiver. I enclose $25.00 deposit.

Name__________
PLEASE PRINT

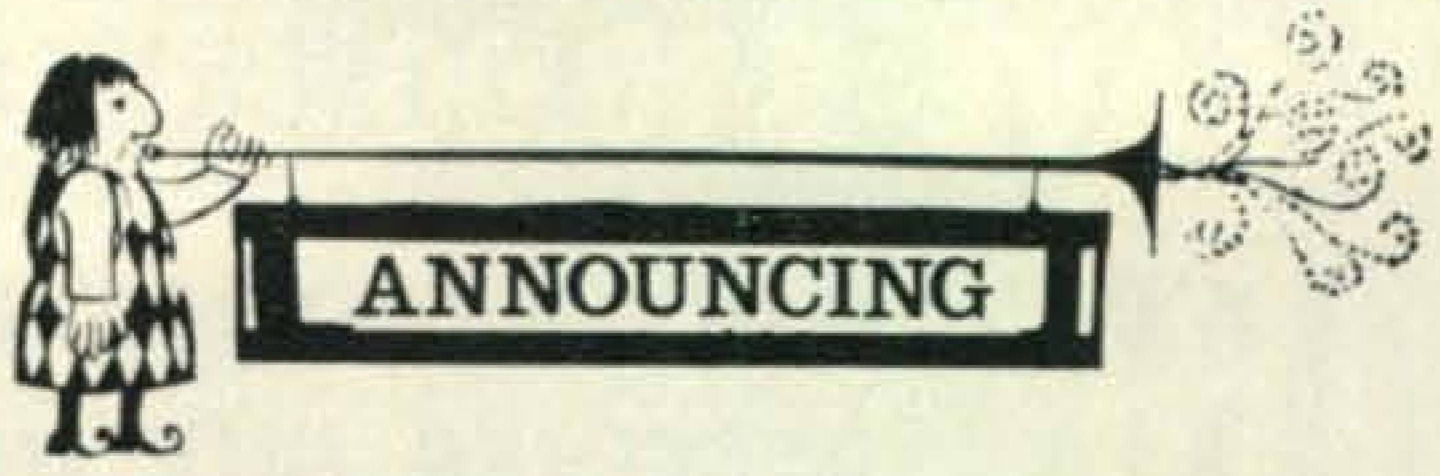
Address__________

City__________ State__________ Zip__________

☐ I am interested in buying above receiver for nothing down on B-A's Easy Terms. Send details.

For further information, check number 13, on page 110

For further information, check number 14, on page 110



Sayreville, New Jersey

The annual Raritan Bay Radio Amateurs Christmas Party will be held at the Community Hall, 9 Krumb Street, Sayreville, New Jersey, on January 22, 1966. Tickets are available from WB2NOB, WA2YBT, WA2CHN, WA2CHS, and K2KFE. Price includes dinner, gift exchange, door prizes for almost everyone, and a guest speaker. Those who want more information can get in touch with WA2YBT, Edward Reed, 38 Riverdale Drive, Keyport, New Jersey, Telephone 566-1934.

Northfield, New Jersey

The Southern Counties Amateur Radio Association (New Jersey) will hold its annual Installation Dinner on Friday, January 14, 1966 at Copsey's Restaurant on the White Horse Pike in Absecon, N.J. All Hams, XYLs and anyone interested in amateur radio are welcome to attend. Cocktails at 6:30 and dinner at 7. Radio Station WFPG of Atlantic City will present its annual "Amateur of The Year" award at this time. Anyone wishing further details may contact K2SOX, Northfield, N.J. for further details.

Los Angeles, California

The world of the ham radio operator will be made available to ham as well as non-ham individuals on KPFK (90.7 mc f.m.) on a weekly basis beginning October 31, 1965, at 10:30 A.M.

The program, "Calling CQ", will be moderated by Ray Meyers, well-known ham and columnist for the *Los Angeles Herald-Examiner*. He will conduct interviews and comment on news affecting ham groups across the United States.

Meyer, a long-time Los Angeles resident, has been involved in the ham radio field for over 50 years and is a retired Lieutenant Commander in the U. S. Navy.

The first program of the series will be moderated by KPFK's Director of Drama and Literature, David Ossman.

Check Your Log

Bill, K2HVN has lots of QSLs he is willing to send for QSOs on his mobile trip to Prince Edward Island. Send your QSL and s.a.s.e. to Bill, QTH ok in callbook.

Floral Park, New York

On or about November 17, 1965, a complete HW-22 was stolen from the mobile of Samuel Garshofsky, W2PWF, while the car was in the garage next to the house. The unit had his call letters taped to it and the antenna connector was changed to a SO-239. Anyone who has information concerning the theft please contact: Samuel Garshofsky, W2PWF, 7842 264th, Floral Park, N.Y. 11004.

For further information, check number 16, on page 110

CLUB FORUM

AL SMITH,* WA2TAQ

WELL! what do you know, the CLUB FORUM has completed its first year of existence and this issue starts us off in the direction of yet another.

It has been a sometimes long hard road to travel and this writer extends sincere gratitude to the amateur radio club officers and members as well as to non club members who so kindly wrote to the CLUB FORUM offering their suggestions and remarks which lead to subjects that could be used for a column.

Unlike other interests in amateur radio the topic of the amateur radio club is somewhat limited as to subject column material. My own activities have been the primary source of material and I'm thankful for my associations with The Rockaway Amateur Radio Club, The Hudson Amateur Radio Council, The Federation of Long Island Radio Clubs, The Hospital Amateur Radio Network Association, AREC, RACES, MARS, and a few others.

Both the Amateur Radio News Service and The Amateur Radio Editors Association have been mentioned several times in the CLUB FORUM and the plugs have been well deserved. There is no doubt that the column may not have come to pass without the advice and council of many of the members of both organizations. Particular thanks to Harry Tummonds, W8BAH, Bill Welsh, WA6VTL, and Ray Meyers, W6MLZ.

We're sorry to hear that Ralph "Andy" Anderson will be leaving the Washington, D.C. scene. Andy did a fabulous job as Editor and Publisher of *Auto Call* and the former *Washington Amateur Radio News*. We hope that Andy's retirement and subsequent return to his home state of Kansas will only mean a change of headquarters for his amateur radio activities.

If you're interested in providing good public relations or in putting out a first rate club type publication you should get on the bandwagon by joining AREA or ARNS or both.

Just to participate in the "Swap Program" in which publications are exchanged with those of other amateur radio clubs is a revelation in itself. Here's an opportunity to cash in on the experience of those, though radio *amateurs,* can only be described as *professional* journalists.

Incidently the swap program is also a good source of material as the members of these

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

groups have the privilege of reprinting items from each others' publications.

Have you ever attended a radio club meeting and had the unfortunate experience of mingling with radio amateurs that do not have the decency to wear clean neat clothes. It seems that many of our brother hams put amateur radio club meetings in the same class as perhaps the street corner gang that is about to get up a game of touch football.

It's said that clothes make the man. We won't go as far as to say that everyone should be a Beau Brummel, but . . . we will say that such articles of clothing as dungarees have no place at a radio club meeting. The well dressed man would arrive on the scene in a suit or at least a sports jacket and clean trousers. Sloppy sweatshirts and similar articles of clothing will only lower the level of the club this would be particularly so in the eyes of a visitor whether a member of the amateur radio fraternity or not. So what say gang, let's keep our standards up, off the air and on.

We should be aware of our appearance in all activities involving amateur radio. One way for clubs to give a good impression at such things as amateur radio displays at expositions, fairs etc. is to wear a uniform type of shirt. The CLUB FORUM has heard from Doc Cully, WA8CPA of The Van Wert (Ohio) Amateur Radio Club. Doc is an exponent of the shirt idea and in his Official Bulletin of the "National Shirt Crusade" Doc states in part: "Am not implying that a complete uniform should be worn, just a decent looking shirt." As can be seen in the photo the shirts worn by Doc and Bill Madden, WA8IBA exemplify the degree of neatness that the CLUB FORUM has been stressing.

Uniforms for a club are nothing new but it seems that amateur radio clubs are somewhat behind the times in this respect. Many other groups wear a part of a uniform to identify their organization such as bowlers wearing shirts and yachtman wearing caps.

The uniform shirt could be a popular item to wear at a hamfest, auction, convention or any other gathering involving large numbers of radio amateurs. The club name could be embroidered

Doc Cully, WA8CPA (left) and Bill Madden, WA8IBA, wearing their club shirts.

For further information, check number 17, on page 110

on the back or patches with the club name, and your call and name could be made up and sewed on. If club members do not want to go into the expense of purchasing shirts then they could agree on a common color shirt and merely affix patches on one they already own.

Stimulating interest within clubs has been the biggest problem of those writing to the CLUB FORUM. This shirt idea could be a big help in keeping interest. We'll go a step further than Doc Cully and suggest that a jacket or blazer be worn in conjunction with a shirt. A crest depicting amateur radio would be right in style with those jackets worn today. Such a blazer could be worn to almost any event whether it be a banquet or hamfest or public demonstration of amateur radio.

Many communities have yearly parades and almost every local club or group participates. Usually among the missing is the amateur radio club. With a uniform of sorts the club could very well become a complete part of the community by joining the festivities.

We would like to hear from our readers on the subject of uniforms and will welcome photos from clubs who may already have either jackets, shirts, hats or complete uniforms. Speaking of pictures why not have photos taken of your installation of officers or other group events and send us a copy identifying the members for possible inclusion in this column. 73, Al, WA2TAQ.

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (act of October 23, 1962; Section 4369, title 39, United States Code) (1) Date of Filing—October 1, 1965; (2) Title of Publication: CQ THE RADIO AMATEUR'S JOURNAL; (3) Frequency of Issue—Monthly; (4) Location of known offices of publication: 14 Vanderventor Avenue, Port Washington, County of Nassau, New York 11050; (5) Location of the headquarters of general business offices of the publishers: 14 Vanderventer Avenue, Port Washington, County of Nassau, New York 11050; (6) Names and addresses of Publisher, Editor and Managing Editor; Publisher—Sanford R. Cowan, 6 Embassy Court, Great Neck, New York; Editor—Richard A. Ross, 4512 217 Street, Bayside, New York, N.Y.; Managing Editor: none; (7) Owner (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given)—Sanford R. Cowan, 6 Embassy Court, Great Neck, L.I., N.Y. (8) Known bondholders, mortgagees and other security holders owning or holding 1 percent or more of total amount of bonds mortgages or other securities (if there are none, so state)—NONE. (9) Paragraphs 7 and 8 include, in cases where the stockholder or security holder appears on the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear on the books of the company as trustees, hold stock and security in a capacity other than that of a bona fide owner. Names and addresses of individuals who are stockholders of a corporation which itself is a stockholder or holder of bonds, mortgages or other securities of the publishing corporation have been included in paragraphs 7 and 8 when the interests of such individuals are equivalent to 1 percent or more of the total amount of the stock or securities of the publishing corporation. (10) This item must be completed for all publications except those which do not carry advertising other than the publisher's own and which are named in §132.231, 132.232 and 132.233, Postal Manual §(4355a, 4355b and 4356 of Title 39, United States Code) (A) (average no. of copies each issue during preceding 12 months) Total No. Copies printed (net press run) 74,250; (b) Paid Circulation 1. Sales through dealers and carriers, street vendors and counter sales 37,500; 2. Mail subscriptions 34,186. (c) Total Paid Circulation 71,686; (d) Free Distribution (including samples) By Mail, Carrier and other means 588 (e) Total Distribution (sum of c and d) 72,274 (f) Office use left over, unaccounted, spoiled after printing 1,976; (g) Total (sum of e and f—should equal net press run shown in a) 74,250. Single Issue Nearest to Filing Date; (a) Total No. of Copies Printed (net press run) 73,987; (b) Paid Circulation 1. sales through dealers and carriers, street vendors and counter sales 37,500; 2. mail subscriptions 33,282; (c) Total Paid Circulation 70,782; Free distribution (including samples) by mail, carrier or other means 619; (e) total distribution (sum of C and D) 71,401; (f) office use left-over, unaccounted, spoiled after printing 2,586; (g) Total (sum of E & F—should equal net press run shown in A) 73,987. I certify that the statements made by me above are correct and complete. (signed) Harold Weisner, Bus. Mgr.

An Invitation...

Compare The Heathkit SB-100 With Any Other Make of SSB Transceiver

180-Watt, 80-10 Meter SSB Transceiver...... $360.00

• Full five band transceive SSB & CW operation, 80-10 meters • 180 watts P.E.P. SSB-170 watts CW • Switch selectable Upper/Lower sideband/CW operation • Operate PTT & VOX • CW with built-in sidetone • Can operate crystal control in the transmit mode with variable tuning of receiver or can operate crystal-controlled transceive mode–excellent for net control • Separate offset CW carrier crystal • Triple action Level Control™ • Built-in 100 kc crystal calibrator • Enclosed relays for quiet, trouble free operation • Heath SB-Series LMO (Linear Master Oscillator) provides truly linear tuning with 1 kc dial calibration–less than 100 cps per hour drift after warm-up–400 cps accuracy • Perfect companion for HA-14 KW Kompact or SB-200 final amplifiers • Fixed station operation with HP-23 power supply–mobile with HP-13 & SBA-100-1 mobile mount for quick plug-in/quick disconnect mobile installation • Fast circuit board assembly • Simple alignment–requires only a VTVM or VOM, a dummy load and a broadcast receiver

If you are considering the purchase of an SSB transceiver, we urge you to read every word on the next two pages before deciding. ▶

An Invitation...
Compare the
Heathkit SB-100
With Any Other Make
of SSB Transceiver

Heathkit SB-100—The SSB Rig You've Been Waiting For

The Newest And The Hottest Of The SB-Series! Here's a complete 80 through 10 meter 180-watt SSB transceiver. It includes all of the high-performance features you've read, heard talked about, or experienced on the already famous Heathkit SB-Series Amateur Radio Equipment ... plus 5-band coverage with fast, simple bandswitching and tune-up . . . alternate "remote" power supplies for fixed or mobile operation . . . new Heathkit Switch-Board™ coil and bandswitch assembly . . . and a new ALC control circuit (TALC™) that allows even greater variation in speech level. All this and more in the new SB-100!

Here's Engineering That Sets The Pace For The Industry! The Heath SB-Series crystal filter features a 6 pole lattice filter (6 individual crystals) to produce a superior 2 to 1 shape factor for sharper receiver tuning . . . greater sideband suppression. The filter pass-band is symmetrical ... for identical characteristics on both upper and lower sideband signals . . . and for optimum SSB reception with steep skirts for adjacent signal rejection. What's more, the entire filter assembly is hermetically sealed to retain its published specifications just as they were when "checked out" at the time of production. Compare these specifications with any other SSB filter on the market!

Improved Heathkit Techniques Produce Better Than Factory Assembled Results! The new Heathkit Switch-Board™ coil and bandswitch assembly virtually eliminates the troublesome point-to-point wiring of tuning circuitry . . . eliminates the critical job of "lead dressing" required in "wired" circuitry. Here the assembly procedure is simplified further by a removable switch shaft which enables easy "stacking" of the individual Switch-Boards. Switch-Board construction is a new step forward in achieving electronically stable circuit construction, plus ready accessibility to tuning coils.

Power Consistent With Maximum Versatility. 180 watts P.E.P. is the best transmitter power level for most hams. This power level permits using the right tubes for the job and does not require eliminating useful features to pay for increased power. The SB-100 produces a "barefoot" signal comparable to the higher power transceivers and is ideally suited for driving a grounded grid linear for a really big signal without the problems of excessive drive.

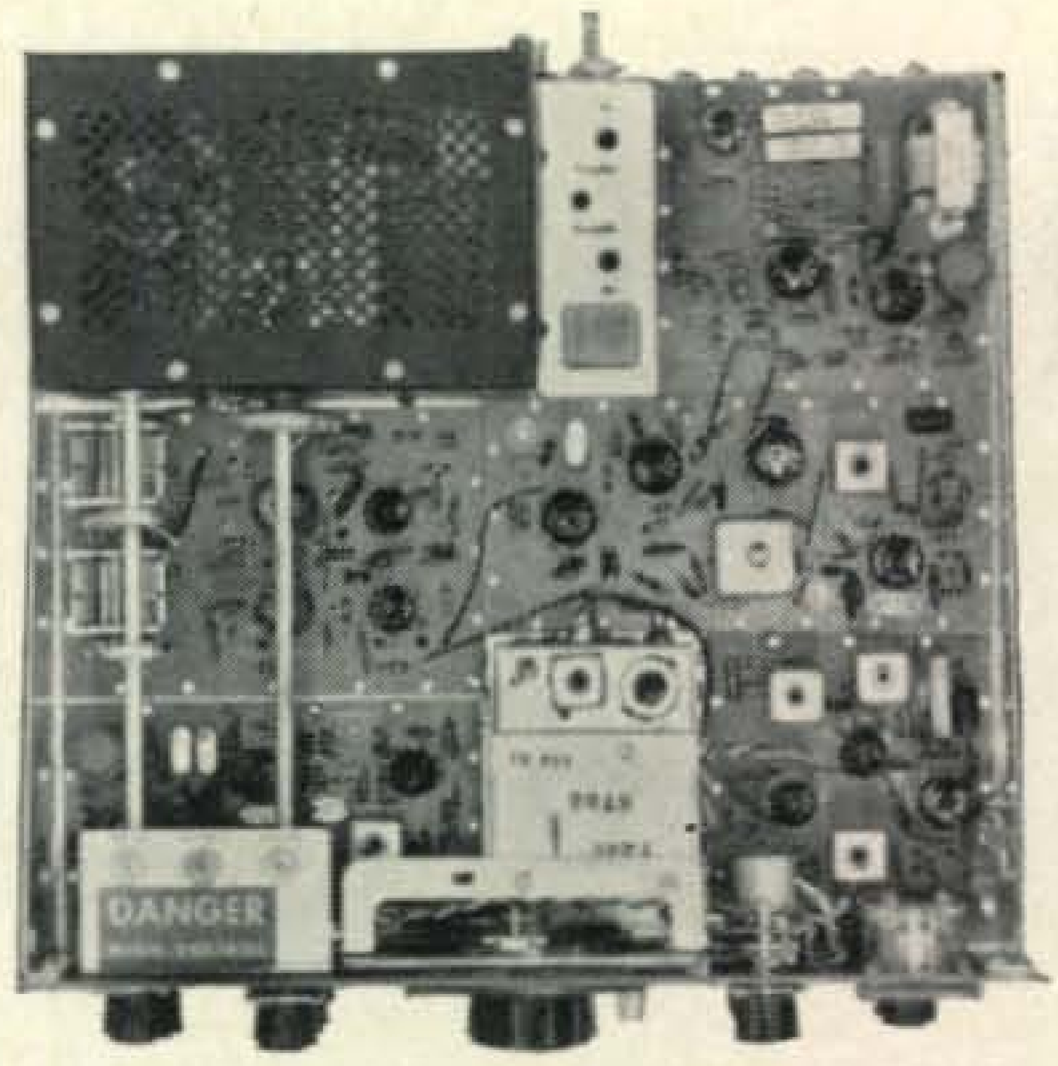
TALC™ (Triple Action Level Control) Sets New Standards For Automatic Level Control. Control from three separate circuits is combined in TALC™ to provide greater speech compression . . . allow for even more variation in speech level . . . and boost the performance of the SB-100 still higher.

Operating The SB-100 Is A Pleasure . . . Like Driving A Fine Automobile! Select the band, dial the frequency, peak-up the preselector, and tune. Receiver and transmitter bandswitching is simultaneous. The preselector control peaks up the driver. Final tuning is quick, sure, and positive. And for CW op's who prefer headphone listening, there is a separate headphone level control to adjust the headphone audio level independently of speaker volume. In addition, the transmitter and receiver are always on the same frequency ... no "leap-frogging" around the frequency when you're working round tables.

Order The SB-100 For The Best Value In SSB Transceivers . . . Regardless! We invite comparison of the *complete* SB-100 specs on the next page with those of any other make SSB transceiver. Also consider circuit design as related to inherent stability, use of quality components and fine mechanical construction, cost of companion power supplies and linear amplifiers, band coverage in view of increasing 10 and 15 meter activity, ease of circuit familiarization with regard to possible maintenance, and resale value. You will agree that the SB-100 is the best investment you can make in amateur radio equipment. (Recommended for hams with previous electronic or kit construction experience.)

Kit SB-100, 23 lbs., $36 dn., $31 mo.........**$360.00**
SBA-100-1, Mobile Mounting Kit, 6 lbs.......**$ 14.95**
GH-12, Mobile PTT Mike, 2 lbs.............**$ 6.95**
HDP-21, Communications Microphone, 4 lbs....no money dn., $5 mo......................**$ 29.40**
Kit HP-13, DC Power Supply, 7 lbs ...no money dn., $6 mo................................**$ 59.95**
Kit HP-23, AC Power Supply, 19 lbs....no money dn., $5 mo..............................**$ 39.95**

Better than factory assembled!—sectionalized circuit board construction, a minimum of point-to-point wiring, the use of pre-assembled wiring harnesses, plus the personal care given to kit assembly assure the quality you demand.



Just how hot can a SSB transceiver be?—Heath SB-Series leads in amateur radio electronics. Modern circuitry, select components, ample shielding, and the rock-stable Heath LMO give the SB-100 pace-setting high performance.

SB-100 SPECIFICATIONS—Receiver section: Sensitivity: Less than 1 microvolt for 15 db signal plus noise-to-noise ratio for SSB operation. **SSB selectivity:** 2.1 kc minimum at 6 db down, 5 kc maximum at 60 db down—2:1 nominal shape factor—6:60 db. **Input impedance:** Low impedance for unbalanced coaxial input. **Output impedance:** Unbalanced 8 and 600 ohm speaker, and high impedance headphone. **Power output:** 2 watts with less than 10% distortion. **Supurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **Transmitter section: DC power input: SSB:** 180 watts P.E.P. continuous voice. **CW:** 170 watts—50% duty-cycle. **RF power output:** 100 watts on 80 through 15 meters; 80 watts on 10 meters (50 ohm nonreactive load). **Output impedance:** 50 ohms to 75 ohms with less than 2:1 SWR. **Oscillator feedthrough or mixer products:** 55 db below rated output. **Harmonic radiation:** 35 db below rated output. **Transmit-receive operation: SSB:** Push-to-talk or VOX. **CW:** Provided by operating VOX from a keyed tone, using grid-block keying. **CW side-tone:** Internally switched to speaker and headphones in CW mode. Approx. 1000 cps tone. **Microphone input impedance:** High impedance. **Carrier suppression:** 50 db down from single-tone output. **Unwanted sideband suppression:** 55 db down from single-tone output at 1000 cps reference. **Third order distortion:** 30 db down from two-tone output. **Noise level:** At least 40 db below single-tone carrier. **RF compression (TALCTM):** 10 db or greater at .1 ma final grid current. **General: Frequency coverage:** 3.5 to 4.0; 7.0 to 7.3; 14.0 to 14.5; 21.1 to 21.5; 28.0 to 28.5; 28.5 to 29.0; 29.0 to 29.5; 29.5 to 30.0 (megacycles). **Frequency stability:** Less than 100 cps per hour after 20 minutes warmup from normal ambient conditions. Less than 100 cps for ±10% line voltage variations. **Modes of operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Dial accuracy—"resettability":** Within 200 cps on all bands. **Electrical dial accuracy:** Within 400 cps after calibration at nearest 100 kc point. **Dial mechanism backlash:** Less than 50 cps. **Calibration:** 100 kc crystal. **Audio frequency response:** 350 to 2450 cps. **Front panel controls:** Main (LMO) tuning dial; Driver tuning and Preselector; Final tuning; Final loading; Mic and CW Level Control; Mode switch; Band switch; Function switch; OSC Mode switch; Meter switch; RF Gain control; Audio Gain control. **Internal controls:** VOX Sensitivity; VOX Delay; Anti-trip; Carrier Null (control and capacitor); Meter Zero control; CW Side-Tone Gain control; Relative Power Meter Adjust control; P.A.—Bias; Phone Vol (headphone volume); Neutralizing. **Rear Apron connections:** CW Key jack; 8 ohm output; 600 ohm output; ALC input; Power and accessory plug; RF output; Antenna switch; Receiver Antenna. **Power requirements:** 700 to 800 volts at 250 ma; 300 volts at 150 ma;—110 volts at 10 ma; 12 volts at 4.76 amps. **Cabinet dimensions:** 14⅞" W x 6⅝" H x 13⅜" D.

Buy Now—Use This Order Blank

FREE 1966 HEATHKIT CATALOG

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

Heath Company, Dept. 12-1
Benton Harbor, Michigan 49023

HEATHKIT®

☐ Please send FREE 1966 Heathkit Catalog.

☐ Enclosed is $__________ plus shipping.

Please send model(s)__________

Name__________

Address__________

City__________ State__________ Zip__________

Ship Via:

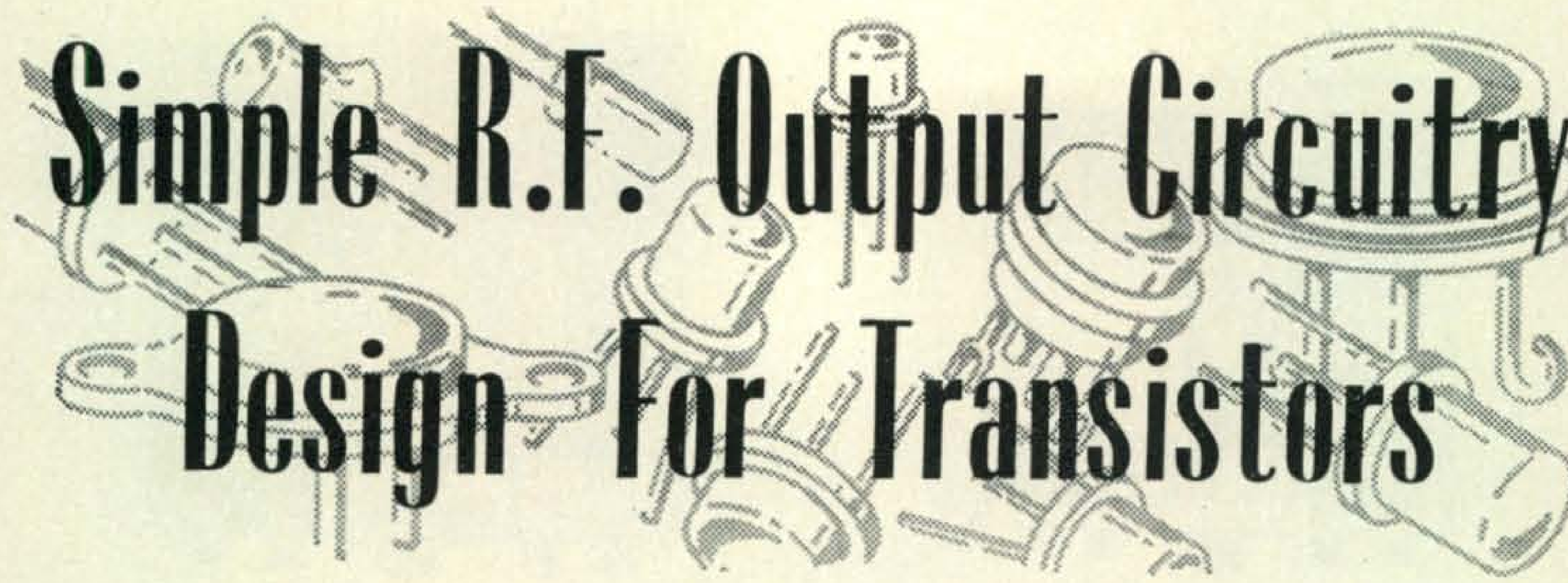
☐ Parcel Post ☐ Express Collect ☐ Freight

☐ 20% Included, C.O.D. ☐ Best Way

All prices & specifications subject to change without notice. AM-160R

For further information, check number 21, on page 110

Simple R.F. Output Circuitry Design For Transistors



BY ROBERT W. SCHOENING,* WØTKX

The use of transistors in r.f. power amplifier circuits creates problems in designing the collector load and the impedance transformation circuit. Presented below is an insight into the problem and the step-by-step design procedure for pi-networks, T-networks and L-networks.

SINCE the very early days of transistors when only a few types would work at high frequencies, the manufacturers of these wonderful devices have speeded up their action until v.h.f. and u.h.f. operation is no longer novel, nor are the transistors for these frequencies terribly expensive. Five watt CB transmitters using transistors are common, and most manufacturers make units capable of 25 watts or more at even higher frequencies, although such transistors cost something over $30.00.

Radio transmitters using transistors offer remarkable advantages when used with dry-battery power, and a significant simplification of mobile units' power supplies. In receivers, tubes may soon be obsolete. Transistors, however, continue to be inferior to tubes in high-power, a.c. operated, r.f. amplifiers: we don't propose to discard over a half century of intensive development invested in DeForest's audion!

Transistor r.f. amplifier circuits are compared to vacuum tube circuits in fig. 1. Self-biased shunt-fed vacuum tube stages using common cathode and common grid configurations are shown in fig. 1(A), while the equivalent transistor circuits are shown in fig. 1(B). The use of rectified-signal bias in both cases requires that operation be in Class B or C, the usual situation in transmitters. If the bias resistor is small enough to load the circuit, or if zero bias (common in transistor applications) is used, an r.f. choke is used in series with, or replacing, the bias resistor.

Because of the bulky heat sink, connected electrically to the collector in most cases, the circuits of fig. 1(C), called grounded collector common emitter and grounded collector common base, are useful at higher frequencies. When these are used, the excitation must be from an ungrounded source, such as a link, coupled to the driving stage's output circuit. At least one manufacturer produces r.f. power transistors having their cases connected to the emitter, so that this devious circuitry is unnecessary.

There is no theoretical difference in the performance of circuits in fig. 1(B) and their corresponding versions in fig. 1(C). While certain advantages may be predicted for either common

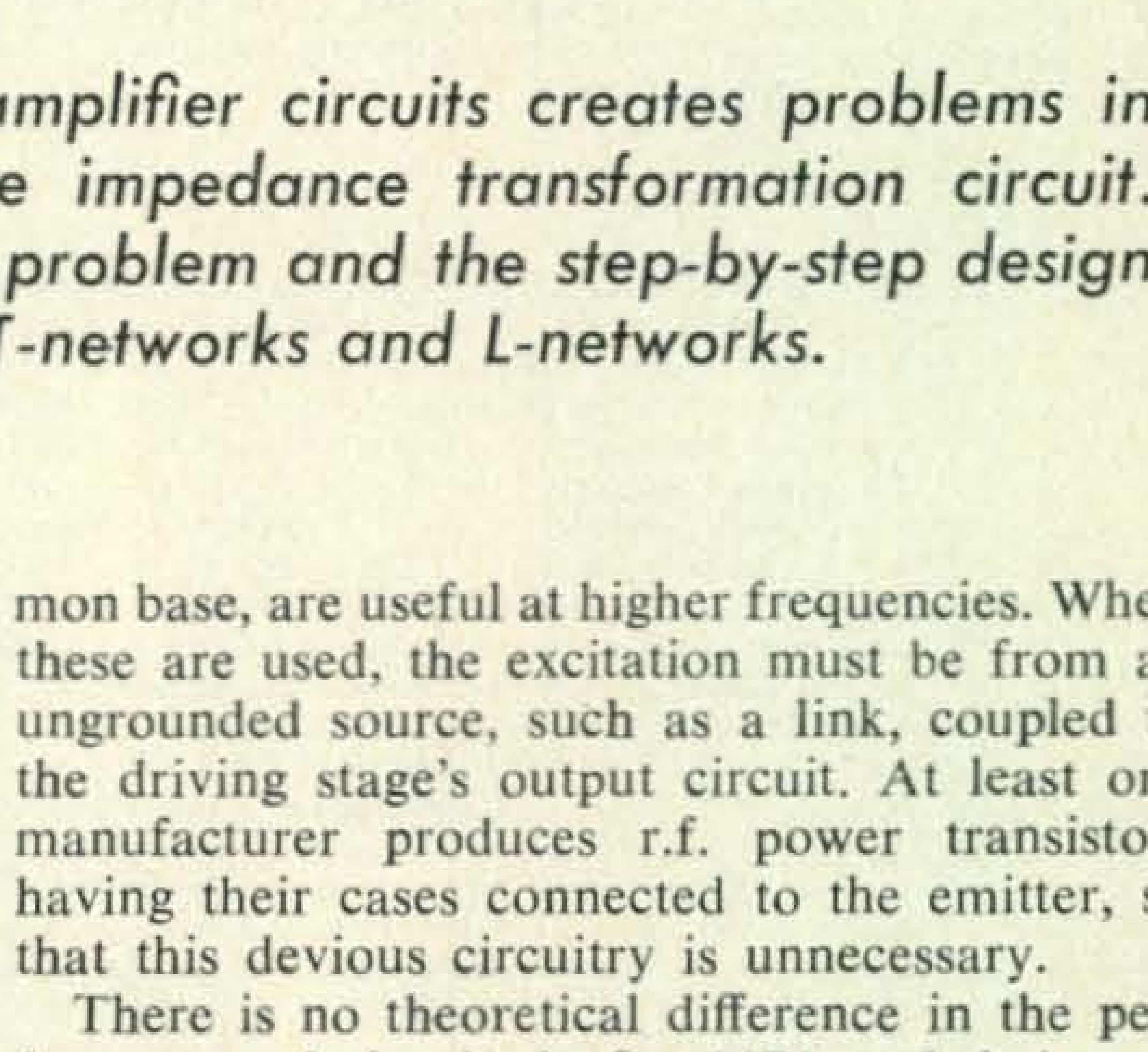


Fig. 1(A)—Basic vacuum tube circuits for grounded cathode and ground grid configurations. (B) Transistor circuit equivalents. (C) These circuits permit grounding of the collector to simplify heat sink problems and are "grounded collector common emitter" and "grounded collector common base" configurations.

*10040 Brookside Avenue, Bloomington, Minnesota 55431.

base or common emitter configuration, experimental results do not always turn out as predicted. Unknown parameters are introduced by circuit strays at high frequencies.

In all of these circuits, the driving signal simply tells the tube or transistor how to switch the direct current through the output circuit on and off. This driving signal, incidentally, is often incorrectly called the "power input," a term which the FCC requires that we reserve for the d.c. fed to the output circuit from the power supply. The changing direct current, in pulses from the d.c. supply, causes current changes through the output load impedance, Z_L, which produce the r.f. output energy.

Vacuum tube stages switch high-voltage low-current d.c. in their plate circuits, developing high output voltages across high impedance loads. The parallel-resonant tank circuit loaded by the antenna (or other desired resistive components) is ideal for this purpose, smoothing the current pulses into a nearly-sinusoidal output waveform by responding over only a small band of frequencies. Unfortunately, transistors can not operate at the voltages required to develop high power across high load impedances, so other approaches must be found. In all cases, the load must represent a pure resistance in order to keep the high current pulses from occurring when the voltage drop across our "switch" is not at its minimum—a condition which would sharply increase plate or collector dissipation.

Shunt Feed

Although shunt fed amplifier output circuits are shown in fig. 1, series feed might well be used in many cases. The shunt fed circuit requires an r.f. choke representing a high impedance at the operating frequency, at least 10 times the load impedance. Ordinary chokes used in vacuum-tube stages have adequately high impedances, but lack the current-carrying capacity for transistor applications. Although shown as a choke, the transistor circuits should use a coil having large enough wire to carry the d.c., in parallel with a small adjustable trimmer, tuned (with a grid-dip oscillator and the transistor and heat sink in place, but the load removed) to about 5% below the operating frequency of the amplifier. Due to the low voltage across it, r.f. current in this circuit will be negligible. About 200 to 800 ohms each of X_L and X_C should be satisfactory. Tuned this way, the circuit represents a high capacitive reactance in parallel with the load, and its reactive effect, including heat-sink to chassis capacitance—will be swamped out by the low Z_L in operation.

Push-Pull

Probably because vacuum tubes are seldom used in push-pull r.f. amplifiers these days, designers have neglected push-pull transistor circuits. This omission disregards several unique advantages for push-pull transistors. First, in push-pull the excitation generator is loaded on both halves of its cycle, preventing destructive inverse voltage peaks across the base-emitter junctions. This particular rating is quite low for some high frequency power transistors, so that near the limit of operating frequency they cannot be driven harder to make up for loss of current gain; they must be operated at lower power and efficiency levels. Another advantage of push-pull is the use of a load impedance four times that for a single-ended stage, reducing losses in the output circuit itself.

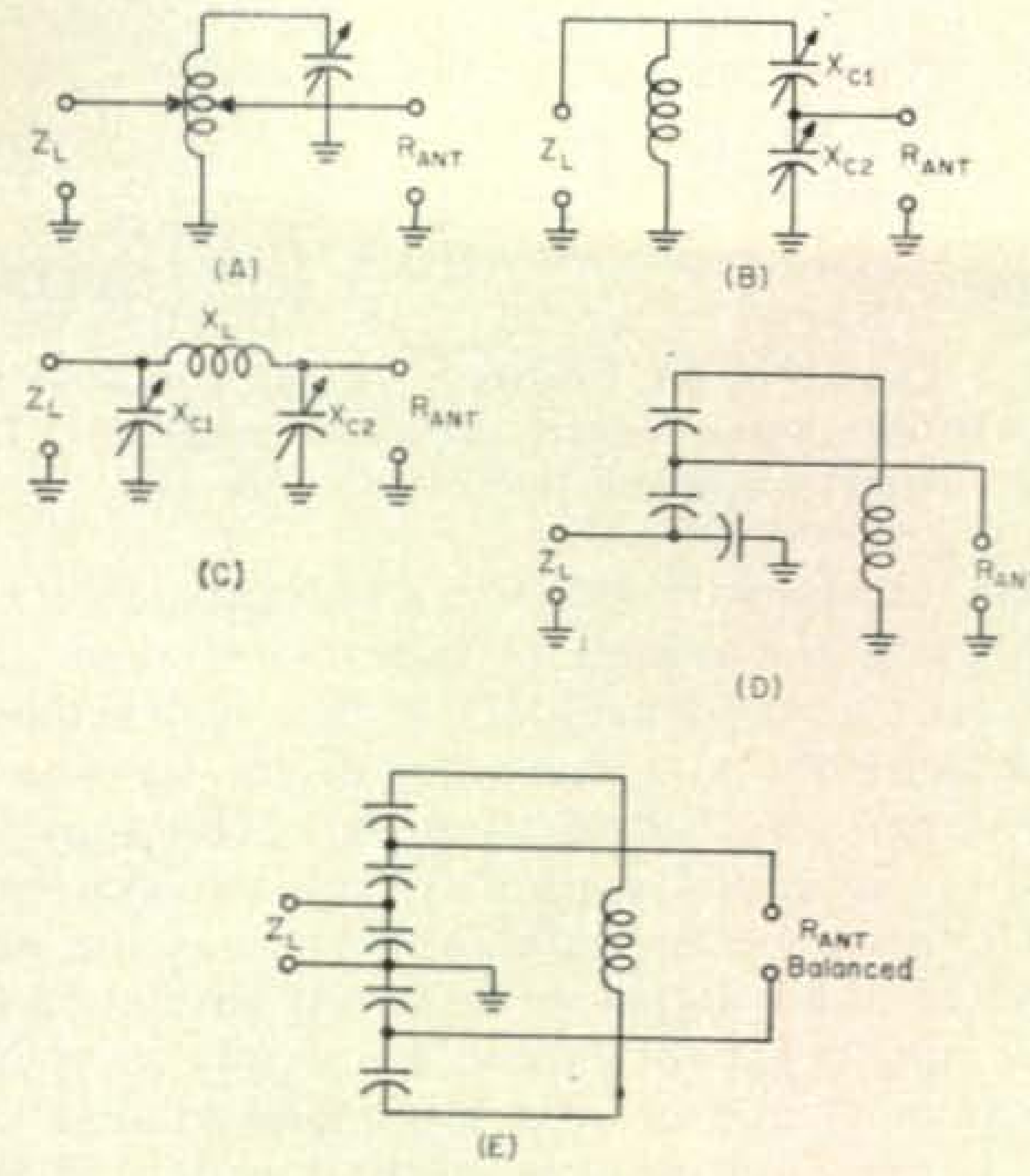


Fig. 2—Various load and impedance transformation circuits described in the text.

Load Impedances

Operating r.f. amplifiers at high currents and low voltages, an ordinary tank circuit would require impractical values of L and C to achieve an operating Q high enough to produce a good waveform. An operating Q (loaded) of 12 is generally considered the minimum required for reducing the second harmonic content of the output wave, so that a load impedance (Z_L) of 12 ohms would require reactances having the ridiculous value of *one ohm*. If the antenna itself has a Q of 12 or more, it still cannot be used directly, since its distributed constants give it multiple resonances; besides it might not represent the *correct* impedance, and is almost ceratin to be slightly (or greatly) reactive. This means that for Z_L we must include selective devices capable of cancelling the antenna's reactance and presenting a purely resistive load of the proper value to the amplifier.

Figure 2(A) shows a frequently-encountered method of cancelling antenna reactance. If the load impedance required is not too low, suitable taps on the coil may be found by experimentation. A mathematical solution is not available due to the incomplete and unpredictable flux linkage between the various parts of the coil. Developing the output voltage across an inductive tap has been found to result in higher peaks of voltage than the predicted maximum of twice the d.c. supply voltage; so for transistors with their rigorous voltage limitations, this circuit requires caution. Connecting the antenna

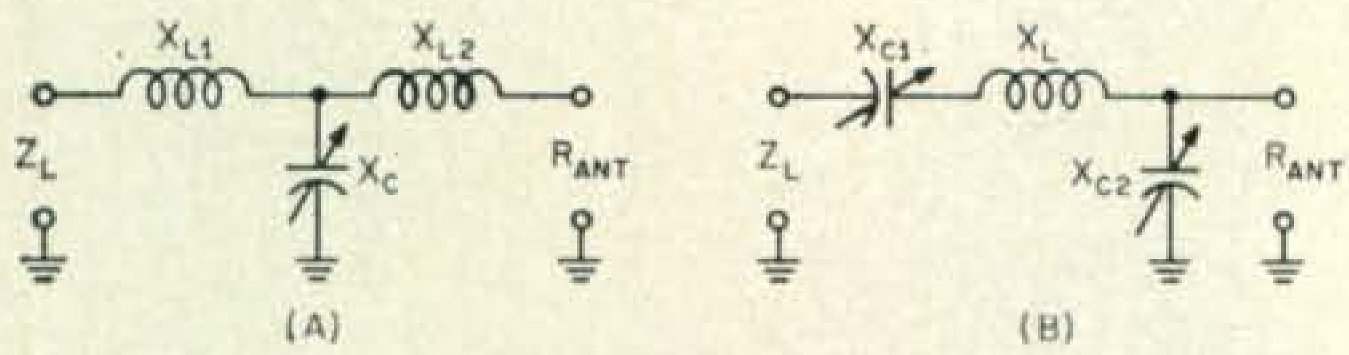


Fig. 3—Circuits of the T-network (A) and L-network (B) for use with transistorized r.f. power amplifiers. The design procedure is covered in the text.

across an inductor has the disadvantage of accentuating the output at harmonics, since the reactance across which this voltage is developed varies directly with the order of the harmonic.

For harmonic attenuation, fig. 2(B) may be used. It is called capacitive antenna coupling and offers a better waveform, but has the mechanical disadvantage of requiring insulation of the tuning capacitor's rotor. By simply reversing the antenna and ground terminals, so that the circuit common point is at the junction of the two capacitors, this circuit becomes the familiar pi-network shown in fig. 2(C)—widely used in modern vacuum-tube amplifiers. Unfortunately, the pi-network requires the same reactance value as a parallel-resonant tank—values impractical for transistors at high power levels. A tap on the coil, as in fig. 2(A) might be used, but with the same disadvantages as outlined previously.

With circuits such as those in fig. 2(D) and 2(E), the problem begins to look discouraging. Figure 2(D) brings up the insulation problem again, and 2(E) shows this system feeding a balanced load. Consider what a balanced (push-pull) generator feeding a balanced transmission line would look like.

L and T-Networks

Figure 3(A) shows a T-section network for impedance matching. Experiments indicate that the two inductive elements (not coupled) can be computed closely enough so that only the capacitor need be made variable. However, if the output load impedance represented by the antenna is complex, or is not entirely predictable, adjustment of X_{L2} would be useful. For a Q of 12 to 15, the values of L and C are quite practical for very low load impedances.

Figure 3(B) shows a resonant L-network which permits convenient loading adjustment by making X_{C2}, or a portion of it, variable. The values of L and C are quite practical at high frequencies, becoming rather cumbersome below five megacycles or so.

The T and L-networks result in a series resonant circuit, so that they are tuned for *maximum* d.c. current rather than minimum as with the pi-network or regular tank.

Antenna Impedances

To make use of these circuits, the load required for the amplifier and the anticipated antenna impedance must be known. Most transmitters today are designed to look into a 50 to 75 ohm resistive, unbalanced, antenna, so that R_{ant} in the design problem will be in this region unless other conditions are known to prevail. Antenna reactance, if not *too* pronounced, can be tuned out with the adjustable elements; otherwise a separate antenna tuner must be used.

Calculating Z_L

The load impedance, Z_L, into which the tubes or transistors look, is often computed by squaring the d.c. supply voltage and dividing by twice the anticipated power output. Using this, it must be recognized that an assumption has been made that the peak a.c. voltage is equal to the d.c. supply voltage, and that this condition will not be achieved. The impedance found this way will always be too high, therefore Z_L should be computed for 10 to 20% more power than is anticipated. For very low impedances, tank loss resistance will also increase Z_L, so adjustments, particularly toward lower-than-computed value of load impedance should be provided.

Selecting Q

Very low load impedances will inevitably reduce the efficiency of the tuning circuit used, since loss resistance becomes an appreciable percentage of the total load. For this reason, large wire or tubing should be used for the coils, and connections should be well made. To further increase tank efficiency, the lowest suitable value of loaded Q is recommended. While the circuits in fig. 3 both furnish excellent harmonic attenuation, a Q of 10 or more should be used for feeding a selective antenna which does not respond at the second harmonic. If the antenna is not definitely known to conform to these requirements, a Q of 12 to 15 should be chosen. A Q of 5 to 7 is satisfactory for interstage coupling, or where additional selectivity appears between the stage's output and the antenna. The rule for tank efficiency is simple: high unloaded Q, low loaded Q.

Calculations

Because of their frequent use in phase-shifting circuits, L-C networks found in handbooks tend to be surrounded by mysterious mathematical formulae. For impedance transformation, however, the calculations can be simplified. In providing these solutions, a step-by-step procedure has been outlined which should make it possible for the average experimenter, amateur, or serviceman to design transistor power amplifier circuits. The networks operate by connecting inductance or capacitance to the antenna resistance to make it look like a different value, and then tuning out the residual reactance by introducing reactance of the opposite sign.

The pi-network is very good for vacuum tube amplifiers and for very low-power transistor circuits where Z_L is several hundred ohms or more. Where the load impedance is much less, the other two circuits are useful. Figure 3(B) may be used only when the load is less than the antenna resistanse. An operating constant, D, has been introduced to simplify computation and notation. Slide-rule answers are adequately accurate because of circuit strays.

For each of the systems, follow the steps inserting your Q, Z_L, and R_{ant}. Remember to make Z_L a bit lower than the formula indicates. If in doubt about Q, use 12. Where Q is more than about 10, the quantity $Q^2 + 1$ may be simplified to Q^2, since adding one in these cases will not appreciably change the result. If the answers are not real and positive, the circuit is not suitable for your particular impedance transformation, and a different configuration must be chosen.

Pi-Network Design

To design a pi-network proceed as follows:

1—Determine Z_L as previously explained.

$$Z_L = \frac{E_{d.c.}^2}{2 P_{out}} \qquad (1)$$

2—Select the values for Q and R_{ant} as previously explained.

3—Find the constant D_Q:

$$D_Q = 1 + Q^2 \qquad (2)$$

4—Find a second constant, D_K:

$$D_K = \frac{R_{ant} D_Q}{Z_L} \qquad (3)$$

5—Find the third constant, K:

$$K = \sqrt{D_K - 1} \qquad (4)$$

6—To determine X_{c1}, (in ohms) of fig. 2(C):

$$X_{c1} = \frac{Z_L}{Q} \qquad (5)$$

To Convert X_c to C in mmf use the formula:

$$C_{mmf} = \frac{159{,}000}{X_c f_{mc}} \qquad (6)$$

7—To determine X_L (in ohms) of fig. 2(C):

$$X_L = \left[\frac{Q Z_L}{D_Q} + \frac{K R_{ant}}{D_K}\right] \qquad (7)$$

To convert X_L to inductance in microhenries, use the formula:

$$L_{\mu h} = \frac{0.159 X_L}{f_{mc}} \qquad (8)$$

8—To determine the value of X_{c2} in ohms use:

$$X_{c2} = \frac{R_{ant}}{K} \qquad (9)$$

To convert to mmf, use formula (6).

T-Network Design

To design a T-network as shown in fig. 3(A) proceed as follows:

1. Determine Z_L as previously explained.
2. Select Q and R_{ant}.
3. Find the constant D when:

$$D = Q^2 + 1 \qquad (10)$$

4. Determine the value of X_{L1} in ohms by:

$$X_{L1} = Z_L Q \qquad (11)$$

To convert X_L to L use formula (8).

5. Determine the value of X_{L2} in ohms by:

$$X_{L2} = \sqrt{R_{ant}(Z_L D - R_{ant})} \qquad (12)$$

To convert X_L to L use formula (8).

6. To determine X_c in ohms:

$$X_c = \frac{R_{ant} Z_L D}{X_{L2} + Q R_{ant}} \qquad (13)$$

To convert X_c to C in mmf use expression (6).

L-Network Design

To design a tuned L-network as shown in fig. 3(B) proceed as follows:

1. Determine Z_L as previously outlined.
2. Select the values for Q and R_{ant}.
3. Find the constant D when:

$$D = \frac{R_{ant}}{Z_L} \qquad (14)$$

4. Calculate X_{c2} in ohms where:

$$X_{c2} = \frac{R_{ant}}{\sqrt{D - 1}} \qquad (15)$$

Convert X_{c2} to C in mmf using expression (6).

5. Calculate X_L in ohms where:

$$X_L = Q Z_L \qquad (16)$$

Convert to L in microhenries using expression (8).

6. Calculate X_{c1} in ohms, where:

$$X_{c1} = \left[X_L - \frac{X_{c2}(D - 1)}{D}\right] \qquad (17)$$

Convert X_{c1} to C in mmf using expression (6).

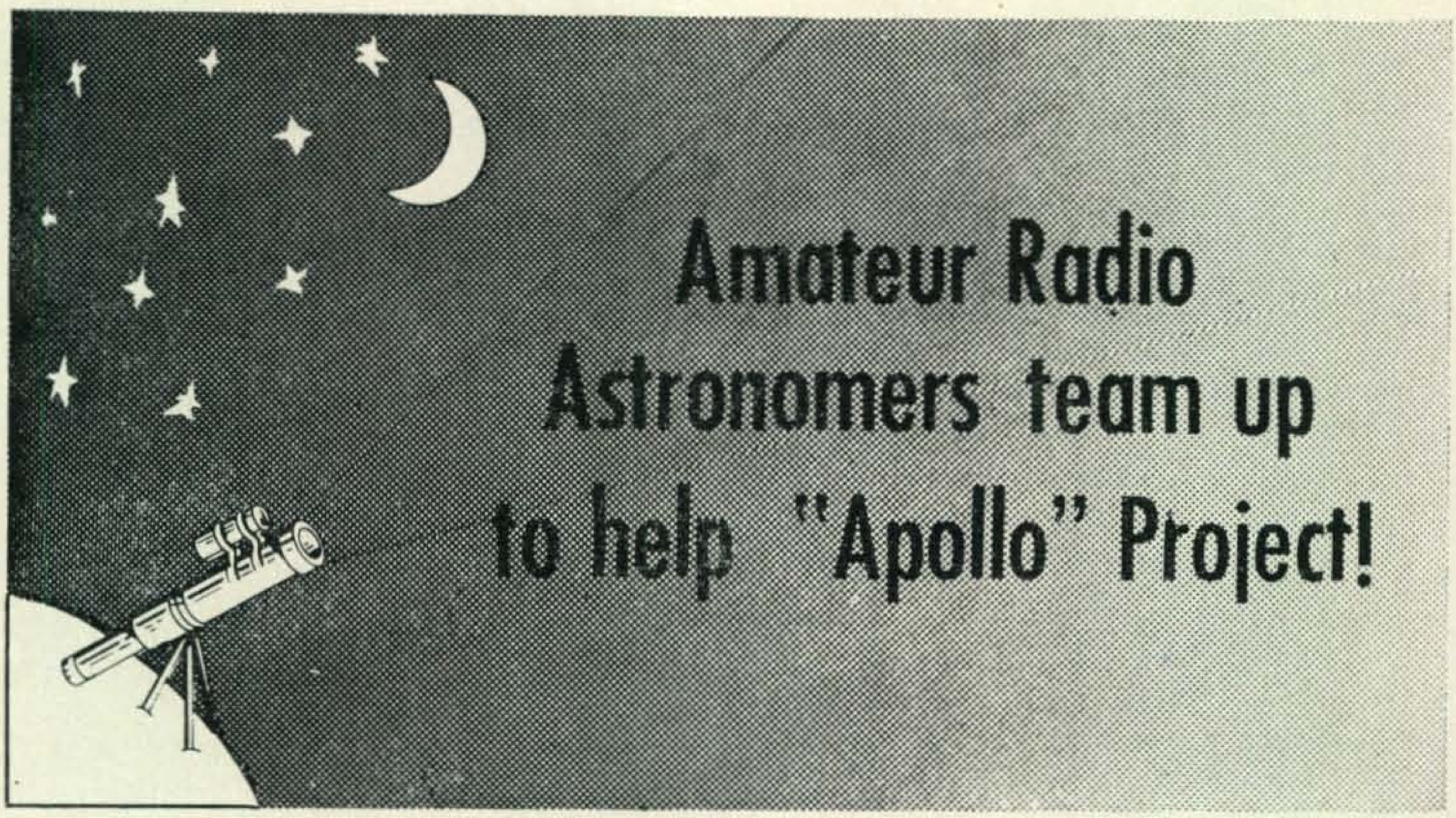
Coil Design

To construct your coils, after determination of the required inductance in microhenries, the number of turns required may be approximated by:

$$N \cong \frac{1}{a} \sqrt{L_{\mu h}(9a + 10b)} \qquad (18)$$

where a = winding radius in inches.
b = winding length.

■



Amateur Radio Astronomers team up to help "Apollo" Project!

BY KIRK CHRISTIAN*

How would you like to help America's "Apollo" Moon mission?

More than 50 amateur radio operators in California, Arizona and New Mexico are, and there's a need for more volunteers in those states and for additional stations across the nation.

In their newest public service project, the California, Arizona and New Mexico amateurs have teamed with more than three dozen amateur and professional astronomers to establish something they call the "Argus-Astronet" moon watching network.

Together, the radio operators and astronomers are maintaining a concerted vigil of the Moon's surface, hoping to detect events and phenomena that scientists know occur.

Founded June 1, the Argus-Astronet is the brainchild of Dr. Gerald A. Guter (WA6OQU) of Glendora, California, a space scientist who has been a key member of a National Aeronautics and Space Administration (NASA) lunar research program for the last three years. Concerned about the lack of definite knowledge on lunar activity and phenomena, Dr. Guter conceived the idea of teaming the radio amateurs with the astronomers to provide simultaneous lunar observations and instant communications.

"Over the years there have been thousands of reports of phenomena occurring on the Moon," Dr. Guter explained. "In virtually every case, the events were seen by only one pair of eyes and, therefore, couldn't be verified."

Definite information about lunar events that could help American astronauts is very sketchy.

An amateur astronomer himself, Dr. Guter contacted and met with dozens of star gazers throughout Southern California and by letter interested others in Northern California, Arizona and New Mexico. And, to handle the radio end of the network, Dr. Guter turned to another aerospace expert, W. R. "Wally" Calkins (W1KUX) of West Covina, one of Southern California's best known radio amateurs.

As Dr. Guter enlisted interested amateur and professional astronomers, Calkins contacted many of his amateur radio friends and tried to team them with nearby astronomers. Thus far, approximately 35 astronomer-radio teams have been organized and observing schedules arranged to lighten the observing load for everyone.

Dr. Guter and Calkins appropriately named the observing program "Argus" after the Greek mythological creature with one hundred eyes.

Astronet swings into action every weekday when the moon is observable between 0300 and 0600 GMT on the 75 meter band (3.885 kc). S.s.b. is being used with phone patches.

Calkins has been designated Astronet "control" and directs all traffic on the frequency over his son's station (WA6UCR).

On the average, four astronomer-radio teams maintain their simultaneous watch. At the beginning of the evening, each checks in with Calkins to let net "control" know they're on the job. The astronomers divide up the moon into quadrants and slowly eye every peak, crater and ridge seeking any scrap of activity. When a suspicious occurrence is spotted, the alert is sounded over the Astronet and all eyes converge on the area.

Dr. Guter also has made arrangements with four large professional observatories to zero in suspected "sightings." They are the Lowell Observatory of Flagstaff, Arizona; Organ Mountain Observatory of Las Cruces, New Mexico; the Lunar and Planetary Observatory of Tucson, Arizona; and the Ford Observatory of Mount Peletier, California.

Thus far, the Argus-Astronet has had one

*427 South Lupin Lane, Glendora, California 91740.

"sighting." On the nights of August 2 and 3, Dr. Guter reports, one of the moon's craters (Aristarchus) was seen giving off a pulsating white light. This wasn't a new discovery. A similar observation was made in the same crater two years ago by a pair of astronomers at Lowell Observatory. What was significant is that the August 2-3 sighting was the first ever observed by astronomers watching from a number of points.

The "first" was scored by four astronomers working with three radio amateurs observing from three cities:

They were:

1. A pair of young astronomers—Ron Emanuel of Azusa, California and Steve Welch of Covina, California—teamed with Dr. Guter on WA6-OQU.

2. Amateur astronomer Larry Bornhurst of Monterey Park, California teamed with Calkins on WA6UCR.

3. Bob Leasure of Phoenix, Arizona, a double-threat radio amateur (K7UNK) and amateur astronomer. Leasure has his observatory organized in such a fashion that he can keep his eye on the moon and his hand on the transmitter.

"No conclusions have been drawn on what the observers saw," Dr. Guter said. "That's for the scientists and professional astronomers to unravel."

But just guessing, Dr. Guter theorizes the pulsations could have been caused by intense radiation from the sun illuminating gas from a volcano, or a fluorescent material.

Since the network was established, interest in its work has been widespread in the Southwest and radio amateurs have offered assistance of all kinds. Thomas K. "Tommy" Tamashiro (W6YBB) of Cucamonga, California frequently hauls amateur astronomers into the nearby San Gabriel Mountains for "smog free" moon watching. Tamashiro sets up nearby with his automobile mounted s.s.b. equipment to tie into the Astronet. It works fine—except when wandering bears scare the devil out of Tamashiro and the astronomers.

Dale B. Dorothy (W7CTK) of Las Vegas, Nevada has contributed his 8-track tape recording equipment and keeps a permanent record of all Astronet sightings. Hugh Cabot (WA5-KSQ) of Shafter, Texas has offered to be a relay point for stations in the east.

"Expanding the Astronet into the East, Canada, Mexico and Hawaii is Argus' next goal," Dr. Guter explained. "That's where the radio amateurs can help. More stations in the Southwest also are needed."

The key areas are:

California—Covina, Inglewood, Manhattan Beach, Pasadena, Pomona, Santa Monica, San Francisco, Torrance and Whittier.

Arizona—Flagstaff, Phoenix and Tucson.

New Mexico—Las Cruces.

Missouri—Neosho.

Iowa—Eldora.

Illinois—Champaign, Lisle.

Ohio—Delphos, Fremont, Hudson, Lima.

Amateur astronomers and radio operators in California, Arizona and New Mexico have their eyes on the moon and hands on the transmitter in a combined new public service project—the "Argus-Astronet" moon watching network. Here, Dr. Gerald A. Guter (left) mans the eye piece of an 8-inch telescope while T. K. Tamashiro (W6YBB) stands by the transmitter.

Georgia—Atlanta.

In each of these communities, there is an amateur astronomer willing to participate in the Argus network who needs one or more radio partners.

"We'll probably have to add a 40 meter Astronet band in the future," Calkins commented, "to reach across the country and to other distant places."

Recognition of the work the amateur radio operators and astronomers are accomplishing has been given by one of California's most prominent professional astronomers, Dr. C. H. Climinshaw, director of Los Angeles' Griffith Park Observatory and Planetarium.

"The point is that these men are doing something the large observatories can't do because the observatories have other assignments," Dr. Climinshaw said. "The work is very worthwhile and I hope it's carried on," he added.

"Any information the Astronet acquires will be reported to NASA," Dr. Guter said. "NASA recently has become extremely interested in a network similar to Astronet using a hot line telephone communications hook-up. It probably will take months and years of patient, night-in, night-out observing to spy out the moon's secrets," Dr. Guter said. "But even the tiniest hint of information has to help America's Apollo effort. Maybe we'll find something that will warn us to steer our astronauts away from certain areas, or maybe we'll find minerals or materials that can be of use to them."

Amateur radio operators interested in participating should contact Calkins on WA6UCR or at 814 Cameron Avenue, West Covina, California. ■

The Volt-Ohm-Milliammeter

BY WILFRED M. SCHERER,* W2AEF

Sooner or later, most hams will find themselves in a building or trouble-shooting situation that requires a little test equipment. It may call for only a simple VOM, or a grid dip meter, but whatever instrument it is, it will be worth its weight in PL-68's if you know how to use it. However, most newcomers (and a fearsome number of old-timers, too) have only the slightest notion of what makes that old VOM tick, nor do they really know how to get the most use from the test equipment they have.

CQ is pleased to begin this month a down-to-earth series, written by our own Bill Scherer, W2AEF, which will attempt to take the mystery out of instruments in general. This month the subjects are the basic measurements, and the volt-ohm-milliameter.

A PRIME requisite for testing, servicing and maintaining electronic equipment is knowledge of the voltage, current, resistance or continuity at various points of the circuitry. This knowledge can be obtained easily with a volt-ohm-milliammeter, (v.o.m.), which is a multimeter with which the measurement of these values can be made, all with *one* instrument. For this reason the v.o.m. is without a doubt the most universally used piece of test gear to be found in the ham shack, service shop or laboratory.

The vacuum-tube voltmeter or v.t.v.m. is another combination-type instrument that is becoming more and more popular because of other desirable features it provides; in fact, sooner or later you'll find it best to have both instruments on hand.

As the name implies, the v.t.v.m. utilizes vacuum tubes. It has the following advantages over the v.o.m.: higher input resistance that allows more accurate measurements on high-impedance circuits; greater sensitivity that allows the measurement of smaller voltages and larger resistances; lower input capacitance that permits a.c. measurements up to radio frequencies; inherent circuitry that protects the meter movement against damage.

On the other hand, the v.t.v.m. has some disadvantages, namely: it requires power for operation, usually obtained externally from 117 v.a.c.;[1] warm-up time is needed and heat is generated within the unit that can affect stability and accuracy; heating and cooling cycles may age and change component values and thus require occasional recalibration of the instrument; current cannot be directly measured.

Advantages of the v.o.m. over the v.t.v.m. are: it provides instantaneous operation; usually is smaller and less bulky (pocket models can be had); is more stable and does not require external power. It is thus handy to cart around and is well adapted for service and maintenance work in the shop or in the field. Also, completely wired models usually cost less than assembled v.t.v.m.'s.

Let us now take a look at the methods used for measuring different electrical quantities.

Ammeter

Current flow through a device called a meter is the basic principle underlying the measurement of voltage, resistance and current with the instruments about which we're concerned.

Meters used for measuring current are called ammeters. For direct-current applications most meters have the D'Arsonval type movement as shown at fig. 1. A pointer, attached to a small armature coil mounted on pivots within a magnetic field, moves over a calibrated scale as the current flowing through the coil causes the coil to turn due to its interaction with the magnetic field. The action is like that of an electric motor.

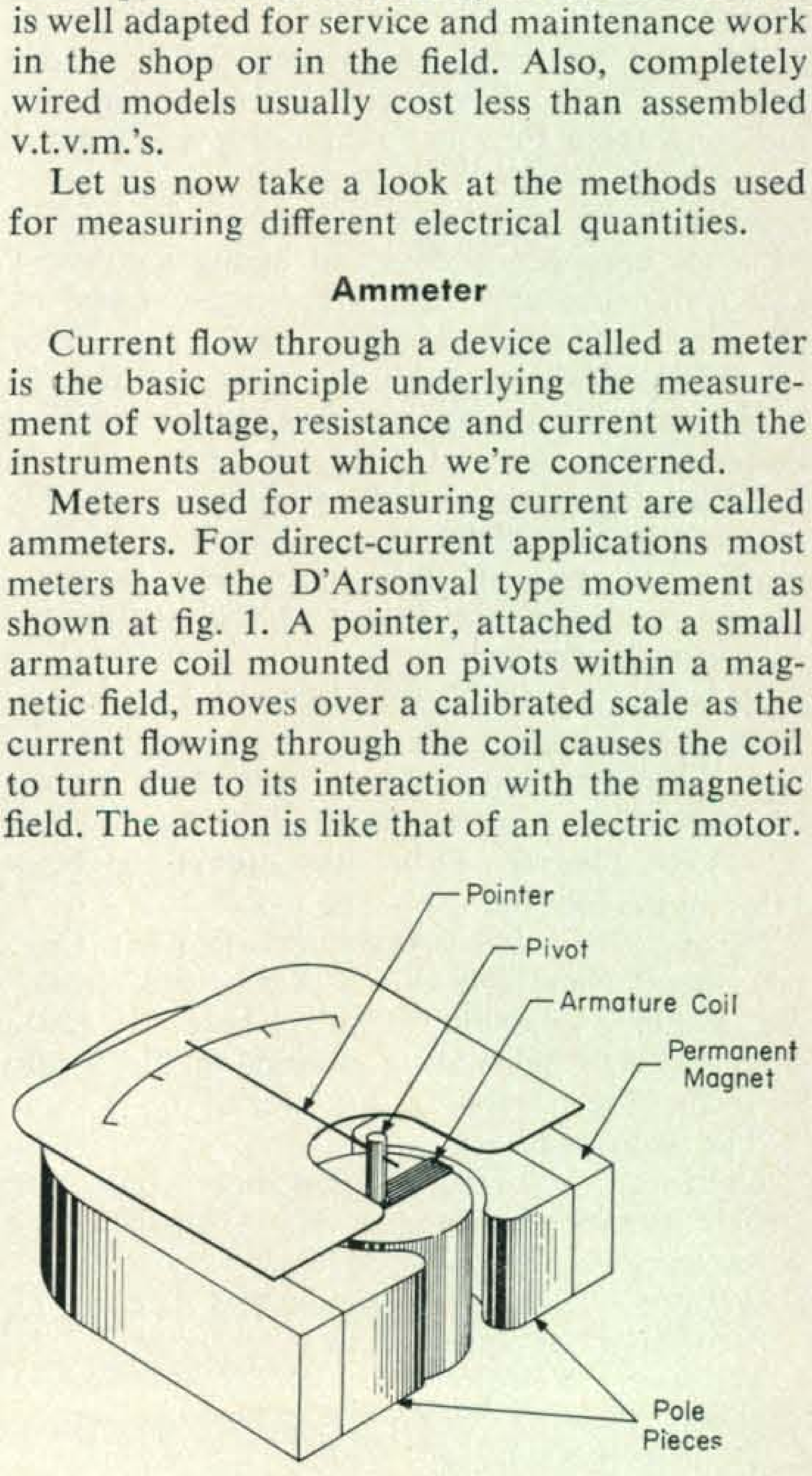


Fig. 1—The D'Arsonval-type meter movement. See text.

*Technical Director, *CQ*.

[1]A recent innovation is a v.o.m. in combination with a v.t.v.m. operated from self-contained batteries.

The degree of rotation is generally proportional to the current flowing through the armature, so the scale may be made linear with its calibrations equally spaced over the range.

Meters with other type movements are sometimes used for special applications or low cost, but they will not be discussed here, since they are not well suited for use with v.o.m. or v.t.v.m. work.

Most of the currents encountered in electronic work are small (less than one ampere), so meters having basic full-scale ranges in milliamperes or microamperes generally are used.

Current Measurement

To measure current, the meter is inserted in series with the load as shown in fig. 2. Note that the polarity of the meter must correspond to that of the voltage source.

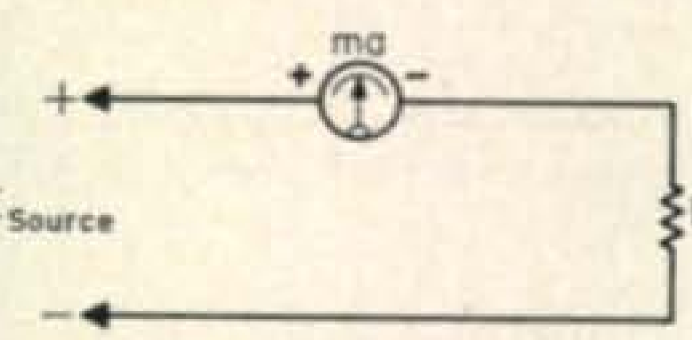


Fig. 2—Circuit for measuring current.

If the current to be measured exceeds the full-scale range of the meter, a *shunt* resistor must be placed across the meter to extend its range accordingly. See fig. 3. The current is thus divided between the shunt resistor and the meter, the amount of current in each branch depending on the ratio of the shunt resistance to the meter resistance. The current that flows through the meter then can be kept within its full-scale range by proper choice of a shunt resistor.

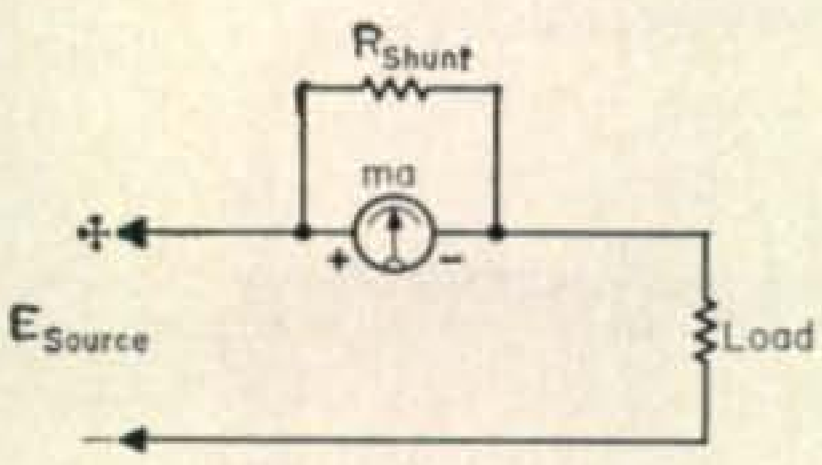


Fig. 3—Circuit for extending range of a milliammeter.

For example: If a 0-1 milliammeter having an internal resistance of 90 ohms is shunted with a 10-ohm resistor, nine tenths of the current will flow through the shunt, and one tenth will go through the meter. Then, if the total curent drawn by the load is 10 ma, 9 ma goes through the shunt and 1 ma passes through the meter which now will read full scale. For lower currents the calibrations on the meter may be multiplied by a factor of ten, since the meter now indicates the amount of current by this same ratio. Similarly, for a 0-100 ma range with a 0-1 ma meter, 99% of the current will have to go through the shunt, 1% through the meter, and the shunt therefore must be proportionately smaller.

Further details for determining the correct size shunt will not be taken up, since these already have been worked out by the manufacturers of the instruments under discussion.

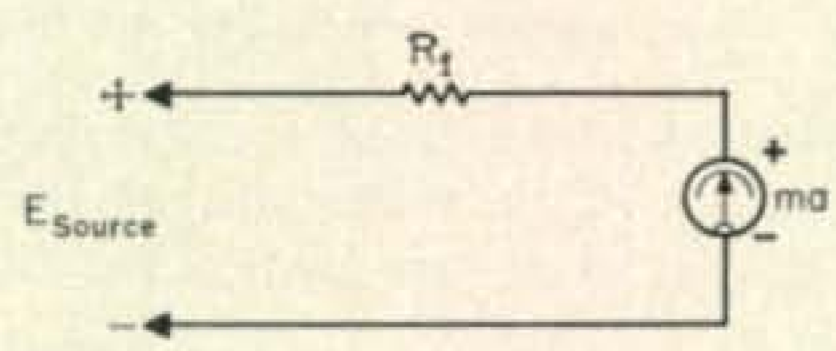
Voltmeter

Voltage also is measured by a current-operated device which in the case of the v.o.m. usually is a milliammeter or a microammeter. This is how it works:

Referring to fig. 4, R_1 is a *multiplier* resistor connected in series with the meter and the combination of the two is connected across the source of voltage to be measured. R_1 is proportioned so as to limit the current through the metering circuit to the full-scale-current range of the meter when the desired full-scale voltage is applied.

For instance: If the full-scale range is to be for 10 volts and if the meter is a 0-1 ma unit, the circuit resistance will have to be 10,000 ohms to limit the full-scale current to 1 ma, since by Ohm's Law: $R = E \div I = 10\text{ v.} \div .001\text{ a.} = 10{,}000$ ohms. R_1, the multiplier resistor, then will be the circuit resistance, R, minus the meter resistance, R_m, or $R_1 = R - R_m$. Except for ranges below about 10 volts, the meter resistance is negligible compared to the multiplier resistance, so the latter may be considered the circuit resistance.

Fig. 4 — Basic circuit for measuring voltage.



A lower applied voltage will cause less current to flow and the meter will read proportionately lower. The meter then can be calibrated in terms of voltage up to 10 volts and the setup thereby constitutes a voltmeter with a full-scale range of 10 volts.

Substituting values in the above formulas will show that the circuit resistance would have to be increased to 50,000, 100,000 and 250,000 ohms for full-scale readings of 50, 100 and 250 volts respectively. The same 0-1 ma meter there-

A pocket-size volt-ohmmeter. The individual functions and range are selected by inserting the test leads into separate jacks instead of using a selector switch. The sensitivity is 10,000 ohms/volt on both d.c. and a.c. ranges which go up to 1200 volts. The maximum resistance reading is 10 megohms.

A 20,000 ohms/volt v.o.m. with carrying handle. Up to 5000 volts d.c. or a.c. may be read (5000 ohms/v. on a.c.) on a 4½" scale. The selector switch has separate positions for the individual d.c. and a.c. ranges. The ohms scale covers up to 20 megohms. Full-scale current ranges are from 0-100 μa to 0-10 a.

fore can be used for measurements over a wide range of voltages simply by the insertion of the correct size multiplier resistor.

Ohms-Per-Volt

Dividing the circuit resistance by the full-scale voltage, as given in the above examples, we find that for each volt of *full-scale* deflection the circuit resistance must be 1000 ohms in order to limit the maximum current of a 0-1 milliammeter around which the voltmeter is built. This is indicative of the voltmeter's sensitivity. It is termed "ohms-per-volt" and may quickly be determined by dividing one volt by the full-scale-current rating of the meter.[2]

The voltmeter resistance for a given range then is equal to ohms-per-volt times the *full-scale* voltage range. Thus the resistance of a 1000 ohms-per-volt meter on its 10-volt range will be 1000 × 10, or 10,000 ohms. On the 100-volt range it will be 1000 × 100, or 100,000 ohms, and so on for the various other ranges.

Similarily we find that a voltmeter made with a 0-50 microammeter will have a sensitivity of 20,000 ohms-per-volt, since 1 v. ÷ .00005 a. 20,000 ohms. The voltmeter resistance on the 10-volt range now will be 200,000 ohms (20,000 × 10), and 2,000,000 ohms on the 100-volt range (20,000 × 100). Higher value multiplier resistors therefore will be required with this meter than with a 0-1 ma meter.

The resistance of the voltmeter on its different ranges is an important consideration when accurate measurements are desired to be made on high-impedance sources, as will be discussed subsequently.

[2]Meter sensitivity also is referred to as the basic full-scale current range of the meter. The smaller the full-scale current; the higher the sensitivity.

A.C. Voltmeter

If a.c. is applied to a d.c. meter, the armature of the movement will tend to rotate in an opposite direction with each reversal of the a.c. cycle and since each cycle essentially is of the same amplitude, the armature tends to stand still or vibrate slightly, as it cannot move fast enough to follow each reversal. There are special meter movements for conducting a.c. measurements, but our discussion will be limited to the method employed in the v.o.m.

A typical arrangement for measuring a.c. voltages is shown at fig. 5. It simply consists of an a.c. rectifier, the d.c. output of which is applied to a d.c. milliammeter or microammeter.

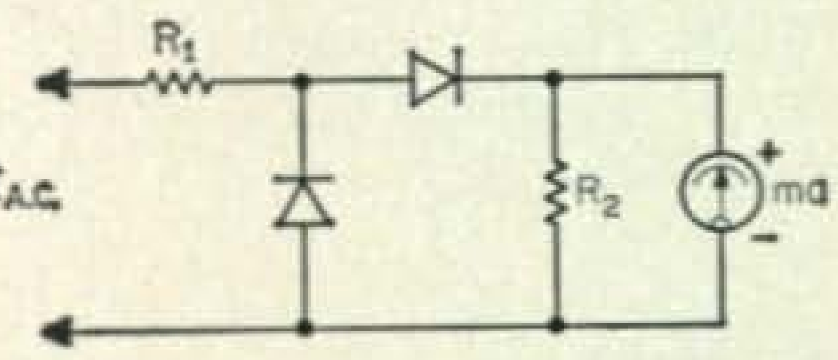
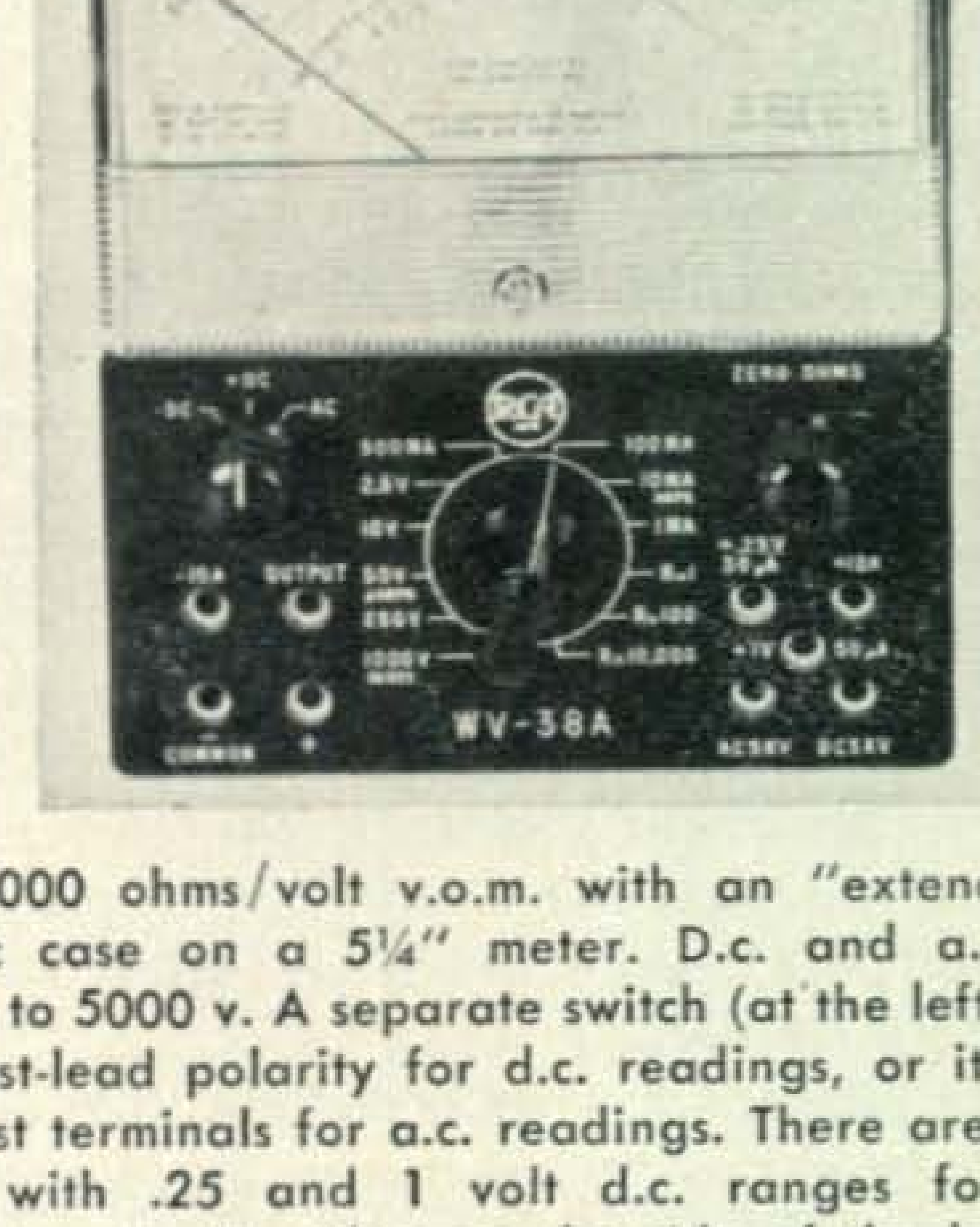


Fig. 5—Circuitry for rectifier-type a.c. voltameter. The horizontal rectifier is CR_1; the vertical one is CR_2.

