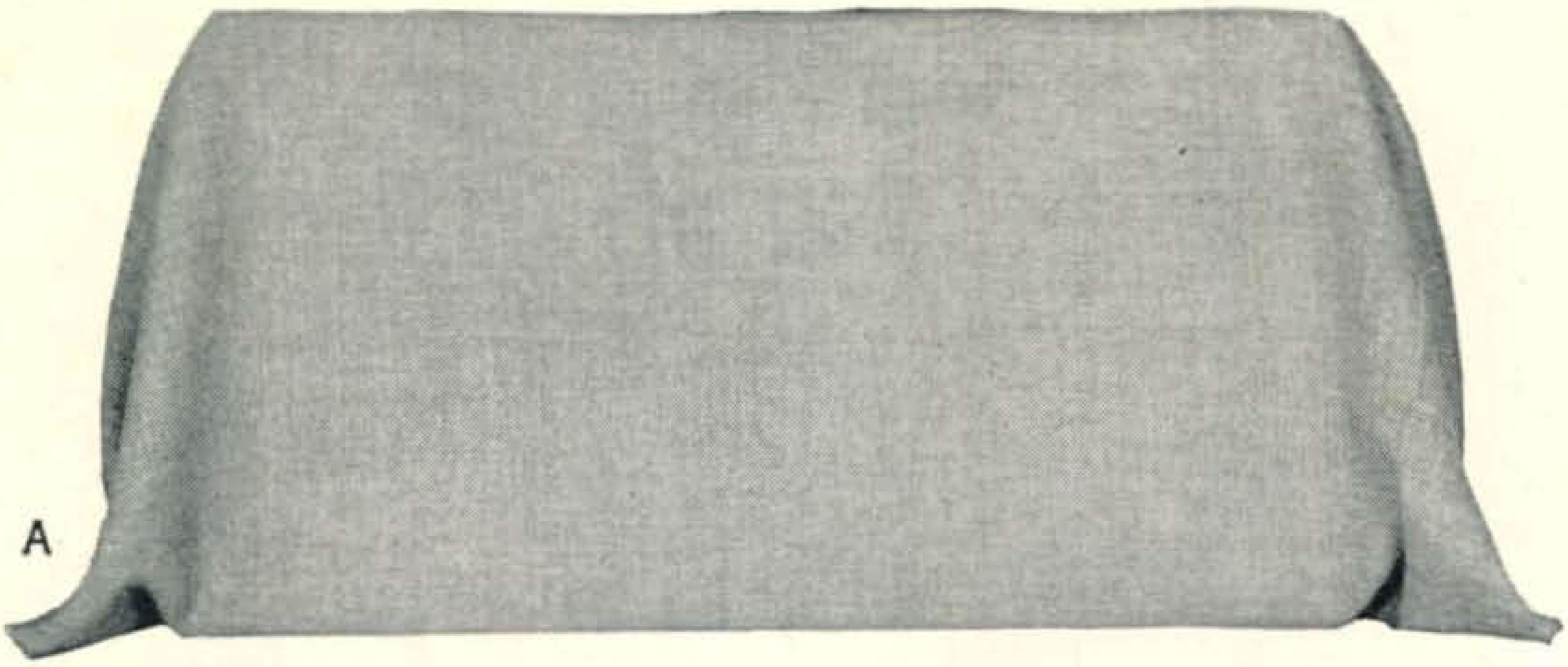
CQ

September 1961

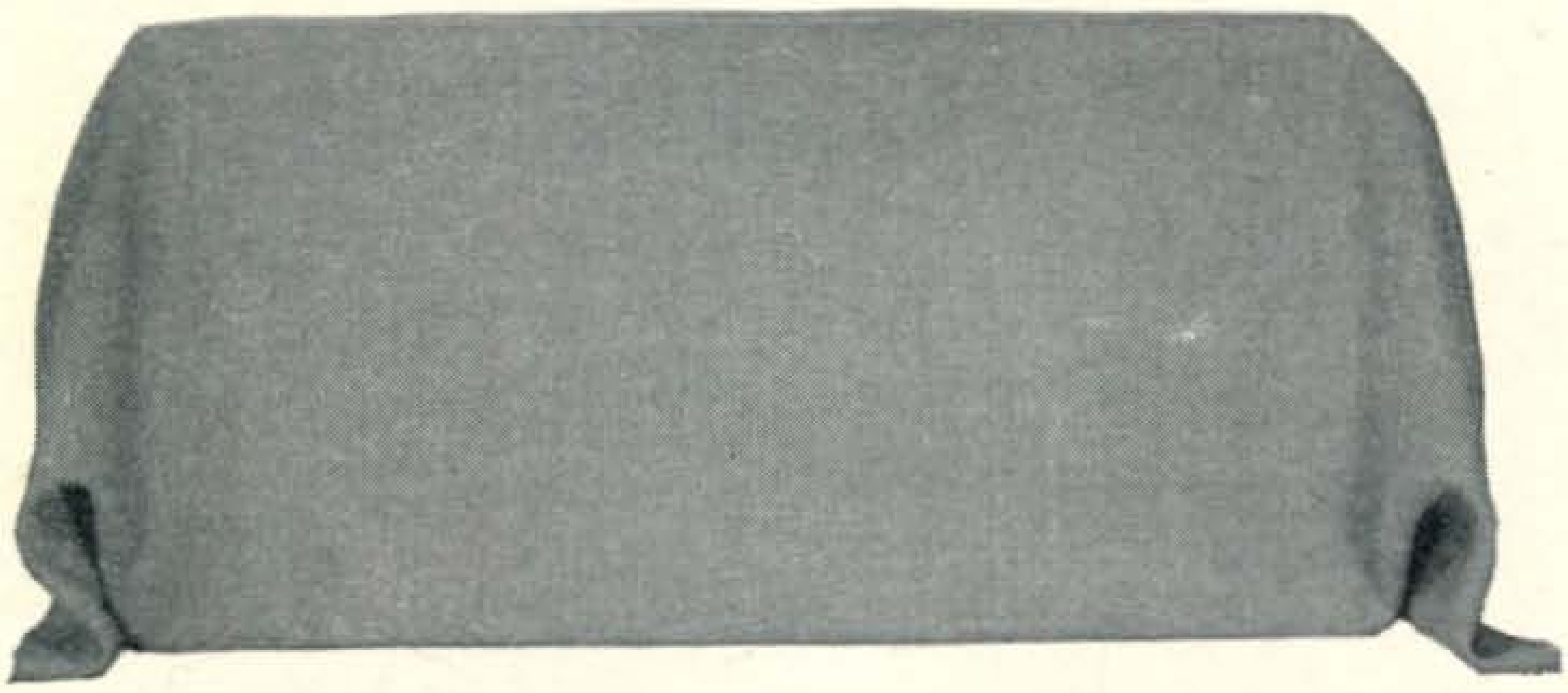
50¢

The Radio Amateur's Journal

A



B



C

THREE SIX-YEAR-OLDS

(But Only One Retains 83% of its Value)

All three of these receivers were made in 1955. Receiver A now sells for a fairly respectable 52%* of its original cost, B for 37%*. But receiver C, the Collins 75A-4, has retained its value. Today it's worth 83% of the original cost. Like all Collins equipment, the 75A-4 has proved to be more than just a good buy — it's been a smart investment.

COLLINS

****Based on a survey of prices for 1955 and 1961 in two national amateur magazines. A and B are both well known receivers, covered for obvious reasons.***

COLLINS RADIO COMPANY • CEDAR RAPIDS • DALLAS • BURBANK • NEW YORK

For further information, check number 1, on page 126

25 YEARS with PR!

■ Adolph Schwartz, W2CN, is celebrating his 25th year as sales representative for PR Crystals. But W2CN was a ham operator long before that. His original ham license was dated April 12, 1916 . . . Commercial First Class License dated 1917. Before and after World War I, Adolph had call letters 2AFT and 2ASK. He has always been an active amateur, and his present license is Amateur Extra First Grade.

■ Here is W2CN at his rig. Rx-Collins 75A4. Tx-Johnson KW Final. Driver Johnson Pacemaker. Antennas: 40M, inverted vee dipole. 20, 15, 10 M, 3 separate 3-elem. beams. W2CN is active on SSB, AM, and CW, on 40, 20, 15 and 10 meters. He likes to chase DX and has over two hundred confirmations. Give him a call sometime.

■ Top Row: 1916 Ham license; renewal 1917 Commercial License; Bill Eitel and W2CN. Lower Row: First Class Commercial License, 1921; 1919 Ham License 2AFT; U.S. Army Discharge; W2CN tied to ball and chain.

■ PR Crystals have been the standard of quality since 1934. It was their outstanding performance and dependability that first interested Adolph Schwartz. In March 1936 he started using PRs in his rig at W2CN. He was so impressed by PR Crystals that he immediately asked to be their sales representative in the New York territory. Says W2CN: "It is a pleasure to sell PR Crystals because they are quality products that operate without trouble to their owners."

Yes, it is a pleasure to sell PR Crystals, but the most pleasure comes in using them in your rig. Many thousands of hams have used PRs for years with complete satisfaction. Every PR Crystal is UNCONDITIONALLY GUARANTEED. Get them from your jobber.

PR Crystals

Since 1934

USE PR AND KNOW WHERE YOU ARE

PETERSEN RADIO COMPANY, INC.
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Z-2

Z-9R

For further information, check number 3, on page 126

5 WATT INPUT* TRANSMITTER

FULL COVERAGE RECEIVER

C. B. OR HAM-BAND OPERATION

all new!

HAMMARLUND HQ-105 TR

CITIZEN-HAM BAND TRANSCEIVER

$219.50 AMATEUR NET

*New 24 hour Clock-Timer optional.

- PUSH-TO-TALK OR SWITCH-TO-TALK OPERATION
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EXCLUSIVELY BY HAMMARLUND—

The only citizen-ham band transceiver employing a full-coverage, continuously tunable receiver (540 KCS to 30 MCS) plus a five watt input single crystal controlled transmitter designed for citizens band or 10 meter frequencies. All you need to be "on-air" is a push-to-talk microphone, S-100 speaker, and a citizen band antenna. Single channel crystal is supplied.

AND THAT'S NOT ALL! This top-quality, feature-studded transceiver stands alone in its price class. MORE features — MORE quality — MORE FOR THE MONEY!

SEE AND TEST THE AMAZING HQ-105 TR TODAY — AT YOUR LOCAL HAMMARLUND DISTRIBUTOR.

HAMMARLUND

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For further information, check number 4, on page 126

CQ The Radio Amateur's Journal

OFFICES

300 West 43rd Street
New York 36, N. Y.
Telephone, JUdson 2-4460

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Postmaster: send Form 3579 to *CQ*, 300W. 43rd St., N. Y. 36, N. Y.

VOL. 17, NO. 9 SEPTEMBER 1961

TABLE OF CONTENTS

DEPARTMENTS

New compact beauty...

New transistorized dependability...

for the Stradivarius of electronic keyers

Again, the "Stradivarius of electronic keyers" advances the art of CW with a clean, compact new design that's completely transistorized... costs less to own... brings you new technical skill and personal enjoyment whatever your level of experience.

HA-4 Features

- Employs digital techniques. Advanced circuitry assures constant ratio of dot-to-space-to-dash over entire speed range. Dots and dashes self-completing.
- Employs eight transistors and ten semi-conductor diodes. Transformer operated. Employs a high-voltage transistor to key the transmitter.
- Monitor or sidetone may be heard via built-in speaker.
- Semi-automatic position permits manual control of dash length for retention of individual characteristics, or straight key operation.

FRONT PANEL: Function control: AC off, Auto keying, Semi-auto, Hold. Speed control: Two ranges; 8-18 and 18-50 WPM. Volume control.

REAR CHASSIS: Term. strip for key connections; weight (dot duration); hi/lo speed range switch; term. strip for transmitter connection.

The new ideas in communications are born at...

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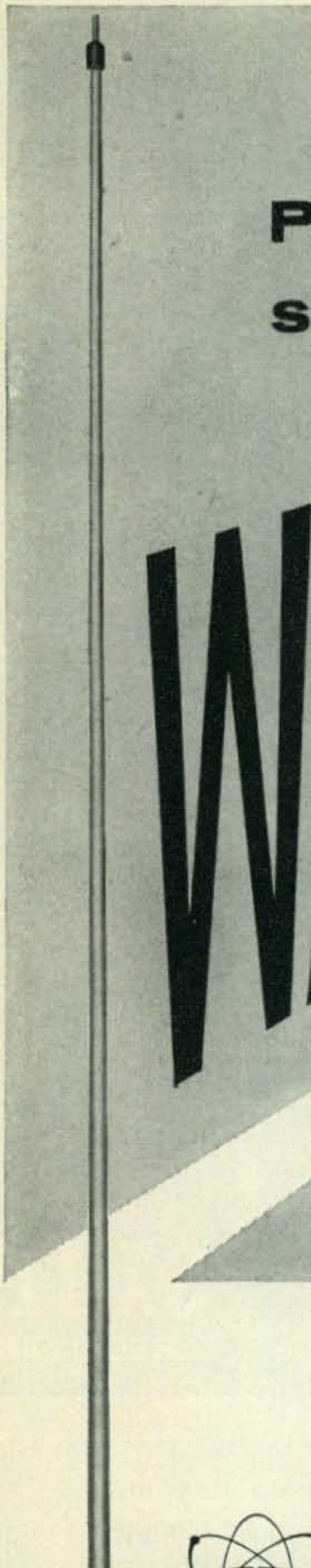
Export Sales: International Div., Raytheon Co., Waltham, Mass.
Canada: Gould Sales Co., Montreal, P.Q.

For further information, check number 5, on page 126

For further information, check number 6, on page 126



ZERO BIAS

It is now apparent that American amateurs are placed in the awkward position of being required to volunteer.

After the extension of twenty meters (in the segment 14,300-14,350 kc) took place early last year, it became evident that amateurs abroad were feeling the sting of American stations in what was previously DX territory.

The extension of 50 kc to the American phone band is well warranted. Anyone listening to the bedlam on 20 will agree that s.s.b. communications needs the extra spectrum space to properly carry out its operations.

The League's Board of Directors did little to heed the pleas of foreign interests in this matter and the results have been nothing less than chaotic since the change took place.

For the first fifteen months of operation, many DX'ers found it necessary to move to the lower segment of 20 in an effort to escape the W/K-QRM, while others waded through the onslaught, in an attempt to stand firm upon their convictions.

It soon became obvious to the League that ill feeling was rapidly growing concerning the acquisition of this segment and, on May 5, 1961 the Board unanimously voted that U.S. and Canadian amateurs voluntarily refrain from operation from 14,335 to 14,350.

CQ feels that radio amateurs, also being somewhat related to the human race, are as disciplined as any other intelligent adult group. How successful has the request been to voluntarily curb poor operating practices; QSL 100% of the time; "Switch to Safety"; etc., etc. It should be noted that the latter points are considered as operating axioms, not a question of ethics—with which we are involved here.

We feel strongly that this voluntary plan is unreal, foolish and can lead only to chaotic conditions reflecting the unwillingness of the minority to conform with the majority.

If we are willing to forego the upper 15 kc for DX—why then do we not relinquish this segment legally? Or perhaps ask our DX brethern to utilize frequencies below 14,200 kc, as has been done in the past.

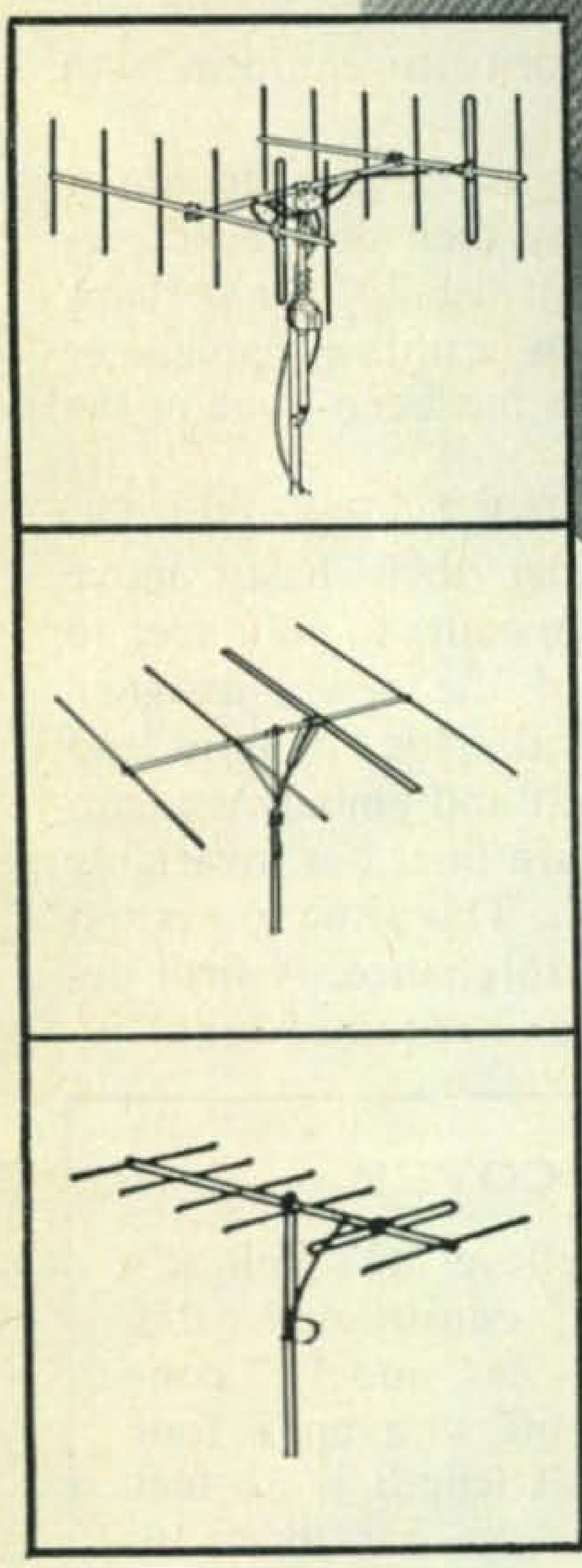
We urge the A.R.R.L. Board of Directors to reconsider their hasty move asking American amateurs to volunteer to relinquish 15 kc of the newly assigned 20 meter phone band. This can only lead to further congestion and embarrassment. Voluntary actions are fine, but invariably not effective enough. This situation is too important to leave to chance. A firm decision is required, and required soon!

OUR COVER

You don't believe it? Well it's true! W6WFR constructed this "whip" using 1″, ¾″ and ½″ conduit, topping it off with an 8 foot whip. The overall length is 32 feet 5 inches and works out to a ¼ wave on 40. If you've ever worked Vic on 7,205 you can testify to its effectiveness. Vic claims it goes up in one minute and cautions others that power lines and "low" bridges *are* a hazard.

IT'S OFFICIAL!

THE GONSET COMMUNICATOR IV SERIES for 2, 6 and 1¼ meters is now approved for OCDM matching funds



For forty years hams have been "saving the day" during public disasters. That's why our government agencies look to amateurs for emergency communications assistance. And, as always, operators look to Gonset for *reliable* equipment.

Gonset is proud to be part of such a great team. And we're especially proud that, through the efforts of amateurs, the OCDM has approved the Communicator IV series for use on CD nets. When your net is ready for additional VHF or UHF equipment, call in your Gonset distributor for a bid.

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For further information, check number 7, on page 126

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GONSET VFO Model 3357

Covers 2, 6 and 1¼ meter bands. Works with Communicator I, II, III and IV. Also provides NBFM. Only 5" x 6½" x 8½" . . . $69.50

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For further information, check number 8, on page 126

Letters..... to the Editor

Cycle 19

Editor, *CQ:*

I have just finished reading the Sunspot article by Messrs. Jacobs and Leinwoll for the third time! All I can say is a very hearty "Thanks"; it's the best darned practical article of its type I have ever had the pleasure to read.

Would it be possible to obtain copies of this article in loose-leaf or bound form, for reference information? I sure wish that everyone that works with radio, amateur or commercial, could read this article. . . .

Roland A. Gann, W5TLY
Box 357
Everman, Texas

Reprints of this article are now available—*Ed.*

Editor, *CQ:*

Just a brief note to say 'thanks very much' for the excellent series of three articles on Sunspots and their relationship to amateur radio which recently appeared in *CQ*. I enjoy your regular columns, too. . . .

Kermit Slobb, W9YMZ
1605 Oakwood Road
Northbrook, Ill.

Editor, *CQ:*

I am impelled to let you know that I have greatly enjoyed the very interesting and informative three part article on the Sunspot cycle published in the April, May and June issues of *CQ*. Your presentation has been excellent. To achieve the clarity of expression, I know has required much work. I thank you very much. . . .

W. A. Simkins, K5BBA
1617 Cherokee Place
Bartlesville, Oklahoma

Editor, *CQ:*

Your Sunspot article made for very interesting and informative reading. I have long been recording the monthly averages as broadcast by the Swiss radio, but your plot of all 19 cycles was marvelous. . . .

George R. Cox
147 Atlas Drive, Collins Park
New Castle, Del.

Editor, *CQ:*

I want to compliment Mr. Jacobs and his co-author, Mr. Leinwoll, on their excellent work with the Sunspot Story; the articles are well written and informative as well as interesting . . .

Elton Heubach, W9CQN
132 S. Main Street
Morton, Illinois

Code Practice

Editor, *CQ:*

I read Mr. Steinberger's letter in the July edition of *CQ*. I agree with him completely, the conditions that arise from the negligent operation of the various code operators around the A.R.R.L. code-practice frequencies are deplorable.

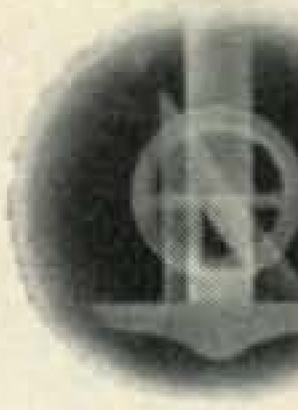
I believe though, that with everyone's cooperation a solution can be brought about that will afford some peace and quiet when code practice sessions are on the air.

◄ For further information, check number 9, on page 126

your choice of 2 GREAT EICO® TRANSMITTERS...

designed by Hams... for Hams...

to the highest Ham standards



90-WATT CW TRANSMITTER* #720
Kit $79.95 Wired $119.95
*U.S. Pat. #D-184,776
"Top quality"—ELECTRONIC KITS GUIDE
Ideal for veteran or novice. "Clean" 90W CW, 65W AM-phone with EXT plate modulation. 80 through 10 meters.

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Kit $49.95 Wired $79.95
"Compact; well-planned layout. Clean-sounding, absolutely hum-free carrier; stable." — ELECTRONICS WORLD.
Perfect for novice or advanced ham needing low-power standby rig. "Clean" 60W CW, 50W AM-phone with EXT plate modulation. 80 through 10 meters.

New! **VARIABLE FREQUENCY OSCILLATOR (SELF-POWERED) #722**
Approaches crystal stability. 80 through 10 meters.
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New! **CITIZENS BAND WALKIE-TALKIE #740**
Complete with rechargeable battery and charger. 9 transistors, 1 diode. Full superhet. U.S. made.
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Superhet; prealigned xmitter osc; match different antennas by variable "pi" network. Single & multi-channel models.
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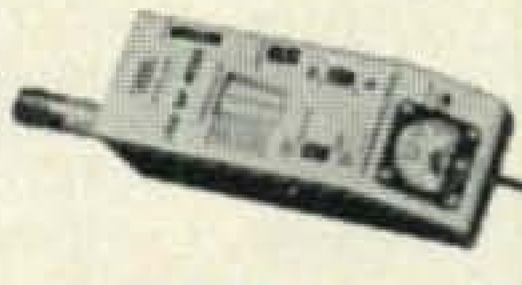
HIGH-LEVEL UNIVERSAL MODULATOR-DRIVER #730
Kit $49.95 Wired $79.95
Delivers 50W undistorted audio for phone operation. Can plate-modulate transmitters having RF inputs up to 100W. Unique over-modulation indicator. Cover E-5 $4.50.



GRID DIP METER #710
Kit $29.95 Wired $49.95
Includes complete set of coils for full band coverage. Continuous coverage 400 kc to 250 mc. 500 ua meter.

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ENGINEERS: Excellent career opportunities in creative electronics design. Write to the Chief Engineer.

For further information, check number 10, on page 126

My proposition is this: If the FCC would make the frequencies 500 cycles either side of the code practice frequencies taboo to all other amateurs during the time when A.R.R.L. is broadcasting, I think that interference can be cut down considerably. This will by no means eliminate strong key clicks, harmonics, and spurious sideband but it will take care of all the direct interference that is caused by amateurs at present . . .

Russel Appleyard, WA2MHY
16 Coolidge Street
Larchmont, N.Y.

Editor, *CQ:*

I have heard many hams complain about QRM, particularly near code practice frequencies. In my case, a good *Q*-Multiplier and a little knowledge of its use has certainly helped eliminate interference . . .

Stanley B. Eyre, K1LZA
Hard Hill Road, R.F.D. 2
Woodbury, Conn.

Conversions

Editor, *CQ:*

I enjoyed reading your article "Operation Rebuild" by W2IAZ, (July *CQ*). It was an excellent way for his son to learn his General Class Theory. I learned some things I didn't know myself.

This is an excellent idea for Novices and beginning amateurs who don't have rigs. How about something of this sort for the v.h.f. bands? For me, I would love to see an article of this sort on the conversion of some of the more popular surplus equipment into v.h.f. ham gear. I have wanted to get on v.h.f. for some time now, but the expense has been too great.

Steve Marshall, K4WUN
24 Hawthorn Road
Salem, Va.

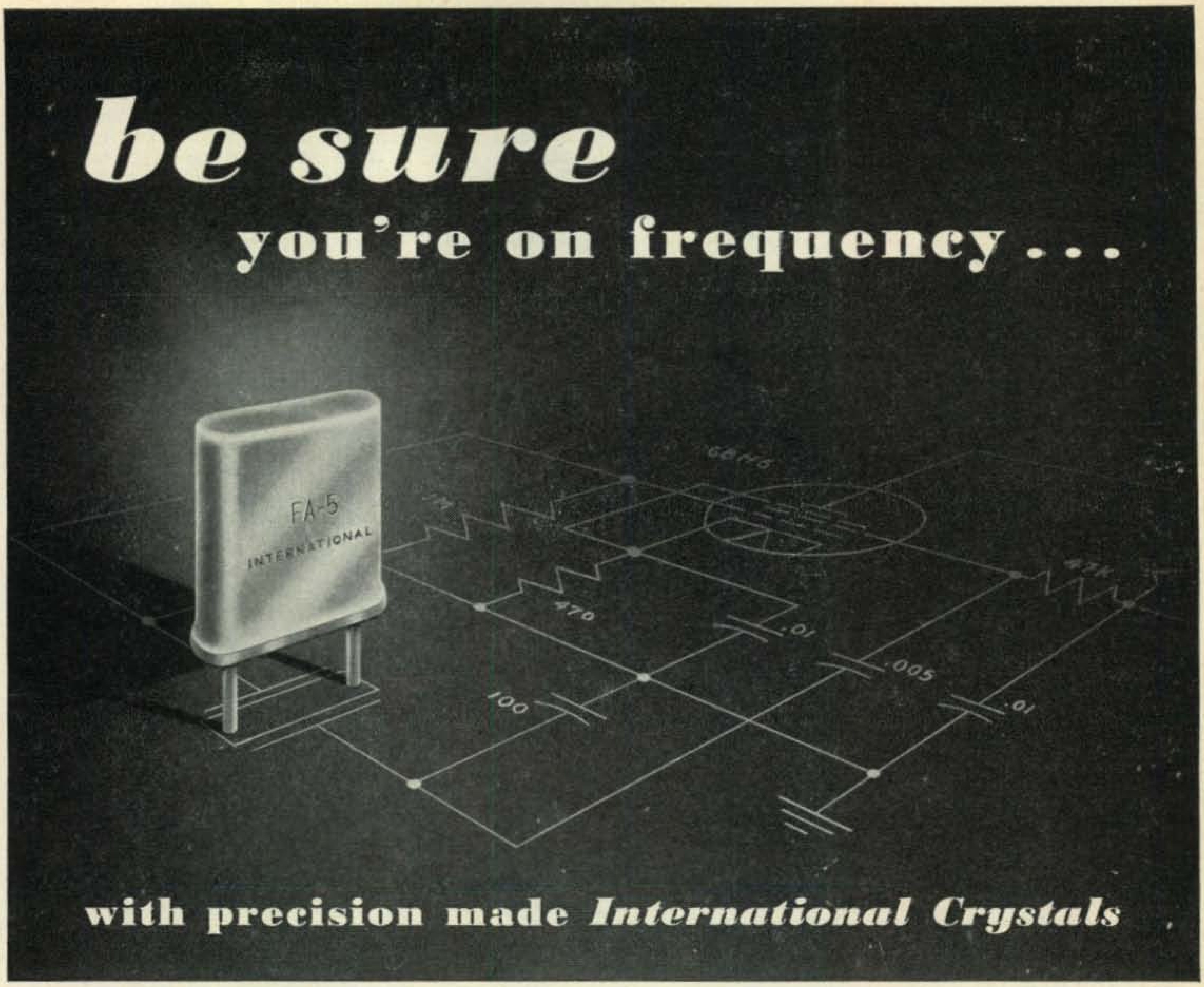
An excellent conversion of the AN/ARC-3 will be published shortly.—*Ed.*

Flying Hams

The ubiquitous Clif Evans, K6BX informs us of another "nifty." All licensed pilots or crew members who are licensed radio amateurs qualify for the "Flying Ham's Club" Certificate. Life membership can be obtained by writing for application (s.a.s.e. pse). Fee is $1.00. Working Flying Hams also brings an award. Full info can be obtained through the *Directory of Certificates* via Box 385, Bonita, California.

Black Diamond A. R. C.

Hinton, West Virginia (*Summers* County) will be the gathering place, on September 3rd for the annual Bass Lake Ham Picnic, sponsored by the Black Diamond Amateur Radio Club. Although primarily a social get-together, many prizes will be awarded. Information and registration tickets at $1.00 each may be obtained by writing to Tom Ball, K8BUX.



International Crystals are designed for all types of communication service . . . Amateur — Commercial — Citizens. Thousands of transmitters, transceivers, and receivers this very moment are on frequency with International Crystals. From a quartz blank to the finished plated crystal, hermetically sealed in its can, International insists on the highest standard of manufacturing. You can be sure you're on frequency because International precision made crystals have built-in DEPENDABILITY!

For information on International's complete line of Amateur, Commercial and Citizens band crystals write International Crystal Manufacturing Company today.

International type FA-5 and FA-9 wire mounted crystals are for Amateurs and Experimenters where tolerances of .01% are permissible. Priced from $3.30 to $5.75 for fundamental frequencies, and from $3.30 to $9.35 for 3rd, 5th, and 7th overtones.

INTERNATIONAL CRYSTAL MANUFACTURING CO., INC.
18 NORTH LEE • OKLAHOMA CITY, OKLAHOMA

For further information, check number 11, on page 126

For further information, check number 12, on page 126

Illinois County Award

The Peoria Amateur Radio Club is now sponsoring an "Illinois County Awards" for confirming contacts with Illinois Counties starting with 72 working groups of ten to the grand total of 102. Gold seals are awarded for each additional ten counties. No time, band or emmission limitation are made. Mobile and portable contacts count as such if named on QSL card. A county map of Illinois is available for s.a.s.e. Application for basic certificate can be obtained by sending a certified list of confirmations (two licensed Amateurs or Radio Club official, or Notary Public) with 50¢ or 5 IRCs, and for later gold seals s.a.s.e. or 1 IRC to Cliff Corne, K9EAB, 711 West McClure Avenue, Peoria, Illinois. Cliff, pictured on page 91 of the May issue of *CQ* conceived the program and designed the award.

Old Old Timers

Last month, on page 18, we mentioned the Old Old Timers Club. This month we have further information from K6BX and *The Directory of Certificates* that will be of interest to the Certificate Hunters. The OOTC is now sponsoring an award given in several classes as separate awards for confirmed contacts with OOTC members, *after* 1947, when the OOTC was founded. These are:

Class	*Requirements*
AA	100 Members in 50 U.S. States
A	50 Members in 50 U.S. States
B	25 Members in 25 U.S. States
C	50 Members in any U.S. State or country.
D	25 Members in any U.S. State or country.

Each award will be endorsed separately, all one bands or all one mode of operation. Applications are made to OOTC Secretary, Earl C. Williams, W2EG, 507 Wayside Road, Neptune, N.J. QSL cards are not required with application. Send list of full log data (QSL's must be in your possession) confirmed by two licensed amateurs, an official of an amateur radio club or Notary Public, together with handling fee of $1.00 or 10 IRC.

Central Texas A.R.C.

The Central Texas Amateur Radio Club will hold its 6th annual Hamfest at the Waco Syrian Club, September 3rd, beginning at 9A.M. until 5 P.M. Catering service will be available and many prizes will be given away. The C.T.A.R.C. is at P.O. Box 1032, Waco, Texas.

Massachusetts Award

The Scallop City A.R.S. of the greater New Bedford, (*Bristol County*) area is issuing a new certificate called the "Worked Scallop Capitol of the World." The Requirements are; for stations outside the greater New Bedford area, contact five members of the S.C.A.R.S. Stations in greater New Bedford must make 10 contacts with members. All contacts must be dated after April 23, 1961. Applications should go to K1INO, 60 Lafayette Street, New Bedford, Mass. No charge for certificate. Club members are, W1AGG, APN, AQS, ATI, DIY, EKW, HSU, LHY, MHN, ONK, VID, UQH, WAY; K1AWX, BVD, BZL, CFK, DCE, DPI, EJX, EKP, INO, JNM, NWU, OIC; KN1RMO and SMR.

N. E. DX Association

The third annual dinner sponsored by the North Eastern DX Association will be held at the Town House Motel, in Albany, N.Y. on October 7th. Tickets are $5.00 each and reservations should be mailed before Sept. 23, to Fred Spinning, W2TVR, 38 Highland Drive, Albany 3, N.Y.

Peoria A. R. C.

The Peoria Amateur Radio Club wants to inform everyone that their hamfest will take place on September 17th at the Exposition Gardens, North University Ave., and Northmoor Road, in Peoria, Illinois. K9PWQ is handling the incidentals.

COAXIAL TYPE SWITCHES
. . . multi-position, single or multiple gang

Now you can switch coaxial line circuits quickly and without error. These handy, inexpensive units are available with "UHF", "BNC", "N" and Phono type connectors for use with either 52 or 75 ohm lines. Phono connector types are specific for Hi-Fi applications. Other types are designed to handle RF Power up to 30 MC, 1 KW input.

Stock items ready for shipment are:

Model 550A—Single gang, single pole, 5 position switch with UHF connectors. Price: $8.25 each.

Model 551A—Single gang, 2 pole, 2 position special purpose switch with UHF connectors. Ideal for switching any device in or out of series connection in coax line circuits. Price: $7.95 each.

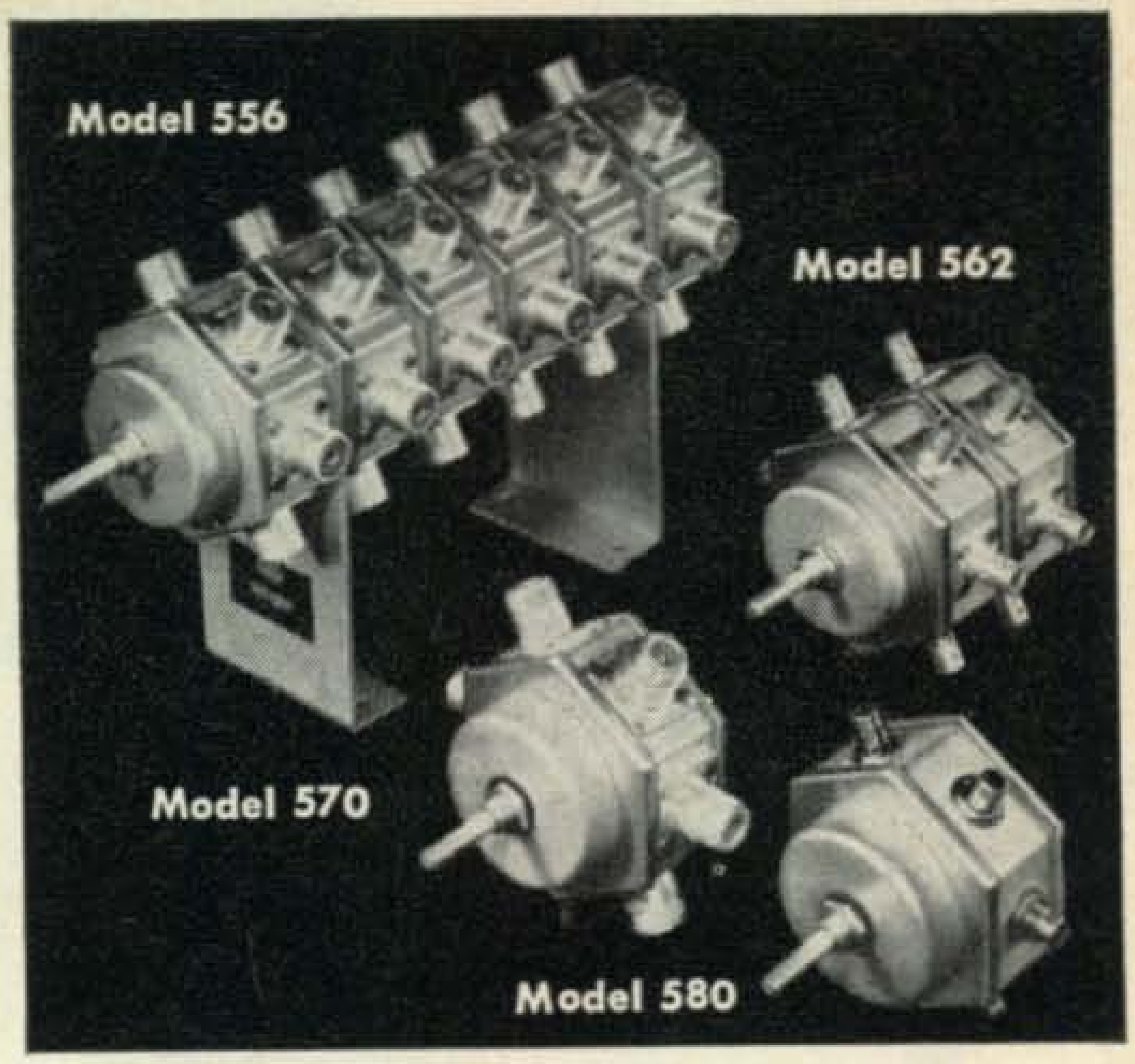
Model 560—Single gang, single pole, 5 position switch, same as Model 550A except with BNC type connectors. Price: $11.95 each.

Model 561—Single gang, 2 pole, 2 position special purpose switch, same as Model 551A except with BNC type connectors. Price: $9.95 each.

Model 570—Single gang, single pole, 5 position switch, same as Model 550A except with N type connectors. Price: $13.35 each.

Model 580—Single gang, single pole, 5 position switch, same as Model 550A except with Phono type connectors. Price: $7.35 each.

Multiple gang types, up to 6 gang for single pole—5 position switches, and as required for 2 pole—2 position switches, are made to order with any connector types listed above. Prices on request.



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OTHER B&W EQUIPMENT: Transmitters AM-CW-SSB • Transistorized Power Converters and inverters • Dip Meters • Matchmasters • Frequency Multipliers • Low Pass Filters • T-R Switches • R. F. Filament Chokes • Transmitting R. F. Plate Chokes • Band-Switching Pi-Network Inductors • Cyclometers • Antenna Coaxial Connectors • Baluns • Variable Capacitors • Toroidal Transformers • Fixed and Rotary edgewound Inductors • Plug-in Coils with fixed and variable links • Straight type air wound coils in a variety of dimensions.

For further information, check number 13, on page 126

THIS is the microphone for mobile use

THE TURNER 350C

Good performance on mobile operations — citizen's band, 2-way commercial radio and amateur radio — requires a microphone *designed* for mobile use. Tape recorder type mikes can't do the job. The Turner 350C is a reasonably priced, ceramic microphone especially designed for quality voice reproduction. DPST switch is wired for relay operation with easily reversible terminals to allow modification (if necessary). A wiring diagram is enclosed with each microphone. Hanger button and standard dash bracket are included for mobile rig mounting. Microphone furnished with 11" retracted (five foot extended) Koiled Kord. Response: 80 to 7000 cps. Output: −54 db. List price: $16.80 complete. See your electronic parts distributor. He has the Turner 350C in stock.

THE TURNER MICROPHONE COMPANY
925 17th Street NE
Cedar Rapids, Iowa

For further information, check number 14, on page 126

For further information, check number 15, on page 126

Pictured above are some of the OT that showed up at the first QCWA picnic held June 4th at Guerneville, California. Front row: l. to r., Ray Newby, W6LGW; Pete Peterson; Roger Williams; W6WGF; Len Johnson, K6QMT; Earl Wohler, W6FS; E. N. Vetter; Howard Cookson, W6GW; William Temp Campbell, W6ELW. Middle row; l. to r, L. E. Grogan (AZ); Wally Wood, K6EQW: Chet Ullom, W6BDW; George Snell, K6VTC; George Hubbard; Erv Rasmussen, W6YPM; Earl Putzker, W6FQA; Art Messineo, W6UDL; Cliff Olver, W6SXK, Jack Slater, W6WF; C. H. Cannon, ex-6TR. Rear; l. to r, Palmer Walsh, W6DVD; Frank Warnick, W6KYO; Wm. Peterson, W6OJU; F. Wayne Taylor, K6KVZ; Fran King, W3ATM/6; Tom Ware, W6GSX; W. A. Vetter; H. W. Dickow, ex-6SN (former publisher of *Radio)*; and Tom Atherstone, W6IV

Newfoundland Radio Club

The Society of Newfoundland Radio Amateurs is commemorating the 60th Anniversary of Marconi's first Transatlantic wireless communications by holding a week-long QSO celebration later this year. Operations are expected to be on all bands, phone and c.w. The Dept. of Transport has been petitioned for a special call, VO1MSA (Marconi's Sixtieth Anniversary), which is expected to be issued. VO1AK is Secretary of the Marconi Celebration Committee. The first transatlantic communication was made from Poldhu, in Cornwall, England, and received by Marconi himself on Signal Hill, in St. John's, Newfoundland on December 12, 1901.

Ontario Convention

VE3ETM informs us that the Windsor Amateur Radio Club will hold its Ontario A.R.R.L. Convention at the Prince Edward Hotel in Windsor, on September 29 and 30. This is the first such convention to be held in that area and they are all hoping for a big turnout. The Windsor A.R.C. is located in the Red Cross Building at 1226 Ouellette Ave., Windsor, Ontario, Canada.

New Mexico Certificate

The amateurs of Deming, New Mexico (*Luna County*) are issuing a new certificate called the "Worked All Deming Award." Requirements are; to work any five members of the club and send a transcript of the log to K5IKL, giving date, time, station worked and frequency. Beginning date is January 1, 1961. Club members are W5AGS, AHB, DJB, K5FMY, FMX, FQE and IKL.

Ohio Hamfest

The 24th Annual Stag Hamfest sponsored by the Greater Cincinnati Amateur Radio Association will be held all day Sunday, September 24, 1961 at Stricker's Grove, Compton Road, Mt. Healthy, Cincinnati, Ohio. Two meals are provided (noon and 5 P.M.) as well as donuts, hot-dogs, snacks and drinks in between, all for the $3.50 gate fee. Many attendance prizes will be given each hour. Equipment displays, hidden transmitter hunt and other attractions. One lucky person will take home a Hallicrafters SX-115 Receiver and another will own a Gonset Communicator IV 6-Meter Rig. For further information contact Elmer H. Schubert, W8ALW 3965 Harmar Ct., Cincinnati 11, Ohio.

IMAGINATIVE DESIGN CONCEPT

PRODUCES COMPACT, LOW COST SSB, AM, CW COMMUNICATIONS RECEIVER WITH FINE RECEIVER PERFORMANCE

Clean, functional panel layout and compact cabinet of receiver and speaker will compliment the finest Amateur Station. Baked on dukane grey and black enamel over heavy gauge steel. Receiver: 10½" x 7½" x 8" deep. Speaker: 7½" x 7½" x 8" deep.

Now the leading manufacturer of quality amateur radio antennas offers you tried and proved components in the new Mosley CM-1 Communications Receiver. But – FOR THE FIRST TIME – these have been combined so as to result in performance equal to or better than that of receivers selling for several times the price.

Ask for demonstration of the CM-1 at your favorite dealer. Prove to yourself that you need not spend more to get fine receiver performance!

FEATURES and PERFORMANCE DATA:

- Double conversion with crystal controlled first oscillator.
- Diode detector for AM and product detector for SB and CW.
- Covers complete range of all amateur bands – 80 meters through 10 meters. Ten meter band segmented in three overlapping increments of 650 kc. each. Each band and each segment covers full 12" dial scale.
- Calibration every 5 kc. WWV reception at 15 mc.
- S-meter functions on AM, CW or SB, with or without BFO.
- Five dual-purpose tubes plus two semi-conductor diodes provide functions of 12 tube sections. TUBE and DIODE LINEUP: One 6AW8A, triode mixer and crystal oscillator; one 6AW8A, 2nd mixer and tunable oscillator; one 6AW8A, 1st IF and 1st Audio; one 6AW8A, 2nd IF and product detector; one 6AW8A, 2nd audio and BFO; 1N34, AM detector; 2F4, power rectifier.
- SELECTIVITY: 2.5 kc. at -6 db.
- SENSITIVITY: ½ microvolt for 10 db. signal-to-noise ratio on ten meters.
- STABILITY: Less than 500 cycles drift after one-minute warm-up. Less than 200 cycles change for 10% line voltage change. Temperature compensated and voltage regulated.
- IMAGE and IF REJECTION: 35 db. minimum.
- AUDIO OUTPUT: ½ watt at 6% distortion.

REAR CHASSIS ACCESSORY FACILITIES: Transmitter Relay Terminals, Accessory Power Socket, External Speaker/VOX Terminals.

POWER CONSUMPTION: 33 Watts. (117 volts AC, 50 to 60 cps.)

Net Price, only $169.95

Matching Speaker, Model CMS-1. Net Price, $16.95

(slightly higher west of the Rockies and outside the U.S.A.)

Mosley Electronics, Inc. – 4610 North Lindbergh Blvd. – Bridgeton, Mo.

For further information, check number 38, on page 126

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington 25, D.C.

In the Matter of

Section 12.21(*d*) and 12.44(*a*) of Part 12, Rules governing amateur radio regarding eligibility for Conditional Class licenses. DOCKET NO. 14025 } DOCKET NO. 14025

REPORT AND ORDER

By the Commission: Commissioners Hyde and Lee absent.

1. The Commission has considered the comments filed in the above-entitled matter as a result of the issuance of a Notice of Proposed Rule Making (26 FR 2875) April 6, 1961. The proposed rule amendments would permit an applicant residing temporarily outside the United States to take an examination for a Conditional Class license even if his residence in the United States is less than 75 miles from a legal Commission examination point.

2. Three comments were received in this proceeding, all favoring the proposed change. Two were from amateur radio clubs located in the Panama Canal Zone, while the third was from the American Radio Relay League which had submitted the original petition in this matter. The filings express the opinion that should these rule changes be adopted many American citizens forced by work or study to reside outside the United States will be able to operate in the foreign countries where they are temporarily residing once they obtain a United States amateur radio station license.

3. The Notice of Proposed Rule Making discussed the question of what should constitute a reasonable period of residence outside the United States and proposed therein that the Rules should require that this tenure be for at least twelve months. The Commission will permit applicants who have been, or will be, residing outside the United States for this twelve-month period to take the Conditional Class examination provided, of course, adequate evidence of such residence is presented. What will constitute sufficient evidence will be determined from the particular facts in each case.

4. Authority for the amendments set forth in the attached Appendix is contained in Section 4(*i*) and 303 of the Communications Act of 1934, as amended.

5. Therefore, IT IS ORDERED, This 19th day of July, 1961, that Sections 12.21(*d*) and 12.44(*a*) of Part 12 of the Commission's Rules are amended as set forth in the Appendix attached hereto, effective September 6, 1961.

FEDERAL COMMUNICATIONS COMMISSION
BEN F. WAPLE
Acting Secretary

APPENDIX

Part 12 of the Commission's Rules is amended as follows:

1. In § 12.21, paragraph (*d*) is amended to read as follows:

§ 12.21 Eligibility for license.

* * * * *

(*d*) *Conditional Class.* Any citizen of the United States:

(1) Whose actual residence and amateur station location are more than 75 miles airline distance from the nearest location at which examinations are held at intervals of not more than 3 months for General Class amateur operator license.

(2) Who is shown by physician's certificate to be unable to appear for examination because of protracted disability.

(3) Who is shown by certificate of the commanding officer to be in the armed forces of the United States at an Army, Navy, Air Force or Coast Guard

[*Continued on page* 22]

For further information, check number 17, on page 126

USA-CA

RECORD BOOK

NOW AVAILABLE

CONTAINING:

- COUNTY Outline Maps of All 50 States
- RULES, Regulations, Certification Forms
- ALPHABETICAL List of Counties By State.
- CROSS-Indexed Maps.
- 108 pages, 8½ × 11″.

Price – $1.25, Postpaid

Obtain Your Copy *Now* From:
CQ – 300 W. 43rd St.
New York 36, N. Y.

Complete Rules Appear on Page 95 of The July Issue.

USA-CA
CUSTODIAN

Clif Evans, K6BX
Box 385, Bonita
California

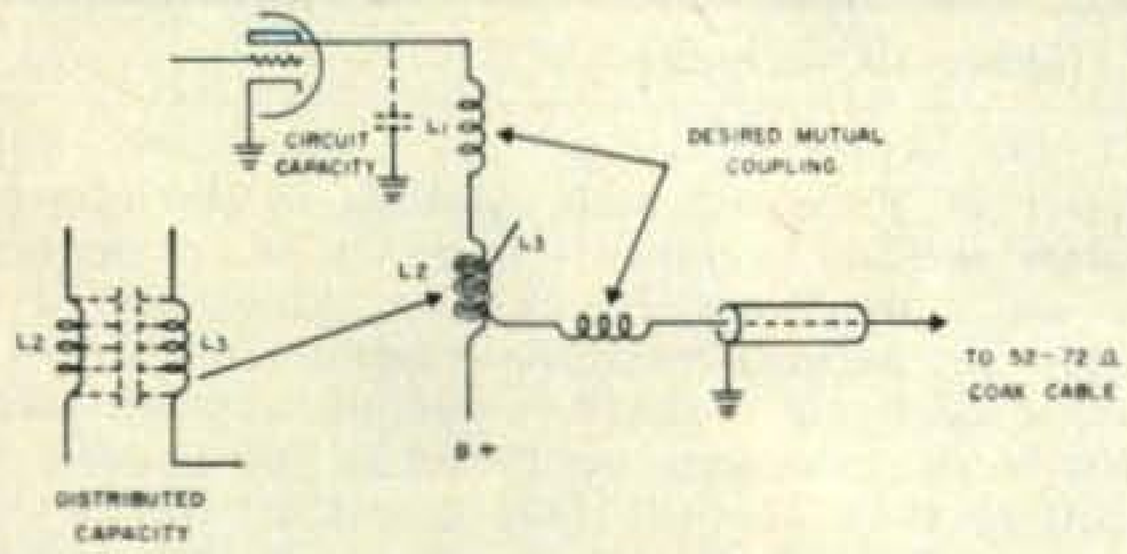
ONLY ONE KNOB TO TUNE THE 200V!