R_1 is the multiplier resistor and CR_1 is a copper-oxide half-wave rectifier. Its back resistance is low enough to allow a small current-flow through the meter circuit in the opposite direction when the a.c. cycle reverses. This tends to reduce the the average forward meter reading and produce an erroneous indication; however, the effect is eliminated by using CR_2 to provide a low-resistance path that bypasses the reverse current around the meter circuit.

The rectifier is non-linear at very low currents, so R_2, which is several times smaller than the meter resistance, is used to raise the current



A 20,000 ohms/volt v.o.m. with an "extended-view" plastic case on a 5¼" meter. D.c. and a.c. ranges go up to 5000 v. A separate switch (at the left) reverses the test-lead polarity for d.c. readings, or it transfers the test terminals for a.c. readings. There are separate jacks with .25 and 1 volt d.c. ranges for use on transistor circuits. Clips on the side of the handle are for carrying the test leads along with the instrument.

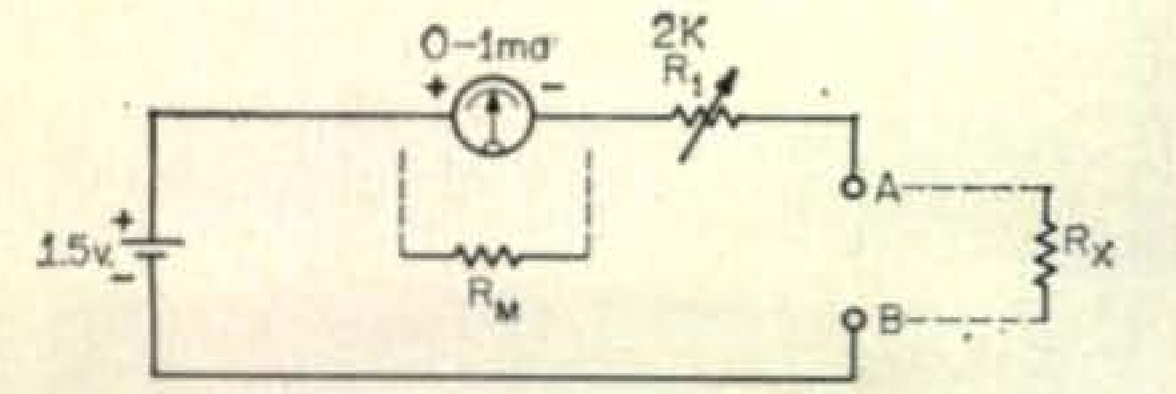


Fig. 6—Series-type ohmmeter circuit. R_1 is the zero-ohms adjust.

to the point where the diode characteristics are nearly linear. Consequently, the sensitivity of the rectifier-type a.c. voltmeter is somewhat lower than that of a d.c. voltmeter having the same basic meter movement (except with a 0-1 ma meter). Typical values are 1000 ohms/volt with a 0-1 ma meter and 5000 ohms/volt with a 50 μa meter.

Bridge-type rectifiers are often used in place of the arrangement just described. Rectifier-type a.c. meters are calibrated according to the r.m.s. value of a sine wave, so readings taken on a.c. waveforms that are not nearly sinusoidal will result in a degree of error. The use of copper-oxide rectifiers usually limits the frequency response to up through the audio range, but crystal diodes, which are sometimes used, may provide a response up to near 100 kc.

Ohmmeter

The simplest type ohmmeter consists of a milliammeter or a microammeter connected in series with a battery and a current-limiting resistor as shown at fig. 6. With terminals *A* and *B* shorted, R_1 is adjusted for a full-scale meter reading. The resistance of R_1 plus the meter resistance, R_m, according to Ohm's Law will then be $R = E \div I$. Using a 0-1 ma meter, R = 1.5 v.÷.001 a. = 1500 ohms. When an unknown resistor, R_x, is substituted for the short across *A* and *B*, less current will flow through the meter and it will be $I = E \div (R+R_x)$. If R_x is 3500 ohms, then $I = 1.5 \div (1500+3500) = 1.5 \div 5000 = .0003$ a. = .3 ma. Various values of R_x therefore will produce different current readings against which the meter may be calibrated directly in ohms according to the corresponding current determined by the formula. The arrangement then can be used as an ohmmeter for conveniently measuring resistance.

For high values of R_x the current may be too low to accurately read on the meter scale, but this can be changed by increasing the battery voltage and R_1 to raise the current and provide a "high-ohms" range. Another expedient is the use of a more sensitive meter such as a 0-50 microammeter.

Also, for resistances below several hundred ohms, the *change* in current may be too small to accurately note the resistance change, in which case it is better to use the shunt arrangement as shown at fig. 7. With terminals *A* and *B* open, R_1 is adjusted for a full-scale meter reading. When an unknown resistor, R_x, is connected across the meter at *A* and *B*, a lower reading will be obtained, because the current will be divided between the meter and R_x, just as it is with the ammeter shunt described earlier. The unknown resistance then is $R_x = I_2 \times R_m \div (I_1 - I_2)$, where I_1 is the initial current *without* R_x connected, I_2 is the meter current *with* R_x connected, and R_m is the resistance of the meter. The low-ohms scale is then calibrated accordingly for different values of R_x.[3]

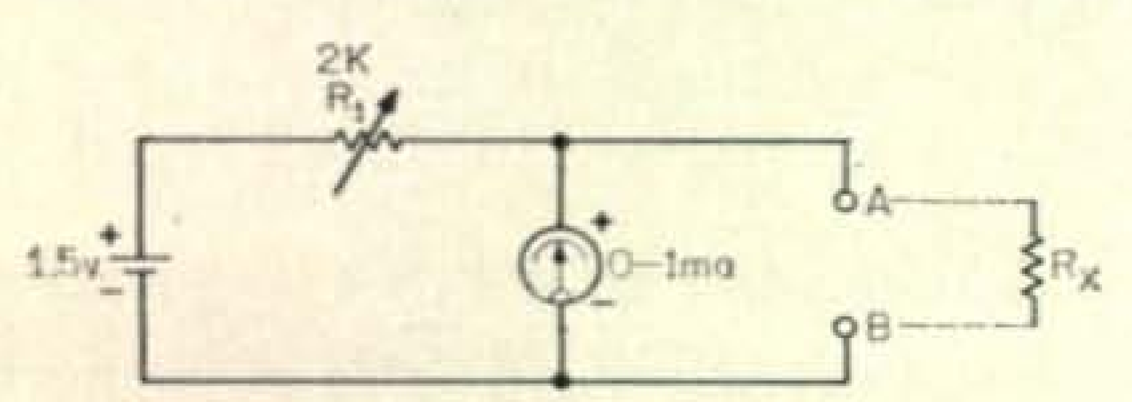


Fig. 7—Shunt-type ohmmeter circuit.

This arrangement often is used in ohmmeters that have a 0-1 ma meter and may be identified by the fact that the low-ohms scale calibrations go in the opposite direction than those on the high ranges.

Another shunt-type of ohmmeter circuit uses the voltmeter method of measurement. This is shown at fig. 8. Here the initial voltage across R_1, as measured with *A* and *B* shorted, is compared with the voltage drop across R_1 with the unknown resistor, R_x, across *A* and *B* instead of the short. R_x then may be found from $R_x = R_1 \times (E_1 - E_2) \div E_2$, where E_1 is the initial meter reading and E_2 is the meter reading with R_x connected.

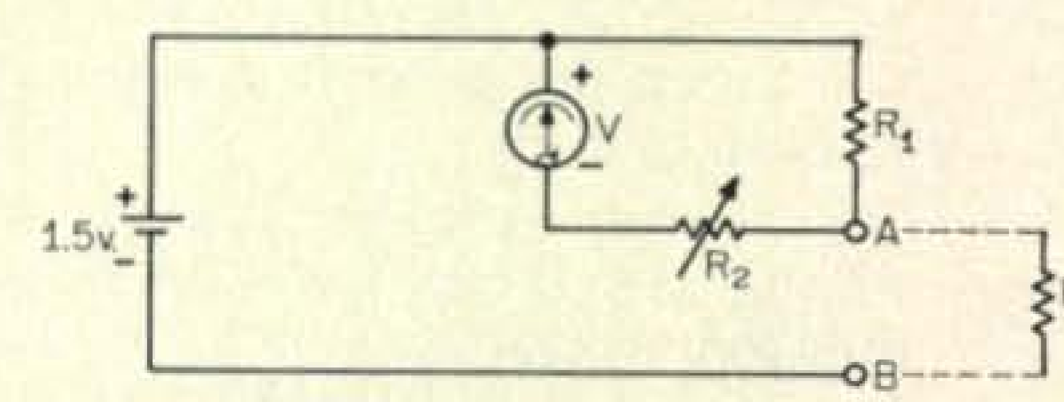


Fig. 8—Ohmmeter circuit using voltmeter method.

R_2 is an adjustable voltmeter multiplier used to set the meter reading to full scale when *A* and *B* are shorted. The voltage across R_1 will be that of the battery, in this case 1.5 v. If R_1 is 1000 ohms and the voltmeter reads .5 v. when R_x is connected across *A* and *B*, then R_x = 1000 ohms × (1.5 v.—.5 v.)÷.5 v. = 1000×1÷.5 = 2000 ohms.

The meter can be calibrated for various values of R_x. For lower or higher ranges, R_1 and the voltmeter range are altered as needed. A high-resistance voltmeter is required to offset the effects of the meter resistance shunted across R_1, so this circuit is used only in instruments having a low-range microammeter.

The V.O.M.

The v.o.m. is built around a milliammeter or a microammeter and is arranged so that the various functions just described and the ranges associated therewith may be selected by means of a multi-section switch or with individual jacks. Self-contained batteries are incorporated for use with the ohmmeter section. A common set of terminals is provided for the "test leads"

[3]With the above calculations a slight error is introduced which increases as R_x is lowered, since the total current flow in the circuit will be progressively raised. This error can be minimized by using a larger battery and increasing R_1.

used to connect the unit to the circuit being measured. This one instrument then can be used to directly measure a wide range of d.c. and a.c. voltages, resistances and direct currents.

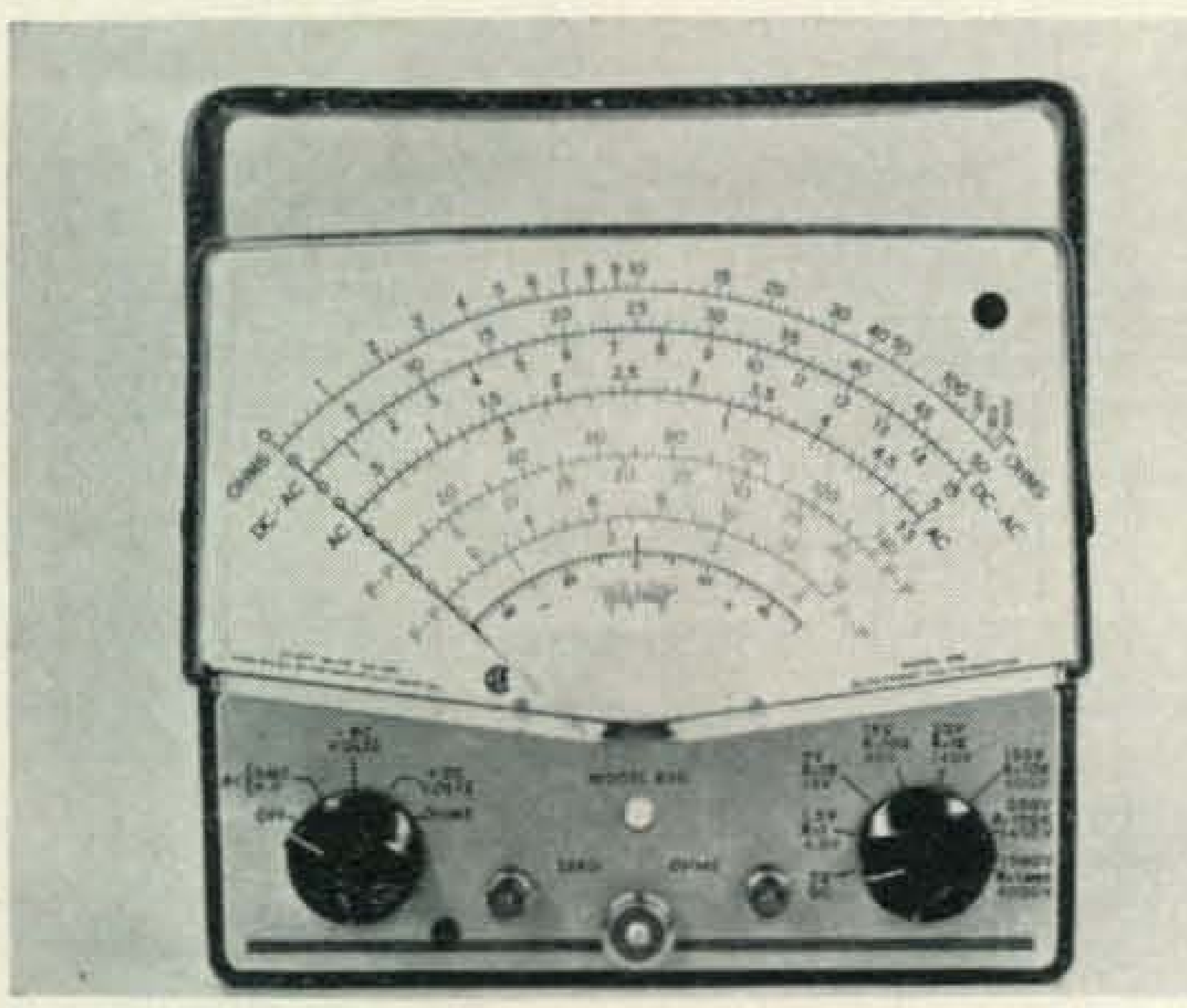
The d.c. and a.c. voltage ranges usually vary from 0-2.5 v. to 0-1000 v., with special d.c. ranges of 0-.25 v. and 0-1.5 v. sometimes included for use on transistor circuits. An additional range of 0-5000 or 6000 v. is often found; however, this range, instead of being selected by means of the switch through the regular terminal connections, has a separate jack for the "hot" lead, in order to avoid high-voltage breakdown that may otherwise occur through the circuitry from the normal terminals.

Many models have a "polarity-reversing" switch that does away with the need for interchanging test leads for different polarity requirements. This switch is often used to change between the a.c. and d.c. functions, also.

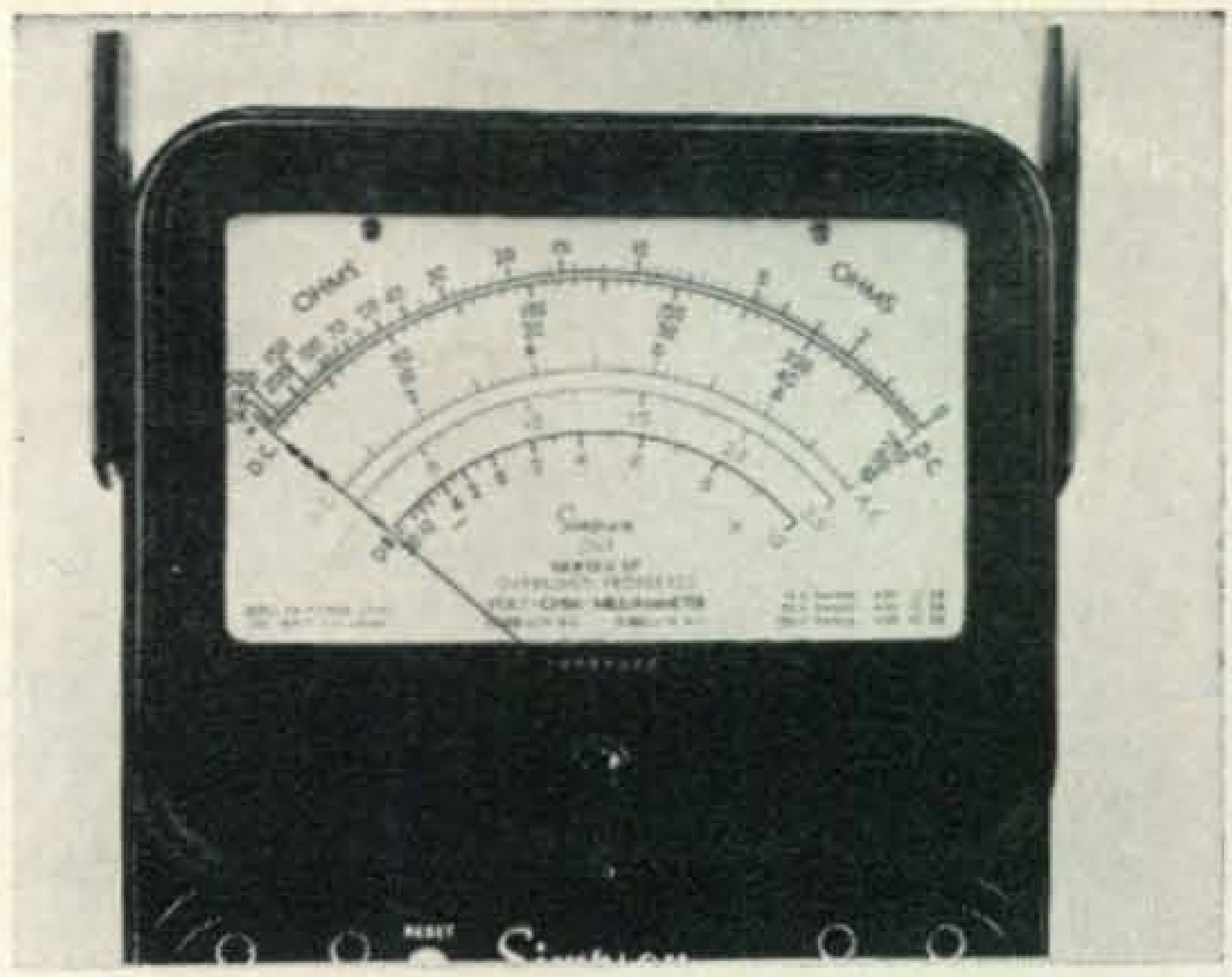
The a.c. voltage ranges sometimes have two different inputs available. One goes through the regular terminals for direct measurements on a.c. circuits. The other has a separate test terminal which is labelled *output*. When this is used, a blocking capacitor is placed in series with the a.c. metering circuits which makes it possible to read the a.c. component on a live d.c. circuit (such as at the plate of an a.f. amplifier tube), since the capacitor isolates the d.c. and will pass a.c. only.

Current ranges (d.c.) usually start with the basic range of the meter and vary up to 0-500 ma, plus additional ranges of 0-1 and 0-10 or 15 a. The selector switch usually cannot carry heavy currents and the switch contact resistance may be too high for use with low-resistance shunts, so the high ampere range usually has separate terminals directly to the shunt for the test leads.

Low-cost v.o.m.'s have a 0-1 ma meter with a sensitivity rating of 1000 ohms per volt on both



A v.t.v.m. with a full-view 7" meter scale. Input resistance is 11 megohms on all d.c. ranges, .83 megohms on a.c. The meter indicates up to 1500 volts d.c. and a.c. (r.m.s.) and to 4000 v.a.c. peak-to-peak. The a.c. frequency response is up to 3 mc. Resistances may be read up to 1000 megohms.



A typical v.o.m. scale. The ohms scale is at the top with a linear d.c. scale below it. Then comes a separate a.c. scale that is slightly different than the d.c. one, because on a.c. the response is not quite linear due to the rectifier characteristics. A second a.c. scale follows for potentials below 2.5 v. where the rectifier linearity departs further from that of the higher-voltage ranges. The bottom scale, which is included on many larger instruments, is a db range that may be used to obtain absolute a.c. power measurements referred to a given base or for taking relative-power readings, The a.c. voltage scales are in red, the others are black.

the d.c. and a.c. voltage ranges and measure resistance up to between 200,000 and 1,000,000 ohms. More expensive models customarily employ a 0-50 microammeter and have a rating of 20,000 ohms per volt on d.c. and 5000 ohms per volt on a.c., with resistance readings possible up to between 20 and 100 megohms. Some special models have been introduced that use a lower-current meter and have a sensitivity of 100,000-200,000 ohms per volt on d.c. and 10,000-20,000 ohms per volt on a.c.

An added feature sometimes found is overload protection of the meter against burnout. One such system employs a silicon diode shunted across the meter terminals. Excessive current through the meter results in a high voltage drop across the meter resistance. This voltage then causes the diode to conduct and effectively provide a near short that shunts the excess current around the meter. A second diode, connected in the reverse direction, is sometimes added in the event the overload takes place at the same time the test-lead polarity is incorrect. Fuses also may be found used to guard both the meter and the other components against damage.

A more exotic arrangement provides that when an excess voltage appears across the meter, it goes through a transistor amplifier that then actuates a latching relay which opens the input circuit and thereby disconnects the instrument from the test source. The circuit cannot be restored until the cause of the overload is removed and the relay is manually reset by a push button.

Next month we'll take a look at the v.t.v.m., after which applications of both types of meters will be discussed. ■

RTTY From A to Z

BY DURWARD J. TUCKER,* W5VU

Part XVIII

The RTTY'er is closely concerned with the problem of detection, location and measurement of distortion and finally its elimination. This part covers additional test equipment to aid in getting some answers on distortion.

It was indicated sometime back that the accuracy of the author's polar relay keyer set could be checked by simply plugging a distortion measuring set into jacks J_3 and J_9 provided for that purpose. This part covers information on the distortion set that was used, since a limited number are available direct from the manufacturer to radio amateurs at a special reduced price of $75.00. The set used was an Atlantic Research Corporation[17] Distortion Measuring Set, Model DMS-1A.

DMS-1A Distortion Set

A close-up view of the front panel of the DMS-1A distortion measuring set is shown in fig. 107. (Atlantic Research Corp.[17]) The circuit diagram is shown in fig. 108 but no circuit values are given since this instrument is patented. This should not cause too much concern since the material given here is not for building or duplicating the distortion set but for the purpose of shedding some light upon the operation and use of the device.

This set is completely transistorized and battery operated. It is relatively simple to operate and the instructions are printed on a card that is mounted in the detachable lid of the instrument. A single 8 volt mercury cell powers the set and provides for more than 250 hours of operation. It is possible to check the battery voltage by means of the front panel meter. An inspection of the close-up view of the set discloses that there is no ON-OFF switch on the front panel. The set is turned on and off by means of a set of contacts on the input jack.

The jack plugged into the input may not always provide a properly polarized signal so there is a reversing switch located on the right hand side of the front panel. It is the sliding switch designated —TIP and +TIP. This switch reverses the polarity without opening the teletype circuit that is under test.

The set is extremely compact; it measures 3½ × 6½ × 2½ inches (including the protective lid over the front panel) and weighs 1½ pounds, including the battery. The set is quite flexible, since it will operate at the three most popular teletype baud speeds of 45.45 (60 w.p.m.), 56.9 (75 w.p.m.) and 74.2 (100 w.p.m.). An important feature, but of less interest to amateur RTTY'ers, is that according to the manufacturer, it will accept all code formats, including 6.0, 7.0, 7.28, 7.42, 7.5, 8.42, and 10.42 unit-element characters (start-stop or synchronous). Distortion can be measured in circuits whose neutral loop currents are 20.0 or 62.5 ma, as well as polar circuits. The accuracy of the set is ±2 percent distortion, when the set is properly calibrated, and it has an input impedance of 150 ohms non-reactive (series connected to telegraph circuit).

Theory Of Operation

The DMS-1A Distortion Measuring Set uses the "short-pulse theory" of measuring teletype circuit distortion. This simply means that you measure individual pulses that have been shortened. A shortened *space* pulse gives a longer *mark* pulse, which means marking distortion. Likewise, a shortened *mark* pulse gives a longer *space* pulse, which means spacing distortion. This type of distortion was thoroughly covered sometime back. (If there is any doubt, at this point, as to what we are looking for, review figs. 75, 76, 77 and 78, showing marking and spacing distortion.)

Figure 109 shows a simple resistance-capacitance (*RC*) timing circuit with a peak reading voltmeter connected across capacitor *C*. Let us suppose that capacitor *C* is charged to 10 volts and that the charging voltage is then removed.

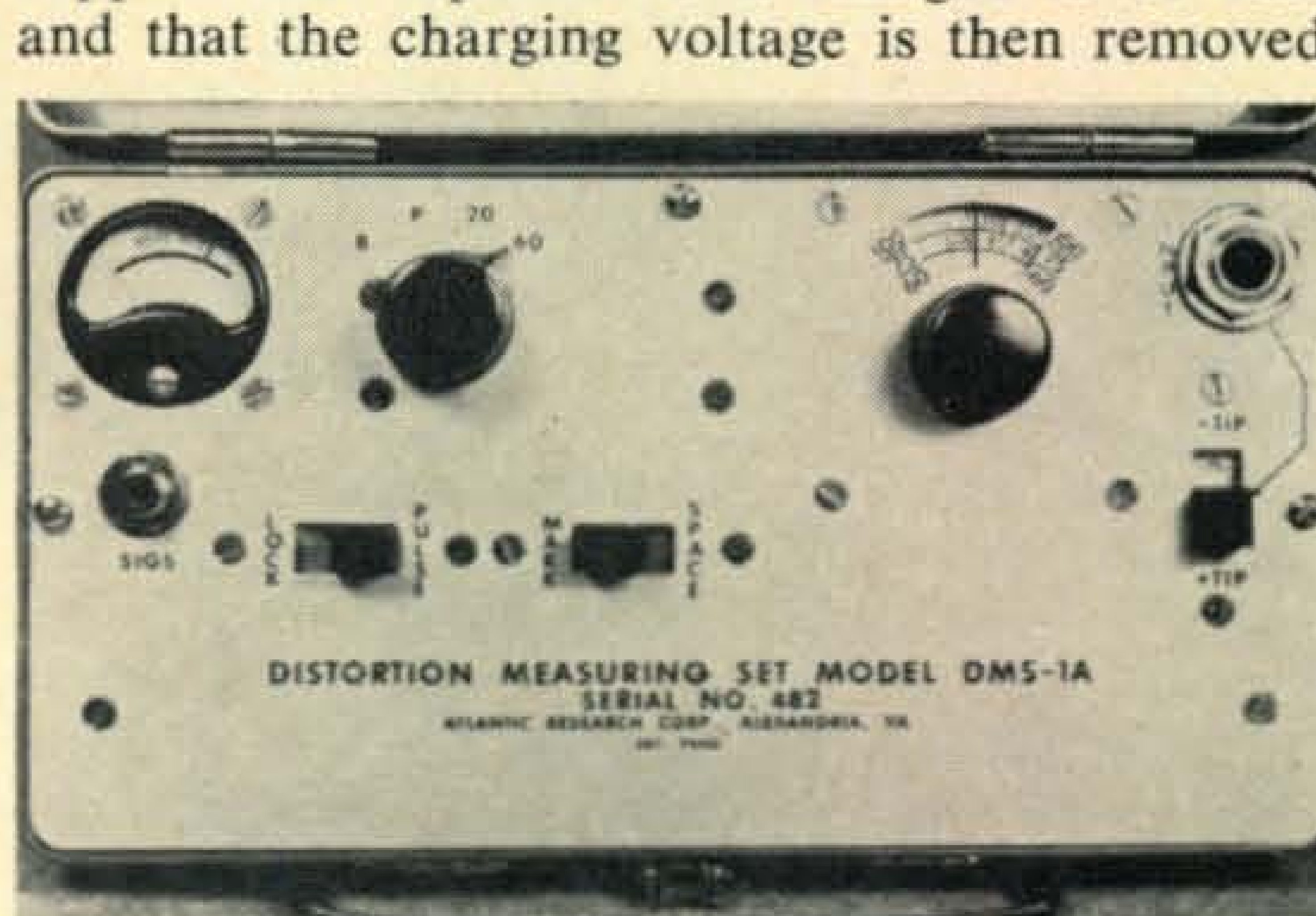


Fig. 107—Close-up view of the DMS-1A Distortion Measuring Set showing control locations and designations.

*6906 Kingsbury Drive, Dallas 31, Texas.
[17]Shirley Highway at Edsall Road, Alexandria, Virginia.

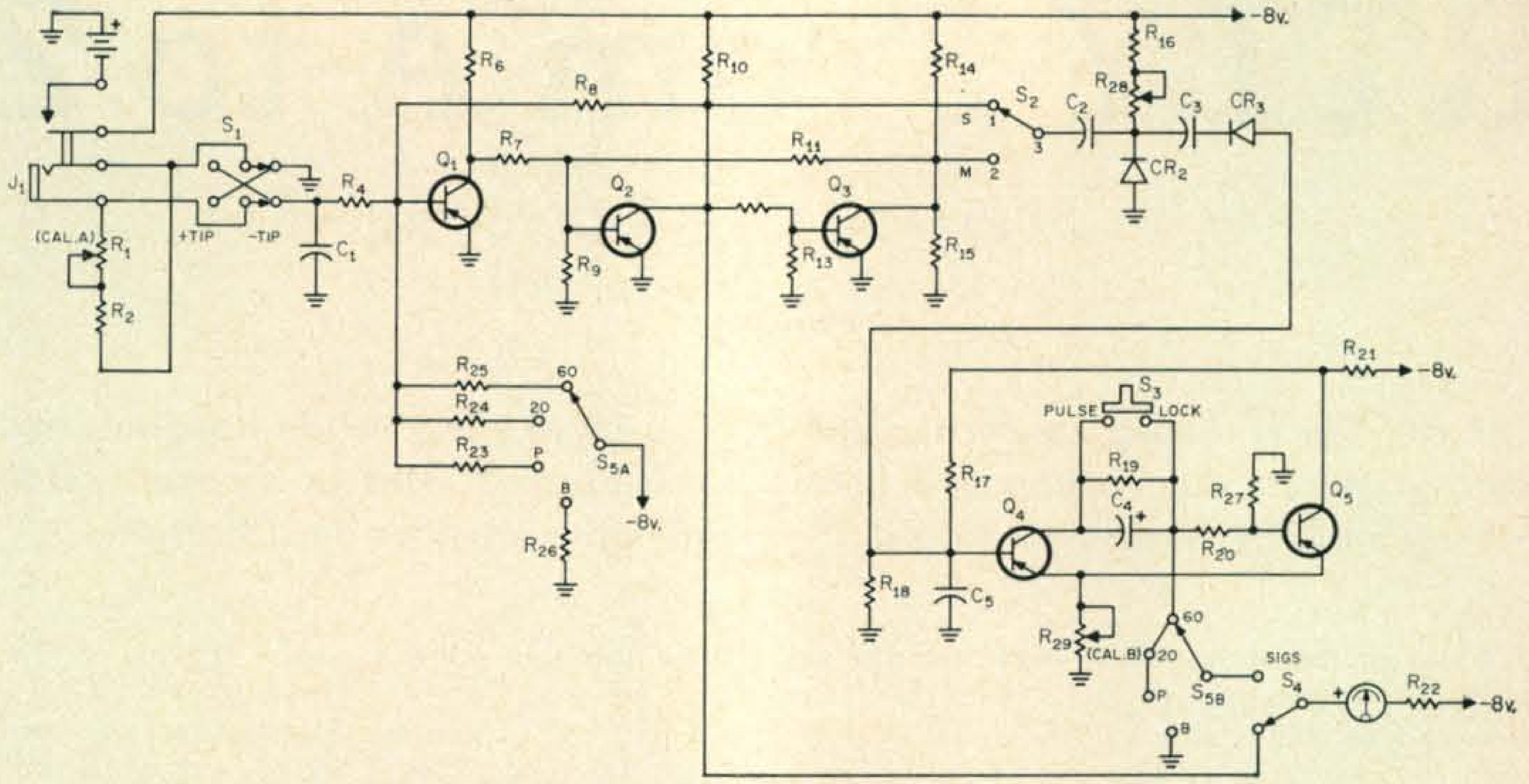


Fig. 108—Circuit of the Atlantic Research Corp. Distortion Measuring Set, DMS-1A.

If switch *S* is closed, the capacitor starts discharging. The time that it takes for the charge on the capacitor to be dissipated and the voltage *E* to be reduced to zero is dependent upon the capacitance of *C* and the resistance of *R*. The capacitor *C* is analogous to a reservoir. Its storing ability is increased as its value of capacitance is increased. A higher value of *R* means that the discharge current is smaller than it would be if *R* had less resistance.

It is noted that $T=RC$, where *T* is the time in seconds for the voltage in the above instance to lose 63.2 percent of its voltage (6.32 volts), *R* is the circuit resistance in ohms, and *C* is the capacitance in farads. *C* may be in microfarads if *R* is in megohms. The values of *C* and *R* could be selected so that the time is one second, for instance. The time constant *T* can remain at one second even if the capacitance of *C* is decreased *if* the value of *R* is *increased* accordingly so that the product of *RC* is still equal to one second. The discharge of the capacitor is not linear as shown in fig. 110. In fact, the last small portion of the charge is longer in dissipating, tending to extend the time considerably, as also shown in fig. 110. A further inspection of the voltage-decay curve of fig. 110 shows that the major portion of the capacitor charge, as represented by the voltage across it, is dissipated much earlier than the time at which the capacitor becomes completely discharged (voltage across it reaches zero value). It will be noted that at unity time constant (*T* in fig. 110) that the remaining capacitor charge voltage is 3.68 volts (point *P*) or 36.8% of its original voltage of 10 volts. Considered in the light of discharge, the capacitor has lost 63.2% of its charge or 6.32 volts. Thus, $2T$, $3T$, *etc.*, represent times of twice the time of time constant T, three times the time of time constant T, *etc.* For instance, if T was 6 milliseconds, then $2T$ would simply be 12 milliseconds.

The time constant, *T*, has many applications in radio and electronics. We are interested here in its application to the measurement of distortion in the DMS-1A Distortion Measuring Set.

The time constant *T* can certainly be more than one second by a proper selection of the value of *R* and *C*. For many applications the time constant *T* is a fraction of a second which is the case in this instance.

The value of *C* and *R* in fig. 109 can be so chosen that, for all practical purposes, the voltage *E*, across *C*, is zero at the end of 22 milliseconds. Twenty-two ms is the standard length of a *mark* or *space* pulse in the 5 unit 60 w.p.m. teletype code used by the radio amateurs. If the discharge time of *C* is 22 ms, then at any lesser time, such as 16½ ms there would be a voltage remaining across *C*. In this instance, this voltage would represent 25 percent distortion (See fig. 76). That value of voltage reading on the peak reading voltmeter would indicate the 25 percent distortion calibration point. The scale of a peak reading voltmeter can be calibrated directly in per cent distortion using this procedure.

If switch *S* (fig. 109) is closed at the instant of the *space*-to-*mark* transition and opened on the following *mark*-to-*space* transition, this gives us a distortion (if present) measurement of a *mark* pulse. Likewise, to measure spacing distortion, switch *S* should be closed at the instant of a *mark*-to-*space* transition and opened on a *space*-to-*mark* transition.

It will be recalled that the voltmeter across *C* was a peak reading device. The DMS-1A distortion measuring set is also a peak reading device, holding the highest reading while ignoring longer pulses (lower voltage, lower distortion, stop pulses, as well as two or more like pulses which occur together). All of the switching, sampling, *etc.*, associated with the distortion measurements in the DMS-1A, is done electronically. A faster speed, such as 75 w.p.m. means shorter pulses. The 5 "intelligence trans-

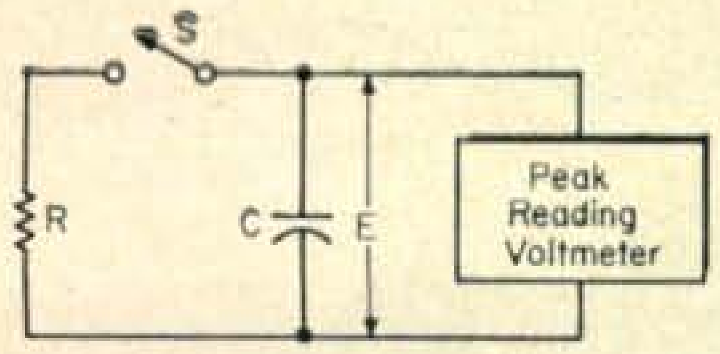


Fig. 109—Basic R-C timing circuit discussed in the text.

mitting" pulses of a 75 w.p.m. signal are 18 milliseconds long. The *time base* of our measurement must be narrowed down. This is done by reducing the resistance, *R*, in fig. 109. This is done in the DMS-1A and the same scale and distortion calibration is used. This is true for the various other code speeds covered by this distortion measuring set.

A monitor to give an alarm on distortion can be devised using the aforementioned *RC* network. A circuit may be set up so that any pulse coming along, which is shorter than the standard pulse (with its subsequent standard time base), will trip a flip-flop circuit which in turn sets off an alarm. The shorter the pulse, the higher the charge left in capacitor *C*, fig. 109. The flip-flop circuit may be present to operate at any predetermined voltage. This predetermined voltage represents some distortion calibration point. A monitor alarm then can be devised so that it sounds an alarm at the preset level of distortion.

Operation Of The DMS-1A

A close inspection of the front panel of the close-up view of the DMS-1A makes its operation almost self-explanatory. There are very few controls, and the function of each of these is, for the most part, obvious.

The test set is connected in series with the local loop or teletype circuit to be checked for distortion. Two good examples of this can be found in the Polar Relay Keyer Test Set previously covered. Any distortion present in the plate circuit of the 6AQ5 keyer tubes may be measured by placing the DMS-1A set in series with the plate circuit of the two keyer tubes. This is accomplished by plugging one end of a patch cord into the input jack of the DMS-1A distortion measuring set and the other end of the patch cord into jack J_3, J_4 or J_5 (fig. 101). Any distortion present in the keyed output circuit of the polar relay circuit may likewise be measured by placing the DMS-1A set in series with this circuit by the use of jack J_9 or J_{10}.

It is a simple matter to use the DMS-1A distortion measuring set. It is placed in series with your local loop or other circuit where teletype distortion is suspected to exist. This is done by a plug to the set's input jack, J_1, as shown in the circuit of fig. 108. It may, or may not be necessary to reverse the polarity switch, designated as S_1 in the circuit, and as +TIP and —TIP on the front panel. Press SIGS button, S_4, located on left side of front panel under the meter. If signals are present in the circuit, the meter will pulse when the polarity switch is correctly positioned. If the meter does not pulse up and down (usually somewhere around half scale) then this is a good indication that the polarity switch is in the wrong position or else there is little or no signal present.

The internal battery voltage can be checked by rotating the selector switch, designated as S_{5A} and S_{5B} in the circuit diagram (located just to the right of the meter) to position B. The battery should be replaced if the meter pointer comes to rest to the left of the indicator line on the meter scale.

Next, the selector switch should be rotated to the proper position for the circuit under measurement (P for polar, 20 ma or 60 ma). The PULSE-LOCK switch should be placed in the PULSE position. Place the MARK-SPACE switch in either position. Set the distortion calibrated dial (turning clockwise) at some value higher than the value of distortion expected. Slowly rotate the dial counterclockwise while observing the meter pointer (not the dial). Stop the counterclockwise movement of the dial when the meter pointer definitely shows an upward pulsing movement. Turn the dial back (clockwise) just to the point where the pulsing action of the pointer stops and read the distortion percentage.

The dial is calibrated for three teletype speeds, 60 w.p.m., 75 w.p.m. and 100 w.p.m. The "60" scale would be used, since amateur RTTY is at 60 w.p.m. If the above procedure was done with the MARK-SPACE switch set on MARK then the procedure should be repeated with this switch set on SPACE. The important thing is that this procedure be carried out for both *mark* and *space*.

The set will not indicate seldom encountered distortion which causes only lengthening of unit *mark* and *space* pulses. The set can be used as an unattended monitor to indicate any distortion greater than a predetermined level. This is accomplished by switching the PULSE-LOCK switch to the LOCK position and setting the distortion calibrated dial to the desired preset distortion value on the 60 w.p.m. scale. When a pulse comes along that is greater than this value, the meter swings upward and locks into position. The pointer is released to return to its normal position by pressing the SIGS button.

It will be recalled that the distortion set calibrations for 60 w.p.m. are for a baud speed of 45.45 and an element time length of 22 milliseconds. This, in turn, means that the square wave generator signal to the input to the Polar Relay Keyer Test Set *must* be set to 23 cycles.

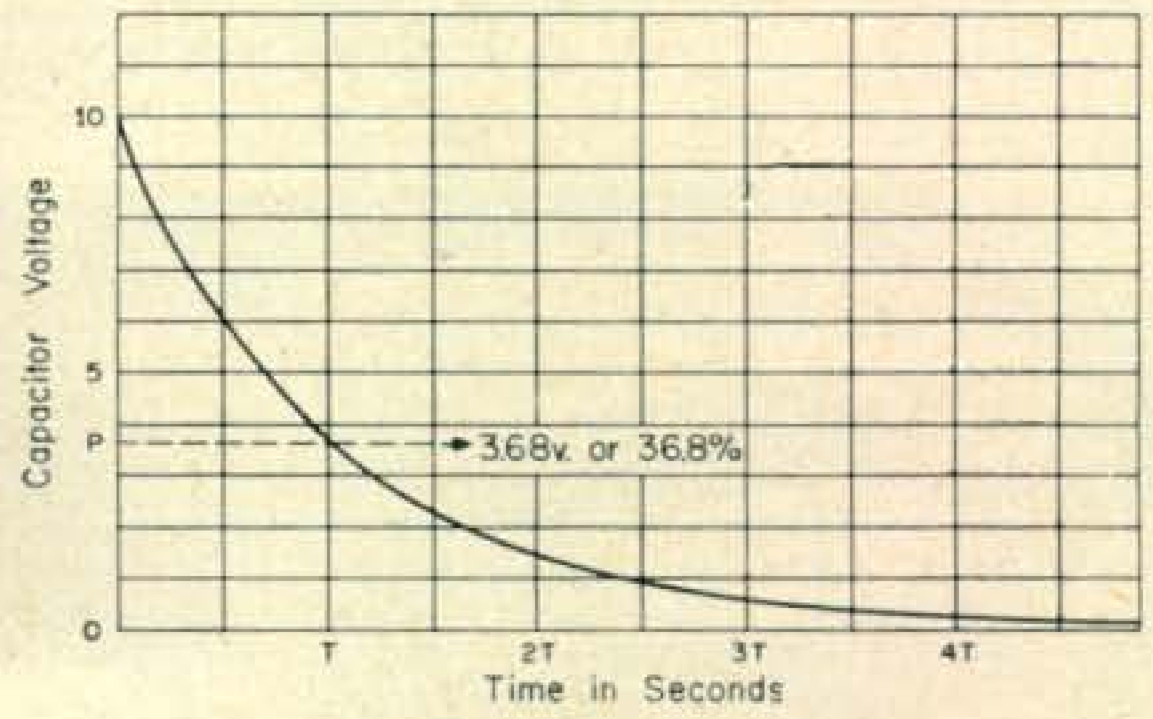


Fig. 110—Curve showing the non-linear nature of the discharge of a capacitor through a resistor in a circuit such as shown in fig. 109.

If the square wave generator frequency is increased, the pulses will be shorter than 22 ms and the distortion meter will give a false distortion reading. This is easily demonstrated by increasing the frequency and checking with the distortion meter. The false reading increases with the frequency. This is easily detected since it gives a reading of distortion for both *mark* and *space* since both pulses are shorter than 22 ms.

If the square wave generator is set to a frequency lower than 23 cycles the square wave pulses from the generator now become longer than 22 ms for which the set is calibrated. Distortion could be present in the relay keyed output due to bias distortion in the relay and the distortion set would not show it unless the shortened pulse was less than 22 ms. Even then the reading would be less than the actual distortion present.

Consider a frequency of 15 cycles which would give 30 square wave pulses (half cycles). $1/30 = .033$ or 33 milliseconds which would be the length of one pulse. Bias distortion of 25 percent present in the circuit would lengthen one pulse to 41 ms and shorten the other to 25 ms. Since 25 ms is more than the 22 ms for which the distortion set was calibrated, the set would not indicate that any distortion was present. It can be seen from this, that it is important that the square wave generator be set at 23 cycles and that we have some means of knowing that the generator calibration is right if we doubt its accuracy.

The use of the DMS-1A set in connection with the author's Polar Relay Keyer Test Set was covered first since it has been thoroughly described and discussed. The DMS-1A set may just as readily be used to measure RTTY distortion in any RTTY circuit adjusted for either a current of 20.0 or 62.5 ma. This includes local loop circuits containing either the teletypewriter keyboard transmitter contacts or selector magnet coils or both, such as circuits shown in figs. 24 and 25.

Other Distortion Sets

The Atlantic Research Corporation makes a complete line of teletype distortion measuring sets as well as numerous associated instruments and devices. Most of their distortion measuring sets are for commercial applications and are quite sophisticated, as well as expensive. The DMS-1A series is made in quite a number of different models, such as DMS-1A-1, DMS-1A-2, etc. Of particular interest to the amateur RTTY'er is the DMS-1A-5, shown in fig. 111. In this set the distortion can be read directly from the meter, which has a scale calibrated in distortion percentages.

Fig. 111—The model DMS-1A-5, an improved distortion measuring set with direct meter calibration.

Next Month

In the last few installments the author covered a number of subjects related to RTTY. It was necessary to cover these subjects in order to give the reader a rounded background in order for him to more fully understand much that is yet to come.

Next month we will return to the *"hard core"* of RTTY, namely the teletype machine itself. This will initiate the coverage of servicing, maintenance, and adjustments of Teletype equipment. Where possible, photographs, with identifying charts for all major parts and lubrication points will also be given.

Subsequent installments will delve deeper into the innards of the Teletype machine, giving specific and detailed instructions for adjustments, spacings, spring tensions, *etc.* This is a must for anyone faced with the necessity of caring for his own machine (and who isn't?)

[*To be continued*]

New Amateur Product

Pennwood Numechron Co.

PENNWOOD announces a new addition to their line of electric clocks. Called the Satellite, it has a plastic case, recessed 3-D grill type face, different colored numerals, gold escutcheen and a full-vision windshield type window. It comes in several color combinations. The unit sells for $11.95. For more information write to Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh 8, Pa. 15208, or circle 70 on page 110.

A 5 ELEMENT QUAD-YAGI FOR 20 METERS

BY RONALD LUMACHI,* WB2CQM

This antenna is designed for optimum side rejection and front to back ratio to aid in picking up that elusive signal buried in the QRM. In this quad-yagi combo the yagi element is driven.

THE increased participation in the realm of amateur radio necessitates the need for more sophisticated and elaborate equipment. At one time, the dipole, 20-30 watts of a.m., and a grid leak type t.r.f. receiver were all the components necessary to "work the world" at leisure. Today's improved methods of communication, elaborate receiving apparatus, and a reasonable 2-3 element beam array are not truly sufficient to combat the chaos on the high frequency bands. This beam antenna article presupposes the fact that a three element beam, because of its inherent shortcomings, cannot cope with the QRM level to the side and rear of the listening station.

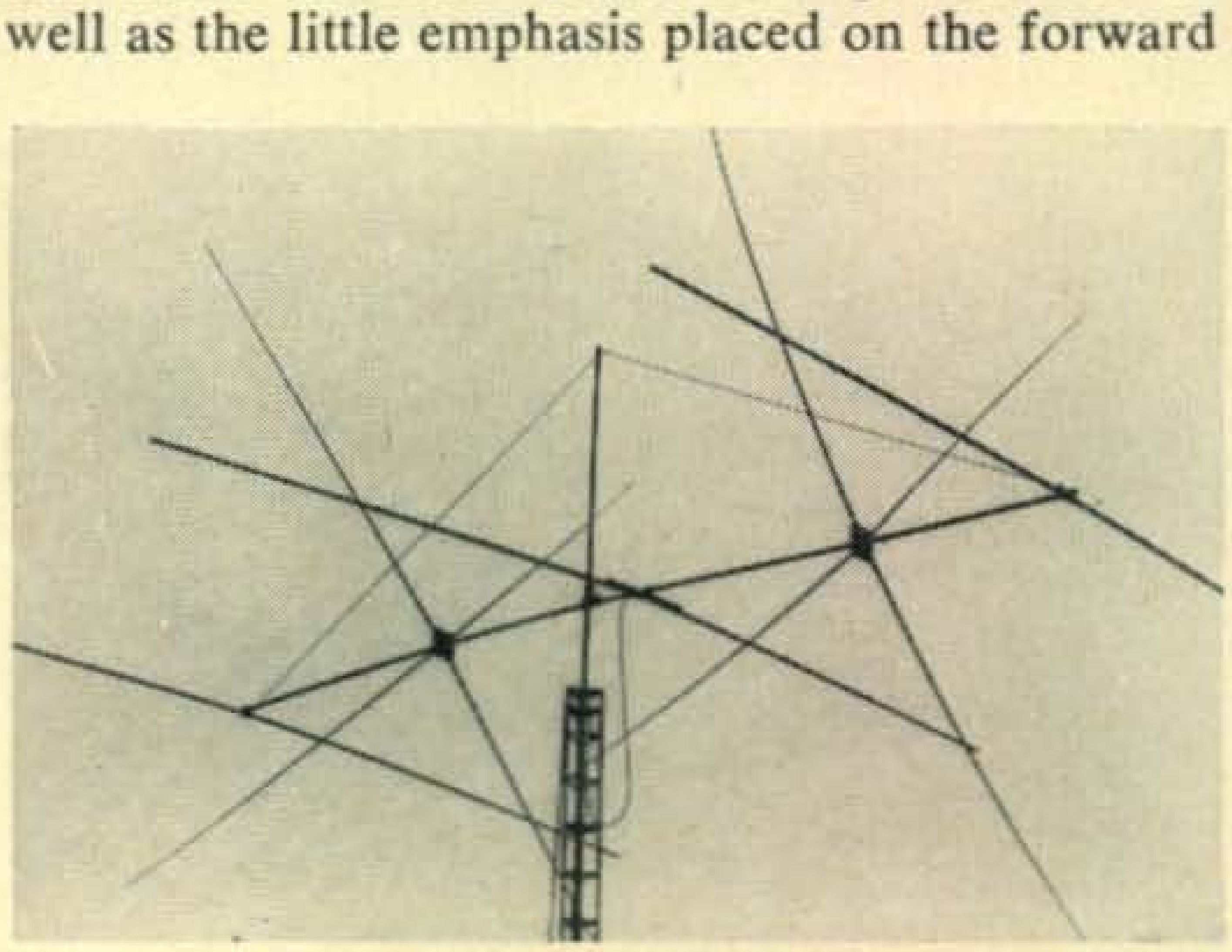
For example, most east coast amateurs will not argue the fact that a yagi's 25 db front-to-back ratio is unable to cancel out signals emitted from the central and western states while Europe and East are being scanned. They will also agree that the gain of the 3 element array, in conjunction with even moderate power, is sufficient to project a signal to even the most remote parts of the world; however, listening for the faint S2 reply in a backdrop of S7 QRM is disheartening. Carrying this antenna problem to its logical conclusion, a design was arrived at for maximum attenuation to the side and rear, with perhaps some slight sacrifice in forward gain.

This quad appendage project is geared primarily toward the amateur who presently boasts a commercial yagi installation and who has, at least on one occasion, wished for improved side and rear rejection. Taken into consideration in the subsequent text is the beam-less station with a discussion related to the simple construction of the three element yagi component.

Much work by amateurs has been undertaken in perfecting the quad system with yagi additions, and the results have stimulated this beam project along those lines. However, this system added a *quad director* and *reflector*, parasitically coupled, while maintaining yagi matching and feed points exactly as found with only some slight element resonance adjustments. Primary justification includes a reasonably accurate knowledge of the yagi's driven element input impedance since most commercial beams incorporate the driven dipole as the exciting source. Rudimentary data depicts the high current input terminals of the dipole as a roughly 72 ohm load with only slight variations in the practical installation. Consequently, an estimate of reasonable accuracy concerning the load impedance can be assumed. Data concerning the high current points of the quad are diverse. However, personal experiences indicated a roughly 100-120 ohm antenna line terminus. Needless to say, alteration of the quad feed point for impedance matching is cumbersome and the amateur usually tolerates the excessive s.w.r.

Of equal import in choosing to feed the yagi element was the very convenient method of frequency adjustment. The telescoping provisions of the yagi elements in conjunction with very accurate length versus frequency formulas provided simple element-to-element relationships. With the driven quad, stubs are the usual method of altering frequency, however, the geometric and electrical balances are disturbed by these additions. It might be well to mention that perhaps some loss to the low angle of radiation results with yagi drive.

This was considered and overlooked in light of the more accurate adjustment procedures as well as the little emphasis placed on the forward



View of the complete 5 element 20 meter quad-yagi antenna atop the mast.

*73 Bay 26th Street, Brooklyn, New York 11214.

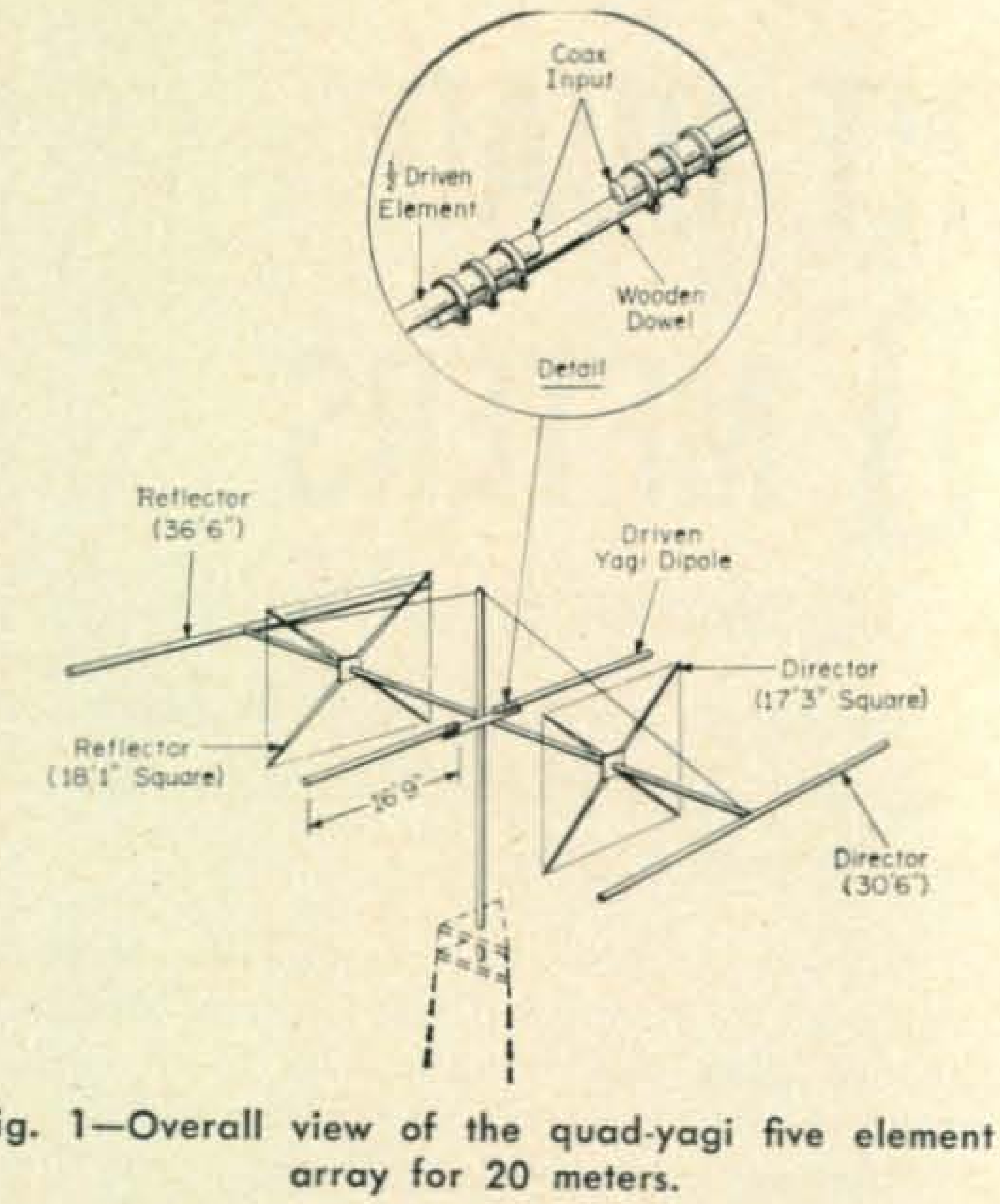


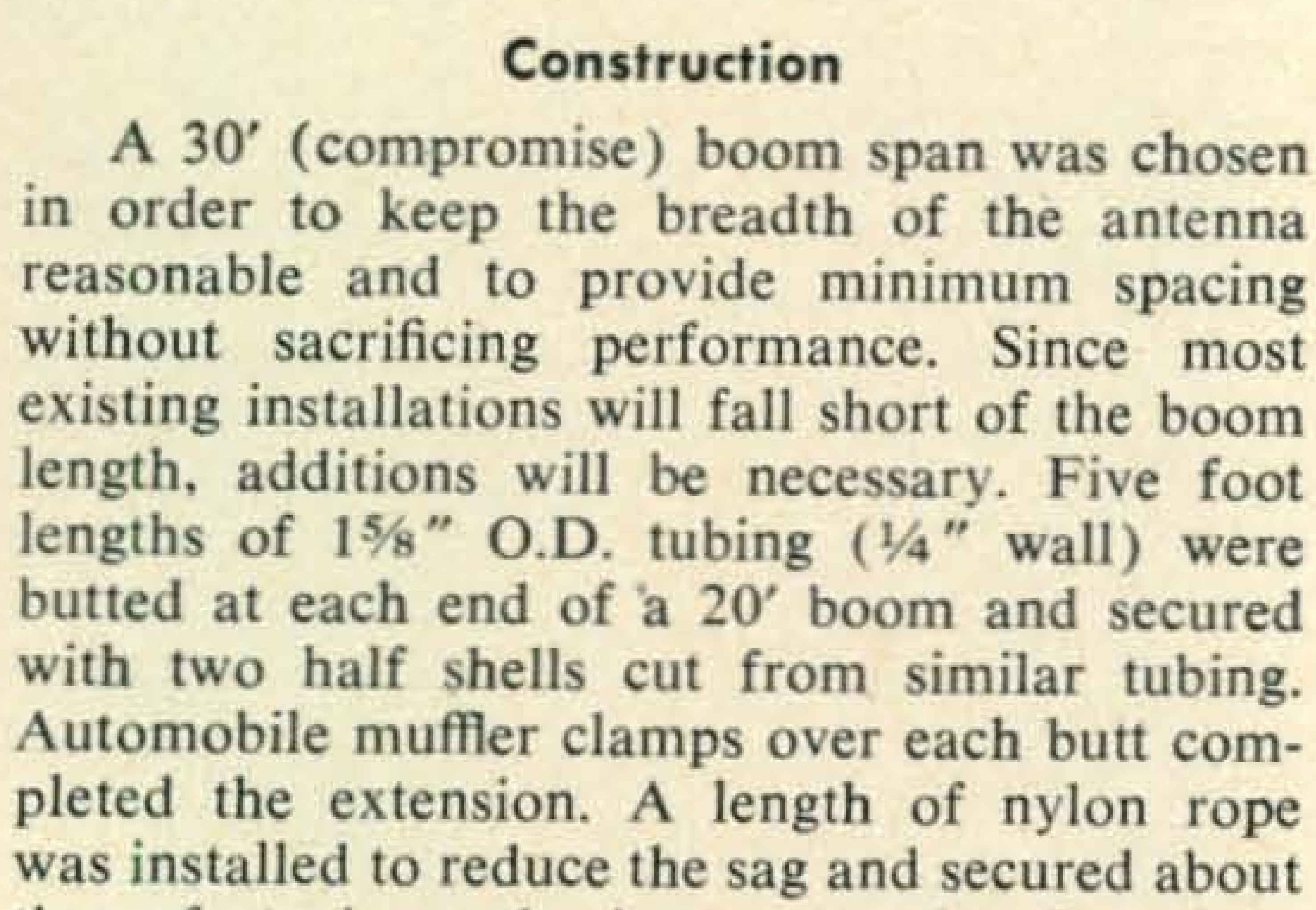
Fig. 1—Overall view of the quad-yagi five element array for 20 meters.

gain factor. I might also mention that maximum gain and minimum signal attenuation to the rear do not occur simultaneously, and one is available to the amateur only at the expense of the other.

Construction

A 30' (compromise) boom span was chosen in order to keep the breadth of the antenna reasonable and to provide minimum spacing without sacrificing performance. Since most existing installations will fall short of the boom length, additions will be necessary. Five foot lengths of 1⅝" O.D. tubing (¼" wall) were butted at each end of a 20' boom and secured with two half shells cut from similar tubing. Automobile muffler clamps over each butt completed the extension. A length of nylon rope was installed to reduce the sag and secured about three feet above the boom-mast bracket via a mast extension.

For those with no previous beam system, yagi construction was accomplished rather cheaply and simply by utilizing a product manufactured by Rota-Lock, Berkeley, California. These units were designed for rapid assembly of



View of two interlocked members of the array using a one bolt adjustment Rota-Lock made by the Up-Right Scaffolds, 1013 Pardes Street, Berkeley, California.

Parts List

Quad Components

2 pieces 12" × 12" plywood ½" thickness.
2 Nu-Rail #40 floor flanges 1¼" I.P.S.[1]
8 Fibreglass hollow spreader arms.[2]
16 carriage bolts, nuts, washers 2½" × ¼".
2 rolls #14 copper wire 72'.
8 lengths of 12" × 1⅛" wooden dowel.

Yagi Components

3 lengths of 12' × 1½" o.d. tubing 0.058" wall thickness.
6 length of 6' × 1⅜" o.d. tubing 0.058" wall thickness.
6 lengths of TV masting, 10'.
6 stainless steel hose clamps 1½".
6 stainless steel hose clamps 4".
1 length of wooden dowel 4' × 1½".
3 Rota-lock scaffold clamps 1¼" I.P.S.[3]

[1]Available from: Hollaender Manufacturing Co., 3841 Spring Grove Avenue, Cincinnati 23, Ohio, or, Whitehead Metals Inc., Milik Street, Carteret, N.J.
[2]United States Fibreglass Co., 5101 NW 36 Avenue, Miami, Fla.
[3]Rota-lock, 1013 Pardes Street, Berkeley, California.

scaffolding where lengths of pipe are fitted perpendicular to each other. The 1¼" units worked perfectly and provided a rigid boom-element connection with the tightening of only one bolt. The yagi elements consisted of two 6' lengths of 1⅜" 0.058" wall tubing inserted 6" into each end of a 12' length of 1½" 0.058" wall tubing. A small hole was drilled through the interlocked elements and secured with a self-tapping screw for a low loss electrical bond. Inch and a quarter TV masting, (10' lengths) available universally, were inserted into each end of the 1⅜" units and adjusted to resonance (fig. 1). Since subsequent adjustments will probably be made with each element due to installation pecularities, slit the 1⅜" tubing lengthwise about 2" and install a 1½" stainless steel hose clamp over the joint, facilitating a telescoping movement.

After completing construction of the driven element yagi component, measure the exact center of the 1½" tubing and cut through with a hack saw. The exciting element is in essence a dipole and must be insulated above the ground potential of the boom. A 4' length of 1½" diameter wooden dowel serve as the insulator. Several coats of varnish protected the raw wood. Three stainless steel hose clamps (4") secured around the tubing and the wooden dowel supported the elements and have proved adequate. In this high current application, the wood has

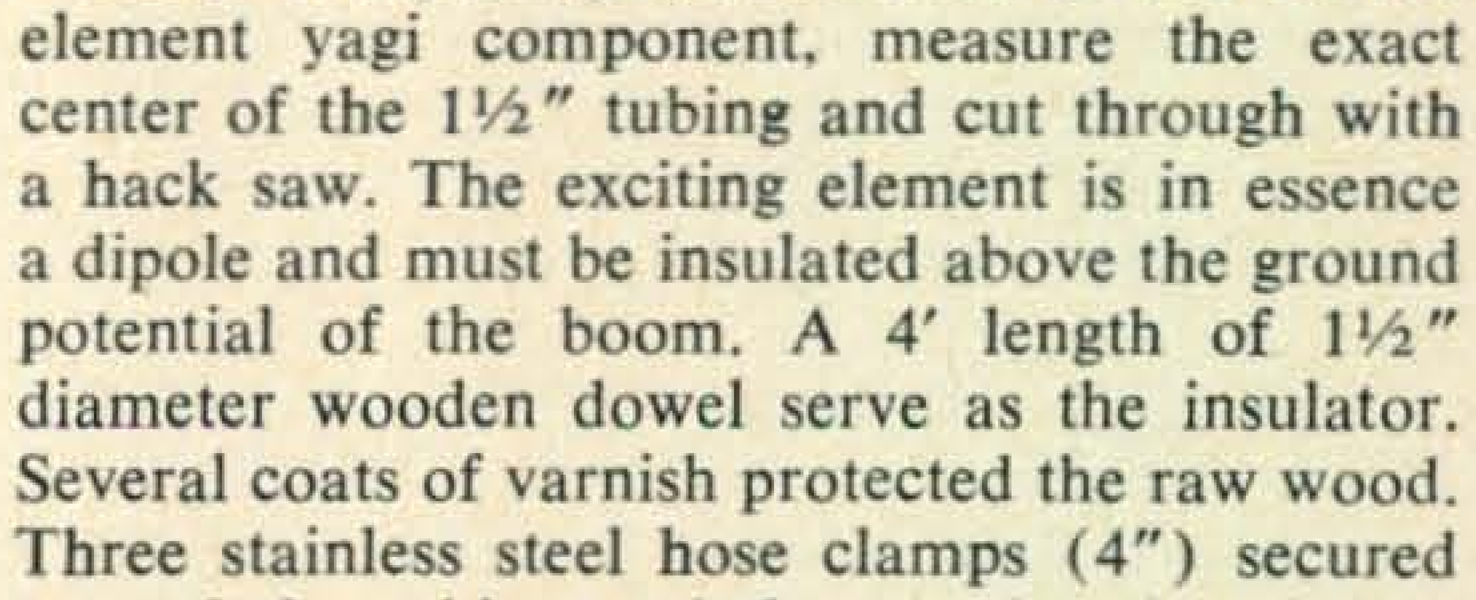
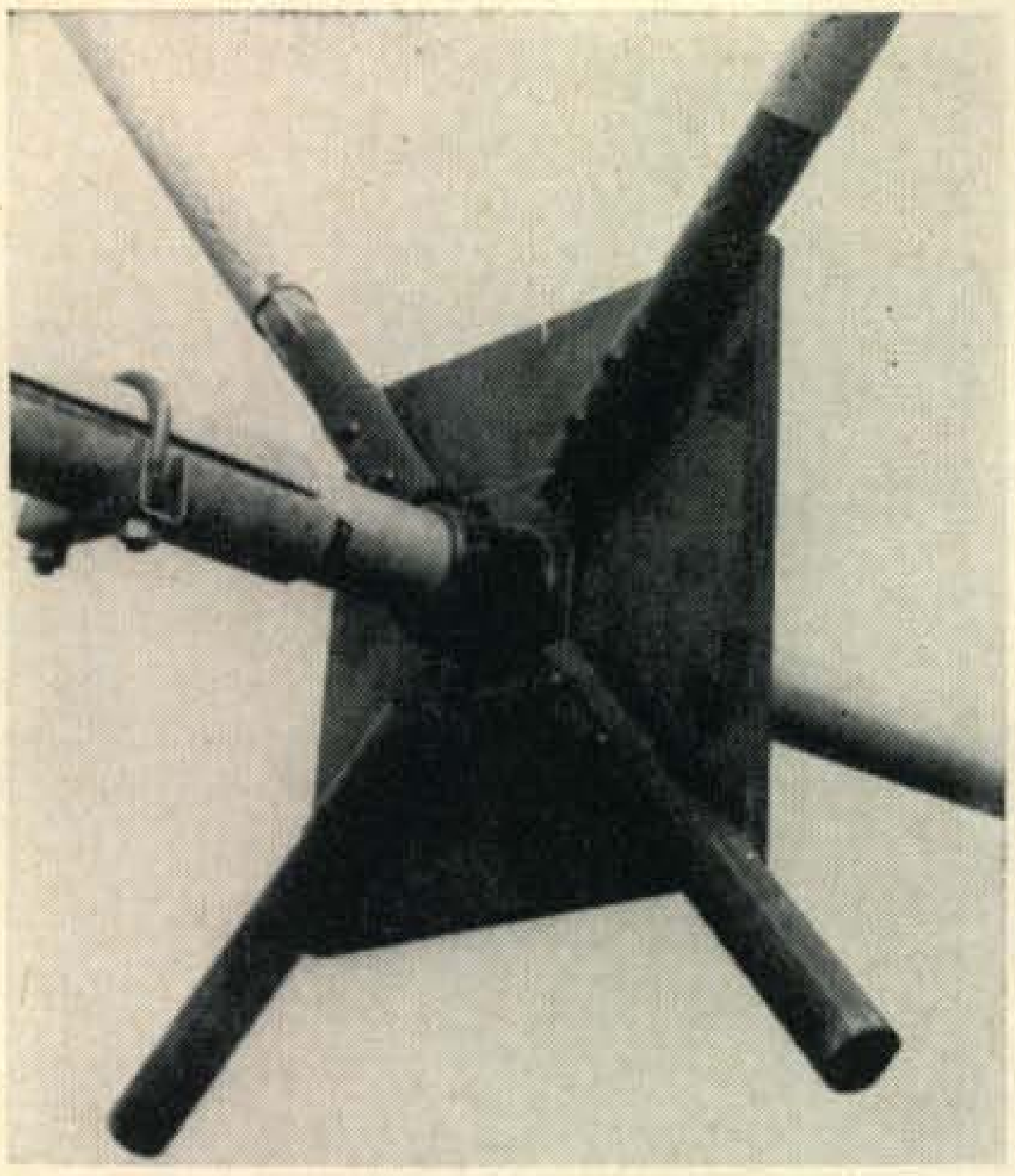


Fig. 2—Element location and spacing along the 30' boom of the 5 element quad yagi.



Spider construction showing the two vertical fibreglass members wedged in place.

been a satisfactory insulator. A more detailed sketch is shown in fig. 2.

Quad Construction

The spider complex was designed around an aluminum flange 1⅝" O.D. (with set screws) and a 12" square of ½ or ¾" plywood. A 1¾" hole, centered on the plywood, allowed for movement on the boom. Since the fibreglass arms were hollow, with an inside diameter of 1⅛", dowels of equal diameter, 12" long, were cut and attached at each right angle corner of the plywood by drilling and installing 2" × ¼" carriage bolts and nuts. To prevent the dowel from splitting, small half shells made from a length of TV masting were drilled and placed between the bolts and dowel. This rather crude but efficient spider unit mates perfectly with the spreader arms. To ease construction, the two upper support arms were assembled at ground level by simply placing the spider dowel into the fibreglass base for a "jam fit".

The perimeter of the quad reflector measured 72'5" and the director element measured 69' (resonance at 14.270 kc). Heavy formvar #14 wire was stretched and marked along its length (fig. 3) with a small dab of white paint. ⅛" holes were drilled in each fibreglass arm 12' 9" and 12' 1" above the hub of the reflector and director respectively. The wire was installed horizontally between the two upper elements and the remaining lengths allowed to hang freely. The yagi elements and quad components were then positioned on the boom (fig. 4) while still at ground level convenience. The antenna was then raised about 9' and the four remaining lower support arms lifted from the tapered ends and fitted into the dowel rods. The dangling wire was then passed through the lower vertical support at the pre-drilled points and the two loose ends bonded together and soldered completing the closed loop. The antenna was then raised to its operating height for the completed installation.

Performance

On-the-air performance at an operating height of about 40' has netted extremely gratifying results. For example, a local 5-9/40 db signal was attenuated below the noise level when the antenna was at right angles to that station and the signal reduced to S4 with the back of the antenna pointing in that direction. These figures are certainly an advantage to the DX'er ever-searching for the rare one that can now be heard.

Dut to the mutual impedance affects of the close spacing, the radiation resistance measured approximately 40 ohms. Those with the modified commercial yagi systems can easily adjust their matching devices for a perfect power transfer, however, for the average homebrew installation, connect the center conductor and shield of the coax to each dipole element directly.

Feeding a balanced dipole with an unbalanced coax seemed to produce no ill results. I purchased a 1:1 balun for $10 from Fugle labs. 1835 Watchung Ave., Plainfield, New Jersey and it proved worthwhile. The coax is now free from r.f. and the bridge shows a very low s.w.r. ■

Simple Mobile Power Source

BY VICTOR H. ORTEGREN,* W6WFR

Now you can go mobile without a d.c. to d.c. supply if you car has an alternator instead of a generator. When the automobile salesman said that the car had a three phase alternator I started checking. Sure enough, it was 3 phase. It took a little fishing to find the single phase pair of the three wires leading from the field windings to the diodes.

I connected directly to these two wires, before the diodes, and came out to a duplex a.c. receptacle and a 0-130 v.a.c. meter and mounted both beneath the dash. (The voltmeter can also serve as a tachometer.) The output is about 80 cycles.

At the peak engine r.p.m. it is possible to get 130 volts a.c. output. I have been operating a KWM-2 s.s.b. rig on this for 10,000 miles now and it has held up fine.

When driving in heavy traffic some extra shifting is required to hold the engine r.p.m. at the correct level for a 117 volt output. If the voltage drops or rises the transmitter frequency is not too stable. A voltage swing of 95 to 130 volts seems to have no adverse affect on the receiver stability. ■

*199 Random Way, Pleasant Hill, California.

The Waters Nuverter, Model 346, a band-switched 6 and 2 meter receiving converter. It is a completely self-contained package that makes a nice appearance as shown here placed on top of a receiver from where it also may be conveniently operated. The r.f. gain is at the left, the band/range switch is at the center with a pilot lamp at the right.

CQ Reviews:

The Waters Nuverter Model 346 V.H.F. Converter

BY WILFRED M. SCHERER,* W2AEF

THE Waters Nuverter, Model 346, is a v.h.f. receiving converter that is somewhat of a departure from the run-of-the-mill ones to which we are accustomed. First of all, it consists of *two* converters combined into a single package along with a self contained a.c. operated power supply. One converter is for 6 meters, the other is for 2 meters. Either one can be chosen with a panel switch that also selects three different crystals for each converter to cover a wide range on each band when the unit is used with a ham-band-only receiver.

Nuvistors are used throughout, ensuring excellent front-end performance and at the same time cutting down the overall physical height of the unit which otherwise would be required if conventional vacuum tubes were used instead. This leads to another innovation, namely, the packaging of the Nuverter into a small size case that is trim and neatly styled, eliminating the unsightly chassis-type of v.h.f. gear such as ordinarily seen.

Other features include: separate 50 and 144 mc antenna connectors for 50 ohm inputs to each converter, normal h.f. antenna input for the regular receiver that is used as the variable i.f., output jacks from the crystal heterodyning oscillator in each converter for possible transceive operation, built-in heating element to maintain uniform crystal temperature as long as the a.c. power cord is plugged in, provisions for applying a.g.c. from the receiver, r.f. gain control, auxiliary plug for connecting external mobile supply.

*Technical Director, *CQ*.

All the r.f. circuits, crystals, antenna inputs, i.f. output, receiver input and power are switched automatically for the operation concerned when any one of the converters is turned on or off.

Performance-wise the Nuverter is rated for a *maximum* noise figure of 4 and 5 db on 50 and 144 mc respectively, and with a 4 mc bandwidth at 3 db down that covers the entire v.h.f. band in each case. Image and i.f. rejection is given as 70 db minimum. Antenna input and i.f. output impedances are 50 ohms.

Circuitry

Both converter sections have an inductively-neutralized r.f. amplifier using a semi-remote cutoff 6DS4 Nuvistor which is followed with a 6DS4 mixer. Three tuned circuits are used between each stage to provide a flat 4 mc bandpass with high skirt selectivity for improved rejection of out-of-band signals such as may produce images or i.f. signal feedthrough. On 2 meters there is a single-tuned input and on 6 meters the input is double-tuned.

For 6 meters, a 6CW4 is used as a straightforward overtone-crystal oscillator with a parallel-tuned plate circuit. The crystal frequencies are: 21.5, 22.1 and 22.7 mc (3rd overtone) each of which produces an i.f. output of 28.5-29.1 mc on signal ranges of 50-50.6, 50.6-51.2 and 51.2-51.8 mc respectively, for which the mixer-output tuning is centered on 28.8 mc.

On 2 meters, another 6CW4 functions as a cathode-tuned overtone oscillator with frequency tripling in the plate circuit. The 3rd overtone crystal frequencies are: 38.833, 39.033 and 39.233 mc, each of which when tripled produces the 28.5-29.1 mc i.f. for the band ranges of 144.0-144.6, 144.6-145.2 and 145.2-145.8 mc. From the i.f. range and the 600 kc band segments, it is obvious that the setup was intended for use with Collins s.s.b. gear; however, this does not preclude operation with other receivers. As a matter of fact, even wider band coverage may be realized with any receiver that tunes across the whole ten-meter band. For instance: we copied translated signals from OSCAR III on 145.875-145.925 mc using the Nuverter with our Hallicrafters SX-115 tuned to 29.175-29.225 mc.