What's behind this knob? The Broadband Principle.

What is meant by a broadband transmitter? It is a transmitter with all stages designed to eliminate the need for manual tuning. Each stage has tuned circuits that are broadly resonant over a predetermined portion of the radio spectrum; for instance, 3.5 MC to 4.5 MC, 13.5 MC to 14.5 MC, etc. The signal is amplified in each broadband stage and is ultimately coupled from the plate of the final RF Amplifier to the antenna feed line through a broadband coupler.

WHAT'S IN A BROADBAND COUPLER? No copper sleeves, ferrites or any other "lossy" elements . . . just wire!

There are no motors, servos or sensing circuits required to keep the 200V tuned up! The design of the broadband coupler does the job for you. It works like a transformer with a primary and secondary.



The primary L_1 L_2 is resonant at the high frequency end of the desired passband. Part of the secondary L_3 L_4 is wound bifilar with part of the primary. The bifilar winding has a distributed capacity between the wires. This capacity appears as a series resonant circuit with L_4 at the low frequency end of the desired passband. By controlling the size of the bifilar winding and the mutual coupling between L_1 and L_4, it is possible to show the amplifier plate an essentially constant load impedance across the desired passband.

EFFICIENCY? As long as the tube sees the proper plate load impedance, it will deliver power to that circuit. If this impedance is equal to that produced by a normally tuned and loaded circuit and the broadband coupler is not constructed with "lossy" elements, it follows that the RF power will be transferred to the load at essentially equal efficiency.

LOADING? Why do you normally tune and load an RF Amplifier? To make the tuned circuit show the proper load impedance to the plate of the tube at the desired frequency.

The output circuit of the 200V is designed to match 52 to 72 ohm coaxial transmission lines without dipping, loading, or tuning of any kind!

SWR? If the SWR is 2:1 or less, the reflected change in plate load impedance through the broadband coupler will be negligible.

HARMONICS? The broadband coupler could be designed wide enough to pass the 2nd Harmonic generated by the output tubes; however, since this is undesirable, the passband is restricted to one megacycle and a series trap circuit built-in to reduce 2nd and higher order Harmonics better than −50 db. The Harmonic rejection of the broadband coupler is equal to or better than a properly tuned Pi network.

The overall broadband circuit design makes possible a true single knob controlled transmitter. The *ONLY* tuning control is the VFO. In fact, the bands are so arranged that if you have the VFO set to 7280 KC and band switch to 20 meters, the transmitter is instantly ready to operate on 14280 KC; or switch it to 15 meters, and you are instantly on 21280 KC. The 200V is a Band Hopper's dream transmitter. It is the only transmitter that tunes like a receiver and yet provides the best sounding signal on the amateur bands!

73 *Wes*

Wes Schum, W9DYV

Write for 200V brochure for more detailed specifications.

Central Electronics, Incorporated

A subsidiary of Zenith Radio Corporation **1247 W. BELMONT AVENUE CHICAGO 13, ILLINOIS**

For further information, check number 18, on page 126

For further information, check number 19, on page 126

Announcements [*from page* 18]

station and, for that reason, to be unable to appear for examination at the time and place designated by the Commission.

(4) Who furnishes sufficient evidence, at the time of filing, of temporary residence for a continuous period of at least 12 months outside the continental limits of the United States, its territories or possessions, irrespective of other provisions of this paragraph.

2. In § 12.44, paragraph (*a*) is amended by changing "or" at the end of subparagraphs (2) and (3) to a period, and by a new subparagraph (4) to read as follows:

§12.44 Manner of conducting examinations.

* * * * *

(*a*)

(4) If the applicant demonstrates by sufficient evidence that his temporary residence is for a continuous period of at least 12 months outside the continental limits of the United States, its territories or possessions, irrespective of other provisions of this paragraph.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington 25, D.C.

In the Matter of

Amendment of Section 12.90 (*b*) (2) of the Commission's Rules to permit Maritime Mobile operation on a World-Wide Basis in the 14.00-14.35 mc Band.	DOCKET No. 14026

REPORT AND ORDER

By the Commission: Commissioner Ford absent.

1. On April 3, 1961, the Commission released a Notice of Proposed Rule Making in the above-entitled matter seeking comments in favor of, or in opposition to, an amendment to Section 12.90 (*b*)(2) of its Rules to permit maritime mobile operations in the frequency band 14.00-14.35 mc on a world-wide basis. This Notice was duly published in the Federal Register, April 6, 1961 (26 FR 2876), and all timely comments filed in response thereto have been considered by the Commission.

2. Comments were received both from organizations and individuals, all unanimously favoring the proposed rule amendment. By adopting this change, amateurs licensed by the Commission who are operating beyond the continental limits of the United States, its territories and possessions will be on a somewhat more equal footing in terms of privileges with amateurs operating within these areas. In light of the absence of opposition and for the reasons which were set forth in detail in the Notice of Proposed Rule Making, the Commission sees no reason why the proposed rule amendment should not be adopted.

3. Authority for the amendment set forth in the attached Appendix is contained in Section 4(*i*) and 303 of the Communications Act of 1934, as amended.

Therefore, IT IS ORDERED, This 12th day of July, 1961, that Section 12.09(*b*)(2) of Part 12 of the Appendix attached hereto, effective August 21, 1961.

FEDERAL COMMUNICATIONS COMMISSION
BEN F. WAPLE
Acting Secretary

APPENDIX

Part 12 of the Commission's Rules is amended as follows:

In § 12.90(*b*), the introductory text and subpara- [*continued on page* 106]

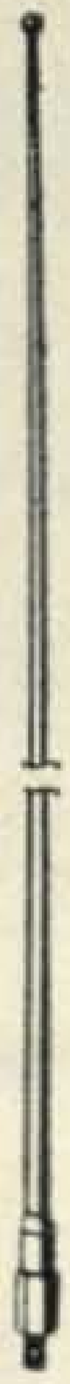
MASTER MOBILE-TOPS IN QUALITY & PERFORMANCE

NEW DELUXE HI-"Q" COILS

New wide space deluxe antenna coil. Greater efficiency on individ. bands. Easily handles 750 W. P.E.P. Lightest coil of its kind commercially available. Use with 36" base sect. 60" whip.

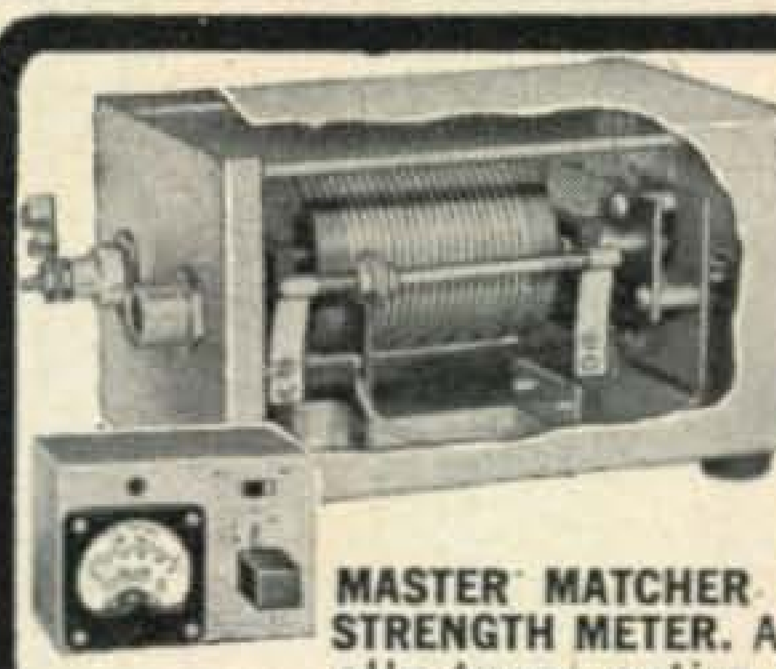
15M	$ 5.95
20M	6.95
40M	7.95
75M	9.95
160M	14.95

FIBRE-GLAS ANTENNA



The Feather-Weight with Spring-Steel Strength. Completely weatherproof. Fibreglas covering, minimizes electrostatic noises generated by heat, moisture and foreign particles in the air.

FG-60 60" $4.95
FG-72 72" $4.95
FG-84 84" $5.15
FG-96 96" $5.25
FG-103 103" $6.95

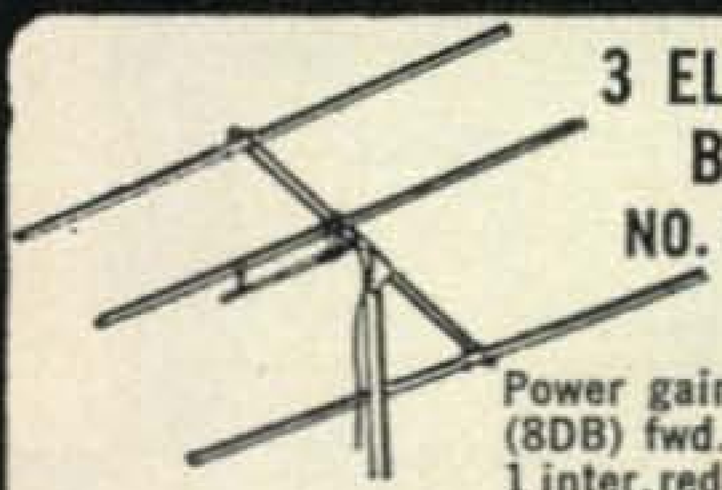


6 or 12 volt models

Complete **$24.95**

MASTER MATCHER & FIELD STRENGTH METER. Automatically tunes entire band by remote control.

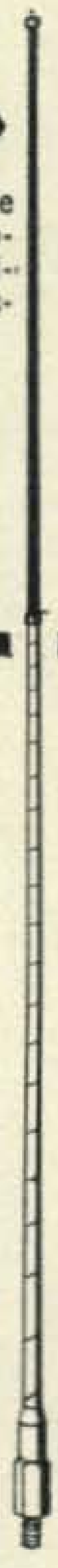
3 ELEMENT BEAM NO. SR-500



Power gain app. 2½ (8DB) fwd. dir. 10 to 1 inter. red. from sides & rear VSWR-1 1-1 at band center when fed with 52 OHM coax.

SR-500-10 $24.95 SR-500-6 $12.95
SR-500-11 24.95 SR-500-2 10.95

MASTER-MAGIC TUNABLE WAND



New! easy-to-install, single band, top-loaded, plastic covered fiber-glas antenna. Maximum performance on the desired band.

10 Met.-	5 Ft. L	$8.95
11 Met.-	5 Ft. L.	8.95
15 Met.-	5 Ft. L.	8.95
20 Met.-	5 Ft. L.	8.95
40 Met.-	6 Ft. L.	9.95
80 Met.-	6 Ft. L.	9.95

MULTI-BAND COILS

New plug-in type, operates with std. 3' base, 5' whip. Q of 525. 500 W input. Oper. with 52 ohm cable. Factory pre-tuned.

No. 900-10,15,20,40,75M
No. 999-10,15,20M
No. SSB-156-40, 75M

YOUR CHOICE **$14.95**

NEW! SLIM-JIM

ALL-BAND BASE LOADING ANTENNA COIL

FOR 10, 11, 15, 20, 40, 80 METERS

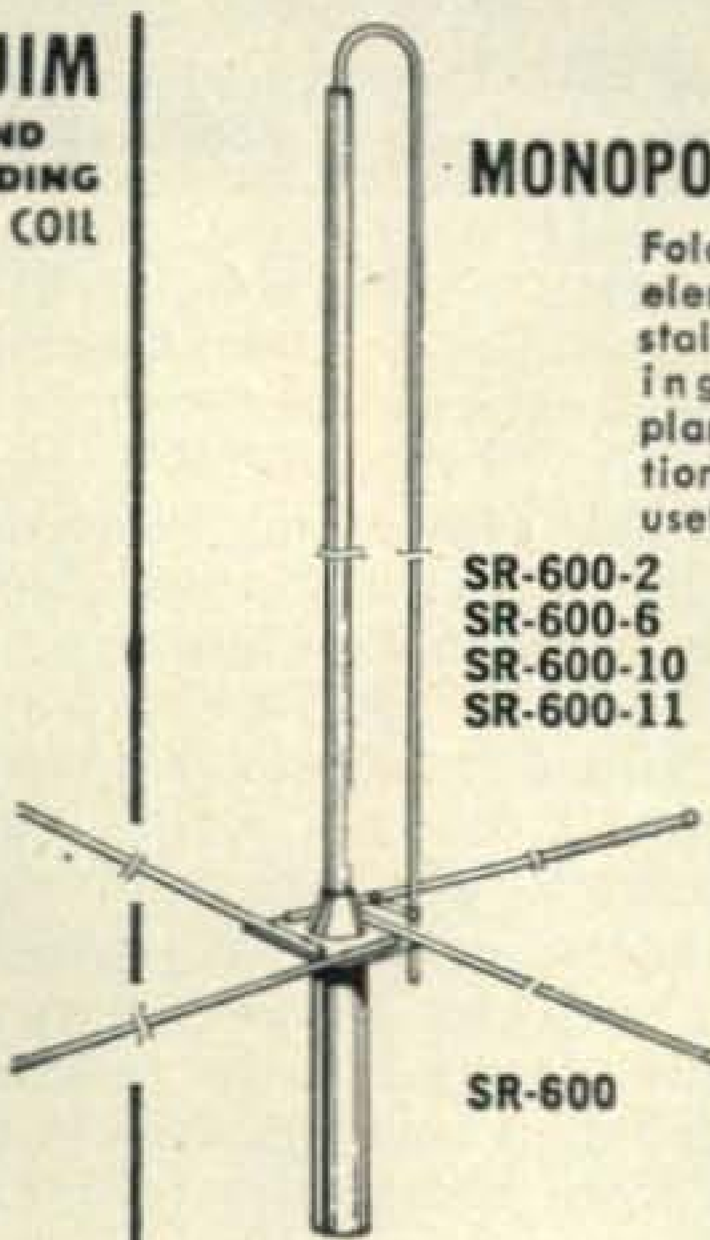
SIZE 1⅜"x 19"

Positive action, just slide whip in or out to loading point and lock nut into position.

NO. B-1080

$17.95

MONOPOLE ANTENNA

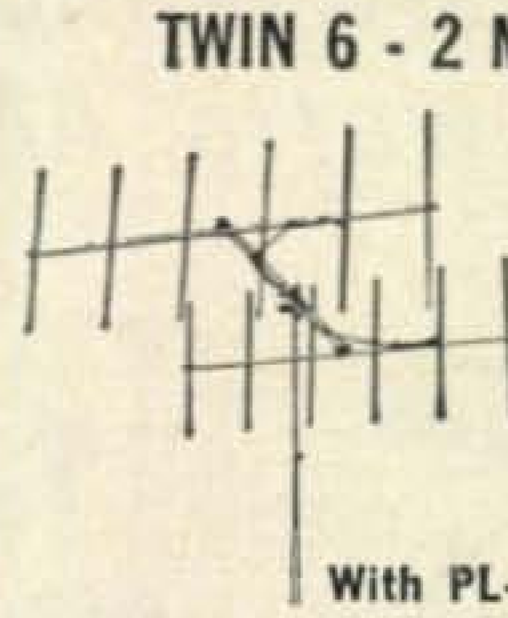


Folded radiating element for installation requiring a ground plane configuration and a wider useful range.

SR-600-2	2 Met.	$14.95
SR-600-6	6 Met.	16.95
SR-600-10	10 Met.	24.50
SR-600-11	11 Met.	24.50

WRITE FOR FREE CATALOG

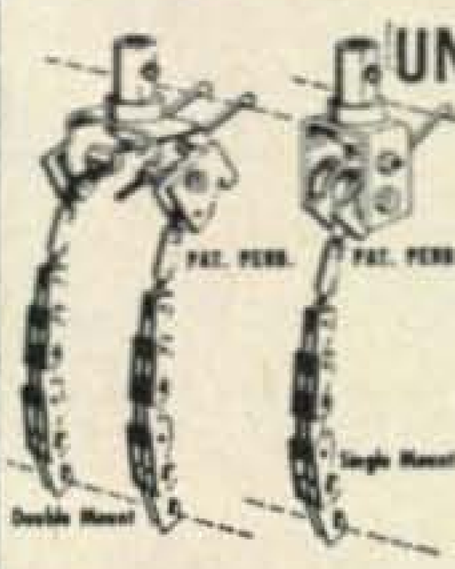
TWIN 6 - 2 METER BEAM



May be rotated by TV rotor. Complete with baluns, match. harness to 52 ohm. Vertical or horiz. pol. Trem. forward gain. Excell. front to back ratio. Lightweight, sturdy.

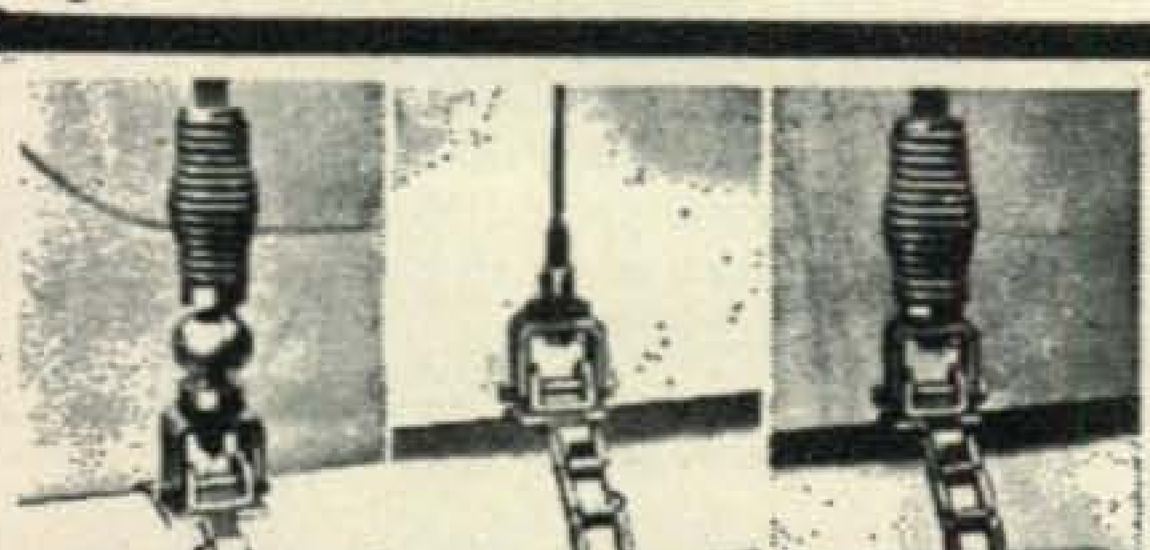
With PL-259 COAX **$16.95**

UNIVERSAL MOUNTS



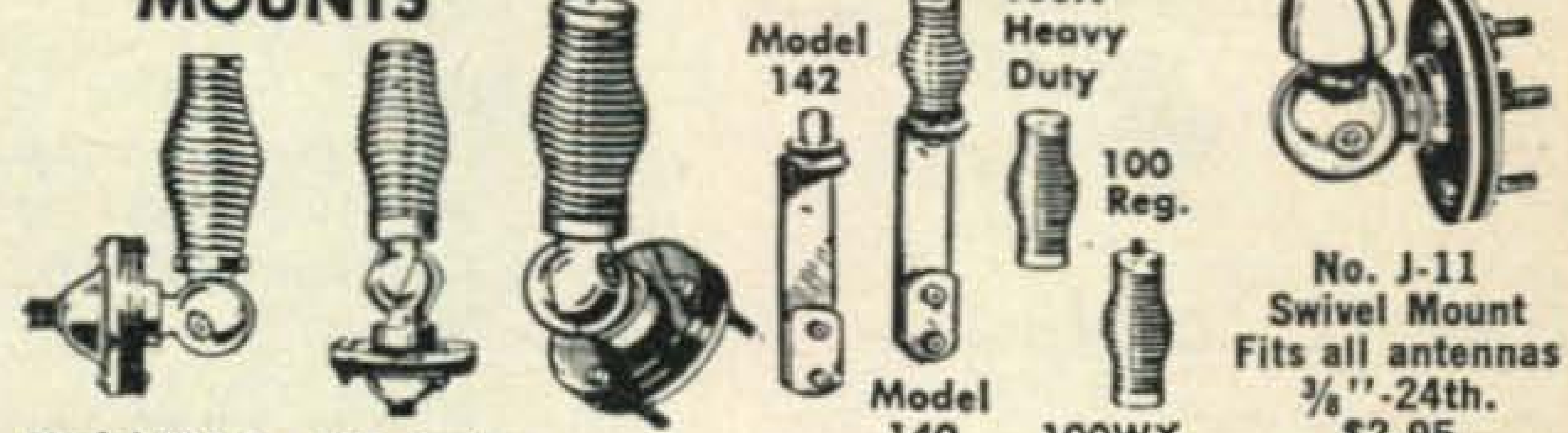
Heavy duty comm. ant. mts. Can be attached through opening as small as 3/16". For spring or whip. Pheno insulators. ⅜"-24 th.

530	Double SS.	$21.95
531	Single SS.	11.95
520	Db. S-Cad. Pl.	7.95
519	Sl. S-Cad. Pl.	4.95



No.444 $17.80 No.445 $7.95 No.446 $13.45
Adjustable to any bumper. No holes to drill.

MOUNTS



No. J-11 Swivel Mount Fits all antennas ⅜"-24th. $2.95

232X	Base Mount—H.D.—Dble. Tpred. Spring—Swivel Base	$ 9.85
232XC	Base Mount—H.D.—Dble. Tpred. Spring—Coax, Conn.	9.85
232XSSC	Base Mount—H.D.—D. Tpd. Sg.—Sp. Sless—Coax Conn.	14.95
232XSS	Base Mount—H.D.—Dble. Tpd. Spg.—Spec. Stainless	14.95
321 or 321C	Base Mount—Where no spg. des.—w. sp. rig. type ball jt.	7.95

All products are for Universal Use-Mobile, Home, Marine, C.A.P., Civil Defense, Emergency, etc.

EIA

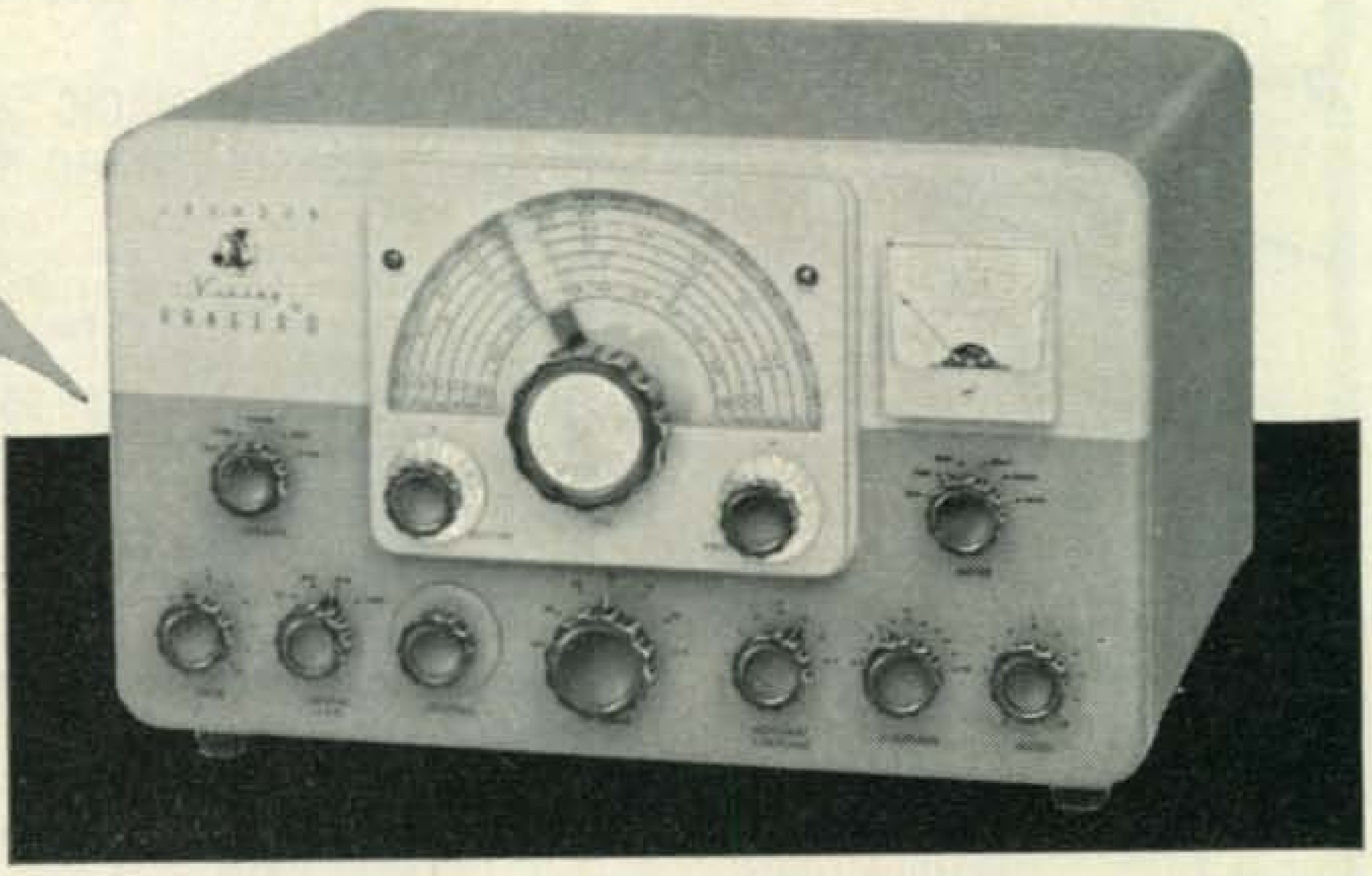
Master Mobile Mounts, Inc.
4125 W. JEFFERSON BLVD. • LOS ANGELES 16, CALIF.

AT LEADING RADIO JOBBERS EVERYWHERE

For further information, check number 16, on page 126

NEW! RANGER II

NOW COVERS 6 METERS IN ADDITION TO 160, 80, 40, 20, 15, 10



75 watts CW input ... 65 watts AM!

Now—a new version of the popular Viking "Ranger" . . . the "Ranger-II" Transmitter/Exciter! Completely self-contained in a handsome re-styled cabinet, the "Ranger II" now covers 6 meters! As a transmitter, the "Ranger II" is a rugged and compact 75 watt CW input or 65 watt phone unit. Pi-network coupling system will match antenna loads from 50 to 500 ohms and will tune out large amounts of reactance. Single-knob bandswitching on six amateur bands: 160, 80, 40, 20, 15, 10 and 6 meters—built-in VFO or crystal control. Timed sequence (grid block) keying provides ideal "make" or "break" on your keyed signal, yet the "break-in" advantages of a keyed VFO are retained.

As an exciter, the "Ranger II" will drive any of the popular kilowatt level tubes, provides a high quality speech driver system for high powered modulators. Control functions for the high powered stage may be handled right at the exciter—no modification required to shift from transmitter to exciter operation. Nine pin receptacle at the rear brings out TVI filtered control and audio leads for exciter operation. This receptacle also permits the "Ranger II" to be used as a filament and plate power source, and also as a modulator for auxiliary equipment such as the Viking "6N2" VHF transmitter. Unit is effectively TVI suppressed . . . extremely stable, temperature compensated built-in VFO gives you exceptional tuning accuracy and velvet smooth control. Complete with tubes, less crystals, key and microphone.

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

Cat. No. 240-162-2 Viking "Ranger II" wired and tested.................. **Amateur Net** **$359.50**

New Catalog

Write today for our newest Amateur Catalog! Available now—contains photos, schematics, and detailed specifications!

FIRST CHOICE AMONG THE NATION'S AMATEURS

Viking ®

E. F. JOHNSON COMPANY • WASECA, MINNESOTA

For further information, check number 40, on page 126

INVADER

INVADER 2000

The finest SSB signal on the air!

Here's the transmitter with the sharp, penetrating signal you've been waiting for—plus more exclusive operating and convenience features than any other SSB Transmitter on the market today! Instant bandswitching coverage 80 through 10 meters—no extra crystals to buy—no realigning necessary—delivers a solid 200 watts CW input; 200 watts P.E.P. SSB input; 90 watts input on AM! Unwanted sideband suppression is 60 db or better! Built-in VFO is differentially compensated. Exclusive RF controlled audio AGC and ALC (limiter type) provide greater average speech power—high gain push-to-talk audio system has plenty of reserve gain for either crystal or dynamic microphones. VOX and anti-trip circuits are extremely smooth in operation—built-in anti-trip matching transformer—adjustable VOX time delay circuit. Mixer-type shaped keying is crisp, sharp—click and chirp free. Single knob wide range pi-network output circuit—fully TVI suppressed.

Cat. No. 240-302-2 Wired and tested with tubes, crystals and crystal filter. . . **Amateur Net** **$619.50**

INVADER-2000—All the fine features of the "Invader", plus the added power and flexibility of an integral linear amplifier and remote controlled power supply completely wired and tested. Rated a solid 2000 watts P. E. P. (twice average DC) input on SSB; 1000 watts CW; and 800 watts input AM! Wide range output circuit (40 to 600 ohms, adjustable.) Final amplifier provides exceptionally uniform "Q". With multi-section power supply, tubes and crystals.

Cat. No. 240-304-2. . . . . Amateur Net **$1229.00**

Add hi-power conversion overnight for an integrated 2000 watt desk-top transmitter!

HI-POWER CONVERSION—Take the features and performance of your "Invader" . . . add the power and flexibility of this unique Viking "Hi-Power Conversion" system . . . and you're "on the air" with the "Invader-2000". Completely wired and tested—includes everything you need—no soldering necessary—complete the entire conversion in one evening!

Cat. No. 240-303-2 **Amateur Net** **$619.50**

FIRST CHOICE AMONG THE NATION'S AMATEURS

Viking ®

E. F. JOHNSON COMPANY • WASECA, MINNESOTA

For further information, check number 41, on page 126

A Completely Transistorized 75 Meter Mobile Transmitter

BY HERK WALL*, W5NEP

This fifteen watt, 75 meter mobile transmitter plugs directly into a twelve volt automobile electrical system and it draws little more current than the filaments in most mobile rigs; truly the ideal rig for most mobileers.

Ever since the day I first placed this rig on the air, I have happily been swamped with questions inquiring about it. In the following pages I have tried to answer all of these questions.

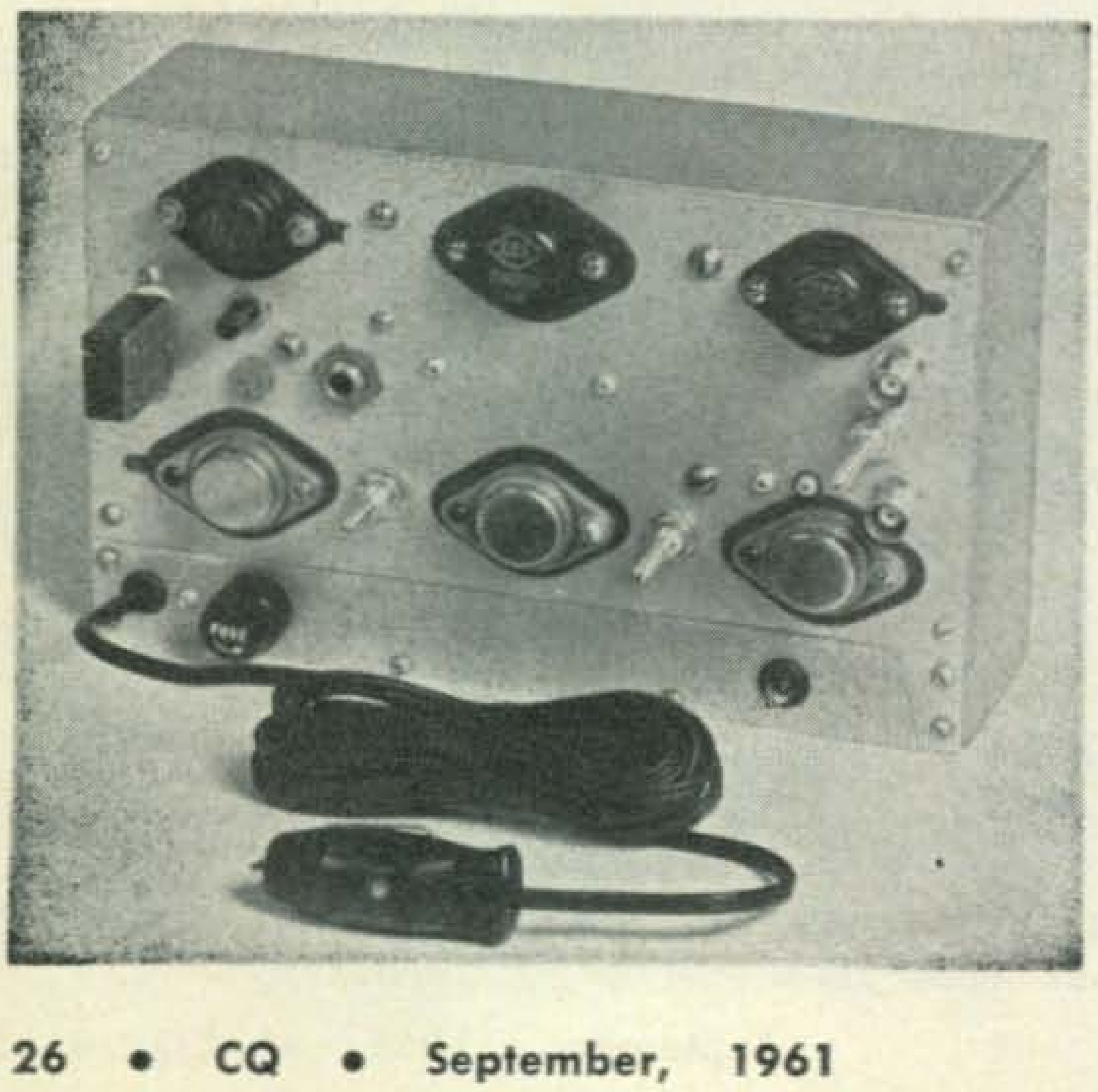
We all know the inefficiency of dynamotors, inverters, or the like, for converting a twelve volt battery system into high voltage B+ necessary for generating r.f. power in mobile rigs. Most rigs draw enormous filament currents even while on stand by. By using transistors throughout in a mobile transmitter, presto, out with the high voltage power supply and away with the filament current drain. In the transistor transmitter described below for instance, the total current drain on modulation peaks is only three amperes. While on stand by there is no current drain. As a matter of fact the mike button is the ON-OFF switch.

A Fast Run Down On The Rig

If I have successfully aroused your imagination as to the feasibility of using transistors in your mobile rig, let's get down to brass tacks and find out how to go "Transistorized On 75 Meter Mobile."

The rig described here uses a total of seven transistors. It is contained in an aluminum chassis base measuring 2¼ × 5 × 8 inches. The r.f. section uses three Texas Instrument type 2N1046 power transistors. This is a germanium PNP high frequency power transistor. The audio section uses a 2N79 as a speech amplifier, a 2N255 driver and two 2N256's as push-pull class B modulators. All four of the audio transistors are the PNP type. The oscillator is crystal controlled for stability. The r.f. buffer stage and the r.f. final stage are operated class B. The power output will vary from five to fifteen watts, depending upon the merits of the particular transistors used in the r.f. section. The final r.f. amplifier is collector modulated from the class B modulators. A push to talk carbon mike input is provided. The tip of the mike completes the circuit for the collector of the oscillator, the antenna relay, the receiver muting relay, the modulator bias, and the speech amplifier bias. The rig is instant starting when the mike key is depressed,

*2606 Maple Drive, Garland, Texas



Front view of the completely transistorized 75 meter mobile transmitter showing layout of components. Modulator section is located along the upper edge of the chassis The three power transistors starting at the upper left hand corner are Q_5, Q_6, and Q_7. Directly to the right of the crystal are Q_4, R_4 and an unused transistor socket. To the extreme right of the mike jack is L_3. The BNC connector just above L_3 goes to the whip antenna. Starting at the left of the lower line of power transistors are Q_1, L_1, Q_2, L_2, and Q_3. The neon indicator is protruding through a rubber grommet just below Q_3.

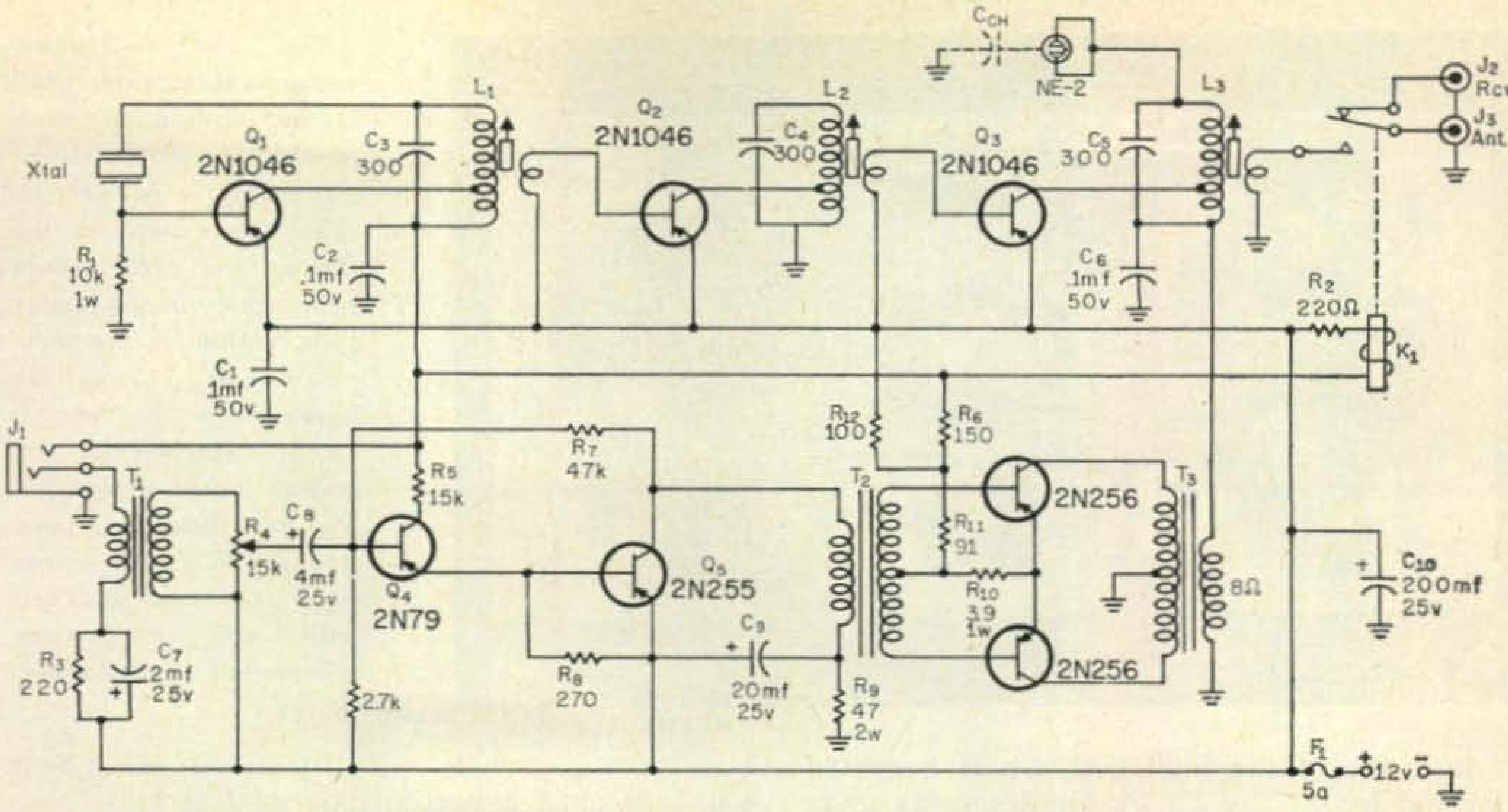


Fig. 1—Circuit of a 75 meter transistorized phone transmitter for mobile operation. Output is from 10 to 15 watts and is determined by the transistors. All resistors are ½ watt unless otherwise marked and unmarked capacitors are 450 volt ceramics in mmf.

C_{ch}—See text.
J_1—3 connector jack to fit PL68
K_1—S.p.d.t. 6 or 12 volt relay. Eliminate R_2 if 12 volt unit is employed.
L_1—30t #22 E tapped 3 turns from the low end. Secondary is 2¾ turns of #22 E on low end. *
L_2—30t #22 E tapped 2¾ turns from the low end. Secondary is 2¾ turns of #22 E on low end. *
L_3—30t #18 E tapped 2¾ turns from the low end. Secondary is 4 turns of #18 E on low end *
* All coils wound on CTC PLS-72C4L/H½" diam. forms.
T_1—Input transformer, Triad TY-54
T_2—Interstage transformer, Triad TY-61 or constructed as explained in text.
T_3—Modulation transformer, Triad TY-64 or constructed as explained in the text.

so there is no need for an off switch. A neon bulb (NE-2) is used to monitor the final r.f. output and its modulation. The unit has a five amp fuse in series with the twelve volt line just in case. All three of the r.f. coils are wound on ceramic slug tuned coil forms one half inch in diameter.

The Oscillator

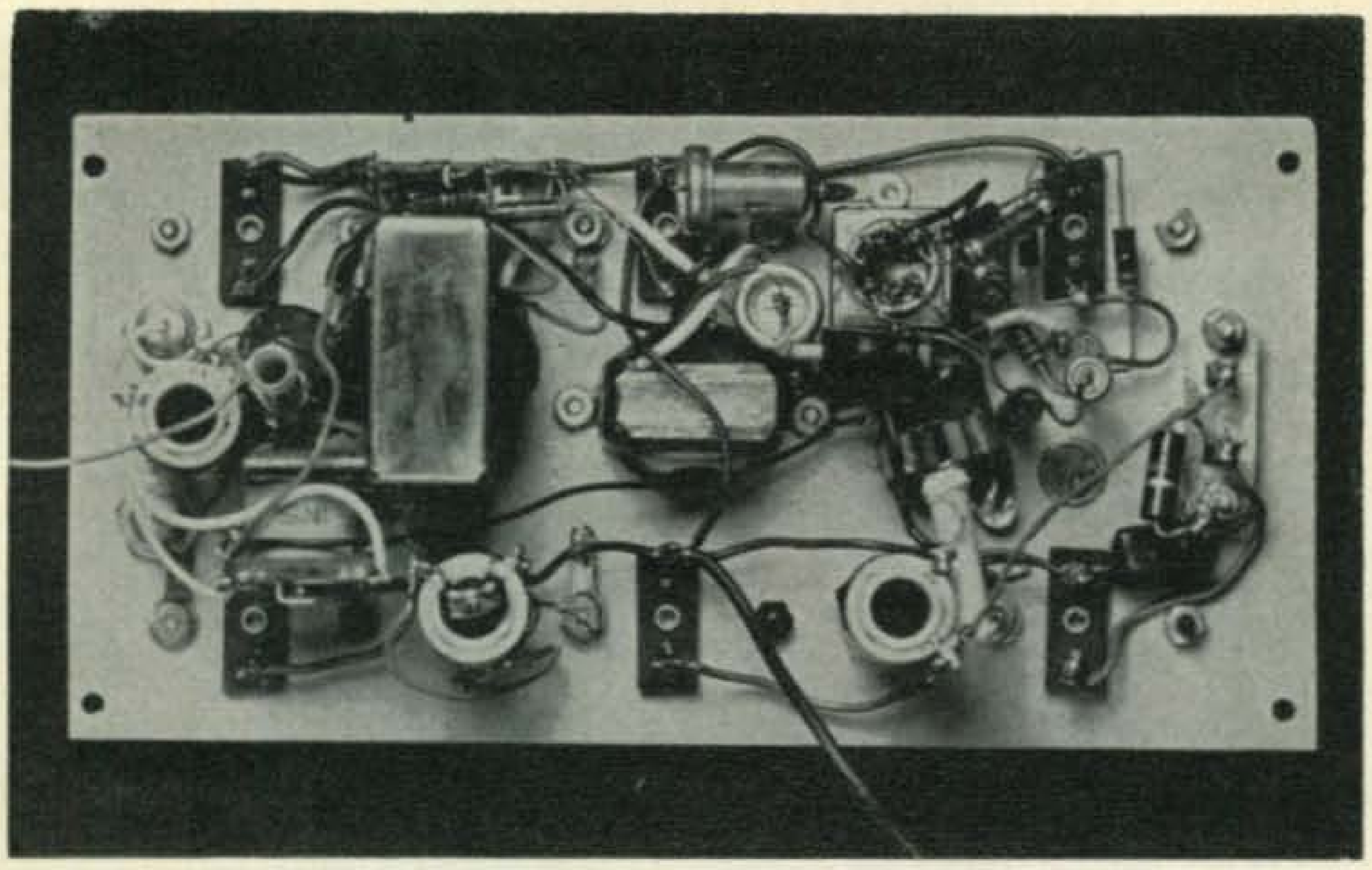
The oscillator stages oscillates easily, however, it requires some attention if you wish to obtain maximum power. Since the buffer and final are operated class B, the final power output will depend heavily on how well the oscillator is driving the buffer stage. Transistors being what they are some units will just give more output than others. Therefore, it will be wise to pick out your hottest high frequency transistor and use it in the oscillator circuit. I had one r.f. transistor that drove the final to a full eighteen watts when used in the oscillator circuit. I do not recommend driving the final that hard as it gets pretty hot. The final r.f. transistor will normally operate quite warm, but should not be operated hot to the touch. If the final gets hot, indicating that it is being over driven, decrease the drive by detunning the oscillator slug in a clockwise direction. The oscillator coil, L_1, is tapped so as to match the low collector impedance and at the same time act as a step up transformer necessary to sustain oscillation. The oscillator coil is wound with fairly large diameter wire and shunted with a high value capacitor to maintain a reasonable circuit Q. The secondary link going to the base of the buffer stage is lightly coupled for the same reason. The low side of the oscillator coil completes its curcuit to ground through the mike tip. The r.f. is bypassed to ground through C_2. The base is forward biased by R_1, just enough to start oscillation. Capacitor C_1 is required to keep the oscillator from squegging.

The Buffer Stage

The buffer stage is operated in class B. About the only thing that can go wrong here is in the impedance matching. If you wind the coils as shown you should not have any trouble. Otherwise this stage just sits there like a bump on a log until the oscillator tells it to do something.

The Final Stage

The r.f. final stage is also operated class B. It is very similar to the buffer stage except that it is collector modulated. The diameter of the wire used in the coil L_3 is also larger due to higher currents being drawn by the collector. A very low impedance of eight ohms is required for the modulation transformer secondary due to the low collector impedance.



The largest audio transformer (center left) is the modulation transformer. The audio driver transformer is shown near the center of the chassis. The small square transformer in the upper right corner is the mike transformer. Along the lower edge is the r.f. section, starting at the crystal socket and working left. The audio section starts in the upper right and works back left until you reach the modulation transformer.

The low side of the final coil, L_3, is bypassed to ground for r.f. by C_6. A small surplus relay is used as an antenna change over relay. A neon bulb is connected to the high side of the final coil, to serve as a modulation and r.f. monitor. Capacitor C_{ch} is the capacity formed to chassis through the rubber grommet mounting.

The Modulator

The transistor class B modulator is "old stuff" by now, and the one shown is no exception. The only differences are in the way it is keyed and the low impedance output transformer as explained earlier.

Construction

The construction as shown was not chosen as a design of beauty. However, it does have the ruggedness needed for a mobile installation. The chassis also gives adequate shielding. The entire rig measures 2¼ × 5 × 8 inches. The lower panel on which the neon bulb and fuse are mounted is one inch wide. The unused space here will later be needed for a 75 meter transistor converter. In other words if you wish to build only the transmitter, it will package into a 2¼ × 4 × 8 inch chassis base. The fuse could then be the in-line type placed in series with the 12 volt line. There's plenty of room left on the front panel for the neon indicator.

Notice that all of the components are mounted on the bottom cover of the chassis base. This bottom cover must be made of aluminum at least .063 inches thick. This thickness is necessary for proper heat dissipation. Plenty of silicon grease should be used in mounting the power transistors which are insulated from the chassis. This will aid in the transfer of transistor heat to the chassis.

The small antenna change over relay is mounted on an insulated bracket. This particular relay has the wiper arm common to the frame and insulation was needed. Since you may not wish to fabricate your own chassis base, a near size is a Bud type AC-421. You will still need a bottom cover of at least .063 in. thickness. The cover is easy to make.

You may purchase the audio transformers, or you might prefer winding your own as I did. Low impedance transformers are easy to hand wind, and here's how to duplicate mine. The modulation transformer is wound on a ten watt audio output transformer core. Use number 24 enamel wire and wind a primary of 192 turns center tapped. The secondary is number 18 enamel wire with a winding of 90 turns.

The audio driver transformer T_2 is wound on a small audio core. The primary is number 24 enamel wire of 60 turns. The secondary is number 24 enamel wire with 72 turns center tapped. You may jumble wind all of the windings with no ill effects. The primary should be insulated from the secondary with electrical tape.

The mike transformer is cheaper to buy. The one I used is from the "scrounge box." The power transistors are all insulated from chassis with anodized aluminum insulators made for this purpose. Most of the small parts are commonly used in transistor radios and should not be hard to find.

Alignment

It is best to wire the rig so that by removing one wire, the 12 volts may be removed from either the audio or r.f. section. You should also have a variable voltage source so that you can bring the voltage up easy while watching the current. To check the modulator separately connect the eight ohm output of the modulation transformer into a speaker. *Make sure that both the audio and r.f. output circuits are always loaded, or you might blow a transistor.*

After you are satisfied with the quality of the audio, connect the modulation transformer back into the circuit. Hold the mike button down and bring the voltage up slowly. If

[*Continued on page 106*]

Why All Those Key Clicks?