The i.f. output is taken from a tap on each mixer plate coil and is fed through a 50-ohm 6 db attenuator that provides a match to the 50-ohm input of the communications receiver which is used as the variable i.f. It also minimizes the possibility of overloading the receiver. Consequently, you don't get a loud roar of noise fed to the receiver that deludes you into thinking that you have an exceptionally hot converter. If you're so inclined to being fooled, you can cut out the attenuator and bring up the noise. As is, the Nuverter output is high enough to override the inherent noise of any high-quality receiver.

Power Supply

A transformer-type of power supply uses a half-wave silicon-diode rectifier and R-C filtering. Another rectifier, connected to the heater supply, furnishes a variable d.c. bias that is applied to the grid of the r.f. input stages to provide a means for controlling the r.f. gain. When a.g.c. from the i.f. receiver is to be used on the Nuverter, the d.c. bias is disconnected by removing a jumper on the rear of the unit, and the receiver a.g.c. is connected instead to the grid and gain-control side of the jumper terminals.

Plate voltage is not regulated, so like with other converters that do not have such regulation, a slight oscillator-frequency shift may be experienced with changing line voltages. In many cases this may be inconsequential, unless severe recurrent power fluctuations occur.

The heater-supply potential is 2.6 volts and the Nuvistor heaters therefore are connected in series-parallel. This also permits operation from a 12 v.d.c. mobile source, for which an auxiliary plug is provided along with connections for plate power also from an external mobile supply.

Switching

The tube heaters in the r.f. section of each converter are automatically turned on and off with the band-selector switch, according to which converter is to be used; however, to minimize frequency drift, the heaters of *both oscillator* tubes remain on as long as either converter is in use. Plate power is continually applied to all tubes at the same time.

When the switch is turned off, all plate and heater power is removed and a heating element in the crystal compartment is connected across the 117 v.a.c. power line in order to maintain a relatively uniform crystal temperature for eliminating warmup drift when the converters are first turned on.

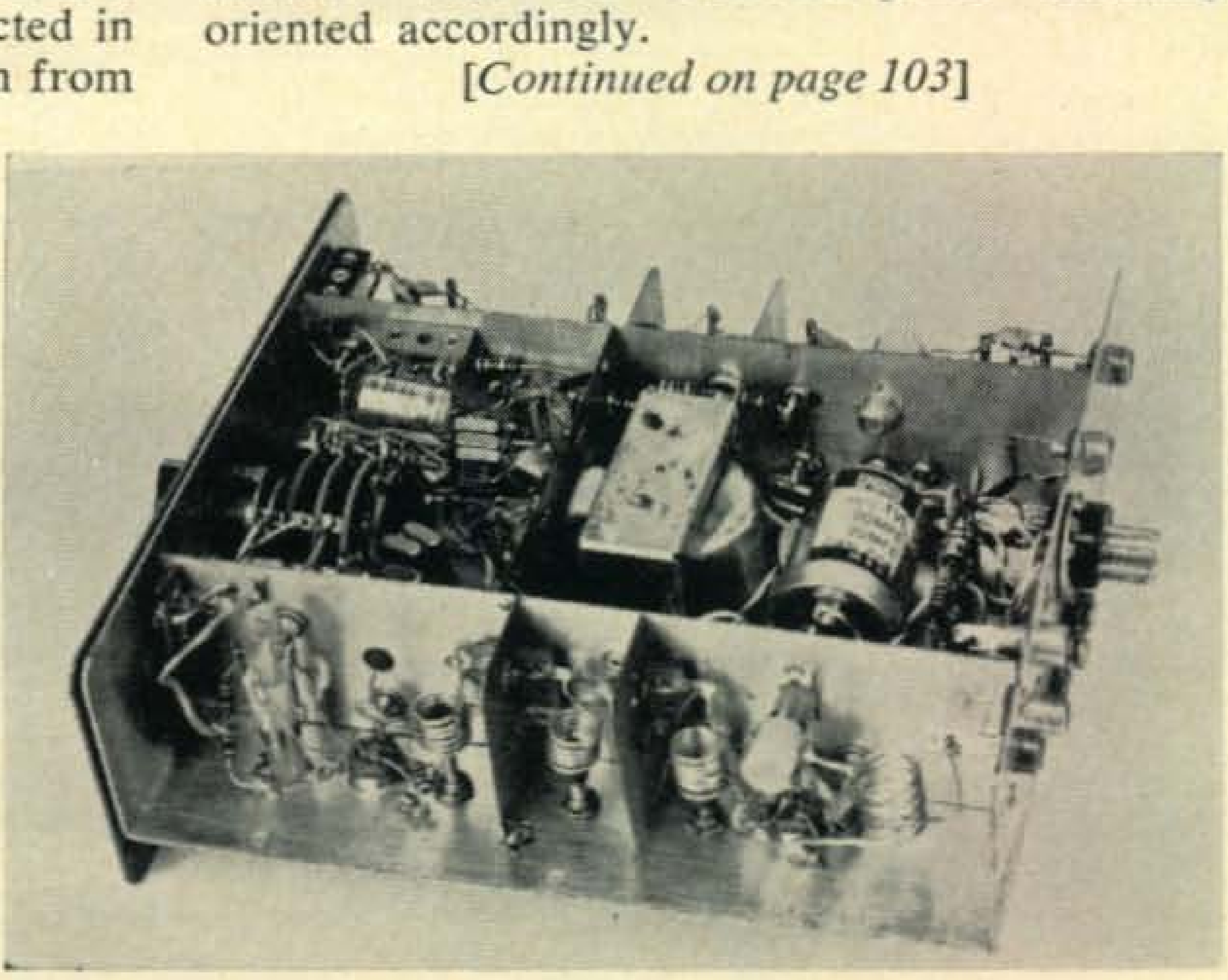
The selector also changes the i.f. output connector from one converter to the other, and when it is placed at OFF, it automatically transfers h.f. antenna to the i.f. output jack and thus feeds it directly to the communications receiver for normal operation.

Construction

The Nuverter is built in a low U-shaped chassis that is entirely enclosed with a tight-fitting U-shaped cover. Extensive shielding is used throughout with separate compartments for the different stages. The triple-tuned circuits also are isolated with shields. All the metal parts used for shielding, the chassis and the cover are copper plated and high-quality components are used.

The Nuvistors and the screws of tuning slugs which protrude outside of the enclosure are protected under a baffle plate supported on metal standoffs. The entire unit is installed in a compact wrap-around type of case, the size of which is 2⅝" × 6½" × 7¼" (H.W.D.). A typical Waters-patented reversible panel is included to allow the Nuverter to be placed horizontally on top of or vertically next to the communications receiver with the Nuverter-panel labelling oriented accordingly.

[*Continued on page 103*]



Inside view of the Waters Nuverter. Shield partitions separate the 2-meter converter section in the foreground, the crystal-oscillator portion at left center, the power supply at right center, and the 6-meter converter along the top edge. Air-wound coils are used on 2 meters, nylon coil forms on 6 meters.

Putting The NC-183 On S.S.B.

BY KEN SCHOUTEN,* W6DDA

This article was written for the amateur who is unable to afford a new receiver or the amateur who enjoys meeting the challenge of conversion. Here is a junk-box method of extending the useful life of a fine old receiver.

About four years ago, a friend of ours, W6ASW, with whom we have held weekly schedules on 21 mc, a.m. phone for the past ten years, played a dirty trick on us—he went sideband.

This left three paths of action open to us. Buy a new receiver, drop a friendship of more than thirty years, or rebuild our present receiver, an NC-183 purchased in 1948 and unaltered.

Being almost sixty years of age at the time and with more than forty years of amateur operation behind me, the old build it yourself bug bit hard, so we decided on moderate surgery for the veteran receiver.

A little re-engineering, as suggested in an article in *CQ*[1] and the construction of a 300 watt home built linear[2] took care of the transmitting problem.

Receiver

Of course the first requisite of a receiver on sideband is stability. The 183 came equipped with some built in frequency drift, so that was the first problem to solve. This proved to be a very simple thing to beat and was accomplished in the following manner.

The first step was to short out C_{57}. This capacitor is located among the cluster of low frequency oscillator coils. With the set upside down on the bench, front panel toward you, these coils are on the left and in the front.

Unfasten the bracket holding C_{47}, C_{56} and C_{54}. Leaving these ceramic capacitors soldered to their respective coils, bend the whole assembly forward. This will facilitate the shorting of capacitor C_{57}.

Second, remove the blue wire from pin 3 on the 6J5 oscillator socket, V_4, and solder it to the vacant pin 4 on the same socket. Then solder a 350 mmf silver mica capacitor between pins 3 and 4. This takes the place of the shorted C_{57}. Retuning of all oscillator coils will be necessary after this operation.

The product detector circuit was taken from the ARRL *Handbook*. The PHONO-RADIO switch leads in the receiver should be disconnected from the PHONO-RADIO switch and soldered in the radio mode, after which the switch is removed and a triple pole double throw wafer switch is installed in its place. This gives us either diode or product detection.

Four tie point bars, a nine pin socket, a metal angle bracket to suppor the socket and a 12AU7 tube are needed in addition to the wafer mode switch in order to complete the revision.

A five terminal tie point bar #1 supports the connections of the radio phono wires that were removed from the switch. Tie point bar #2 supports the 0.001 tubular audio coupling capacitor from the plate of the 12AU7. Tie point bar #3 supports the plate resistor of the 12AU7 and tie point bar #4 is used to connect the various resistors and capacitors to the socket of V_7. A 6SN7 replaces the 6H6 detector a.v.c. in V_7.

In order to increase the output of the 6SJ7, b.f.o., the shielded wire is unsoldered from pin 8 of V_9 and C_{71}. Bend the ends of this wire out of the way and leave it in the chassis. Now install a piece of RG-59/U in place of the shielded wire and solder it to pin 8 of V_9 and C_{71}. An r.f. choke is used to replace R_{38} feeding the plate of the b.f.o.

[*Continued on page 98*]

*1718 Lock Berry Road, Winter Park, Florida.

[1]Blinkley, W., "Put Your Ranger on Sideband," *CQ*, September 1959, p. 41.

[2]Smith, H. L., "An Economical Half Gallon Linear," *CQ*, March 1958, p. 28.

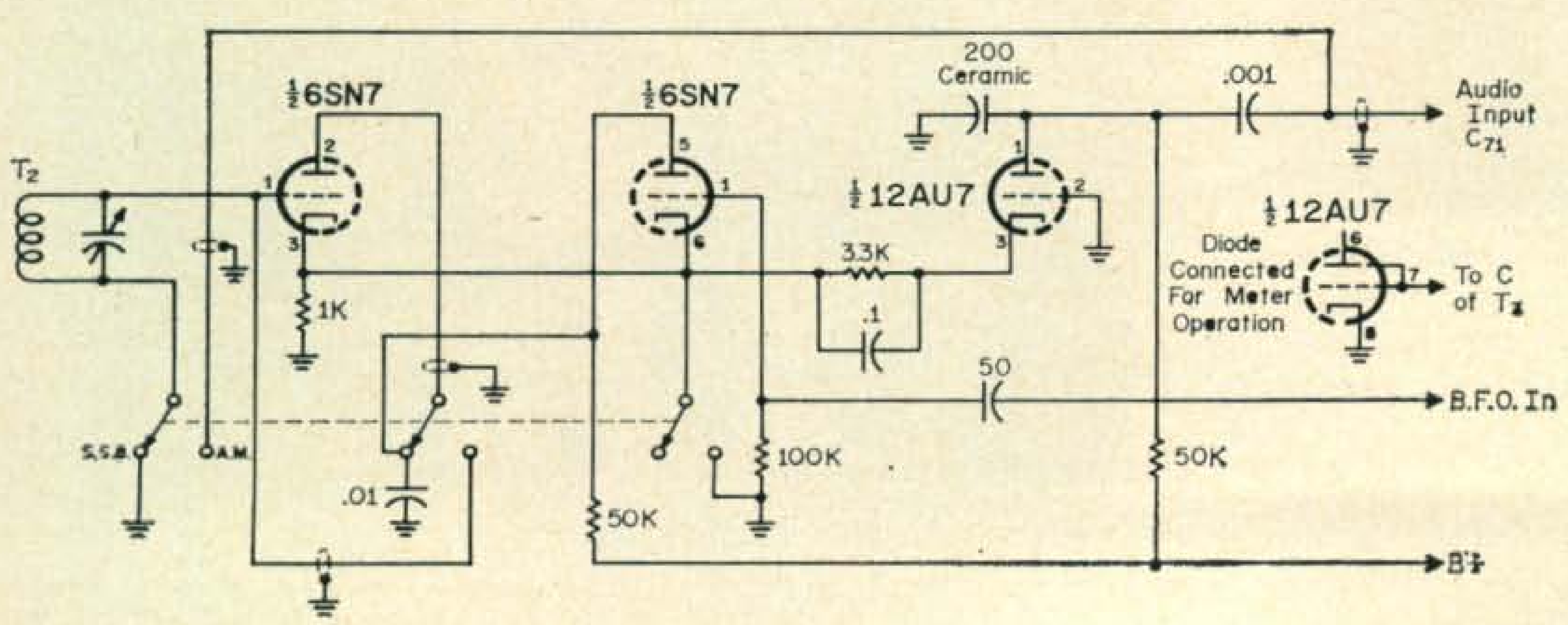


Fig. 1—Circuit of the product detector and mode switch used for putting the NC-183 on s.s.b. The mode switch is shown in the s.s.b. position. All resistors are ½ watt and the capacitors are in mf.

SERIES TYPE TRANSISTORIZED REGULATED POWER SUPPLIES

BY MORTON H. BURKE,* K2ENU

The widespread use of regulated d.c. power supplies in transistorized equipment requires that technicians be acquainted with them. The mechanics of the common series type transistorized regulated power supply is described for the purpose of clarifying the operation of such units.

A REGULATED d.c. power supply provides a constant d.c. output voltage with only a small amount of a.c. ripple superimposed upon it over varying conditions of changing input line voltage and changing load current. For example, a typical transistorized power supply might have the following specifications. It would be a variable power supply adjustable from 0 to 24 volts. It would regulate at any voltage within this range over a current range from 0 to 5 amps. The amount of regulation one could expect from such a supply is 0.01% and the ripple content of the output would be less than 1 millivolt peak to peak over an input line variation from 105 to 135 volts. This 0.01% regulation is usually considered a percentage of full output, or in the example under discussion 0.01% × 24 volts or 2.4 millivolts. This kind of performance is readily obtainable with present day design techniques.

The most common type of transistorized power regulator is the "series" type. The sections that form such a supply are shown in fig. 1.

Section I, Block A, A.C. input—Regulated power supplies are always transformer coupled to the a.c. input line to provide electrical isolation between the power supply output and a.c. input line. In addition the use of a transformer allows the designer a large measure of design freedom, since he can obtain almost any output voltage he desires by changing the turns ratio of the transformer secondary winding.

Section I, Block B, Rectifier and filter—Before the d.c. is finally converted to its regulated low ripple condition, it is crudely converted to d.c. by a full-wave rectifier. In transistor circuits a full-wave bridge rectifier as shown in fig. 1 is usually used. However a two diode full-wave rectifier could also be employed. But most designers prefer the bridge rectifier because they can avail themselves of the full voltage across the secondary winding of the transformer.

The capacitor shown on the output of the bridge rectifier provides what is commonly called "brute force" filtering. That is, if the capacitor is large enough (500 mf is commonly used in low voltage supplies) the time constant, the product, $R \times C$, of the capacitor in farads and load resistance in ohms, will be so large that the capacitor will discharge at slower rate than the rectified voltage from the bridge is changing. As a result, the capacitor has a tendency to hold its voltage, thus providing filtering for the d.c. Note that Section I of fig. 1 is a conventional power supply which is providing Section II with unregulated, crudely filtered d.c. Section II will provide the sophisticated circuitry necessary to convert the output of the brute force power supply of Section I into a highly regulated, low ripple voltage.

Section II, The Regulator—Every series regulator circuit contains the component parts shown in Section II of fig. 1. All regulators of this type operate on the so called feedback principal. That is, a portion of the output voltage is continually monitored by a comparator which compares a sampled fraction of the output with a stable voltage reference source. Any difference between the two voltages is amplified in an amplifier stage, and this resulting signal is applied to a transistor which is in series with the output.

*9 Greenbrier Road, Oakhurst, New Jersey 07755.

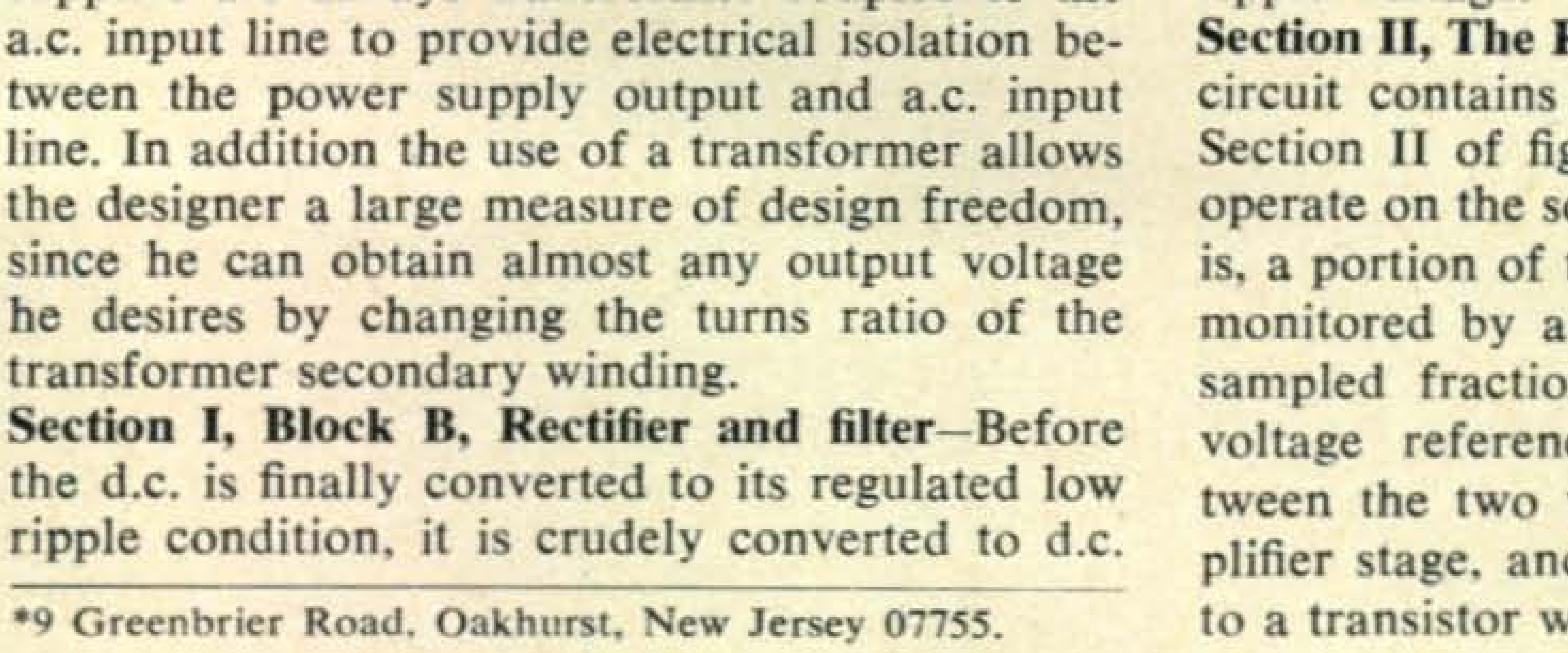


Fig. 1—Basic block diagram of a transistorized series type regulated power supply. Section I is a conventional bridge type power supply and Section II is the regulator circuit.

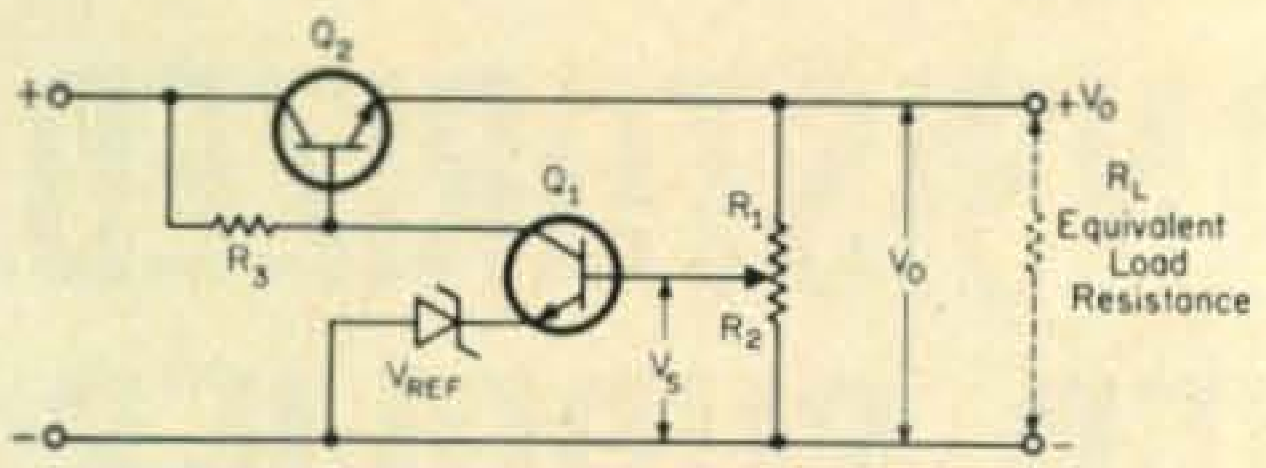


Fig. 2—Circuit of a basic but operational regulator circuit. The operation and limitations of ths fundamental circuit is explained in the text.

This amplified difference signal is applied to the series transistor in such a way as to cause it to compensate for the change in the output voltage.

Circuit Operation

Figure 2 is the schematic of a workable regulator circuit. Transistor Q_1 is functioning in the dual role of a comparator and amplifier. Transistor Q_2 is the series element. Note that the load current must flow from R_L to the emitter and then to the collector. Transistor Q_2 acts like a variable resistance that changes in such a way as to maintain the output voltage, V_o, essentially constant. Reference voltage V_{ref} can be obtained from a battery, a reference cell, or a zener diode. Most transistorized regulated supplies utilize a zener diode as the reference element.

The output voltage, V_o, is continually sampled by applying a portion of it to the base of Q_1 by way of the voltage divider consisting of R_1 and R_2. Note that the base voltage, V_s, of Q_1 must at all times be almost equal to the reference voltage, V_{ref}. The difference will be the base to emitter voltage of Q_1 (a fraction of a volt). Thus, if a potentiometer were used as a divider (this is often the case), as the arm is moved away from the positive output terminal, where R_1 is increasing in resistance and R_2 is decreasing in resistance, the output voltage would increase in magnitude. This must be so because the base to ground voltage V_s will always be

$$V_S = \frac{R_2}{R_1 + R_2} V_o$$

and this quantity must always be equal to V_{ref}. The opposite is also true. That is, as R_2 is made larger and R_1 smaller, the output voltage V_o will decrease. However, in a circuit such as this, the lower limit that the output voltage can be reduced to is the value of V_{ref}. If the sampled voltage, V_s, were to become less than V_{ref}, the base of Q_1 would become negative with respect to its emitter, and transistor Q_1 would be cut off and could not function as an amplifier. As a result of this requirement, low voltage supplies of this type must have a low voltage zener diode as a reference.

With the base voltage of Q_1 established, Q_1 will conduct current through resistor R_3. This resistor serves a dual function; it is the collector load resistor for Q_1 and also provides the path for the bias current for series transistor Q_2. The regulator action of series transistor Q_2 can be easily understood if the reader will recall that collector current in a transistor used as an emitter follower is β times the base current. (Refer to fig. 2, note that the load R_L is in series with the emitter of Q_2 and that the output voltage is developed across this load resistor. Transistor Q_2 is in effect operated as an emitter follower.) Thus a small change in base current can cause a larger change in collector current. This is the same as providing a variable resistor in series with the load that can compensate for changes in output voltage.

What happens if the output voltage of the regulator tends to go down? (This could be caused by a decrease in line voltage or an increase in load current.) In this regulator, a decrease of output is reflected into the comparator by way of the resistance divider, R_1, R_2, of fig. 2. The decrease in base voltage V_s of Q_1 causes less current to flow in the collector of Q_1. Since R_3 is in series with the collector of Q_1, less current through R_3 causes a decrease in voltage across R_3. Resistor R_3 is also located between the collector and base of Q_2. This decrease of voltage between the collector and the base of Q_2 causes the base emitter voltage of Q_2 to increase (base more positive), thereby causing more base current to flow in Q_2. This is, in effect, the same as decreasing the equivalent resistance of the emitter collector path which is in series with the output, R_L. And since the emitter-collector resistance of Q_2 and load, R_L, form a voltage divider, decreasing the resistance of Q_2 will cause the voltage across R_L to increase. This compensation for changes in output voltage is going on continuously. If the output were to increase in voltage, the regulator would tend to return it to its original value by a reversal of the previously discussed process.

In addition to providing a regulated d.c. out-

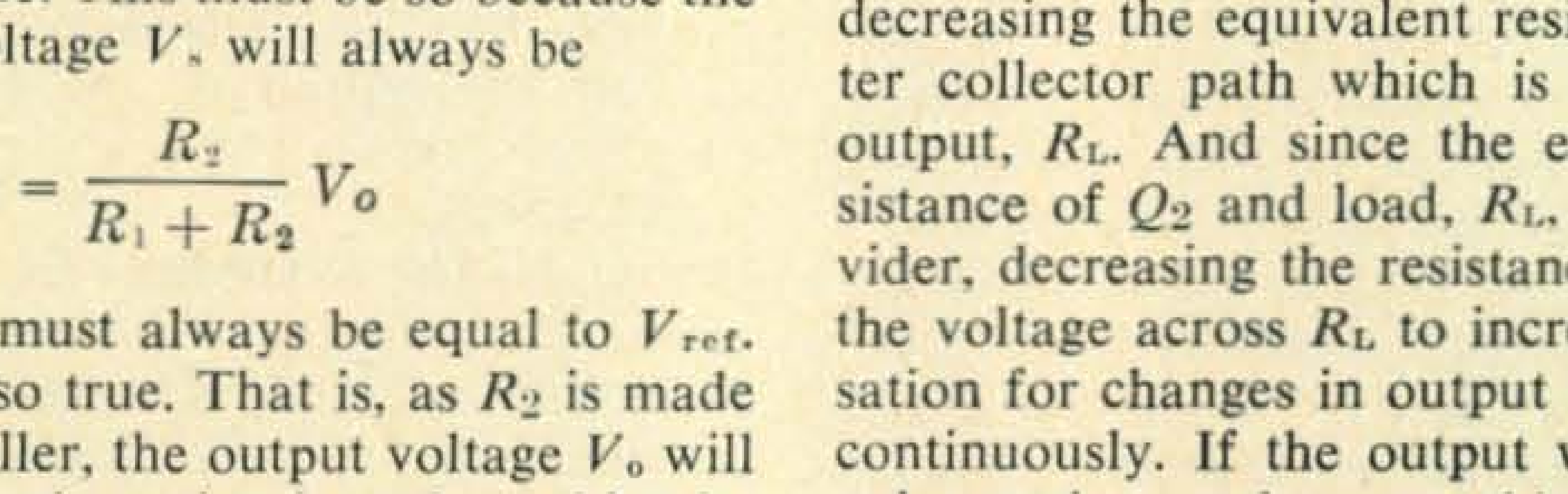


Fig. 3—Regulated supply with pre-regulator consisting of D_1, D_2, Q_3, R_4 and R_5. Silicon diode D_2 is forward biased to provide temperature compensation for Zener D_1. Diodes D_1 and D_2 together provide a constant emitter-base voltage for transistor Q_3. As a result, collector current of Q_3, which passes through R_3 and V_{ref} is held essentially constant. This stabilizes bias current for series transistor Q_2 and also zener reference V_{ref}. Because of this pre-regulator circuit, performance of supply is greatly improved for temperature and line voltage fluctuations.

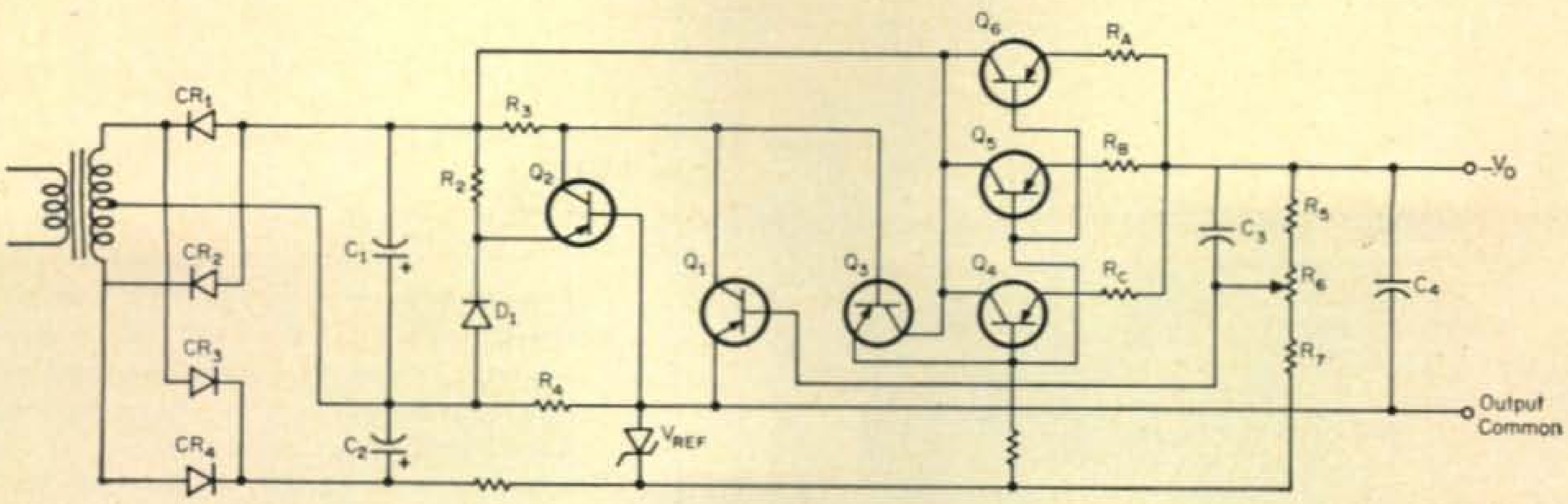


Fig. 4—This more sophisticated regulator circuit has automatic overload protection, an output that can be varied from zero to maximum volts and either positive or negative grounded output. Transistor Q_3 is connected to paralleled series transistors Q_4, Q_5 and Q_6 in a Darlington arrangement to provide the necessary base current. Resistors R_a, R_b and R_c in series with the emitters help balance currents through these transistors. Capacitor C_3 provides a path for high frequency ripple or transients directly to the base of transistor Q_1. This improves supply regulation for high frequencies by eliminating the signal reducing effect of the output voltage sensing divider R_5, R_6 and R_7. Capacitor C_4 reduces output impedance of supply and prevents high frequency oscillations when the supply is lightly loaded.

put, the circuit of fig. 2 will also reduce the ripple content of the output voltage. This a.c. ripple superimposed on the d.c. output voltage acts just like an ordinary voltage change appearing across the voltage divider R_1, R_2, and this variation in voltage is compensated for by the normal regulating action of the circuit.

This series type of regulator acts as a closed loop servo system that is constantly correcting itself with respect to its reference voltage R_{ref}. However, there are factors which affect the ability of this system to be a perfect regulator. Some factors that influence the performance of the system shown in fig. 2 are:

1—The stability of the reference voltage V_{ref} is important to the regulating ability of the supply. Since most reference voltages are zener diodes, the voltage across the diode will vary with changes in current through the diode. The zener current will change with variations in line voltage and ambient temperature.

2—Variations in bias current through the base of Q_2 caused by changes in current through R_3 as a result of line voltage fluctuations will cause the output voltage of the supply to drift.

3—The gain of the amplifier stage, Q_1, that is providing the correction signal to the series transistor Q_2 should be high enough and constant enough to provide the necessary regulation. Should this stage gain vary with time, performance will suffer.

4—The ability of the series transistor to supply the necessary load current is also an important performance factor.

Pre-Regulator

The detremental effects of the conditions discussed in items 1 and 2 can be greatly compensated for by the addition of an extra circuit called a pre-regulator. This circuit consists of another zener diode and a transistor which together act as a constant current source for both the zener diode, V_{ref}, and the base bias for Q_2. The temperature dependency of the zener diode V_{ref} can be corrected by using a temperature compensated zener. This compensation is obtained by placing a silicon diode biased in the forward direction in series with the zener. Since the normal temperature variations of these devices are opposite to each other, they have the net affect of canceling any tendency to change with temperature. Temperature compensated zeners are available with temperature coefficients as low as 0.001% per degree cantigrade. A pre-regulated circuit is shown in fig. 3.

The required amplification of the difference voltage (item 3) can be obtained by adding amplifier stages in cascade. It is not unusual to find 3 stages of amplification in a regulator circuit.

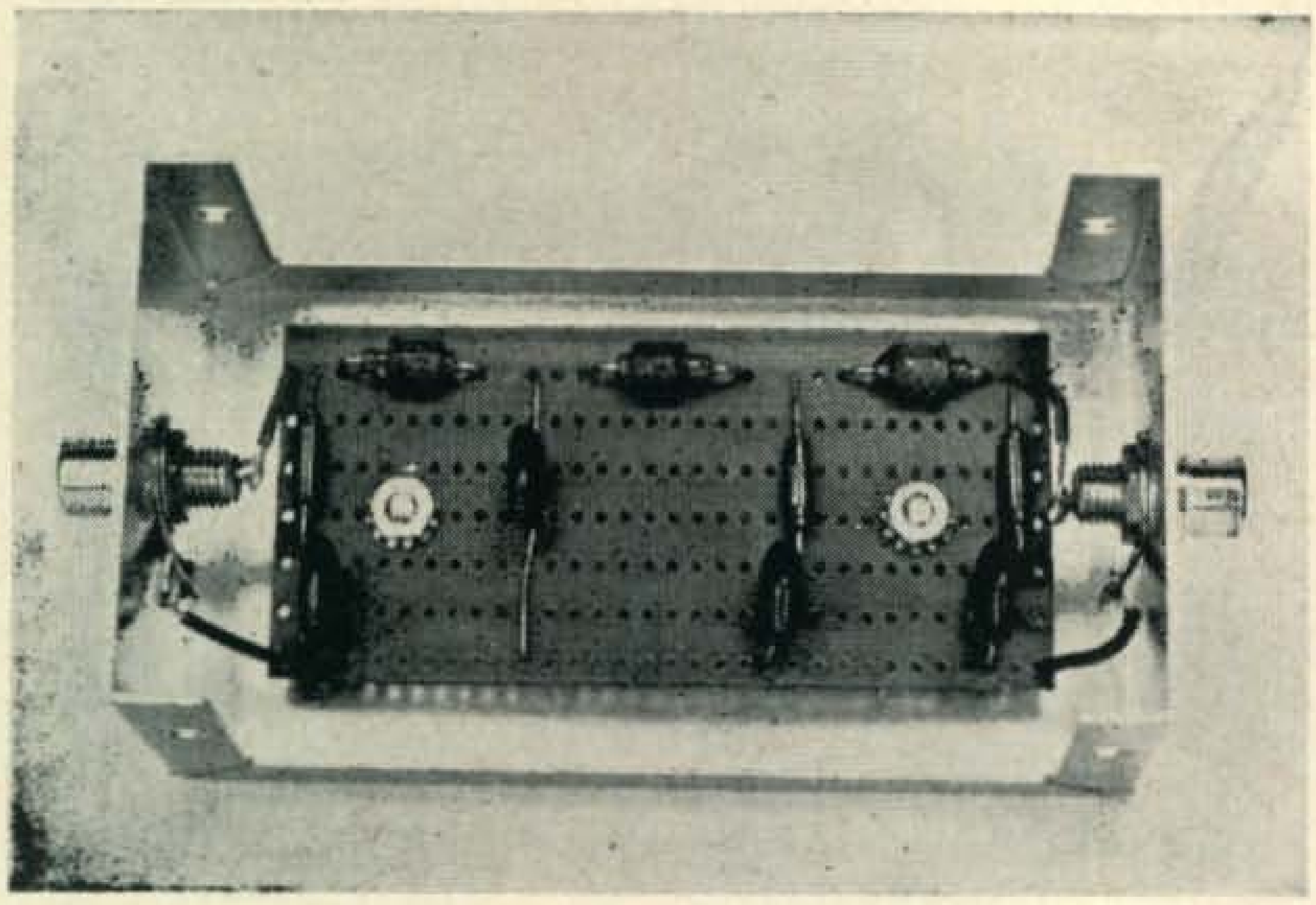
The current limitation noted in item 4 can be eliminated by providing enough "series" transistors connected in parallel, if necessary, to handle the required load current. Also, it may be necessary to provide enough transistors connected in the so-called Darlington arrangement to supply the required base current to the series transistors. See fig. 4.

Overload Protection

An important factor that must be considered in every series regulator is overload protection for the series transistor. Note in fig. 2 that if V_o were shorted to ground, the entire voltage from the bridge rectifier would appear across series transistor, Q_2. Under these conditions of high current and voltage, transistor Q_2 might easily be destroyed. Fuses, as a rule, do not help in such a situation because the transistor will usually fail before the fuse opens up. However, circuits have been devised which will limit the current through the series transistor to some predetermined amount. This limiter acts rapidly enough to prevent the series transistor from burning out.

Current limiting to protect the series transistors from output shorts or overloading is shown in fig. 4 and is achieved by a current regulator circuit consisting of R_4, D_1, R_2, and Q_2. Resistor R_4 is in series with the load current. At a predetermined amount of current, the voltage

[*Continued on page 102*]



The 500 kc low-pass filter designed for use with v.l.f. receivers to eliminate the generation of inter-station beats in the receiver caused by standard broadcast-station signals. It is assembled on a circuit board (Veroboard) which is mounted on spacers in a minibox. Phono-type jacks are used for input (left) and output (right). The components are placed and wired on the board in the same order as they appear in the schematic diagram. The output should be connected to the receiver input through a short length of shielded cable (RG-58U).

LOW-PASS FILTERS FOR 5-500 KC RECEIVERS

BY WILFRED M. SCHERER,* W2AEF

VERY-low-frequency receivers often do not have enough front-end selectivity to sufficiently attenuate standard broadcast-station signals. Such b.c. signals that can reach the receiver mixer and generate v.l.f. inter-station beats that interfere with the reception of signals below 500 kc. Such is the case when the 5-500 kc range of the HRO-500 is used, for which the l.f. antenna is fed directly to a diode mixer that has no tuned input circuit. Although a preselector can be used to eliminate these effects, a simpler scheme is the use of a low-pass filter ahead of the receiver to cut off all signals above 500 kc.[1] Such a filter can easily and inexpensively be built using standard size components.

Circuitry

The configuration and constants for the filter we dreamed up are shown in fig. 1. The filter cuts off sharply above 520 kc and the attenuation on the broadcast band is at least 60 db. It consists of a constant-K, T-type mid-section, an M-derived T-type mid-section and two M-derived end-sections. The filter is designed to work into a load of 1000 ohms to match the input impedance of the HRO-500 (for the 5-500 kc range) and to permit the use of standard size inductors and capacitors that are readily available.

The selected impedance should be suitable for use with other v.l.f. receivers with which a long-wire high impedance antenna is used directly coupled to the set. However, if necessary, the filter can be built with component values for other terminating impedances by *multiplying* the given target values of the inductances by $Z/1000$, where Z is the new impedance. The standard values that are nearest the sizes just determined should then be used. Similarly the capacitances may be found by *dividing* the given target sizes by $Z/1000$.

Construction

The components may be assembled and wired on a perforated board or on a printed-circuit Veroboard such as we used.[2] The board is then mounted on ¼-inch spacers in a 4" × 2⅛" × 1⅝" minibox with a phono-type jack

*Technical Director, *CQ*.

[1] A preselector also will increase the sensitivity of the receiver.

[2] "Circuit Boards—Quick and Easy", *CQ*, Dec. '65, page 35.

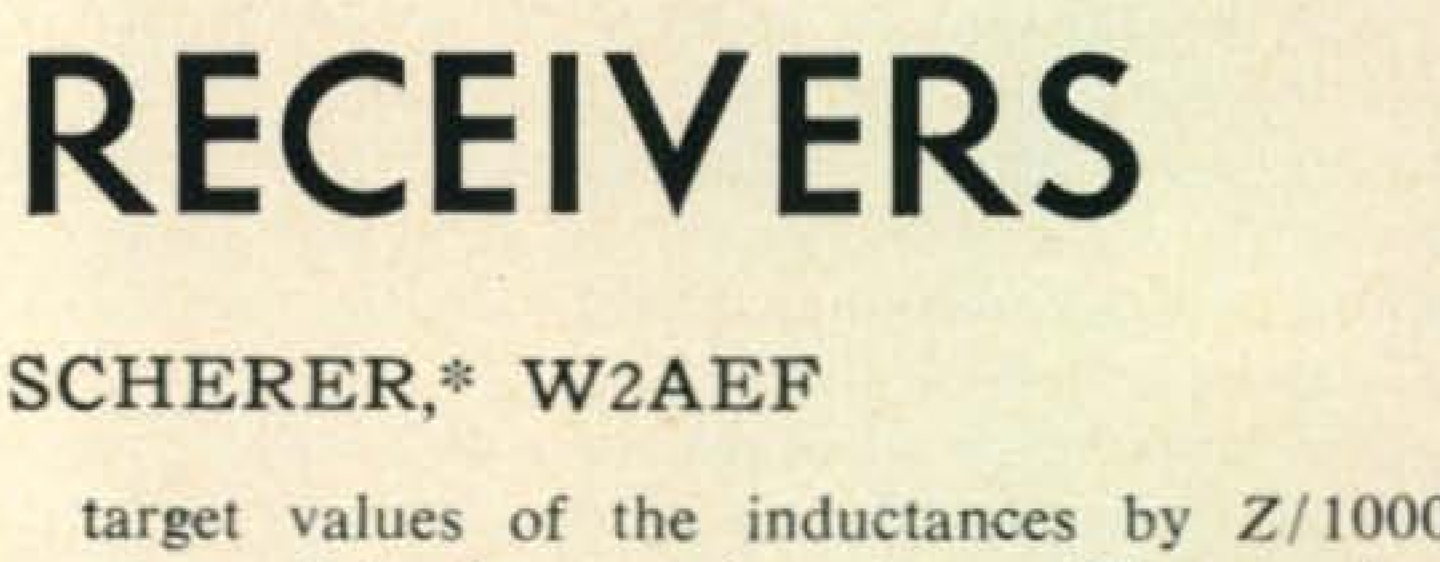
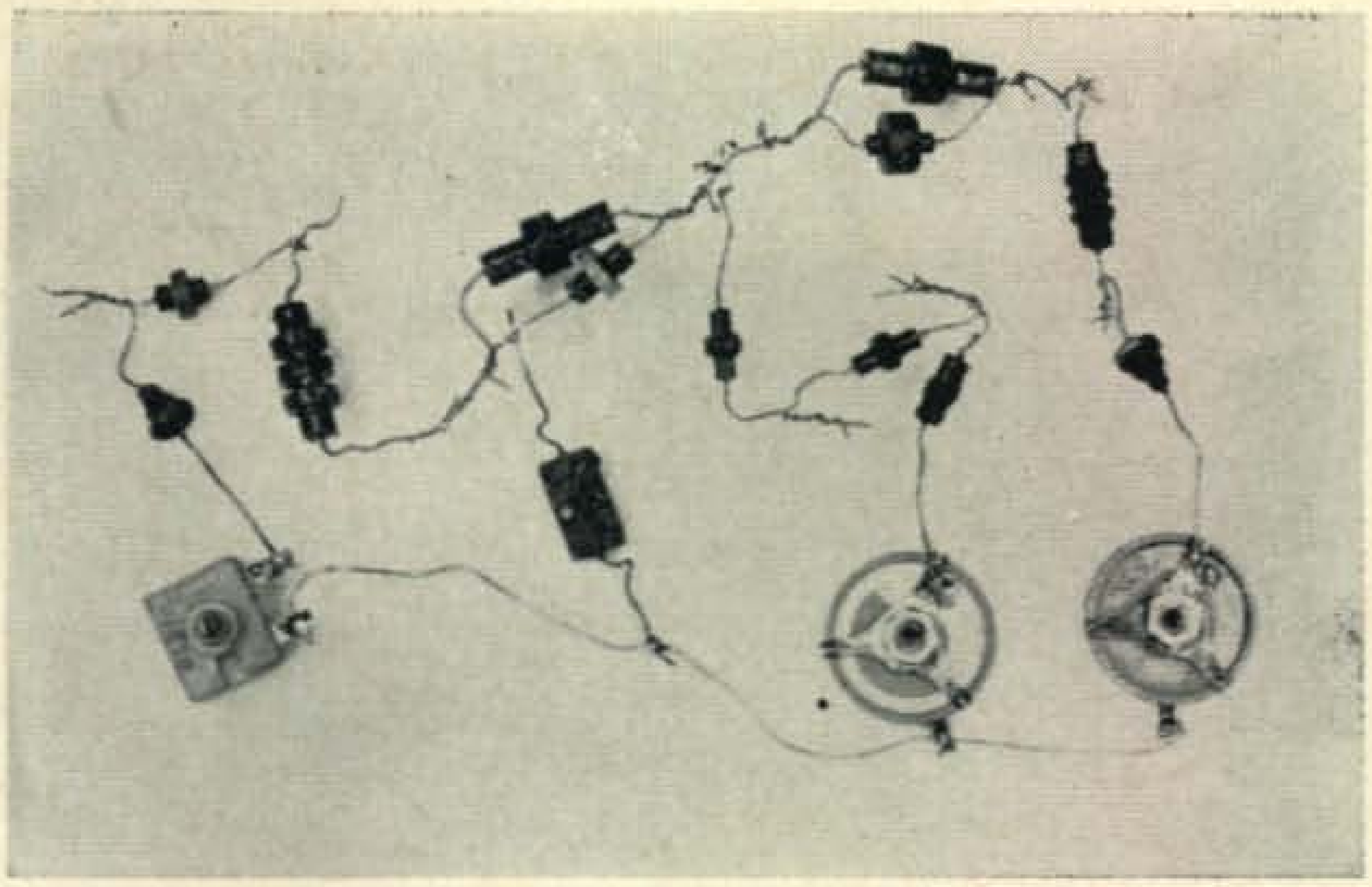


Fig. 1—Circuit of a low-pass filter designed to attenuate broadcast signals that interfere with v.l.f. reception. Both the input and load impedances are one thousand ohms for the values listed. Capacitors should be 5% tolerance.

L_1, L_3—470 μh (target value 480 μh), Millen J300-470 or equiv.
L_2, L_6—330 μh (target value, 320 μh), Millen J300-330 or equiv.
L_4—150 μh (target value, 150 μh), Millen J300-150 or equiv.
L_5—360 μh (target value, 360 μh), Millen J300-360 or equiv.
C_1, C_4—180 mmf (target value 180 mmf), dipped mica.
C_2—620 mmf (target value 600 mmf), dipped mica.
C_3—360 mmf (target value 360 mmf), dipped mica.

The layout for the 500 kc low-pass filter is not critical as may be seen from this haywired test setup that was hastily thrown together from junk-box parts and which was used to confirm the initial design values and the possible performance of the filter; nevertheless, we do not recommend this type of construction!



installed on each end of the box for the input and output connections.

The parts are arranged on the board as they appear in the circuit diagram. Theoretically the inductors should be spaced far apart from one another or be shielded to minimize coupling between sections of the filter. However, this is not of too great concern as may be seen from our haywired breadboard model that was built, using a conglomeration of series and parallel connected r.f. chokes we had on hand, to confirm performance using our design values.

Results

Here, in the New York area, there are dozens of broadcast stations, many of which are 50 kw jobs. Reception of 15-500 kc signals with the HRO-500 used barefoot (without preselector) is virtually impossible due to the multiplicity of inter-station beats that are produced in the mixer by the b.c. signals.

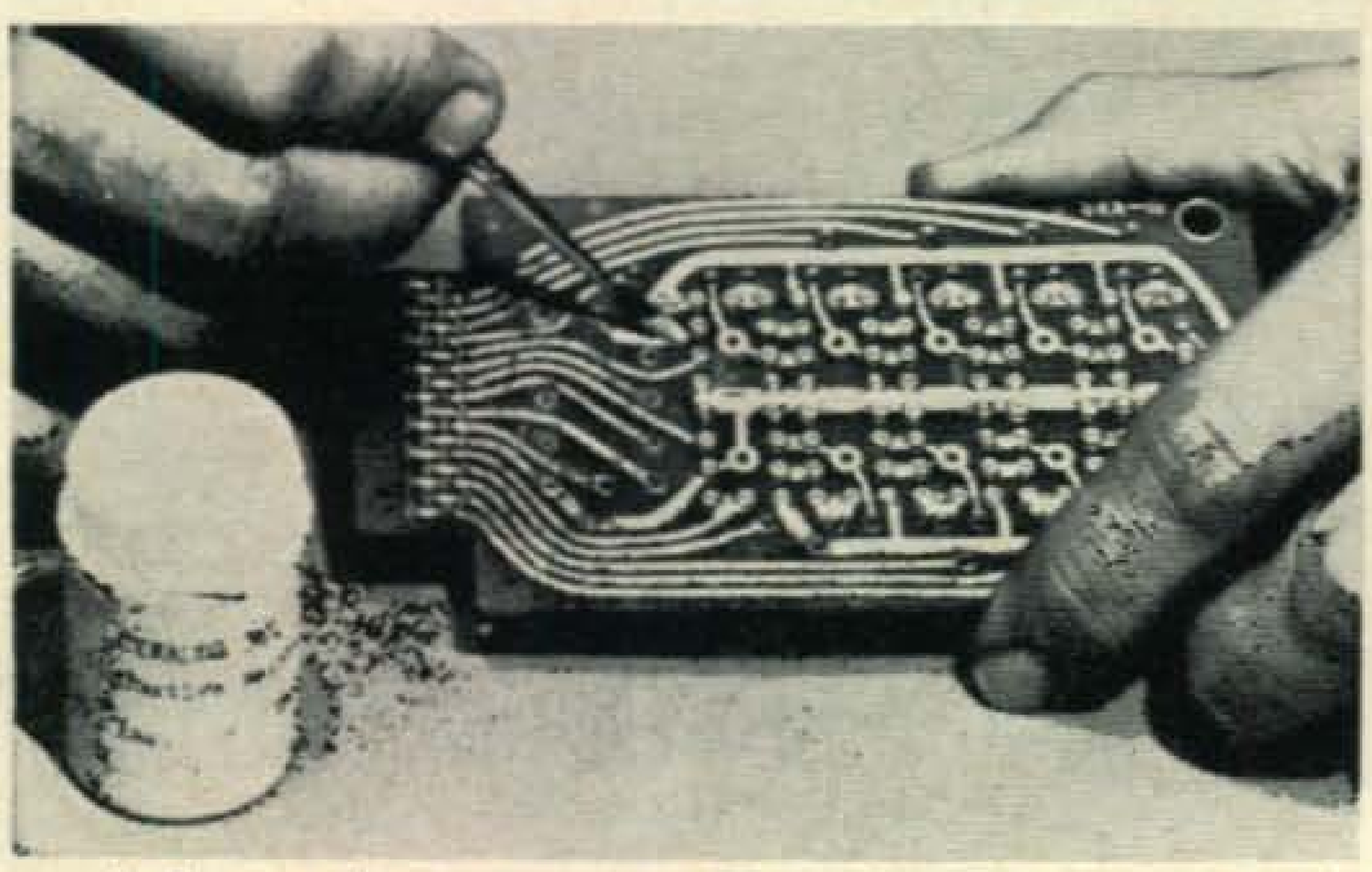
Use of the low-pass filter between our 200-foot long l.f. antenna and the receiver completely eliminates all the spurious beats and perfect copy of v.l.f. signals can be had. One striking demonstration we like to give in this respect is that normally the S-meter is pinned by a 220 kc beat generated in the receiver by WNBC on 660 kc and WCBS on 880 kc, each of which pump 50 kw into the same antenna located a few miles from us. With the filter installed, their signals disappear completely and an S-1 beacon signal on 220 kc can be copied perfectly!

Also, using the filter we can copy GBR in England on 18 kc all day long with an S-1 signal, but without the filter, the signal cannot be found at all due to b.c. station crud.

In some locations inter-station beats may be produced by rectification and radiation from external sources, in which case neither a preselector nor the filter will help. We recently ran into such a situation when on a windy day, b.c. station beats were intermittently heard all over the v.l.f. spectrum of the receiver in spite of the fact that the filter was in use. The cause was traced to the antenna lead-in which was rubbing against a rusty iron grating. This resulted in r.f. rectification and mixing which produced low-frequency signals that were in the passband of the filter and thus were fed directly to the receiver input. Therefore, if your filter does not clear up spurious l.f. beats, it is suggested that you look for an external culprit.

One final note. The lead between the filter and the receiver should be shielded. RG-58 A/U may be used if the filter is placed right at the rear of the set in order that the cable may be kept as short as possible. ■

New Amateur Product



Dynaloy, Inc.

DYNALOY, Inc. has developed a silver-filled, electrically-conductive paint which will air dry in 15 minutes to a tack-free fill. Designated Dynaloy 340, the paint offers excellent adhesion to any surface—metal, plastic, glass, rubber, or ceramic. Applications include electrostatic shielding, repair and prototype production of printed circuits. Trial quantities of Dynaloy 340 are available at $10.00 for 3-oz. cans. Commercial quantities include pints, quarts, and gallons, with prices as low as $1.25 per ounce. For additional information, contact Dynaloy, Inc., 408 Adams St., Newark, N.J. or circle 72 on page 110.

NUVISTOR CONVERTERS

FOR 50, 144, 220 & 432 Mc

Plus

A NUVISTOR PREAMP FOR 144 Mc

BY FRANK C. JONES,* W6AJF

Presented below are four converters, using nuvistors exclusively, for 50, 144, 220 and 432 mc operation. Also thrown in is a preamplifier for 144 mc that peformed as well as the 416 B job formerly in use at W6AJF.

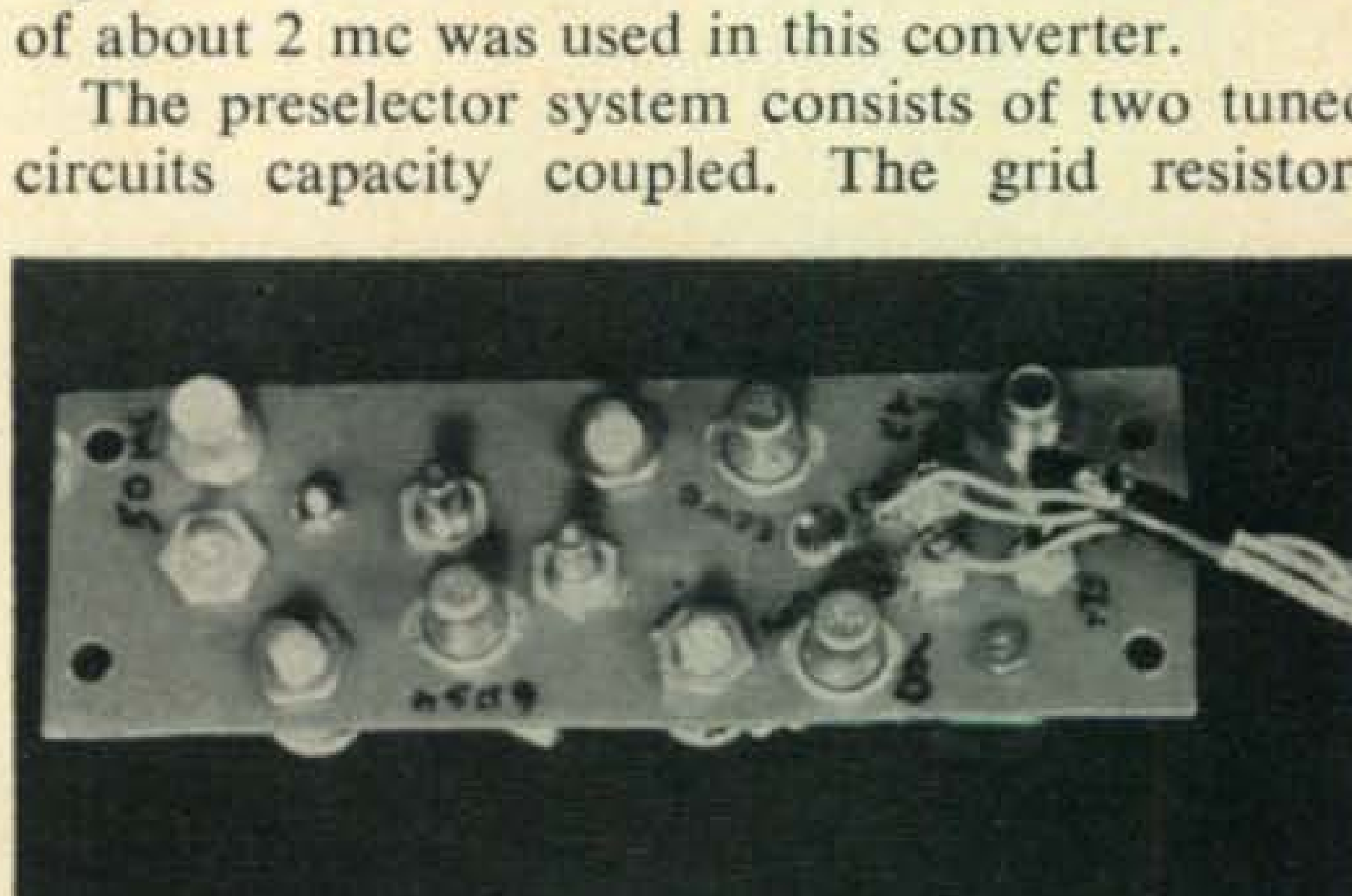
SOME very good nuvistor tube converters and amplifiers have been described in the past few years. A few more are described briefly in this article, since there are many ways of accomplishing certain results. Some amateurs like to make exact copies of equipment, while others like to make use of parts of a circuit to work out their own designs for the different v.h.f. bands. The writer falls into this last classification, being one of the old timers who enjoys building anything from a simple pre-amplifier to a complete communications receiver. There are usually at least two or three v.h.f. converters for each band at W6AJF with complete separate homebuilt receivers for each type of signal to be received. Examples are one or two each for c.w., n.b.f.m., a.m., and MARS wideband a.m. signals. The nuvistor converters described here have been some of the many built during the period since my handbook *VHF for the Radio Amateur*[1] first appeared in print. These little gems of u.h.f. tubes were just appearing, too late to be shown in that handbook.

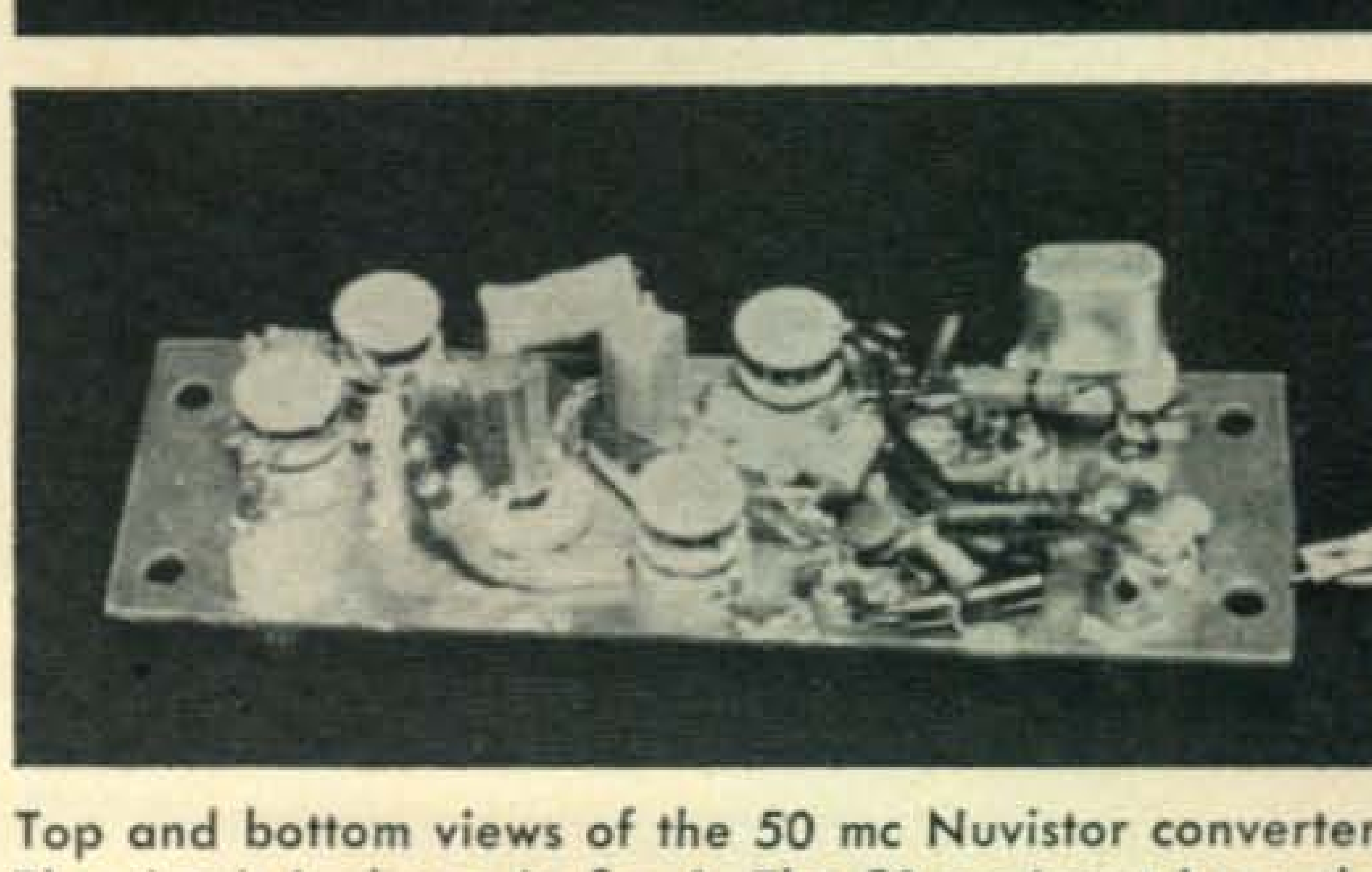
50 Mc Converter

While nuvistor tubes can be used at low or high radio frequencies, they really begin to shine as performers in the v.h.f. bands. Long life operation, small size, small heat losses and ease of building them into v.h.f. circuits are some of the advantages of nuvistor tubes. A 50 mc converter is shown in the photograph and the circuit in fig. 1. Ths particular series of converters were all built on 2 by 6 inch strips of copper clad bakelite for mounting in a 6 × 3 × 17 inch chassis as a bottom cover and shield.

The circuit of fig. 1 shows the use of preselection ahead of the r.f. amplifier followed by two tuned circuits ahead of the mixer tube. The circuits were designed for a *Q* of approximately 20 in order to pass somewhat more than the 50 to 52 mc band desired. If the full 50 to 54 mc band is desired. the *Q* should be reduced to about 12, which would mean less image interference rejection. In the wider band design, the total capacity would be 12 mmf instead of 20 for the single ended circuits for the same impedance of about 3300 ohms. More turns would be needed in the coils to tune to the 50 mc band when less capacity is used. At W6AJF location, a channel 2 TV station practically wipes out the high end of this 6 meter band, so the band width of about 2 mc was used in this converter.

The preselector system consists of two tuned circuits capacity coupled. The grid resistor-





Top and bottom views of the 50 mc Nuvistor converter. The circuit is shown in fig. 1. The 50 mc input is on the left and the 14-16 mc output on the right end.

*850 Donner Avenue, Sonoma, California.

[1]Cowan Publishing, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

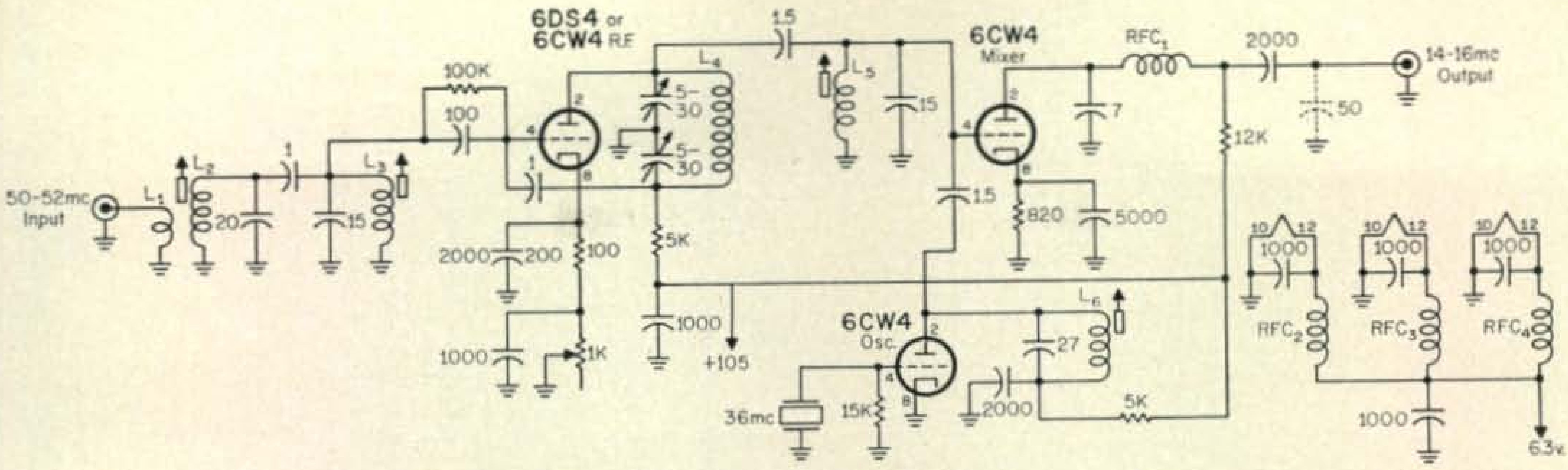
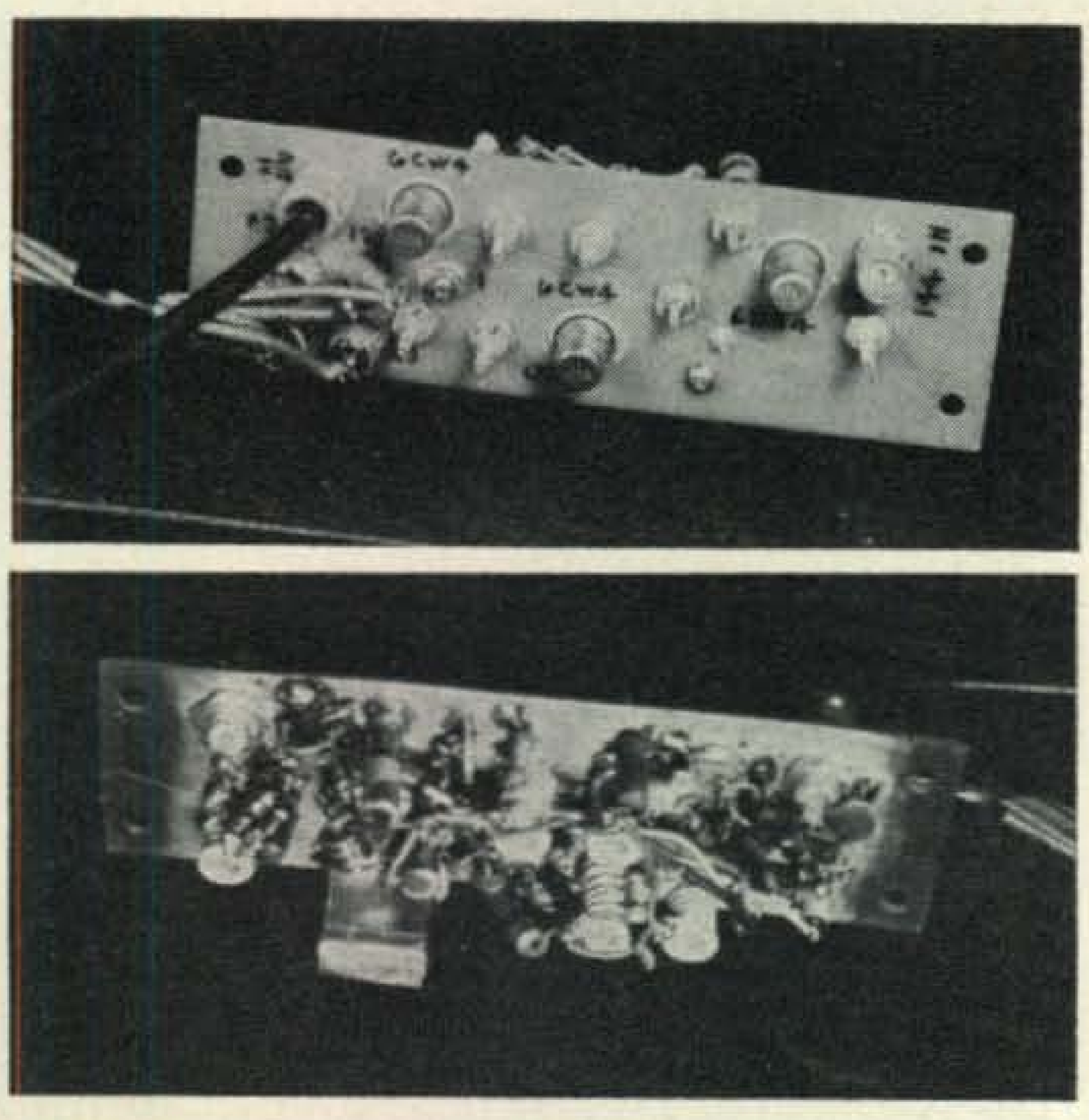


Fig. 1—Circuit of a 50 mc converter using Nuvistor tubes described in the text. All resistors are ½ watt and all capacitors are in mmf.

L_1—1 t #24 e. on cold end of L_2.
L_2, L_3—7 t #24 e. 3/16" long on 0.4" dia. brass slug tuned form.
L_4—18 t #20 d.c.c., ¾" long, ¼" dia., air core.
L_5—6 t #24 e., ⅛" long on 0.4" dia. brass slug tuned form.
L_6—8 t #24 e. 3/16" long on 0.4" dia. brass slug tuned form.
RFC_1—12 μh or 80 t., #32 e. ¾" long ¼" dia.
RFC_2, RFC_3, RFC_4—8 or 10 t small hookup wire, ½" long, ⅛" dia.

capacitor in the r.f. stage is solely for tube protection against fairly high power transmitter feedback in case of faulty antenna relay operation. Operation in the 50 mc band requires a low cross-talk front end design, so cathode bias is used with an external 1000 or 2000 ohm pot in the circuit for gain control.

The r.f. amplifier uses a split plate circuit with two separate variable capacitors for tuning the plate coil to 50 mc. Adjustment of these two capacitors one way or the other, permits wide band neutralization of this stage with a fixed one mmf ceramic capacitor. The 5K plate feed resistor also tends to produce some balance in the split circuit, so neutralization is easily accomplished and holds very well over a wide band of frequencies. The plate circuit can be either capacity coupled to the mixer grid circuit, or link coupled. The latter provides better circuit balance but less image interference rejection since the oscillator is on the low side (36 mc).



Top and bottom views of the 144 mc converter. The 144 mc input is on the right and the output, 14 to 18 mc, is taken out on the coax on the left.

The nuvistor mixer plate circuit has to operate at very low Q values so a single parallel tuned circuit is difficult to couple into the usual communication receiver. A pi section resonant circuit is much more effective in coupling the mixer plate impedance of several thousand ohms down to the usual 50 or 70 ohms for coax connection to the receiver. An inductance of about 12 microhenries with two capacitors forms a pi coupling circuit suitable for Q values of 2 to 5 (needed to pass 14 to 16 mc or even higher values). A 12 microhenry r.f. choke is suitable for this coil. The output capacity of 50 mmf, together with a couple of feet of coaxial line, reduces the output impedance to match the receiver input circuit. If a longer line of coax is needed, the 50 mmf capacitor should be omitted. A 1 to 10 mmf trimmer can be used to tune the output circuit to the middle of the i.f. band in place of the 7 mmf fixed capacitor.

The oscillator is a standard triode overtone type with a 36 mc crystal. All of the single ended coils were brass-slug tuned. However, some circuit loss can be reduced by using "white" coded ferrite slug tuned coil forms of appropriate number of turns to tune to a little above 50 mc with the values of capacitance shown in fig. 1.

144 Mc Converter

This converter shown in the photograph and in fig. 2 covers the 2 meter band of 144 to 148 mc. It was also built on a 2 × 6 inch piece of copper clad bakelite. An advantage of this type of construction is that a converter may be changed, rebuilt, or discarded without much cost or difficulty. The copper clad board provides an excellent grounding surface which can be easily soldered to with a small soldering iron. All r.f. ground leads can be made very short which generally means better stability, higher gain, and better sensitivity for weak signals.

The circuit of fig. 2 shows a total of four tuned circuits at 146 mc. This is about the mini-

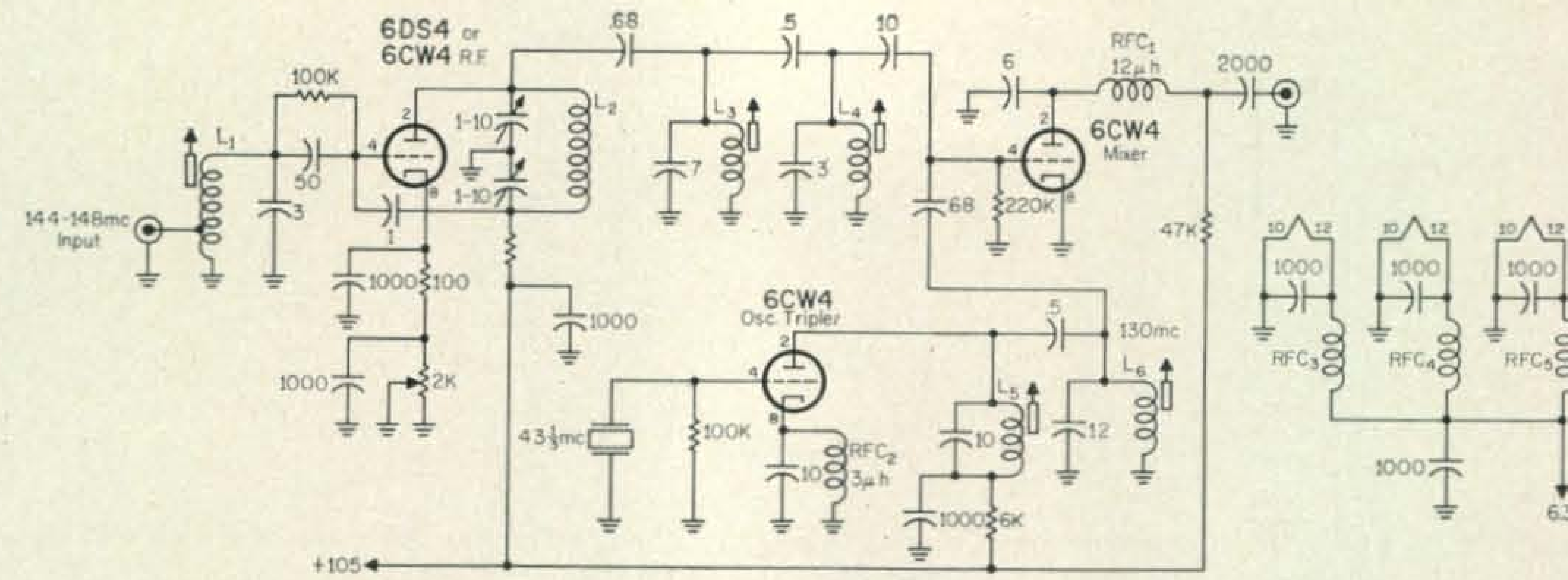


Fig. 2—Circuit of a 144 mc converter using Nuvistor tubes. All resistors are ½ watt and all capacitors are in mmf.

L_1—5 t #20 d.c.c. tapped 2 t up from ground, ⅜" long on ¼" dia. slug tuned form.
L_2—6 t #18 e., ¼" long, ¼" dia. air wound.
L_3, L_4—5 t #20 d.c.c. ⅜" long on ¼" dia. slug tuned form.
L_5, L_6—4 t #20 d.c.c., 5/16" long on ¼" dia. slug tuned form.
RFC_1—12 μh or 80 t #32 e., ¾" long, ¼" dia.
RFC_2—3 μh or 34 t #28 e., ½" long, ¼" dia.
RFC_3, RFC_4, RFC_5—8 to 10 t of small hookup wire, ½" long, ⅛" dia.

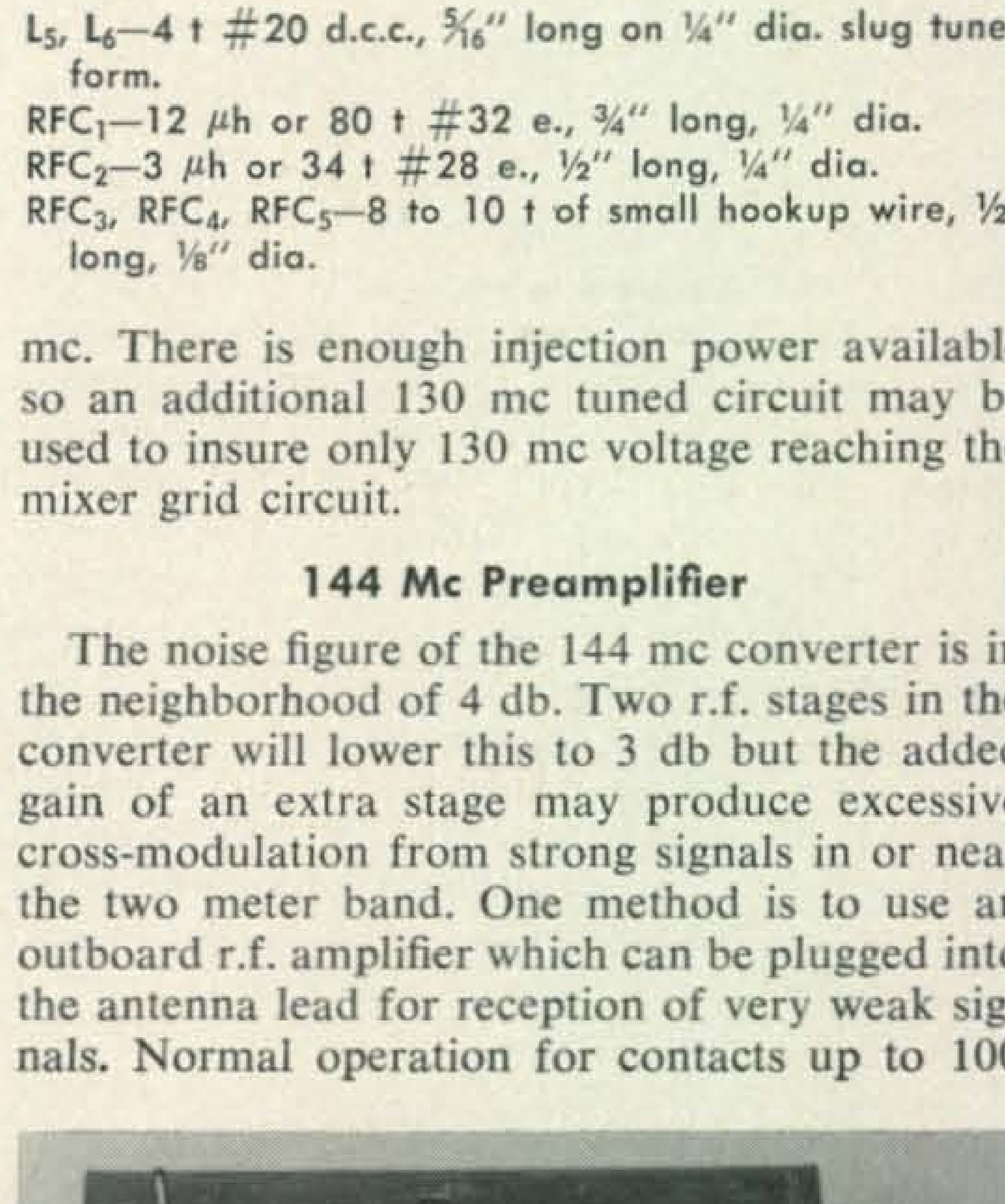
mum permissible in good two meter converter design. Less may produce excessive image interference problems in most locations. The circuit Q should average about 20. The two grid circuits, r.f. and mixer, will usually be much less due to grid loading and probably will not be over 15. The r.f. plate circuit and second tuned circuit in the three tuned portion, can be set up for values of up to 40 or 50 but "unloaded" coil Q values may limit these possibilities. The unloaded Q values should be several times that of the operating Q values in order to minimize tuned circuit losses. Within the limitations set by the passband of four megacycles, the operating Q should be as high as possible in order to provide good image rejection. The image frequencies are 14 to 18 mc below the oscillator injection frequency of 130 mc, or 112 to 116 mc.

The mixer uses grid leak detection as it is less critical for oscillator injection power than for cathode bias. Its disadvantage is that it is more subject to cross-modulation from strong signals in the two meter band. In some locations, cathode bias detection for mixer action is necessary and some experimenting is needed to get the proper injection voltage. The mixer plate circuit needs to cover from 14 to 18 mc, which means an operating Q of about 3. The pi-network shown in fig. 2 accomplishes this effectively and transforms the mixer output load from several thousand ohms down to 50 or 75 ohms. If less than about three feet of coax is used between the receiver and the converter, some capacitance must be placed across the output jack to make the desired step-down ratio of 6 or 7 to 1.

The oscillator injection of 130 mc is obtained by using a 43⅓ mc overtone crystal with a single nuvistor tube. The cathode has a low Q circuit resonant around 25 to 30 mc to insure oscillation at 43⅓ mc and not at the fundamental of around 14½ mc. The plate circuit can then be tuned to 130 mc, the third harmonic of 43½ mc. There is enough injection power available so an additional 130 mc tuned circuit may be used to insure only 130 mc voltage reaching the mixer grid circuit.

144 Mc Preamplifier

The noise figure of the 144 mc converter is in the neighborhood of 4 db. Two r.f. stages in the converter will lower this to 3 db but the added gain of an extra stage may produce excessive cross-modulation from strong signals in or near the two meter band. One method is to use an outboard r.f. amplifier which can be plugged into the antenna lead for reception of very weak signals. Normal operation for contacts up to 100



Top and bottom views of the 144 mc preamplifier.

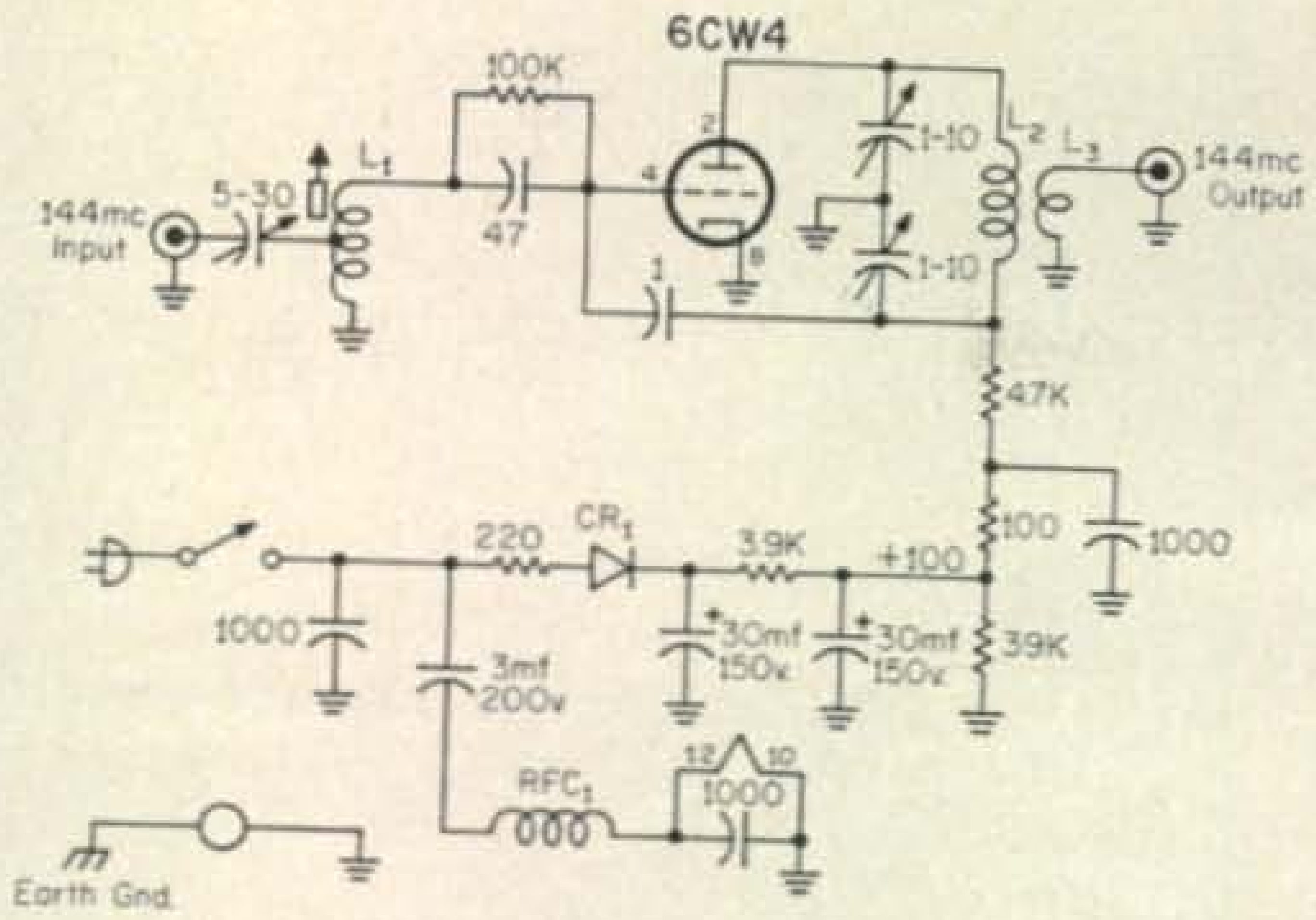
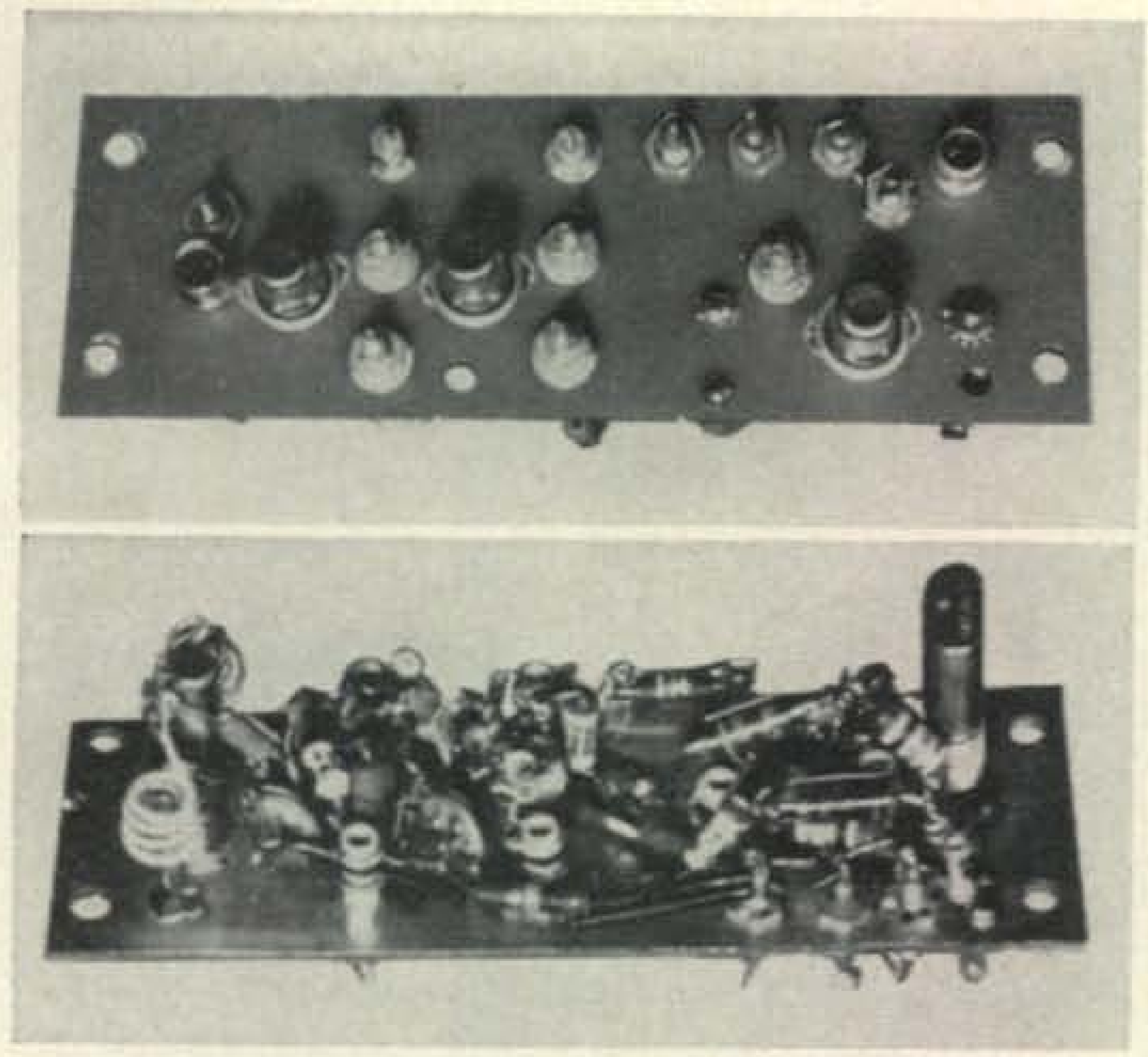


Fig. 3—Circuit of a 144 mc preamplifier. All resistors are ½ watt and all capacitors are in mmf unless otherwise noted.

CR$_1$—Silicon rectifier, 400 p.i.v. any current rating from 50 ma up.
L$_1$—5 t #18 e., center tapped, ½" long on a ¼" dia. slug tuned form.
L$_2$—9 t #18 e., ½" long, ¼" dia. air wound.
L$_3$—1 t #18 e., coupled to the center of L$_2$.
RFC$_1$—8 to 10 turns of small hookup wire ½" long, ⅛" dia.



Top and bottom views of the 220 mc converter. In the bottom view the multiplier crystal may be seen to the left of the 22.9 mc plug in unit.

miles or so from average locations can be done without the preamplifier.

The preamplifier shown in the photograph and in the circuit of fig. 3 was built with its own power supply in order to see if it would be as good as the 416B preamplifier described in the previously mentioned handbook. The noise figure measured within a few tenths of a db. Since tube life of a nuvistor is apt to be much greater than for a 416B, the latter now is in storage at W6AJF.

The input circuit is tuned for best noise figure at 144 mc by adjusting the slug coil and series antenna capacitor. A noise generator is needed for this purpose since these adjustments usually are not the same as for maximum r.f. gain. The plate circuit is tuned to 144 mc by means of the two variable capacitors with one set at a different value than the other in order to get neutralization. These adjustments can be juggled back and forth until the amplifier does not oscillate and best noise figure is obtained. Grid leak bias was used in order to get best noise figure but this makes the tube subject to cross modulation from local two meter stations. In some locations, cathode bias on the 6CW4 tube would be necessary with probably not over 0.1 or 0.2 db nf deterioration.

The built-in power supply is about as simple as possible. The heater voltage is dropped to about 6 volts by means of a 3 mf paper capacitor in the 115 v.a.c. line. This method causes quite a time lag in the tube reaching normal operation after the a.c. switch is turned on as compared to

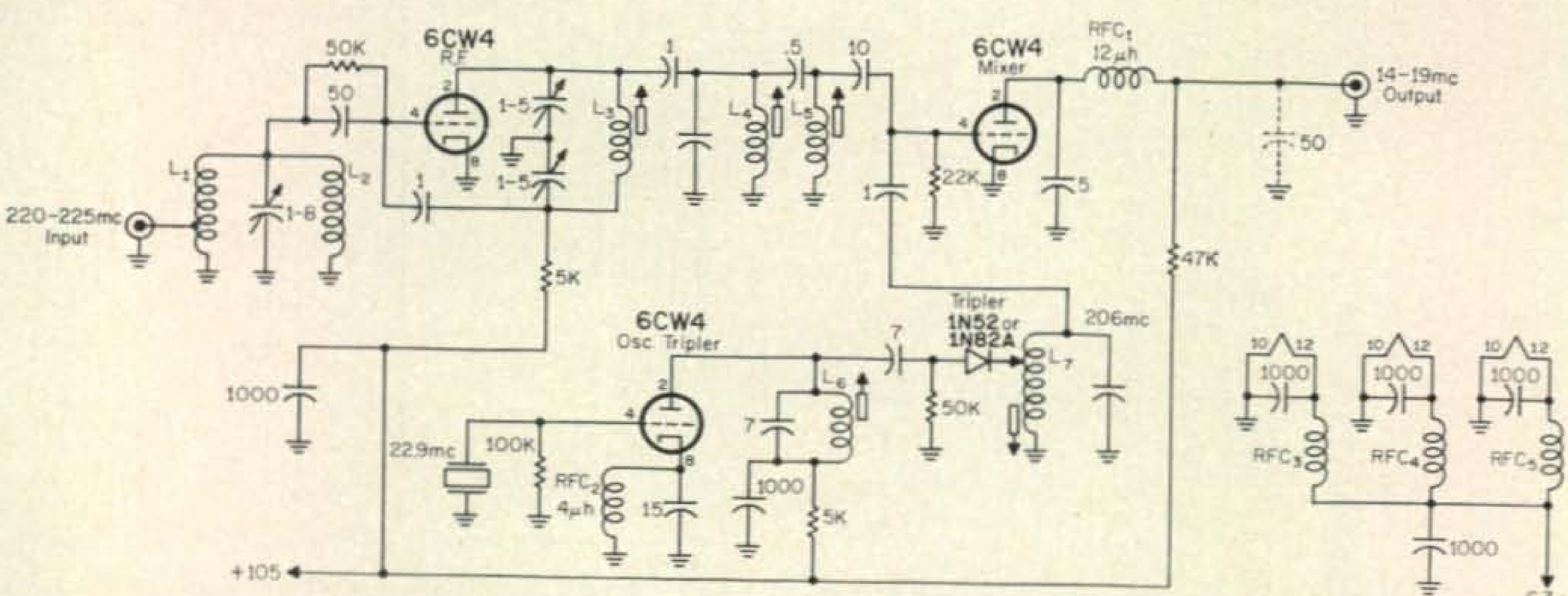


Fig. 4—Circuit of a 220 mc Nuvistor converter with an i.f. output from 14 to 19 mc. All resistors are ½ watt and all capacitors are in mmf.

L$_1$—4 t #20 d.c.c. tapped 1 t up from ground, ¼" long, ⅜" dia., air wound.
L$_2$—4 t #20 d.c.c. ¼" long, ⅜" dia., air wound.
L$_3$—7 t #20 d.c.c. ½" long, ¼" dia., air wound.
L$_4$, L$_5$—4 t #22 e., ¼" long wound on $^3/_{16}$" dia. slug tuned form.
L$_6$—12 t #24 e. ¼" long, on $^3/_{16}$" dia. slug tuned form.
L$_7$—4 t #24 e. ¼" long wound on $^3/_{16}$" dia. slug tuned form. Diode tap point chosen for max. output. See text.
RFC$_1$—12 μh, 80 t #32 e. ¾" long, ¼" dia.
RFC$_2$—4 μh, 40 t #30 e. ½" long, ¼" dia.
RFC$_3$, RFC$_4$, RFC$_5$—8 to 10 t of small hookup wire, ½" long, ⅛" dia.

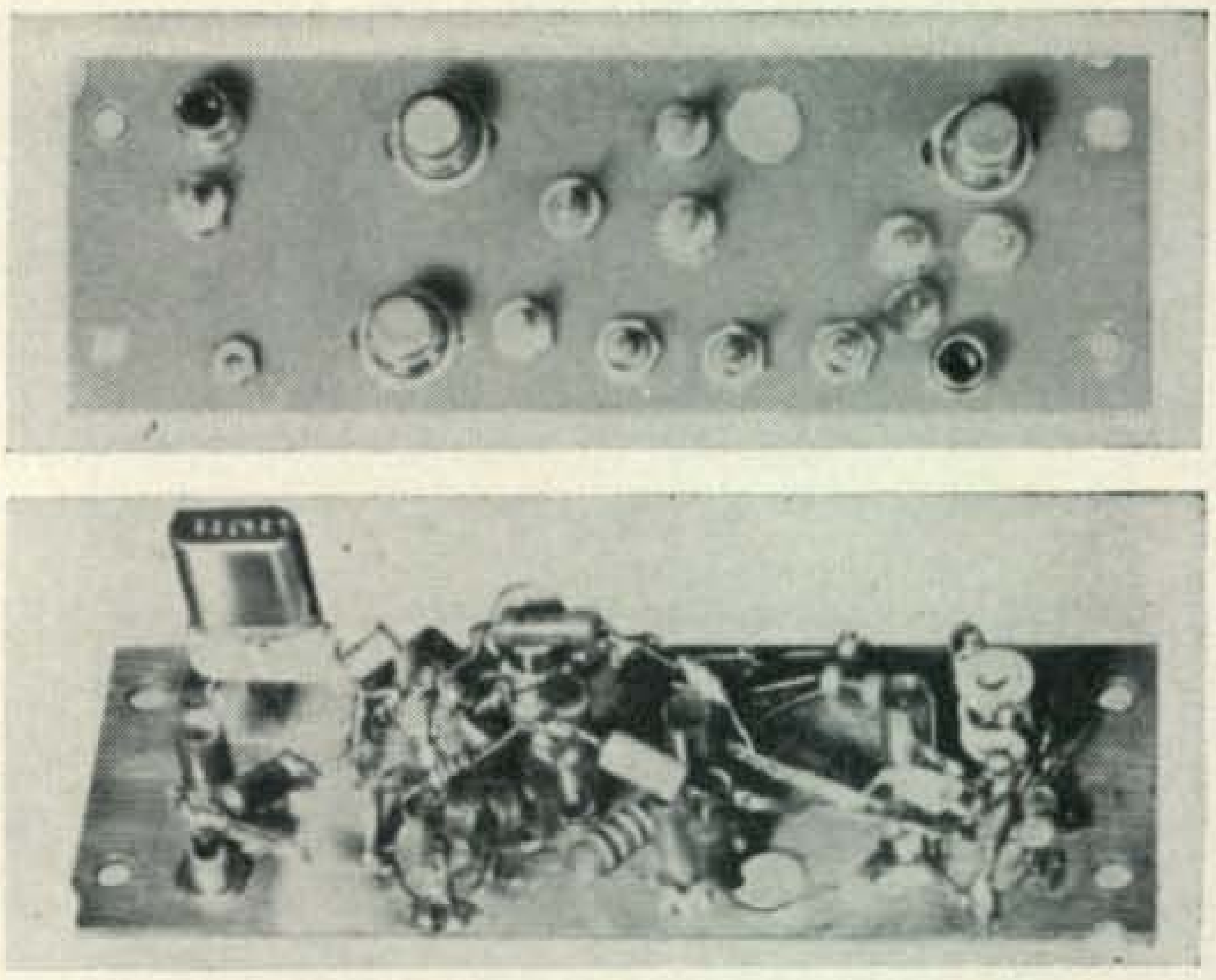
the use of a filament transformer. The 3 mf capacitor takes less space and has no heat loss. The preamplifier only uses about 7 ma of plate current at 100 to 125 volts, so both heater and plate supply may be taken from a receiver, or converter power supply.

220 Mc Converter

This converter, shown in one photograph and the circuit diagram of fig. 4, was built for average signal reception in the 220 to 225 mc region with an i.f. output of 14 to 19 mc. For very weak signal reception, a 222 mc paramp is used at W6AJF ahead of this and other 220 mc converters.

The single tuned double coil circuit in the r.f. stage grid circuit was used to more effectively ground out an i.f. signal. It seemed to be getting through the converter for a period of time during on the air tests. The improvement was not very great and wasn't entirely fixed without the use of a preamplifier, until the commercial station seemed to go out of operation (probably a temporary cure).

The circuit of fig. 4 is quite similar to that of the 144 mc converter except for coil and capacitor values. A 68⅔ mc crystal was not available so a surplus 22.9 mc one was used. A 68⅔ mc crystal could be used with a cathode circuit in the oscillator tube similar to that used in the 144 mc converter, with the plate circuit tuned to 206 mc. The use of a 22.9 mc crystal meant that an additional frequency tripler was needed. A type 1N52 or preferably a 1N82A diode can be used to triple the frequency to the desired value of 206 mc as shown in fig. 4. Some diodes will give more output when tapped across only part of the 206 mc tuned circuit. The value of grid leak and the coupling capacitor to the diode tripler can also be modified to advantage with some types of diodes.



Top and bottom views of the 432 mc converter. The bottom view shows the input pi-network on the left and the output tank L_5 on the extreme right.

The noise figure runs at about 5 db as measured here. The image rejection is only fair due to the higher signal frequency as compared to the i.f. value. The paramp solves that problem very well but can only be used over a small part of the 220 mc band. Two or even three grounded grid 6CW4 or 6DS4 nuvistor stages with several more tuned circuits would be a more practical method of getting good sensitivity, better image rejection, and complete coverage from 220 to 225 mc.

[*Continued on page 100*]

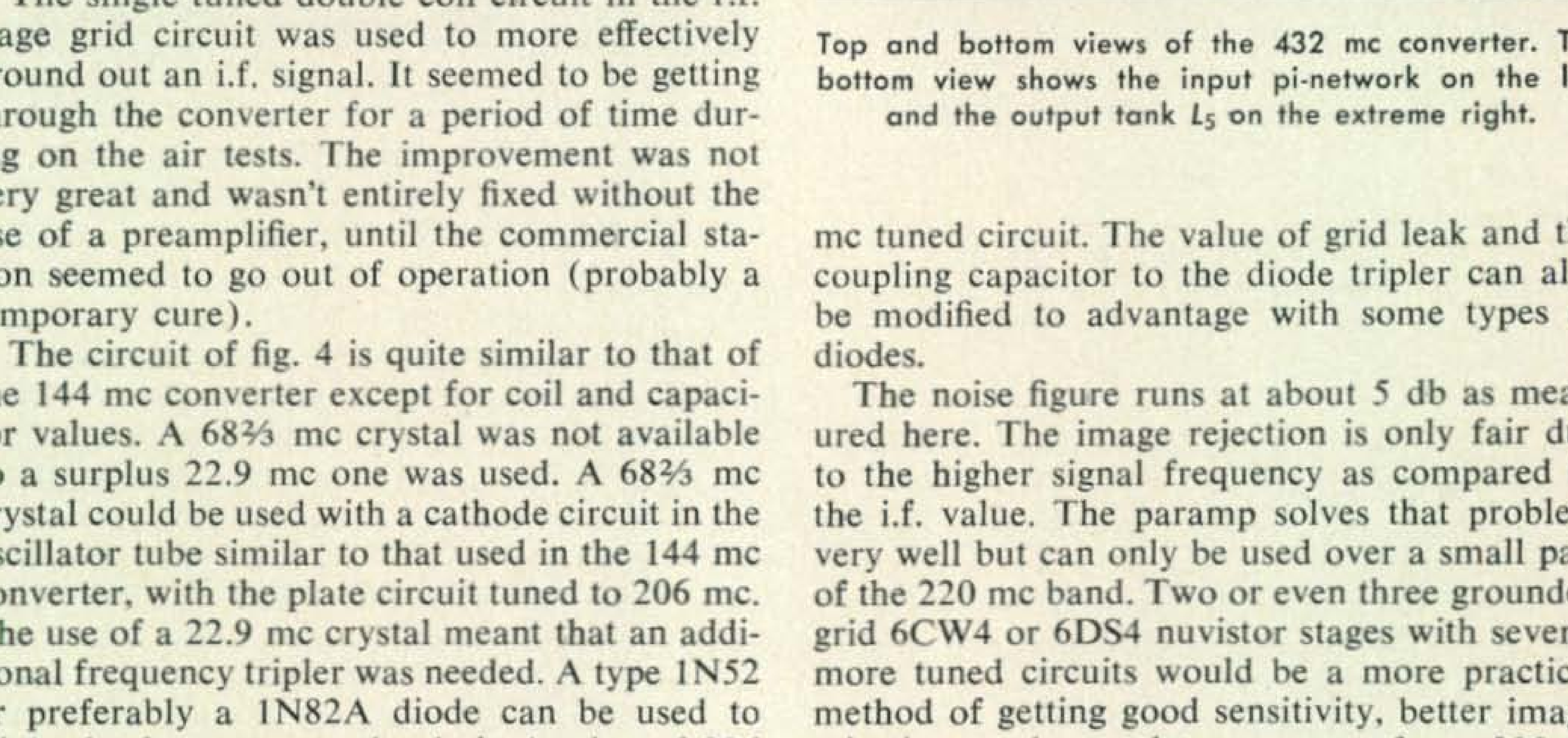
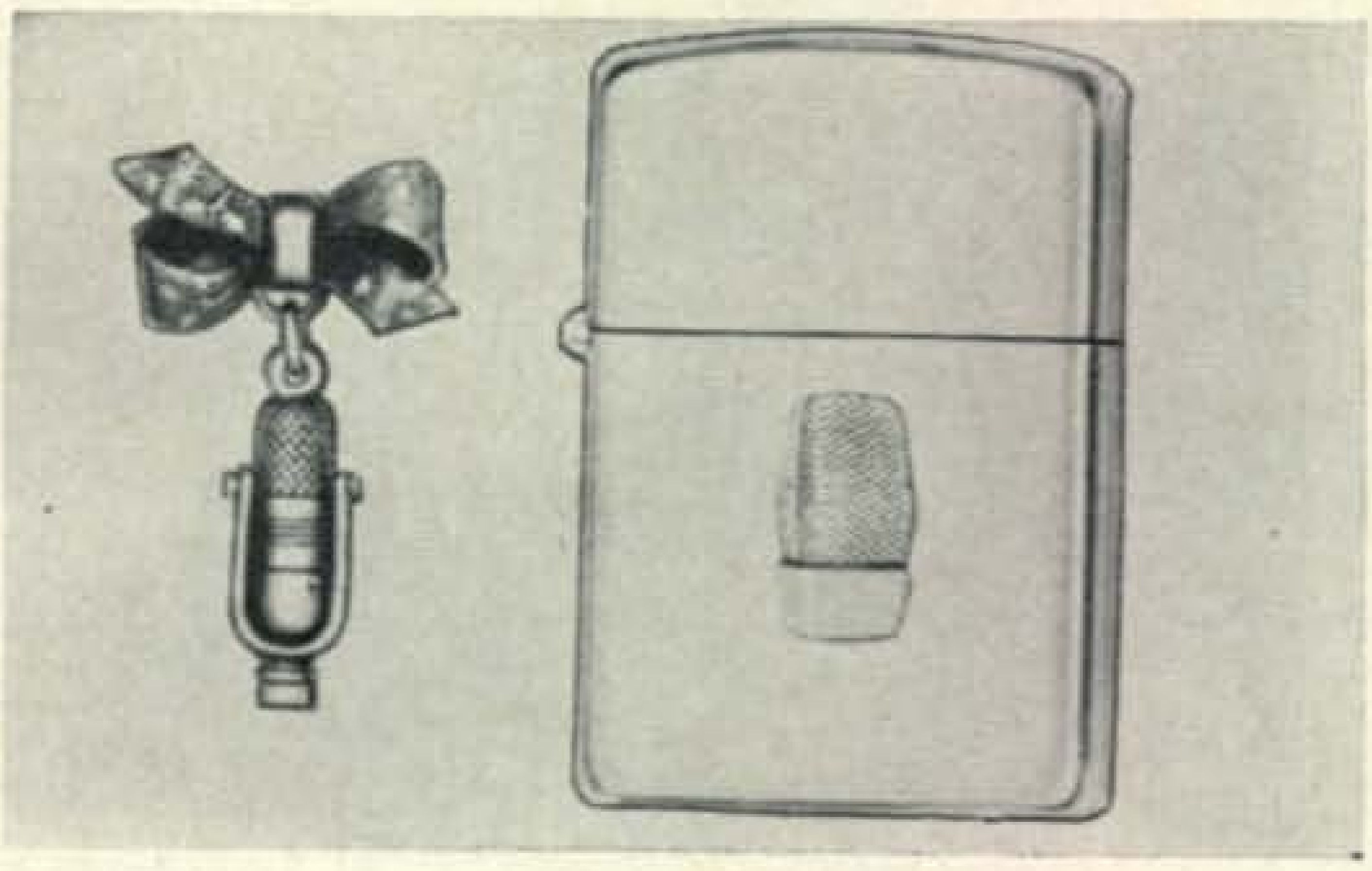


Fig. 5—Circuit of a 432 mc converter. The output with the link coupled circuit shown above is at 14 mc with a 1 mc passband. For wider coverage the pi-network similar to that shown in fig. 2 or fig. 4 should be used. All resistors are ½ watt and all capacitors are in mmf.

L_1—⅛" wide copper strap, 1¼" long.
L_2—3 t ⅛" wide copper strap ¾" long, ⅜" dia.
L_3, L_4—⅛" wide copper strap, 1½" long, spaced ½" to ¼" apart.
L_5—25 t #28 e. ⅜" long wound on ¼" dia. slug tuned form.
L_6—4 t hookup wire link on cold end of L_5.
L_7—6 t #22 e. ¼" long, wound on ¼" dia. slug tuned form.
RFC_1—8 t # 20 or 22 e. ⅜" long, ⅛" dia.
RFC_2—3 µh, 34 t #28 e. ½" long, ¼" dia.
RFC_3, RFC_4, RFC_5—8 to 10 t. small hookup wire, ½" long, ⅛" dia.

New Amateur Products

Nordlund Radio Products



NORDLUND presents for the XYL or YL an attractive bow pin with microphone charm. It is available in either gold or rhodium finish. For the OM, a brushed-chrome finish windproof lighter with a gold-plated microphone emblem. Price for the bow-pin—$2.00, lighter—$3.00. For more information write to Nordlund Radio Products, 7635 West Irving Park, Chicago, Illinois, 60634, or circle 66 on page 110.

Terado Corporation

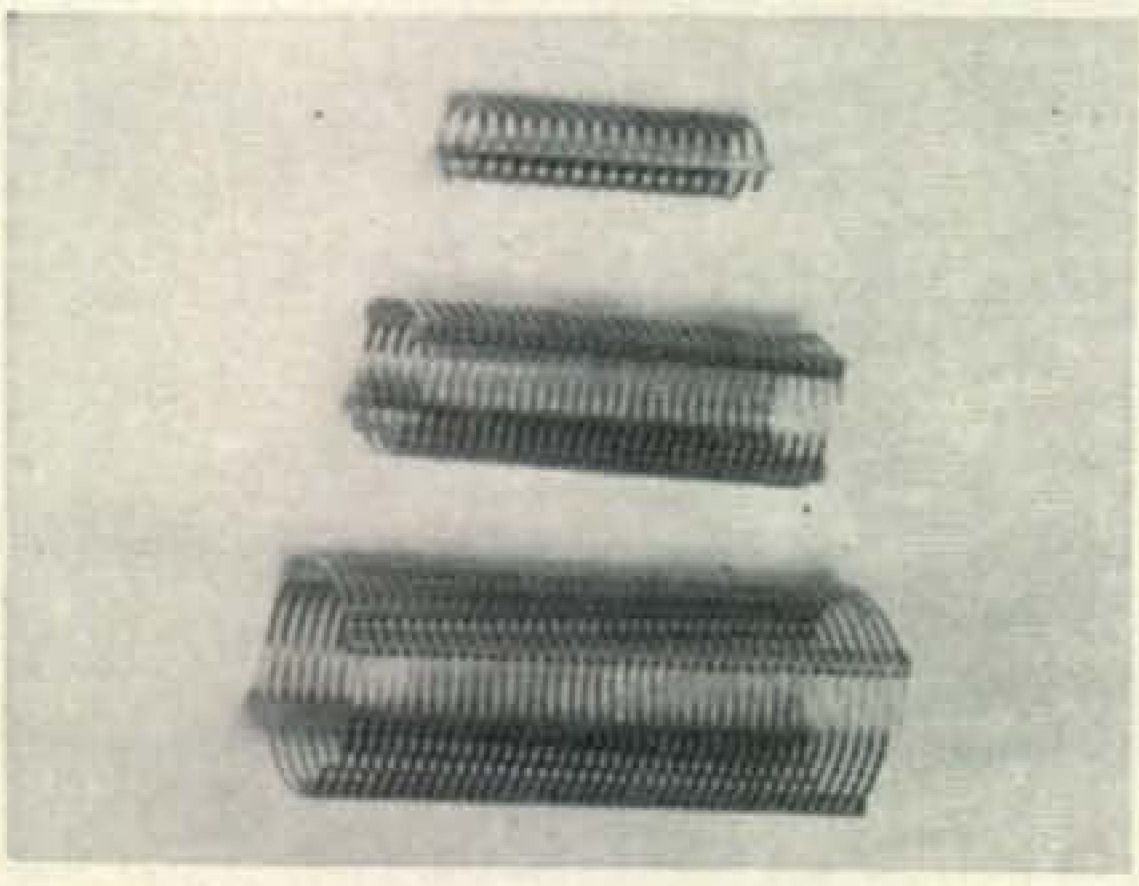
THE Terado Corporation of St. Paul, Minn., announces a new battery charger designed for a 12 volt storage battery, the Taperite Model #50-192. This charger turns on and turns off automatically. The average battery can be charged in 6 to 10 hour periods in the high switch position. In the low switch position, the charge rate starts high then tapers to almost zero so may be left on indefinitely. For more information and literature write Terado Corporation, St. Paul, Minnesota 55108, or circle 67 on page 110.

HTH Code Oscillator

HTH Electronics is introducing a battery powered, all transistorized combination c.w. monitor and code practice oscillator priced at $9.95.

It features built in speaker, on-off switch, earphone jack, tone and volume controls. Requires no r.f. pickup line or modification to present equipment.

For more details write to Electronic House, P.O. Box 873, Tarzana, California, or circle 68 on page 110.



Polycoils

A new series of air-wound inductors is being introduced by the Polyphase Instrument Company. With 55 different types ranging from ½″ to 3″ diameters and 2″ to 10″ in length, the coils fit most amateur needs. Their sales bulletin CP-1001 lists all available types and specifications including a cross reference to other manufacturers coils. For further information and a copy of sales bulletin CP-1001 write to Polyphase Instrument Company, East Fourth Street, Bridgeport, Montgomery County, Pa. or circle 69 on page 110.

THE QSL PRINTER

BY ALEX. F. BURR,* K3NKX

ONE of the first expenditures that a new amateur makes is the check he sends off to a QSL printer almost as soon as he reads his call letters on his new license. By the time he has been on the air for several years and changed addresses a few times, several other checks have followed the first one, yet the QSL printer usually remains just a box number to the average ham.

Recently I was able to visit several QSL print shops and found them almost as varied as the cards they put out. Some are elaborate plants employing many people doing all kinds of printing jobs, but most are small one man shops operating out of a basement or a rented garage with little help other than the family.

One such shop is run by Isaac Luttrell under the name of Bluebird Press (Baltimore, Md.). Isaac runs a small shop which depends on QSL orders for almost 50% of its business. He has the help of his wife and three young daughters although he says that his children are better at breaking type down than setting it up.

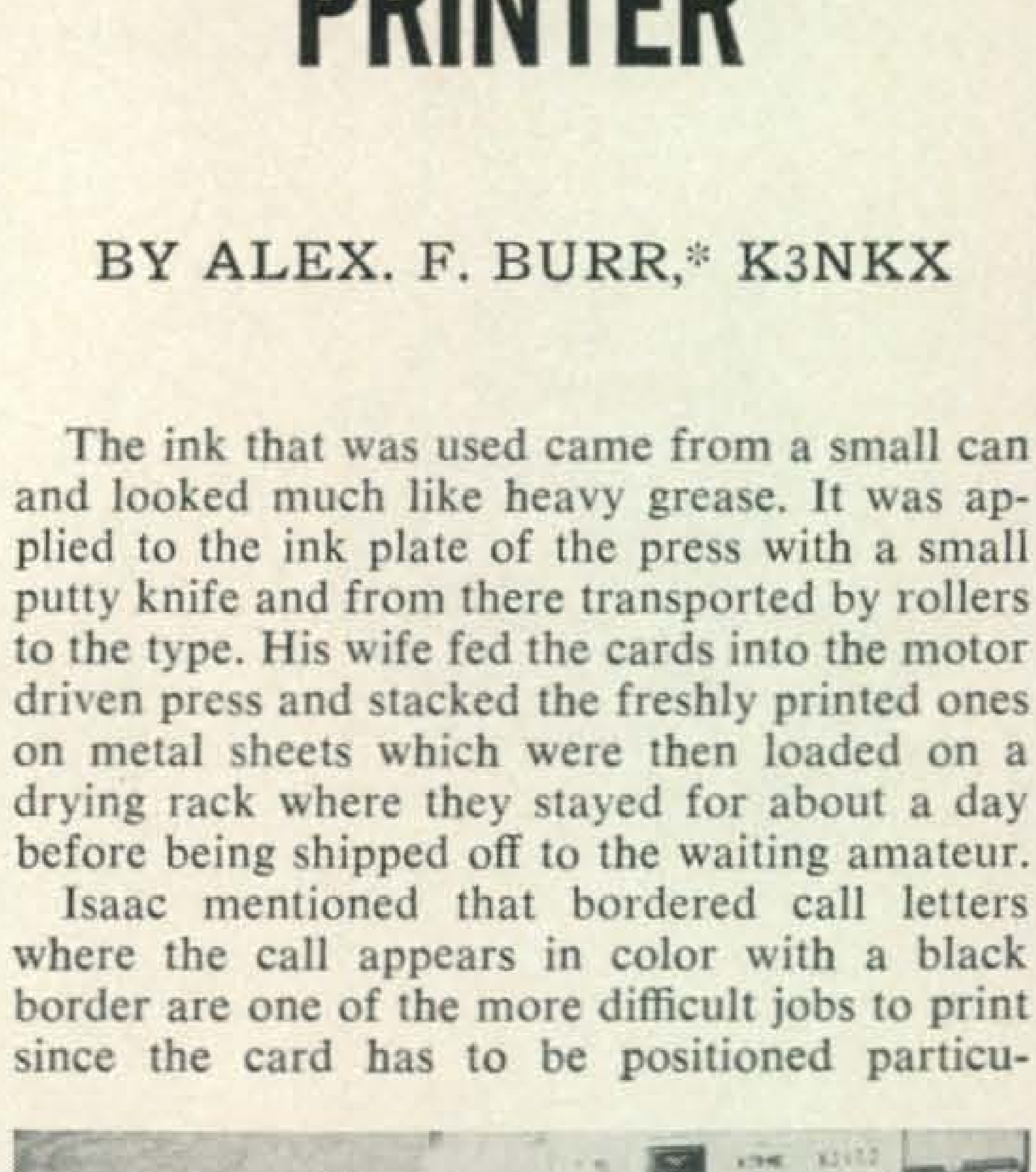
He receives orders from many states on both coasts and in between but was working on an order for 500 cards from a W4 when I visited his shop in a small building out toward the edge of town. The cards that he was working on had already been through the press twice and were going through a third time to receive the report form on the back.

He carefully adjusted the card holder on his old letterpress and ran off a few trial impressions to be sure that everything was centered. The run was delayed when it was discovered that there was an almost imperceptible defect in the letter *s* on the word meters. The block of report form type was taken off the press and a line of type with a perfect *s* was substituted for the damaged one and then everything was set up again.

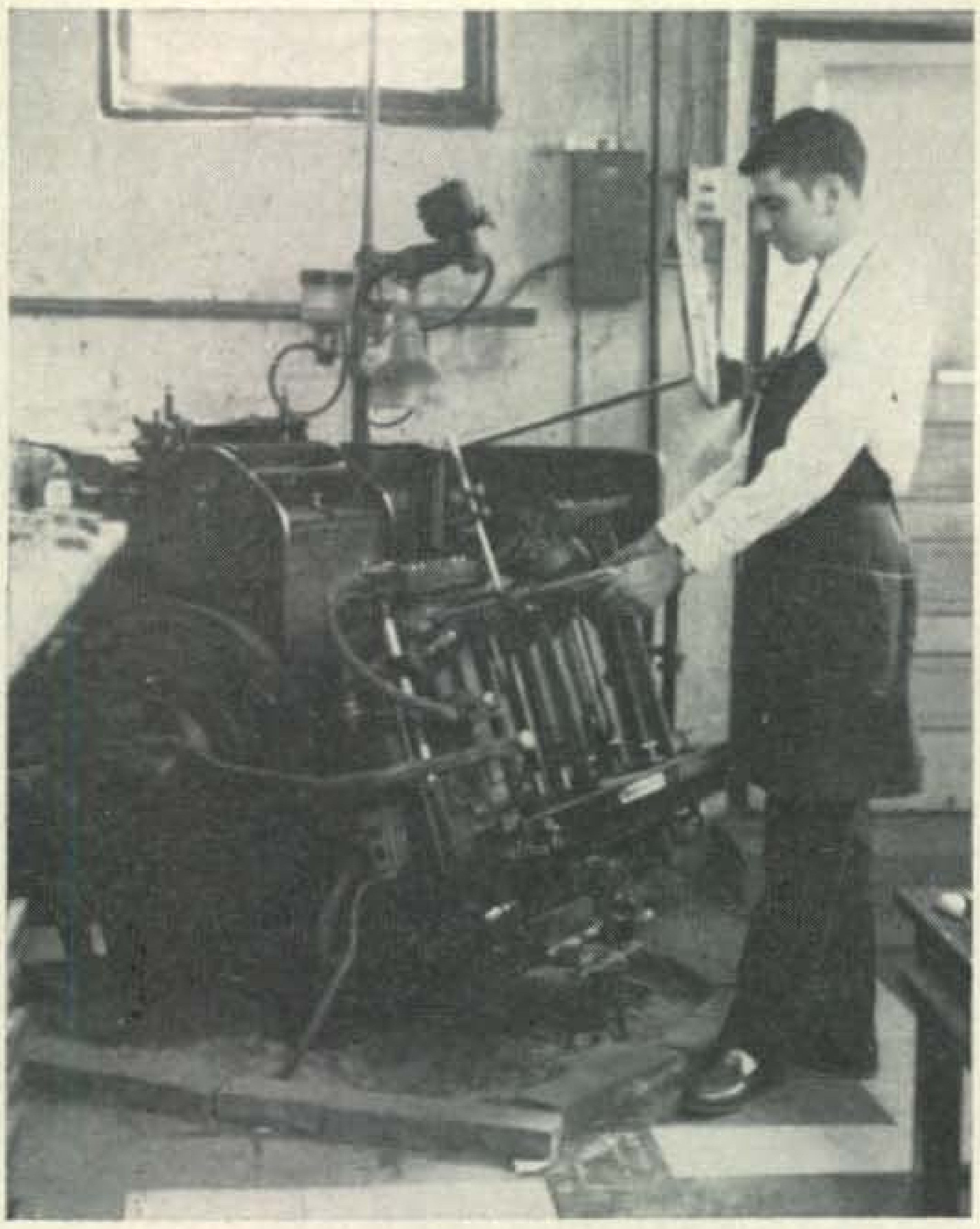
*Apt. 102, 5533 Oxon Hill Rd., Oxon Hill, Md. 20021.

The ink that was used came from a small can and looked much like heavy grease. It was applied to the ink plate of the press with a small putty knife and from there transported by rollers to the type. His wife fed the cards into the motor driven press and stacked the freshly printed ones on metal sheets which were then loaded on a drying rack where they stayed for about a day before being shipped off to the waiting amateur.

Isaac mentioned that bordered call letters where the call appears in color with a black border are one of the more difficult jobs to print since the card has to be positioned particu-



Iscac Luttrell puts together the type for a QSL card. Above his work area is a board displaying some of his designs. The rack of little wooden blocks on the right contains spacers to fill out the QSL frame.



James Constantine makes some adjustments on his father's high speed letterpress.

larly carefully so that the two impressions register properly without any of the card showing through. Another difficult job was to get a good gold ink. He mixed his own from gold ink powder and a special varnish to get just the right shade.

Another family operation that I visited was run by Fred Constantine, his wife, and son James as the Constantine Printing Service (Bladensburg, Md.). Fred is a real old time ham having held the call 4AFO. There was no mistaking his interest in radio when I entered his shop in a small building behind the house and heard call signs and 73's coming from the Hammurlund with which he monitored the bands.

He has been in the QSL printing business for 14 years and has built up quite an interesting stock of cards. For hams in a hurry he has a wide selection of backgrounds already printed up over which he can place your call in a short time. He said that he usually keeps a stock of more than 50,000 cards with different backgrounds printed on them.

In common with most other printers he will custom design a card to your sketch. Fred gives the sketch to a commercial artist who produces a finished drawing and then he makes a cut from that drawing. The finished design is then run off on one of Fred's high speed presses which cost up to $5,000 when new.

Fred has found that over the years even the QSL business can come up with some strange happenings. One of the strangest is a mystery order that he received some time back. The order form came back, with the money enclosed, but the writer had forgotten to fill in the space with his name and address and had even forgotten to give his call letters. Of course he may have been a bootleger but Fred at least expected him to inquire about his money.

Perhaps the most frustrating experience came after he had shipped an order off to a southwest air force base. The base had requested that a requisition form be filled out (in triplicate, of course) so that he could get paid from a special service fund. Sometime later it developed that he had been given the wrong forms, so in the mail he got another set with a request to fill them out (in triplicate too, naturally). Well all this form filling was eating up what profit he had made so he wrote back a short note offering to donate the cards. By return mail he got a special delivery letter saying that the U.S. government couldn't accept the donation and would he please fill out the enclosed stack of forms and sign them. I guess he did eventually get his money.

I think the thing that impressed me most during these visits to QSL print shops was that the people enjoyed their work. They were turning out a good product in a highly competitive field and they all were trying to give the amateur the best job for his money. ■

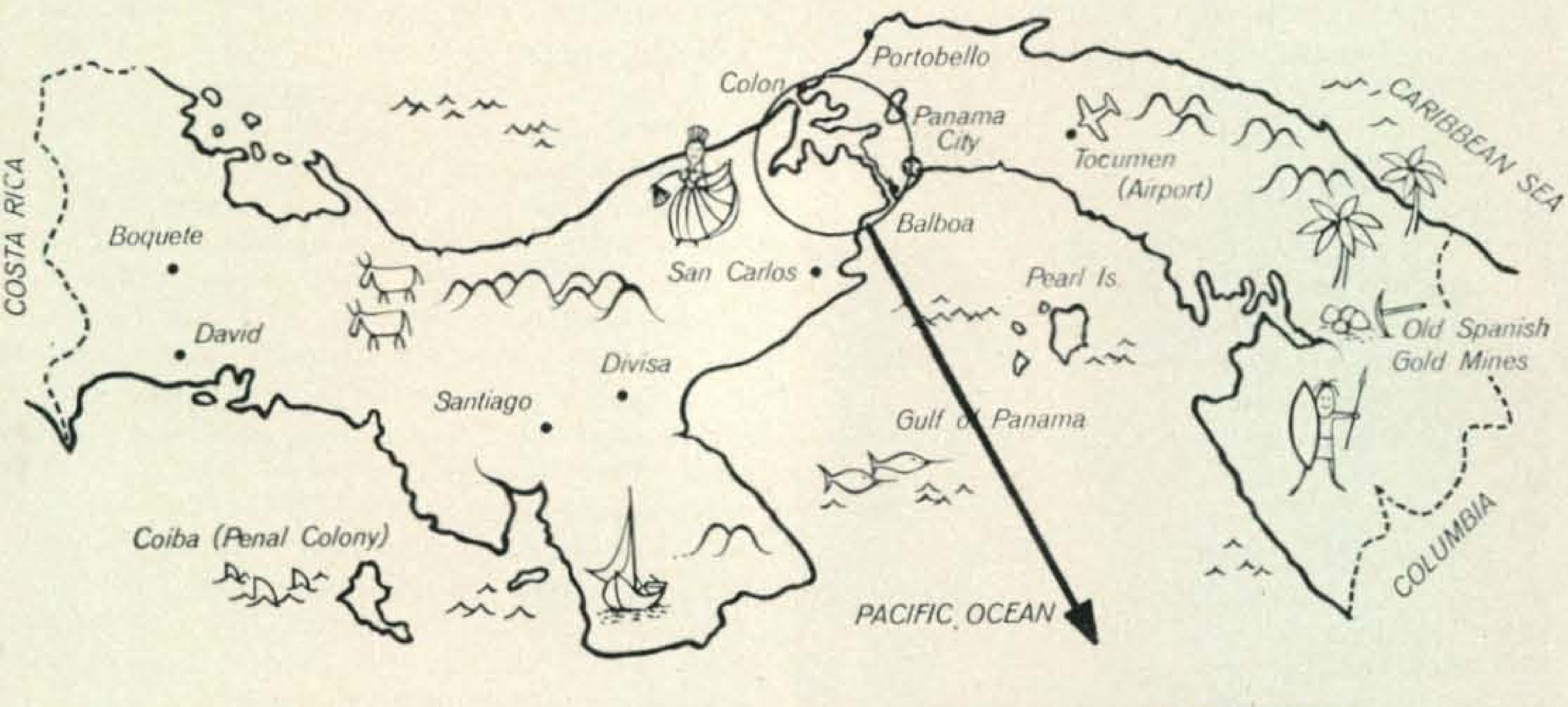
New Amateur Product

Caig Laboratories

Caig Laboratories announces the availability of Cramolin Spray Plastik, an air drying, colorless plastic spray coating. Cramolin Plastik seals, insulates, protects and coats. It prevents and reduces arcing and jumping on high voltage transformers, prevents creeping currents on fine circuits in coils and transformers, insulates cables and wires, protects parts and antennas from moisture, atmospheric influences and waste gases.

For further information contact Otto Lohkemper, Caig Laboratories, 46 Stanwood Road, New Hyde Park, L.I., N.Y., or circle 71 on page 110.

SWEEPSTAKES EXPEDITION



TO THE CANAL ZONE

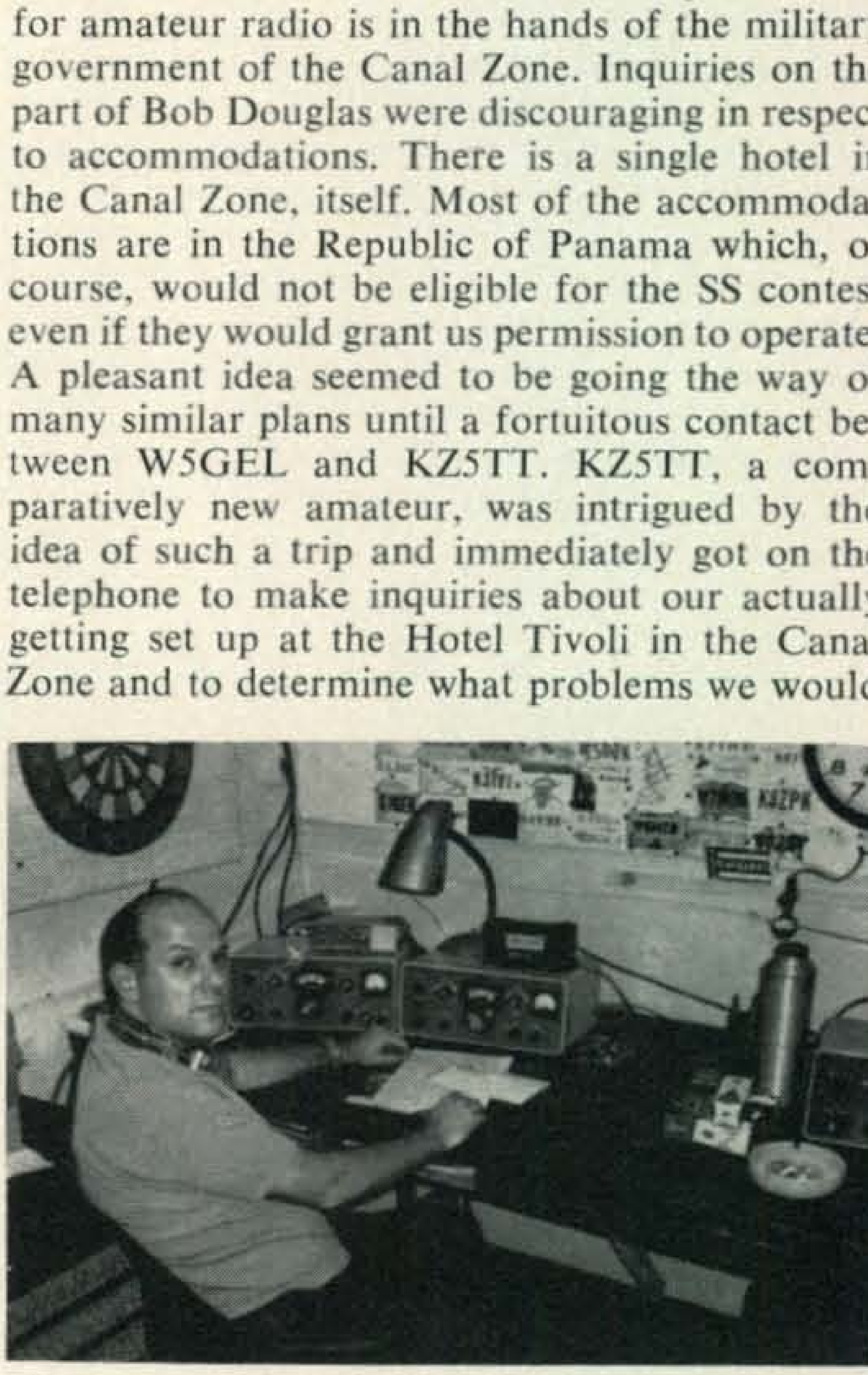
BY LARRY LEKASHMAN,* W9IOP

TWENTY-FIVE hundred miles from South Bend, Indiana, a tiny American escapement, surrounded by a less than enthusiastic native population, is about as unlikely a spot for an A.R.R.L. sweepstake section as one can imagine, especially if you make a trip specifically to get on the air from it. What at least some Panamanians lack in hospitality and goodwill, is more than made up by those hams I met during my brief trip to Panama. This story is about a rare experience which, perhaps, can be shared to some extent with the many hams who would like to make such a trip but have not.

An amateur does not necessarily have to be interested in the sweepstakes contest to find this chronicle of ham radio in Central America interesting, but it was the sweepstakes contest, itself, with its significant multiplier for the amateur who works all sections that resulted in this trip. Bob Douglas, W5GEL, and myself both have been keenly interested in the SS contest for many years. During the industry trade show in May of 1964, Bob and I talked about the interesting possibilities of making a trip to Canal Zone to operate in the sweepstakes contest. We visualized such an expedition, if expedition is the proper description, as combining much of the lure of a DX trip with the interesting advantage of being much sought after by sweepstakes contestants. Airplane service to the Canal Zone or the adjacent country of Panama is good, and, most important, we did not visualize any difficulty in getting permission to operate from American controlled territory.

*V.P. Sales, Electro-Voice, Buchanan, Michigan, 49107.

Subsequent to our meeting in Chicago, I contacted the FCC and was advised that jurisdiction for amateur radio is in the hands of the military government of the Canal Zone. Inquiries on the part of Bob Douglas were discouraging in respect to accommodations. There is a single hotel in the Canal Zone, itself. Most of the accommodations are in the Republic of Panama which, of course, would not be eligible for the SS contest even if they would grant us permission to operate. A pleasant idea seemed to be going the way of many similar plans until a fortuitous contact between W5GEL and KZ5TT. KZ5TT, a comparatively new amateur, was intrigued by the idea of such a trip and immediately got on the telephone to make inquiries about our actually getting set up at the Hotel Tivoli in the Canal Zone and to determine what problems we would



Larry, W9IOP/KZ5OP, at the operating position in the Canal Zone.

have with license requirements. Just prior to this contact, I had written to the Commanding General of the Canal Zone and received a pleasant reply, sending a number of applications to be filled out in great detail which included some unanswerable questions such as the name of our "sponsor" entering into the Canal Zone.

In his helpful zeal, KZ5TT was aided and abetted by KZ5LT, who happens to be the administrative assistant to the chief communications officer in the Canal Zone, responsible for the issuance of amateur licenses as one of the less important of their innumerable duties. In a matter of a few minutes, the procedure for obtaining the licenses was detailed quite simply and the hospitality of KZ5TT's residence was offered to us as well as his sponsorship for entering the Canal Zone. The influence of KZ5LT in this particular whirlwind resolution of our problems must be underscored in view of the fact she is Mrs. KZ5TT.

A flurry of correspondence and telephone dispatches back and forth underscored our good fortune in meeting KZ5TT and KZ5LT. They already had set up a handsome radio station in a large room which they added to their residence, fully air-conditioned, and with a Hy-Gain TH14 tri-bander already set up. We made reservations at one of the better hotels in Panama City, but neither Ben or Lil would consider this and a bedroom was turned over to us in their residence. I do not mean to suggest that all trips contemplated by intrepid ham adventurers would end up with this kind of good fortune, but it is an example of some of the remarkable camaraderie in ham radio.

Now with a sponsorer to get into the Canal Zone and with all of the paperwork quickly dispatched to get our Canal Zone licenses, which incidentally are readily available to any American citizen holding a valid FCC license, the mechanics of the trip, itself, had to be planned. One interesting sidelight—Lillian Smith sent us the Canal Zone *Callbook* and we were able to choose any unassigned Canal Zone call that particularly stirred our fancy. I choose KZ5OP; Bob selected KZ5GE.

The hours of darkness had not been reported

This is probably the first photo of what a "brass pounder" really does. Bob Douglas is shown pounding some brass in a local Panama City bazaar.

as particularly productive in the Canal Zone for stateside contacts, and we felt this was an essential ingredient if we were going to utilize at least the majority of the 24 hours available for the contest. As a consequence, we obtained from Sid Kittrel, KØDOM, of Hy-Gain Antenna (a kindred soul when it comes to this type of trip), one of their new 7 mc, 2-element beams. (Model 402B) In addition, it was felt that we should put up a dipole for 3.5 mc, and for this application, one of the new Hy-Gain BN48 broadband baluns plus two Model C1 doublet end insulators were installed. The antennas were shipped by air freight to arrive comfortably before Bob and myself.

R.f. equipment was selected on the basis of our familiarity with Collins equipment and the outstanding reputation it had earned for DX expeditions. Indeed, Gus Browning, W4BPD's fabulous trip in which his Collins equipment survived insurmountable abuse, was the deciding factor. The Smiths already had in their shack the complete Collins S-line, but since this was a domestically planned trip, we decided it was best to take our own equipment. A Collins 32S-3 and a Collins 75S-3B with accompanying power supply was thoroughly checked and packed for the not-so-hazardous trip along with a generous supply of hard pencils, a spare headset, and a pair of electronic keys as insurance against possible failure in the contest. In addition, as an afterthought, at the last moment, I took along a tape recorder to let some of our good friends from up north hear what their c.w. signals sounded like on a comparative basis, many thousand of miles away.

Up to this point, the trip was relatively uneventful. Indeed, it was almost ominous in the ease that everything was falling together. I was called out of town for several days on an urgant business matter in Chicago, and, in my absence, Fred Nichols (W8GGT/K9ZHR), one of my associates, made certain that the equipment on my list was packed and ready for a hasty departure. Bob, basking in the perpetual sunshine of Corpus Christi, Texas, left to rendezvous with me in Miami to catch our flight to Panama City. I left in the first snowstorm of the season only to be delayed due to the weather while United Airlines held the flight to the point where I missed the last possible connection to put me in Miami on the day prior to the contest. United sent a telegram to W5GEL awaiting me at Pan Am. I telephoned and left messages for him, but all of these modern communications devices failed. On a hunch that he might not get the word, I called Panama just prior to the departure of the flight and reported on my plight and that I would try to get the same set of connections the next day which would get me into the Canal Zone about dawn the day that the contest began. This was bad from the standpoint of my inability to help them with antenna work and equally important a total lack of rest prior to the contest.

Ultimately, the weather did break, the flight did leave, and I arrived in Panama at 5:30 in the morning to be greeted by Bob Nelson, KZ5BO, and Ben Smith, KZ5TT. Lil Smith had come out to meet the flight at its scheduled 1:30 A.M. arrival based on poor information on our previous schedule. Since the Tocumen airport is some forty miles from the Canal Zone, this is no small inconvenience. The customs people were most cooperative, and despite my substantial quantity of cartons and boxes, it was a mere formality, and I was on my way in a matter of moments.

A brief note about the people. The Canal Zone is, of course, under American authority, directly controlled by the military government. With the exception of a single residence in the zone, there is no privately owned property. Everyone directly or indirectly is employed, operating the great canal or protecting it. Economic competition, as we know it in the States, is not a part of Canal life. There is less preoccupation with material things and far more with the business of government and the problems of running normal family groups under abnormal circumstances. The residents are enthusiastic sportsmen with golf courses abounding. There is a very high percentage of hams although, unfortunately, a negligible number of them on c.w.

Except for the military personnel, there is a relatively high stability of permanent residents. I met many Americans who had been there through most of their working career. It is not difficult to understand that living and working in the Canal Zone is a unique way of life. If one comes to accept it and enjoys it, it would probably be difficult to accept a harsher climate and a different set of social conditions. There is certainly no such thing as a utopia, and the Canal Zone is not that, however one can trade values. The climate is kind and living costs are surprisingly modest because of the non-profit nature of the *company*. The Canal itself, is a self-liquidating government business enterprise, however, the services to the employees in the Canal Zone are on a non-profit basis.

What about the Smith's themselves? Captain Ben Smith is the personification of the American's mental picture of what one of our fellow citizens would be like in the Canal Zone, although I am certain that he would quite modestly disclaim this. He is one of the Canal pilots who share the responsibility of taking every single vessel through the Canal. The Canal Zone pilot takes command of the ship, and it makes no difference whether it is a modest pleasure boat or an Essex class carrier. The pilot is in charge with full responsibility for taking the vessel from one ocean to the other ocean. This, after all, is the whole reason for the complex, for the existence of all of the supporting services, the millions of dollars invested in the Canal itself, and the maintenance of this vital commercial and military link. Ben Smith's interesting tales of the Canal and the Canal people were certainly one of the highlights of our trip.

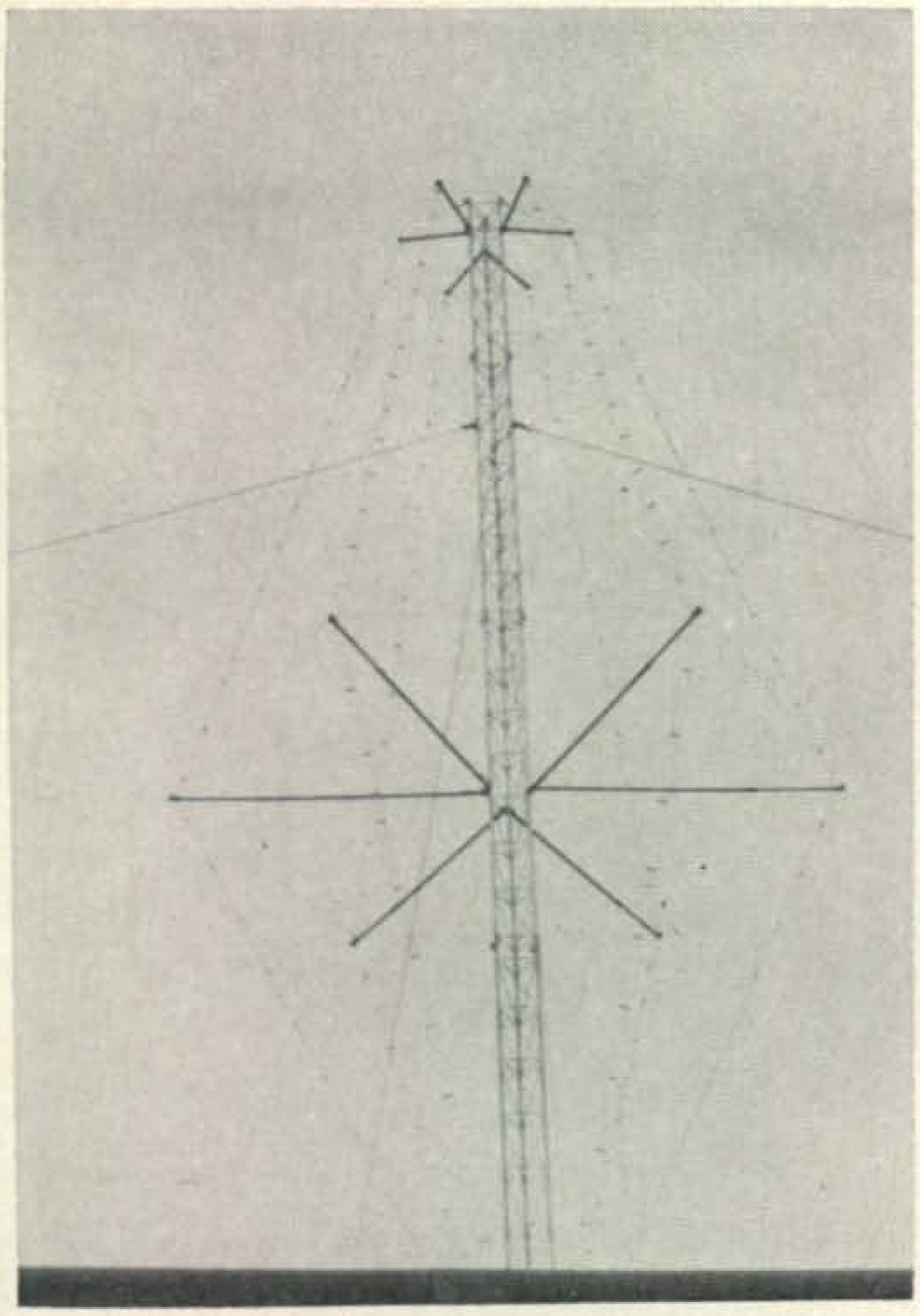
From left to right: Lil Smith, KZ5LT, Ben Smith, KZ5TT, Bob Douglas, W5GEL/KZ5GE, photographed in front of the officer's club.

What about Lillian Smith? Their only son is a student at a school in Tennessee. It was their feeling that the very crowded schools in the Canal Zone, a problem shared at most public schools in the United States, was not a sufficient challenge for their youngster. Lillian, rather than to get involved in a routine that might become tedious at times, put her expert secretarial background to work and is currently administrative assistant to the communications chief.

What about ham radio in the Canal Zone? Does it differ greatly from that in the United States or that in other DX locations? On both counts, from all observations, it does. In the Canal Zone, amateur radio has far more meaning than to most American hams. Two-thousand or more miles is a long way from home. Frequent use of the telephone is an essential morale builder in the Canal Zone. While it was not discussed, it would seem to me that having hams scattered around the Zone who are in daily communication with Americans, create a sense of neighborliness that tends to minimize the comparative isolation of the Canal Zone, itself. Of course, "KZ5" is a DX location. While there are many hams in the area, most of them are interested in relatively mundane communications with the States. As a consequence, for someone interested in DX activity or contest work, this is a fertile territory. There is an abundance of technical knowledge in the Zone, so staying on the air is not as difficult as the geography would make it appear.

Perhaps the most difficult problem facing an aggressive competitive operator from a location such as Canal Zone would appear to be the large number of Americans who still want a contact with this country. Things are relative always, and a new ham who has not been on the air for very long probably considers a KZ5 just as choice as the oldtimer might consider Lord Howe Island. It would appear this way because a "CQ DX" generally brought a preponderance of W's answering. While it is not too difficult to distinguish between W's and Europeans for example, on 21

[*Continued on page 105*]



The Conical Monopole

BY LT. LOREN A. STROUP,*
W5WEU/4

This vertical type antenna has a 4 db gain, a wide bandwidth and is very suitable for backyard installations.

View of a 43 foot tall long haul military installation mounted atop a building. Note the use of spacers to keep the pairs parallel.

THIS is it! Down through the years many antennas have been introduced to the amateur as the answer to his problems. This antenna, I feel comes closer to being a true answer to the general requirements of the amateur than any antenna henceforth proclaimed. Multi-band antennas are a poor to fair compromise, at best, of an amateur's desires, needs, available space and cost versus performance. This bomb of an antenna gives a continuous bandwidth of 4:1, less than 2.5:1 s.w.r. over the *entire* bandwidth, coaxial feed, a nice 4 db gain and good old DX low angle radiation. If you are tired of pruning and tuning, raising and lowering, limited in space and getting burned by old man s.w.r. for using your 75 meter dipole to meet MARS nets, then you are ripe for the Conical Monopole. This little gem is patented, sad to report, so build accordingly.

I am sold on this antenna. I took some antennas, similar to the one in the photo on top of the building, several Collins KWM-2A's and other gear and a team of operators to the Dominican Republic and they outperformed log periodiocs, rhombics, inverted Vee's, and whips so much of the time that I was swamped with wheels wanting phone patches to the USA. It does a mere Lieutenant's heart good to see full Colonels standing in line to use his KWM-2A's! I was sold on the Conical Monopole before this, but brother, that did it!

Construction

On the 43 foot antenna you almost have to use three-cornered tower. If it can be gotten as big as 12″ or 14″ across and imbedded in concrete to be self supporting, then so much the better. On the 23 foot and 12 foot high antennas, 2″ or 3″ pipe can be used, and also imbedded in concrete to be self supporting.

The cross arms are best made from one inch conduit or larger. The three cross-arms are bolted to the sides of the tower so that there are, in effect, six arms out from the tower at sixty degree intervals. This is done top and bottom, with the top and bottom arms being aligned. Each cross arm has a wire on each side of it, spaced 1″, 2″ or 3″ as per the chart in fig. 1. These 12 wires are tied to the top of the mast, run to the tip of the small cross arm, down to the side of the tip of the large cross arm and toward the base of the mast. There at the base and *only* there are they insulated by a strain insulator or another suitable type. All of these wires are tied together just above the insulator by a ring of wire and the center of the coaxial cable is connected to it.

The spacing of 1″, 2″, or 3″ should be maintained the entire length of the 6 pairs of wires. Spacers are used on the larger antennas to keep the vertical wires from twisting. When they do twist, it seems to make a "blind spot" and upset the s.w.r. At every point where the vertical wires touch a cross-arm or the mast, except the base, they are *solidly grounded!* "Grounded?", a skeptic mumbles, "How does it work that way?" All I can say is, that it works *fine*. The cross arms are solidly grounded to the mast and the mast is solidly grounded to a good earth ground or a good counterpoise. This is important.

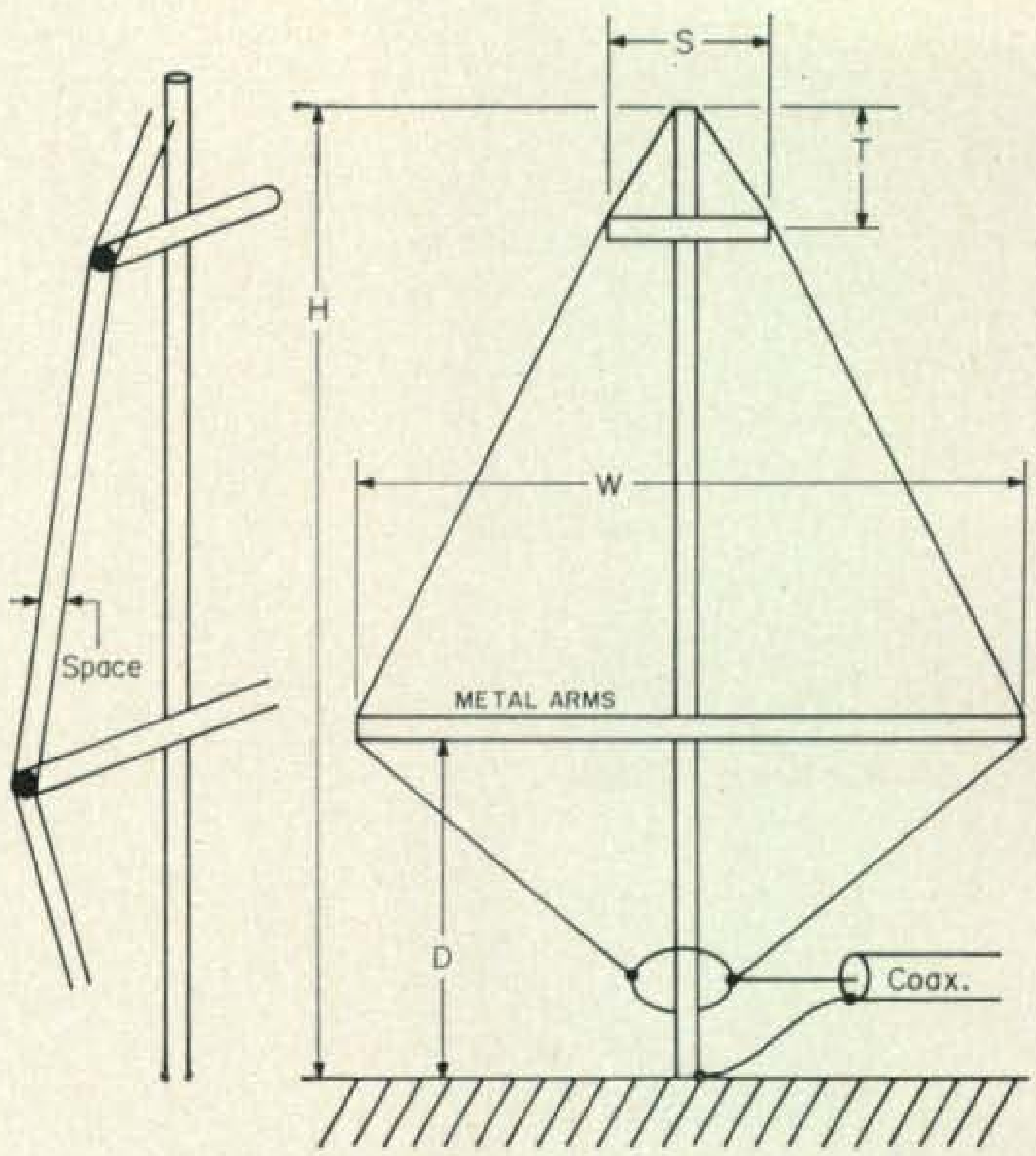
The ends of all six cross-arms are tied to-

*117 Eastland Drive, Smyrna, Tenn. 37167.

gether with a wire that forms a six sided circle when looking down from the top. This is done to the top and bottom arms and they are called Peripheral radiators. These, too, are solidly grounded to the ends of the crossarms.

On the small antenna, you might get satisfactory operation by using one wire per arm. For those who must build with newly purchased material, it would be worth a try. If it doesn't work out the second wire can be added with little trouble.

These antennas can be mounted on buildings, and the smaller ones seem to work a little better higher off the ground as long as they are well grounded wth a good counterpoise. If guy wires are needed, they should be insulated or ropes should be used. Existing wooden poles can be used to construct Conicals, just run three or four heavy wires down the length of the pole and tie them to the cross arms securely and ground them at the base. The pictures tell more than a book of descriptions can, and the 96 foot antenna figures were included in case someone wanted a whopping signal on 160 meters. One fellow has a 23 foot Conical and has a knife switch and a loading coil and an insulator in the base of the antenna so that a throw of the switch makes his "40 thru 10" do double duty on 75, with good results, too.