FRED STANLEY HOWELL*, W6MTY

W6MTY employs a vacuum tube keyer to reduce key clicks. Packaged with the keyer is a sidetone generator for monitoring and a T-R circuit. All functions are accomplished with remarkably few parts.

FOR a number of inter-related reasons having to do with job, home and family, W6MTY has been confined to a few hours per week on 40 c.w. for the past year. In that period it has become quite clear that a significant number of the ham fraternity have key clicks and apparently don't realize how easy it is to get rid of them.

W6MTY has been noted in the past as the station with the fewest possible components[1], so to carry on the tradition an attempt has been made to design a monitor, vacuum tube key click filter and automatic transmit receive switch with the fewest possible components. The result is the circuit of fig. 1. This circuit (or variations of it) has been in use at W6MTY for over 10 years. W6PBI can vouch for the effectiveness of the key click filter since W6PBI and W6MTY are located less than a mile apart, both operate 40 c.w. and both run over 500 watts. Quite often both have been on unknown to each other and on several occasions operating within 10 kc of each other without any interference.

Circuit Description

The circuit consists of a 12AU7 keyed multivibrator which generates the monitor tone. With the circuit values indicated, the tone is near 1 kc and the output from the loudspeaker is adequate for normal room volume. The 6C4 draws enough current in the key-up condition to hold the T-R relay, K_1, in the open position. At the first touch of the key, the 1 kc signal from the multivibrator cuts off the 6C4 closing the relay. The time delay for pulling the relay open again is controlled by the 5 meg potentiometer which is used for a grid leak in the 6C4.

The vacuum tube key click filter function is performed by the 6AS7. Both sections of this tube are operated in parallel to keep the voltage drop across the tube to a minimum. Point A goes to the cathode of the keyed stage, and of course

[*Continued on page 110*]

[1]Howell, F., "Simplest Is Best," *CQ* August 1955 p. 26.

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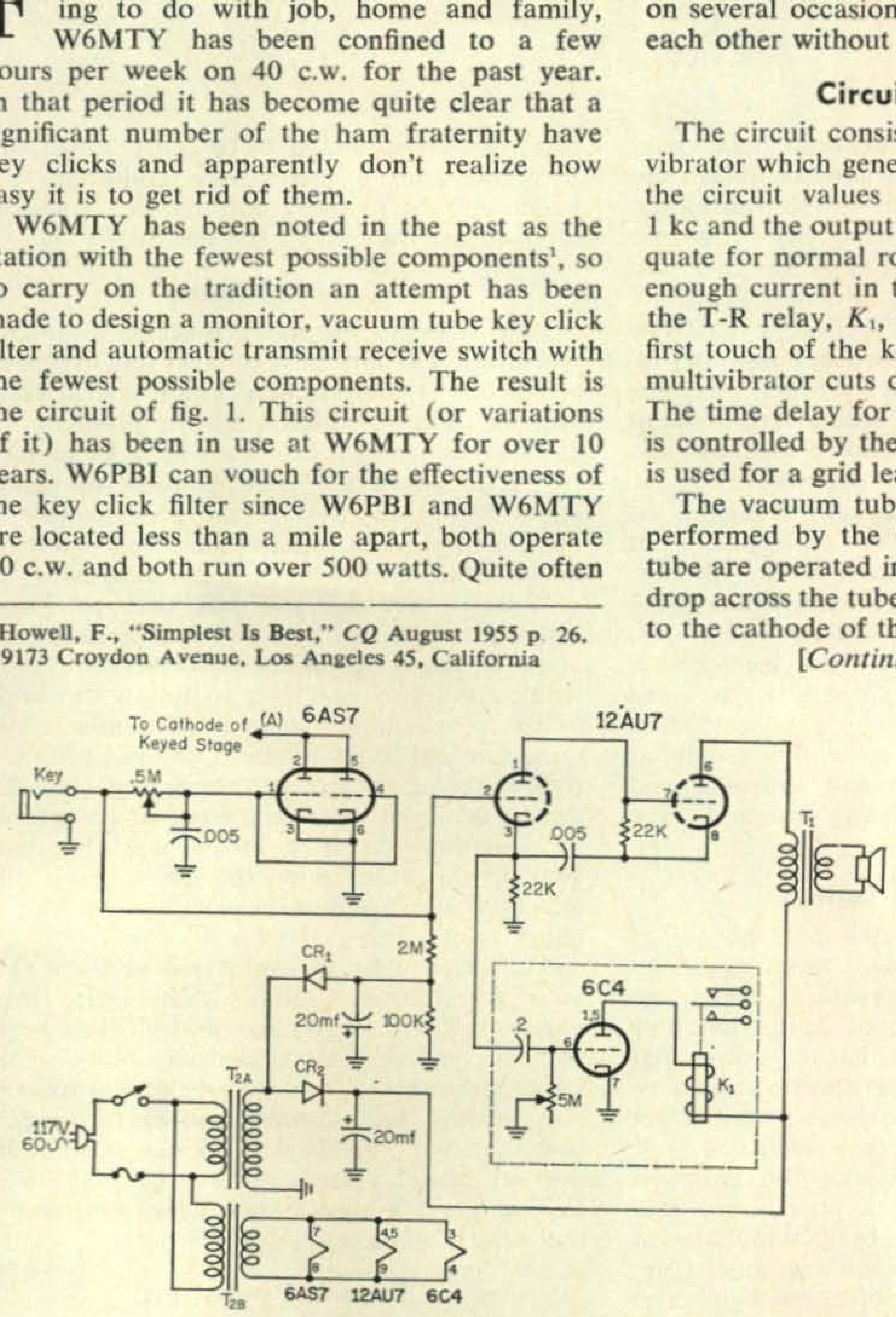

Fig. 1—Circuit of a combined vacuum tube keyer, sidetone generator and T-R switch. The T-R function is enclosed in the dotted box and may be omitted if desired.

CR_1, CR_2—Selenium rectifiers, 10 ma. Sarkes Tarzian type 10

K_1—6000 ohms 50 mw sensitivity s.p.d.t. Sigma 11F-6000G/SIL

T_1—2000 ohms to 3.2 ohms Stancor A-3332

T_{2a}—117 to 125 v. @ 15 ma. Knight 61G410

T_{2b}—6.3 v. @ 3 a. Triad F16X

A Delayed T-R Relay

FRANK P. MERRITT, JR.*, K6YCX

A simple method of introducing a time delayed relay to control the antenna relay. It will key "on" instantaneously and hold in for a preadjusted period after key-up

FROM time to time a number of schemes have been used to permit the antenna to be transferred from the receiver to the transmitter. Among the schemes that have been tried are different types of electronic T-R switches and a number of switched relay schemes. There are two main requirements for a T-R system. The first requirement is that the operation of antenna switching be performed without any type of manual switching. The second requirement is that the antenna relay (if used) must be held during periods of close-spaced keying.

The conventional antenna relay (coaxial, of course) provides a positive changeover but must be commanded from position to position. Usually this requires a switch somewhere in the system that must be thrown when the transition from receive to transmit, or vice-versa, is desired. VOX operation is practical for voice operation but c.w. operation provides more stringent requirements. On c.w. this continual switching becomes clumsy and tiresome and some other approach is usually sought by the amateur operator.

Electronic T-R Switch

A logical system improvement is the use of an electronic T-R switch. With this type of device no changeover relay is required. There are different forms of this type of device but they all share the common result that the power that is introduced to the receiver during periods of transmission is reduced to a level that will not be harmful. The use of the electronic T-R switch is not without drawbacks. One common trouble is suckout. This is a phenomena that often plagues the operator by making one or more portions of the amateur spectrum completely dead. Often this can be cured by a careful juggling of the system cables and changing other system parameters. The energy that is applied to the receiver, during periods of transmission, is not enough to do damage to the receiver but is enough to be quite bothersome. It is possible to incorporate additional electronic circuits to overcome this deficiency but, often it just isn't worth the effort.

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Delayed Relay

At this point the problem seems quite overwhelming. Do not despair however, as there is a way out of the problem. There are, in fact, a number of good solutions to the problem. One of these solutions is an idea which seems to incorporate all of the good features of the antenna relay and most of the good features of the electronic T-R switch. This idea is not new in basis but, it is a bit of a different twist.

What is needed is a circuit that will key-on instantaneously and be held for a period of time after the key is opened. This means that the antenna relay does not have to follow the keying of the transmitter. Unless the antenna relay is quite unusual in its design, it will not be able to follow keying, except at the slowest rate. This can be achieved through the use of complicated and involved circuitry but it was the design goal, in this case, to do the job with no tubes and only one additional relay, besides the antenna relay.

The transmitter in use at the author's QTH is a grandfather Collins 310B. Quite fortunately, this transmitter has grid-blocked keying and has enough bias current capability so that some additional current may be drawn from the bias supply. The advantage in performing the switching with the keying voltage is that only one set of relay contacts are required on the keying relay. Figure 1 shows the schematic of the control circuitry.

Circuit Operation

Upon closing the key, the first action in the keying circuit of fig. 1 is to activate the keying relay, K_1. It will be noted that the relay dropping resistor R_2, is bypassed by a 3 mf capacitor. The function of this capacitor is to provide a larger-than-normal current to instantaneously pull the relay in. It will be remembered that a relay is essentially an inductance, therefore exhibiting inductive reactance. Functionally, the effect of this inductive reactance is to round off the leading edges of the keying pulses and prevent immediate or drop out. The 3 mf capacitor reduces this problem to a tolerable point.

There is another action, in addition to the normal keying, that takes place as soon as the key is closed. This action begins charging C_1, the 15 mf time constant capacitor. It will be noted that the 25K potentiometer and the 15 mf capacitor form a series RC network. The resistance is bypassed with an additional capacitor to increase the immediate charging rate of the 15 mf capacitor.

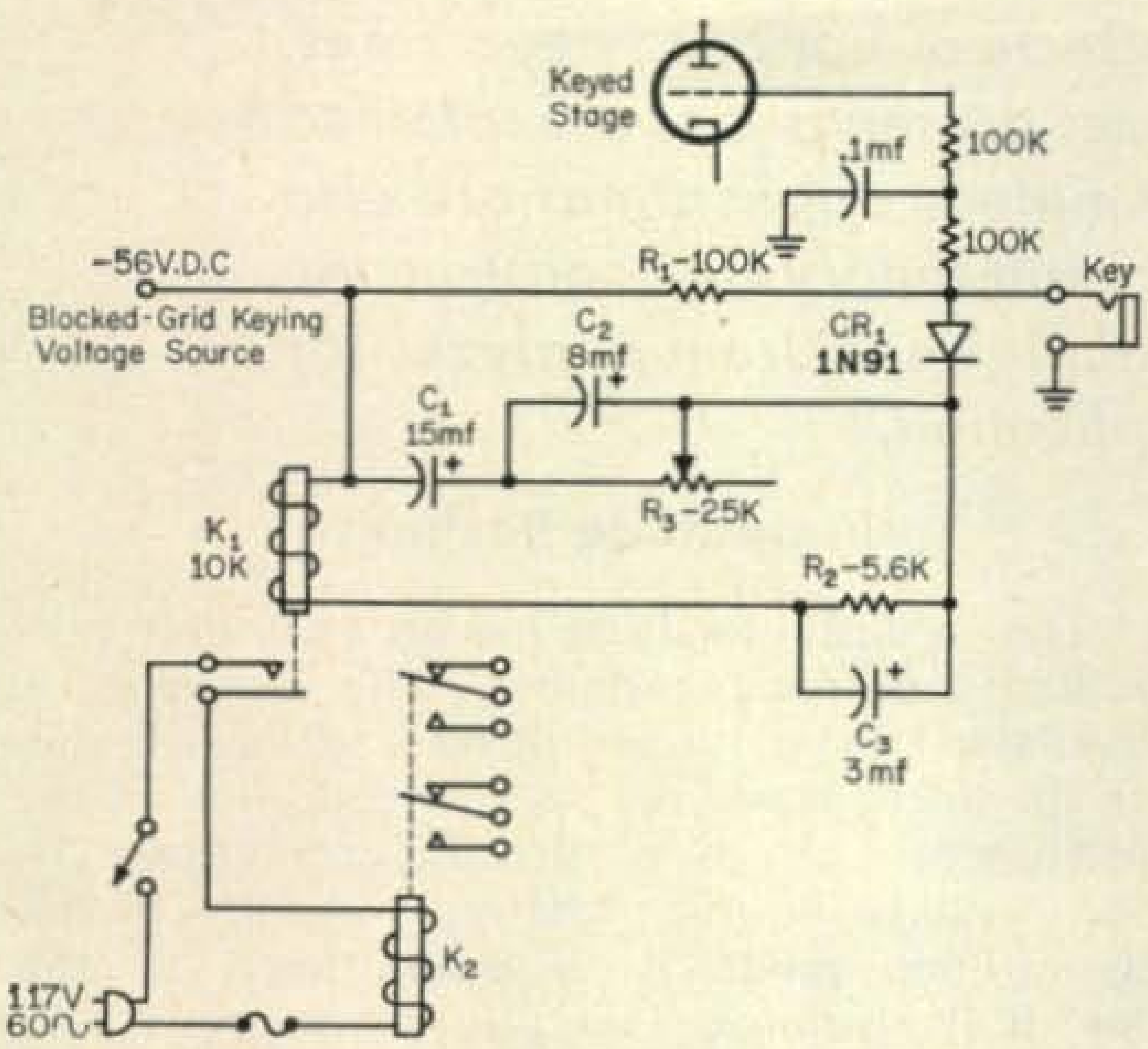

Fig. 1—Circuit of the delayed T-R relay employed with a grid block keyed stage. When key circuit is closed the anode of CR_1 is grounded thus conducting and energizing K_1. Relay K_1 energizes K_2, the antenna changeover relay. Relay K_2 may also be used to mute the receiver.

K_1—Potter Brumfield SML5S (10K) or equivalent
K_2—Advance CE/IC/115VA

As soon as the key is opened, the keying circuit is removed from the bias circuit by the action of the 1N91 diode CR_1. An open-key condition removes the ground from the key side of resistor R_1. When this ground is removed, both sides of R_1 are at the same potential, -56 vdc. The capacitors are charged so that the positive potential is applied to the cathode of CR_1 and the anode is connected to the -56 v. This condition effectively opens the diode and isolates the transmitter keying circuit from the delayed T-R circuit.

The relay K_1 will remain energized, after the key has been opened, for a period of time which is determined by the constants of the potentiometer R_3 and the timing capacitor (C_2). In practice the values shown result in a maximum delay of approximately 3 seconds. The antenna relay K_2 is energized by the contacts of the timing relay, K_1. It is interesting to note that even in the minimum timing position of the potentiometer R_3 the keying relay K_1 will not open between dits. The dropout is almost instantaneous when the potentiometer is at minimum.

Other Keying Systems

This system of T-R keying may be adapted to any transmitter using any other type of keying. Of course, there is additional cost and in this case the cost is an extra relay. The extra relay is used to directly follow the keying. A schematic of this circuit is shown in fig. 2. This schematic is virtually the same as fig. 1 with the exception of the addition of the straight keying relay K_1. The operating voltage is obtained by tapping the bleeder resistor in the high voltage line. Any source of a reasonably constant voltage may be used as the operating potential.

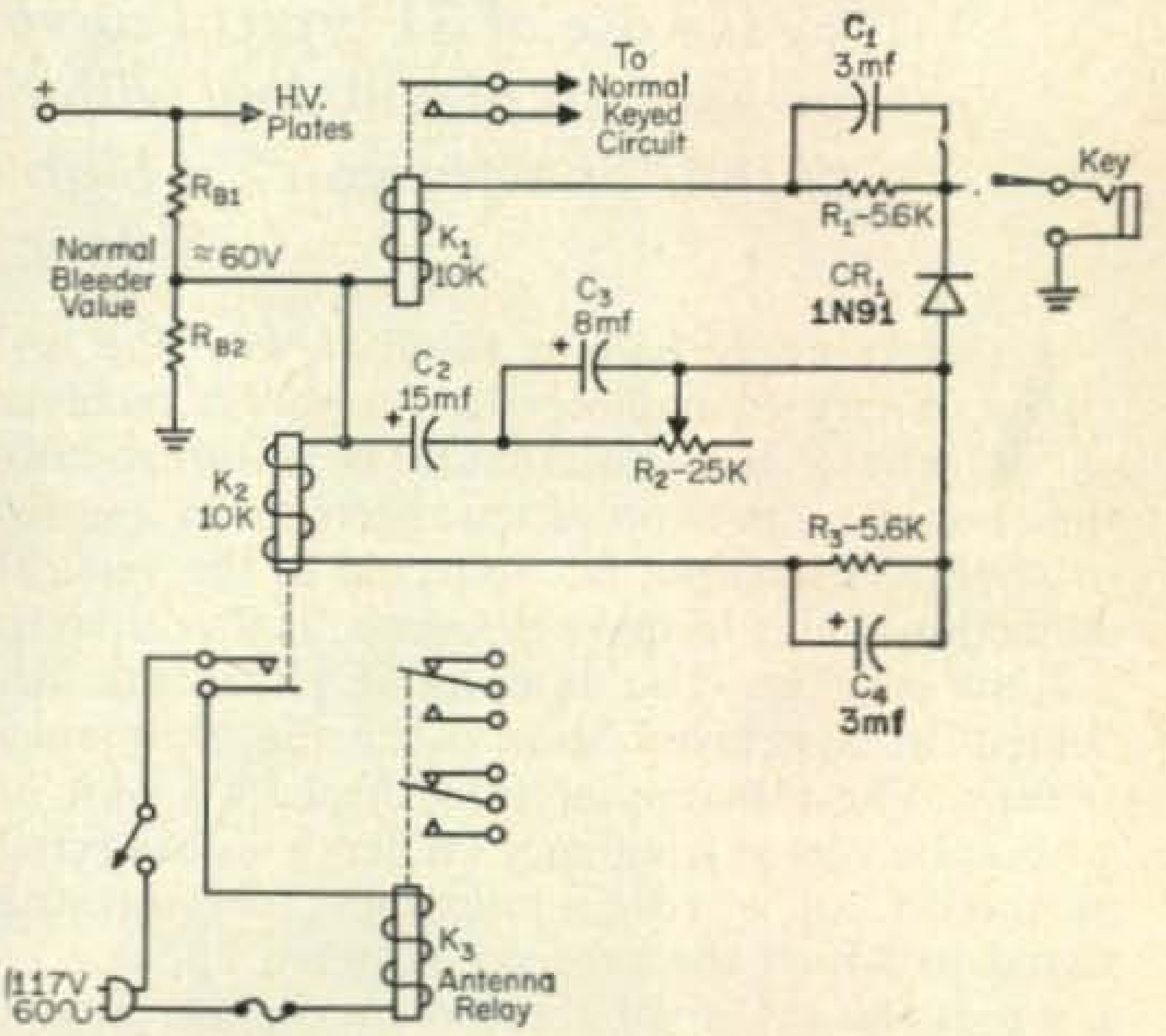

Fig. 2—The delayed T-R circuit of fig. 1 for use in a stage that is not grid block keyed. This requires a source of stable d.c. and an additional relay, K_1, to key the normal circuit. The voltage at the junction of R_1 and R_2 should be 60 volts.

$K_{1,2}$—Potter Brumfield SML5S (10KW) or equivalent
K_3—Advance CE/1C/115 VA or equivalent

The additional contacts on the antenna relay (K_2 of fig. 1 and K_3 of fig. 2) are used to mute the receiver during the period that the antenna relay is energized. This is especially desirable so that the side-tone, if used, will not have to compete with r.f. energy from the transmitter.

Construction

The entire unit may be built on a small piece of phenolic board or aluminum. The unit built by the author uses the small capacitors from the low frequency ARC-5 receivers. Since these capacitors use the case as one electrode, it was convenient to build the unit on a small piece of phenolic board. The completed T-R relay unit may be tucked away in a convenient corner of the transmitter. . . ■

BASIC SPECTRUM ANALYSIS

Part II Spectrum Analyzer Displays

BY SIMON RAND*, W2QZJ and CHATLAND WHITMORE†, K2BAJ

The concept of modulation energy distribution along the frequency spectrum was covered in Part I last month. In Part II of this series, the authors discuss the basic concept of the spectrum analyzer; how the c.r.t. screen is calibrated, the meaning of resolution and the effects of various sweep rates. How to translate spectrum analyzer presentations is explained by the use of 31 typical curves. Amateur applications are also given. Part III will deal with the circuit theory and construction of the "Spectroscan", a high resolution spectrum analyzer for amateur application.

ALMOST every ham is familiar with the ordinary Panadapter. It's simply a receiver whose local oscillator is automatically tuned across a portion of the spectrum in a series of sweeps. Its output is connected to the vertical deflection plates of an oscilloscope rather than to a loud speaker. The horizontal plates are deflected in synchronization with the frequency sweeps. The Panadapter thus displays a plot of amplitude versus frequency. When it is connected to the i.f. of a communications receiver, the signal to which the receiver is tuned appears as a pip at the center of the screen. Signals higher in frequency appear to the right of center. Signals lower in frequency appear to the left of center. On some Panadapters this order may be reversed.

A high resolution spectrum analyzer is essentially a refinement of the ordinary Panadapter. It is capable of scanning a portion of the spectrum, and indicating the frequencies and amplitudes of the various signals therein. However, its primary use is the analysis of one signal, its sidebands, carrier, and their relation to each other. The spectrum analyzer is capable of very sharp selectivity. This selectivity is obtained through the use of a multiple stage crystal filter. This filter sharpens the selectivity of the spectrum analyzer much in the same way as the crystal filter in an ordinary communications receiver. Its selectivity is variable and it affords a resolution from as broad as a 2 kc to as sharp as 10 cycles. Due to this sharp response, ringing and slurring of the trace would occur if sweep speeds as fast as those used on an ordinary Panadapter were employed. To overcome this limitation a special highly stable, very linear, slow speed sweep generator is used.

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Amplitude Response

The spectrum analyzer has an accurately calibrated amplitude response. This response is available in two ranges; linear and logarithmic. In the linear mode the vertical deflection of the oscilloscope screen is directly proportional to the voltage of the received signal. In the logarithmic mode it is proportional to the log of the voltage. This provides a greatly expanded amplitude response, and permits viewing signal components as much as 40 db below peak level. In addition, a 20 db expansion feature is provided permitting measurements as low as 60 db below peak level.

All of these features make the spectrum analyzer an outstanding piece of test equipment which is capable of measuring and analyzing modulation characteristics of a.m. transmitters, carrier and sideband suppression of single sideband transmitters, filter characteristics, and many other frequency dependent phenomena. But one of the most valuable uses of the spectrum analyzer is as an analyzer of received signals, when used in conjunction with a communications receiver. It has been found to be an invaluable aid in determining causes and effects of malfunctions in transmitters and associated equipment. It makes it possible for the amateur single sideband operator to thoroughly analyze any received signal at a glance.

Scale Calibration

Now let's take a look at some typical displays and find out what an amateur operator, using a spectrum analyzer, might expect to see. Figure 9 is a drawing of the calibrated grid placed in front of the cathode ray tube. This grid is particularly important since the spectrum analyzer is an ac-

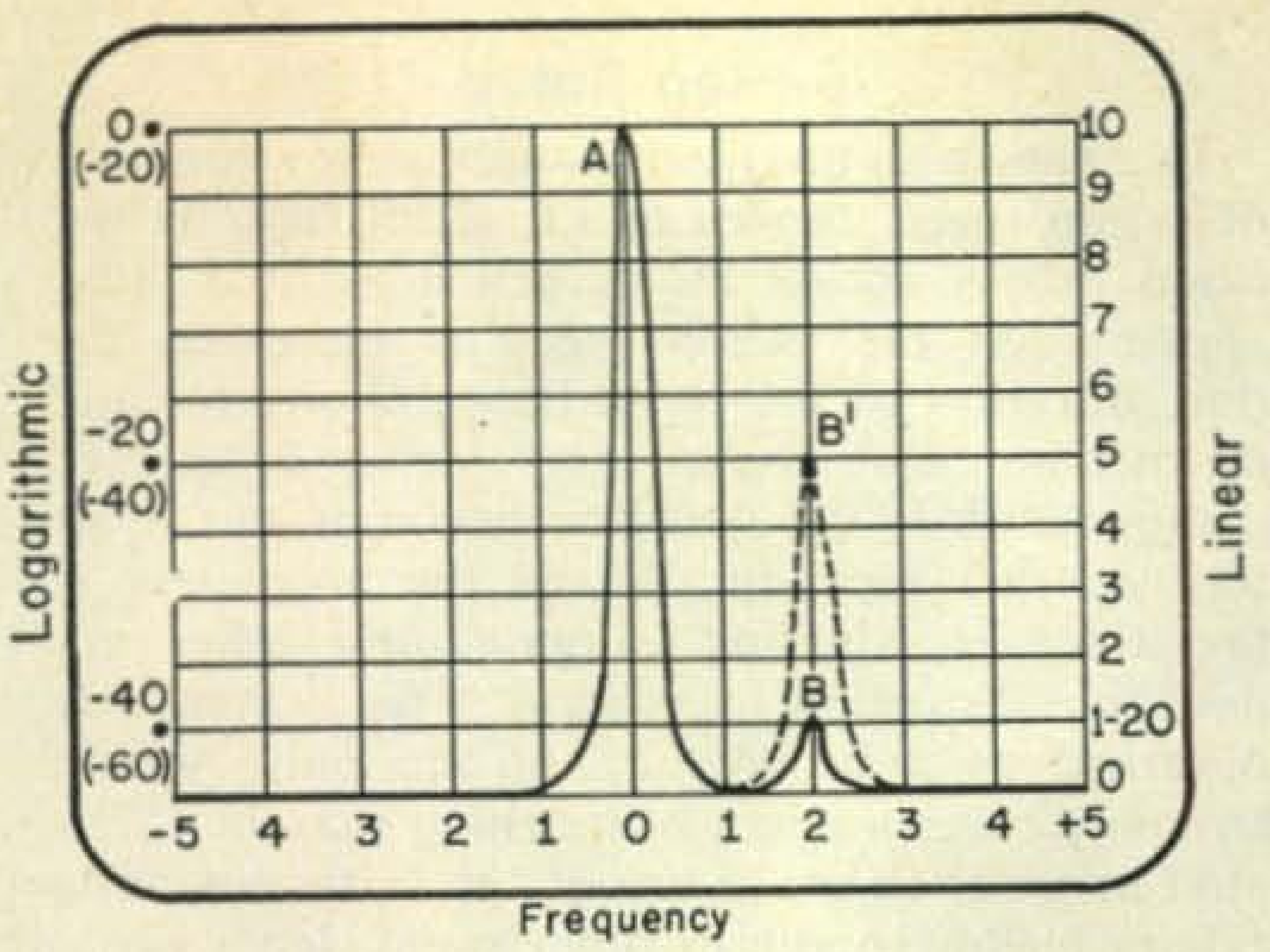

Fig. 9—A reproduction of the calibrated grid placed in front of the spectrum analyzer c.r.t. The Y axis has both a linear and logarithimic calibration. The log scale, on the left, has two ranges, 0-40 db and 20-60 db. The X axis is calibrated in frequency and the range is adjustable. If the width selected is 1 kc, each division would equal 100 cycles. The significance of the signals A, B and B[1] are explained in text.

curate quantitative reading device. The scale on the right hand side, with numbers running from zero to ten, is a voltage scale and is used when the mode switch is in linear position. Relative voltage differences may be read directly on the screen.