Freq. Range	H	W	D	T	S	Space	WIRE SIZE
3.5 - 15mc	43'	17' 8"	16'10"	26"	5' 10"	3"	#8
7 - 28mc	23'	9' 6"	9'	12"	38"	2"	#10
14 - 56mc	12'	5'	4' 9"	8"	20"	1"	#12
1.8 - 7.3mc	96'	39'	37'	4' 9"	13'	9"	#14

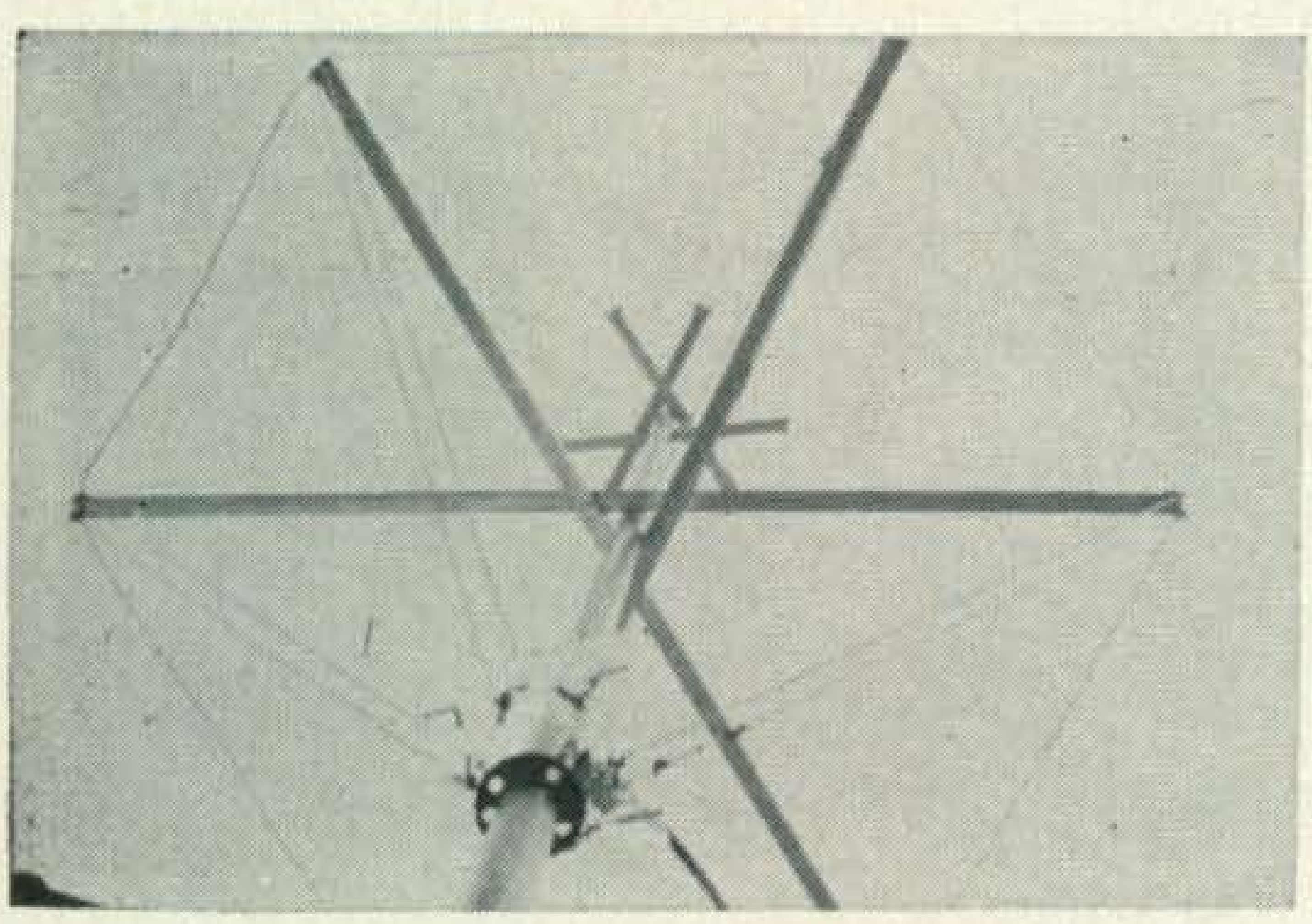
Fig. 1—Construction data and dimensions for the Conical Monopole antenna. The measurements are given for four overlapping frequency ranges. Construction details are given in the text. Figures for 1.8 to 7.3 mc are given on the offhand chance that someone might want to use this on 160.

Operation

Be very careful to dip your rig on the fundamental and not on an harmonic, for this antenna will accept it and radiate it very effciently. Its wide bandwidth requires that your rig be fairly free of spurious signals, but TVI has been no problem so far with me. I found a tunable, calibrated field strength meter a very handy and cheap means of avoiding loading out on harmonics.

You can mount clearance lights or small antennas, not to exceed ten percent of the Conical's height, on top of the Conical Monopole without altering its performance. Just run the lines inside the poles or towers.

When I built my 12 foot Conical, it brought my receiver to life as it had never been livened up before. The frequencies above 16 mc were brought to an unprecedented high activity level, or so it seemed. I had always thought that above 16 or 18 mc the spectrum was dead except for ham bands and an occasional VOA or RTTY station. On 20 meters, I heard stations 5/9 that previously I could only hear east coast stations calling. On 20 c.w., I knocked off an F8, PY2, DJ1, KZ5, LU6, and others not so far off. So what? I was using a rock bound five watt rig, that's what! This may be due to my present location being very poor in that there is no usable skip into W6 land! A friend ten miles away hears nothing but W6 land, but he doesn't have a Conical Monopole antenna, yet! One Saturday on 15 meter s.s.b. I could have gotten half of a WAC, but I'm never stationed in one place long enough to get it so I didn't try them.



Inside view of the 12 foot amateur version of the Conical Monopole.

This antenna may be just shy of the performance you could get from a good, well made, expensive tri-bander beam, but the cost differential and all the extra frequency range thrown in doesn't hurt me in the least. I rather enjoy digging out my old Heath CB'er and simply hooking it up to this antenna to check out my mobile friends every now and then. The 12 and 23 foot antennas are real good for CB, even if you just want to listen. Marconi, I hope this antenna increases your convenience and pleasure as much as it did mine. ■

WA9EOC at the controls of the rig set up by the Hamfesters R. C. in Chicago.

The Bedford Incident

LAST month in ZERO BIAS we decried the lack of participation in the "Bedford Incident" promotion in the New York Metropolitan area.

As though to counter our complaint, we promptly received a photo and story from the fellows at Harrison Radio in New York describing the operation of K2AGW/2 at the Astor Theater in the east part of New York's Broadway theater district. The photo shows Howie Wolfe, K2AGW in the most unnatural situation imaginable for a dyed-in-the-wool c.w. man—at the mike of an s.s.b. rig! Good grief! Where will it all end!

The young lady is Mrs. Carole Lindsay, wife of Navy Corpsman Lindsay, 3rd Marine Division, wishing her husband a safe and speedy return from his tour of duty.

Also participating in the N.Y. Astor Theater operation was Charlie Taintor, K2LJL, who acted as a relay for K2AGW/2.

Moving to the midwest, the live-wire Hamfesters Radio Club really got into high gear. Club President, Tony Seckus, WA9OC, described the action:

"On Sunday, October 24th, I received a phone call from Sam Hart, Publicity Agent for Columbia Pictures, Inc., who just arrived from New York. Someone at *CQ*'s office had told him to contact me with regard to setting up a Ham Station at the Roosevelt Theater here in Chicago. This was okay until he said that we must be on the air by Wednesday, Oct. 27th. I called a fast conference for Monday night at the Roosevelt. Present at this meeting was Hal English, W9-LDP, my consulting antenna expert. Another call got out Harry Charvet, Hallicrafters' Sales and communications expert, two engineers from B & K, plus other big heads from both B & K and Columbia. It was decided that I order whatever was needed and charge it to B & K. They in turn would furnish engineers and union electricians, a must in Chicago. I would in turn furnish Hal English, as an antenna consultant, and the operators.

"Well, we figured we would set up Tuesday and be ready to roll Wednesday, but it seems that this was a big engineering problem and it needed a few days study. So the heads studied. Wednesday morning we went to work. We got up on the roof of the Roosevelt Theater, about ten stories high. There was no place to put the 14AVQ, so we compromised. There was an old wooden flagpole, so we tied the 14AVQ to this with nylon cord. Harry Chavet brought in a full 1000 watt station on loan from Hallicrafters, plus men to install it, and believe it or not, we were ready to operate at 6:00 P.M.!

"We went on the air and that's when we got hit. We have pretty good public relations set up with Chicago, so by 7:00 P.M., they started: newspapers, radio, and even NBC television, which I understand was shown in New York. Well, we stayed on the air from 7:00 P.M. until closing time for Wednesday, Thursday, Friday, Saturday and Sunday. We passed quite a bit of traffic and talked to at least 500 people who wanted to know our procedure, what *CQ*

The Utah Amateur Radio Club set-up in Salt Lake City.

WAØADV and KØATZ proudly display the ham station in the lobby of the Denver Theater, manned by the Denver Radio Club.

was, etc., (*CQ* being the letters on our posters.) So consider this a shot in the arm for both *CQ* and ham radio. Four Hamfesters and myself club members operated the station for the five nights we were on the air. We also received help from the lady Larks, Pauline, WA9CNV, and Yo, WA9CCP who picked up all traffic we couldn't relay and sent it through the proper channels.

"All this was accepted with open arms by the Chicago public. We probably would have kept the station going continuously, but even Hams get tired so we had to close down. But the phone calls are still coming in and we are still passing traffic. After reading your ZERO BIAS in the November issue I noticed you left one thing out: "It's easy to get in, but it's hard work keeping the station going." But when some mother calls you up with tears in her voice and thanks you for the message she just received from Okinawa, you're ready to go again."

Score one for the amateur radio in Chicago, thanks to the Hamfesters Radio Club.

Moving further west, we come to the Denver Radio Club, WØOUI, which set up a mighty impressive station in the lobby of the Denver Theater with the help of Denver's own Burnstein-Applebee Co., which supplied the Collins S-line, shown in the photo. In addition to making the station a showcase of the best amateur radio has to offer, the club extended a public invitation to any interested passers-by to attend the club's meeting. Just another example of how "The Bedford Incident" promotion is being used to further public understanding of ham radio.

Working along similar "public information" lines was Jess Daughtrey, K2EEM, President of the Westchester (N.Y.) Amateur Radio Association. The club, with Jess at the helm, set up an NCX-5 in the lobby of the Bronxville Theater, and instead of making the affair only a message-handling ordeal, Jess set out to teach theater-goers what this thing called "ham radio" was all about. The result: An open invitation to the Westchester Amateur Radio Club to return at any time to demonstrate ham radio in operation.

Also receiving an offer for a "return engagement" was the Utah Amateur Radio Club whose Vice President, Max Burggraaf, WA7AIA, writes: "The theater manager was so pleased with the hams that he invited us back for a special program. Also, he arranged for the publicity as evidenced by the enclosed clipping. It is seldom that local amateurs get any local publicity. This is a notable exception, and we intend to try harder to improve our public relations."

Max also outlined twelve points that should serve as a firm guide to any ham club planning a similar operation:

1. Make plans as far in advance as possible.
2. Prepare a schedule for operators and equipment.
3. Make arrangements for the best antenna possible. (How about an auto with a mobile antenna parked in front of the theater?)
4. Consider having a local ham standing by at his base station to receive messages transmitted from the theater lobby. (Check out possible audio rectification problems in the theater sound system first.)
5. Make, and display, some large posters which *simply* explain what you are doing and *who you are*.
6. Pick operators who can talk easily with the public and consider in advance the comments that may be made by the public about TVI, etc.
7. Establish contact with the news media as far in advance as possible and get as much publicity as you can.
8. Have message blanks, pencils, etc., on hand as well as chairs and writing tables for the public to use.
9. We used carbon paper under the original blank and gave the originator the carbon copy. This blank had a brief "plug" for amateur radio on it, and gave the originator something concrete to prove he'd actually sent a message.
10. Have traffic rules available for the operators to familiarize themselves with. Third party traffic permitted? Can traffic be sent to that particular military address? etc.
11. If for some reason a message is accepted that cannot be forwarded, be sure to take the

[*Continued on page 109*]

W2AGW originates one of many messages he handled from New York's Astor Theater, with the help of K2LJL.

WPX

The following list indicates the amateurs who have qualified for the Worked Prefix award as of November 20, 1965 and their relative standing. A prefix is defined as the first one- or two-letters of the call sign and its accompanying numeral; *i.e.*, W1, K1, WA1, WV1, KN1; G2, G3; etc. Amateurs are encouraged to work as many different prefixes as possible and apply for the award directly to the WPX Certificate Committee, 14 Vanderventer Ave., Port Washington, L.I., N.Y. Application forms may be obtained from the above address or from the DX Editor, W2DEC. See the DX section in this issue for more information.

CW WPX

W2HMJ	694
W2EQS	675
W8KPL	671
W2AIW	658
W5KC	656
W4OPM	653
W6KG	640
ON4QX	622
W8LY	612
W2HO	611
W9DWQ	605
IT1AGA	591
SM7MS	591
K2ZKU	587
W9UXO	582
W9GFF	581
IT1TAI	576
W6WO	575
OK1SV	575
DL1QT	573
W2NUT	571
K6CQM	565
W5OLG	564
W9UZS	564
K2UKQ	559
W5LGG	558
G2GM	558
W2KIR	555
W3GJY	555
DL3RK	552
K2CPR	550
W1EQ	549
W1IJB	546
W9YSX	544
KP4CC	542
WØAUB	518
SM3TW	517
K9AGB	515
PY4OD	512
DJ2KS	511
VE3ES	511
K9EAB	510
W2GT	510
W7HDL	510
OE1FF	508
VK3AHQ	507
W8UMR	506
W8RQ	505
PAØLOU	505
ON4FU	503
G3EYN	503
YU1AG	503
WA2CBB	502
WA6SBO	502
W6YY	502
DL7CS	502
W9SFR	501
OK3EA	501
K6VVA	500
W2EMW	500
W2FXA	500
W2MUM	495
W1WLW	494
LA3DB	491
OK3DG	488
SM5CCE	488
W4BYU	487
W8PQQ	481
W8KSR	480
W4HYW	478
SM5BPJ	478
W8IBX	476
W5BUK	473
G3HIW	473
WØMCX	472
G8JR	472
K4HPR	470
W3OCU	466
K6SXA	464
W4BFR	463
VK3XB	462
JA2JW	461
SM5AJU	461
VE4OX	461
W9WIO	460
OK1AEH	460
SP6FZ	459
W3AYS	458
W9IRH	458
W9WCE	458
W3BCY	457
F9MS	457
OK2QR	456
UC2AR	456
W4RBZ	454
W7ABO	452
SP4JF	452
K4TEA	451
OK3HM	451
K1SHN	450
K4IEX	450
W3PGB	450
DL1YA	450
DL9KP	450
W8JIN	449
K2PFC	444
W3AYD	443
W6UNP	442
OK3UI	439
SP6AAT	439
W3BQA	437
LA5HE	437
SM7TV	436
DJ4HR	435
DJ5VQ	433
W4CKD	431
K5LIA	428
W2RA	428
W5EJT	428
DL3AR	428
F2MA	428
OK1MB	428
W3CGS	426
W1EIO	425
OE3WB	425
W6ISQ	424
KL7MF	424
SM5WI	424
VK3RJ	423
W4HVQ	422
K5DGI	421
WØPGI	420
HB9TT	419
KH6BLX	418
W8GMK	417
UA4IF	417
K2YMO	416
SP8HR	416
W1DGT	415
W6RKP	415
G3LPS	415
VU2MD	413
W5AWT	412
W5DA	412
K5LZO	411
WA2DIG	411
W2PTD	411
W4DKP	410
HA5KBP	409
W1CKU	408
UC2AW	408
W4HUE	407
K4JVE	407
OE8KI	407
OK1AW	407
W5AFX	407
SM5AJR	406
WA6HRS	406
W4YWX	404
DJ5GG	404
GI3OQR	404
KP4AOO	404
LA3UF	404
SP7HX	404
VK5RX	404
ZS4MG	404
K2ZRO	403
W9DYG	403
W9IHN	403
G2FFO	403
VE6VK	403
W1BPM	402
W2FLD	402
G8PL	402
UT5CC	402
K9BVR	401
WB2FMK	401
W4HOS	401
WØVBQ	401
VE3JZ	401
K1HVV	400
W4BHG	400
W4RVW	400
LU8BAJ	400
PY4AYO	400
VE1AE	400
VK3KB	400
ZL2GS	400
K1HVV	395
W8QNW	393
W8TTN	387
I1IZ	386
SM3AGD	384
ZL4BO	384
IS1FIC	383
SP2AP	383
UB5ES	380
SM6AVD	379
WA2KSD	378
W4BJ	377
WØQYE	377
DL1IP	377
CE3AG	375
G8KU	374
HA5BI	373
ZE3JO	371
W4GYP	370
JA1GC	368
UA3AN	368
DL1BO	366
DL6MK	366
JA5FQ	366
K8ONV	365
W3GRS	365
W4AZK	365
HA5KFR	365
W6DLY	364
MP4BBE	364
K8LSG	363
CR6AI	363
OK1AEV	363
VE5JV	362
W9QGR	361
W9ZB	360
WØMLY	360
K2UYG	359
WØCDP	359
W2GNQ	358
UA9DT	358
G8KS	357
UC2AA	357
VE3DIF	357
W1AIO	356
K2OUS	356
W3TXQ	356
K4YFQ	356
W7LZF	356
I1SF	356
UA4PA	356
DL6OS	355
OH2VZ	355
W2KXL	354
W4OMW	354
HA5AM	354
K4GSS	353
W5EZE	351
W6ID	351
F3DM	351
HB9YL	351
KR6BQ	351
OH5UQ	351
UB5DQ	351
K1KPS	350
K1NOL	350
K2PKT	350
K6KII	350
KØJPL	350
W4ZYQ	350
W6UDR	350
W9MQZ	350
WØGNX	350
CN8AW	350
DL7CW	350
PAØZL	350
VE2IJ	350
YU1BCD	350
W3GAU	349
OH2DP	348
W9OVF	346
SP5HS	346
VK2APK	346
W6PQT	345
W9IU	344
HA5KAG	344
OK3UL	344
DL6QW	343
W6OMR	341
DL3JV	341
LA1H	340
OK2KOS	340
PAØWOR	340
OH9NC	339
SM7ID	339
DL1IA	337
W6BZ	336
DL7BK	336
HK4JC	335
UR2BU	335
W3AHX	334
WØRJV	334
W3HA	333
UH8DA	333
W2BOK	332
LU5ABL	332
OH9PF	332
OK3EE	331
WØVFE	330
IT1AGA	330
K1HTV	329
WA6MWG	328
K2QXG	327
WØSNL	327
G3HCV	327
SM7CNA	327
SP6ALL	327
UQ2AS	327
VK3KS	327
VK5NO	327
LU8EN	326
UA9CL	326
UI8LB	326
WA2JBV	325
W2OWX	325
VK3CX	325
W1BGA	325
WA6OET	324
W6RLN	324
DJ3HW	324
W2HUG	323
W6JKJ	323
HA5BU	323
OK3KAG	323
PAØVER	323
W8CJN	322
DL9VN	322
F9IL	322
UW3DR	322
DJ1UE	321
OK1JN	321
PAØOI	321
UA6MF	321
W6IPH	320
W9KA	320
DJ1RZ	320
DJ9HA	320
SL5AB	320
UA1AI	320
UA3FT	320
UA9DR	320
UL7CH	320
K4AUL	319
G8DI	319
VK3JF	319
EA4CR	318
LA6CF	318
SM7EH	318
ZB2I	318
W1ZJJ	317
DJ4OP	317
EA2CR	317
HA5KDQ	317
SM6CMU	317
VK5NQ	317
K4SXR	316
WØQGI	316
DJ1VS	316
OK1ZL	316
SM5BGK	316
VK6WT	316
K1RTB	315
W2BYP	315
W2HQL	315
DJ2JE	315
DL3ZA	315
PAØVB	315
PAØVO	315
UA3NP	315
K9GVE	314
W1NHJ	314
DJ5IM	314
W1IUU	313
W1RCQ	313
W3NCF	313
W6YC	313
UA6UI	313
VK7SM	313
ZS6AJQ	313
DL3YQ	312
DL7DE	312
G3FPK	312
G3GSZ	312
SM5WI	312
W3RZL	311
W5BRR	311
W5EJV	311
EA5BD	311
SM5AHK	311
UA9VB	311
UC2CS	311
K9GTK	310
W2FVI	310
W3GHD	310
W7DIS	310
W7STC	310
W9BPW	310
W9UX	310
WØEWH	310
DL1VG	310
OH3TH	310
OK1ZW	310
OK2OQ	310
OK2QX	310
PAØLY	310
SP5AIB	310
SM7TQ	310
SVØWZ	310
UA3BN	310
VE2IL	310
W3FDH	309
ZS1ACD	309
G2BUL	309
LU7AU	309
PAØLV	309
SM5BHW	309
UA2KAA	309
UB5KBA	309
K2ZYR	308
K3CNN	308
DJ3BB	308
F9BB	308
G3GAD	308
HB9EO	308
SM5BCE	308
VQ2W	308
5Z4KRL	308
W9YNB	307
DL1RK	307
DU7SV	307
SM5BBC	307
SP5AFL	307
SP4RF	307
UA3HK	307
UA9JH	307
W2SAW	306
W8NAN	306
W8RSW	306
W9WJH	306
DJ2EO	306
DJ7CX	306
F9RS	306
G5GH	306
OK1AFC	306
PAØSNG	306
PY5FO	306
SP5ALG	306
UA3HI	306
UA9DN	306
VE3CWE	306
VK4SS	306
K4HXF	305
KP4BEA	305
W2TP	305
W4LRN	305
W4SHX	305
W5AZB	305
W5WZQ	305
W8ONA	305
WØGUV	305
JA2DO	305
SM5BDY	305
UA6LF	305
VE3BWY	305
VP9BO	305
YO6XI	305
YO8CF	305
ZL1AV	305
K4BVD	304
K4DRO	304
K5JZY	304
K6RTK	304
K8GHG	304
W1BFT	304
W1FZ	304
W3GOQ	304
W6NWI	304
W6RLP	304
W7AIB	304
CP5EZ	304
DJ2GG	304
DJ2SR	304
DL4BS	304
HB4FD	304
LA8PF	304
OK3IC	304
PY4ZI	304
PZ1AH	304
SM3CJD	304
UB5FY	304
YO2BU	304
YO3CR	304
ZL2PM	304
W1FPS	303
K2UPD	303
K2ZCD	303
K5UYF	303
K6HOR	303
K8IKB	303
K8MFO	303
W2ECU	303
WA2HXC	303
W2NR	303
W6BYB	303
W7CNL	303
W8WT	303
W9KXZ	303
W9VIN	303
WØLBB	303
DJ3WP	303
DL1ES	303
DL1TA	303
DL3CM	303
DL3TW	303
JA1BN	303
OK2KJU	303
OY7ML	303
SM4BZH	303
SP2HL	303
UA1KBA	303
VE3HB	303
VP7NQ	303
K1LWI	302
K8KTZ	302
K8YCM	302
K9CLO	302
W1HGT	302
W3DBX	302
W5LEF	302
W8YAH	302
W9MZP	302
WØDMA	302
G3HRY	302
G3NRZ	302
OH2FS	302
OK1KKJ	302
PY4AP	302
SM3BEI	302
SM5CXF	302
SP9ADU	302
SP9PT	302
SP9TA	302
UA3BK	302
UC2AF	302
VE3IR	302
VE3PV	302
YV5ACP	302
K3GKF	301
K4OMR	301
K8CVQ	301
K9WTS	301
W1WHQ	301
W2DGW	301
W2ZXL	301
W4IMI	301
W4PLL	301
W4ZYS	301
DJ6LD	301
G3HFP	301
HK7ZT	301
I1ZQ	301
JA3FT	301
LU5AQ	301
OK1CX	301
SP8EV	301
UA6FD	301
UC2WP	301
VK3TL	301
ZL4CK	301
K2HIY	300
K2KBI	300
K2QHL	300
K2QIL	300
K3ERC	300
K3LXN	300
K3RRA	300
K4KOY	300
K4SCT	300
K4TKM	300
K6ESW	300
K6EIV	300
K6JIC	300
K6TQR	300
K7ADL	300
K8ITH	300
K9DKI	300
K9LIO	300
K9OKD	300
KØIAD	300
KØIKL	300
W1BGW	300
W1BPW	300
W1CV	300
W1HWH	300
W1IJO	300
W1QQV	300
W1YPH	300
W2ASF	300
W2CUE	300
W2DEO	300
W2GKE	300
W2IP	300
W2LJX	300
W2PDB	300
WA2RUB	300
W2UGM	300
W3ZHQ	300
W3PVZ	300
W2QHH	300
W3DKT	300
W3HNI	300
W3LMA	300
W3SOH	300
WA4CXR	300
W4GXB	300
W4YMG	300
W4ZYQ	300
W5ARJ	300
WA5CBL	300
W5VA	300
W5VSQ	300
W6BIL	300
W6DIX	300
W6FLT	300
W6JNX	300
K6KII	300
W6MDK	300
W6NUQ	300
W6WWQ	300
W7TPE	300
W7VIU	300
W7VRO	300
W8BQV	300
K8EHD	300
W8JAQ	300
W8LZV	300
W8UEX	300
W9FJX	300
W9QQG	300
WØDVZ	300
WØFLK	300
WØOVQ	300
CE4AD	300
CR7IZ	300
DJ6BW	300
DL1PM	300
DL9PF	300
F8GB	300
G2MI	300
G3JUL	300
G3KMQ	300
G3PJW	300
GI3JEX	300
KH6DKA	300
KP4AQQ	300

KP4RK 300
KR6JZ 300
LA2MA 300
OE5LX 300
OE5PWL 300
OK1MP 300
PY4AO 300
PY5ASN 300
SM2BCS 300
SM3BNV 300
SM3CJD 300
SM4CHM 300
SM5CEU 300
SM7BHF 300
ST2AR 300
SVØWAA 300
UA4SM 300
VE3CIO 300
VE3XQ 300
VE7SB 300
VK3AXK 300
VK4TY 300
VO2NA 300
YO3FD 300
ZS1RM 300
ZS5UP 300
LA5HE 354
K1SHN 350
K2POA 350
PZ1AX 345
VE3BQP 334
XE1AE 324
W2VCZ 320
W2YBO 318
W8PQQ 315
DJ2QZ 314
K4JEY 313
G6LX 310
W5PQA 308
K4PUS 305
W9DWQ 305
DJ3CP 304
TG9AD 303
K2TDI 300
KØRDP 300
WA2SFP 300
W6USG 300
CN8AW 300
VE3BKL 300
WØCVU 298
SM5UF 295
GI6TK 278
K5OGP 277
K8ONV 275
VE3ES 274
DL3RK 273
SM5BPJ 271
G3KXT 269
K2JFV 266
KG6AJB 265
K2MGE 263
W3AYD 262
W4EEU 262
DL1PM 257
G3WW 257
XE1CV 256
G3FKM 255
UR2AR 255
ZB1A 254
W1EQ 253
K2ZKU 251
K3BNS 250
W4HKJ 250
W8QNW 250
DL2AB 247
PAØSNG 247
W1GR 246
K8LSG 241
W2HMJ 240
K8LSG 238
DL9OH 235
OK1ADP 234
W6EKZ 233
DL4FX 233
DJ8EG 232
OA4PD 232
VP7NS 232
K8PUU 230
EP2AG 229
VQ2WR 228
VE6ABP 227
W6DLY 223
W8JXY 222
W1WDD 221
GW3NWV 221
DJ8RR 220
YV5AST 220
W8WT 219
VE7PU 218
W3CGS 217
W1DGJ 216
DL6EQ 216
OY7ML 216
W1AOL 215
W6YY 213
SM3AZI 213
VE6VK 213
K2CJN 212
DL1BS 212
F2MO 212
KP4AOO 212
ON4UN 212
W4ZYS 211
W9YHE 211
I1TBU 211
VP6WD 211
G8FC 210
W9SFR 210
DL2DM 209
DL5AO 209
DL4AS 208
GI3CDF 208
KL7MF 208
SM3BIZ 208
K9RNQ 207
WØLBB 207
K1RTB 206
K2JXY 206
VE2BCK 206
W5DA 204
VK5GG 204
K4HYL 203
W1MZB 203
WA2VOH 203
W3BVL 203
W5RHW 203
W8EVZ 203
W9WIO 203
LA5LG 203
UA9AO 203
VE6SF 203
K1GHT 202
W4BFR 202
W5DVV 202
WA6ESB 202
KA2BW 202
UA3BT 202
ZE1JE 202
W9EXY 201
DL4NQ 201
KG6ALD 201
UW9CC 201
K2KGS 200
K2YIY 200
K4LYG/7 200
K4VOF 200
K4ZJF 200
W5DNL 200
W5QKZ 200
W5LEF 200
W5QKZ 200
W6OHU 200
W9OKM 200
KP4AQQ 200
TG9SC 200
UA3FG 200
VE3PV 200
VE8RG 200
VQ2AT 200

SSB WPX

W4OPM 550
W4NJF 506
G3DO 466
MP4BBW 462
HB9TL 452
W3NKM 451
G8KS 450
W3MAC 449
K9EAB 439
W6YMV 438
W3DJZ 435
G3AWZ 428
G3NUG 423
I1AMU 403
W1UOP 400
PJ2AA 379
K1IXG 373
W4RBZ 371
W1ORV 370
WA2EOQ 362
W3VSU 362
W6RKP 360
W2HXG 359
TI2HP 356
W4RLS 355

Mixed WPX

W4OPM 658
G3DO 638
W8WT 631
W9YSX 622
DL3RK 609
K9EAB 606
W3NKM 605
W8JIN 605
W8UMR 599
W3OCU 588
W9DWQ 571
W6YY 570
W5LGG 565
YU1AG 559
W4BYU 557
K2ZKU 555
W3AYD 552
HB9EU 551
SP9RF 542
WØMCX 529
W2GT 528
DJ2KS 524
G8KS 520
OE1FF 519
K9AGB 510
PAØLOU 510
G3HDA 509
HK3LX 508
W4BQY 505
W3KDP 501
KP4AOO 500
LA5HE 500
K2SHZ 497
SM5BPJ 490
ST2AR 489
JA2JW 480
W4BFR 478
W4RBZ 477
ZL4BO 477
DL9OH 475
W3CGS 474
W9FVU 474
K1SHN 463
G3FKM 463
WA6MWG 462
DL1YA 456
W1ORV 455
VK2DI 454
WØVBQ 452
DJ5VQ 452
G3NUG 452
GI6TK 450
W5EJT 449
K8ONV 448
W2GNQ 442
F3ZU 441
VE5JV 439
GI3OQR 434
OK3EA 433
W1EIO 432
W8GMK 429
PY1ADA 429
G2BOZ 427
GI3CDF 427
JA1BK 427
SP8HR 427
W9YT 422
W5EZE 419
ZS6IW 419
W5PQA 417
G6VQ 413
W3BVL 411
W8QNW 411
K4RID 410
MP4BBE 410
VE7CE 409
I1SF 408
LA5S 408
W9IRH 405
W9KA 405
G2FFO 405
WA6SBO 404
W8TTN 404
WØLBB 404
K3COW 403
K2ZRO 402
K4BAI 402
ZL1AMO 402
4X4FU 402
W1MQV 401
W4NNH 401
W4ZYS 401
W5LEF 401
W6WX 401
W9EXY 401
K9LIO 400
W1UOP 400
W4BHG 400
W4HKJ 400
W5RU 400
W6USG 400
W8JXY 400
DJ2GG 400
DJ8RR 400
I1HL 400
PY4AYO 400
SM5AJR 400
VE3BKL 400
VE3PV 400
ZS4MG 400

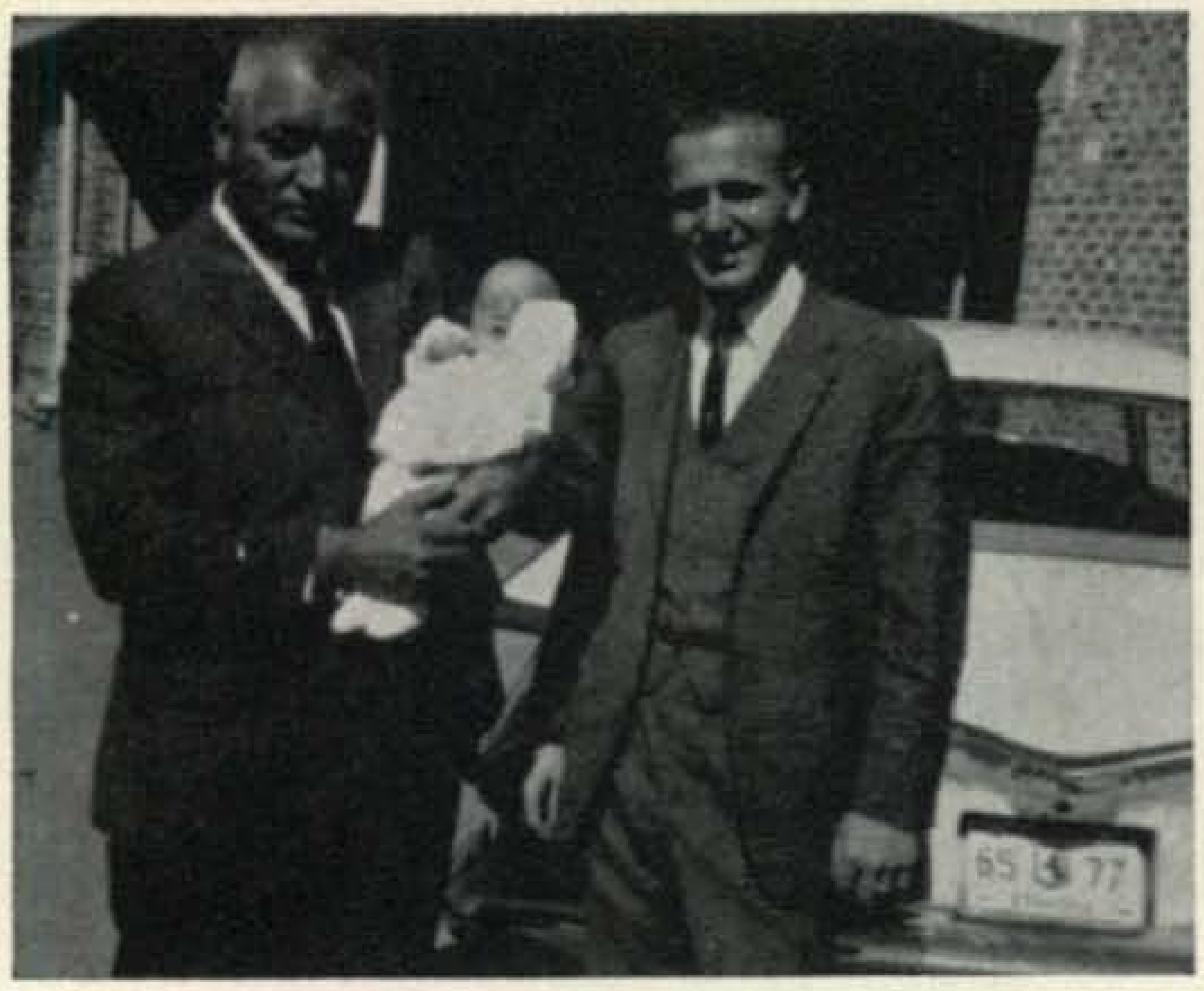
Phone WPX

W9WHM 629
CT1PK 610
W8WT 600
G3DO 598
CT1HF 586
MP4BBW 506
DJ3CP 473
W9YSQ 471
PAØSNG 468
W9UZC 462
PAØHBO 453
G3NUG 451
K9EAB 450
W6YY 448
W3DJZ 447
G8KS 430
VK6RU 421
W3AYD 420
F8PI 418
PZ1AX 413
K2CJN 409
W1ORV 404
DL3TJ 404
OE1FF 404
W1UOP 402
W6USG 400
XE1AE 398
VE3BQP 386
SP7HX 385
DL3RK 383
TG9AD 381
DL6VM 376
G3FKM 366
W8UMR 363
SM3AZI 362
DL2UZ 361
SM3EP 361
CX2CN 359
W1DGJ 358
W5ERY 358
W6CHY 358
W4RLS 356
W8JIN 356
G3GHE 356
G3WW 356
PY2CK 354
5A5TO 353
DL9OH 351
LA5HE 351
ZS6IW 350
W8PQQ 347
W5PQA 344
LU9DM 343
UQ2AN 337
YV2CJ 334
UR2BU 333
WØMLY 332
KP4WD 328
F8HA 327
ZE1JE 326
HB9MX 325
VE1ADE 325
TG9AZ 319
W3CGS 317
WA2EOQ 316
ZL4BO 316
F9MD 315
I1AIJ 313
G2AFQ 312
G3BID 312
GI3CDF 312
I1CBZ 312
YO2BN 312
XE1CV 311
YU1AG 311
W9SFR 310
GM3BCL 308
I1SF 308
I1PDN 307
VE3PV 307
K3COW 306
ZP5CF 306
W9EXY 305
IT1SMO 305
YV5BBU 305
ZE2JE 305
W3HUG 304
SM3BIZ 304
K2POA 303
W5JCY 303
G3NFV 303
OE1PC 303
VE2AFC 303
VE6TF 303
VK6KW 303
W1BPM 302
EP3RO 302
PY1NC 302
EI3R 302
K8CFU 301
W9PQA 301
K5MDX 300
W1FAB 300
W1ZSU 300
W3BNU 300
DJ2UU 300
DJ3OJ 300
EA2EL 300
EA2FE 300
GB2SM 300
VE3BKL 300
ZS1AB 300

New Amateur Product

Design Industries Inc.

Design Industries, Inc. recently announced a line of furniture for amateur, commercial and industrial use. The desk is designed for use in the home and office can be moved by means of casters. The front panel can be removed for new panels and equipment. Current cut outs include: Collins, Drake, Hallicrafters, National, and SBE equipment. The desk can be closed and locked when not in use. The walnut and other wood finishes combined with white formica front panel and desk top is easily placed in any home decor. The chair is also available. The desk sells for $550.00 and the chair $193.00. A brochure is available by writing to Design Industries, Inc., P.O. Box 6825, Dallas, Texas, 75219, or circle 73 on page 110.



Al, K1QHP/FL8AK, with ex-K4YFE, Jim and his son. Al, leaving ET3 (Ethiopia) land for K1-land, turned reins of Kagnew Station ARC over to Jim.

CQ's George Jacobs, W3ASK, seen with the Voice of Vienna, Frank Friedl, OE1FF, in front of Frank's QTH. The contented looks on both faces is not due to working any rare DX, but to the excellent meal just consumed, which was prepared by Frank's XYL Maria.

PEOPLE AND PLACES

"Otts" Beyer, K8CIR, shown here adjusting the rig, was one of three hams (K8CIR, W9VW and K8BPT) who supplied communications during the SMALL Race last October. The SMALL Race is for small aircraft flown by women over a triangular 200 mile course. The route started at Grand Haven Airport, Michigan, South along Lake Michigan shore to Watervliet Airport, then to Ionia which lies East of Grand Rapids then back to Grand Haven. "Otts" flew the route with a Michigan Aeronautics Safety Officer prior to the race to determine weather and safety factors. During the race, "Otts" dispatched information to W9VW at the first leg who relayed the order of passing contestants followed by reports from K8BPT as the planes passed Ionia. The operation was a complete success and a credit to amateur radio.

Who says amateur radio isn't hereditary? This photo shows Master David Wesley Banks at age 14 months (photo taken a year ago) following in the family tradition. David is the Grandson of W8AER, David Sears of Columbus, Ohio, and Leon W. Banks K1HJV, of Bethlehem, Conn. David's Father is W8FEH and three Uncles are ex-K1TOG, K1TOH and W8RVK. To round it all off, the family cat is named "CQ". Davey started his radio training, beginning with a license manual in his Christmas stocking at three weeks of age. When this picture was taken he could point out the mike, receiver and key when asked.

HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV

As predicted in this column many months ago, the day would surely come when the high power high radio frequency transistor would make its appearance. Although progress has been slow in developing the transistor that would operate at frequencies in the order of 400 mc, a transistor called the *overlay* transistor (OLT) is available that will now handle a minimum of 10 watts of r.f. at 400 mc. Within the next year or so, the OLT will be available which will handle twice that power at 400 mc and up to 100 watts at 50 to 60 mc. When used at lower frequencies in parallel, there is no reason that the OLT cannot be made to handle 200 watts or so, and this would be ideal for *completely* transistorized amateur radio transceivers.

The OLT is unlike the usual transistor in that it contains a large number of emitters, anywhere from 16 to 400 or more. These emitters are connected in parallel. This was done for the purpose of handling larger currents and to provide low capacitance and short carrier transit time between the collector and emitter groups.

The emitters of the OLT transistors are so small they cannot be connected by the usual bonding leads and it was necessary to use an aluminum layer directly above the emitter matrix and base region. The transistor was named the *overlay* because of the use of the aluminum layer for conducting current to the terminal lead of the transistor.

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

It is not possible in the space avaliable for this column to go into the intricate technical details of OLT construction and the reader is referred to two superb articles in *Electronics* for August 23, 1965 by D. R. Carley, P. L. McGeough, J. F. O'Brien, D. J. Donahue and B. A. Jacoby, all of RCA, Somerville, N.J. the first company to produce the OLT.

Overlay Transistor Transmitter for 10 Meters

Figure 1 shows the use of three RCA overlay transistors in a 10 meter transmitter adapted from a CB transmitter design. This transmitter is capable of delivering 10 watts of peak power with 100% modulation. The modulator used can be any good transistor amplifier delivering from 2 to 6 watts of a.f. power. The antenna used should have an impedance of 50 ohms (52 ohms will work okeh). The modulation transformer may be hard to obtain because of the low secondary impedance required. However, it is suggested that a speaker output transformer with multi-taps be tried with the associated modulator for proper modulation. About 50 ohms should do the trick.

For those desiring to experiment with the RCA 40292 transistor for 144 mc, they are referred to the article mentioned above which describes a circuit for an aircraft transmitter which operates at 135 mc and has an output of 10 watts with a driving power of 100 milliwatts. Modification would be easy for 144 mc.

Questions

Measuring Grid Current in GG Amplifiers—"How can I measure the grid current of a cathode driven amplifier?"

Measuring the grid current of a cathode driven amplifier can be a delicate and exasperating task as it is a ticklish job to "unground" the grid sufficiently to permit a metering circuit to be used, yet still hold the grid at r.f. ground potential. The inherent inductance of most bypass

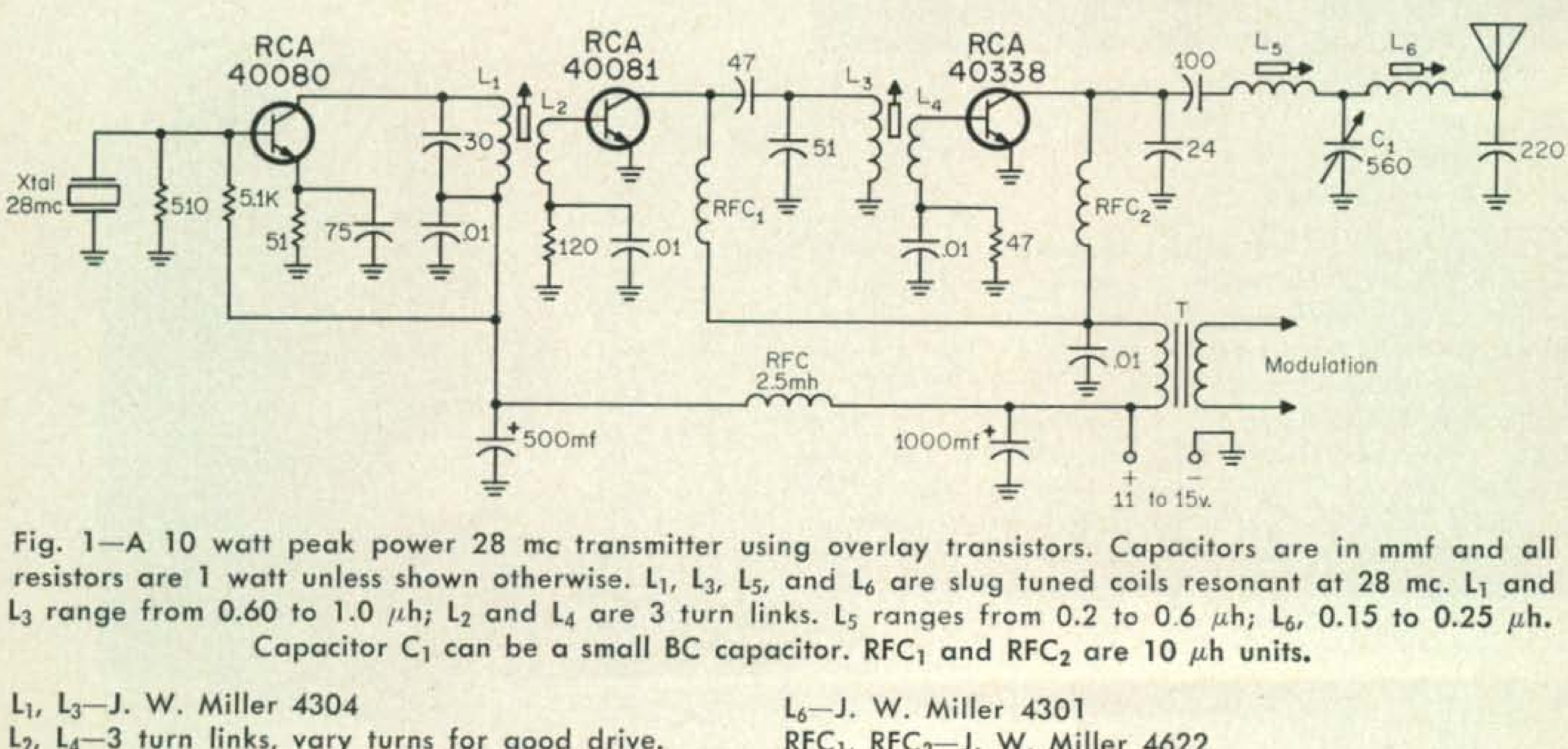


Fig. 1—A 10 watt peak power 28 mc transmitter using overlay transistors. Capacitors are in mmf and all resistors are 1 watt unless shown otherwise. L_1, L_3, L_5, and L_6 are slug tuned coils resonant at 28 mc. L_1 and L_3 range from 0.60 to 1.0 μh; L_2 and L_4 are 3 turn links. L_5 ranges from 0.2 to 0.6 μh; L_6, 0.15 to 0.25 μh. Capacitor C_1 can be a small BC capacitor. RFC_1 and RFC_2 are 10 μh units.

L_1, L_3—J. W. Miller 4304
L_2, L_4—3 turn links, vary turns for good drive.
L_5—J. W. Miller 4303
L_6—J. W. Miller 4301
RFC_1, RFC_2—J. W. Miller 4622

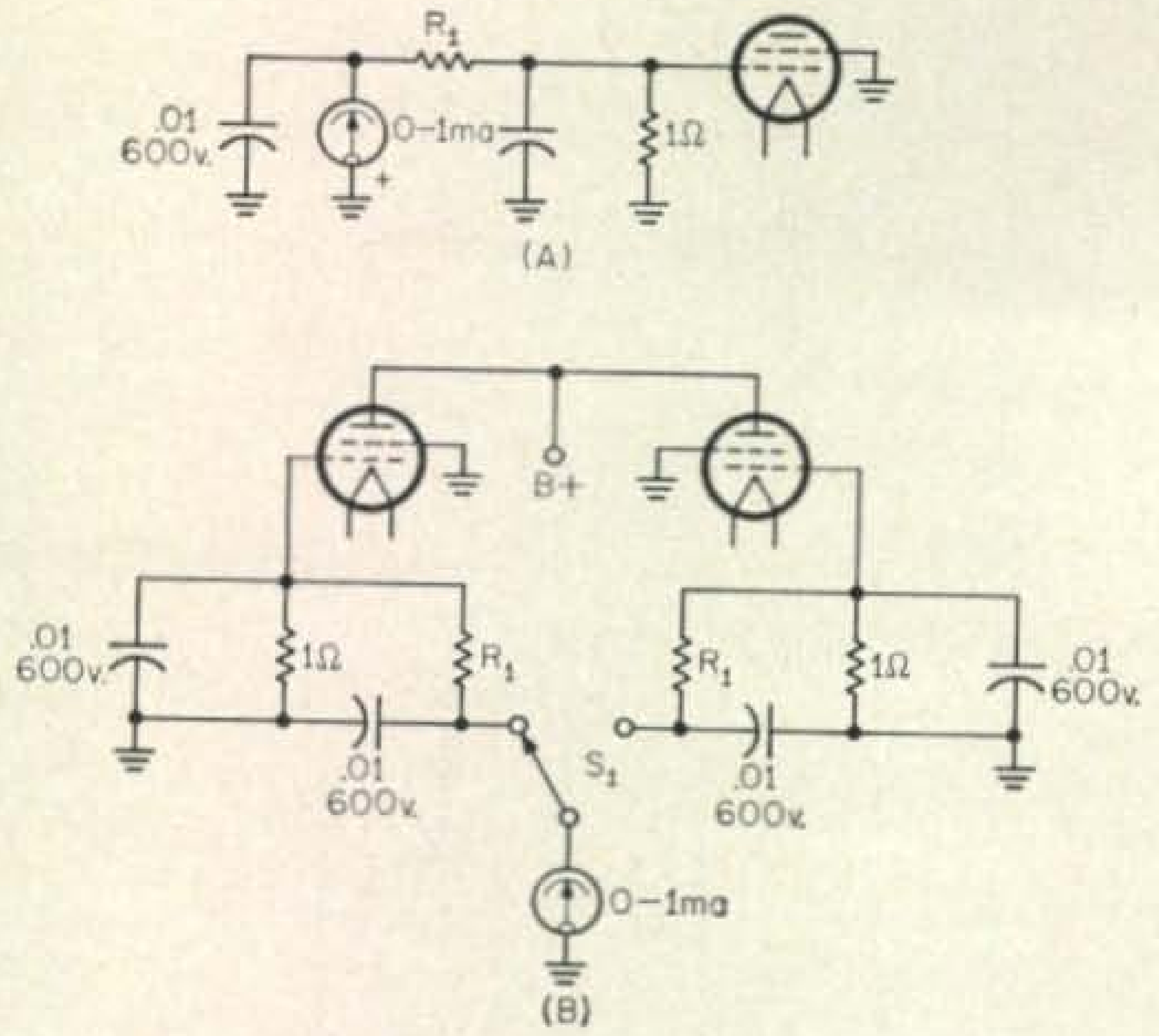


Fig. 2—(A) Measuring circuit which avoids instability problem in GG circuit when attempts are made to "unground" grid for current measurements. (B) individual grid current measurement of parallel tubes.

capacitors permits the grid circuits to "float" above ground at some high frequency, and as a result the amplifier exhibits instability and parasites. This problem can be avoided with the measuring circuit of figure 2(A). The control grid is grounded through a 1 ohm composition resistor, bypassed by a .01 mmf disc capacitor. The voltage drop generated by the flow of grid current across the resistor can easily be measured by a millivoltmeter which is calibrated to read in terms of grid current. Individual grid current for each of a parallel pair of tubes may be measured by the circuit of figure 2(B).

The internal resistance of the 0-1 d.c. milliameter plus the series resistor R_1 determines the maximum current that can be measured. Suppose it is desired to read grid current in the order of 60 ma. The meter should therefore read 0-100 ma. This is very convenient, as the reading of the meter scale can easily be multiplied by 100 to obtain the actual value of current. Now when 100 ma flow through 1 ohm, there exists a potential of 0.1 volt across the resistor. The meter should therefore read 0.1 volt full scale to correspond to a grid current of 100 ma. Assume the meter is a Triplett #221-T, which has an internal resistance of 55 ohms. The voltage drop across the meter itself is 0.55 volts when 1 ma flows through it. To convert the milliameter to a voltmeter reading 0.1 volt full scale, a series multiplier must be added. A voltage drop of 0.1 volt exists across a 100 ohm resistor when one ma of current flows through it. The *difference* between 100 ohms and 55 ohms, or 45 ohms, must therefore be added in series with the meter to convert it to read 0.1 volt, full scale. On the other hand, placing the meter itself across the 1 ohm resistor without the series multiplier will result in a full scale reading corresponding to 55 milliamperes. Thus, if maximum grid current is below this latter figure, no series resistor is required for the meter. Conversely, high values of grid current produce greater voltage drop across the 1 ohm resistor, and larger values of series multiplier resistance are needed. Thanks to Bill Orr of Eimac Division (of Varian) for the information from Eimac's amateur service newsletter (W6SAI).

Transistor Calibrator for the NCX-3—"How about a circuit using transistors for a 100 kc calibrator for my NCX-3? Power can be a battery (preferably the small 9 volt kind used in pocket transistor radios). Can do?"

See fig. 3. This simple but accurate crystal calibrator using only one transistor will work fine. Please note that its output is connected on the *receiver's* antenna input side. If connected to the common antenna terminal the whole thing will go "poof."

Transistor Checker—"Can you supply me with a very simple circuit which will allow me to check surplus transistors quickly? I want nothing elaborate and the set should use a minimum of inexpensive parts. I am not interested in dynamic characteristics as such."

Well, you can take your pick from three circuits in figures 4(A), 4(B) and 4(C).

The circuit in fig. 4(A) is for the purpose of checking collector current when the emitter is grounded and there is no signal applied to the transistor base. To determine whether a transistor is "good" or not, multiply its beta (current amplification) by the collector current (I_{co}) and then by a factor of 3. The factor takes into "consideration" the characteristic variations of the transistor in manufacture. The resultant answer after multiplying beta, I_{co} and 3 is indicative of the limit of collector current. If collector current as read on the meter exceeds that obtained by the multiplication, then the transistor is "bad."

The checker in fig. 4(B) checks current gain or beta. This is done by applying a small voltage to the base of the transistor through the switch sw and 200 k resistor. The base current should increase by .03 ma and the collector current an equal amount for a beta of 10. A transistor having a beta of 100 will show a current increase of 3 ma. Compare the manufacturer's beta rating with the one you obtain, if yours is lower use another transistor.

Remember, that for the checkers in figs. 4(A) and 4(B), the battery voltage must be reversed for checking NPN transistors.

The checker shown in fig. 4(C) will check both NPN and PNP transistors. With S_1 open if the transistor is good, the meter will read the

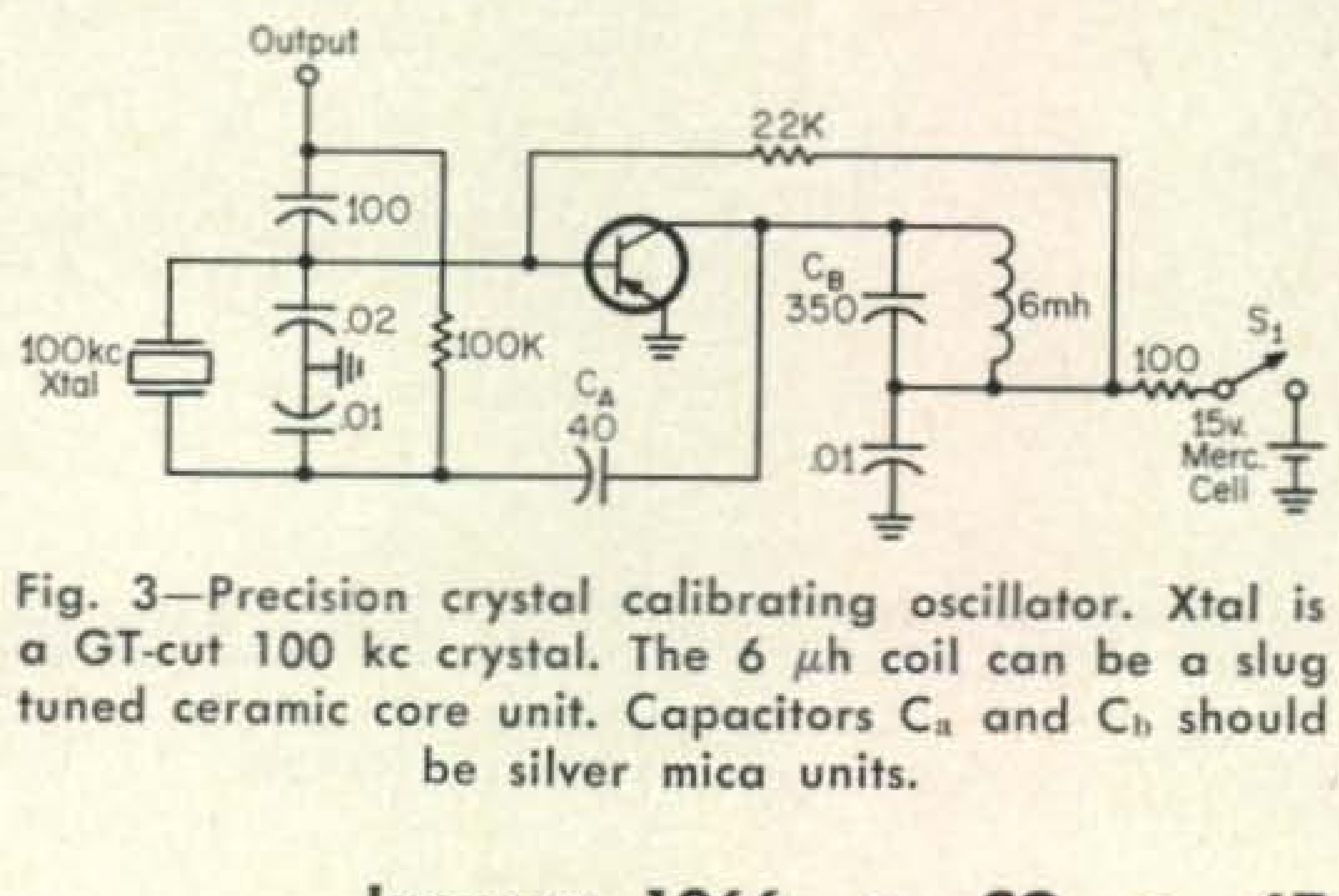


Fig. 3—Precision crystal calibrating oscillator. Xtal is a GT-cut 100 kc crystal. The 6 μh coil can be a slug tuned ceramic core unit. Capacitors C_a and C_b should be silver mica units.

transistor's collector cut-off current (I_{co}). The current should be low. Generally, if the meter reads higher than ¼ scale then the transistor is considered as too leaky. A full scale reading will indicate a shorted unit.

To check gain, sw is closed. When this is done the collector-emitter current flow is increased, the amount depending on the gain (beta) of the transistor. If a high reading is indicated this indicates a good transistor (if the leakage current is low). No current reading indicates that the transistor is open. Note that this checker is essentially a combination of the two in figs. 4(A) and 4(B).

To get a *rough* approximation of the beta of a transistor with the checker of 4(C), if the leakage current in the first test was zero or near zero, multiply the meter reading (on depressing sw) by 20. For example, if the meter reads 1.6 ma, this multiplied by 20 will give a "beta" of about 32.

In operating the checker *make sure* that the switch is in the proper position for either an NPN or PNP transistor. The circuit as shown is testing a PNP transistor.

Noise Limiter for Transceivers—"I own an SR-150 and a Swan 240, can you suggest a noise limiter that I can try in both of these sets? I use the Swan in the car and the 150 in my home shack. If possible I'd like something simple and solid state. Can you help me out?"

You might try the NL circuit given in fig. 5(A). This is a circuit that has been used with success by a number of hams and came to me through HB9ACN. The European version is shown in fig. 5(B).

The diodes must be chosen very carefully. The higher the back resistance, the better. The 1N626A was used successfully in the model I constructed, however, there is no reason why other good silicon diodes cannot be used.

Depending on the a.g.c. voltage available, the value of the resistor used to the a.g.c. line (shown is the 480K) may need adjusting.

When the unit is connected there may be a little loss of a.f. gain, but not much to worry about. Good luck.

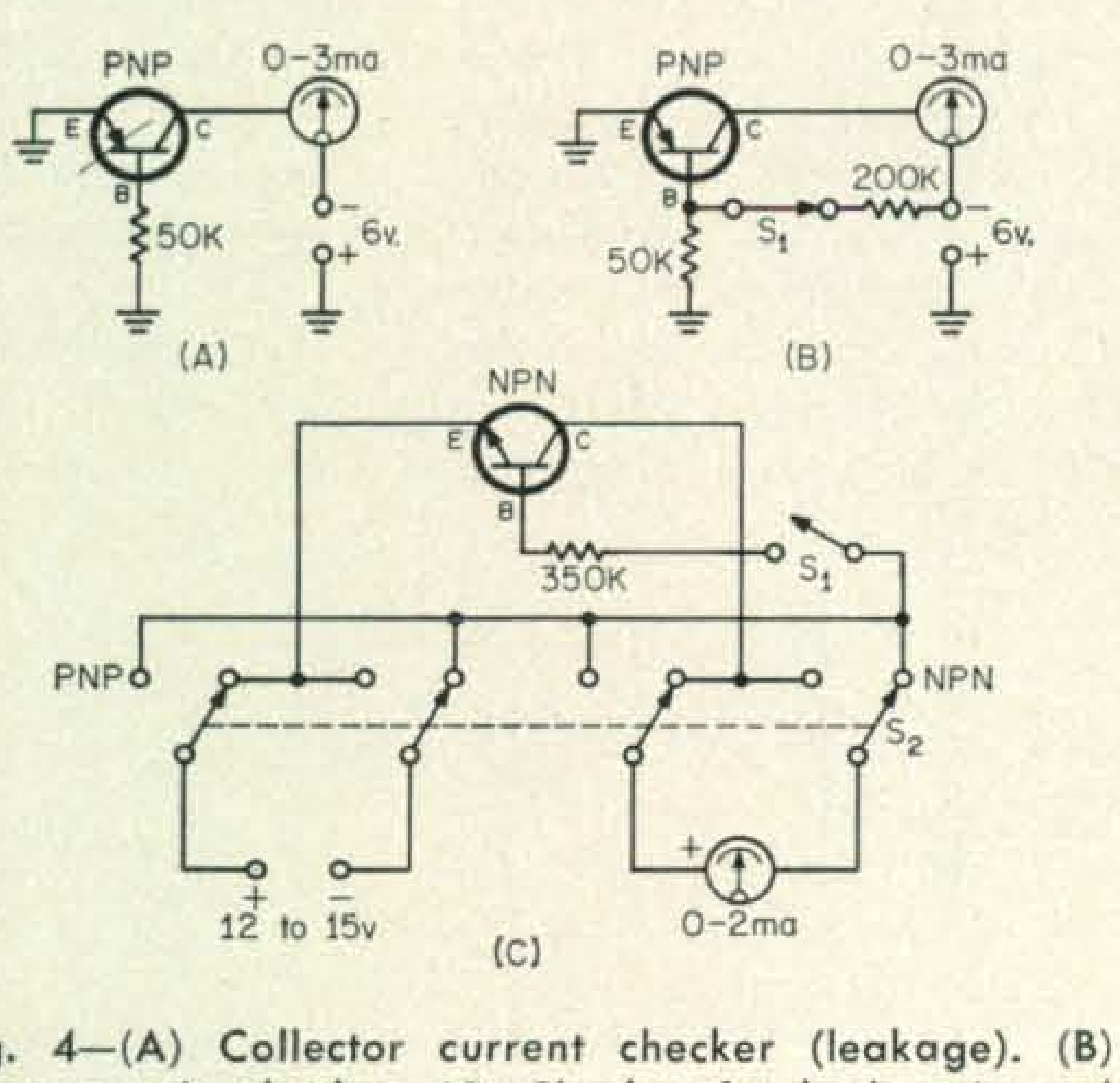


Fig. 4—(A) Collector current checker (leakage). (B) Beta or gain checker. (C) Checker for both gain and leakage. Only one socket needed as switch (4 pole 2 position rotary) changes polarity.

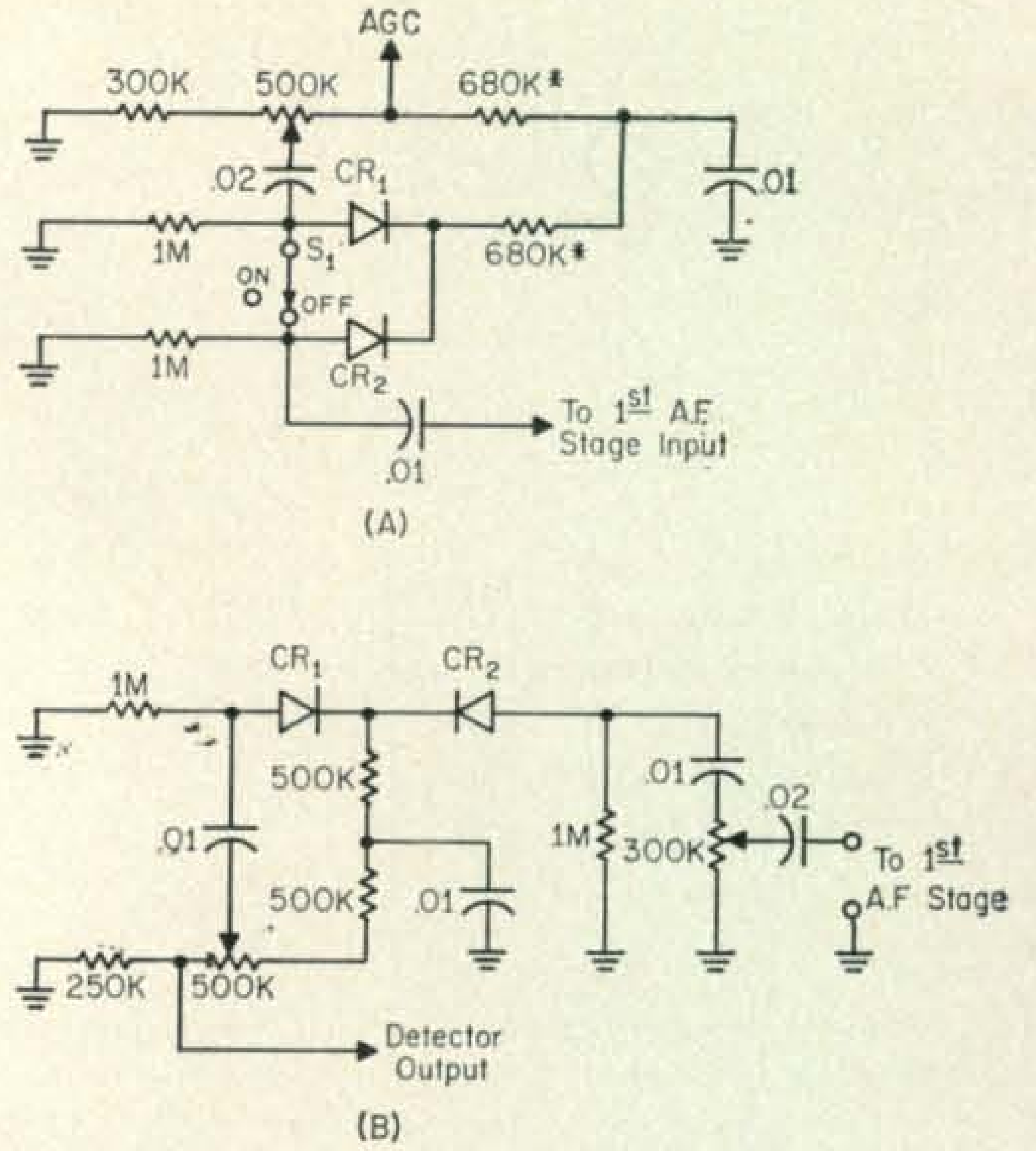


Fig. 5—(A) A practical noise limiter. Diodes CR_1 and CR_2 must be those described in the text. The 680 K* resistors may have to be adjusted for best results. (B) An effective noise limiter. Diodes CR_1 and CR_2 should be matched silicon types with extremely high front to back ratio.

Simple Signal Tracer—"I tried out your signal tracing oscillator described in the November 1965 issue of *CQ* and it works fine but can't you come up with one that uses no transformers?"

Sure. See fig. 6. This is a simple multi-vibrator type circuit that can be used for r.f. and a.f. signal tracing. The output is rich in harmonics and the fundamental frequency is around 800 cycles.

Mobile Tune-up Indicator—"Can you suggest a simple transmitter tune-up indicator for my mobile setup? What I'm looking for of course is something that I can either mount on the dash or have on the seat beside me that will indicate maximum r.f. output from my antenna. I've seen a couple of the gadgets around but don't know how they work. Can you help me?"

I think so. See. fig. 7. This field strength meter is self-powered. Enough r.f. will get in through the windows of the car to let you know when you are putting out maximum r.f. It is easy to make and can also be used as a "fox-hunt" receiver if you add a loop to it. Good luck.

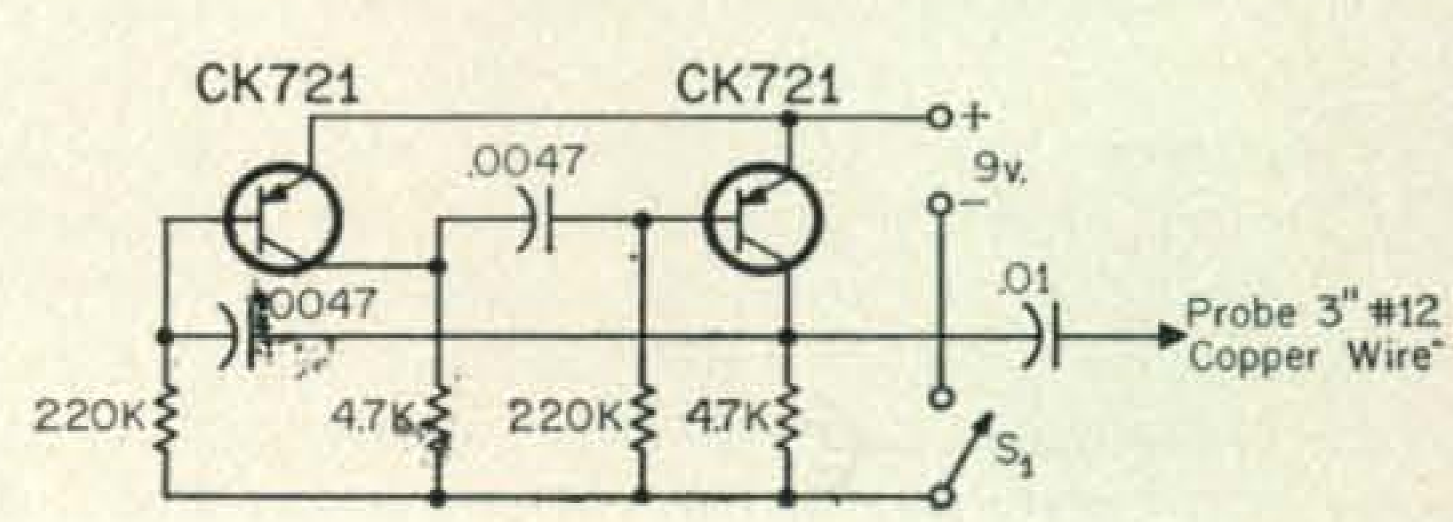


Fig. 6—Simple signal tracer. The whole unit can be mounted in a small can or plastic box. Transistors can also be types; 2N624, 2N370, AF102, or 2N1264.

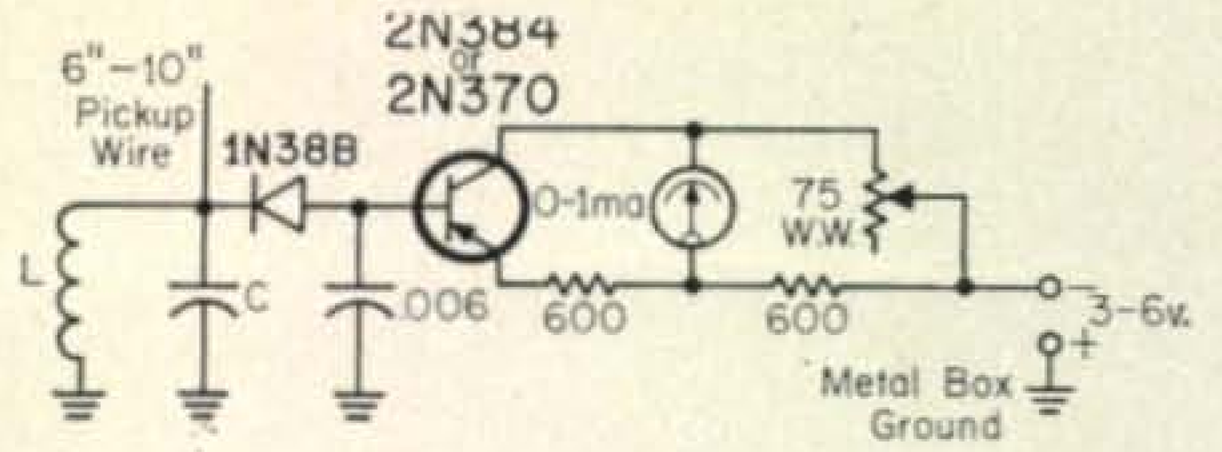


Fig. 7—A tune-up indicator for mobile or fixed use. Use coil and capacitor (L and C) to cover desired band.

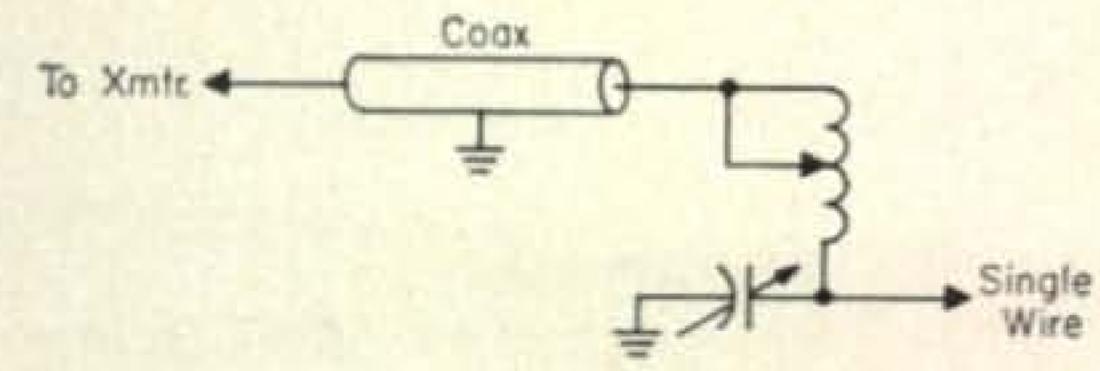


Fig. 9—A tuner for matching a single wire antenna to unbalanced transmitter output. See text for part values.

Vibrator Replacement With Solid-State—"It seems that I saw an article sometime back in 1963 in some ham magazine that gives the necessary information to make up a transistor switching device that will replace the mechanical vibrator used in some mobile power supplies. Can you tell me in which magazine the article appeared?"

Yes. See *Popular Electronics* for December 1963. The article you inquire about was the cover story. By the way TAB, 111 Liberty St., N.Y. 6, N.Y. has the "OZ4" for $1.75, the "5R4" for $9.00 both solid state, which can be used with the solid state vibrator replacement.

Transistorized S Meter—"I purchased an all-band transistorized receiver made in Japan but it does not have an S meter. I'd like to add one. Can you please help me?"

Yes. See figure 8. For Q_1 the following transistors may be used: 2N438A, 2N439A, 2N440A or 2N1304. For Q_2 you can use: 2N394A, 2N396A, 2N415A or the 2N416. Depending on the a.v.c. voltage available you may have to adjust the value of the input resistor (shown as 1 meg on the diagram). This circuit is easy to connect to any receiver and works very well. Any meter between 0-1 and 0-5 may be used.

Single Wire Feed for Transceivers—"When I take my SB-33 to the mountains with me I'd like to be able to use it with a long wire antenna already installed at my cabin location. Can you tell me how I can match the antenna to my transceiver without an elaborate or heavy antenna tuner?"

Yes. See fig. 9. This circuit enables you to match *any* single wire antenna to the low impedance (input-output) of your transceiver. The coil can be one out of a surplus command set and the capacitor can be of 250 mmf or so. Adjust the rotable coil and capacitor (preferably using an s.w.r. meter if you have one) for proper matching and maximum transmitter output. Incidentally, this circuit will work for mobile operation too.

YL Complaint—"The guy I am engaged to is a ham, an avid ham. Unlike other fellows when we take a drive he operates his mobile ham set instead of giving me any attention. When we are at his house he operates the station there. About the only time he notices me is when we dine out together or go to a theater. Tell me, what do I seem to be in for anyway? Ham radio is okeh I guess but it sort of leaves me a little cold. Sure, I think it is fun to talk to people but *all* of the time? I would appreciate your advice."

If ham radio leaves you cold and your husband-to-be is an avid ham my "crystal ball" tells me that you are going to be a bit lonely until the first child arrives. As I have said before, ham radio has its time and place. Compromise is a two-way street and I would advise you to let your man know *now* how you feel so you can *both* work out a solution. Some hams think everyone will like ham radio if exposed to it properly but this is not true. But there is one big point in favor of the ham however, when he is hamming at home you know where he is. Every man needs a hobby and so does every woman. By the way what is *your* hobby?

I.f. Feedthrough on the NCX-3—"I seem to receive a commercial station on 5200 kc with my NCX-3. Anyway to stop this?"

Yes. See fig. 10. Inclose the trap in a shielded can. Use regular coax connectors for input and output. For padding capacitor *C*, use three capacitors (1 kv disc ceramics in series) to give the value of 950 mmf. The exact value may have to be adjusted, along with the 50 mmf variable capacitor which is first set at half mesh. With the trap installed, tune the variable capacitor for maximum attenuation of the interfering signal. The trap does not seem to disturb the operation of the receiver/transmitter at all. Thanks National for the info.

A farther tip on the NCX-3: make sure that the antenna you use is resonant for the band in

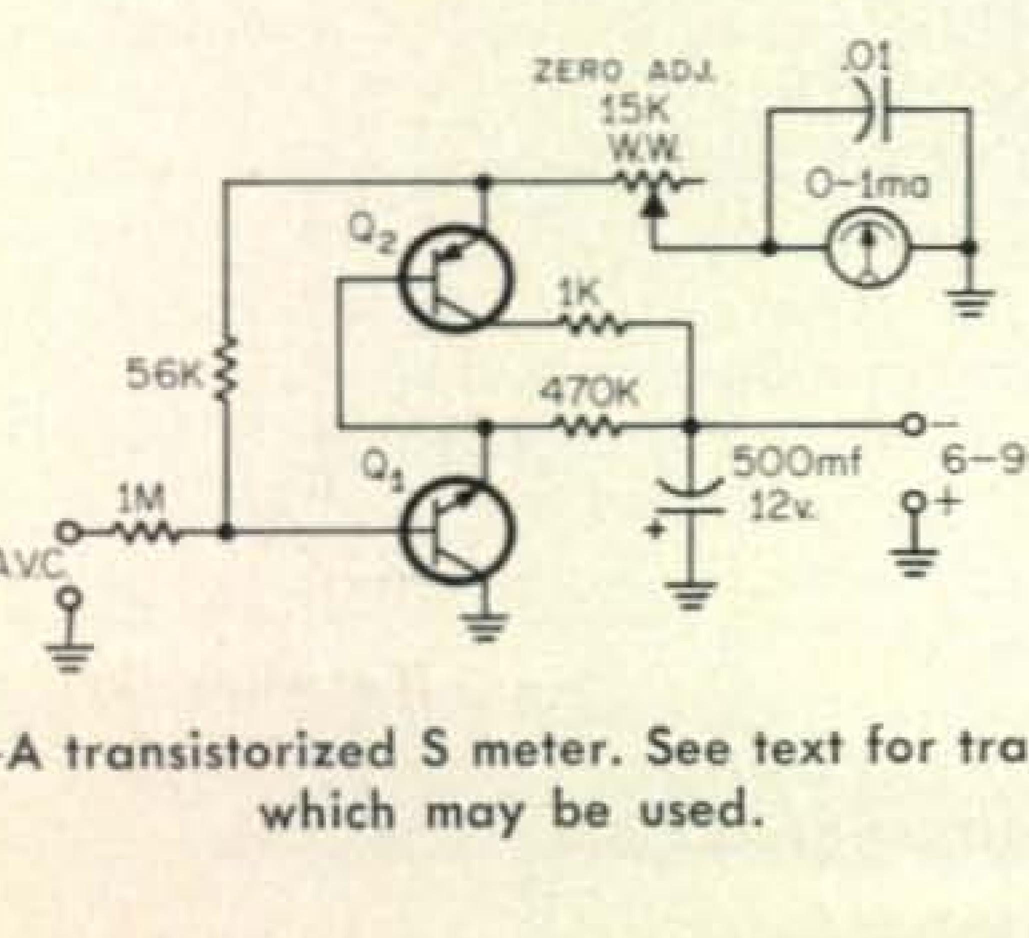


Fig. 8—A transistorized S meter. See text for transistors which may be used.

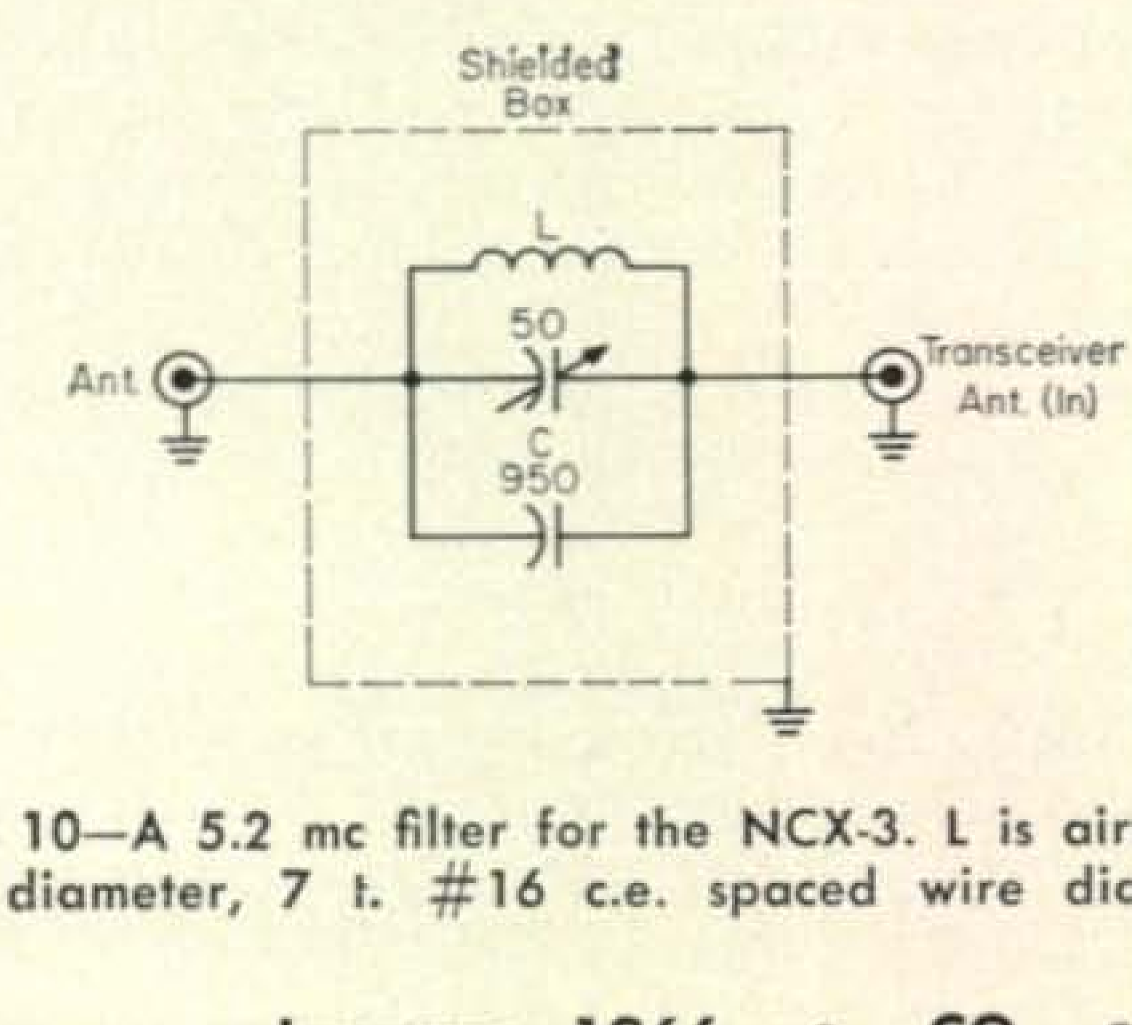


Fig. 10—A 5.2 mc filter for the NCX-3. L is airwound 1" diameter, 7 t. #16 c.e. spaced wire diameter.

use. If you have a high s.w.r. (and this applies to any other set) you *may* have i.f. leak-through.

ARC-5 on 2 Meter s.s.b.—"Back issues of *CQ* ever contain info on converting the ARC-5 for 2 meter s.s.b. operation?"

Yes. See the June 1959 *CQ*. Article extracts $1.00 from the editor of *CQ*.

APX-6 Source—"I want to obtain an APX-6 transponder and convert it in accordance with the Oct. and Nov. 1965 articles by K2ZSQ and K2UYH which appeared in *CQ*. Know of a source?"

Yes. Try Arrow Sales—2534 S. Michigan Ave., Chicago, Ill. They did have some for $7.95.

Smith Chart Circular Slide Rule—"Where can I obtain a professional Smith chart circular slide rule?"

Send $3.00 to Business Services Inc., Dept. CQ, Newton Road, PO Box 427, Danbury, Conn. The rule is a combination radio transmission line calculator and circular slide rule by Amphenol. The Smith chart calculator relates the series components of impedance at any position along open-wire or coaxial transmission line to the following: impedance at any point; standing wave amplitude ratio and attenuation. In addition, it makes possible the determination of voltage and current at any position along the line. The circular slide rule on the reverse of the Smith chart is equivalent to a 28¼″ straight rule. Nine common scales are provided: D, C, CI, A, K, L, T, S and ST. It *is* a honey.

Adding Bands to the HW-12—"I'd like to add a couple of additional bands to my HW-12. Can you give me detailed instructions for doing this? If not, where can I go for help?"

Time does not permit us to do personal design work for readers, unless there is a great demand and then the results are always published in the column. I suggest that you contact Dynalab Co. 215 Spencer Ave., Queens Village, N. Y. and ask about their kit for $39.95 which enables you to add two bands. I don't see how you could do it cheaper yourself. They also have kits for the same price for Heath HW-22 and HW-32 owners. Tell them HAM CLINIC made the suggestion.

CK-722 Replacements—"Tell me, what other transistors are now available to replace that old reliable CK-722?"

The following will replace the CK-722: 2N105, 2N283, 2N370, 2N371, 2N372, 2N373 and 2N374.

Potentiometer Noise—"The r.f. gain control in my receiver has always been noisy. I have replaced it twice and after a time the new pot got noisy too. I have used cleaner without results. What do I do?"

No doubt the type of pot you are using is at fault. A number of r.f. gain controls are connected in the cathode circuit of the 1st r.f. tube, they do handle some current. I suggest a higher wattage replacement, this may cure your trouble.

Ignition Noise—"Here's one for you. After completely suppressing everything I could in my car I still got noise when the car was moving

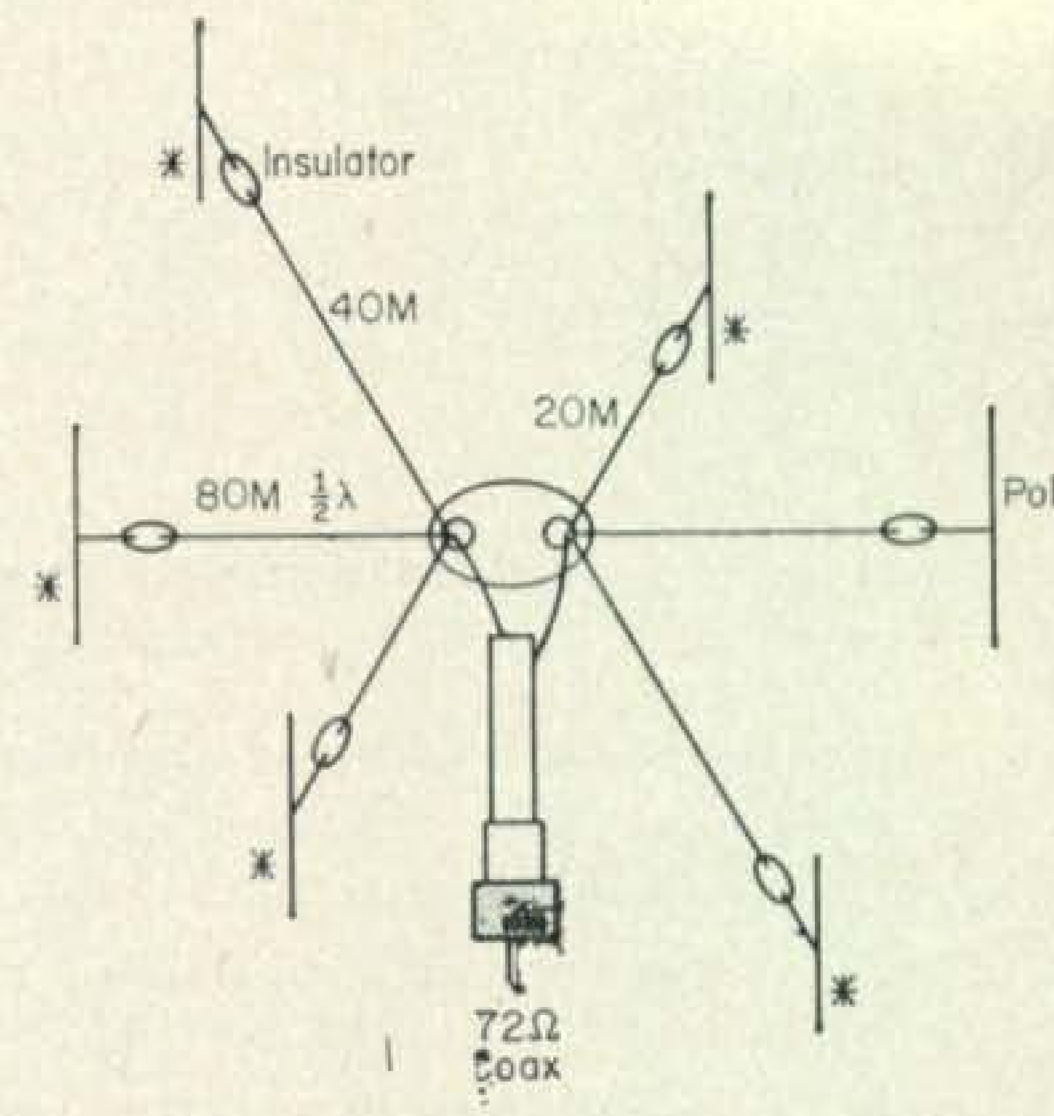


Fig. 11—A multi-band doublet mounted in a flat-top configuration.

forward. I noticed however, when I put the car in reverse and backed up, the noise disappeared. What's the solution?"

Bond your engine at its front and rear to the car frame and give 'er a try. A friend of mine F8PI had the same trouble with his 4CV. Make sure too that your exhaust pipe is bonded and not floating.

AN/ARC-1 Conversion for 2 Meters—"In what issue of *CQ* did information appear on converting the AN/ARC-1 surplus set for 2 meter operation?"

See the May 1960 *CQ*. Article abstract, $1.00 from the editor of *CQ*.

New FET Information—"Any new information on field effect transistors (FET) and their applications?"

Yes. Next month we'll *feature* some good solid information from Siliconix Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif. 94086. Incidentally, they are offering *two* FET's that normally sell for around $5.00 *each* for $2.75 postpaid with suggested applications. Siliconix evidentaly realizes that hams do experiment and that among them are many working engineers. Offering the FETs at a low price will no doubt turn up a large number of applications. To order your two FET's for the low price, direct your orders to the company at the address above, mention "ham offer" and HAM CLINIC. See this column next month for details on the FET and how it resembles the pentode vacuum tube, even to some design considerations.

Design Changes—"Tell me, why do some manufacturers make design changes to supposedly lab tested equipment a few months after introducing it? What are the considerations involved?"

As I have stated before in this column, manufacturers do *not* have control over components obtained from outside sources. Sometimes their source of supply fails and they must redesign around available components. Sometimes a better circuit refinement is discovered after the set is introduced and the manufacturer makes it available in the newest models—this is his prerogative. To make changes to any set costs

[*Continued on page 98*]

DX

BY URB LE JEUNE,* W2DEC

DON MILLER

To even the casual DXer, this name has a certain magical connotation. Indeed, with the possible exception of Gus Browning, I dare say that Don's name is the best known in DX circles. Anyone reading this without knowing of Don's exploits is, I'm sure, just passing through on his way to the VHF COLUMN.

Don, on many occasions in concert with K7LMU, has made the impossible almost commonplace. Not only has he managed to extract operating permits where all others have failed, but his operating proficiency defies belief. There is absolutely no question that Don is one of the finest operators in the world. His ability to overcome obstacles can be shown by the fact that he turned in the first legal operation from both Indonesia and Cambodia and added 3W8, 5W1, YJ, BY, HS and XZ for good measure. He has also activated two brand new DXCC countries, Spratly Islands and Cormoran Reef. To try and pin a pair of horns on Don might indeed be foolish, but that is exactly what I will try to do.

During the 1S9WNV (Spratly Islands) operation, some form of lunacy seized Don. During all but the last hour of the operation, Don absolutely refused to work a large group of stations. The one thing all these stations have in common is the fact that they are highly placed on the DXCC honor roll. There was no question that they were getting through. These stations don't hold their positions on the honor roll with peanut whistles. During the Cormoran Reef operation, these stations were not worked at all. The fact that these stations were entered in Don's log WITHOUT a two-way exchange shows that this was obviously done with premeditation for some purpose which Don has yet to explain as of this writing (mid-November).

We have all thought of operating a DXpedition station, the operating techniques we would use and how we would give the "big boys" a hard time. However, to ignore them completely is just plain dirty pool. The people of the honor roll are where they are because they have a combination of operating proficiency, good equipment, and have sacrificed much time. Everyone on the honor roll has missed countries on many occasions due to a variety of reasons, including being in the wrong place at the wrong time. But when one man chooses to reshuffle the honor roll to suit his own whims, this is poor sportsmanship and I will not be a party to it. The *CQ* SSB Honor Roll will accept no confirmations from Don's operations on Spratly Islands or Cormoran Reef or any other places where this practice is used in the future.

The reason most of us love DXing is that we crave the competition—the chase. Is it too much to ask to be able to compete fairly and honestly? Let's lose if we must, but lose without prejudice.

There have been many DXpeditions where the operator has traveled half way around the world at great personal expense, and, on many occasions, great personal danger, to give us the satisfaction of working a new one. In the future, I sincerely hope Don will see fit to follow in this tradition—the tradition of CEØAA, the HKØTU gang, Danny, VQ9HB, CR8AA, the Clipperton Island gangs, WØMLY and Gus, just to name a few. It's up to you Don.

SSB Honor Roll

W9WNV/8F3 pushed WØQVZ and K4TJL to 305 and W2TP to 304 . . . Les, G8KS, adds 18 with such goodies as CEØXA, VQ8AMR, W9WNV/XU, YK1AA, VS5LX and VQ8BFC to move to 298 and 300 SSB certificate number 12 . . . LA2QJ/P, PY2BZD/PYØ, and VK9JO Cocos, push Jack, WA2IZS, to 288 . . . Shel, K6CYG, added 48 to bring him to 252 . . . ZS6YQ is added to the list at 202.

In early April of 1965 Wallace Carpenter, K4TJL, submitted the last of the necessary cards to qualify for SSB 300. In a way in which only your editor can foul things up, I never issued the authorization. He should have received certificate number 6. I have issued him certificate number 5A so I don't have to make a complete mess of the system. Sorry for the inconvenience. Wallace.

Congratulations

Congratulations to Chuck Bolvin, W4LVV, editor of the *Florida DX Club Report* on his election as ARRL Southeastern Division Director. It's good to have another DXer on the Board.

New Stamp

Of interest to radio hams is the new U. S. 11 cent stamp commemorating the centenary of

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

*Box 35, Hazlet, New Jersey 07730.

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

CW-PHONE WAZ

2111	SM3BNV	Bengt Eurenius
2112	VQ8AI	Raoul Thomas
2113	WB2CKS	Andrew B. Bodony
2114	W6JNX	Norman D. Nash
2115	UA4KED	Radio Club Station
2116	UB5ND	Nikolay N. Emshanov
2117	DL6KK	Dr. Hans Werner
2118	VE3BCT	John W. Treskin
2119	DJØPN	Perry W. Esten
2120	JA8ADQ	Shigetaka Shishibori
2121	OK1KAM	Radio Club Station

ALL PHONE WAZ

317	VE3BCT	John W. Treskin

TWO-WAY SSB WAZ

347	UA4KED	Radio Club Station
348	VE8AH	Terry F. Keim
349	VE7MT	Bill Martin
350	OK1ADP	Frantisek Meisl
351	PAØLOU	Louis Van de Nadort
352	VE3BCT	John W. Treskin

CW WPX

687	K2GTF	Stephen Berens
688	YO7DO	Victor Vazian
689	UB5MZ	Edward Zilberman
690	OK3IC	Josef Surmik
691	W1DPJ	George E. Levensalor
692	K7CHH	Mike Churchill

SSB WPX

219	SM3BNV	Bengt Eurenius
220	PY2CTL	Luiz Piccinini

300 TWO-WAY SSB

5A	K4TJL	Wallace Carpenter
12	G8KS	S. L. Hill

200 TWO-WAY SSB

132	ZS6YQ	Bushy Roode
133	W4HUE	George A. Mack

100 TWO-WAY SSB

478	W4MVB	Jesse H. Morris
479	ZS6YQ	Bushy Roode

the International Telecommunications Union. It shows a map of the world with red interlaced wave forms and the letters ITU repeated in Morse code characters.

Here and There

CR4 Portuguese Guinea: Octavio, CR3AD, has been active around 2300 GMT on 14 mc c.w. *(Tnx LIDXA).*

CT3 Madeira Island: CT3AV, Fernando, is active on 20 s.s.b. around 1800 GMT. 14115 looks like his preferred frequency. Also CT3AQ on 21190 a.m. at 1600 GMT. *(Tnx LIDXA).*

EA9 Rio de Oro: From several different sources in Spain, I have received word that no less than two different DXpeditions will take place to Rio de Oro in early 1966. Keep your fingers crossed.

FB8X Kerguelen Islands: FB8XX should be operational on s.s.b. by the time you read this. A Swan transceiver was sent by F5AX. *(Tnx LIDXA).*

FC Corsica: F9UC/FC is active again, mostly weekends. Try 14080/90 kc around 1700/1800 GMT. *(Tnx WGDXC).*

FK8 New Caledonia: Yves, FK8BH, and Felix, FK8AC, are both QRV on 14 mc c.w. and s.s.b. *(Tnx VERON).*

WAZ and WPX

THE WAZ and WPX certificates are awarded by the *CQ* DX department. WAZ is issued for proof of contact with the 40 Zones of the world as shown on the official WAZ Zone Map. WAZ is issued in three classes, *i.e.* Any mode, all phone and all s.s.b. For complete rules, see the January, 1962 *CQ*, page 50.

WPX is issued in four classes, *i.e.*, all c.w., all phone, all s.s.b. and Mixed. The number of prefixes required are: C.w.-300; Phone-300; s.s.b.-200; Mixer-400. For complete rules, see January, 1962 *CQ*, page 52. WAZ applications, Zone Maps and WPX applications may be obtained from the DX Editor at the address shown at the head of this column. Please send a self-addressed, stamped envelope or a self-addressed envelope and an IRC. All applications should be sent directly to the DX Editor.

FL8 French Somaliland: Andre, FL8RA, active on 21065 kc listening 3 up. Try between 1700 and 1800 GMT. FL8MC also active on 14 mc c.w. various times and frequencies. *(Tnx LIDXA).*

HR Honduras: Gus, HR2GK, advises he operates the lower end of the US phone band daily, using an HW-32 and a TA-33.

KG6I Marcus: Chuck, KG6IF, on 14268-270 daily at 0030 GMT. *(Tnx LIDXA).*

TN8 Republic du Congo: TN8BK, Bernard, and TN8AA, Guy, both active on 15 meter a.m. around 1900 GMT. *(Tnx LIDXA).*

TT8 Tchad: TT8AE and TT8AB both active on 15 meter a.m. between 1800 and 1900 GMT weekends. Very limited English. *(Tnx LIDXA).*

UA1 Franz Josef Land: UA1KED is now active on s.s.b. around 14110. QSL via RAEM, Ernst Krenkel, Chaplig Str., 1-A Moscow. Logs are received only three times per year so please be patient.

VK9 Papua: Jim, VK9PL, has been very active between 1300 and 1500 GMT on 14140 listening 14220 and between 1000 and 1100 GMT on 21380/21400 kc. *(Tnx LIDXA).*

VKØ Macquarie: VKØTO has been reported on 7006 at 1015 GMT. *(Tnx LIDXA).*

YA Afghanistan: YA4A, (K4UTE), has gone QRT after more than 60,000 QSOs from all districts. Dick reports, via WGDXC, he may QSY to 6O6 land after a short stay at K4UTE.

ZD8 Ascension Island: ZD8LV on 21432 at 1800 GMT. *(Tnx LIDXA).*

ZS2MI Marion Island: ZS2MI is again active. Look for Wynand on 14234 around 1500 GMT. *(Tnx LIDXA).*

VK9 New Guinea: Jerry, VK9GN, is currently active on 14 mc s.s.b. around 0900 GMT *(Tnx VERON).*

VK9 Cocos Keeling: VK9JO now has a 15 meter beam up and holds daily skeds with KR6IL at 0000 GMT on 21350 kc. *(Tnx LIDXA).*

7G1 Republic of Guinea: Josef, 7G1A, is QRV at the following times and frequencies: 3505 or 3510 between 2200 and 2400 GMT, 7005 or 7010 between 1900 and 2300 GMT, 14050 between 0700 and 0900 and 15/1700 GMT, 21050 between 1200 and 1800 GMT. *(Tnx VERON).*

7Q7 Tanzania: The family of 7Q7PBD has returned to the UK and Peter promises to be especially active until he departs about April 1st. *(Tnx VERON).*

8Z4/8Z5 Neutral Zones: Les, G8KS, advises that he has not received the logs for the HZ1AT/8Z4/8Z5 operation of last April and May.

Awards

The Gateway Of India Award

The Gateway of India Award is sponsored by the Amateur Radio Society of India, Western Zone, in memory of the late Rev. R. Conesa, S.J., VU2SX, the founder and first secretary of the Western Zone. This attractive certificate is available to all licensed amateurs of the world.

This certificate may be claimed by working the following:

(a) Amateurs in Asia to work ten amateurs in the Western Zone.

(b) Amateurs in the rest of the world to work five amateurs in the Western Zone.

All contacts must have been made on or after November 9, 1957, the day on which the Western Zone was founded. There are no band or mode restrictions and there are no endorsements.

The present list of amateurs in the Western Zone, which comprise the States of Maharashtra, Gujarat and Kerala, and the Laccadive Islands, is appended below:

VU2s: AA, AE, AH, ATZ, AU, BH, CA, CG, CJ, CL, CM, CQ, CV, CY, DD, DM, DS, DW, DY, EEZ, EJ, EK, EW, FB, FP, GC, GD, GG, GH, GI, GJ, GP, GS, HA, HBZ, HP, HR, HS, JC, JDZ, JSZ, KD, KG, KJ, KTZ, KU, KW, LC, LI, LN, LWZ, MB, MD, MQ, MT, NAZ, NH, NP, OM, PA, PC, PT, PY, RD, RE, RI, RT, RX, SG, SL, SQ, ST, SX, TH, TKZ, TM, TP, TRZ, TV, UKZ, VA, VC, VHZ, VJ, VK, VM, VQ, WZ, XO.

Contacts with amateurs who have moved out of, or were temporarily in, the Western Zone are also valid for this award, provided their QTHs are clearly indicated on the QSL cards.

QSLs are not required. Send certificate list signed by another amateur or club official together with six IRCs to Dady S. Major, VU2MD, Awards Mgr., Petit Mansion, 85, Sleater Road, Bombay 7, India.

160 Meters

During the 100th anniversary of the International Telecommunications Union, 4U1ITU was activated on 160 meters. A strong vote of thanks is extended to John Gayer, HB9AEQ, HB9CM, G3OOH, HB9UD, OK1FY, and HB9AET for making this operation possible. The 4U1ITU operating frequency is 1827.5 kc. The antenna was an inverted Vee 70 feet at the apex. The rig is an HQ-170A and HX-50A. 156 QSOs with G, GM, GW, GC, OK, DL, OE, PA, HB, OH and VO were logged. W1BB/1 was heard but not worked. The station will be active on 160 again this season especially looking for North American contacts.

The Upper 5 kc: It is hoped this season that all W/VE/VO stations will refrain from operating in 1820-1825 kc segment during DX periods since the weak DX stations creep down as far as 1821 kc and cannot compete with our W/VE signals there. We feel sure the W/VE/VO 160 DXers will do this without any question. Additionally, it would be nice if each of us try to induce the phone boys and others in this segment of 5 kc to QSY below 1820 during DX hours. Sunrise-Sunset-0430-0730 GMT etc. This, of course, should be done in a nice way since we realize that everyone has an equal right to operate here if he so chooses, but most fellow Hams will be found cooperative if approached correctly and it could be explained that his applies primarily to the weekends. *(Tnx to W1BB for the above.)*

QTHs and QSL Managers

CP8AM	via K4GOX.
CR3AD	Box 205, Bissau, Portuguese Guinea.
CR6FE	Box 16232, Luanda, Angola.
CR9AI	Jose Maria Dr. Rodrigo Rodrigues 7, Macao.
DU1HR	Box 4083, Manilla, Philippines.
DU3PAR	PARL, 67 Espana Ext St. Quezon City, Philippines.
EL2AD	via K5SGJ.
FL8MC	via W7WLL.
FL8RA	Andre Rotger, B. A. 188, Djibouti, French Somali.
FR7ZD	Box 600, Tampon, Reunion.
GC8HT	R. H. Taylor, La Coeur de Longue, Rue des Issnes, St. Saviours, Guernsey Is., England.
HB9XCU/M	via I1RB.
HI8XPS	via K7EPE.
HR1HZY	via WA5CNP.
HR2GK	Gustav Kuether Apartado 17, San Pedro Sula, Honduras.
I1RB	after March 1st, 1965 via DXpedition of the Month, GPO Box 7388, New York, N. Y., 10001.
I1RB/IS1	GPO Box 7388, New York, N Y. 10001.
I0FGM	via I1BER.
ex-KA5ZS	Lt. Col. Zane Sprague, USMC H & HS-1, MWHG (G-4), First MAW C/O FPO, San Francisco, Calif.

KG6IF	via W6ANB.	**VK9GN**	Box 73, Ukarumpa, Territory of New Guinea.
KJ6DA	via WA6OET.		
KR6HZ	via K8AAG.		
KR6JZ	via W2CTN.		
KV4CF	via K3AHN.	**VK0KH**	via VK2AGO
LA5CI/P	via LA1NG.	**VP1HB**	via VE3ACD.
LU7ZA	via LU4DMG.	**VP1JKR**	via VE3ACD.
LU7ZC	via LU4DMG.	**VP1LB**	via VE3ACD.
M1N	via K5JLQ.	**VP1WH**	via W6SHC.
MP4TBO	via VE1AKZ.	**VP2AC**	via K1IMP.
OA4U	via K5ABV.	**VP2GL**	via W5QMJ.
OE9ZUH	via G2DHV.	**VP2KD**	via VE3ACD.
OK1ADM	via K4ZJF.	**VP2SY**	via K1IMP.
ON5ZQ	via G2DHV.	**VP2VD**	via W4PJG.
ON8IR	via G2DHV.	**VP5AR**	via WA8GUA.
PZ1CM	via W2CTN.	**VP8HJ**	via W2CTN.
SV0WFF	via K7UCH.	**VS9AFR**	Ron Ford, 47th Royal Dragoon Guard, B.F.P.O., London, England.
SV0WOO	via K0GVB.		
VK2APK	via W4MVB.		

[*Continued on page 105*]

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

January	8-10	Arkansas QSO Party
January	22-23	Virginia QSO Party
January	**29-30**	**CQ WW 160 DX**
January	29-30	Louisiana QSO Party
January	29-30	R E F C.W.
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.

Arkansas QSO Party

Starts: 2200 GMT Saturday, January 8
Ends: 0400 GMT Monday, January 10

The North Arkansas Amateur Radio Society of Harrison announces its first Arkansas QSO Party.

Use all bands and modes. The same station may be worked once on each band and each mode. And there is no time limit or power restrictions.

Exchange: QSO number, RS/RST and QTH. County for Arkansas stations and state, province or country for all others.

Scoring: Arkansas stations: 1 point per contact and multiply total by the sum of states, Canadian provinces and foreign countries worked. Out of state stations: 5 points for each Arkansas station worked and multiply total by the number of Arkansas counties worked.

Awards: Certificates to the highest scoring station in each state, Canadian province and foreign country. And also in each Arkansas county. (A minimum score of 100 points required for an award.)

Frequencies: Suggested spots are: c.w.–3525, 7025, 14025, 21025, 28025. a.m.—3825, 7225, 14225, 12325, 28560. s.s.b.–3975,7275, 14325, 21425, 28650. Novice—3735, 7175, 21110.

Logs must be postmarked not later than Jan. 30th and they go to: North Arkansas Amateur Radio Society, c/o Don Anderson, WA5GVG, 508 North Robinson, Harrison, Arkansas.

Virginia QSO Party

Starts: 1800 GMT Saturday, January 22
Ends: 0200 GMT Monday, January 24

All amateurs are invited to join in the Virginia QSO Party sponsored by the Roanoke Valley Amateur Radio Club. Besides contest certificates, this party also offers an opportunity to earn credits for the Old Dominion County and the Virginia Civil War Centennial and the USA-CA awards.

Use all bands and modes. The same station may be worked once on each band. There is no time limit or power restrictions. C.w. and phone will be considered separate contests, therefore separate logs must be submitted. (No distinction between a.m. and s.s.b.)

Exchange: QSO number, RS/RST and QTH. County for Virginia stations, and state, province and countries for all others.

Scoring: 1 point per QSO. Virginia stations multiply their QSO total by the sum of states, provinces, countries and Virginia counties worked for their final score. Out of state stations multiply their QSO total by the number of Virginia counties worked.

Awards: Certificates to the highest scoring station in each state, Canadian province and foreign country. Virginia stations will compete for 1st, 2nd, 3rd, 4th and 5th place certificates.

Frequencies: Suggested spots are: 3575, 3830, 3930, 7030, 7205, 7235, 14070, 14250 and 14340 kcs.

Logs must be received not later than March 1st and they go to: Roanoke Valley Amateur Radio Club, P.O. Box 2002, Roanoke, Virginia.

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.

Rules are the same as last year with one additional paragraph, #7 which pertains to disqualification for violation of rules and regulations and duplicate contacts in excess of 3 per cent of the total made. See last month's CALENDAR.

Although most of the activity will be confined to state side contacts the DX is there if you dig for it. W2EQS figured that 28 countries participated in the last one, and conditions were not at their best.

You will find most of the DX in the 5 kc, between 1825 and 1830, although you might be able to dig some of it out of the 1800 to 1825 mess. The West Coast stations will be found at the high end of the 1975 to 2000 kc segment and you can work them cross-band. The other two segments don't get much of a play but its

*14 Sherwood Road, Stamford, Conn. 06905.

worth a try, especially on a preset schedule. When working cross-band always indicate where you will be listening. It is highly recommended that you study the FCC regulations for 160 on this page. And be careful of out of band operation, you not only cover up the DX but leave yourself open to disqualification. The FCC will be monitoring the contest this year.

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

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

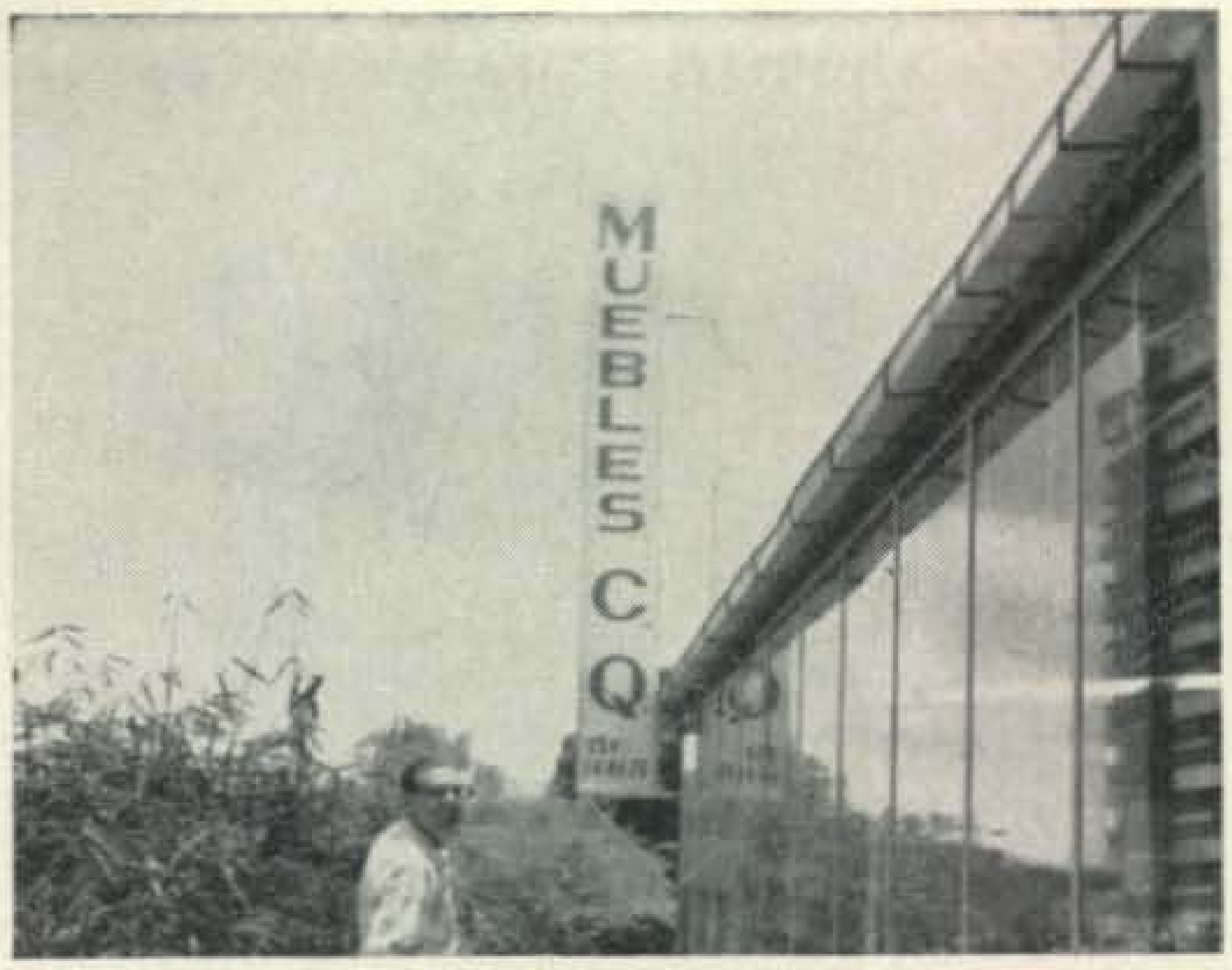
Mailing deadline for your logs is February 28th and they go to: *CQ*, Att: 160 Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

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

Louisiana QSO Party

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

Rules for the first annual Louisiana QSO Party were covered in last month's CALENDAR.



What's this, CQ has gone into the furniture business? That's what the sign says on a store in Caracas, Venezuela.

Mailing deadline for logs is February 28th and they 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.

The French insist on hanging on to their old contest dates, even though the suggested change would have been a big improvement. *C'est La Vie.*

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

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

[*Continued on page 104*]

CLAIMED SCORES
CQ W W Phone DX 1965

Single Operator All Band

I1BAF	808,572
OD5BZ	628,056
W6ITA	372,690
K1HVV	239,430
PJ2CR	200,604
K3BNS	181,800
K4SHB	177,656
5X5IU	155,077
KR6DB	152,358

28 mc

CX2CN	33,201
WA4WIP	6,512
K9BTU	1,980

21 mc

DJ1ZG	112,216
CR6DX	101,158
W1RIL	88,889
KH6AHQ	64,324
YV5AST	56,965
W4HKJ	56,508
K9PPX	45,924

14 mc

YV5BQF	354,322
VE1TG	144,343
KA5ZS	140,910
W1JYH	122,100
KA2RJ	121,152
DJ7VY	76,626
ZS4JB	72,459
W7TDY	55,088

7 mc

JA1ADD	3,542
W4RLS	3,204

3.8 mc

YV5BTS	14,784
W1AQH	9,000
PJ3CD	4,560
K6BPR	1,971
SM6CRA	1,080

1.8 mc

GW3PMR	360

Multi-Operator Single Transmitter

WA6IPY	252,056
DL5FL	162,626
KG6SZ/KC6	109,935
KL7WAH	65,604

Multi-Operator Multi Transmitter

OH5SM	842,634
W3EQA	88,416

THE VHF COLUMN

BY BOB BROWN, K2ZSQ
AND ALLEN KATZ, K2UYH*

All ardent VHF column fans will recognize that traditionally this is the month we unveil our plans for the coming year. Unfortunately, since our literary epics stream from the typewriter a good two months before reaching print, we find ourselves in a rather embarrassing situation.

What we are talking about is WA4LTS's suggestion in November *CQ* that we undertake the awarding of certificates honoring individuals for outstanding performance on v.h.f. each year. If you will recall, response was requested by the readership on this one, our decision pending the QSL results. And now that issue is just beginning to hit the mails. Alas. Perhaps next month we can have something positive for you in this department.

Last year was certainly an innovating one for us and the v.h.f. world in general. Moonbounce communication truly came to the forefront, ham TV prospered satisfactorily, six and two meter population advanced better than was expected, f.m. techniques began to make their own mark on the world above 50 mc, and satellite communications continued to highlight the overall picture.

On the lonely front, your columnists suffered through another year of mill-pounding (as differentiated from brass-pounding) amid a flurry of letters and phone calls on such earth-shattering subjects as "What rig should I buy," "What's the *real* scoop on Oscar?" "Who do I contact for information on 432 mc color TV QSO's?" "Who's in Uranga County on 1215?" and a few "Is Allen Katz for real?"

So it was another year of "Buy what *you* think is best," to "Yes, Virginia, there is an Allen Katz."

But enough of 1965. Perhaps the new year's letters will be better.

Century Club Rules

The requirements for earning *CQ*'s VHF Century Club Certificates are actually quite simple:

1. Awards are issued to those holding the required number of QSL cards confirming contacts all made on a *single* v.h.f. band within *any* one 365 day period.
2. On 50 mc, 150 QSL cards are necessary; on 144 mc, 100 cards; on 220 mc, 25 cards; on 432 mc, 13 cards. See reference in column.
3. Separate entries must be made for each award; there is no limit to the number of certificates you can earn provided proper application is made for each.
4. Official application forms are available free of charge from *CQ*. Drop a card to: VHF Century Club, *CQ*, 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050.

Certificates are individually numbered for classification purposes and are issued by band operated. All CCC's bear the cherished autograph of esteemed *CQ* editor, K2MGA.

No Additional V.H.F. Contests

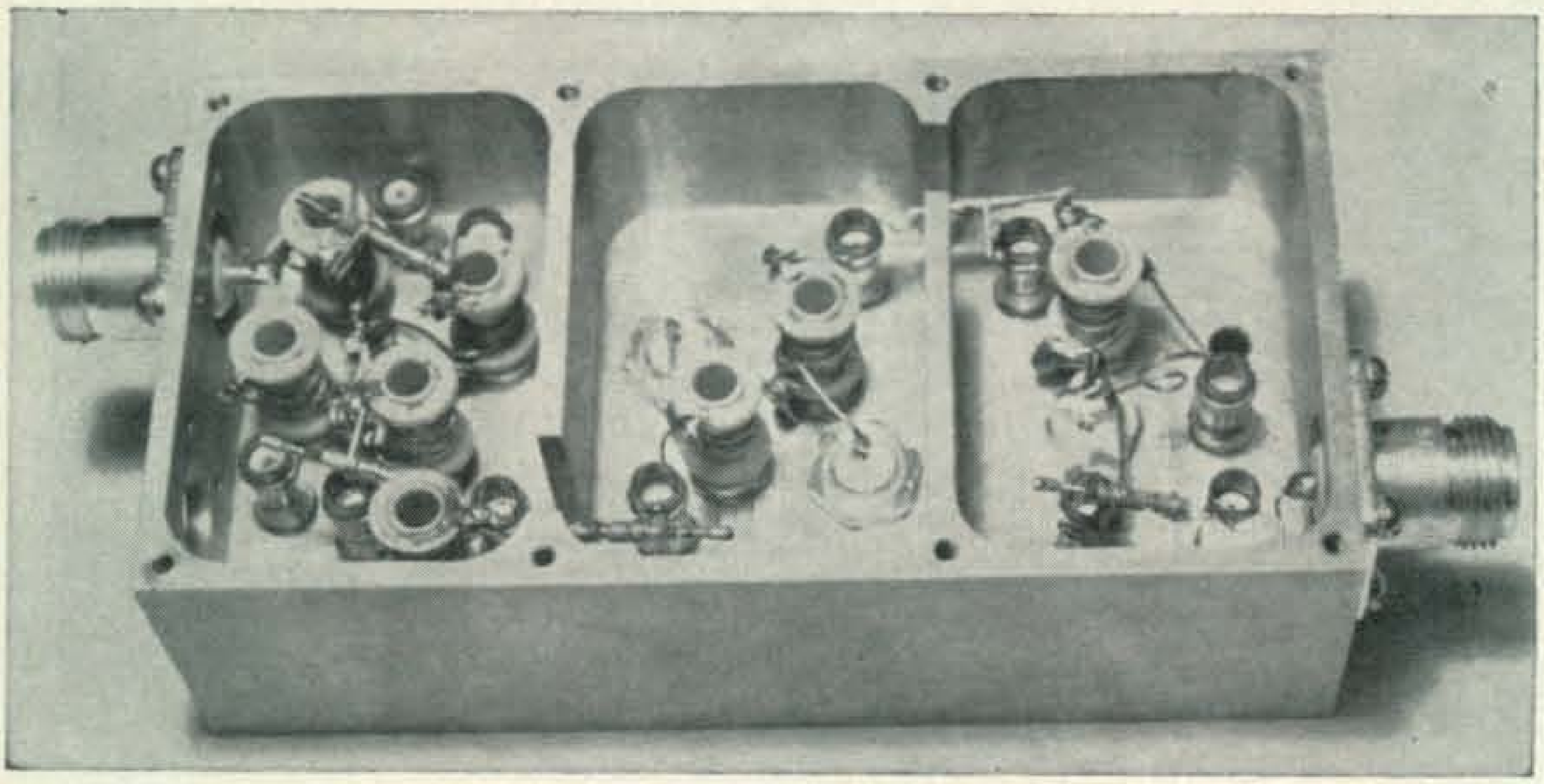
This year we plan no more contests than we ran last year, only different.

Which amounts to our May contest falling in August and the August contest going back three spaces.

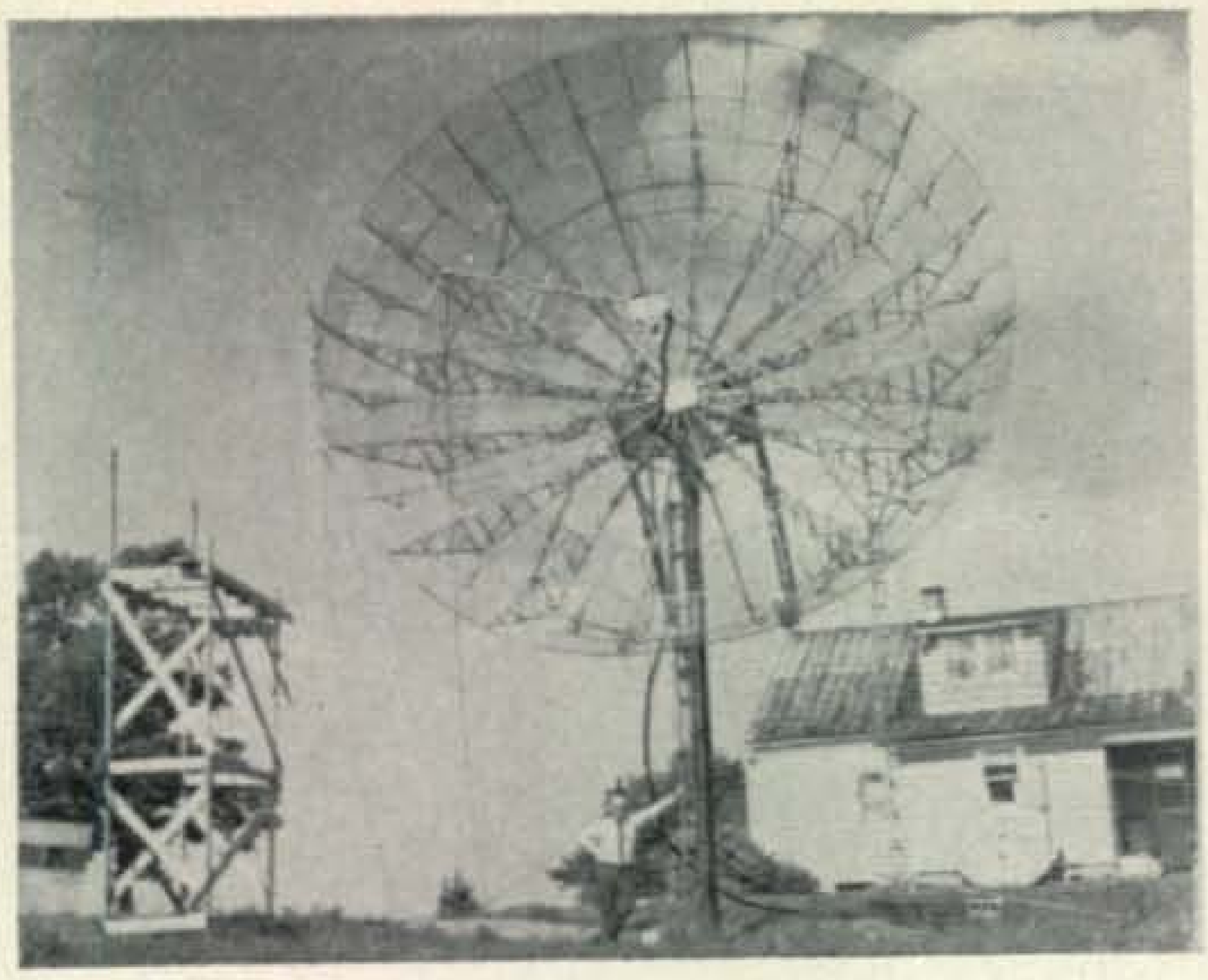
With that out of the way, here's how the contest picture looks for the coming year:

May 7–The *CQ* 12-hour V.H.F. Contest has been rescheduled for the first weekend in May

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



W1FRR's double-tripler for 144 to 1296 mc operation. Requires only 15 watts of two meter drive. See fig. 2.



Here's the W3SDZ end of the Sept. 25 u.h.f. DX fun. He extended the diameter of his 20′ dish between July 3rd and July 24th to catch KP4BPZ even better the second time around. This is the 27′ version used to QSO WA6LET.

(following our "first weekend" tradition), since this month is still within the realm of club participation. There'll be club aggregate listings, Novice awards—the whole gamut—same as last year. Hours: 9 A.M. to 9 P.M. local time. Flip back to July *CQ* and have your group begin making plans now.

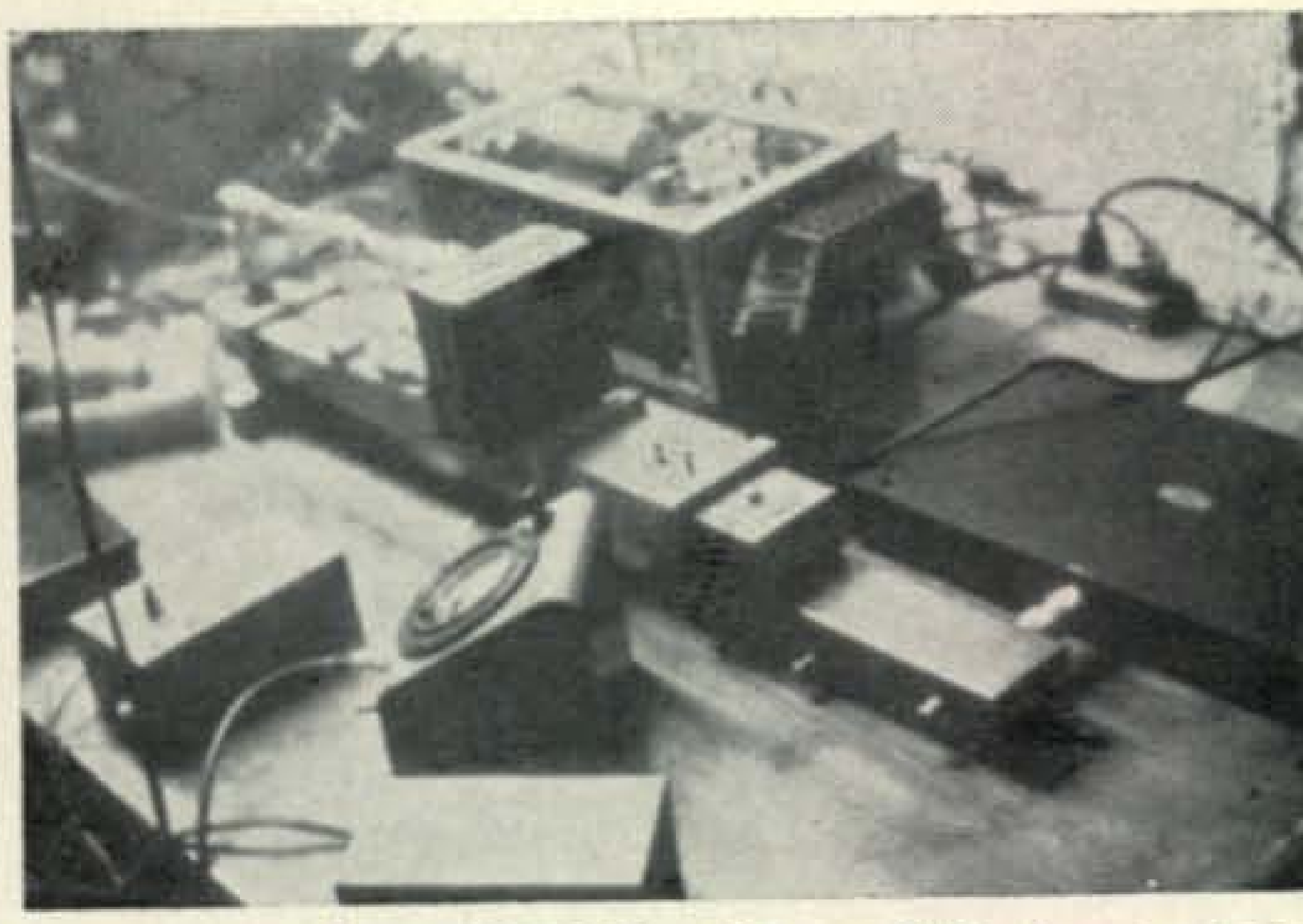
August 6 & 7—The Big One. The famous *CQ* Summer V.H.F. Contest, the marathon noted for contributing to the demise of WA2LRO, will happen on the first weekend in August. Special multi-operator awards will be made this year, as will the continuation of Novice presentations. Rules same as last year, see April *CQ*.

A Visit To W2CCY

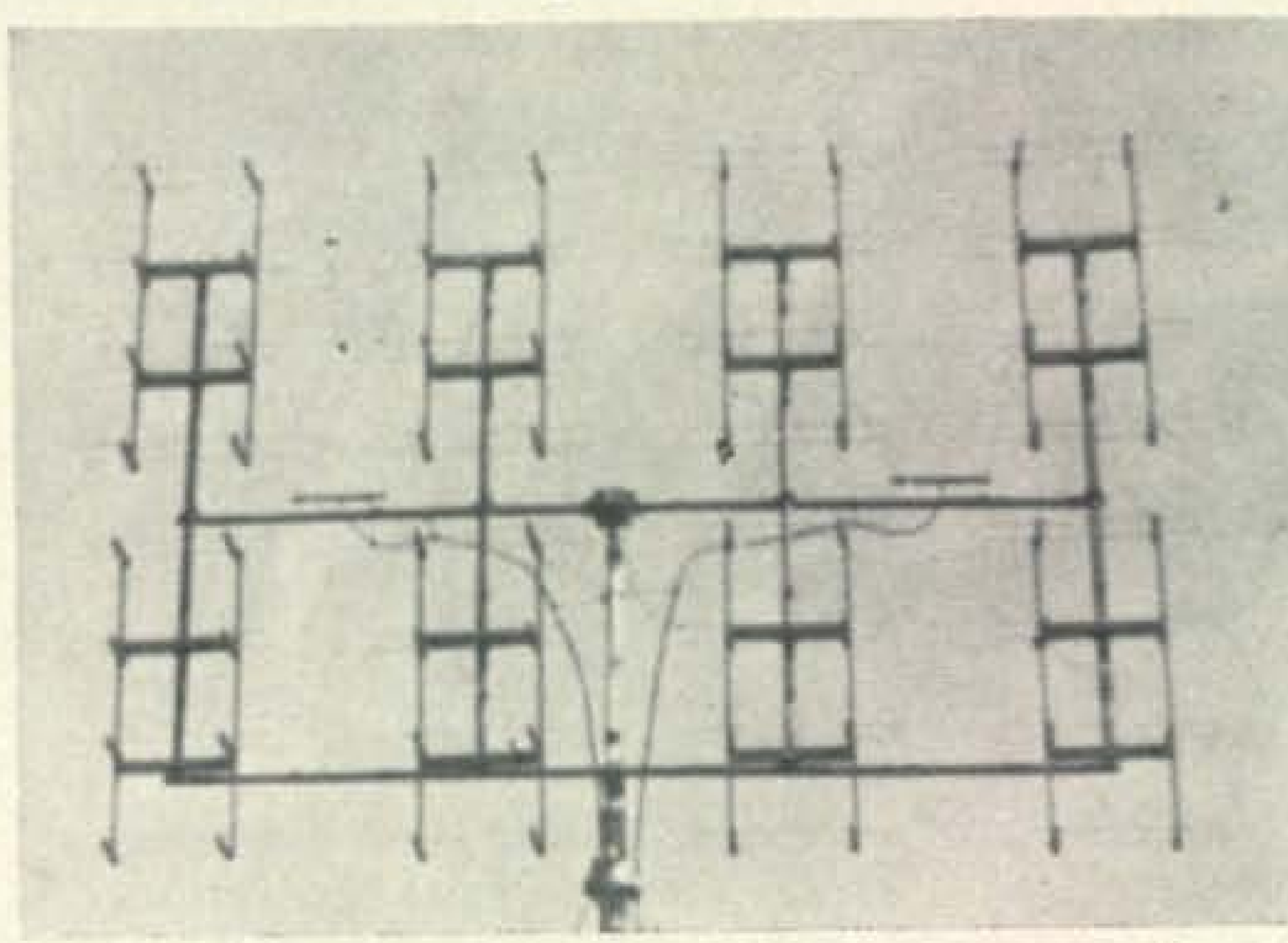
This writer (K2UYH) does not normally have much spare time, but one shack which I had to see was that of Cliff Schaible, W2CCY. So, one Saturday morning not too many weeks ago, I found myself headed for Morristown, New Jersey.

Most people's picture of a moonbounce station is rather grandiose with many racks and large parabolic antennas. Cliff's setup is anything but this, yet he has worked both Puerto Rico and California via 432 mc moonbounce. It is a *true* "amateur" operation. His antenna is not a parabolic reflector, nor even a large collinear: just four 13 element yagis making a package 6′ × 6′ × 8′. Not much larger than the average six meter array and considerably lighter. They are the same type yagis as described in the Orr-Johnson *V.H.F. Handbook*. Yagis, we might add, whose performance on 432 mc has been so often questioned. Apparently someone knows how to make them work up there! Cliff does not claim the full theoretical 23 db gain (he believes it is about 19 db), but they must be doing something right.

The antenna is rotated in the asmuth direction by a conventional CDR AR-22 rotator and tilt is accomplished by an ingenious homebrew method. The array is mounted on a large hinge.



Here's a peek at W2CCY's 432 mc 200 degree noise temperature parametric amplifier. Small square box in center contains a crystal-controlled 4 kmc pump!



Here's a fuzzy glimpse of K2ACQ's 128-element collinear array for 432, partly responsible for Doug's working 36 new stations during 1965 (21 of which are over 200 miles away).

It was an enthusiastic audience that listened at Syracuse to Hank Cross's (W1OOP) talk on moonbounce communications. (Photo by K2AVA).

So who says you need a dish? This is W2CCY's 432 mc moonbounce array, consisting of four 8′ 13-element yagis stacked in a 6′ square configuration for a total of 20 db gain. Small tube barely visible in center on box is CCY's unique "sun detector."

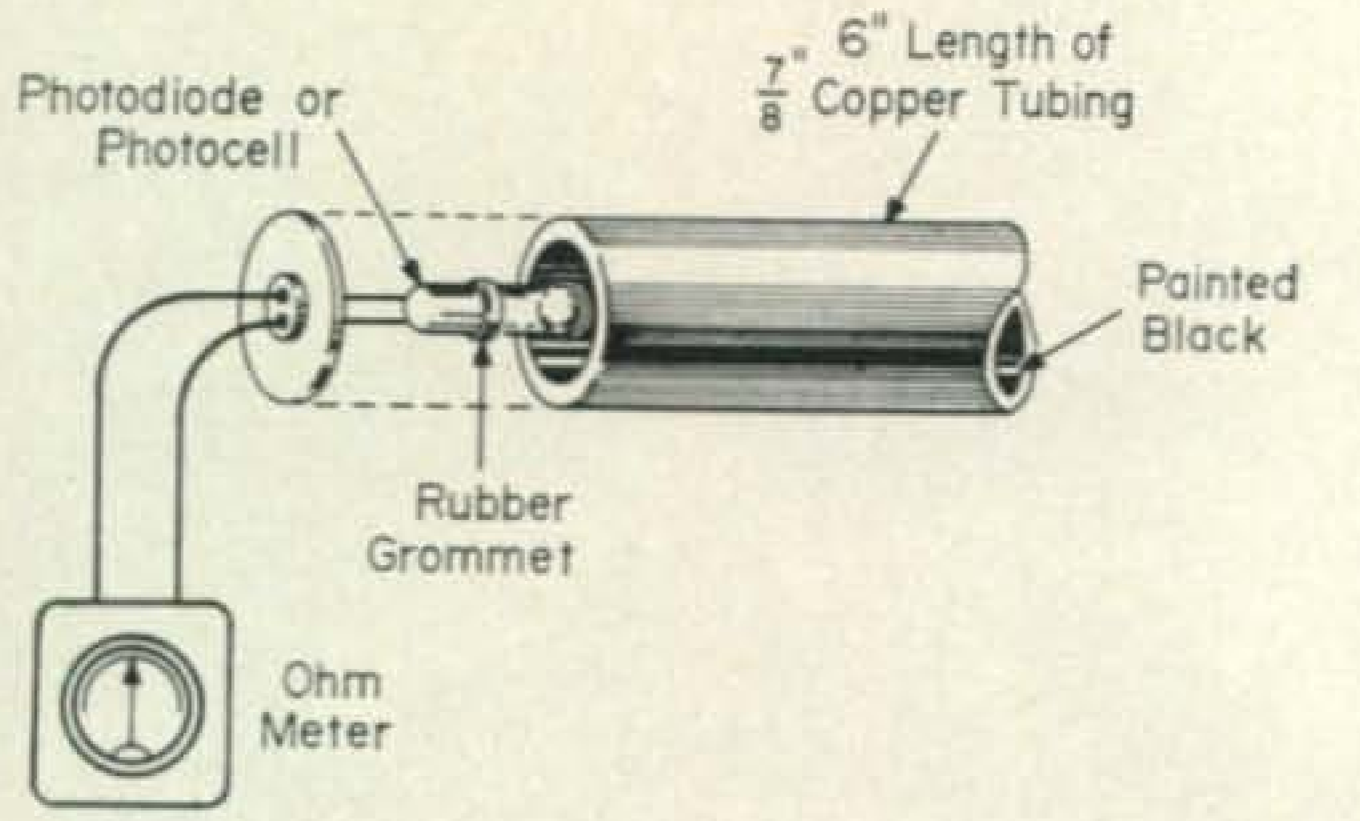


Fig. 1—Sun detector used by W2CCY to calibrate his antenna's tracking system.

The hinge is normally held closed by a spring. This keeps the antenna in a horizontal position. The free side of the hinge is connected to a cable from a small d.c. motor. When the antenna is to be tilted, Cliff starts the motor, which winds up the cable pulling the hinge apart. Thus the antenna can be tilted to any angle desired. Position indication is provided by syncronous motors.

Cliff has one strapped to the boom with a pendulum attached to its shaft. This approach avoids a lot of gears and mechanical couplings.

A particular handy device used by Cliff to check the accuracy of his antenna is a small tube and photo diode (see fig. 1) mounted in the antenna. When the antenna is pointed directly at the sun, the diode will conduct. This enables him to compare the known coordinates on the sun with the direction he thinks his antenna is pointing.

Cliff at present operates only 432 mc. This fact adds considerably to the compactness of his shack. The transmitter is completely housed in a single rack, and consists of a two meter exciter driving a varactor tripler, to a 4X150 amplifier, to a pair of 4CX300's running a kw on 432 mc. His receiver consists of a parametric amplifier (his pride and joy) (having a 200 degree kelvin noise figure) and driven by a crystal controlled 4 kmc pump. It is to this he attributes his moonbounce success. The rest of the receiver is standard except for the fact that the converter is in a semi-breadboard state for which he apologizes. Cliff has big plans for the future which include a larger yagi array and more moonbounce operation. We hope to be hearing of more stations like that of W2CCY now that he has proved that moonbounce can be truly "amateur."

Moonbounce Tests

The Crawford Hill V.H.F. Club, well known for their success at communication via Oscar III (worked all U.S. call areas) and participation in past moonbounce tests, recently scheduled some tests of their own. All stations equipped for this kind of operation were notified to listen for K2MWA/2 during the early morning hours of Saturday, October 17 and Sunday, October 18. Two QSO's resulted with W1BU and W1HCT/1. The signals of W3SDZ and W9HGE were also heard. Upon tapes we have here of the evening's activities, W1BU could be made out clearly sending CQ. Equipment at K2MWA/2 consisted of a 350-watt output transmitter, 2 db parametric amplifier with circulator feeding a converter and h.f. receiver, and a 60 foot parabolic antenn (37 db gain). Here is how they reported the tests.

"All stations noted above were heard on both dates and could be copied with some difficulty. W3SDZ and W9HGE both acknowledged reception of K2MWA but at a very marginal level.

"Radar echoes at K2MWA were very good and estimated at about 6 db above noise peaks. Of particular note was the QSB on the weak moonbounce signals which produce the false effect of keying and is the primary source of difficulty in copying. This effect is typical of multipath fading to be expected during moonbounce communication.

"A radiometer detection technique (weak signal integration detection) we had planned to use was not employed for several reasons. A careful bench test of the available equipment indicated that the minimum detectible signal was on a par with the audible threshold.

In addition the receiving system suffers from frequency and gain instabilities of such a mag-

[*Continued on page 102*]

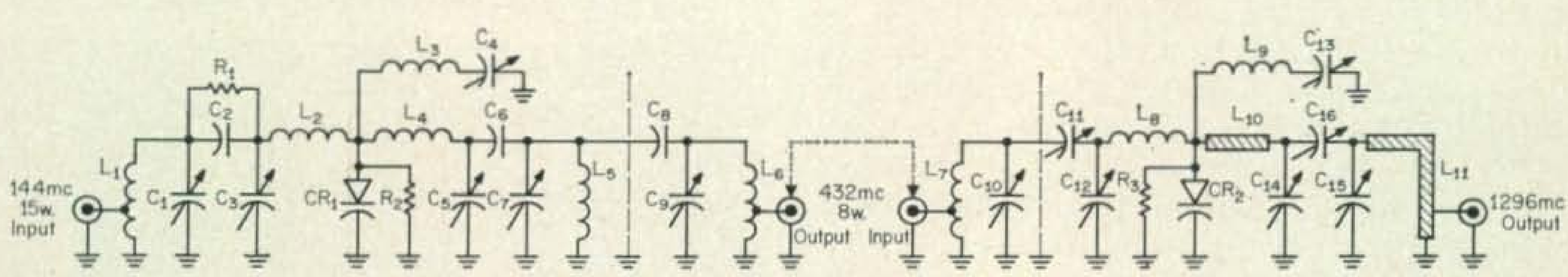


Fig. 2—W1FRR's varactor configuration for 144 to 1296 mc operation. Drive required, approximately 15 watts.

C_1, C_3—1-10 mmf
C_2, C_6, C_{11}, C_{16}—.5-3 mmf
C_4, C_5, C_7, C_9, C_{10}, C_{12}, C_{13}—1-8 mmf
C_{14}, C_{15}—1-5 mmf
CR_1—varactor diode. 20 mmf at 80 v. to 30 mmf at 150 v. Rs—3 ohms max.
CR_2—varactor diode. 8 mmf at 60 v. to 15 mmf at 120 v. Rs—4 ohms max.
L_1—6t. #20e. 3/8" dia. tapped 2t. up.
L_2—6t. #20e. 3/8" dia.
L_3—4t. #20e. 3/8" dia.
L_4, L_5, L_8—3½t. #20e. ¼" dia.
L_6, L_7—3½t. #20e. ¼" dia. tapped 1 t. up.
L_9—1 t. #20e. airwound.
L_{10}—¼" × 1" strap.
L_{11}—¼" × 1" strap soldered across J.F.D. VC20.
R_1—10 K
$R_{2,3}$—20 K

Propagation

BY GEORGE JACOBS,* W3ASK

THE following is an overall picture of h.f. band conditions forecast for January, 1966. For specific times of DX openings refer to the DX Propagation Charts which appeared in last month's column. This month's column contains Short-Skip Propagation Charts for January and February, as well as Charts centered on Hawaii and Alaska. The Short-Skip Charts contain propagation forecasts for circuits varying in length between distances of 50 and 2300 miles.

10 Meters: Some fairly good DX openings, mainly to southern and tropical regions, are expected during the daylight hours. Some short-skip openings, between distances of approximately 1300 and 2300 miles, are also forecast during the late afternoon hours.

15 Meters: Generally good 15 meter DX openings to many areas of the world are forecast for the daylight hours. Some circuits to southern areas may remain open through the late afternoon and early evening hours. Fairly consistent short-skip openings, as a result of regular *F*-layer reflection, are predicted during the daylight hours for distances ranging between approximately 1000 and 2300 miles.

20 Meters: Good DX conditions to most areas of the world are forecast for 20 meters between sunrise and the late afternoon hours. Signal levels may be exceptionally high shortly after sunrise and during the afternoon hours, when conditions are expected to peak on this band. Good short-skip openings, over distances ranging between 750 and 2300 miles, should take place during the daylight hours. Openings over shorter distances should also be possible during the early afternoon hours, when the skip distance may be as short as a few hundred miles. When propagation conditions are normal or better, the band may remain open well into the hours of darkness.

40 Meters: DX openings are expected to begin during the late afternoon hours, with conditions peaking during the hours of darkness and at sunrise. Atmospheric noise, or static, should remain at low seasonal levels during the month, and signals often may be exceptionally strong. During the hours of daylight, good short-skip openings are forecast between distances of approximately 150 and 750 miles. During the hours of darkness, the short-skip range should increase to between 1000 and 2300 miles.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for January

Days	*Forecast Rating & Quality* (4)	(3)	(2)	(1)
Above Normal: **4, 18, 22, 29, 31**	A	A-B	B-C	C
Normal: **2-3, 5, 7-8, 11-12, 15-17, 19, 21, 23-24, 28, 30**	A-B	B-C	C-D	D-E
Below Normal: **1, 6, 10, 13, 20, 25, 27**	C	C-D	D	E
Disturbed: **9, 14, 26**	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 February 28, 1966, and are prepared from basic propaganda data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

80 Meters: Ionospheric absorption and static levels are expected to remain at low seasonal levels during January, which should result in fairly good DX openings to many areas of the world during the hours of darkness. During the daylight hours, short-skip openings are forecast between distances of approximately 50 and 350 miles. During the hours of darkness, openings should be possible between distances of approximately 250 and 2300 miles.

160 Meters: On evenings when static levels are low, some DX openings should be possible on this band from a few hours after sunset to shortly before sunrise. Short-skip openings up to 2300 miles are forecast during the hours of darkness. Because of extremely high solar absorption in this frequency range, ionospheric propagation generally is not possible during the daylight hours. Trans-Atlantic propagation tests are scheduled for 160 meters between Midnight and 2:30 A.M. EST on January 2 and 16. See last month's column for more details.

VHF Ionospheric Propagation

Sporadic-*E* propagation and auroral activity are generally at low levels during January, but some v.h.f. openings of these types may occur when ionospheric conditions are below normal or disturbed. Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are expected to be disturbed or below normal.

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

Sunspot Cycle

The Swiss Federal Solar Observatory at Zurich reports a monthly sunspot number of 21 for October, 1965. This results in a 12-month smoothed sunspot number of 14 centered on April, 1965. This month's *CQ* propagation forecasts are based upon a predicted smoothed sunspot number of 28, as the new solar cycle continues to rise slowly.

Outlook 1966

The sunspot cycle is rising. At the present time it is too early to predict its probable course, although a special report on this subject is now in preparation, and will appear in *CQ* later this year.

Assuming that the new cycle will rise at an average rate during 1966, solar activity at the beginning of the year will likely be in the range of sunspot numbers 25-30. The level should rise to between 60 and 70 by the end of 1966. This predicted rise in solar activity, from a relatively low to a moderate level, is expected to bring about a further improvement in propagation conditions on the 20, 15 and 10 meter bands.

Twenty meters will continue to be an all-year-round DX band from sunrise through the early evening hours. It will, however, open more frequently to more areas of the world, for longer periods of time, than it did during 1965. During the summer months, 20 meters is expected to remain open to many areas of the world during the hours of darkness as well.

A significant improvement in propagation conditions has already been observed on 15 meters during the fall months of 1965. This improvement will continue through 1966, with the band opening to all areas of the world during the daylight hours of the spring, fall and winter months. Good DX openings to many parts of the world should also be possible during the summer months.

Perhaps the most noticeable improvement in propagation conditions during 1966 will take place on 10 meters. During the low period of solar activity, from 1962-1965, very few DX openings took place on this band. During 1966, the band is expected to become alive again with DX signals during the daylight hours. Good openings are expected throughout the year on north-south paths, and to tropical areas. During the fall and winter months, good openings to almost all areas of the world are expected.

DX propagation conditions on 40, 80 and 160 meters are expected to remain much the same during 1966 as they were during the past year. This may, however, be the last year during the rising portion of the new sunspot cycle that peak propagation conditions will occur on these bands.

Shortwave propagation conditions during 1966 are expected to improve on 20, 15 and 10 meters, and remain about the same on 40, 80 and 160 meters.

73, George, W3ASK

CQ SHORT-SKIP PROPAGATION CHART

JANUARY & FEBRUARY, 1966

AT PATH MID-POINT
(24-HOUR TIME SYSTEM)

Band Openings Given In Local Standard Time

Band (Meters)	50-250 Miles	250-750 Miles	750-1300 Miles	1300-2300 Miles
10	*Nil*	*Nil*	10-15 (0-1)	08-10 (0-1) 10-15 (1-2) 15-17 (0-1)
15	*Nil*	10-16 (0-1)	08-09 (0-1) 09-10 (0-2) 10-15 (1-3) 15-16 (1-2) 16-18 (0-1)	06-08 (0-1) 08-09 (1-3) 09-10 (2-3) 10-15 (3-4) 15-16 (2-3) 16-18 (1) 18-19 (0-1)
20	*Nil*	08-10 (0-1) 10-14 (0-3) 14-16 (0-2) 16-18 (0-1)	06-07 (0-1) 07-08 (0-2) 08-10 (1-4) 10-14 (3-4) 14-16 (2-4) 16-18 (1-2) 18-19 (0-2) 19-21 (0-1)	06-07 (1) 07-08 (2) 08-10 (4) 10-14 (4-3) 14-16 (4) 16-17 (2-4) 17-18 (2-3) 18-19 (2) 19-21 (1)
40	07-08 (0-1) 08-09 (1-2) 09-10 (2-4) 10-16 (4) 16-17 (3) 17-19 (1-2) 19-21 (0-1)	07-08 (1-2) 08-09 (2-3) 09-11 (4) 11-15 (4-3) 15-17 (3-4) 17-19 (2-3) 19-21 (1-2) 21-02 (0-2) 02-07 (0-1)	07-08 (2) 08-09 (3-1) 09-11 (4-1) 11-15 (3-1) 15-17 (4-2) 17-19 (3-4) 19-22 (2-4) 22-02 (2-3) 02-07 (1-2)	07-08 (2-1) 08-15 (1-0) 15-17 (2) 17-19 (4-3) 19-22 (4) 22-02 (3-4) 02-04 (2-3) 04-07 (2)
80	07-08 (1-2) 08-09 (3-4) 09-19 (4) 19-21 (3-4) 21-23 (2-3) 23-03 (1-2) 03-07 (1)	07-08 (2) 08-10 (4-2) 10-14 (4-0) 14-16 (4-1) 16-18 (4-2) 18-21 (4) 21-23 (3-4) 23-03 (2-3) 03-07 (1-3)	07-08 (2-1) 08-10 (2-0) 10-14 (0) 14-16 (1-0) 16-18 (2-1) 18-20 (4-3) 20-23 (4) 23-05 (3) 05-07 (3-2)	07-08 (0-1) 08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-23 (4) 23-03 (3) 03-05 (3-2) 05-07 (2-1)

†Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST and 10 hours *behind* GMT

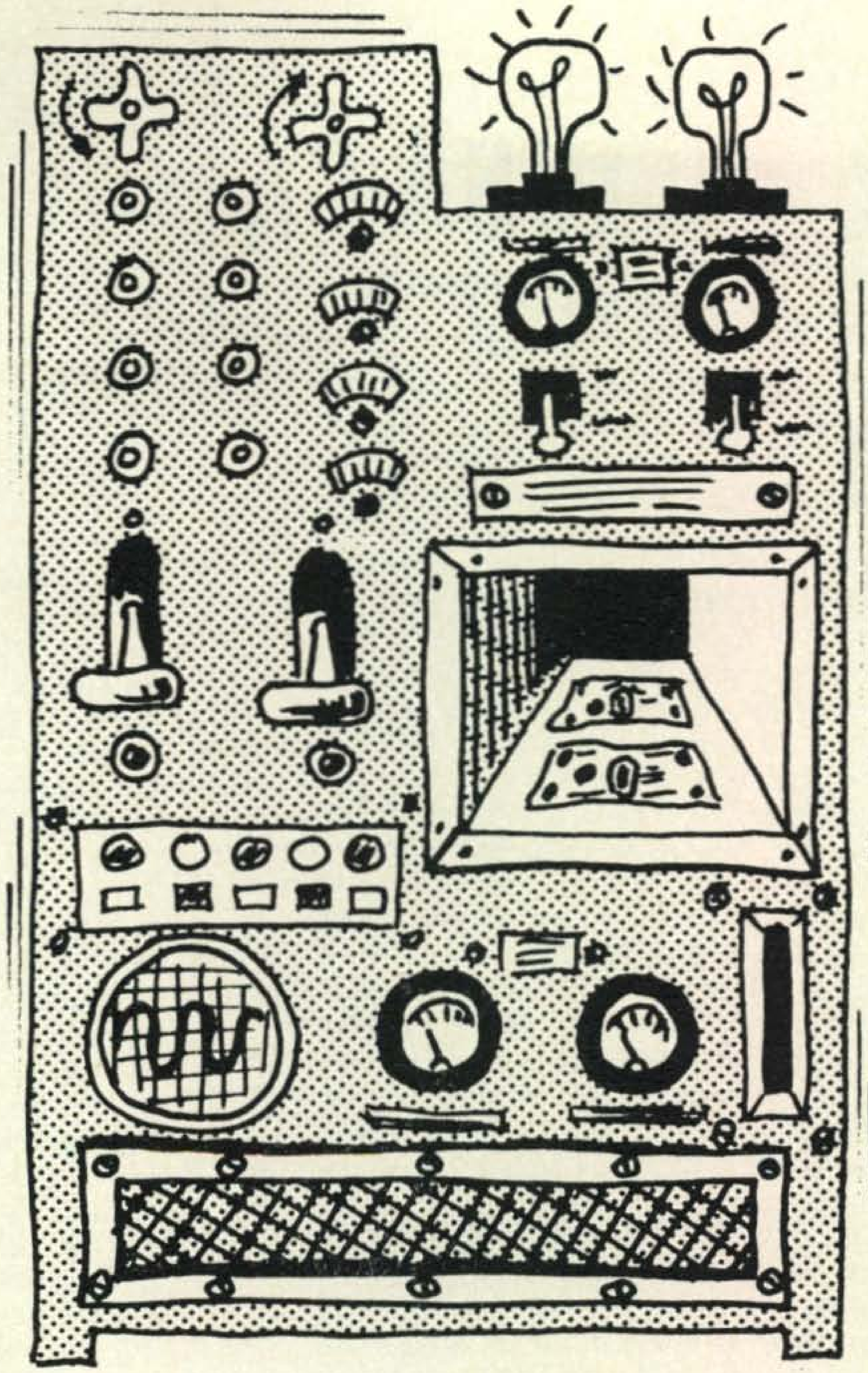
*To convert to local times in Alaska, GMT or Z Time is 8 hours *ahead* of PST, 9 hours *ahead* of Yukon Standard Time, 10 hours *ahead* of Alaskan Standard Time and 11 hours *ahead* of Bering Standard Time.

‡Indicates possible 10 meter openings.

§Indicates possible 160 meter openings.

[*Continued on page 109*]

HOW TO MAKE MONEY!



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

SUBSCRIBE TO CQ NOW!!!

MONEY, MONEY, MONEY WILL BE YOURS IN THE FORM OF GIGANTIC SAVINGS OVER THE REGULAR NEWSSTAND PRICES!!

CQ Magazine • 14 Vanderventer Ave. • Port Washington, N.Y. 11050
Enter my subscription to CQ for:

☐ 1 yr.	**I PAY ONLY $ 5.00**	a saving of $ 4.00
☐ 2 yrs.	**I PAY ONLY $ 9.00**	a saving of $ 9.00
☐ 3 yrs.	**I PAY ONLY $13.00**	a saving of $14.00

Enclosed is $______ for a______ years (s) ☐ New
Subscription to start with the________ issue. ☐ Renewal
PLEASE PRINT!

NAME______________________________ CALL__________

ADDRESS______________________________________

CITY__________________ STATE__________ ZIP__________

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

THE BIG STORY for the month is that Arthur Jablonsky, WØMCX, qualified for #2 USA-3079-CA for All counties Special Honors Plaque. "Art" received #1-C USA-CA-500 Award in September 1961, #11 USA-CA-1000 Award in June 1963, #8 USA-CA-1500 Award in April 1964, #5 USA-CA-2000 Award in May 1964, #3 USA-CA-2500 Award in August 1964, #2 USA-CA-3000 Award in June 1965, and now in November 1965 #2 USA-3079-CA for *ALL* counties. Congratulations Arthur on a job well done! Oh yes, I'm sure you all saw Arthur's photograph in November *CQ* when he was out mobiling and rounding up the last few needed counties.

Awards issued for the month were all for Mixed operations except for Ernest, K1UNM, who received a USA-CA-500 Award for All 75 meter/A3 operation. Speaking of issuing awards, hope you were listed in the Awards Honor Roll in December *CQ*, or did I forget YOU or you forget me?