You can see in the illustration that the taller pip, A, is at ten and the smaller pip, B, is at 1. Also notice that 1 is equal to —20 db. The formula for db is:

$$db = 20 \log \frac{E_{max}}{E_{min}}.$$

Thus 1, being 1 tenth of ten, represents —20 db. For most amateur purposes the logarithmic mode is used. When in log position the left hand scale is used. Notice that —20 db is only half way down on the left hand scale. The dotted pip, B prime, represents a —20 db signal when viewed in the logarithmic mode. A signal 40 db below peak level, as indicated by pip B, would be just visible at the bottom of the screen.

In order to more accurately measure signals of this low level the mode switch is placed in the log —20 position. In this position an additional 20 db of amplification is provided. A signal that was formerly at the —20 db point on the screen now assumes full screen height. A —40 db signal now reads at the half way point and the signal barely visible at the bottom of the screen is 60 db below peak level. This expanded range permits accurate measurement of sideband and carrier suppression of the highest quality transmitters.

Across the bottom of the grid is a line of numbers extending to the right and left of zero. The positive numbers indicate higher frequencies and the negative numbers indicate frequencies lower than center frequency. If the scanning width is set to 1 kc, the entire width of the screen will represent 1000 cycles. Each vertical line will mark 100 cycles of bandwidth. If the scanning width is set to 10 kc each vertical line will mark a 1 kc spectrum segment. If 20 kc were scanned, each vertical line would indicate 2 kc. The numbers would now have to be multiplied by 2 to obtain true kilocycle readings. If the analyzer is used in conjunction with a very accurately calibrated receiver, extremely precise frequency measurements may be made using the calibration lines on the grid.

It will be interesting at this time to examine fig. 10 closely. This illustration indicates the use of the logarithmic expanded scale as well as clearly showing the high resolution capabilities of the analyzer. Figure 10A shows a carrier signal viewed in the linear mode. Hum sidebands exist on this carrier with components as follows: 60 cycles at —20 db, 120 cycles at —40 db, and 180 cycles at —60 db. In the linear mode only the —20 db component is visible. Figure 10B shows the same signal viewed in the logarithmic mode. Here the 60 cycle component at —20 db is clearly visible and easily measured with good accuracy. The —40 db signal is also seen. Figure 10C represents the 20 db expanded display. Notice here that the —40 db and —60 db components are clearly indicated.

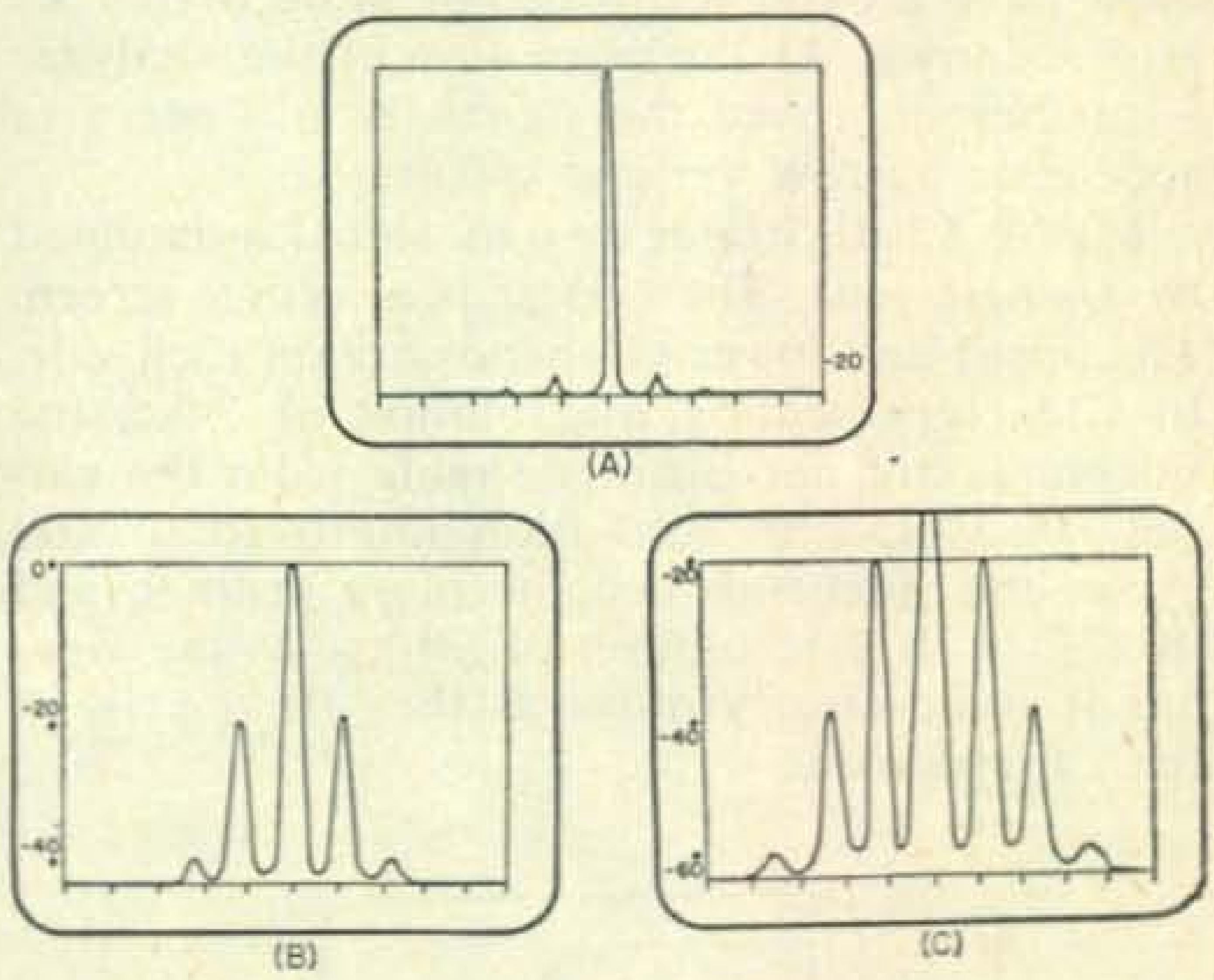

Fig. 10—A carrier signal containing hum sidebands at 60 and 120 cycles is shown in (A). The analyzer is set in the linear mode with a scan width of 500 cycles. In (B) the same signal is viewed but in the log mode, range 0-40 db. Note the increased display level of the 120 cycle signals afforded by the log mode. In (C) the same signal viewed in the log mode, 20-60 db range, now shows still another signal, 180 cycles, not heretofore visible.

Resolution

A few words now concerning resolution. Resolution in the spectrum analyzer is similar to selectivity in a receiver. In the analyzer, the better the resolution the closer two signals may be in frequency and yet appear as distinct pips on the screen. An analyzer using a multiple stage crystal filter with crystals carefully matched to within a few cycles is capable of at least 10 cycles resolution. That is, two frequencies 10 cycles apart will show as distinctly separate pips. When the resolution is not sufficient, the two signals will blend into one broad peak. See fig. 11. In this illustration, the analyzer is scanning a total band width of 10 kc. Notice the wide curve. It

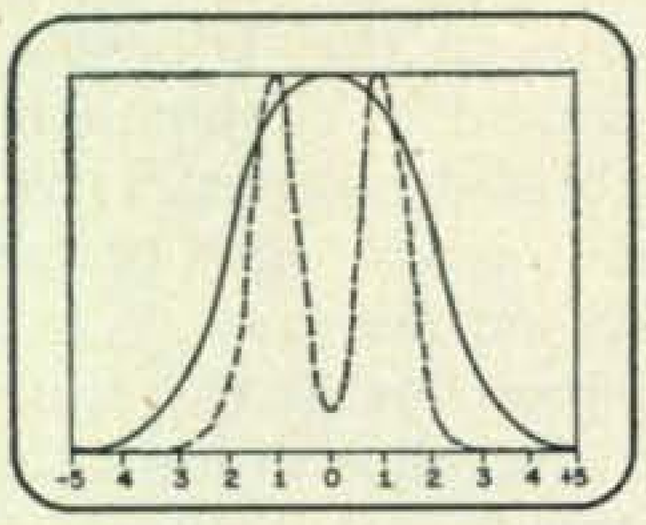

Fig. 11—Spectrum analyzer resolution, the ability to distinguish between two signals close in frequency, is determined by the analyzer i.f. amplifier bandwidth. The two signals represented by the dotted line will blend into the single broad signal shown if the analyzer resolution is inadequate.

is 10 kc wide at the base and 2 kc wide near the top. Disregard the dotted curves at this time. If there were two signals 2 kc apart, they would both fall within the band pass range of the analyzer's i.f. stage and would thus blend into the one broad peaked curve as shown. In order to show these two signals distinctly, the analyzer must have a band width of not more than 1 kc at 6 db down. As the resolution of the analyzer is further improved the signals would begin to appear as narrow vertical spikes.

Figure 12 illustrates an a.m. signal modulated by a single tone. The carrier is at center screen. The upper and lower sidebands are on each side. In 12A, representing a resolution of 2 kc, the sidebands are not distinguishable from the carrier. In 12B, with resolution improved to 200 cycles the sidebands become more distinct, and in 12C with a resolution of 20 cycles the sidebands stand clearly alone as they truly exist in the r.f. spectrum.

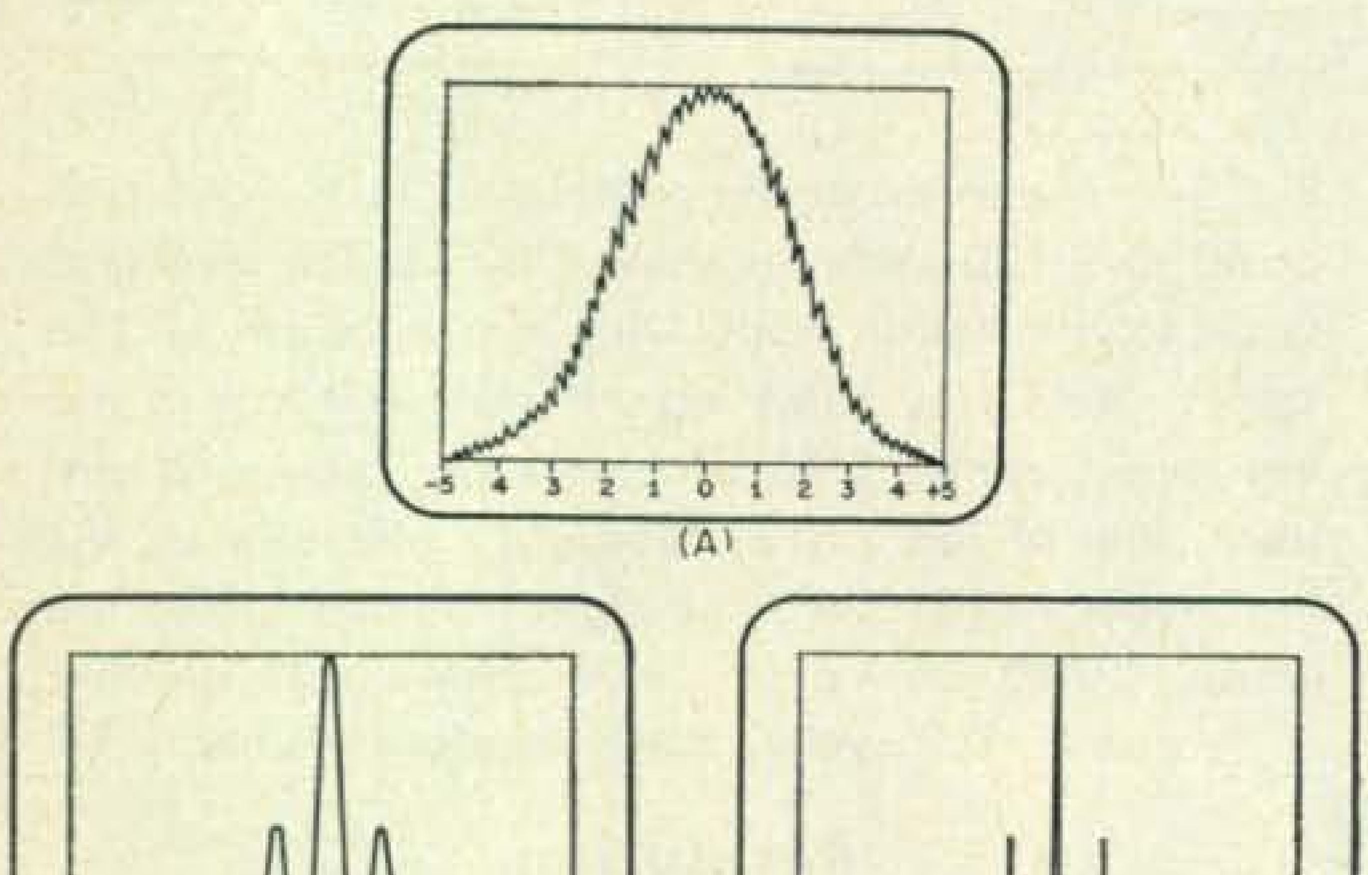

Fig. 12—With a resolution of 2 kc and a scan width of 10 kc, an a.m. signal would appear as in (A). Improving the resolution to 200 cycles causes the same signal to appear as shown in (B). Further narrowing the resolution to 20 cycles and still sweeping 10 kc the signal now appears as shown in (C).

Sweep Rates

In a spectrum analyzer resolution is a function of sweep speed as well as i.f. selectivity. As the beam moves across the screen a vertical pulse appears. As the sweep speed is increased the time duration of the pulse becomes shorter and it thus contains higher and higher frequency components. If the duration becomes too short for accurate reproduction by the amplifiers in the analyzer, slurring, ringing, and other undesirable distortion may occur. This is generally observed as a broadening of the pulse width. In many cases a slight broadening may be tolerated in order to make use of the faster scanning rate to follow speech or other rapid signal variations. This slight broadening will generally not seriously affect the ability to make an interpretation of the signal.

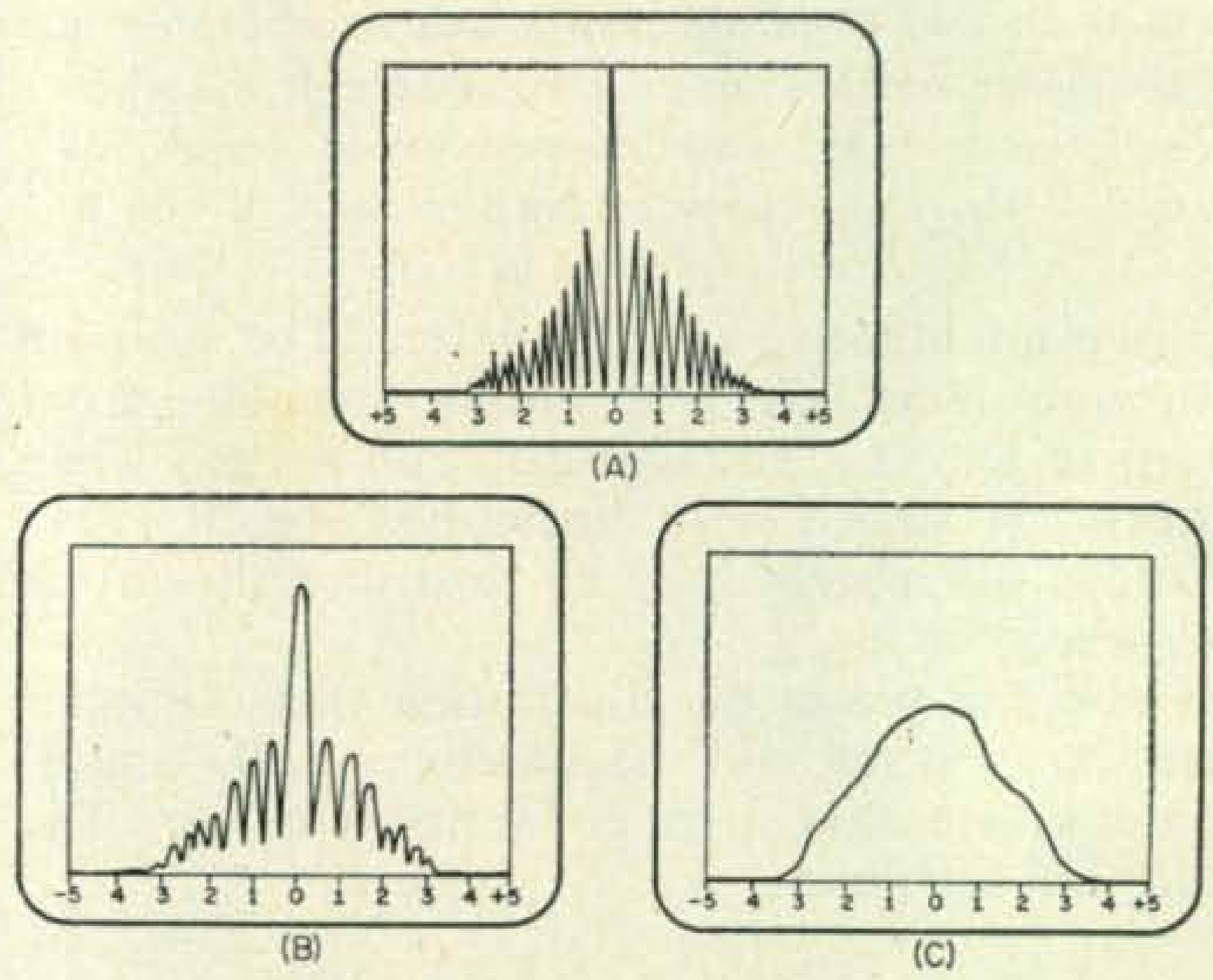

Fig. 13—Sweep rate has a marked effect upon the analyzer resolution as explained in the text. Shown above are three displays of the same signal but viewed at different sweep rates. In (A) the rate is 1 per second; (B) 5 per second (note loss of resolution) and (C) 25 per second. In each case the scan width was 10 kc and the resolution 100 cycles.

Figures 13 illustrates this effect. An a.m. voice modulated signal is shown. The spectrum analyzer resolution is set at 100 cycles. In fig. 13A the sweep rate is 1 cycle per second. In 13B the rate is 5 cycles per second. Some broadening occurs at this point. If the sweep rate is increased greatly, the condition shown in 13C exists. This

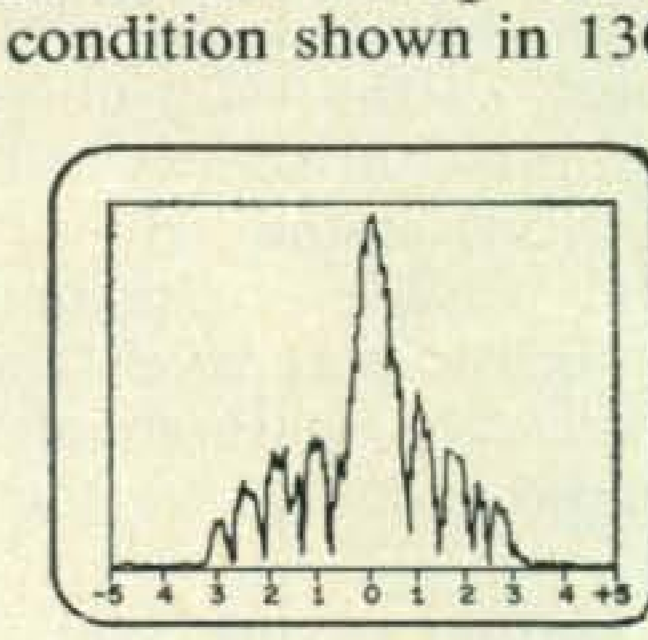

Fig. 14—The use of broad resolution frequently will result in a jagged response curve as shown above due to rectified audio appearing in the signal. This signal has a scan width of 10 kc, a resolution of 200 cycles and a sweep rate of 5 per second

is useless for any critical observation. It has been found through experience that for general viewing of a.m. or single sideband signals on the air, a resolution of approximately 100 cycles and a sweep speed of about 3 to 5 cycles per second is optimum. At this sweep rate a slight broadening effect exists, but it is not so severe as to impair accurate measurement. The use of even broader resolution results in a jagged response on the screen. This is due to the rectified detected audio appearing directly on the face of the screen in addition to the desired signal spikes. (See fig. 14.)

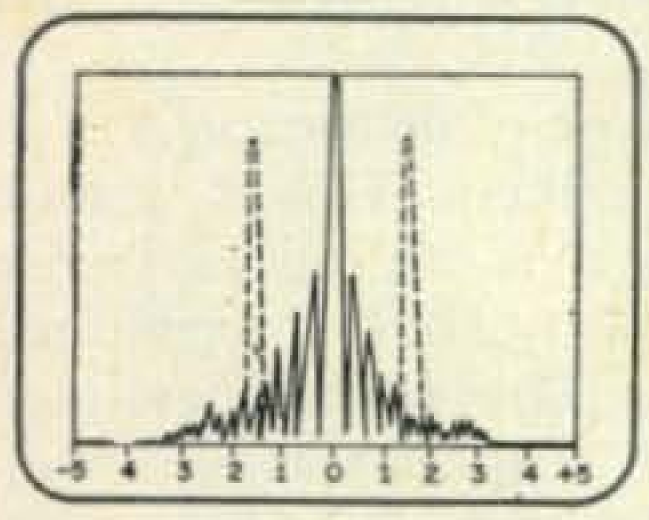

Fig. 15—Illustration of a voice modulated a.m. signal. If the audio power distributed in the sidebands were all lumped into a single frequency the signal would be much greater in amplitude as shown by the dotted sideband signals. By expanding the sweep scales to 20 kc or more splatter or spurious signals may be spotted.

Now look at fig. 15; this illustrates an a.m. signal modulated by speech. The gain of the analyzer is set so that the carrier pip is at full height in the center of the screen. Notice that the amplitude of the sidebands appears to be very low in comparison to the carrier spike. You can readily see that the power in the sidebands is distributed over a wide band of frequencies. If all this power were added up into one tone at, for example, 1 kc and the modulation percentage was 100 percent, the pip representing this single tone frequency would appear much higher on the screen than those of normal voice components. This condition is illustrated by the dotted lines in the figure. When viewing an a.m. signal in this manner, it is very easy to measure the actual modulation bandwidth, and the effectiveness of the audio low and high pass filters may be readily evaluated. By expanding the scanned frequency width to 20 kc or more it is also possible to see any splatter or spurious sidebands caused by modulation.

Figure 16A illustrates the pattern typical of a double sideband suppressed carrier transmission. Figures 16B and 16C illustrate attenuation of the lower sideband. In 16B the lower sideband is attenuated 20 db with respect to the peak level of the upper sideband; in 16C the attenuation is 30 db. Figure 17A shows an upper sideband signal with the lower sideband components attenuated by 40 db or more. This qualifies as an excellent quality single sideband signal. Illustrated in 17B is a similar signal but with the upper sideband suppressed.