YL International SSB'ers.

Another fine story is that of the YL International SSB'ers and who could tell it better than their awards custodian, Stewart L. Brummett, WA4WAO, ex-K7PNC and here is his story: "YL International SSB'ers was created and incorporated in the state of Florida on February 9, 1963 by V. Mayree Tallman, K4ICA/K5LXA. Its major purpose is the increasing of friendship and goodwill between the US amateur and the foreign amateur. For that purpose the organization operates a DX service net, "YL International SSB'ers Communications System", on 14331 kc for four to six hours seven days a week beginning at 1800 GMT. Its primary purpose is to be of service to the DX stations (traffic, needed contacts for various awards etc). When such services are not being performed the stations on frequency make contacts with each other. It is an "open" net with all stations being welcome.

At the present time YL SSB'ers has more than 4,900 members in all 50 states, all six continents and approximately 230 countries. Roughly 3,000 of our members are DX stations. SSB'ers is non-political and non-controversial. Our only interest and purpose is just service and friendship. An interesting note—some low powered DX members have contacted SSB'er members in all 40 zones."

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

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

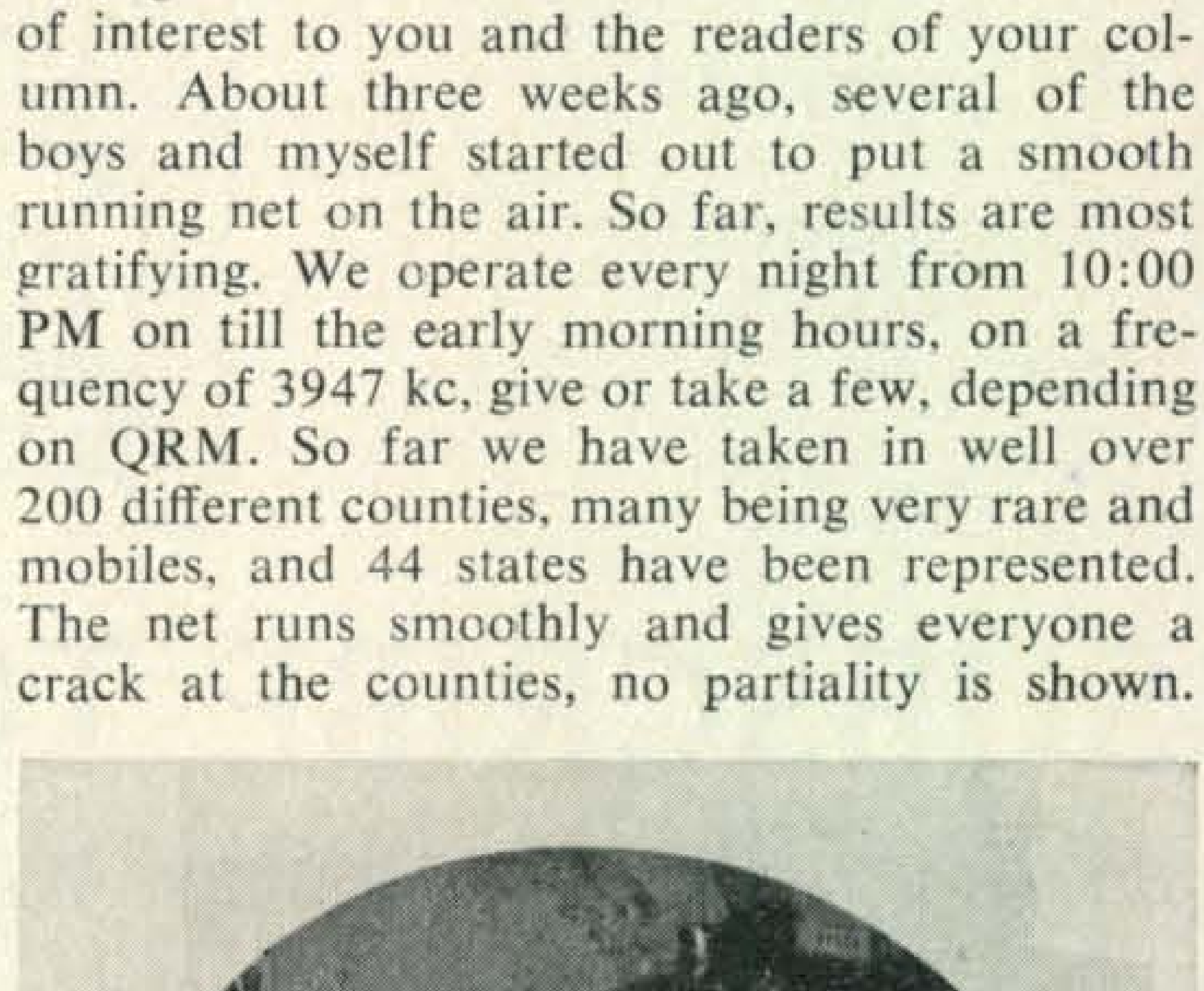
3079	**2515**	**2050**
K9EAB	WØKZZ	K3LXN
WØMCX	K4VOF	**2000**
3054	**2500**	K9UTI
K8CIR	VE3-9301	W5EHY
2953	K8KOM	WA8EZW
K5SGJ	**2410**	K8VSL
K5SGK	WØVFE	K8YGU
2950	**2335**	**1905**
WØJWD	W8UPH	W2JWK
2800	**2280**	**1877**
WA9AJF	W9CMC	W9HAS/6
2780	**2080**	**1787**
K8IWI	W5NXF	K4BAI

USA-CA HONOR ROLL

ALL 3079		**1500**		**500**	
K9EAB	1	WA4CLR	42	K8ODY	531
WØMCX	2			K8OGH	532
				K1UNM	533

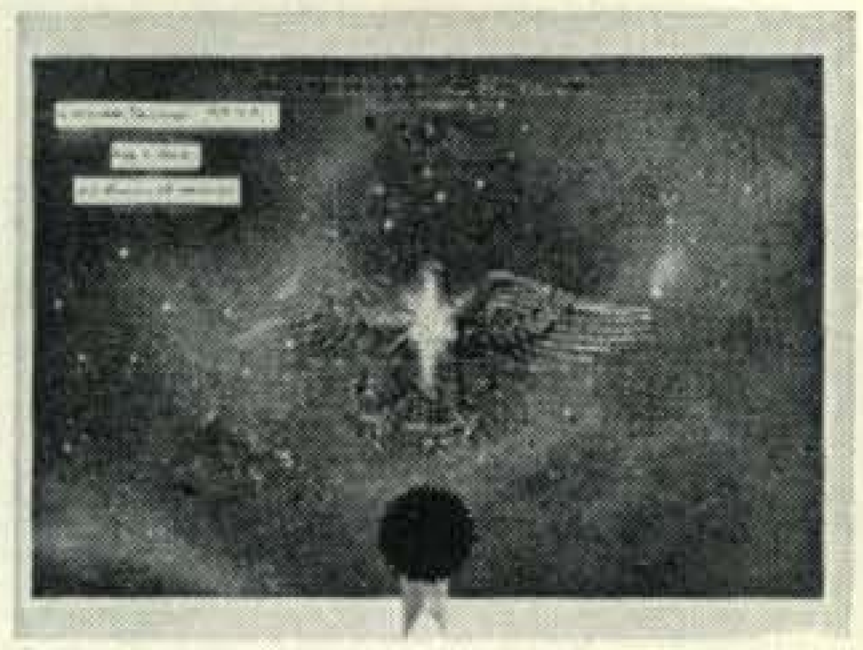
Another County Hunter Net

Frank Gilmore, KØJPJ, President of SMARC Inc., sponsor of WAM and Hillbilly Awards (already described in *CQ*), writes: "I am the manager of a new net which I think would be of interest to you and the readers of your column. About three weeks ago, several of the boys and myself started out to put a smooth running net on the air. So far, results are most gratifying. We operate every night from 10:00 PM on till the early morning hours, on a frequency of 3947 kc, give or take a few, depending on QRM. So far we have taken in well over 200 different counties, many being very rare and mobiles, and 44 states have been represented. The net runs smoothly and gives everyone a crack at the counties, no partiality is shown.



K4VOF, Kenneth Wayne, holder of #4 USA-CA-2500 Award; #5 USA-CA-2000; #12 USA-CA-1500; #34 USA-CA-1000 and #351 USA-CA-500 Award.

Idaho Counties Award


YL Int. SSB'ers North Star WAS

Worked Birmingham Award

Net controls are myself, KØMXK, KØHUU, W5OYG, and sometimes WAØLNM, we only use one NCS per session. Please keep up the good work, will certainly look forward to hearing you on the net."

Letters

Jan Ziembicki, SP6FZ, P. O. Box 30, Bielawa, Poland, writes: "I am one of the "county hunters" for the USA-CA Award. I am sorry the W/K hams don't send QSL cards. I have only about 50% of QSOs with US confirmed. I worked over 500 counties several years and now I have about 700 counties worked, but still less than 500 confirmed. I wonder how it is possible for an American amateur to have 3000 counties confirmed, if a DX ham can't collect even 70% of needed confirmations from among 700 counties worked. I do always QSL and since 1924 I have QSLed all QSOs." *(Ed., well Jan we all have that darn QSL problem, but I hope your letter will shame some US hams so that they send QSLs to your above address and that you get more than the needed 500 QSLs).*

Al, K1WQU, writes: "A fellow was here the other day and showed me his USA-CA-500 Award, what a beauty, I'm trying hard for mine. He told me that you can use the "Independent Cities" in Virginia as counties, or rather for counties they border. Is that corect? Will appreciate any info you have. Here heard lots of comments (good of course) on your award column. Keep up the good work." *(Yes, Al, Independent Cities rule themselves and are not counties but may be used (just once) for a county they are in or border. FB on your 481 confirmed).*

Norman, W5NXF/KH6FQB, writes: "My correspondence is way behind schedule. Here is my standing for your Special USA-CA Honor Roll: 2080. Few additional counties worked, so will be awhile even to the 2100 mark.

The friendly airlines managed to drop my KWM-2 both going and returning, so KH6FQB was on the air about 10 hours in July. Will be operating from KH6FQB after 1st of February. KWM-2 now back on the air since 5 October so hope to have something to report. Applied for Phone WPX, still working for SSB and mixed WPX. WAZ now at 35 zones, who knows, maybe I'll make it yet."

Rod, W9CMC, writes: "County score in mid October: totals confirmed 2280 mixed, 1787 all 40 s.s.b. What with my son's wedding and house hunting for my daughter I seem to have lost some momentum. Always look forward to your column in *CQ*. Congratulations on a FB job."

Awards

Edison Radio Club Inc., Certificate requirements as listed on page 105 in November *CQ* got a bit curtailed in that the title and above first line did not appear. Award was photoed on page 80, also November *CQ*.

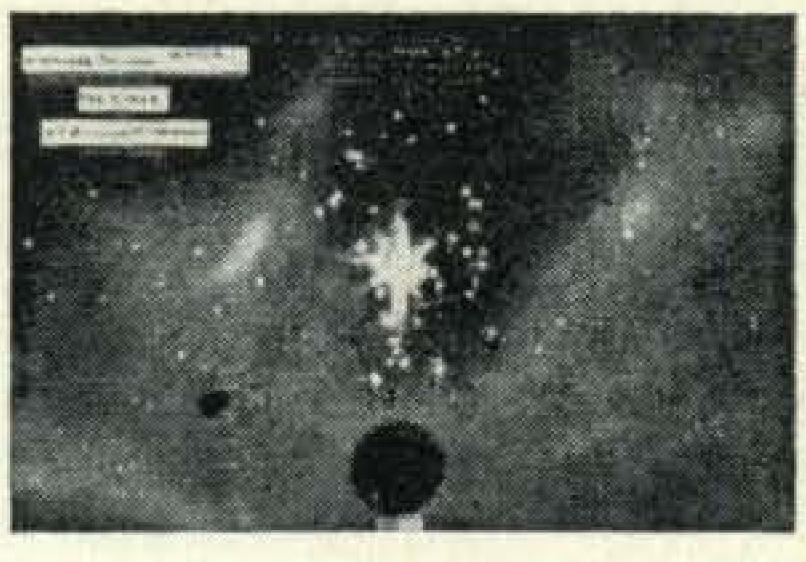
Zone Five Award as shown on page 105, Nov. *CQ*, had rules in October *CQ*.

Idaho Counties Award: The Magic Valley Radio Amateurs, W7SWS, are happy to offer this award. Rules are: Idaho stations contact 12 counties; Continental U.S. and VE stations contact 8 counties; all others contact 4 counties. QSLs are required but are promptly returned. Cost is 50¢ handling charge (postage stamps are ok). Send QSLs and list to Magic Valley Radio Amateurs, Box 1176, Twin Falls, Idaho 83301.

YL International SSB'ers have an extensive awards program on which they have spent a lot of time, effort and money, but the results are well worth all of this and I hope they photograph even half as beautiful as they really are.

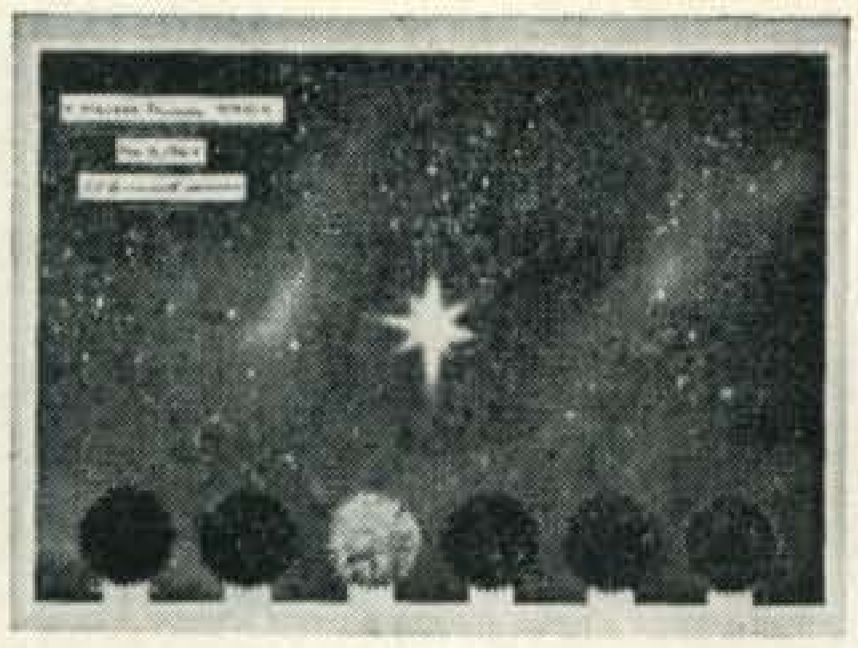
King Neptune Award: For working members after Feb. 9, 1963. Basic award: US stations

American National Cowbelles Award.

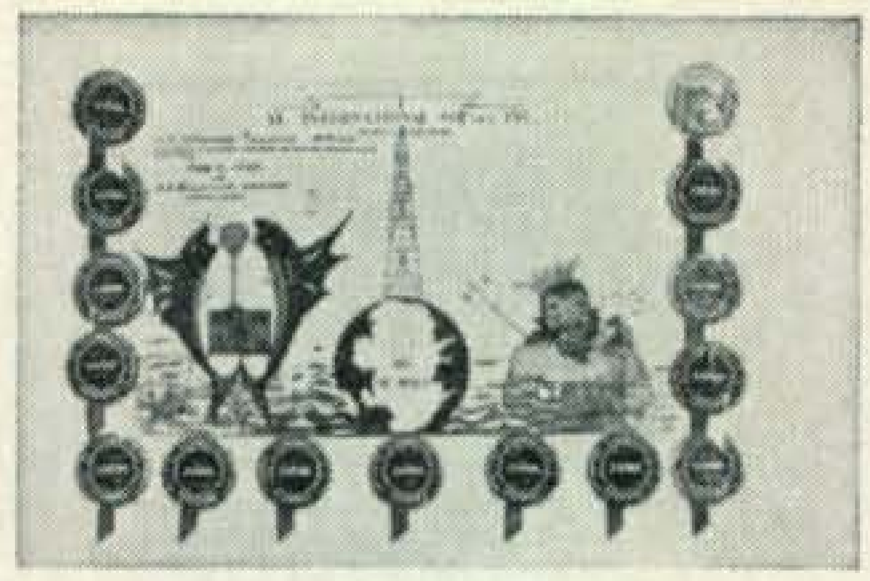

YL Int. SSB'ers North Star Belt of Orion.

Baltimore Nite Owl Net Certificate

SPARC Certificate



YL Int. SSB'ers North Star Award



YL Int. SSB'ers King Neptune Award

work 10 DX members and 5 US (KH6 and KL7 are DX). DX stations work 10 US and 5 DX members for basic award. After basic award seals may be earned up to a total of 15 by working members in steps of 5 US and 5 DX for each seal. After completion of the first KNA with all 15 seals, a second, third or fourth and etc. may be earned on the basis of the same requirements. Fee is $1.00, seals require s.a.s.e. only.

North Star Awards: (Series of Three).

The North Star Awards were created from a commissioned painting by an Arizona artist and are probably among the most expensive and beautiful awards available in amateur radio. Although they are issued at a loss, they are great encouragement for DX stations not interested in awards per se, to work for them.

North Star, Basic award for working members in all six continents *or* 25 countries. Class E—25 countries; Class D—50 countries; Class C—100 countries; Class B—150 countries; Class A–200 countries. Each Class and WAC are seals on the basic award. Fee—$1.00, seals s.a.s.e.

North Star–WAS (With eagle), Work members in all 50 states. Fee—$1.00.

North Star Belt of Orion Award, Work members in 100 countries. Fee—$1.00.

All awards require making all contacts after February 9, 1963. Send log data and GCR. Custodian for the YL International SSB'ers, Stewart L. Brummett, WA4WAO, 1016 Fairway Drive, N.W., Huntsville, Alabama 35805. They issue other awards such as Amateur Radio Teams for working SSB'er man and wife couples; the Vega for working DX YLs and different trophies for working 1000 members, 300 countries and completion of the awards program.

Worked Birmingham Award, sponsored by The Birmingham Amateur Radio Club, Inc., of Birmingham, Alabama. Stations within 100 miles of Birmingham must work 25 stations in Birmingham, Alabama or Jefferson county. All other US stations must work 15, DX stations must work 5. Send complete log data, your own QSL and 50¢ or 4 IRCs to Jerry Fiore, K4HPR, 1711 South 11th Place, Birmingham, Alabama 35205.

SPARC Certificate, issued by The St. Petersburg Amateur Radio Club for working 5 members of the club, any type of emission, or any band. Cost 50¢, send log data only, to Cathy H. Seeds, W4BAV, 829—21st Ave., North, St. Petersburg, Florida 33704. Club station is W4GAC, for list of members send s.a.s.e. to Cathy, also ask for data on Club meetings.

Baltimore Nite Owl Net Certificate, issued by The Baltimore Nite Owl Net for working 15 certificate holders with a special endorsement to the certificate for working 15 certificate holders and one charter member for one hour. Also endorsements for modes and bands that apply. The Baltimore Nite Owl Net was founded in October 1964 for the purpose of good fun, good fellowship, good conversation, the handling of emergency and routine traffic and to modulate the unused static on 6 meters between the hours of 2300 EST and sunrise. The net meets 7 nights a week on 50.25 Mc. Charter members are: W3APY, K3AQK, WA3AUD, K3DCR, K3-FME, K3JVA, K3KNC, K3PEJ, K3TFU, K3-URE, K3VSD, K3YSD, K3YYP and K3ZEK. QSL cards need not be sent in but may be requested. Send log data to either K3URE, James E. Moon, Jr., 1100 Wedgewood Road, Baltimore, Maryland 21229 or K3EJF, David E. Heck, P. O. Box 433, Ellicott City, Maryland 21043. Cost of certificate $1.25. Send s.a.s.e. for list of certificate holders.

American National Cowbells Award, sponsored by the National Awards Hunters Club for contacting six cowbells in six different states. Send GCR (list) and $1.00 to custodian, WØCCD, Louisanna Pickert, 3635 Olin Avenue, Omaha, Nebraska. Active Cowbells are: WA1BPF, Conn., K1EQE, R.I., W1YPH, Me., WB2FFH, N.Y., WA2FYE, N.Y., WA2SNT, N.Y., K3-FFD, Del., K3URP, Del., K3YOH, Pa., K3YSO, Md., W4BAV, WA4BMC, K4BTG, WA4EDL, WA4EEZ, WA4FJN all Florida, WA4IPP, Ala., K4ZZY, Va., WA5KLT, Tex., K5LSI, Tex., K6AYU, Cal., K7CHA, Mont., K7KHU, Wash., K7OUM, Utah, K7UJV, Ariz., WA8BBG, K8CEN, WA8CXU, K8DHK, WA8LZU, W8-VMY all Ohio, WAØBBP, Col., WØCCD, Neb., WAØCVE, Neb., KØJUV, Kans., WAØJYP, Mo., KØRGU, Col., KØZPK, Neb.

The ET3USA Achievement Award, will be presented by the Kagnew Station Amateur Radio Club for working various Ethiopian (ET3/9E3/9F3) stations, with credits accumulating from 1, January 1965. Hope to have full data and foto of award in next column. Custodian will be Albert L. Kemmesies, K1QHP/1, Hq. Co., USASATC&S, Box 643, Fort Devens, Mass. 01433.

I owe apologies to John, K4BAI for erroneously listing him as K8BAI a few times. I want to send along great big thanks to Gil, W1ZCH,

[*Continued on page 104*]

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

POWER supplies for radioteletype terminal and local loop equipment are seldom given enough attention by the amateur RTTYer. Perhaps this is because power supplies are mundane and unglamorous in these days of esoteric electronics. But they *are* necessary, and should be designed to run reasonably cool; that is, with more than adequate current capability for the requirements; and, with good voltage regulation. Again, we would like to emphasize: everything should be fused—intelligently.

The best example we know of beautiful power supply design and fusing is that found in the surplus AN/FGC-1 terminal unit. Western Electric "grasshopper" fuses are used to protect each filament, plate, and telegraph circuit. When any fuse blows, a spring hops out, making contact with an alarm circuit, sounding a buzzer. As the result, it is very easy to isolate trouble when it occurs.

The AN/FGC-1, Part VII
Power Supplies

Some AN/FGC-1 TU's come equipped with two power supplies, one a regulated tube rectifier and the other a simple selenium disc-type rectifier, Western Electric KS-5844, for local loop use. When the disc-type is not provided, local loop current is supplied by the tube unit along with a.c. filament and d.c. plate voltage for the TU. Either of two types of tube rectifiers might be supplied: the X-61680B for a line frequency of 50 to 60 cps, or the X-61680C for a line frequency of 25 to 60 cps. (Naturally, the 25-60 cps unit is much bigger and heavier, but it really runs cool at 60 cps.) Otherwise the two types are identical. The input voltage can be 103 to 127 or the TU supply may be strapped for 207 to 253 volts. The operating temperature range is −20° F to 120° F. While a.c. filament voltages are provided, only the output d.c. voltage is regulated for changes in a.c. input voltage and d.c. load current.

*431 Woodbury Road, Huntington, N. Y. 11743.

Access to the tubes and terminals of the tube rectifier is gained by loosening four thumb screws and removing the front cover. Solder terminals for the a.c. input are on the right; and, a.c. and d.c. output terminals are on the left. Strapping for the nominal 120 or 240 volts input is made on a screw terminal strip on the sub-panel near the center. Removing the cover, by the way, opens an interlock switch in an a.c. lead, but remember that the terminals are still hot.

Figure 1 is the simplified schematic diagram of the regulated tube rectifier. The tubes are WE 394A thyratrons. The output of these tubes is controlled by varying the negative grid bias, which changes the point on the a.c. alternation at which they fire (start conducting). The output current and voltage depend upon how much of each alternation is used by the tubes. Changes in input and output voltages are fed back to the grid control circuit to change the output voltage and return it to the proper value. (Resistors *E* and *F* are parasitic suppressors.)

The regulator for the d.c. output is composed of three parts: the resistor network consisting of fixed resistors *A* and *B* and the pot *R* (accessible via a hole in the front cover); bridge rectifier *H* which furnishes line voltage compensation; and a reference voltage circuit consisting of the auxiliary rectifiers *A* and *B*, resistors *D* and *J*, transformer winding 13-14, thermister *T*, and resistor *C* connected across the auxiliary rectifier. Resistors *A* and *B* and the pot *R* are connected across the d.c. output, and the curent through them is thus proportional to the output voltage. Resistor *A*, the 2-3 section of *R*, thermister *T* and resistors *C* and *G*, and rectifier *H* are connected in series between the filament and grids of the tubes. The normal grid bias is about −3 volts. This may be adusted by pot *R* so that the grids are just enough negative to cause the tubes to fire over the proper portion of the a.c. cycle to maintain the output voltage at the desired value of 130 volts. When the output voltage increases, the current through resistors *A* and *R* increases making the grids more negative, decreasing the conducting time of the tubes and correcting the output voltage. A decrease of the output voltage has the opposite effect.

Line voltage variations are compensated for by rectifier *H*, which is part of the grid bias circuit of the tubes. The input of the rectifier is connected to the secondary winding 15-16 of transformer *T1;* therefore, its input voltage varies with the line voltage. The negative output terminal of *H* (3) connects through resistors *E* and *F* to the grids of the tubes. The positive output terminal (1) connects through resistor *G*, the reference voltage circuit, the pot *R*, and resistor *A* to the filaments of the tubes. Thus an increase in the line voltage causes an increase

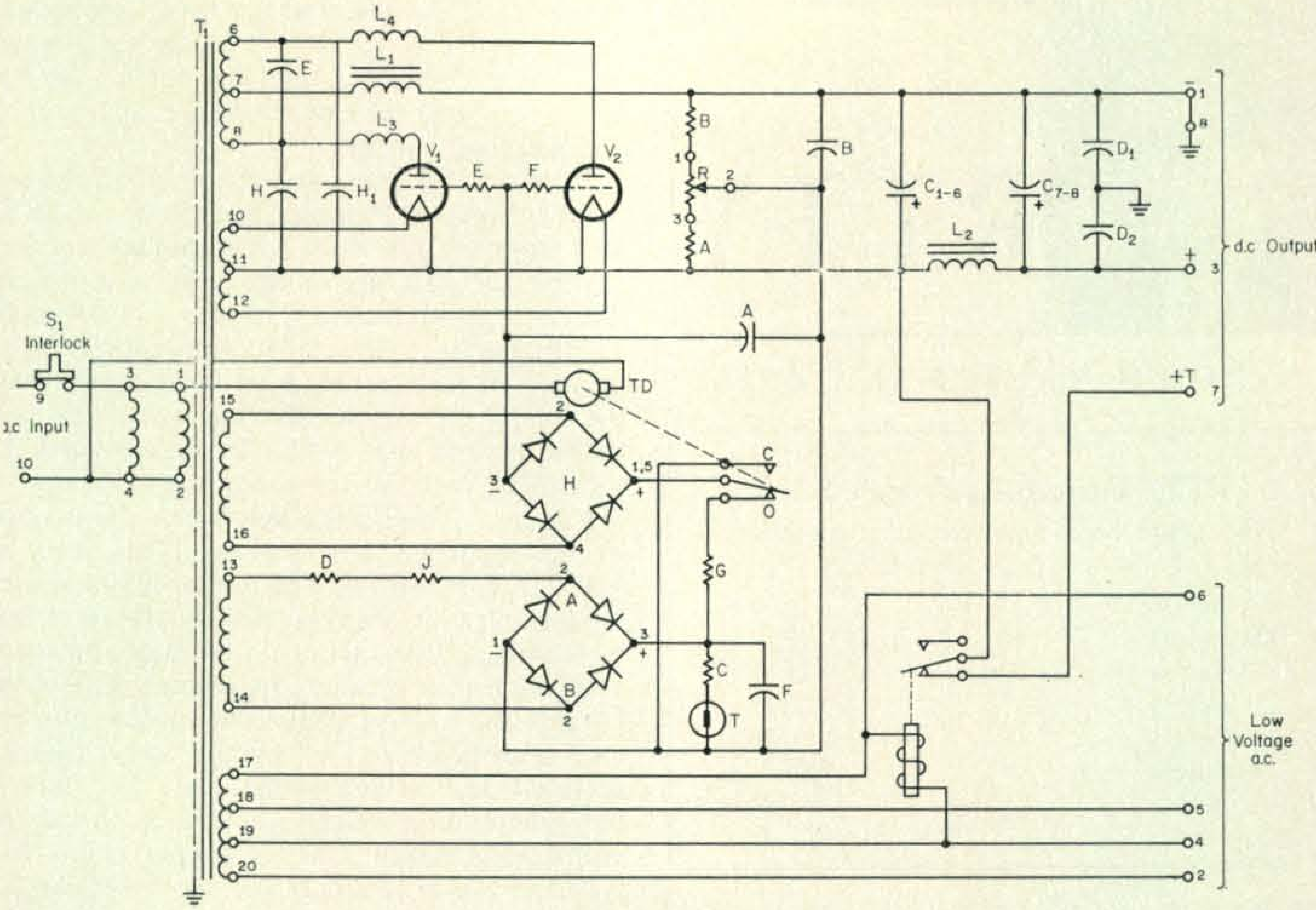


Fig. 1—Simplified schematic of regulated tube rectifier circuit.

in grid bias, which decreases the conducting interval of the tubes and the output voltage. A decrease in the line voltage decreases the grid bias and increases the conducting interval of the tubes, thereby increasing the output voltage.

An increase in current through thermister *T* causes a decrease in the voltage drop across its terminals, while the same current through resistor *C* causes an increase in the voltage drop across its terminals. A decrease in current has the opposite effect in both cases. *T* and *C* have been selected so that the increase in voltage drop across one compensates for the decrease across the other and the total voltage drop across the two in series, as well as the output voltage of the auxiliary rectifier remains, practically constant. As the current through *T* and *C* changes with line voltage variations, there is a corresponding change in the current through the input resistors *D* and *J*. The resulting voltage drops across the input resistors assist in compensating for line voltage changes in the auxiliary rectifier and in maintaining a constant reference voltage.

A time delay relay, *TD*, is provided to delay firing of the tubes until the filaments of the tubes have heated to operating temperature. This is a motor-driven relay with about a 20 to 30 second time interval.

Output d.c. is filtered by a 2-stage filter. Choke input is used, and on the "B" rectifier six capacitors (C_1 to C_6) with a combined capacitance of 750 mf is used in the first stage. On the "C" rectifier seven capacitors (C_1 to C_7) with a combined capacitance of 1400 mf is used. The second stage consists of smoothing choke L_2 and two capacitors (C_7 and C_8) on rectifier "B" for a total of 250 mf. On rectifier "C" three capacitors (C_8 to C_{10}) for a total of 600 mf is used. When no disc-type rectifier is supplied for local loop (telegraph) current, the local loop current is taken from the tube rectifier from the junction of the tube filaments and the smoothing choke L_2, between filter stages, so that noise from the telegraph loop will not get into the B-plus circuit of the TU.

Disc-type Rectifier

The WE KS-5844 supplies 130 volts to the contacts of the receiving (REC) relay and to the receiving "local" loop when this unit is provided as part of an AN/FGC-1 assembly. Input can be 95-127 or 190-253 volts at 25 to 60 cps. Output current rating is 0.24 amps, maximum. Figure 2 is a simplified schematic diagram of the unit. The COARSE ADJ and the FINE ADJ controls are brought to knobs on the front panel to facilitate output voltage adjustment. The rectifier stack, A_1 to A_4, is selenium. Choke input is used with a total of 1000 mf. The bleeder is 4000-ohms, 25-watts.

Conclusion

This concludes our deailed description of the various units that comprise the fabulous monster, the AN/FGC-1. All that remains is a short rundown on the test patches made to line up the unit. This we will try to provide next month. Stay with us (*subscribe*), will you?

On The Bauds

As of Monday, November 1, 1965, W1AW, the Headquarters Station of the ARRL, began Official Bulletin

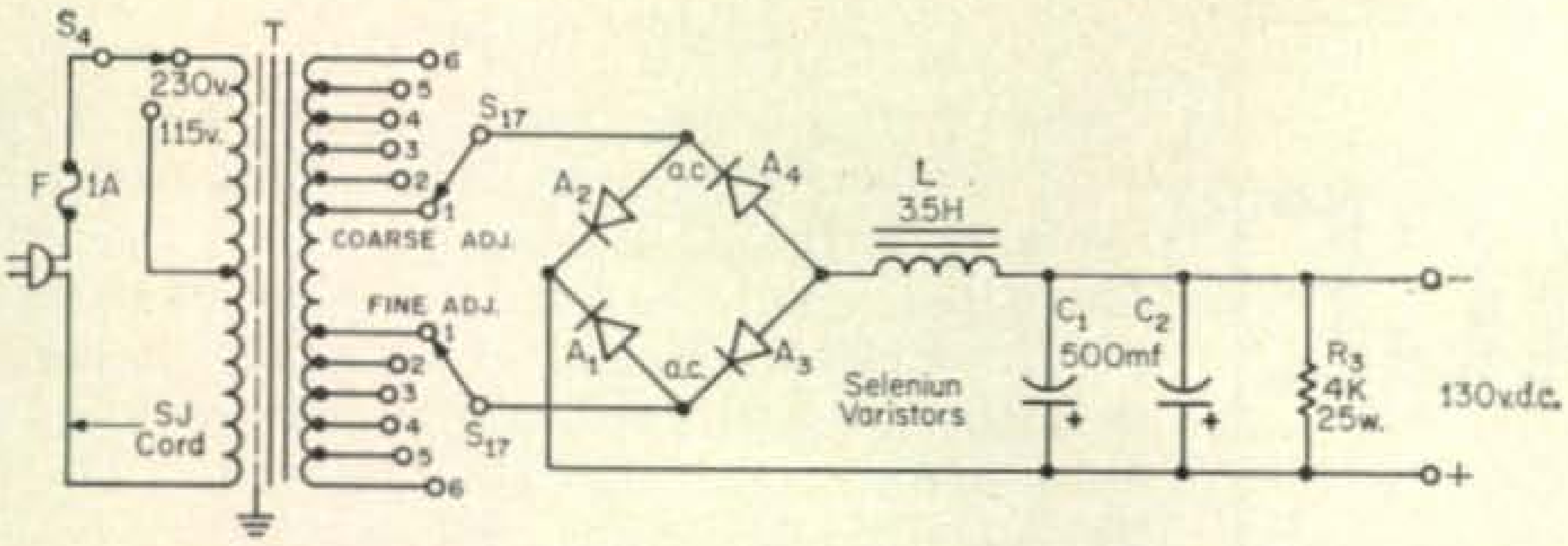


Fig. 2 — Simplified schematic of disc-type rectifier.

RTTY transmissions simultaneously on 3625 and 14,095 kc nightly at 0400 GMT (except Monday, GMT). This is 11:00 P.M. EST. *We would like to suggest that all RTTYers, as well as c.w. stations, make a special effort to avoid the above frequencies at that time. Only about 10 or 15 minutes is required as Bulletins are sent by tape at 60 words-per-minute.* W1EIZ of Slatersville, R.I., and W1WL of Northampton, Mass., work 80; W1WL uses narrow shift on 20. K1NEF/1 at Hebron, Maine, and K1VMR of Exeter, N.H., also work 80 meters.

W2SZ on the campus of Rensselaer Polytechnic Institute in Troy, N.Y., works 80 using a 20A exciter feeding a 300-watt amplifier, an HQ150 receiver, and a dipole antenna. K2DQC of Shirley, on eastern L.I., is on 146.70 f.m. with 300 watts and *vertical* antenna polarization. W2PEE of Old Brookville, L.I., wants to *give* away an FRF converter, but it must be picked up. W2NRY of Briercliff Manor, N.Y., is on 80. K2ADY of Syracuse, N.Y., uses narrow shift with an HT-32 driving an 833A to 1 kw, an SX-101 with a URA-8A, and an inverted-V antenna 65 feet up. W2JAV/2 is on 40 n.f.s.k. from Pitman, N.J. W2LFL of Merrick, L.I., works DX on 20. W2FTX of Millville, near Atlantic City, N.J., also works 80. W2FAN of Lockport, K2SQL of Niagara Falls, and K2AMI of Lewiston, all in N.Y., have a small net going for themselves on 80. K2SBD of Albertson, L.I., uses a Viking II, an SX-101A or BC-1004, a URA-8A TU, and Model 14 and 15 machines on 80, 40, and 20 meters.

K3YZF of Willmington, Del., found a source of paper —at $1.60 per roll. K3OJY of Pocono Pines, Pa., works 80. W4CQI of Warrenton, Va., uses a Navigator into a linear using 811's, a 2B receiver and 14 and 15 machines. K4BUR of Fairfax, Va., uses tape on 80. W4IYP of Gainesville, Fla., looks for DX on 20. W5ENH of Little Rock, Ark., has a manual on the AN/FGC-1 for sale. W5SKU of New Orleans, La., has a Model 26 for sale for $50. W5APM of San Marcos, Texas, uses a pair of 813's, a 2B receiver with a W2JAV TU, and Models 15 and 14 on twenty meters.

K6DDQ of West Covina, Calif., uses tape on 20. K6GKX of Long Beach, Calif., reports that the Earlybird Net meets on 146.70 Sunday mornings at 10 a.m. Don't miss the description of the Mark V solid state TU of W6NRM which appeared in the September and October 1965 issues of *RTTY. ($3 per year via W6AEE, 372 Warren Way, Arcadia, Calif. 91007.)*

W8SDZ is house-hunting in the suburban Detroit (Mich.) area. WA8GVK of Muskegon, Mich., is on 20 looking for DX. WAØAZV of New Madrid, Mo., is on 80 and has a 152 tone keyer and 152 converter ready for 6. *(See page 12, Jan. and page 9, May 1965 RTTY.)* WAØHBS of Fremont, Neb., got a TT40/SGC-1 from Navy MARS and can't find out from them what it is! *(See page 11, Feb. 1965 RTTY.)* WØYTL of St. Paul, Minn., works 20.

DX on 20 meters, printed at W2JTP during late October: DL6YH, ON4BX, F3DM, F3LL/P, VO1BL, VE3RH (40), G3LDI, DL6EQ.

Comments

Book reviews we ordinarily do not do, but we would like to comment on a book recently read. It is not a new book; the copyright is 1956, but we would recommend that you dig it out of your library or order it from your favorite book store. The title is, *A Man of High Fidelity: Edwin Howard Armstrong,* and it is by Lawrence Lessing. No doubt you have heard of Major Armstrong and f.m. What has this to do with RTTY? Plenty, if you stop to think. After all, frequency-shift-keying is a form of f.m., and we *do* use f.m. on 6 and 2 meters.

A Man of High Fidelity: Edwin Howard Armstrong, is a biography. It is the life story of a brilliant inventor, told with understanding of the complex man and knowledge of all the facts. It is also a study in greatness and tragedy. This is a story we should all know, in its entirety.

73, Byron, W2JTP

New Amateur Product

Hallicrafters SX-146

HIGH order frequency stability and freedom from adjacent channel cross modulation are indicated features of a new amateur band receiver just announced by The Hallicrafters Co. Designated the SX-146, the receiver employs a single conversion signal path and premixed oscillator chain. A 2.1 kc six-section quartz crystal lattice filter provides maximum selectivity of s.s.b. The SX-146 also has provisions for plug-in user installation of a 0.5 kc c.w. crystal filter and a 5.0 kc a.m. crystal filter. Sensitivity of the SX-146 in the a.m. mode is less than 1 microvolt for 10 db S/N (30% modulation) and for s.s.b./c.w. is less than ½ microvolt for 20 db S/N. Amateur net price is $269.95. Complete SX-146 specifications may be obtained by writing direct to Bernard J. Golbus, The Hallicrafters Co., 5th & Kostner Avenues, Chicago, Illinois 60624, or circle 76 on page 110.

SPACE COMMUNICATIONS

BY GEORGE JACOBS,* W3ASK

DURING late November, as this column is being written, a strike and some technical difficulties have delayed TITAN-3C launchings at Cape Kennedy. A last minute check with Project OSCAR Headquarters indicates, however, that there is still a 50-50 chance that OSCAR IV will be launched sometime during the last week of December. If it fails to fly then, there's better than a 90% chance that it will be launched during January. If OSCAR IV isn't already in orbit by the time that this appears in print, then it probably will be in a matter of a few days, or at most a few weeks.

In late November, the race was still on to see which of two satellites being built by radio amateurs would actually become OSCAR IV. A beacon version, with transmitters on 144.05 mc, 432.15 mc, and one possibly also on 1296.45 mc was nearing completion and appeared to be ahead in the race to become OSCAR IV. This satellite was being built jointly by OSCAR Headquarters under the direction of Lance Ginner, K6GSJ, and the Rhododendron Swamp VHF Society, under the direction of Fred Collins, W1FRR.

Meanwhile, a translator satellite, which will receive signals in a 10 kc band centered on 144.1 mc and retransmit them over a 10 kc band centered on 431.935 mc was under construction at the TRW Radio Amateur Club, located in the Los Angeles area. The satellite will also contain a beacon transmitter operating on 431.925 mc.

The need to design ground control equipment to comply with international regulations which require such equipment for communication satellites operating in shared bands has slowed the project down, and it is unlikely that the package will be ready in time to become OSCAR IV. In all probability it will become OSCAR V, and will be launched later this year. The 432 mc amateur band is not an exclusive allocation to the amateur radio service, and is shared with other communication services in various areas of the world. Ground control is required to shut the transponder off in the event it causes interference to other services.

In any event, whichever satellite is launched as OSCAR IV, it will be placed in a near stationary orbit at 21,000 statute miles above the earth's surface. See last month's column for more orbital details, and check W1AW transmissions for the latest news concerning OSCAR IV.

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

OSCAR III Report

OSCAR Headquarters has released the first of what is intended to be a series of reports summarizing the results of the OSCAR III experiment. The initial report contains listings of all stations that completed successful two-way contacts through the satellite's transponder; of all stations reporting hearing signals relayed by OSCAR III, and of all stations that were reported to have been heard through the satellite. Reports covering the beacon and telemetry transmissions, as well as other phases of the OSCAR III experiment, are in preparation and will be issued sometime in the future.

The initial OSCAR III report, prepared by Harvey C. Gabrielson, W6HEK, is based upon reception reports and reports of two-way contacts submitted officially to OSCAR headquarters by nearly 300 observing stations.

The reports were coded and punched on cards and data tapes for processing by a 1620 computer located at Foothill College, the headquarters for the OSCAR project.

An honor roll of those stations reporting two-way contacts to Project OSCAR is contained in the report and is reproduced in Table I. Alongside each call is shown the total number of contacts made by each station. The report also contains a listing of the 273 observing stations who submitted reception reports of signals heard through the satellite, as well as a listing of 1097 calls which were reported heard through OSCAR III. These lists will appear in next month's column.

The OSCAR report states that a total of 176 two-way contacts were claimed through OSCAR III during 247 orbits of active translator operation. Contacts were made by 98 amateur radio stations, 67 from North America and the remaining 31 from Europe. All continental U.S. call areas plus Canada and Alaska are represented in the North American total. In Europe, contacts were reported by stations in Germany, Finland, Sweden, France, Spain, Switzerland, Belgium, United Kingdom, Czechoslovakia and the Soviet Union. Transatlantic contacts were reported between Germany (DL3YBA) and Massachusetts (W1BU), and between Spain (EA4AO) and New Jersey (W2AZL). While many transcontinental contacts were reported, the longest distance was the one between Alaska (KL7CUH) and New York (K2IEJ).

The report summarizes that the great majority of all contacts were made using c.w., but 5 stations reported successful voice contacts using sideband. DJ4ZC reported s.s.b. contacts with DL3YBA, HB9RG and DJ4AU. DL3YBA also reported a sideband contact with DJ4EZ. A few weak but unidentifiable a.m. carriers were reported and several observers also reported hearing unidentified teletype signals, but no successful two-way contacts were reported using either of these modes. Write directly to Project OSCAR Inc., Foothill College, Los Altos, California, for copies of the OSCAR III report, and for additional details concerning the availability of the punched

Table I—OSCAR III Two-Way QSO Honor Roll

Europe	G6AG 1	VE3BQN 1	WA4TWV 1	W6PJA 1
DJ3EN 1		W1BU 2	W4WNH 10	WA6QQI 1
DJ3ENA 1	HB9AR 1	W1HDQ 4	K4YYJ 1	WA6RSG 1
DJ4AU 2	HB9RG 10	W1JSM 4	W5AJG 1	W6TYM 1
DJ4EZ 1		W1QXX 3	W5JWL 1	W6YK 2
DJ4ZC 5	OH2BAA 2	W2AMJ 5	W5KXD 2	W7JRG 7
DJ6DT 3	OH2DV 1	W2AZL 1	W5NUK 1	W7UAB 5
DJ9DT 2		K2GUG 7	K5TQP 3	W7ZC 1
DL1EI 1	OK2TU 1	K2IEJ 3	K5WXZ 10	W8FEH 1
DL3BJ 1	OK2WCG 1	K2MWA 21	W6AB 1	W8KAY 3
DL3YBA 21		WA2WEB 18	W6AJF 2	W8NSH 2
DL6EH 2	ON4FG 2	W3BYF 2	W6DQJ 1	W8YIO 1
DL6WG 1	ON4TQ 1	W3SDZ 3	K6GCD 1	K9AAJ 13
DL9AR 1		W4AWS 6	W6GDO 7	W9TGB 5
DL9GU 3	SM5BSZ 3	W4HHK 5	K6HAA 1	KØCER 1
	SM6CSO 4	K4IXC 4	K6HMS 1	WØEOZ 1
EA4AO 7	SM7OSC 10	K4MHS 2	WB6JZY 13	WØEYE 5
		K4MNH 1	WB6KAP 2	WØIC 1
F9MX 1	UP2ON 1	W4MNT 14	W6KEV 1	WØIDY 1
		W4PFQ 1	WA6KLL 3	WØLER 3
G3BAR 1	N. America	K4QIF 9	WA6MGZ 9	WØNWX 1
G3LTF 2	KL7CUH 2		W6MSG 11	WØPHD 1

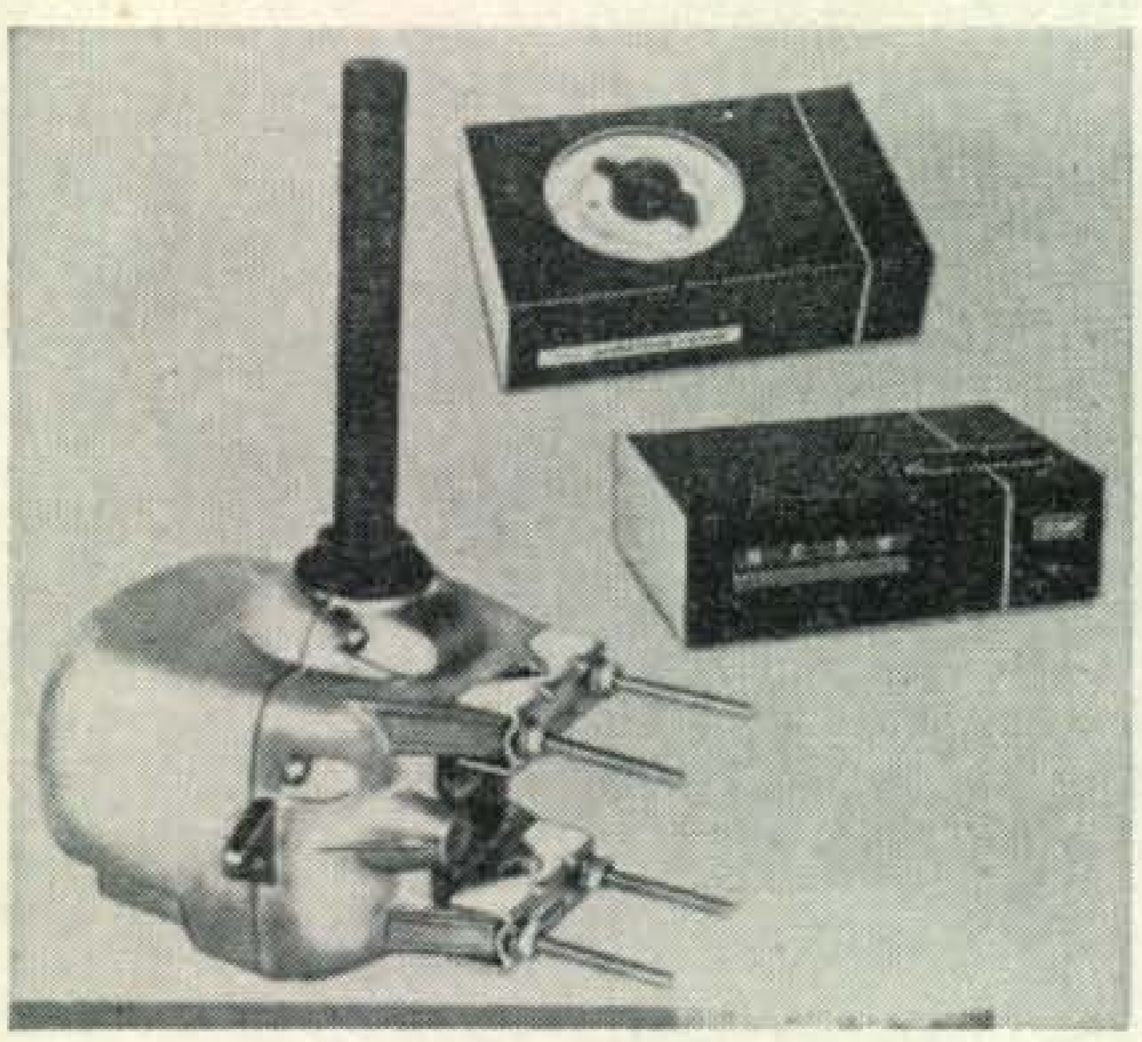
cards and data tapes for use by others interested in making more detailed studies of the communication results of the OSCAR III experiment.

Missing Reports

Many two-way contacts known to have taken place through the OSCAR III satellite do not appear in Table I of the OSCAR report. For example, the W1BU-HB9RG transatlantic contact is not included, nor is the 4X4DH-LZ1AG contact reported in last month's *CQ*. Of the 22 two-way contacts completed successfully by HB9RG only 10 are included in the table. The reason for these omissions, as explained by OSCAR headquarters, is that information concerning these contacts *have not been received at Project headquarters.* In order that all radio amateur stations that participated in this historic communications experiment be included in OSCAR III's roll of honor, OSCAR headquarters urges all stations who have not yet reported their observations to do so as soon as possible. This will make it possible to record the entire OSCAR III story for posterity, giving full credit to all those stations that helped open a new era for amateur radio—the space era.

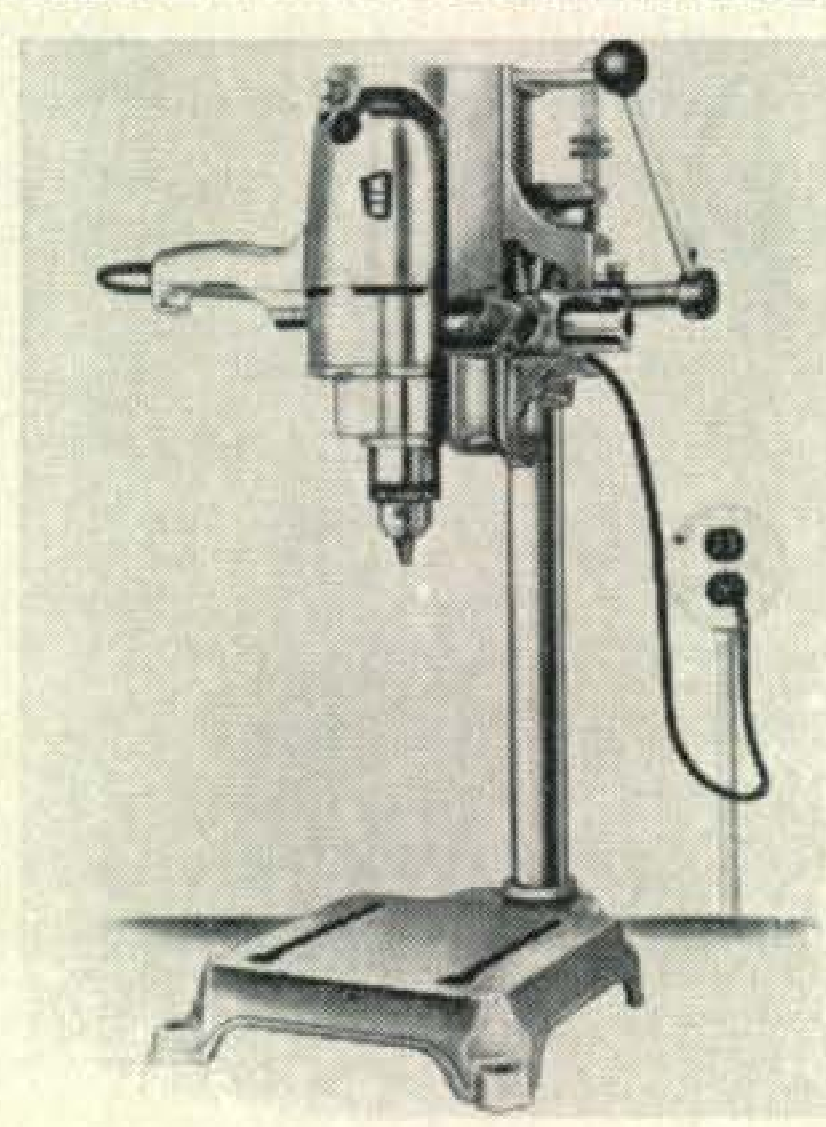
73, George, W3ASK

New Amateur Products



CDR Rotators

CDR has introduced the new AR22R rotator. The unit is automatically controlled with a restyled control box. It exceeds the performance of their previous model, the AR22 which is still very popular. CDR has prepared an 8 page booklet describing their full rotor line, to get a copy write to Cornell Dubilier Electronics, 50 Paris Street, Newark, New Jersey, 07101, or circle 74 on page 110.



WEN Drill and Drill Press

WEN Products has a companion unit to their ½" electric drill (Model 950). The Model 95A60 is an accessory drill press stand which features a calibrated depth gauge, locking nuts, and alignment in all planes. The combination drill and stand retails for $80.90. For complete information write to WEN Products, 5810 Northwest Highway, Chicago, Illinois, 60631, or circle 75 on page 110.

NOVICE

WALTER G. BURDINE,* W8ZCV

As we start this new year, let us take a long sober look at our hobby and its effect upon the world of communications and the art of electronics. Just what are we doing to better our system of communication with those of other lands; are we letting our avrice and selfishness spoil our image of our hobby among those that are not fully acquainted with the purpose of our license? Do we fail to project the goodwill we desire to those of other lands (you see this also applies to those outside our own country), to better our position in the world? We should always be the kind, intelligent and helpful operator that is the mark of any good ham. We are able to talk to the many peoples of the earth regardless of racial, religious or lingual differences. We should try to make a new friend from each contact.

For this one month we are changing the format of the novice and technician column and joining the others to answer a few of the many questions that have been asked over the years. Each question has been asked many times or if not, it will answer the unwritten questions of many who have failed to write because they were too busy. If you did not see the answer to your question when it was answered in the column you now have a second chance. Since your Editor wrote the first column in August 1955 over 21,000 letters have crossed the desk and many have been answered by letter. These have come from 47 countries, all continents, and the 50 states. *CQ* is a well read magazine in other countries, as such it should have a mighty impact upon the hobby of amateur radio. Let's hope so and let's keep trying.

Interference to the W1AW Broadcasts

Many letters have complained about the interference caused to the transmission of W1AW and the code practice drills that have helped so many of us to become amateurs. I guess we should feel sorry for this addle-patted, pee-wee brained idiot that thinks of nothing better to do than try to compete with this well engineered, perfectly located and well operated station. He is depriving some one of the needed practice needed to become a better operator. I feel very strongly for the being that does this dastardly deed then carries the cognomen, Ham, Amateur Radio Operator or other title denoting perfection of operating habits. This wilful interference fractures every law in the amateurs code, it shows absolutely no respect for the rights of any amateur and disrespect for the efforts of W1AW. One such quarter-wit is too many. LET'S TRY TO KEEP THE W1AW FREQUENCY CLEAR, PLEASE. Listen before sending that CQ.

Copying Single Side Band

Many letters ask about copying side band transmissions on their present receivers. Each receiver requires a different method of tuning for reception of single side band signals. The simplest method and the one that requires the least amount of patience is an outboard product detector and audio amplifier coupled to the i.f. of your receiver. Your Editor has built such a unit as part of a receiver, using compactron tubes in most of the sockets to make a good receiver with a small number of tubes. The product detector has only two tubes and a crystal controlled b.f.o. It is very small, and signals may be copied simply by turning up the gain control in the adaptor. The construction of this unit will be described in the column very shortly, as soon as I get the pictures made and another local ham builds and tests this unit. I never print a diagram unless it can be built by some local ham without too much trouble.

A method of copying s.s.b. signals on your receiver would take more space than we have to spare this month, it can be obtained from any of the handbooks on s.s.b. and you will want the book anyway if you become interested in s.s.b. S.s.b. can be copied on *any* receiver that will receive amateur signals if it is adjusted

Rose Dane, WL7FKB, Anchorage, Alaska is shown discussing problems of transmitter construction with Buck Culver, WL7FJZ and John P. Trent, Navy MARS Coordinator at a recent meeting of the Northland Amateur Radio Club. Buck is President and Rose is Vice-President of the club.

The NARC was formed to further the training of radio operators. It was intended for the novice only but many wanted to stay on after their novice license period had ended. Applause for the NARC, we need more clubs like that. Keep me posted, John.

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

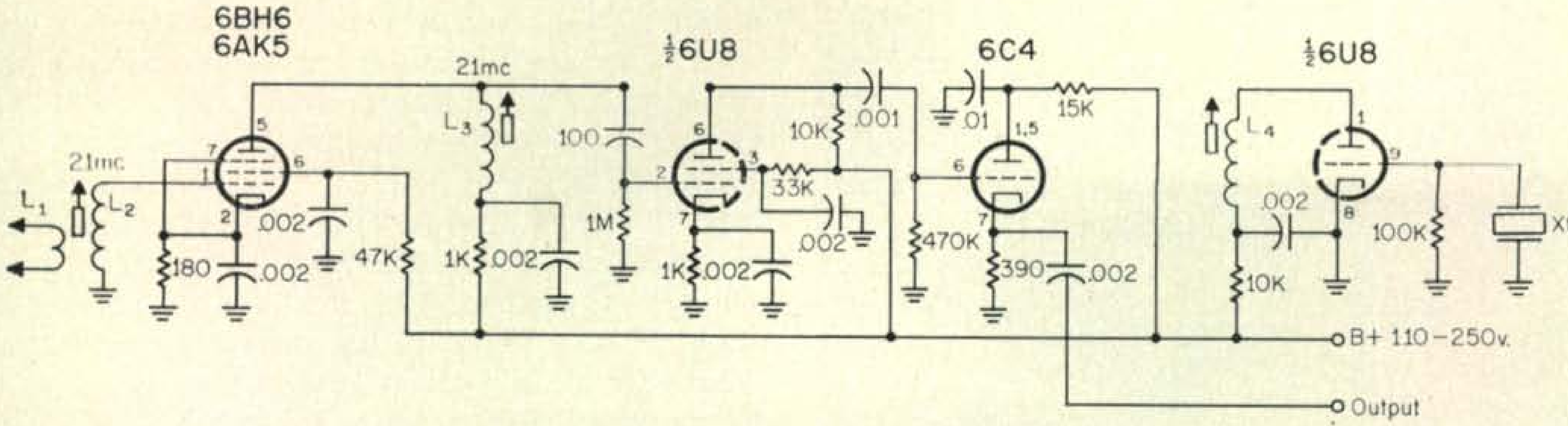


Fig. 1—A simple and sensitive 15 meter converter. All resistors are ½ watt, bypass capacitors are ceramic, and injection is by the interelectrode capacitance in the tube.

L_1—3 t. #24 e. wound on ground end of L_2.
L_2—15 t. #24 e. on ½" slug tuned form.
L_3—Same as L_2.
L_4—23 t. #26 e. wound on ½" slug tuned form. L_4 may need to be changed depending upon the frequency of the crystal. This is for 17.5 mc to give an i.f. of 3.5 mc. The i.f. frequency is the difference between the 21 mc band and the crystal. Use a grid-dipper to check the frequency of the coils.

correctly. By the way, the simple regenerative receiver does a credible job of receiving s.s.b. signals in an emergency. The degree of success in receiving s.s.b. signals on your present receiver depends a great deal upon its selectivity and stability and your ability to use it correctly. The frequency of the beat frequency oscillator (b.f.o.) should be adjustable with possibly a small bandspread capacitor in parallel with the larger capacitor used to change the frequency of the b.f.o. It would be helpful to have the amplitude of the oscillator variable, to control the amount of carrier injection to the detector. Better yet, use the product detector, it can be installed within the receiver.

Another subject that would require a book length column and one about which I receive many letters is improving the sensitivity of receivers. What about a diagram of a beat frequency oscillator; will it improve the sensitivity of my receiver? Would a preselector help my receiver? How can I get more signal into my HE-35? Could I get more sensitivity from my BC-348 by rewiring it for hotter tubes or running it at higher voltages

WHOA! back up and start again. This is a whole hobby in itself. Let us see about a few ideas that might help.

Most any old receiver can be improved by a thorough cleaning and realignment of all circuits by a good serviceman that knows how to tune it correctly and knows how to align it so that it will tune correctly. I have found that installing "hotter" tubes in the receiver usually causes some other trouble to appear. If YOU know what you want and how to do it you can often improve your old receiver so that it will perform almost as good as some of the better receivers. This might cost a good deal and you may want to sell your receiver for enough to add to this cost and by a better receiver.

Many of us have old receivers that we want to keep. Clean them well of any scum, corrosion, rust spots and dust. Check all tubes on a good checker and replace any doubtful ones with new tubes or possibly "hotter" ones. Check all voltages and possibly replace the filter capacitors along with any parts that "just look bad". Remember: your receiver was made to work well when it was built, it should be able to do a good job yet.

Outboard attachments can be added to improve the operation, the preselector will improve the sensitivity, the Q-multiplier will improve the selectivity and the product detector will provide single side band reception. Voltage regulation will improve the oscillator stability. The disadvantage of this is the amount of equipment sitting on the operating table and the amount of space taken by these extras.

I have had some success in stabilizing many receivers by removing the big heat producing power supply from the receiver and providing power to the receiver through a cable. In this case many of the small accessories were installed in the space formerly occupied by the power supply components. Removing the heat also prolonged the life of the other components in the receiver.

As the frequency of a variable oscillator is increased, its stability is decreased. To improve

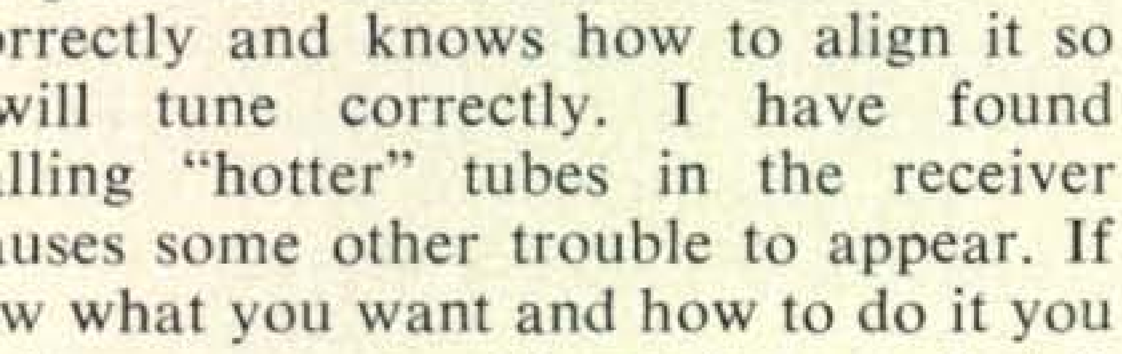


Fig. 2—A simple oscillation indicator. It will indicate oscillation at any r.f. frequency.

L_1—2 t. solid hook-up wire, one inch in dia. The line connecting L_1 and the meter can be twisted lead.

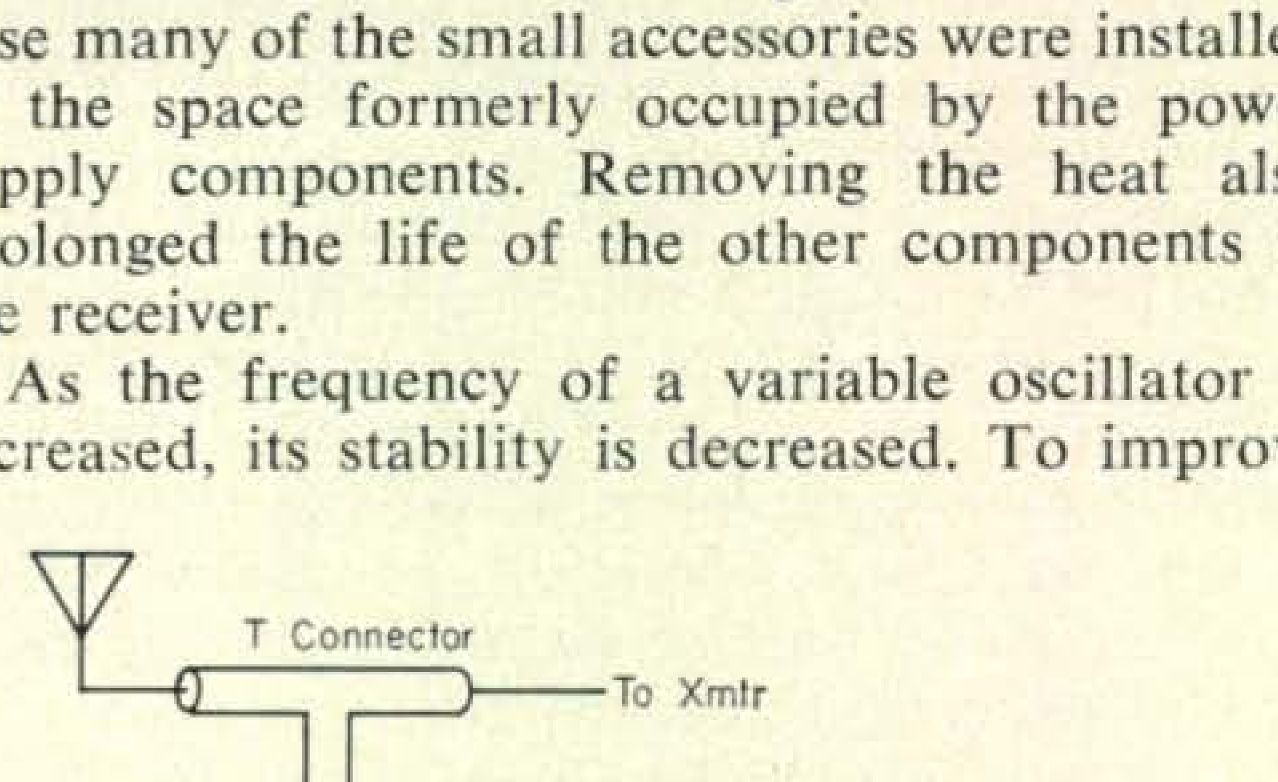


Fig. 3—A transmitter tune-up meter for low-powered transmitters. C_c can be a couple of turns of twisted hook-up wire called a gimmick.

Larry Smith, WN4YYU, 2901 Skidaway Road, Savannah, Georgia sends us this picture of his neat station. He has worked 37 states and 18 countries and is hoping to get his General license in December. He is 15 and thinks amateur radio the best hobby in the world. (So do I.)

the sensitivity and selectivity of the higher frequency bands, I resort to the habit of using converters for the higher frequency bands tuning the frequency of the i.f. where the oscillator stability is best on the receiver. If you have a BC-348, make converters to tune 160, 80 and 40 meters with an i.f. of 200 to 500 kc, the selectivity and sensitivity are greatly improved. Your operating habits will change too, you just won't call CQ and say you are tuning the band, it takes too long to tune the band. You will learn to listen and then call. This is an excellent way to get double or triple conversion, however it is not the answer to all your problems. As Lee Schwindt, WN7DBA is badly in need of a simple 15 meter converter I will show a simple one in figure 1 in exchange for the picture you promised, Lee.

By the way the installation of a b.f.o. will not improve the selectivity of your receiver, it is used to beat against the i.f. frequency to produce the c.w. note of your receiver. The frequency shift of the b.f.o. is about 3 kc, 1500 cycles either side of your center i.f. frequency to produce an audio note of 1500 cps or less.

An article on beat frequency oscillators is in the works, using both variable and crystal controlled oscillators. I am building a b.f.o. for the Gonset two and six meter transmitters. Also a b.f.o. for the different automobile radio receivers that you might need to use for copying c.w. Auto sets make very good i.f. strips and they are fairly stable—and cheap as well as being easy to convert to a.c. operation. I actually built a good receiver set-up for six meters for just about $20.00 using a Vanguard transistor converter and an a.c. operated auto radio set, try it you just might be surprised. By the way you never knew that there was backlash in the tuning dial of those sets, did you?

I operate a Lafayette HE-35 on six meters and while it does a very good job, it still lacks some punch on the long distance signals. Just what can we expect for $57.50? I solved the problem of more signal to the detector for just $5.95 for the new printed circuit preamp using a 6CW4 Nuvistor tube in a grounded-grid amplifier circuit built by Etco, Scottsdale, Arizona. This is not the first time you have heard of this ole boy, he is Ev Taylor, K7YSE ex W8NAF. He has helped the v.h.f. gang for many years. This unit is about 1⅝ by 3⅝ inches and with tube it takes about 1½ inches of space. I mounted it in my HE-35 very nicely, I will publish a picture and installation instruction soon. It sure makes a big difference, especially when operating mobile, guess I'll get one for the Clegg 99'er. By the way I haven't tried it but it looks as if the 13CW4 would be the right tube to use on 12 volt cars, and when operating aeronautical mobile as I did with the HE-35 before installing the preamp. I have both 6 and 12 volt power supplies for the unit, my Volkswagen has 6 volts.

I don't think it advisable to increase the voltage to any great extent on any equipment as the capacitors are not rated high enough to withstand the higher voltages. This would mean you would need to replace many of the capacitors in the set. If you replace the built-in power supply of any set as suggested above, do not increase the voltage to any extent but it is a good idea to increase the current carrying capacity of the power supply to furnish power to the accessories used in improving the set. Using a TV transformer, voltage output can be controlled by using different filter configurations, choke input will decrease the voltage, capacitor input will increase the voltage output. Check your handbook.

I know of a local ham that let his extra set sit idle because he could not buy an 80 rectifier, simple: replace the socket with an octal Amphenol ringmount replacement socket and use a 5Y3. 5Y3 at 80 cents, socket 20 cents, tube always available. Cost of 80 tube $2.40, just shows you, use your handbook and your head.

Tune Up Procedures for the Blind Ham

I have received a few letters about tune up procedures and log keeping for the sightless ham. How can he tune his station for maximum output and how can he tell when he is correctly tuned for maximum output? How can he keep his log correctly without the use of Braille. Any help on this subject would be appreciated and I will publish the ideas for the benefit of the blind operator. How about an audio oscillator operating from the rectified power from the antenna tune up unit of figure 3? I am going to

[*Continued on page 105*]

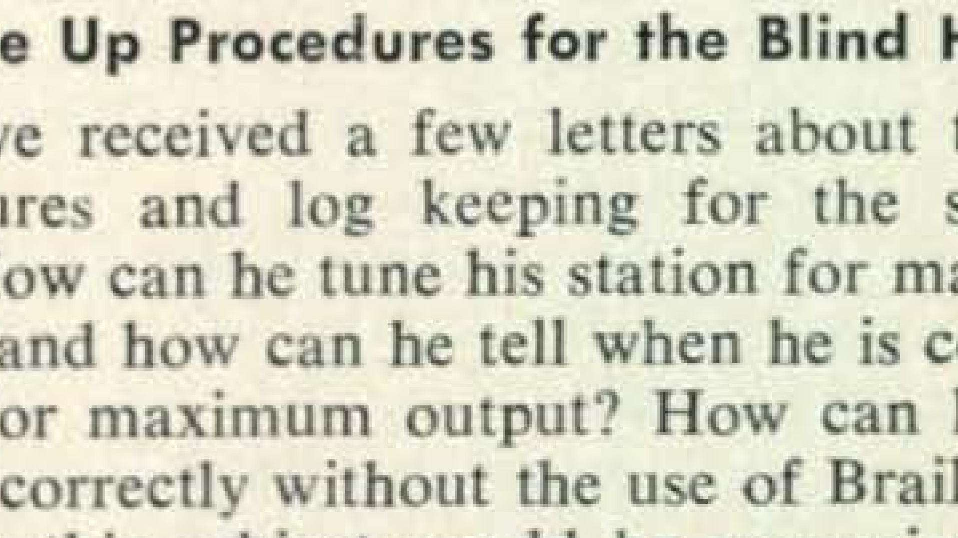


Fig. 4—A code oscillator. To change the tone, change the value of the 4.7 K resistor or the capacitor. Resistors are 1 watt.

YL

LOUISA B. SANDO,* W5RZJ

WHAT do you know—G2YL, Nell Corry, came all the way to Albuquerque to claim the supplemental pages for her copy of our book, *CQ YL!* Of course, this was just one of the many stops on her 3-month tour of Canada and the U.S., but along with all the other YLs, we were mighty happy to meet Nell in person.

Leaving England Aug. 20 on the *SS Manchester Merchant,* Nell then traveled across Canada, visiting the VE3 YLs and with VE6MP, Maude, and VE7NW, Irene, before coming to the States. On Sept. 20th 19 YLs attended the Portland Roses dinner meeting for Nell. On the 25th she was pinned a full member of BAYLARC at a luncheon held in her honor. Nell was "adopted" into YLRL by BAYLARC in 1959 and this visit to her "mother" club established a "first," so far as we know. In addition to the pinning, WA6PKP, Vera, BAYLARC president, presented Nell with a sterling charm bracelet which included a mermaid as the club emblem, the YLRL girl-on-the-globe, several San Francisco high spots and identification discs. K6SZT, Elaine also presented her a BAYLARC Mermaid Certificate, signed by all attending, to commemorate Nell's eyelash QSO with the 21 YLs assembled for the luncheon.

On October 2nd some 23 members of LAYLRC held a luncheon for Nell at Los Angeles. Nell also visited with various of the YLs in California—W6BDE, K6KCI, W6NAZ, W6UHA, WA6AOE—sightseeing and enjoying their famous hospitality.

From our "Land of Enchantment" (where W5DOJ-W5DED, W5YSJ-W5YSK, K5ZWA & OM, and K5GLJ joined us in entertaining her), Nell went on to Colorado to meet YLRL President WØHJL, KØBTV and other Colorado YLs. New Orleans was to be next stop, then D.C. to renew acquaintance with W3CDQ and meet WAYLARC members, and finally New York City and the trip by plane back to England.

G2YL is a real long-time YL having received her license in 1932. She bought a kit of parts, built a receiver and taught herself code by listening. Eventually she met a ham who showed her how to build a transmitter and get a license. Nell was the first European ham to make WAC on 10 meters (1935).

*4417 Eleventh St., N.W., Albuquerque, New Mexico 87107.

17th Annual YL-OM Contest

Time: Phone—Sat. Feb. 19, 1966, 1300 EST (1800 GMT) Sun. Feb. 20, 1966, 2400 EST
CW—Sat. Mar. 5, 1966, 1300 EST (1800 GMT) Sun. Mar. 6, 1966, 2400 EST

Eligibliity: All licensed OM, YL and XYL operators throughout the world are invited to participate.

Operation: All bands may be used. Cross band operation is not permitted.

Procedure: OMs call "CQ YL." YLs call "CQ OM."

Exchange: QSO number, RS or RST report, ARRL section or country. Entries in log should show band worked at the time of contact, time, date, transmitter and power. (ARRL Section list for SASE to V.P.)

Scoring: (a) Phone and CW contacts will be scored as separate contests; submit separate logs.
(b) One point is earned for each station worked, YL to OM or OM to YL. A station may be contacted no more than once in each contest for credit.
(c) Multiply the number of QSOs by the number of different ARRL Sections and Countries worked.
(d) Contestants running 150 watts input or less at all times may multiply the results of (c) by 1.25 (low power multiplier).
(e) SSB contestants running 300 watts P.E.P. or less at all times may multiply the results of (c) by 1.25 (low power multiplier).

Awards: 1st place phone: YL—Cup OM—Cup
1st place CW: YL—Cup OM—Cup
The winner of the phone cup is also eligible for the CW cup. Certificates will be awarded to high place CW and phone winners in each ARRL District and Country.

Vhf Section: Scoring—Number of contacts times low power multiplier. There is no multiplication by ARRL Sections and Countries. Use of both low and high power for any portion of the contest will not allow your use of the lower power multiplier. Awards—1st place phone and CW on VHF both YL and OM will receive special awards.

Logs: Copies of all phone and CW logs, showing claimed scores and signed by the operator must be postmarked no later than Mar. 21, 1966, and received no later than Apr. 2, 1966, or they will be disqualified. Please file separate logs for each section of the contest. NO LOGS WILL BE RETURNED. BE SURE IT IS A LEGIBLE COPY OF YOUR LOG. Send copies of logs to YLRL Vice President Edie McCracken, K1EKO, P.O. Box 285, Westwood, Massachusetts 02090.

No doubt G2YL will be looking especially for the VE and W/K YLs she met on this trip with the new tri-band beam she had installed just before leaving home. Good luck, Nell, and may you return soon for another visit!

Nell Corry, G2YL, photographed at the luncheon her "mother" club, BAYLARC, held in Nell's honor on Sept. 25, 1965.

Our tnx to W6BDE, Esther, for photo and report of Nell's visit with BAYLARC.

YLRL Secretary

Secretary of the Young Ladies Radio League for 1966 is Maxine Hanberry, WA6AOE, of South Pasadena. Maxine came up with her General ticket in 1958 and her first activity was operating 2 meters from the family boat on trips to their vacation home on Catalina Is. OM Bill, with Universal Studios, is K6MQT, and son John is WA6IYM, now a student at the University of Washington.

WA6AOE was president of LAYLRC in 1961-62, and was YLRL's 6th D/C during 1965. She holds YLCC-450, WAC-YL, DX-YL, enjoys c.w., and has a great interest in all YLs. Another hobby of interest to Maxine is oil painting.

First VE YL Club

Congratulations and salutations to "The Ontario Trilliums," first YL club to be organized in Canada! Officers are: Pres., VE3BII, Jan Burgess; V.P., VE3DGG, Jean Evans; treas., VE3BBO, Doris Cody; secy, VE3EZI, Ivy Smyth; soc. chm., VE3FUR, Doreen Aston; publicity mgr., VE3FRN, Doris Taylor.

The club has its own call, VE3TOT, and the club net meets every Sat. at 1800 GMT on 3650 kc. The club also offers the Ontario Trilliums Certificate for contacts after May 19, '65. For W/VE stations, accumulate 6 points, 1 each per member; 2 for club station VE3TOT. Fee $1. Band endorsements; seal endorsements for each 6 points. SASE only. For DX stations, same as above, except 3 points required. S.w.l.s eligible as above. Send list of calls, in alphabetical order, with TOT number and full log details, signed by 2 amateurs that QSLs are in your possession to: VE3CLP, Marion Course, 2727 Russell St., Niagara Falls, Ontario, Canada, enclosing fee or SASE as required.