Figure 18 illustrates an upper sideband signal using various degrees of audio compression or a.l.c. action. The effect on peak-to-average ratio

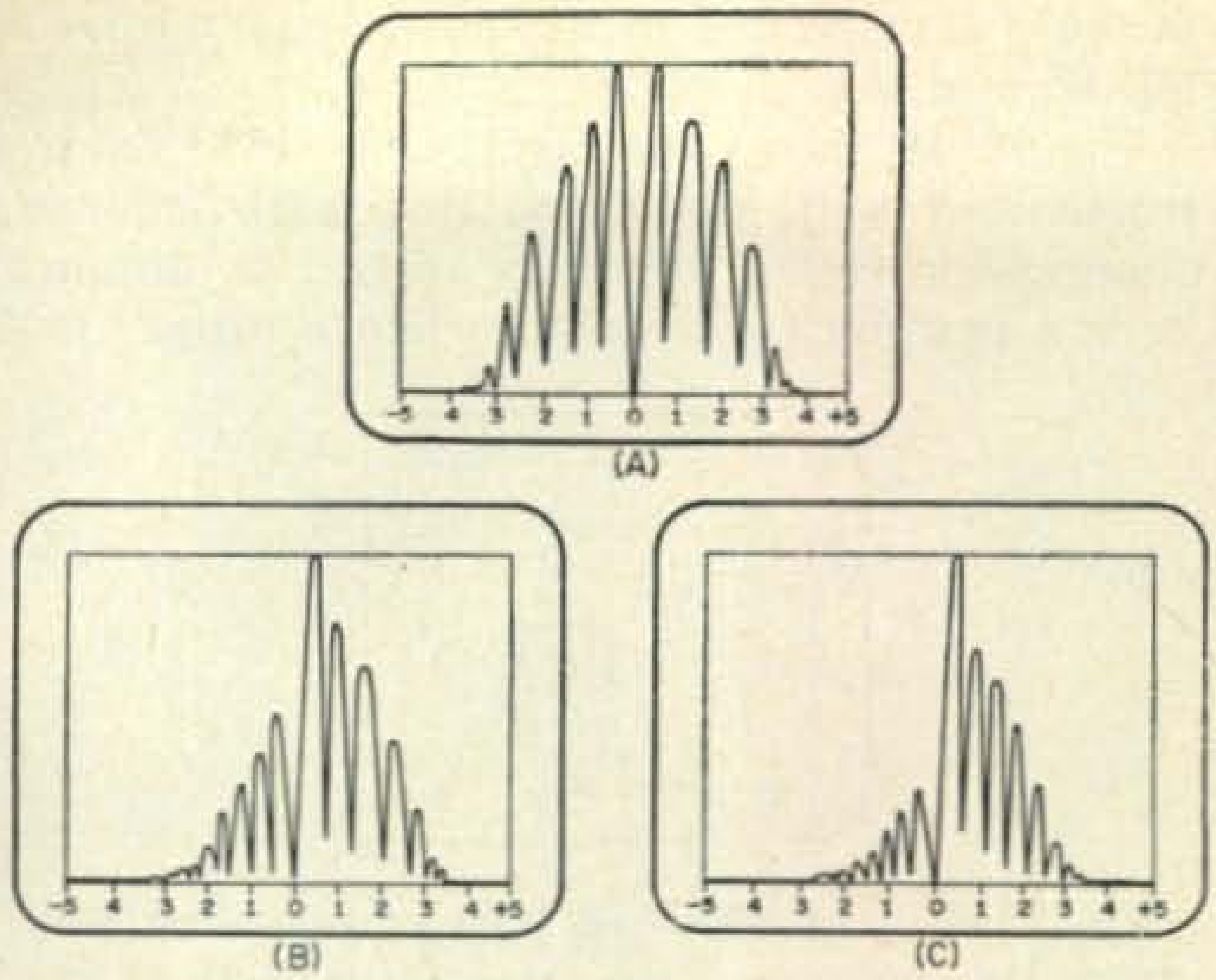

Fig. 16—A double sideband suppressed carrier signal is shown in (A). In (B) the lower sideband is suppressed 20 db and 30 db in (C). All 3 presentations have a scan width of 10 kc.

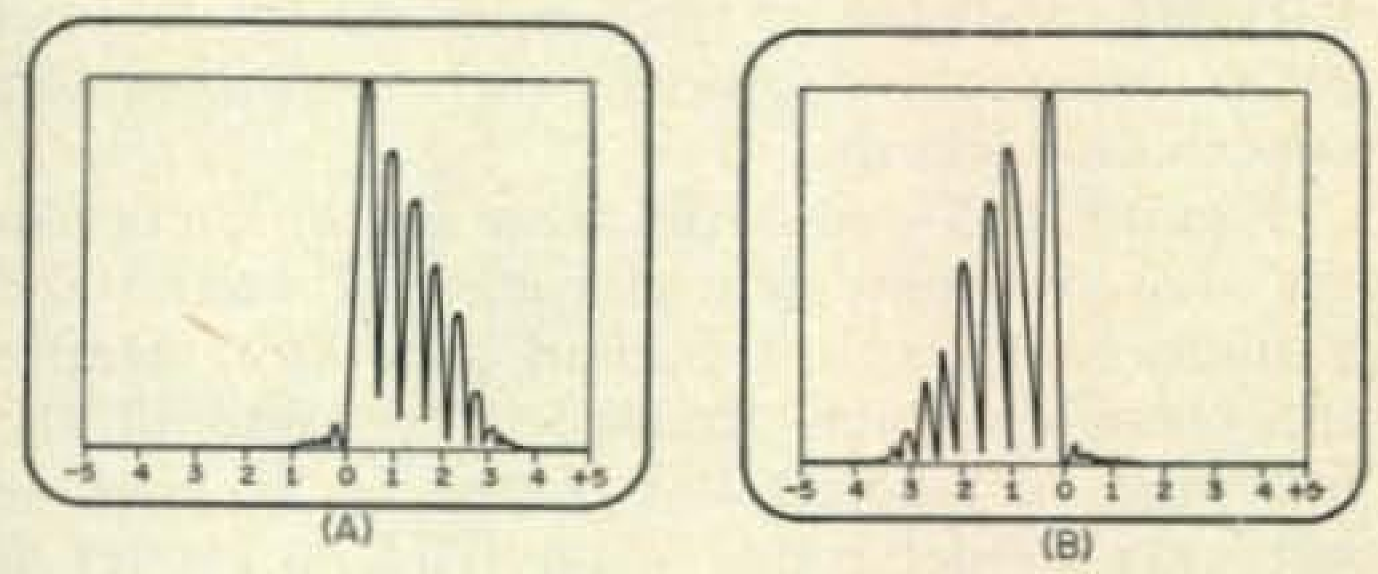

Fig. 17—An s.s.b. signal with the lower sideband attenuated by 40 db. The same signal is shown in (B) except the upper sideband is suppressed. Both would be considered excellent s.s.b. signals. (Scan width in (A) and (B) is 10 kc.)

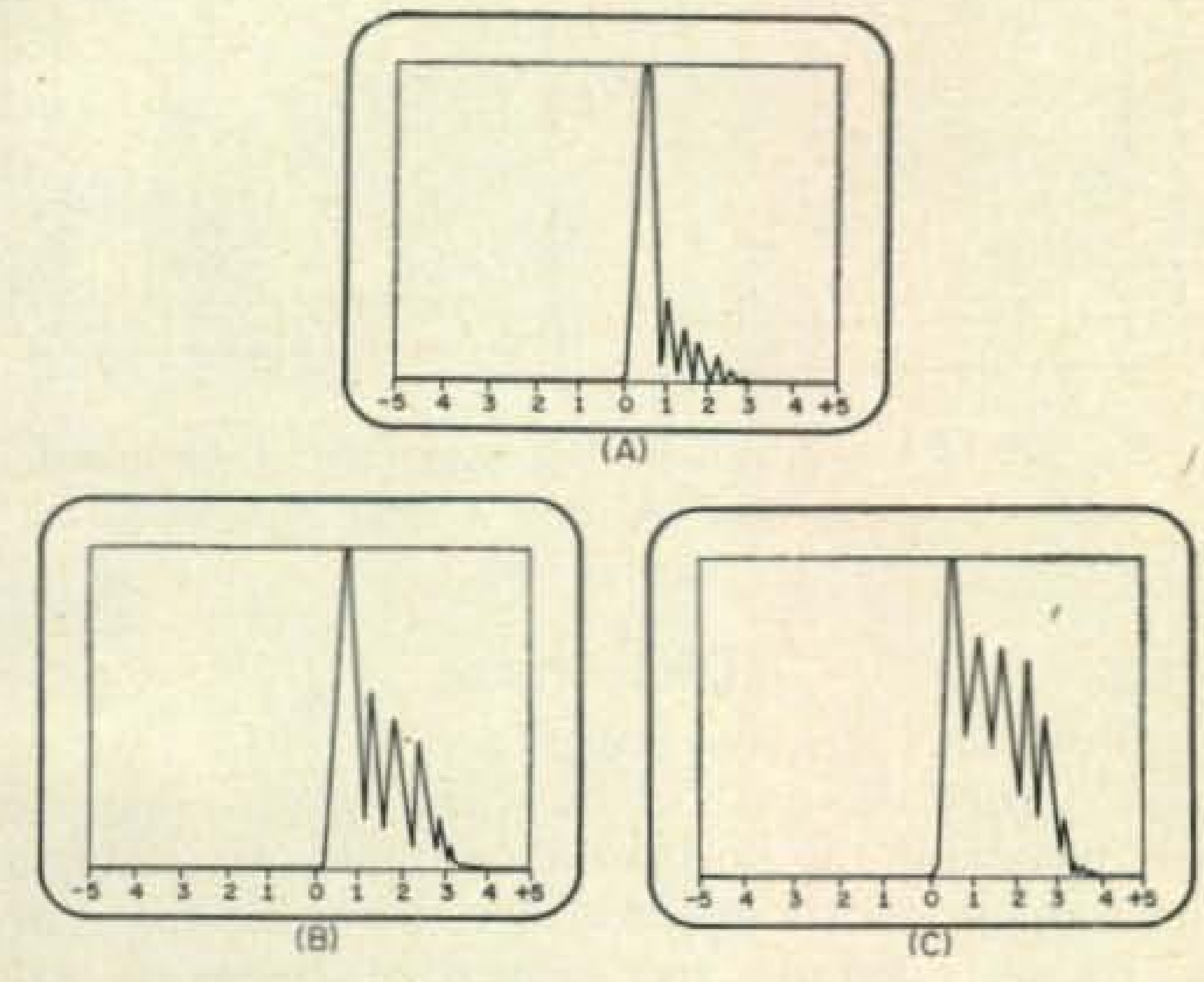

Fig. 18—Three displays illustrating the effectiveness of a.l.c. in the transmitter. Little or no a.l.c. produces a 30 db peak-to-average ration in (A) With increased a.l.c. an improved ratio of 12 db peak-to-average in (C) can be obtained. Scan width is 10 kc.

is clearly shown. With little a.l.c. or compression action, results similar to those shown in 10A are obtained. Here the peak-to-average ratio is far below the level of occasional peaks. Figures 18B and 18C represent varying degrees of improvement. A lower peak-to-average ratio results in more effective use of the power capabilities of the transmitter.

Figure 19 shows the display obtained from a transmitter with poor low frequency sideband suppression. Such an effect might be obtained with a phasing type exciter when a proper high

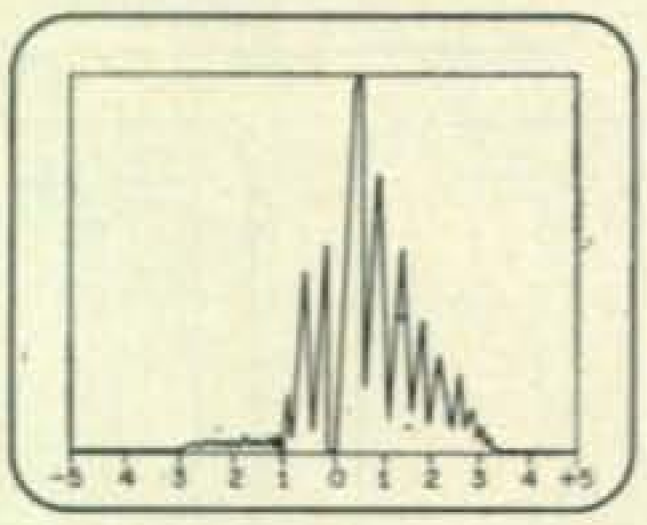

Fig. 19—Display obtained from a transmitter with poor low frequency suppression. (Scan width 10 kc.)

pass filter is not used in the audio stages preceding the phase shift network. The absence of such a filter permits low frequency audio components to pass through to the phase shift network, and as it is not designed to give accurate 90 degrees phase shift at these lower frequencies, incomplete cancellation results.

Figures 20A and B illustrate the difference in the viewed display of a phasing type exciter and a filter type single sideband generator. Notice the clean cut high frequency response of the filter rig. In practice it is found to be possible not only to determine what type of exciter is being used to generate the single sideband signal but often to determine what brand or even what model of equipment is in use at the transmitting station.

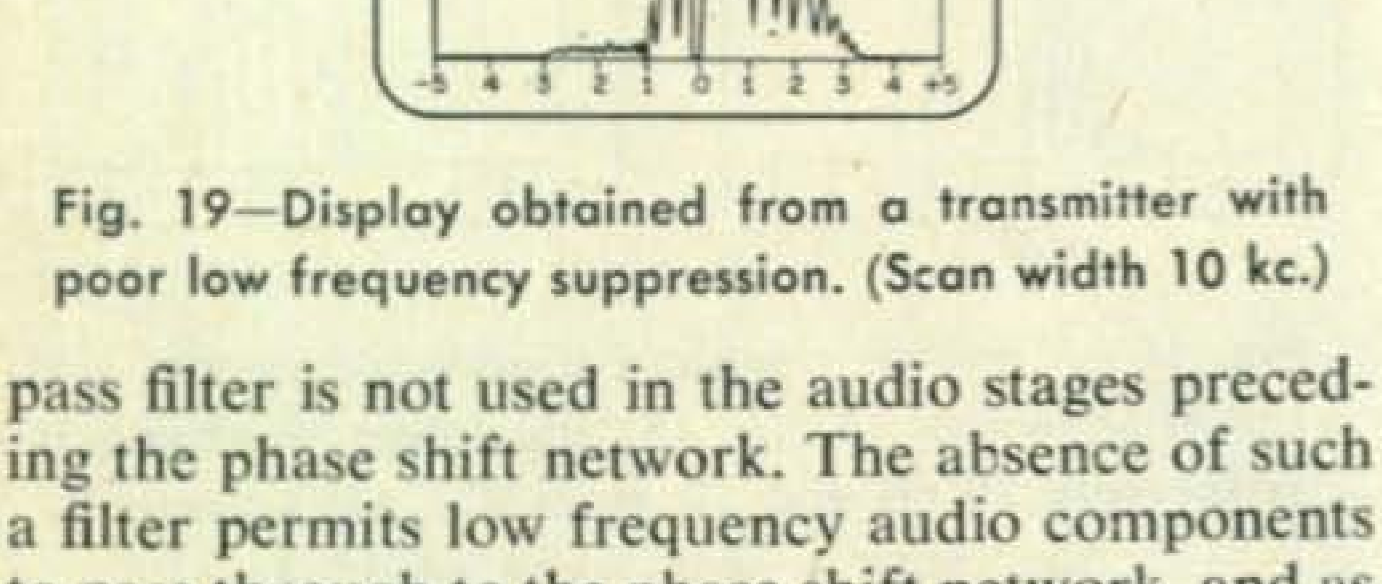

Fig. 20—Comparison of the suppression obtained from a phasing type (A) and a filter type of s.s.b. exciter, (B).

Distortion

Now let's discuss the effects of distortion in signal modulation and how the results may be observed on the spectrum analyzer. If a single frequency tone is injected into the audio input of a single sideband transmitter it must be ex-

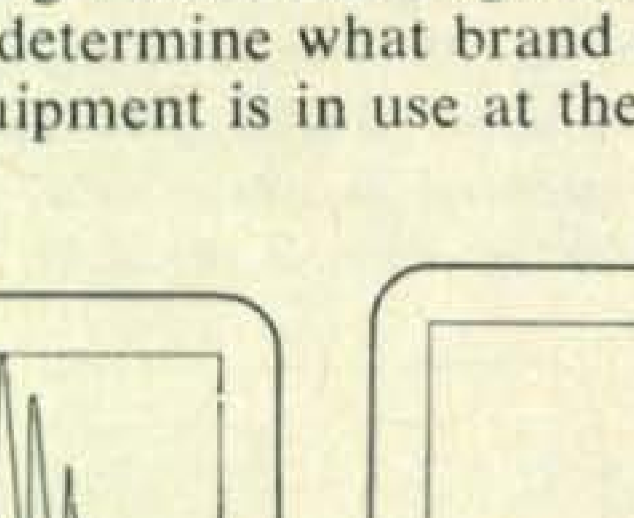

Fig. 21—Upper sideband signal obtained when the modulating tone contains harmonics. The same effect will be observed if the transmitter modulator or audio amplifier causes harmonic distortion.

tremely pure. It's second harmonic should be at least 50 db down or better. If not the harmonics of the tone will appear as small pips diminishing in amplitude at the higher orders as seen in fig. 21. The same effect will be observed if the injected tone is quite pure but the audio amplifier of the transmitter has harmonic distortion. This provides a simple way of testing the transmitter for such distortion. The only requirement is that the input tone must itself be free of distortion. In making such a test it is important that the tone be injected at a level representing the maximum peak level encountered in normal operation, otherwise distortion may not be evident.

Another type of distortion is often encountered in linear amplifiers. This is intermodulation distortion, and it is caused to varying degrees by any nonlinearity in the amplitude response of the amplifier. One of the best methods for testing a linear amplifier is the two tone test. If two audio tones are used to modulate a single sideband transmitter, two r.f. frequencies will be displayed on the analyzer. If the audio frequencies used are 1 and 2 kc respectively and upper sideband modulation is used, the result would be

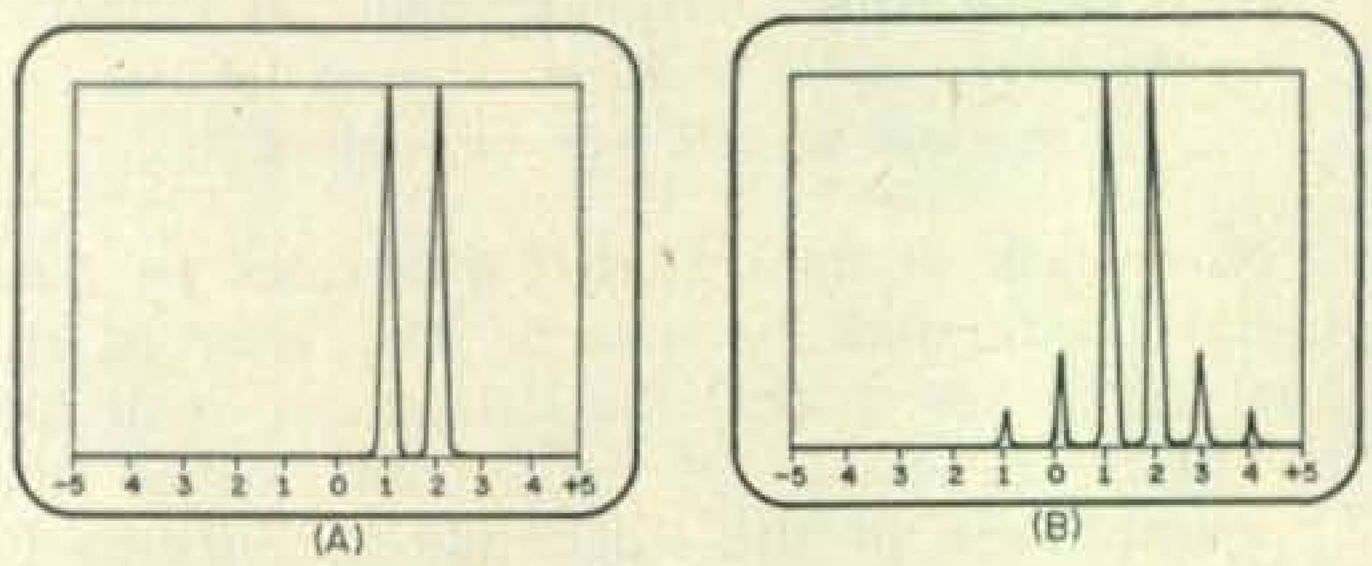

Fig. 22—Output from an s.s.b. transmitter with no distortion and modulated by a 1 and 2 kc tone is shown in (A). If distortion is present as in (B) the unwanted products will appear in both the upper and lower sidebands.

as appears in fig. 22A. This illustrates a linear amplifier having distortion products of 40 db or more below peak level. If distortion does exist however, the effect will be as shown in fig. 22B This figure shows unwanted products appearing in the wanted and unwanted sidebands. The amplitude may be read by observing the level on the analyzer screen, and thus the linearity of the amplifier may be measured.

Application In The Shack

Now that we have discussed the techniques of spectrum analysis and have observed the basic displays, let's revue some typical examples of its use in the ham shack.

One day the signals of a home brew filter type sideband rig were being observed. The owner desired to use the rig for c.w. operation, and rather than key the carrier, he used a keyed tone oscillator fed into the audio input of the transmitter. The results were not encouraging. Instead of a c.w. signal, he seemed to radiate on several frequencies close together in the band. He was at a loss to determine what had been done wrong. With the spectrum analyzer the fault was immediately apparent. The display seen was very similar to that of fig. 21. It was obvious that his audio oscillator had a high degree of harmonic distortion and thus caused radiation not only on the frequency corresponding to its fundamental tone but also on that of each of its lower order harmonics. A quick check had already proved that the distortion was not in the audio amplifiers of the transmitter, as the operator had been asked to whistle a note of approximately 1 kc pitch into the microphone. Even with this crude method of testing it was easy to see that no appreciable harmonic distortion existed in the amplifiers themselves. This problem can be avoided in mechanical filter type rigs, or other rigs with excellent suppression, merely by generating the audio tone at a frequency such as 1500 cycles, so that any harmonics that are present will fall outside the passband of the filter and will thus be attenuated to an acceptable level. In such a case, if the second harmonic tone were 20 db below the level of the fundamental and if that second harmonic fell at a point on the skirt of the filter where the response was 60 db below normal level, the resultant signal would be 80 db below peak level. For all practical purposes it would be nonexistent.

A while ago a friend purchased a new mobile transmitter. He asked for a checkout with the spectrum analyzer. As he drove, severe carrier shift could be seen as the car hit rough stretch of road. This is illustrated in fig. 23A. In the

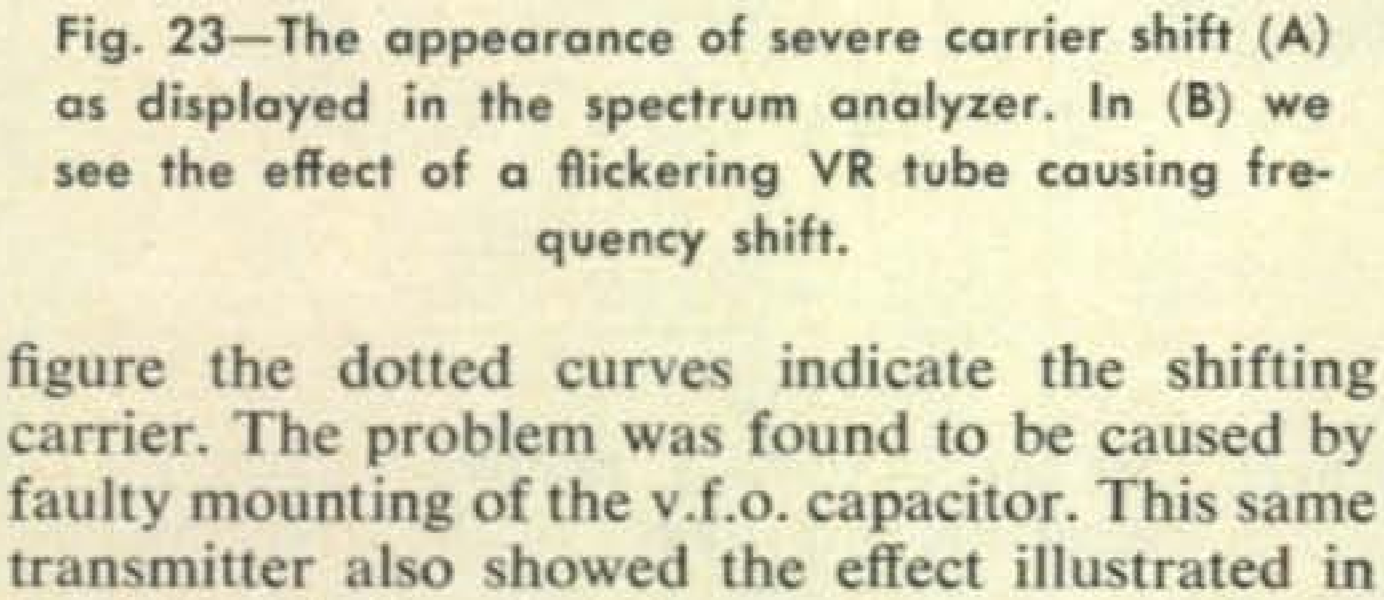

Fig. 23—The appearance of severe carrier shift (A) as displayed in the spectrum analyzer. In (B) we see the effect of a flickering VR tube causing frequency shift.

figure the dotted curves indicate the shifting carrier. The problem was found to be caused by faulty mounting of the v.f.o. capacitor. This same transmitter also showed the effect illustrated in fig. 23B. Notice that the carrier seems to have a lower sideband signal about 400 cycles below the carrier frequency. Since it was an a.m. mobile transmitter this seemed very unlikely. Investigation showed that the VR tube was flickering at a rapid rate and was actually the cause of the carrier shift. To the ear this effect sounded like a tone modulation. On the analyzer the true nature of the trouble was more readily apparent, since the amplitude variation as well as the frequency variation could be clearly seen. The reason for the difference in amplitude was that when the VR tube was ignited the voltage was regulated and thus lower than during the periods when the tube was extinguished. The varying voltage caused the variation in the amplitude of the v.f.o. signal as well as a variation in its frequency. Replacing the VR tube cured this problem. Usually, slowing down the sweep rate of the analyzer would show that these two frequencies did not exist at the same time. This would depend on whether the beam of the analyzer scope swept by the particular frequency in question at a time when the VR tube was ignited or extinguished. Some patience in appraising what you see is required if a fully accurate analysis is to be made.