Buckeye Belles

Further word from the Buckeye Belles indicates contacts with memorial station W8MBI will count as two contacts toward the B.B. certificate, effective July 18, 1965. Custodian is W8HWX, Lillian Richardson, 3709 Starr Rd., Oregon, Ohio 43616. No QSLs needed, but a list with call, Buckeye Belle number, first name, date, frequency and mode are requested along with 25¢ in coins or stamps to mail the certificate in a cardboard tube.

Maxine Hanberry, WA6AOE, Secretary of YLRL for 1966.

Peg Harnois, K1GSF, Editor of YL Harmonics for 1966. For write-up see October '65 CQ. Peg's Dad is K1EFZ.

DX Awards

Congratulations to these YL recipients of the WPX award: On c.w., WA6OET, Jessie Billon; on phone, DJ2YL, Susi Liebig; on s.s.b., VE6-ABP, Margaret Tettelaar. Also congrats to K2MGE, Dorothy Strauber, for earning the 300 Two-Way SSB award. These YLs have been written up earlier in *CQ* for other DX accomplishments.

WAYLARC

Newly appointed certificate custodian for WAYLARC is Ruth, WA4FEY, whose QTH is Rt. 1, Box 360, Leesburg, Va. To earn a certificate one must work 5 active members at other than net times. Send QSLs to Ruth, with 10¢ in coin or stamps to cover mailing of certificate, plus return postage for the QSLs.

Honorable Mention

A note from Dr. W. M. Mitchell of Bangor, Maine: "I think that Hugh, W7PVF, hard working OM of Frieda, K7PVG, should have had honorable mention in your article about K7GS (Girl Scout Senior Roundup station, October *CQ*). Every time I visited the ham shack, which was frequently, he was there and hard at work." . . . We know a lot of OMs helped, but in a YL column we try to stick pretty much to mention of YL participation in various activities.

33, Louisa, W5RZJ

PLEASE include your ZIP code number on all correspondence.

Zero Bias *[from page 7]*

that a native of the remote country became active as a ham.

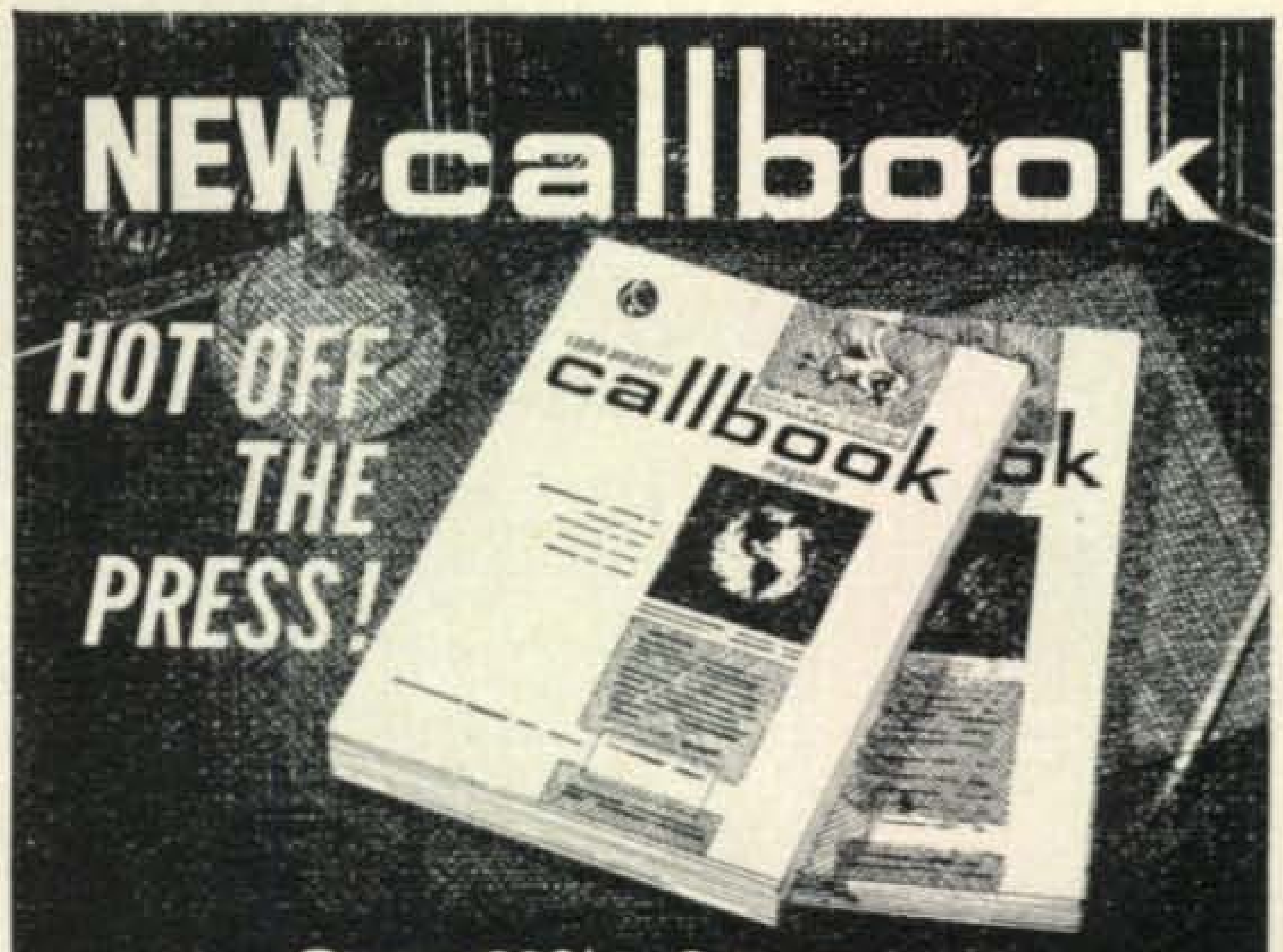
At the risk of antagonizing the fellows so deeply involved in DX and DXpeditions, I propose that a sweeping revision be made in valid-country-status requirements in an attempt to return a measure of sanity to this area of the hobby. At the heart of the revision, I suggest a forceful return to the "new country" situation mentioned above. Specifically, no amateur operation from a previously inactive country should count towards DXCC, WPX or WAZ, unless the operation is verified to be by a native amateur or an amateur visiting during the normal conduct of his business or vacation. An expedition for the sole purpose of creating a new country should be deprived of all country credit.

Strong measures? Certainly, but an air of legitimacy must be returned to DXing if it is to continue to warrant the interest of so many amateurs.

Suggestions have also been made to convert the various Honor Rolls to "term" awards, with a fresh start made every few years, much as the Long Island DX Association's Annual DXCC Contest [*CQ*, Nov. '64, p. 95].

At any rate, it seems that the time has come to do some hard thinking about the course that DXing is taking. I eagerly look forward to receiving reader comments. Don't hold back, please.

73, Dick, K2MGA



CQ TECHNICAL BOOKS

CQ ANTHOLOGY I

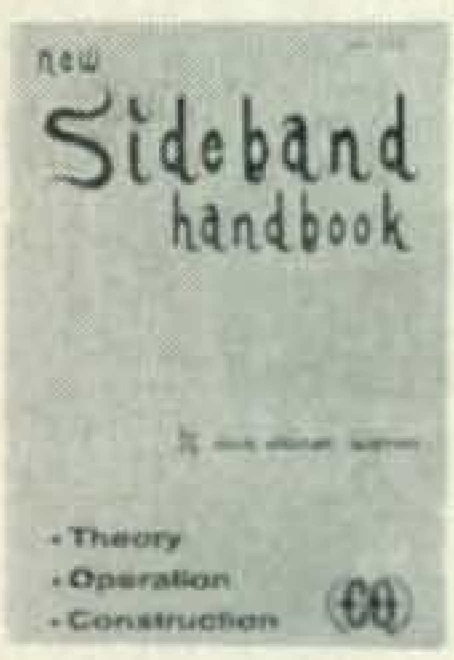
We've looked back through the years 1945-1952 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out and are unavailable.

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.

CQ ANTHOLOGY II

Top favorite CQ articles from 1952 to 1959 . . . including some you may have missed . . . compiled into one new information-packed book! No more need to try to locate sold out back copies of CQ. This Anthology includes past articles of lasting interest to every amateur radio enthusiast. Over 250 pages of text. Over 75 different articles. A definite Must for your shack!



SIDEBAND HANDBOOK

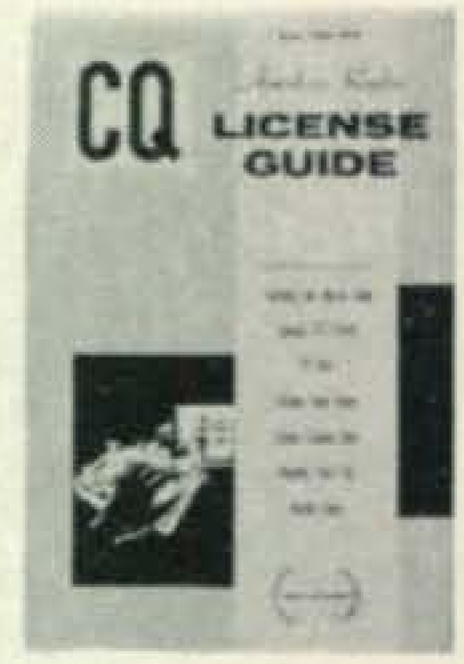
Written by Don Stoner, W6TNS, who was almost one full year in the preparation of this terrific volume. This is **not a technical** book. It explains sideband, showing you how to get along with it . . . how to keep your rig working right . . . how to know when it isn't . . . and lots of how to build-it stuff gadgets, receiving adaptors, exciters, amplifiers.

VHF FOR THE RADIO AMATEUR

If you are, or are planning to be a VHF operator, you can't afford to be without this dynamic new handbook written especially for you. Filled from cover to cover with all new and original construction material presented so you can understand it. Written by Frank C. Jones, W6AJF, nationally acclaimed for his VHF pioneering.

SURPLUS SCHEMATICS

This is a book literally loaded with schematics for all the currently popular pieces of surplus gear. Most amateurs are well aware of the problems encountered in purchasing seemingly inexpensive surplus units, only to find that no schematic diagram is available. Trying to figure out the circuitry cold turkey can be many-times more difficult than the most involved puzzle, and purchasing a single instruction book can run as high as $3.50.



CQ LICENSE GUIDE

212 pages of everything the Amateur must have to get his license and progress toward the general class ticket. Plus many additional pages of vital information for the ham operator.

THE NEW RTTY HANDBOOK

A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section in getting started, all written by Byron Kretzman, a well known authority in the field. First printing sold out. Second printing on hand.

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.

COWAN PUBLISHING CORP. Book Div.
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

CQ ANTHOLOGY I	$2.00	☐
CQ ANTHOLOGY II	3.00	☐
ANTENNA ROUNDUP	3.00	☐
SIDEBAND HANDBOOK	3.00	☐
VHF FOR THE RADIO AMATEUR	3.50	☐
SURPLUS SCHEMATICS	2.50	☐
CQ LICENSE GUIDE	2.50	☐
"NEW RTTY HANDBOOK"	3.95	☐
MOBILE HANDBOOK	2.95	☐
ELECTRONIC CIRCUITS HANDBOOK	3.00	☐
SHOP & SHACK SHORTCUTS	3.95	☐
SURPLUS CONVERSION HANDBOOK	3.00	☐
UNLIGHTED GLOBE	19.95	☐
ATLAS	15.00	☐
CODE RECORD	3.50	☐
REGULAR LOG SHEETS (100)	1.00	☐
SSB LOG SHEETS (100)	1.00	☐
HAM'S INTERPRETER	1.50	☐
TVI HANDBOOK	1.75	☐
BINDER—YEAR WANTED	4.00	☐
DX ZONE MAP	3.00	☐
DIODE SOURCE BOOK	2.50	☐
USA-CA RECORD BOOK	1.25	☐

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

SIRS: My check (money order) for $________
is enclosed. Please send the following items to:

Name____________________

Address____________________

City________ Zone______ State________

For further information, check number 33, on page 110

For further information, check number 34, on page 110

NC-183 on S.S.B. *(from page 42)*

The S meter is actuated by means of the diode connected half of the 12AU7. Simply disconnect the lead from pin 5 of the detector socket V_7 and run it to a tie point lug on tie bar #4. From there, connect a wire to the particular half of the 12AU7 you have chosen as a diode. A 6C4 and a germanium diode may be used instead of the 12AU7 if desired. The values of C_{65} and C_{66} may be increased if slower S meter action is desired.

We realize that there are perhaps a half dozen different ways to perform this surgery. One way would be to go solid state. Another would be to use the accessory socket as the additional socket, instead of mounting one under the chassis. In our case, the accessory socket is occupied by a home built 100 kc oscillator. As far as replacing the submerged 12AU7 is concerned, ours is still going strong after four years.

Operation

As a further improvement to the receiver, the crystal converter described in the ARRL Handbook was added separately to the front end. This increased the sensitivity to some degree, but what is more important, it permits the utilization of the receiver's more efficient 80 meter band. It also creates four times the bandspread. The one disadvantage is that the logging scale must be used and frequencies interpreted. The mode switch in the diode position places the first half of the 6SN7 into a diode configuration. The set then works as originally built. Special note should be made of the shielded wires as shown on the circuit diagram.

This revision of course, is adaptable to the NC173 as well. ■

Ham Clinic *(from page 70)*

money. The manufacturer who makes modifications available in kit form deserves a hearty pat on the back by old customers.

Checking Coax Cable for Moisture—"What is the best and easiest way to check coaxial cable for moisture?"

By using a megger—an instrument that reads in the thousands of megohms. If you do not have one of these try using a scope. If no scope is available, a v.t.v.m. on the highest resistance range may work. With dry, well insulated coax a reading of any kind should not be obtained with the v.t.v.m. With a megger, the higher the reading the better. Connect any of the instruments mentioned above between inner conductor and the shield to check for moisture.

Sweep Trouble—"When using my scope to check transmitter operation, it never seems to settle down. When I get the pattern I want it starts to run horizontally across the cathode ray tube (CRT). What do I look for?"

First check the horizontal sweep circuit and tube. A bad tube, leaking capacitor or bad resistor could cause loss of sync. Also, if the voltage regulation is poor sync will be lost. Check the horizontal amplifier and its components. A bad pot (sync) may also cause instability. If you are using 60 cycle sweep (from the 110 v.a.c. house lines) you may have poor voltage regulation and this is a matter for the power company to clear up.

Highest Failure Cause—"In your experience what would you say contributes to more radio-electronic equipment failures than any other component?"

Vacuum tubes.

Multi-band Doublet Flat-topped—"I have an idea for a multi-band doublet, the drawing is attached to my letter. Think it will work? How?"

See fig. 11. Yes, it will work, but the directivity of the 20 and 40 meter doublet sections will be 180° removed from that of the 80 meter doublet. When using this or any other multiband antenna be sure and check for harmonic radiation.

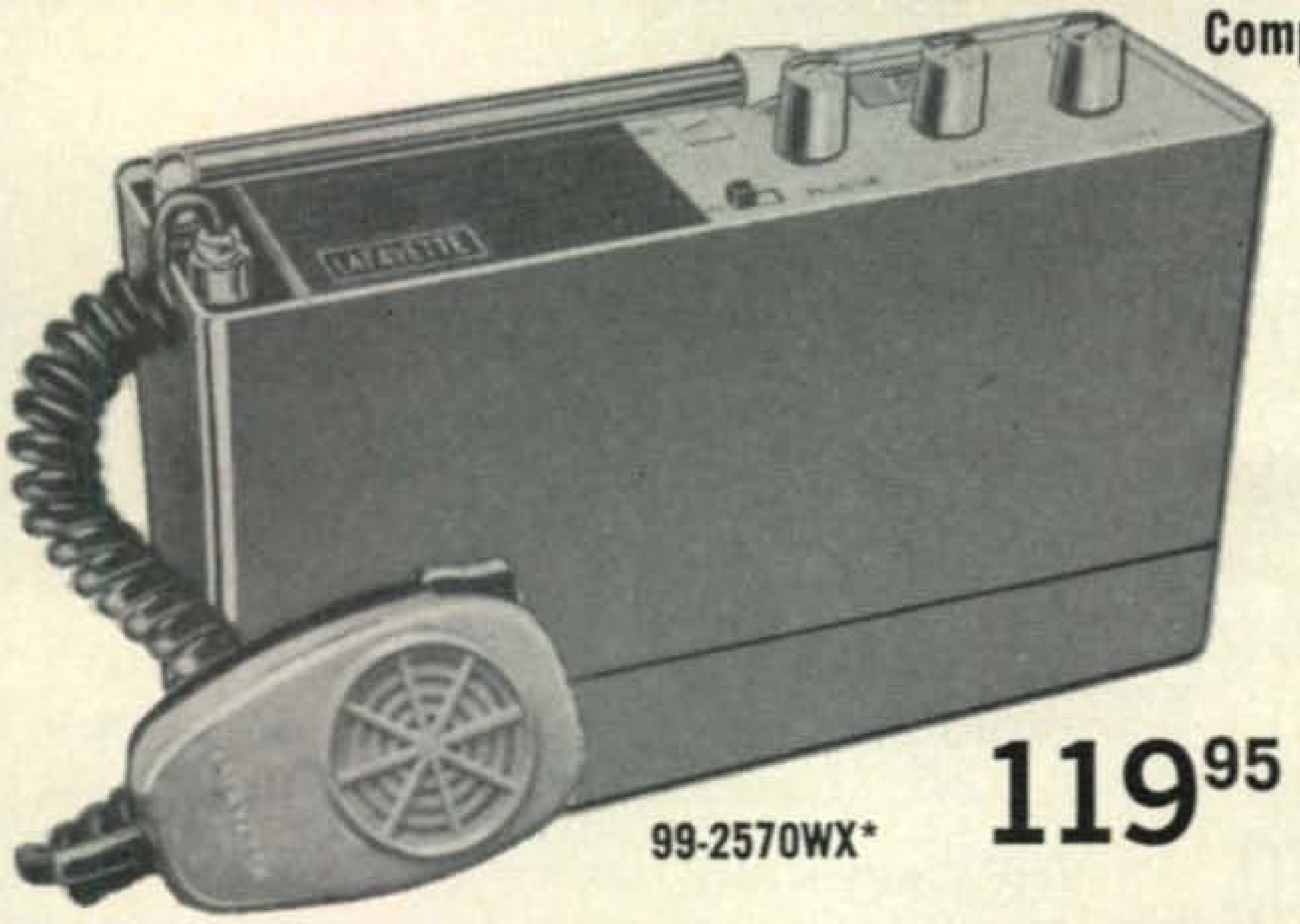
Thirty

HAM CLINIC is now beginning its 9th year. During this time we have answered thousands of questions from readers and we have enjoyed doing it. At times we were "snowed under" by mail, and although we did not please everyone we tried awfully hard to do so. As we have said before, we are human, do make mistakes, do not know it all (and never will) and seem to learn something new every day—even though we have been in the game for over 30 years.

LAFAYETTE 6-Meter Solid-State Transceiver

Completely Portable And Mobile —

Take It With You Everywhere!



99-2570WX* **119^95**

Model HA-650

- 2.5-Watts Input
- Built-in Battery Supply
- 6 Crystal-Controlled Transmit Positions
- Tunable Superhet Receiver
- Portable, Mobile and Fixed Station Operation

A great new 6-meter transceiver designed for portable, mobile and fixed station use (with optional AC supply). All solid-state circuitry delivers more than 50% RF to the antenna. Has phenomenal 1.2 μV sensitivity; noise limiter. Includes push-to-talk dynamic microphone, leather carrying case with shoulder strap, telescoping whip antenna and batteries.

99-2523WX*

Model HA-225 **SALE! 119^95** Was 129.95

LAFAYETTE SSB/CW/AM 14-Tube Amateur Communications Receiver

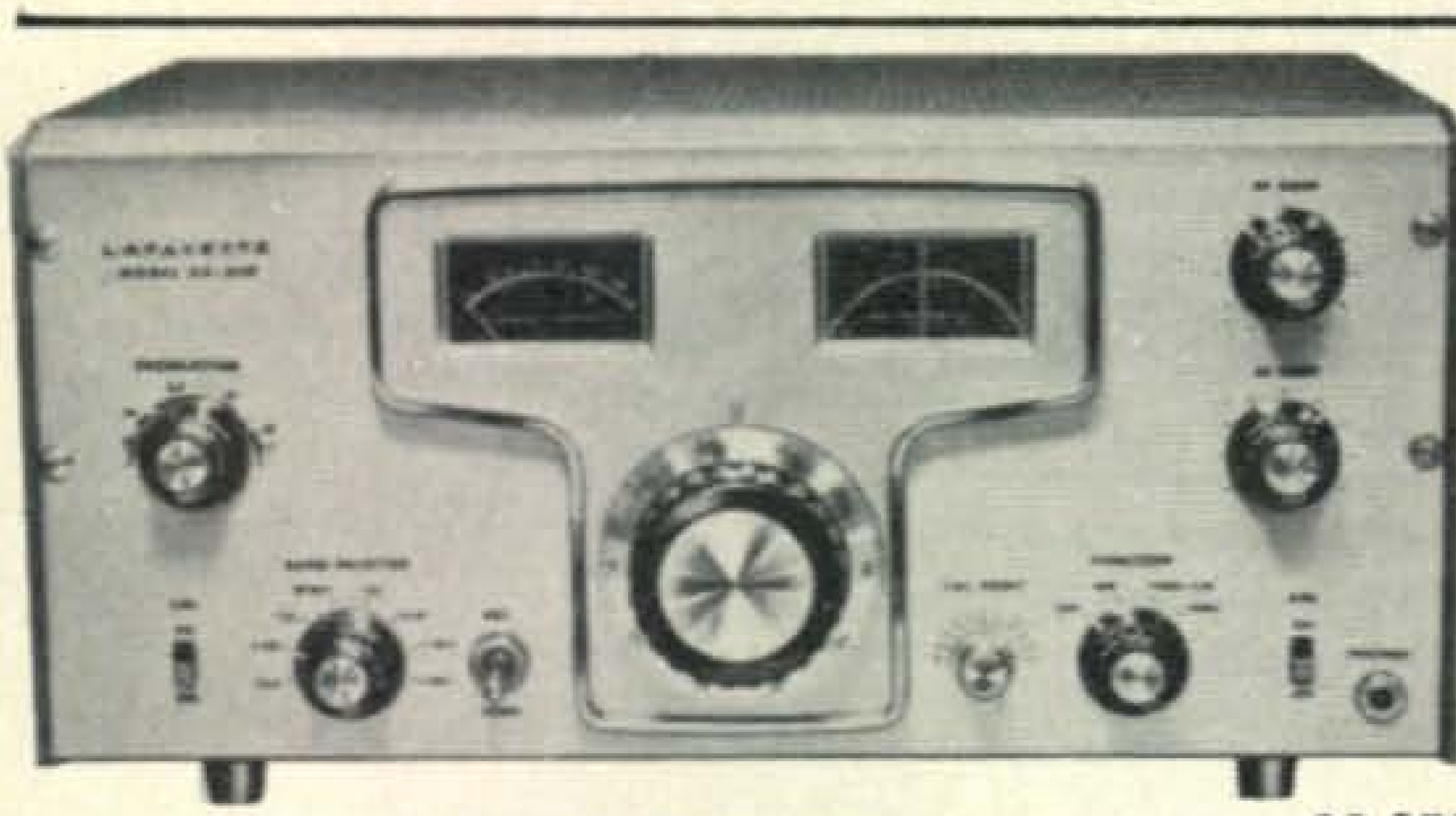
- 5 Bands—150 Kc to 54 Mc
- Extra RF Stage and Mixer/Osc. for Dual Conversion on 6 Meters
- New Product Detector Circuit for Improved SSB Reception
- Crystal Calibrator for Checking Receiver Calibration Markings

99-2522WX*

Model HA-230 **SALE! 69^95** was 79.95

LAFAYETTE 8-Tube AM/CW/SSB Amateur Communications Receiver

- 8 Tube Superhet Circuit: 4 Bands 550 Kc—30 Mc
- 1 RF + 2 IF Stages for High Gain Reception
- Built-in Q-Multiplier for Crowded Phone Operation
- Effective Automatic Noise Limiter
- Built-in Edgewise S-Meter
- Calibrated Electrical Bandspread on Amateur Bands 80 through 10 Meters



99-2524WX*

Model HA-350 **SALE! 139^95** Save 35.00 was 174.95

LAFAYETTE 10-80 Meter SSB/AM/CW Amateur Receiver

- Mechanical Filter for Exceptional Selectivity
- 7 Band-Switching Positions—3.5, 7, 14, 21, 28, 28.0 and 29.1 Mc Plus WWV on 15 Mc
- 12 Tubes Dual Conversion
- Automatic Noise Limiter
- Product Detector for Selectable Upper and Lower Sideband Reception
- 100 kc Crystal Calibrator and Crystal BFO
- Complete with Crystals for 80, 40, 20, 15 and 10 Meters

*Imported

FREE! *Lafayette 512—Pg. 1966 Catalog No. 660. Write: Lafayette Radio Electronics Corp., Dept. CA-6, P.O. Box 10, Syosset, L. I., N. Y. 11791*

For further information, check number 20, on page 110

To our new readers we say welcome and ask that you keep your letters brief and enclose 2 IRC's or 25¢ in coin for airmail postage, and direct your letters to us at 4 Lutzelmatt Str. Luzern, Switzerland (while we are overseas) if you are in a hurry, otherwise send them to *CQ* Headquarters. We will answer all communications as fast as we humanly can and as time permits. You can well realize that it sometimes takes some book and literature research to come up with the answers you seek—but there is no charge for the service at all.

If you like our column HAM CLINIC we would like to hear from you—a postcard will do.

For this month then, we proffer our best 73 and 75. Chuck, W6QLV

VHF Converters [*from page 52*]

432 Mc Converter

This converter has about as few tubes as can be used for 432 mc converter service with crystal control unless one goes to transistors. The converter was built on a 2 × 6 inch copper clad board with three nuvistor tubes and a diode frequency multiplier. The noise figure seemed to run about 6 db which could be reduced to about 5 db by using a nuvistor preamplifier on a separate copper clad board.

The r.f. stage in fig. 5 is a grounded grid type in which an attempt was made to reduce regeneration by a small feedback capacitor from plate circuit to cathode. The small trimmer from antenna jack to ground seemed to solve this problem quite effectively and permitted the use of a 432 mc paramp ahead of this converter. No regeneration problem was noted when the converter was loaded by a 50 ohm antenna system instead of the paramp.

For best noise figure, the 50 ohm antenna impedance should be stepped up to over 100 ohms for connection to the cathode of a grounded grid 6CW4 tube. This is accomplished by means of a pi circuit consisting of the antenna variable capacitor, the 1¼ × ⅛ inch copper strap and the input capacitance of the tube.

The r.f. stage plate circuit consists of a a three turn coil about ¾ inch long and ⅜ inch diameter made of some more ⅛ inch wide copper strap. This circuit was capacity coupled to a pi circuit into the mixer grid. Another pi circuit tuned to 418 mc was inductively coupled to the grid pi circuit by spacing it about ¼ to ½ inch.

The mixer plate circuit was a parallel tuned circuit peaked at 14 mc since all of the stations in this area operate close to 432.0 mc. If wide band coverage is desired, a low *Q* pi system similar to that shown in fig. 4 or fig. 2 should be used. The parallel tuned circuit is only good for about a 1 mc passband at 14 mc.

The crystal oscillator is similar to that of fig. 2 with a cathode circuit resonating between the fundamental and third overtone of a 46.44 mc. crystal. It was also found that a seventh overtone crystal marked 139⅓ mc. oscillated quite well in this circuit. The 139½ mc plate circuit

drives a 1N82A tripler to provide output on 418 mc. The diode tap on the 418 mc line and coupling to the mixer grid line have to be experimentally set for best weak signal response at 432 mc. A signal generator or a noise generator can be used in these tests.

In all of these converters, power connections were made to 0.001 mf feed-thru capacitors in order to prevent stray signal pick-up. Double shielded small coaxial lines should be used between the converters and the communications receiver, so strong signals in the 14 to 18 mc region will not be troublesome. ■

Transistorized Power Supplies

(from page 45)

$(R \times I)$ across R_4 will exceed the bias voltage existing across silicon diode, D_1. At this time, Q_2 will begin to conduct, and as Q_2 conducts it forces current through R_3 which in turn begins to bias transistor Q_3 and the series transistors, Q_4, Q_5, Q_6, off. As more current passes through R_4 (after the bias voltage of D_2 has been exceeded) the greater will be the "turn-off" action directed against the series transistors. This overload action is self-starting and will limit current faster than most fuses will open up.

The circuit of the power supply shown in fig. 4 also allows a way of getting around the restriction that the output voltage cannot be less than V_{ref}. Here, by employing a separate full wave rectifier, CR_3 and CR_4, to bias zener diode V_{ref} positive with respect to the output common, the output voltage, V_o, can be adjusted so that it is almost zero with respect to the output common. Therefore, this supply is continually adjustable from zero volts to some higher value. And since either output may be grounded, this supply can be either positive or negative with respect to ground.

Although the treatment of this article has not been a rigorous one, it is hoped that this non-mathematical description has provided a practical insight into the working of this widely used device. ■

VHF

(from page 78)

nitude as to void all the advantages of the chopping technique tested. We find by direct measurement that the minimum detectible signal with the ear in a 1 kc noise band is 17 db below the noise level. This agrees with the published minimum effective bandwidth of the ear-brain system of about 20 cycles. The notation of using radiometer techniques has not been abandoned however a more elegant receiving system is indicated. Bench tests will continue until a practical answer is reached."

For further information, check number 25, on page 110

K2MWA/2's operating personnel were: Ed Chinnock, W2FZY; Jack Wright, K2IYC; Roger Abson, no call; and Dick Turrin, W2IMU. No tests are planned for the near future as they will be concerned with modifications and improvements for the future. The club hopes to be back on in the spring.

Thirty

We are holding off on the 'From the Mailbag' material until next month. Meantime, keep us posted on your plans for the year.

73, Bob, K2ZSQ and Allen, K2UYH

Waters Converter *(from page 41)*

Phono-type jacks are used for the r.f. connections and the power cable is plugged into a multi-prong receptable through which power from a mobile source may also be applied instead.

Performance

Image and i.f. signal rejection was found to be 3-8 db better than the minimum rating. The given noise figures appear a bit higher than might be expected; however, it is a conservative *maximum* specification. Actually, we found it to be somewhat better (3 and 3.8 db on 50 and 144 mc respectively) and when checked using the same test gear and measurement techniques, the figure of the Nuverter held its own with side-by-side comparisons made with several other v.h.f. converters purported to have lower noise figures.

For further information, check number 35, on page 110

This also was borne out with sensitivity measurements which ran near .1 μv for 6 db S/N (s.s.b.).

From a practical standpoint you'll find it just about as good as you'll mostly need. This may be evidenced by the fact that we were able to obtain Doppler measurements and observe telemetry pulses from OSCAR III (100 milliwatts on 144.85 mc) on as many as nine successive passes in one day (including the West-East orbits near the 70th parallel, 2000 miles away) using the Waters Nuverter ahead of a Heathkit SB-300 receiver and with a hand-held *indoor* dipole located in a 3rd floor apartment!

Although the Nuverter carries a pretty high price tag, those who can afford it will have two converters in one attractive unit of high quality that provides performance, convenience and flexibility. It will make a bandswitched setup possible in conjunction with an "all-band" amateur receiver to provide extended coverage through both the 6 and 2 meter bands.

The Waters Nuverter, Model 346, V.H.F. Converter is priced at $175, complete with all crystals. It is produced by Waters Manufacturing, Inc., Boston Post Road, Wayland, Mass. 01778.

—W2AEF

Contest Calendar *(from page 75)*

identify the DUF country, which is also part of your multiplier.

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

4. Each completed contact counts 3 points.

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

6. Certificates will be awarded to the highest scorer in each country and each W/K and VE call district.

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

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

NYC/LI QSO Party

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

The South Shore Amateur Wireless Association is sponsoring this year's QSO party. Rules and frequencies will be covered in next month's CALENDAR.

ARRL DX

Phone: February 12-13 and March 12-13
C.W.: February 26-27 and March 26-27
Starts: 0000 GMT Saturday. Ends: 2400 GMT Sunday.

This is the 32nd year for the granddaddy of all DX contests. It will again be held on two weekends for c.w. and two weekends for phone. The rules are unchanged from last year. Briefly it's the world working the W/K, VE/VO, KH6 and KL7.

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

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

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

Detailed rules and other pertinent information should appear in the January issue of *QST*. Official log forms are available on request to the ARRL Communications Dept., 225 Main Street, Newington, Conn. 06111.

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 is a party so that the Old Timers can make their yearly renewal of acquaintances. The National Chapter does sponsor a traveling Plaque to the member contacting the most members but there is no point or scoring system. List of frequencies and etc. next month.

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

Coming on the same week-ends as the QCWA and Vermont parties I wouldn't be a bit surprised to hear an exchange of contacts between the three activities.

Check Louisa Sando, W5RZJ's YL Column on page 93 for more information on this one.

Vermont QSO Party

Starts: 2300 GMT Saturday, February 19
Ends: 0300 GMT Monday, February 21

Once again the Central Vermont Amateur Radio Club is sponsoring the annual Vermont QSO Party.

Besides contest certificates, stations can also earn credits for WAS, WANE, W/VT and USA-CA awards.

Complete details and suggested frequencies in next month's CALENDAR.

Editor's Notes

At this writing we are in the starting gate and waiting for the gong to ring and start us off in the "Big One" the last week-end in November. George Jacobs did OK for us in the phone week-end and his prediction for the c.w. section looks good, so here's hoping.

How about some photos of your contest activity. Not the stereotype rig picture, but something of an informal nature. If you were in the contest and the picture identifies you, send it along.

And if you haven't already submitted your log, get it into the mail at once. You fellows in far away places, don't worry about the deadline, I'll take care of it.

The 160 season is also with us. In addition to our 160 Contest the last week-end of the month, don't forget the Transatlantic DX Tests organized by Stew Perry, W1BB. Check W2-DEC's November DX Column.

The claimed scores Phone list are only a *few* of the first logs received, so don't become alarmed if yours is not included. The grape vine on 20 has it that some of the "Big Shots" came up with some fantastic scores, especially in the Multi-multi group. We don't know how they do it but the activity was certainly there. Hope you were on to enjoy it.

73 for now, Frank, W1WY

USA-CA *(from page 84)*

for sending copies of POD 26 direct to G3MKR, G6VC, OA4EY, ON4QX, SP6FZ, RAEM, UWØIK and ZS5UP. Also thanks to the many others who have mailed copies to our foreign friends. It has been a most wonderful year for me because of all the new friends I have made and of course without your kind help there would be no column nor USA-CA Program, so again, many thanks and please keep up the kind help. Hope Santa Claus was very good to you all, A HAPPY and PROSPEROUS NEW YEAR. How was your month?

73, Ed., W2GT

DX *(from page 73)*

VS9MP	via W2CTN.	**ZD5D**	via WB6CWD.
W6FHM/DU	Box 2570, Manilla, Philippines.	**ZD8AR**	Hammarlund, GPO, Box 7388, New York, New York, 10001.
WA4QKY/KG6	APO San Francisco, Calif. 96415.	**1S9WNV**	via W4ECI.
YA1AW	via WA6OOH.	**4X4TP**	via VE3ACD.
YV4NR	Box 524, Valencia, Venezuela.	**5H3JJ**	Peter Peham, Mission Hospital, P. O. Ifakara, Tanganyika.
YV7CQ	Calle Urica, 35 Carupano, Estacio Sucre, Venezuela.	**5VZ8CM**	via W1YDO.
		9H1R	via W2CTN.

73, Urb, W2DEC

Novice *(from page 92)*

try that for a local blind ham and if it works I will let you know soon. Can you help on this one? Thank you for the try.

Q. How do YOU tune up a transmiter for maximum output and proper modulation?

A. I have two meters for fast sure tune up of my transmitters. One indicates any type oscillations, both wanted and unwanted oscillations. The other unit is used to tune my antenna for maximum output, at the same time it also indicates modulation. It tells me when my transmitter is operating and how well it is getting the power to the antenna. When you operate low power you must get all of your available power to the antenna. I adjust my grid drive until I have just enough grid drive to cause upward modulation as indicated by the unit described in either figure 2 or 3. The indicator of figure 2 can be loosely coupled to the antenna coupler or the wire going to the antenna. I set my meter close to the antenna to get a half scale reading, proper modulation will cause the meter to increase on modulation peaks to about 20 percent. Check the proper operating frequency with a grid-dip meter, it can also be used as above by coupling to the output circuit. The unit of figure 2 will indicate oscillation and can be used to tune up the multiplier and buffer stages of either your transmitter or converters, it does not indicate frequency, that must be checked with the grid-dip meter. I couldn't get along without these two units.

Q. Can you send me the diagram for a simple code oscillator?

A. See figure 4. This unit can be built in a very small space with batteries and speaker. I use 3 volts and a 2½ inch speaker. Use the cheapest PNP transistor and a pushpull transformer that sells for about 89 cents. The volume is enough for group (small) use.

Help Wanted

If your need is for some help with the code, theory or getting someone to give you the test, send a letter to me, Walter G. Burdine, W8ZCV, Waynesville, Ohio and I will put your request in this spot for help. We have had very good results from pleas in the space, many letters have proven that this is a good way to get help. Help this fellow, he is the only one that took time to write.

Terry Hendricks, 839 Hilton Drive, Lancaster, Pennsylvania needs help with the code. He wants to meet a local ham to advise him. Thank you.

This copy of *CQ* may be arriving in your home at the festive season and if so, let me say: Merry Christmas and Happy New Year. I know that we are read in 47 countries and that it takes up to two and one half months for you to get your copy, I hope you had a Merry Christmas and best wishes for the best year ahead. If you have the time, write a letter and send some pictures.

73 es best DX, Walt.

Sweepstakes Expedition *(from page 58)*

mc or 14 mc, on 7 mc it becomes quite another matter. Yet, I, for one, felt uneasy about calling "CQ DX no W" and even the few times I did it, the results were fairly predictable—still many W's calling. In view of the similiarity between conditions in the Canal Zone and Continental United States during many of the choice operating hours, I would judge it to be *more difficult* rather than less difficult for someone to achieve prominence in the DX roles from Canal Zone or similar DX locations.

Remarkable to an outsider was the low static level, even during local lightning storms. Except for the fact that 14 mc and 21 mc seemed to stay open later and DX on 7 mc was easier to work (including Japan in early evening), conditions were fairly predictable. 3.5 mc was spotty, but not because of QRN, merely band conditions.

About the contest itself? Only fair. Thousands of Americans were heard on all bands with wonderful signals but they were so busy working S9 and local stations. ■

For further information, check number 28, on page 110

For further information, check number 29, on page 110

For further information, check number 30, on page 110

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $1.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day of the second month preceding date of publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

Direct All Correspondence & Copy to: muriel e. mark, c/o CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

QSLs. Samples, Dime. Print Shop, Corwith, Iowa.

EMBOSSED QSL Cards. Free Samples. Ace Printing Service, 3298 Fulton Road, Cleveland, Ohio 44109.

PICTURE of yourself, home, equipment etc. on QSL cards made from your photograph. 250–$7.50 or 1000–$14.00 postpaid. Samples free. Write Picture Cards, 129 Copeland, La Crosse, Wis.

QSL CARDS $2.50 per 100 in three colors. Samples and catalog free. Garth, Box 51C, Jutland, New Jersey.

QSL CARDS. As low as $2.50 per 100. Samples free. Radio Press, Box 24C, Pittstown, New Jersey.

QSL's 3-color glossy. 100 $4.50. Rutgers Vari-typing Service. Free Samples. Thomas Street, Riegel Ridge, Milford, N.J.

QSL's . . . 18 samples 10¢ . . . Filmcrafters . . . Martins Ferry, Ohio.

QSL's WSL's XYL-OM's (Sample assortment approximately 9¾¢) covering designing, planning, printing, arranging, mailing eye-catching comic, sedate, fantabulous. DX-attracting, Protopay, Snazzy, unparagoned cards. (Wow!) Rogers, KØAAB, 961 Arcade St., St. Paul 6, Minn.

QSL's BROWNIE–W3CJI . . . 3111 Lehigh, Allentown, Pa. Samples 10¢ with catalogue 25¢.

QSL's CB, WPE Samples 10¢ Nicholas & Son Printery P.O. Box 11184, Phoenix, Arizona 85017.

QSL CARDS—100 3-color, glossy $3.00. World globe in silver; report form on reverse side; Free samples. RUSPRINT, Box 7575 Kansas City, Missouri, 64116.

HUNDRED QSL's: $1. Samples, dime. Meininger, Jesup, Iowa.

QSL's—Ham and CB, related products. Free Samples. April Sign Co. 56290 Van Dyke, Washington, Michigan.

DON'T Buy QSL cards until you see my free samples. Bolles, Box 9363, Austin, Texas.

ELECTRONIC CHASSIS PUNCHING and drilling service, Panels cut, etc. Build that magazine article! Send chassis or request estimate. Hole (16ths) diameters to ½", 5¢; to 1½", 25¢; to 4", 50¢; sq., 5¢ perimeter inch in aluminum to 3/16. Steel 20 ga. add 50%. Mark sizes and centers, allow clearances. Payment with material, minimum $2.00, under 2 lbs returned postpaid. Metalwerk, P.O. Box 1372, Cedar Rapids, Iowa 52401.

ELIMINATE Mobile Vibrator Noise. Revolutionary device outmodes noise-creating vibrator. Completely transistorized unit plugs directly into vibrator socket. No moving parts. Same size as vibrator. 12 Volts. Not a kit. Comes completely wired ready to use. **For negative ground only.** State make and model of transceiver. $11.95 PPD.-$5.00 deposit on all C.O.D. orders. Tel-Trol Systems, 2180 Bronx Park East, Bronx, N. Y.

PRINTED CIRCUIT BOARDS Hams, Experiments. Many different projects. Catalog 10¢ P/M Electronics, Box 6288 Seattle, Washington 98188.

WANTED—Laboratory test equipment. Electronicraft, Box 13, Binghamton, N.Y. 13902.

QSL CARDS ???? Samples 25¢ (deductible). Sackers, W8DED, Holland, Michigan.

QSLS. Large selection, including photos, rainbows, glossy stocks, cuts, etc. Fast service. Samples dimes. Ray K7HLR, Twin Falls, Idaho 83301.

"GOLDEN CALLS" QSLs, samples 10¢. Samco, Box 203-G, Wynantskill, N.Y. 12198.

WRL BLUE BOOK PRICES SAVE MONEY ON USED GEAR. Take 10% without trades. 75A1–$199.00; Communicator III (6 or 2)–$169.00; HT-37–$275.00; SX-101A–$219.00; SR-50–$439.00; RX-1 – $159.00; TX-1 – $149.00; 200V – $429.00; Warrior – $199.00; HX-10–$289.00; Loudenboomer/PS–$299.50; Champ 350–$199.00; Valiant–$199.00; NC-303–$269.00; Galaxy 300 –$239.00; hundreds more. FREE LIST. LEO, WØGFQ, Box 919, Council Bluffs, Iowa.

DAYTON HAMVENTION—April 16, 1966—Everyone welcome at the Dayton Amateur Radio Association's 15th annual Hamvention, Wampler's Ballarena, Dayton, Ohio. Watch Ham-Ads for information.

THIS COMPANY is looking for Ham & CB cartoon artists and ideas. $10.00 per idea IF ACCEPTED. For information, write AMBRU PRODUCTIONS, 10 Burbank Street, Yonkers, New York 10710.

WHOLESALE ELECTRONICS, Resistors 3¢, Multimeters $9.95, speakers 49¢, electrolytics 10¢. Hundreds of items. Catalog 25¢. Refundable. ROYAL Box 2591, El Cajon, California 92021.

ATTENTION HAMS! We buy, sell ham gear. Repair and alignment facilities available. Hold Advanced and First phone. Used Gear always reconditioned. Money back guarantee. KitKraft Company, P.O. Bcx 406—Canal St. Station, New York N.Y. 10013.

CASH, SONY TRANSISTOR TV's etc. swapped for G-R, H-P, L & N, etc. Equipment, special tubes, manuals, military electronics. Engineering Associates, 436 Patterson Road, Dayton, Ohio. 45419.

HIGHLY EFFECTIVE HOME STUDY REVIEW for FCC commercial phone exam preparation. Free literature. COOK'S SCHOOL OF ELECTRONICS. Box 747, Riverhead, New York 11902.

CRYSTAL BARGAINS. Free list. Nat Stinnette, W4AYV, Umatilla, Fla. 32784.

CRAZY . . . NOT QUITE. LET'S DEAL. . . . We want to become Nevada's largest ham store! Look! . . . Swan, Transcom, Galaxy, Hallicrafter, Hammarlund. . . . No honest deal refused. Write: Sierra Electronics, P.O. Box 212/ Sparks, Nevada.

WANTED—An APR-14, 13 receivers. SG-13, H-p4, SG-1, SG-2, MD-83, 479 Collins, in any condition. T-368-C xmtrs. R-390, 390A, R-388, 389, 391. Receivers. RT-66 thru 70 Rt units RT/77-GRC-9, GRC-10, GRC-19. RCA, Bendix, Collins Aircraft Radio and Radar Equip. Hewlett Packard, General Radio, Tektronix, etc., Test Equipment. GRC, PRC, GRR, TCC, ARC, sets ARM, PRM, URM, UPM, URM, SG Test sets any and all types. You name it. Call E. Charol, Tech Systems Corp., 42 W. 15th Street, N. Y. 11, N. Y. CH 2-1949 Collect.

CLOSEOUT discontinued full size beams, new ⅞" and 1" aluminum; three element twenty meter, $22; Two element, $16; Three element 15 meter, $16; two element, $12: Express Collect Shipment. GOTHAM, 1805 Purdy, Dept. CQ, Miami Beach, Fla.

SPECIAL! $50.00 credit on station accessories when you purchase a NEW Galaxy V or SB-34. Easy terms. Only $5.00 down. Order today from ELECTRONIC SALES, EXECUTIVE HOUSE #15, LEWISBURG, TENNESSEE.

COUPON BOOK—Special offers from various firms, for Members of Electronic Experimenters' Club. Dues $2.00 or write for further particulars. Box 5332-V, Inglewood, Calif. 90310.

WANTED: Many types Military or Commercial Surplus . . . Airborne, Ground, Try the Big Boys then write or Call Collect Area 703-560-5480. Give YOUR Price. We pay cash and freight . . . Dun Bradstreet rated. RITCO P.O.B. 156, Annandale, Virginia.

TECHNICAL MANUALS—Military equipment world's largest list 10¢. Quaker Electronics, Hunlock Creek, Pa.

NOVICE CRYSTALS 80-40M $1.05 each. Others 75¢. Free list. Nat Stinnette W4AYV, Umatilla, Fla. 32784.

COLLINS FILTERS—F455J series for 455KC IF plug in type 9 pin socket. For 75A4 receiver .5 KC $35.00; 2.1 KC—$30.00 both for $55. W4CAP/8 133 Colerain Pike, Martins Ferry, Ohio.

VIDICON 7038: Brand new—$95; Used—no burns $35. Brand new—6198 $40. W4CAP/8 133 Colerain Pike, Martins Ferry Ohio.

MANUALS, for surplus electronics. List 10¢. W31HD, 4905 Roanne Drive, Washington, DC 20021.

GLOBAL WRIST WATCHES, features 24-hr. World Time Conversion. Free brochure. (Mention "CQ") NORDLUND, 7635 West Irving Park, Chicago, Illinois 60634.

FOR SALE Complete instructions including 28 page booklet and 22" × 36" schematic for converting the ART-13 transmitter to a.m. and s.s.b. Satisfaction guaranteed. $2.50. Sam Appleton, 501 No. Maxwell St., Tulia, Texas.

RTTY GEAR for sale. Write for list—issued monthly. 88 or 44 Mhy toroids. Five for $1.75, postpaid. Elliott Buchanan W-6-VPC—1067 Mandana Blvd., Oakland, California 94610.

HAMMARLUND HQ170A for sale 6 to 160 meters, dial calibrated for 2. Price $335 K. T. Viall, Jr. R.D. #1, Conklin, New York.

WANTED: 1932 tp 1940 Model HRO with power supply and coils—state condition. W1BB.

FOR SALE: Clegg Zeus and 11 ele 6m Beam. Contact WB2CUO 201-756-8340.

SELL, Collins 30/S1 $700.00. Swan SW117AC supply $45. 100 issues CQ 1947-62 four for $1.00. WØMCX.

WANTED—QSTs for private collection. 1920-Jan., Dec., 1916-Feb., May, June, July. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., N.Y., 11050.

PICTORIAL STUDY in Amateur Radio. Free details. Dwight Cross, KØCZU, 1212 Lynch, St. Louis 18, Mo.

WANTED: Pre-1934 QST's. Also Binders. Write or call with list. R. Kampf, 9 Black Birch, Scarsdale, N.Y. 914-723-1467.

FOR SALE—CQ 1948-1960—Make offer—Pick up—W1RO.

WANTED—Old toy trains, prewar, any condition, standard and wide 2⅛ inch gauge, Lionel, American Flyer, Ives. Brian Howard, R.D. #1, South Lake Street, Amherst, Ohio 44001.

FREE FILTERS: Names and addresses of TV manufacturers currently furnishing free high-pass filters for TVI. Complete with application forms, 25¢. Club package (25 lists and forms) $2.00. TVI, 19 Hillview Ave., Port Washington, N.Y.

ENLARGED! 4,000 hamwords, 52 awards German/English. One Dollar. Christian Zangerl, OE9CZI, Dornbirn, Austria.

For further information, check number 24, on page 110

SELL: Elimac 4x250B tubes. Guaranteed good. $6.50 each, $10.00 pair. Prepaid in U.S.A. Send check or money order. Everett Stidham, Jr., W5JLQ, 722 South 30th, Muskogee, Oklahoma.

INTERESTING OFFERS GALORE in the new "Equipment Exchange —Ham Trader"! Rush $1 for next 12 issues. Brand, WA9MBJ, Sycamore, Illinois.

LEARN CODE the V method, money back trial, guided sending, records, tapes, write. Page Electronics Institute 90037.

COLLINS 75A-4 OWNERS: Don't trade up! Investigate our conversion that makes the 75A-4 a real dream. W2VCZ—30 Pitcairn Ave., Ho-Ho-Kus, N.J. 201-652-8494.

Wanted: Complete set, preferabiy bound volumes, CQ for 1945 through 1963. Must be in excellent condition. Write Charles Miller, W4AXV, 2875th GEEIA Squadron, Box 460, APO San Francisco 96323.

REMOTE CONTROL UNIT, brand new $5.00. Postpaid. (Cost Navy $125.00) MDC, 923 W. Schiller, Phila. 40.

ANTENNA tuning unit, brand new $3.00 postpaid (cost Navy $85.00). MDC, 923 W. Schiller, Phila. 40, Pa.

RTTY CHANNEL FILTERS, octal mounted, specify frequency $3.00 each. Toroids 88mh, uncased, 5 for $2.50. WA6JGI, 3232 Selby Avenue, Los Angeles, California 90034.

PRINTED CIRCUIT Materials. Three sample pieces and details. One Dollar. Betty Lou Nolin, 35 Arbor Drive, New Hartford, N.Y. 13413.

CRYSTALS, Transformers, Pyranol condensers, etc., top quality surplus. Write for Bulletin No. 865. R & M Electronics, Box 5234, Knoxville, Tennessee 37918.

NEED ANY BAND coils fitting HRO-7 and components or unit for ART-13 AC Power Supply. G. Evans, W4WVS, 803 Rosselle St., Jacksonville, Fla.

CHRISTIAN Ham Fellowship now being organized among Christian hams for fellowship, tract ministry, missionary efforts among hams. Christian Ham Call book $1 donation. Write Christian Ham Fellowship, P.O. Box 218, Holland, Michigan.

COLLINS 75S-2 receiver. $275. J. F. Young W5HXW 1214 Northlake, Richardson, Texas. Tel: 214-235-6927.

CQ MAGAZINES—Volumes I, II, III, IV, Complete in binders, $40.00 F.O.B. Dick Nebel, W2DBQ, 31 Whitehall Blvd., Garden City, N.Y.

I need and will pay top price for an RFL receiver for my antique radio collection. Same also applies to BRISTOL, WARE, DeFOREST, GRIMES and similar material. WORCESTER, R.D. 1, Frankfort, N.Y.

HALLICRAFTERS Model CRX-1, FM Receiver 30-50 mc. Excellent Condition, $60. John Wrenn, 1204 Central Avenue, Albany, N.Y.

GSB-100 MANUAL—$5.00 paid for manual—Traded and 601 and Snookered—Send COD to Perry Howell, 603 Cox Street, Nacogdoches, Texas, K5ADY.

COLLINS 75A4 Serial 085, 3kc & 6 kc filter with speaker $350. WA9DFH, 5631 West Morris, Indianapolis, Indiana.

PARSIMONIOUS Drake 2-B receiver $150; Heathkit HO-10 monitor scope $40. Both in good condition. John Stoltenberg, 770 South Evergreen, Kankakee, Illinois.

DRAKE TR-3, RV-3 & AC Power Supply—$550. Hallicrafters HA-2 HA-6 & AC Power Supply—$250.00. Absolute finest mint condition. K4TCK, 689 Beth Lane, Lexington, Kentucky.

QST rare collection from Issue #1 Dec. 1915, Seven issues 1916, eight 1917, Six 1919, twelve 1920, ten 1921, twelve 1922, eleven 1923, seven 1924, twelve issues each 1925, 1926, 1927; eleven 1928. Prefer sell total 121 issues complete. Offers W. T. Feeney, PO Box 357, Cana Point, California.

SELL BEST OFFER: Globe King 500B RF Section, 300 Watt AM Modulator with power supply, Asiatic VHF Booster & UHF Converter, Heathkit telephone amplifier, B&W 380B TR Switch, Coaxial relay, Knight VFO, Heath SB-10, Home Brewed 20 watt speech amplifier, Heath GW 10 & GW 10D Citizens band rigs with mobile whip and coax antenna. W2INY, 206 W. 9th St., Elmira.

WANTED: EL 37 British DX transmitter in good condition. Box 101 Chas. SC.

SELLING: HT-27 $295; HT-41 $225; Like new. HA-20 Linear never used $95. FGC-1 terminal unit and power supply $75. W1JTL Armstrong, Reservoir Road, Lunenburg, Mass.

Bedford Incident *(from page 62)*

next best action. We had to send two messages by air mail with an explanation.

12. If the service (amount of traffic) is really large, try for follow-up coverage in the form of an accomplishment report.

Out on Long Island, Ed Daly, WA2CZG, spent several hectic evenings handling message traffic and explaining the nature of the hobby to hundreds of theater-goers at the Roosevelt theater in the sprawling Roosevelt Field Shopping Center. Ed comments that about 25% or more of the theater's patrons stopped and inquired about the station, and demonstrated a lively interest in ham radio, while more than half the customers at least took note of its presence.

And so it goes, from coast-to-coast, amateur radio clubs and individual hams are rallying to the call of public interest. They are *actually getting out and doing something* to re-affirm our public image as useful, intelligent and hard-working members of the community. And, (miracle of miracles!) they're enjoying every minute of it! Hey, fellers, maybe this public interest stuff isn't so bad, after all. ■

Propagation *(from page 80)*

160	09-17 (1-0) 17-19 (3-2) 19-05 (4) 05-07 (3-2) 07-09 (2-1)	17-19 (2-1) 19-21 (4-2) 21-04 (4) 04-05 (4-3) 05-07 (2-1) 07-09 (1-0)	17-18 (1-0) 18-19 (1) 19-21 (2-1) 21-04 (4-3) 04-05 (3-2) 05-06 (1) 06-08 (1-0)	18-20 (1-0) 20-21 (1) 21-01 (3-2) 01-03 (3) 03-04 (3-2) 04-05 (2-1) 05-07 (1-0)

ALASKA

*Openings Given In GMT**

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

HAWAII

Openings Given In Hawaiian Standard Time†

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

For further information, check number 36, on page 110

READER SERVICE

NAME__________ CALL__________
(Please Print)
ADDRESS__________
CITY__________
STATE__________ ZIP CODE__________

Please send me more information on your ads in the Jan. 1966 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77			Total Inquiries				☐

Void after Jan. 29, 1966

CQ MAGAZINE, Dept. RS
14 Vanderventer Ave.
Port Washington, L. I., N. Y. 11050

advertisers index

Adirondack Radio Supply	109
Alcom Electronics	110
Amateur Radio Equipment Co.	101
Automatic Telegraph Keyer Corporation	98
Barry Electronics	97, 98
Bookbinder Publishing Co.	106
Burstein-Applebee Co.	13
Cleveland Institute of Electronics	16
Collins Radio	Cover II
Columbia Electronics	101
Communication Products Company	103
Datak Corporation, The	102
Dow Key Co.	18
Duffy, M. N. & Co.	104
EICO, Electronic Instrument Co., Inc.	9
Eitel-McCullough, Inc.	5
Electronics, Inc.	105
Electro-Voice Inc.	14
Fair Radio Sales	109
Finney Company, The	12
Hallicrafters	2
Heath Company	19, 20, 21
Henry Radio	103
Hy-Gain Antenna Products Corp.	4
Instructograph Company	106
International Crystal Mfg. Co., Inc.	15
Justin, Inc.	109
Lafayette Radio Electronics	99
Lampkin Laboratories, Inc.	105
Millen, James Mfg. Co., Inc.	8
Mosley Electronics, Inc.	6
Music Associated	103
National Radio Company, Inc.	Cover III
New-Tronics Corporation	1
Partridge Electronics, Ltd.	107
Petersen Radio Company, Inc.	108
Port Arthur College	108
Radio Amateur Callbook	95
RCA Electronic Components and Devices	Cover IV
REC Club	102
Rohn Manufacturing Co.	10
Sams, Howard W. & Co., Inc.	17
Space Electronics	97
Subscription	81
Technical Library	96
Teleplex Co.	110
Telrex Laboratories	101
Texas Crystals	101
Tribander	109
Waters Manufacturing, Inc.	11
Western Radio	110
WRL World Radio Laboratories, Inc.	100, 106

SPECIAL CQ *SURVEY*

The questions on the tear-out below have been carefully selected to help us find out what our readers are thinking and doing. We want to know what the trends are and which direction the hobby is moving.

Surveys are nothing new to long-time CQ readers. We've been taking the readers' pulse for some 15 years now, whenever we feel the hobby has undergone sufficient change to warrant it.

Well, it's that time again, so please proceed to mangle the magazine and let us know what's going on out there.

Mail it today to: CQ READER SURVEY, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

CUT OUT—FILL OUT—MAIL OUT TODAY

SPECIAL CQ SURVEY—1966

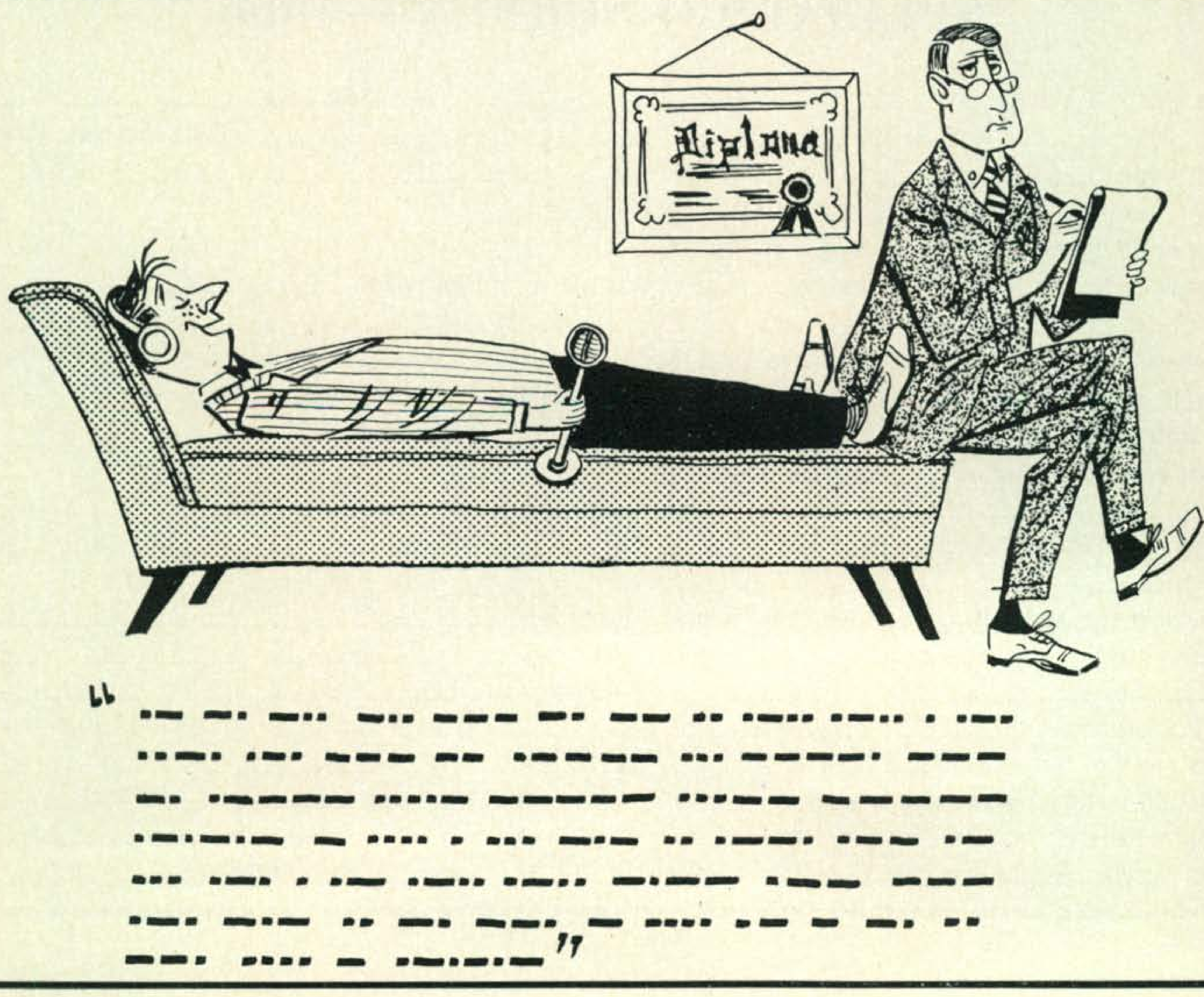
Are you a licensed ham________ Class________ How Long________.
Your age______ Field of work________ Other hobbies besides ham radio: ________
How much have you invested in your rig? $________.
How much do you think you'll spend next year? $________.
Compared to 5 years ago, are you more active or less active in ham radio? ________.
Why? ________.
Obviously, (because you read **CQ**), you're an active ham, but what's your favorite aspect of the hobby, rated 1-5 (1 being least): DX____ Contests____ Building____ VHF____ Mobile____ Awards____ Public Service____. Other: ________.
What band do you use most (%): 160____ 80____ 40____ 20____ 15____ 10____ 6____ 2____ UHF____.
What mode do you use most (%): SSB____ AM____ CW____ RTTY____ TV____ Other: ________.
What's the make-up of your station (what brands)? Receivers________; Transmitters ________; Transceivers ________; Accessories ________; Antennas ________; Test Equipment ________.
How much of the above was built from kits? ________.
What **CQ** features do you look forward to most? DX____ VHF____ Letters____ RTTY____ Propagation____ YL____ Novice____ Ham Clinic____ New Products____ People and Places____ Equipment____ Reviews____ Surplus____ Other________.

QUESTIONS, QUESTIONS! ALWAYS QUESTIONS!

It's reader-survey time again* CQ*! Every several years, we like to put our ear to the ground to see which way the hoards are moving. You can help us serve you even better by filling out the simple survey on the other side of this page, and mailing it to:

CQ READER SURVEY
14 Vanderventer Ave.,
Port Washington, L. I., N. Y. 11050.

What's the prize? Only a bigger and better* CQ *in the months to come.



got a match?

Definitely not. It's a cold fact that no competitive linear amplifier compares with National's NCL-2000 — regardless of price. Take the time to look at the chart below and plug in the specs of *any* amplifier next to those of the '2000 — not a single competitive unit in the maximum power classification offers even half the features of the NCL-2000:

FEATURE	NCL-2000	COMPETITION
POWER	Entire equipment I.C.A.S. rated for full 1000 watt average, 2000 watt peak input; output tubes and all RF components rated for C.C.S. operation. Power input and efficiency identical on all bands — 80 through 10 meters.	
SIZE	Completely self-contained, including power supply, in desk-top cabinet (dimensions only 7⅝" H, 16¼" W, 12¾" D).	
DRIVE REQUIREMENTS	Adjustable passive grid input and use of high power ceramic tetrodes in final permits drive to full output with exciters delivering as little as 20 watts or as much as 200 watts.	
METERING	Separate rear-illuminated precision D'Arsonval plate and multi-meters for simultaneous measurements.	
ALC	ALC output to exciter for maximum talk-power with greatest linearity.	
SAFETY AND PROTECTIVE DEVICES	Fuses, time delay and plate current overload relays, plate power lid interlock and automatic HV mechanical shorting bar.	
CLASS OF OPERATION	Grid-regulated AB_2 permits easiest tune-up, low drive power for maximum exciter linearity, and protection from destructive peak currents.	
EASE OF TUNE-UP	Internal dummy load in grid circuit makes adjustment of exciter into amplifier possible without turning on NCL-2000 and without radiating a signal.	
STYLING	Award-winning design matches NCX-5 transceiver and complements **any** equipment.	
GUARANTEE	National's exclusive One-Year Warranty.	
PRICE	Only $685.00.	

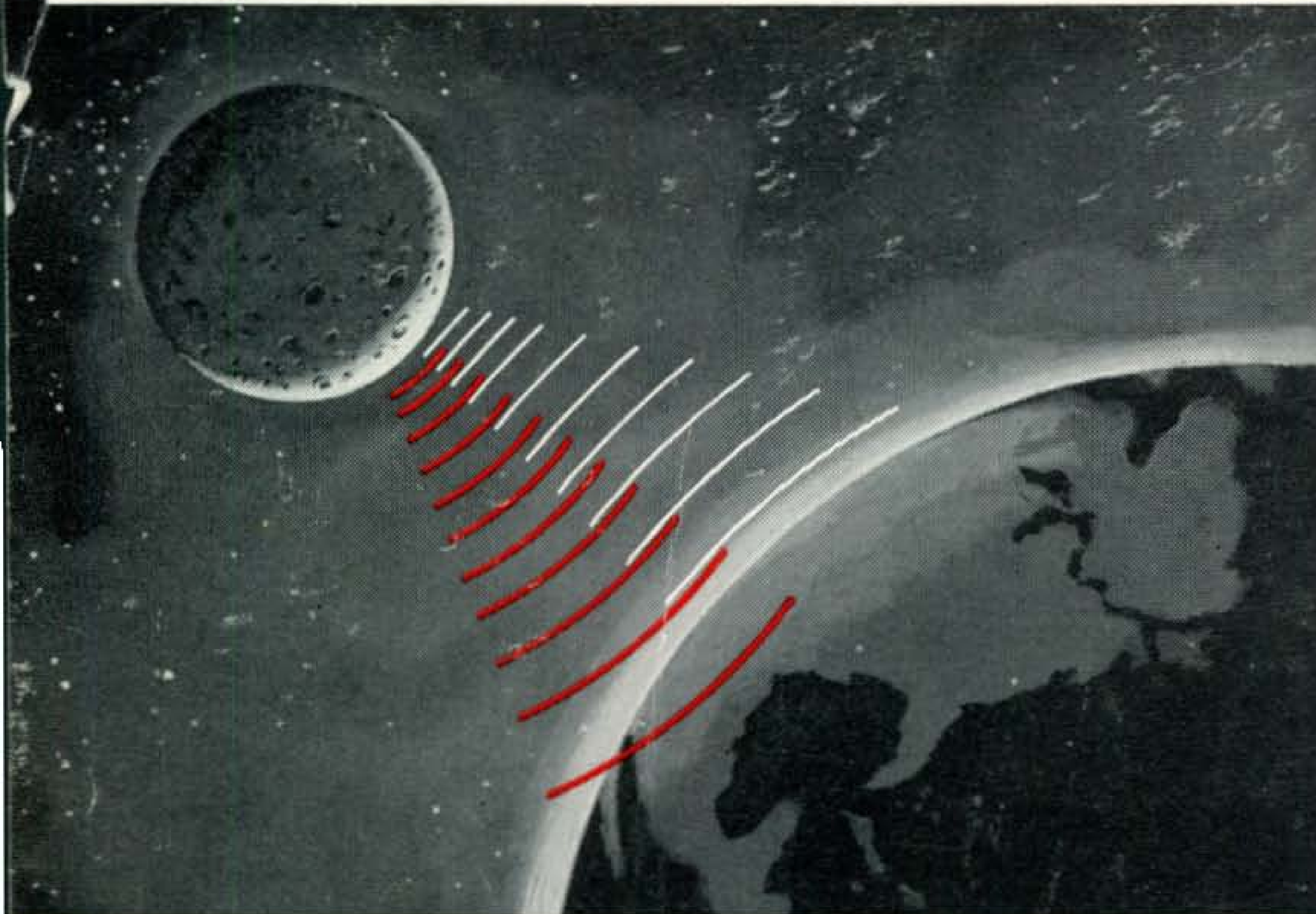
The NCL-2000 is a rock-crusher of a rig built to *commercial* standards. That's why you get I.C.A.S.-rated maximum legal power in a one-piece desk-top package, and why you get ALC and drive power compatibility with high quality exciters. It's why you get two precision meters, and sensible protection afforded by proper safety devices. Match the NCL-2000 with all the others before you buy — then see your National dealer for easy terms and trade-in deals.

NATIONAL RADIO COMPANY, INC.

37 Washington Street, Melrose, Mass. 02176 • World Wide Export Sales: Auriema International Group, 85 Broad St., N.Y.C.

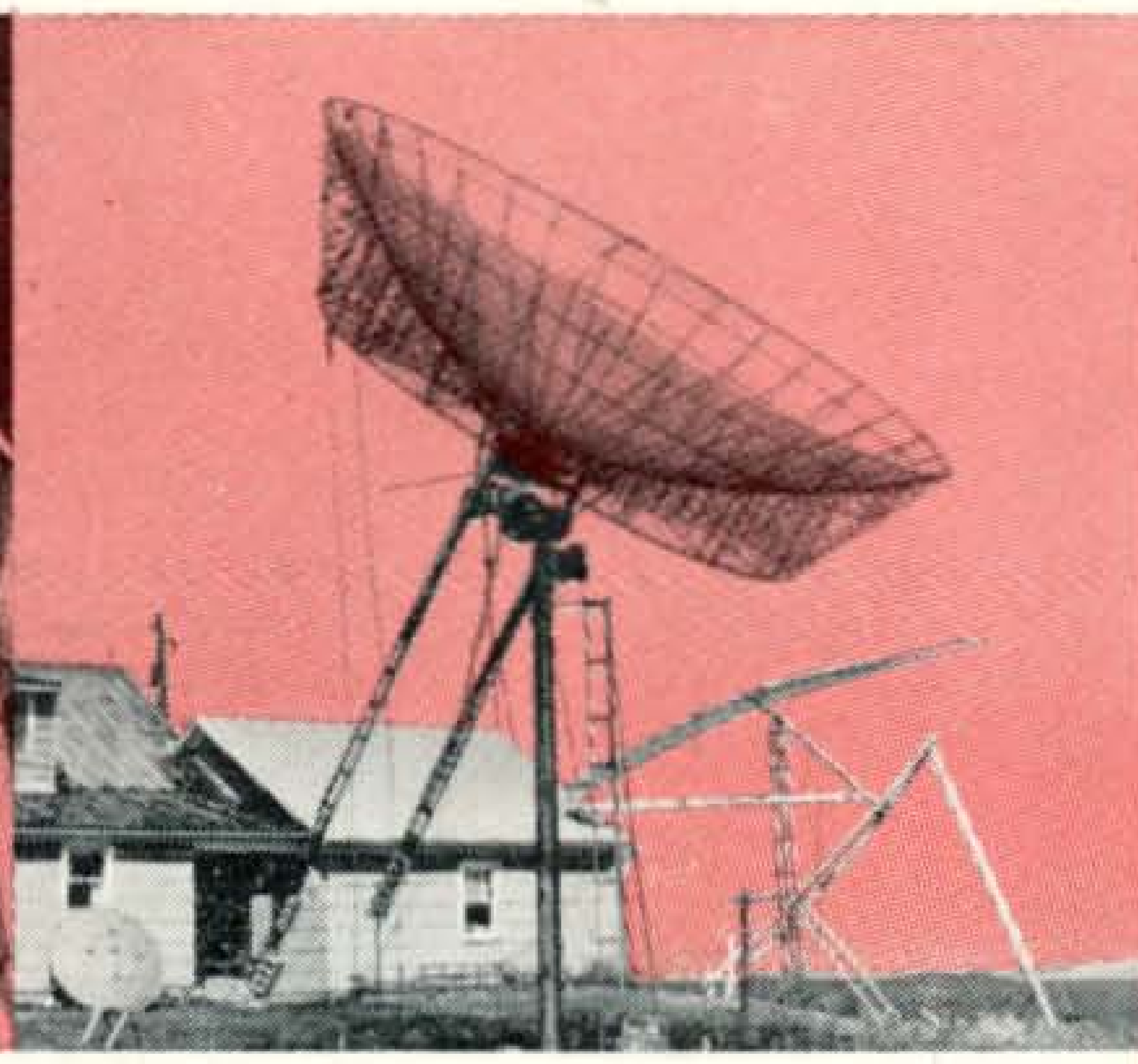
For further information, check number 3 on page 110.

"QUA"...RCA BEAM POWER TUBES



What makes "moonbouncing" possible? Obviously, the skill and ingenuity of stations involved, for one thing. For another, the RCA Beam Power Tubes they use in their "finals" to squeeze the maximum power output into their antennas.

But, you don't have to be a "moonbouncer" to enjoy the benefits of rugged, dependable RCA transmitting tubes. For technical details on all types, pick up a copy of the TT-5 RCA Transmitting Tube Manual at your nearest RCA Distributor.



First lady "moonbouncer"—Mrs. Oliver J. Smith III of Millersville, Pa., operates transmitter used to bounce CW signals off moon and back to receiving station in Puerto Rico.

Moonbounce antenna – the 27-foot diameter parabolic dish built by Mr. Vic Michael, W3SDZ, of Williamsport, Pa.; a measure of the initiative and dedication of moonbouncers.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.

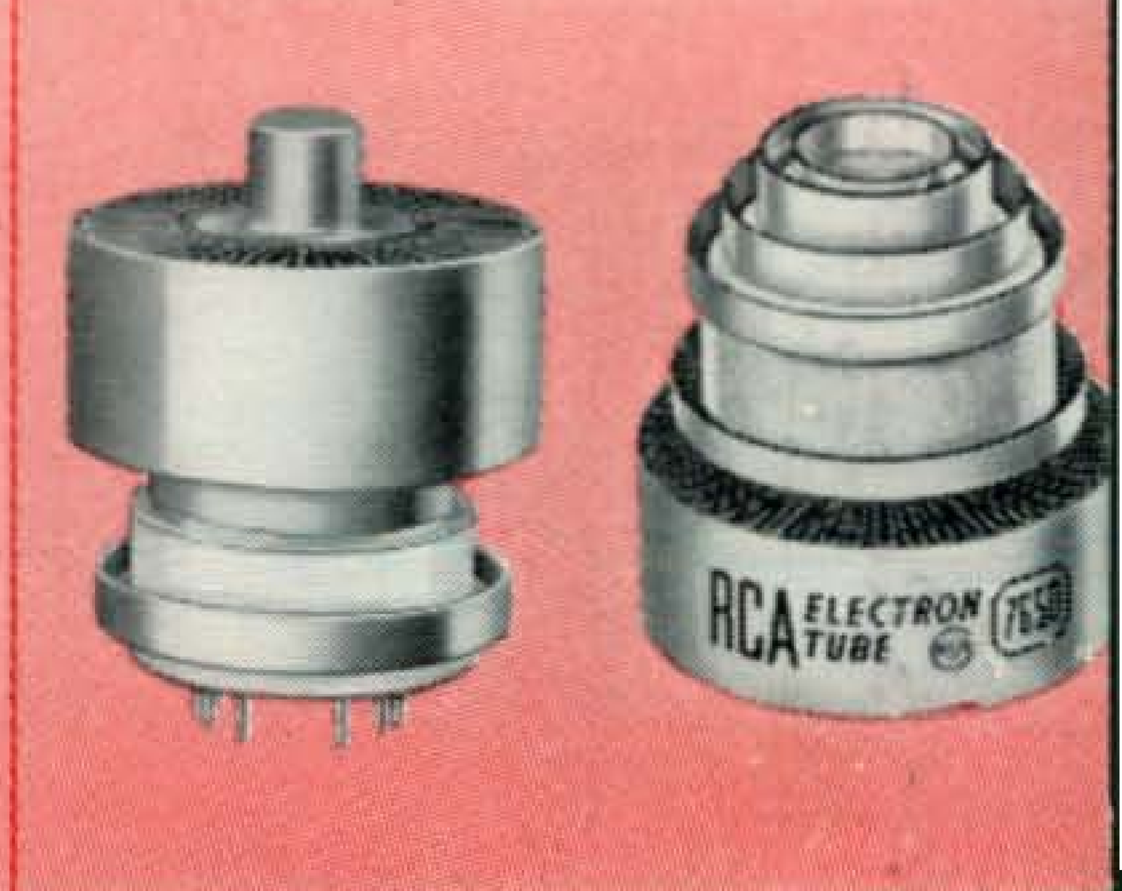
The Most Trusted Name in Electronics

TALK ABOUT DX

Here's how RCA Power Tubes help pioneering amateurs break records..

Using RCA-8122 and -765 Beam Power Tubes, amateur have found a new way to com municate...These pioneers ar now bouncing UHF signals o the moon—for a total transmit ter-to-receiver distance of *hal a million miles!*

Consider the power this take The transmitting antenna o earth sends a relatively straigh beam to the moon...but the con vex lunar surface, as a passiv reflector, dissipates the beam s that the received signal on eart is less than one trillionth th strength of the transmitted sig nal. Because of this power dis sipation, you need utmost effi ciency in power output such a offered by these RCA tubes.



RCA 8122 Beam Power Tube—used in several "moonbounce" transmitters, can provide useful power output of 300 watts up to 500 Mc/s in CW operation with a plate voltage of 2000 volts.

RCA 7650 Ruggedized Cermolox Bea Power Tube – oper ated by a Europea "moonbouncing team, can provid up to 600 watts use ful CW power out put at frequencie of 400 Mc/s.

AVAILABLE THROUGH YOUR AUTHORIZE RCA INDUSTRIAL TUBE DISTRIBUTOR.

For further information, check number 7 on page 110.