One day a ham buddy came on the air with a newly completed sideband rig. It was a converted BC453. The audio seemed to be attenuated at higher frequencies, giving a bassy response. The band conditions that day were fairly good so the spectrum analyzer was used to observe the signal. Careful examination showed that the carrier frequency was incorrectly set on the filter bandpass. About one fourth of his modulation signal appeared on the unwanted side. The general shape of the display indicated that this was not an ordinary lack of suppression but that it was simply due to an incorrect positioning of the carrier frequency with respect to the filter characteristics. This is illustrated in fig. 24 Several days later the same ham was on the air with the transmitter after making the necessary corrections. If the praise of the analyzer that day were money, the world would have had one more millionare.

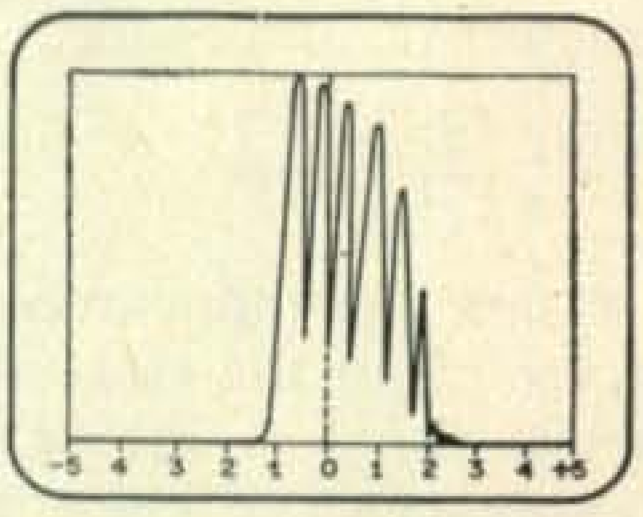

Fig. 24—Check of a newly constructed filter type s.s.b. rig showed this pattern indicating that the carrier was not properly placed on the filter curve.

Adjusting the Transmitter

The spectrum analyzer is unsurpassed for the adjustment of crystal filters. If the crystal filter is within the range of the analyzer input it may be connected directly. Many times, necessary adjustments may be completed in minutes instead of the hours required with other techniques. Crystals can be quickly interchanged and the display will indicate which combination yields best carrier and sideband rejection. Various transformers and coils in the rig may be adjusted for best overall response. When setting up for such a test it is necessary to have the r.f. generator, balanced modulator and audio stages installed preceding the filter. An audio generator is connected to the microphone input jack and a tone is injected. By varying the audio frequency rapidly, an outline of the response curve of the filter may be seen on the long persistence phosphor screen of the analyzer. Correct placement of the center frequency on the slope of the filter can then be easily seen.

[*Continued on page 116*]

Transmission Line Matching Networks and Transformers

B. R. HATCHER*, K1SAW

The author briefly reviews the basic concepts of matching transmission line impedances and then presents the necessary formulas for the simple calculation of matching networks and transformers.

TRANSMISSION lines will have different impedances (and admittances) for different loads and at different frequencies. Since they cannot be characterized by even a few lumped circuit elements for all frequencies, they are said to be "distributed constant" elements, meaning that they have both an inductance and a capacitance per unit length. What is used to characterize a transmission line is its "surge" or characteristic impedance, usually denoted by Z_o. This characteristic impedance is given by:

$$Z_0 = \sqrt{\frac{L}{C}} \text{ ohms}$$

where L and C are the inductance and capacitance per unit length of the line.

Consider a transmission line of length l and characteristic impedance Z_o, terminated in an arbitrary impedance Z_L as in fig. 1. When the load impedance Z_L equals the characteristic impedance of the line Z_o, the line is said to be "flat"; there are no reflections at the end, and the standing wave ratio is unity. Under these conditions, maximum power is delivered to the load, and losses in the transmission line are at a minimum.

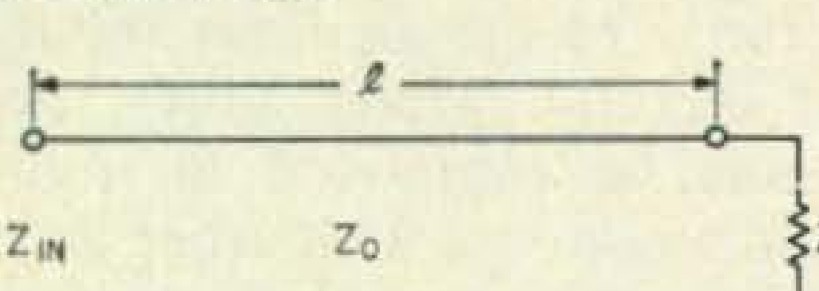

Fig. 1—General transmission line. When Z_o equals Z_L the line is "flat" or has no reflections.

Unfortunately, it does not usually happen that the load impedance (usually an antenna) exactly equals the characteristic impedance of the transmission line, so some method of matching becomes necessary. This can be done in one of the following ways:

1. the use of a network composed of inductors and capacitors.
2. the use of two or more transmission lines having different characteristic impedances and cut to the proper lengths.
3. the use of stubs made of transmission lines.

Each of these methods has advantages and disadvantages. The first two may be used only when the load impedance is purely resistive or nearly so. The third method can be used to match any impedance, but it is much more complicated to figure out theoretically. The first two methods will be discussed in this article.

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Impedance Matching Networks

Impedance matching networks are used to match a resistance of a pure resistive load to the characteristic impedance of the transmission line. There are several antennas which are very nearly a pure resistive load. For example, the half-wave dipole is nearly 73 ohms, and the half-wave folded dipole is very nearly 280 ohms.

For cases where the load resistance is *greater* than the characteristic impedance, the circuits of fig. 2 should be used. Here L and C are given by:

$$L = \frac{1}{2\pi f}\sqrt{Z_0\,(R - Z_0)}\ \mu h$$

$$C = \frac{1}{2\pi f}\,\frac{\sqrt{Z_0\,(R - Z_0)}}{RZ_0}\ \mu f$$

where f is the frequency in megacycles, Z_o is the characteristic impedance of the transmission

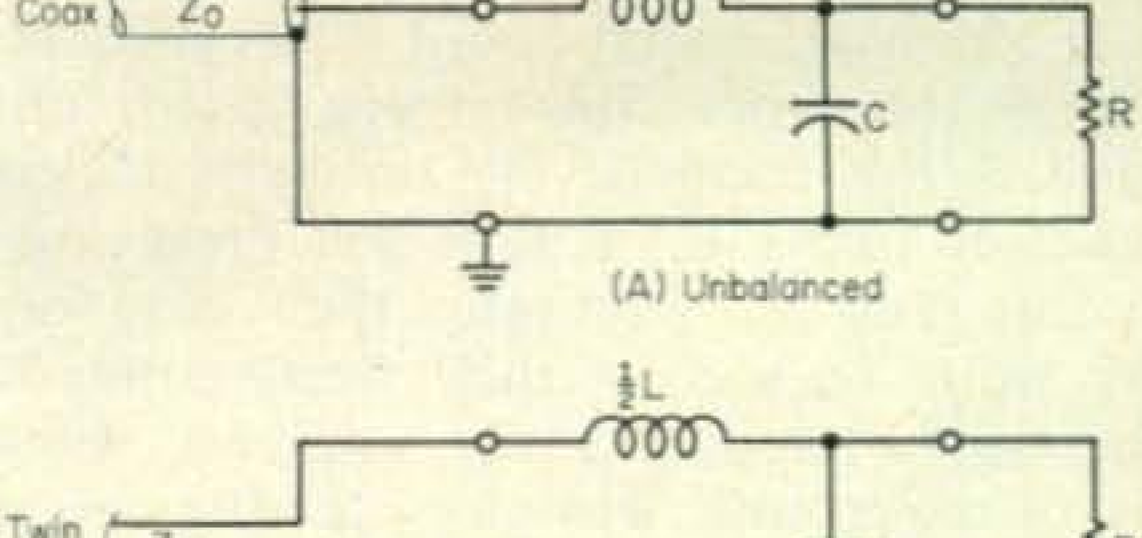


Fig. 2—When matching to a resistive load greater than the characteristic impedance of the feeder these circuits are used. Calculations of C and L are explained in the text.

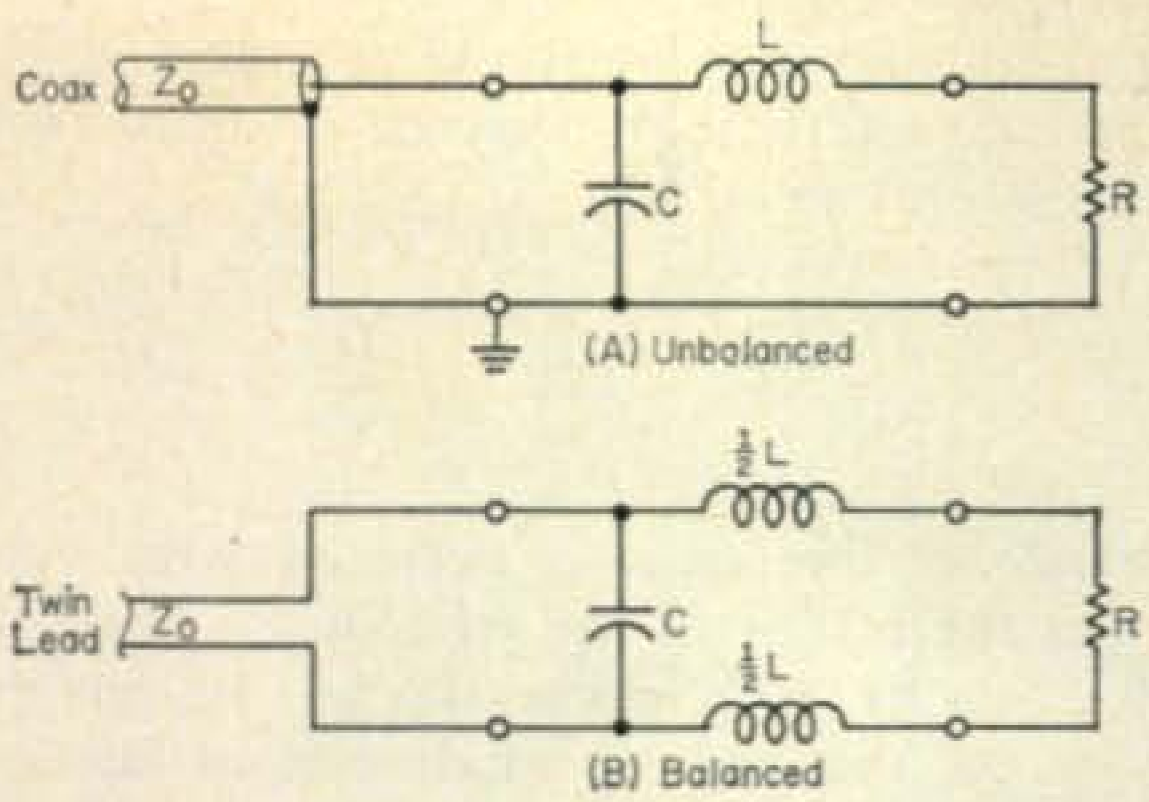


Fig. 3—When matching to a resistive load less than the characteristic impedance of the feeder these circuits are used. The calculation of *L* and *C* are explained in the text.

line, and R is the resistance of the load. ($\pi = 3.14$.)

For cases where the load resistance is *less* than the characteristic impedance of the line, the circuits of fig. 3 should be used. Here L and C are given by:

$$L = \frac{1}{2\pi f}\sqrt{R\,(Z_0 - R)}\ \mu h$$

$$C = \frac{1}{2\pi f}\ \frac{\sqrt{R\,(Z_0 - R)}}{RZ_0}\ \mu f$$

These two cases will handle most amateur needs. However, there are occasions, as in an antenna array of phased elements, when one wishes not only to match impedances, but to specify a phase angle as well.

Matching and Phasing Networks

In such cases, one of the networks of fig. 4 must be used. Either end may be considered to be the load, and the other the transmission line replacing one of the R's by Z_o, but R_1 is assumed to be the larger, and R_2 the smaller resistance. Then

$$X_1 = \frac{\sqrt{R_1 R_2} - R_1 \cos\beta}{\sin\beta}$$

$$X_2 = \frac{\sqrt{R_1 R_2} - R_2 \cos\beta}{\sin\beta}$$

$$X_3 = -\frac{\sqrt{R_1 R_2}}{\sin\beta}$$

$$X_A = \frac{R_1 R_2 \sin\beta}{R_2 \cos\beta - \sqrt{R_1 R_2}}$$

$$X_B = \frac{R_1 R_2 \sin\beta}{R_1 \cos\beta - \sqrt{R_1 R_2}}$$

$$X_C = \sqrt{R_1 R_2}\,\sin\beta$$

Here β is the phase angle by which the wave at R_2 *lags behind* the phase of the corresponding wave at R_1. The values of the capacitances and inductances are:

$$C = \frac{1}{2\pi f X}\quad \mu f \text{ if } X \text{ is negative}$$

$$L = \frac{X}{2\pi f}\ \mu h \text{ if } X \text{ is positive}$$

where again f is in megacycles. The balanced case is used for parallel conductor transmission lines (Twin Lead) and the unbalanced for coax.

Construction and Installation

In all the cases for balanced lines, inductors should be oriented in such a manner as to minimize mutual coupling. Placing them at right angles to each other, or in shielded sections will help to do this.

The coils may be constructed from data in any of the several handbooks which give formulas for single layer coils. The capacitors should be good quality mica capacitors or variable ones with a plate spacing sufficient to handle the power. In most cases however, the nearest standard value of fixed capacitor will suffice, as the networks are not sensitive to small departures from theoretical values.

In order to keep the standing wave ratio as low as possible over as much of the line as possible, and since a resistive load does not appear purely resistive further down the transmission line, matching networks should be installed as close to the load as possible. An alternative is to install them a quarter wavelength down the

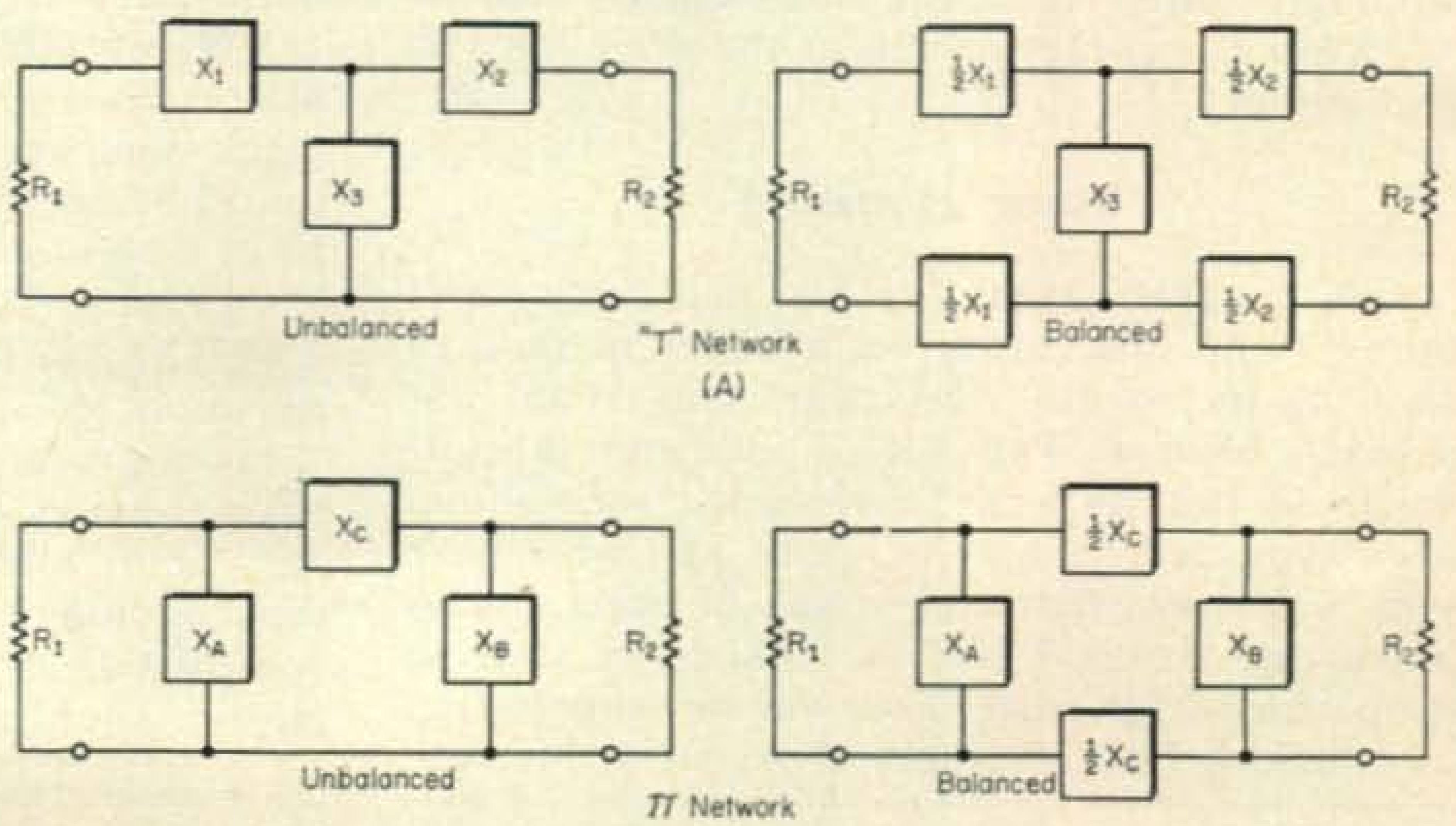


Fig. 4 — When matching impedances and phasing the networks shown above maybe used. Either end maybe considered the load as explained in the text.

line, but if this is done, they must be calculated to match the reciprocal of the load resistance.

Transmission Line Transformers

Figure 5 shows two schemes for matching pure resistances. The one in fig. 5B will provide a lower standing wave ratio over a wider band, but the one in 5A will do quite well for about a $\pm$ 15% band for moderate values of R. In both cases, λ is the wavelength on the transmission line.

The values of the characteristic impedances in the transformers are:

$$Z_1 = \sqrt{Z_0 R}$$

$$Z_2 = \sqrt[3]{Z_0^2 R}$$

$$Z_3 = \sqrt[3]{Z_0 R^2}$$

This technique is especially adaptable when one is using parallel conductor transmission lines, as short lengths of line for application as transformers can be made at home.

The characteristic impedance of an open wire transmission line is:

$$Z_0 = 276 \log \frac{D}{r}$$

where D is the spacing between wire centers and r is the radius of the wire in the same units as D. (See fig. 6). Spacers should be put every foot or so and can be made out of scraps of plastic, or wooden dowels boiled in paraffin. Number 12 or 14 wire should be used. ■

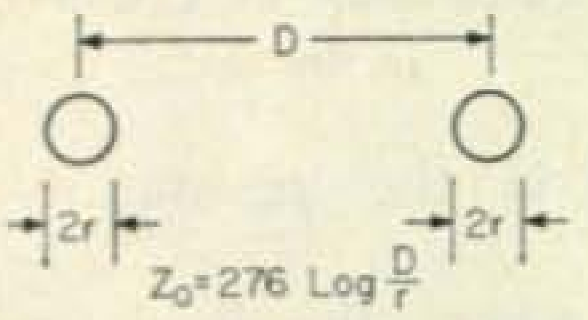
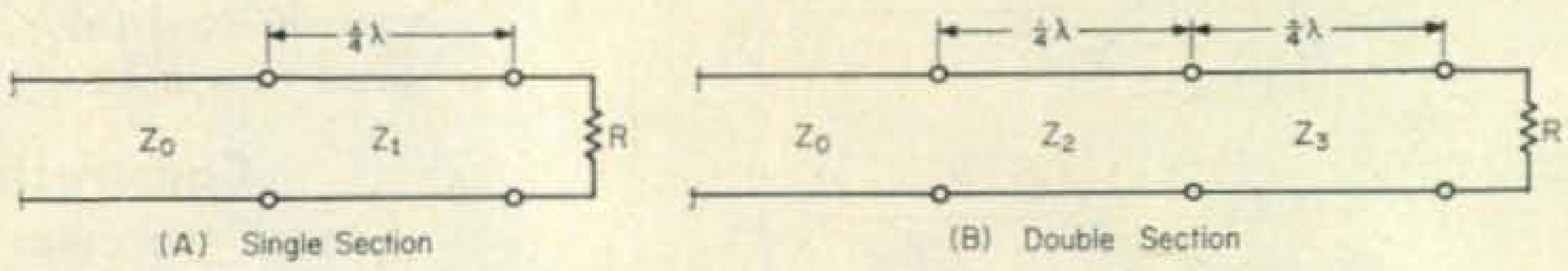


Fig. 6—The characteristic impedance of a parallel open wire transmission line maybe calculated from the measurements and formula shown.

Fig. 5—Single and double section transmission line transformers.



Know Where You're Heading

E. S. TEUTSCHBEIN,* W4LAV

An inexpensive and simple modification of the AR-22 antenna rotator control box for pin-point accuracy.

There must be thousands of us who are using the popular CDR AR-22 rotator. For those of you who have a poor memory for model numbers (no, not the numbers of models), this is the rotator using the control box where you turn the knob, then sit back and smilingly listen to the clack—clack—clack— . . . . until it comes to rest at the direction you had preset.

Beam Heading

For several years I have had very brief thoughts on how to devise a better method of showing me to just what degree my beam was actually headed. The AR-22 indicator is quite vague in this respect. I envisioned such things as selsyns, geared systems, belts, and what have you. Somehow, that lazy streak of mine always got to me before I had the chance, or urge to shop around for parts. This was most fortunate, as I believe I not only saved myself a tidy sum of money, but I have not had to humiliate my lazy streak.

Conversion

Now, let's get to the simple conversion before I divulge more of my lesser qualities. At least one source is available for the purchase of a U.S.N. surplus pelorus compass dial.[1] These plastic dials are about 7½" in diameter, have black numbers on a white background, and sell for $1.95. Besides the dial you will need about 6" of #14 solid copper wire, 2 #6 spacers about 7/16" long, 2 #6-32 x ¾" flat head screws, 2 #8-32 x ½" screws and 2 pieces of solid plastic rod about ½" in diameter and at least 1" long.

Having amassed this handful of parts, and having made certain that DX conditions are very poor, turn your rotator to North and pull the a.c. plug. Remove the plastic cover from the control box by removing the four feet and the plastic knob. Remove the direction indicator

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[1]Herbach and Rademan, Inc., 1204 Arch St., Phila. 7, Pa. Cat. No. TM6552

plate which is held by two screws. Scrape the red paint off the dial pointer, straighten the tip, and bend the whole pointer back towards the aluminum gear to give clearance for the dial. Do this discreetly, as the pointer acts as a lever and can snap the brass sleeve out of the aluminum gear. If you are concerned over this obvious destruction of that which C-D hath wrought, let me relieve you with the fact that C-D will gladly let you have a completely new aluminum gear, sleeve and pointer assembly for a mere fifty cents.[2]

For those of you who wish to preserve the original pointer intact, proceed as follows. Remove the metal knob and the dial pointer-gear assembly by removing the C washer just forward of the brass sleeve. The brass sleeve holds the pointer in place by a press fit of the sleeve into the aluminum gear. By prying under the pointer, the whole sleeve should snap out of the gear. Latch on to a 2" square piece of phosphor bronze or brass shim stock about .018" thick (the same thickness as the dial pointer). Place this between two scrap pieces of about 1/16" aluminum and drill a ½" hole in its center by drilling through all three pieces. This will cut a nice clean hole in the stock. I prefer a hand drill, as a more accurate hole can usually be drilled in this manner in the home workshop. For reference, we want the hole the same size as that in the dial pointer.

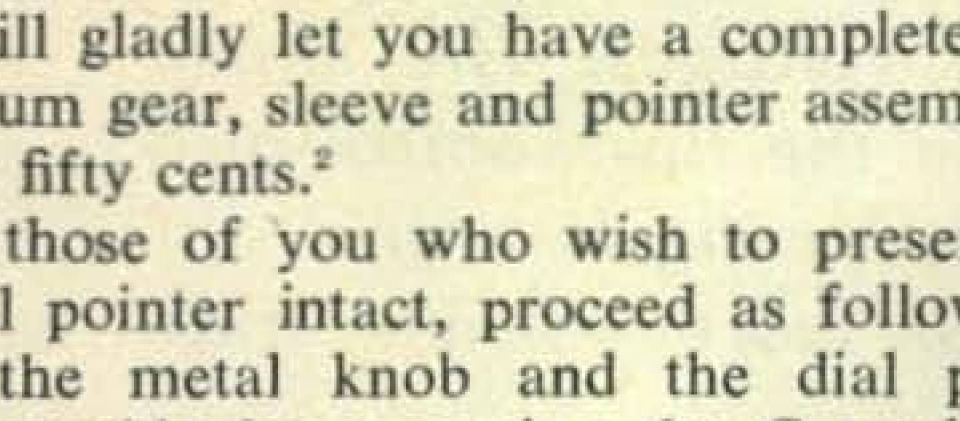
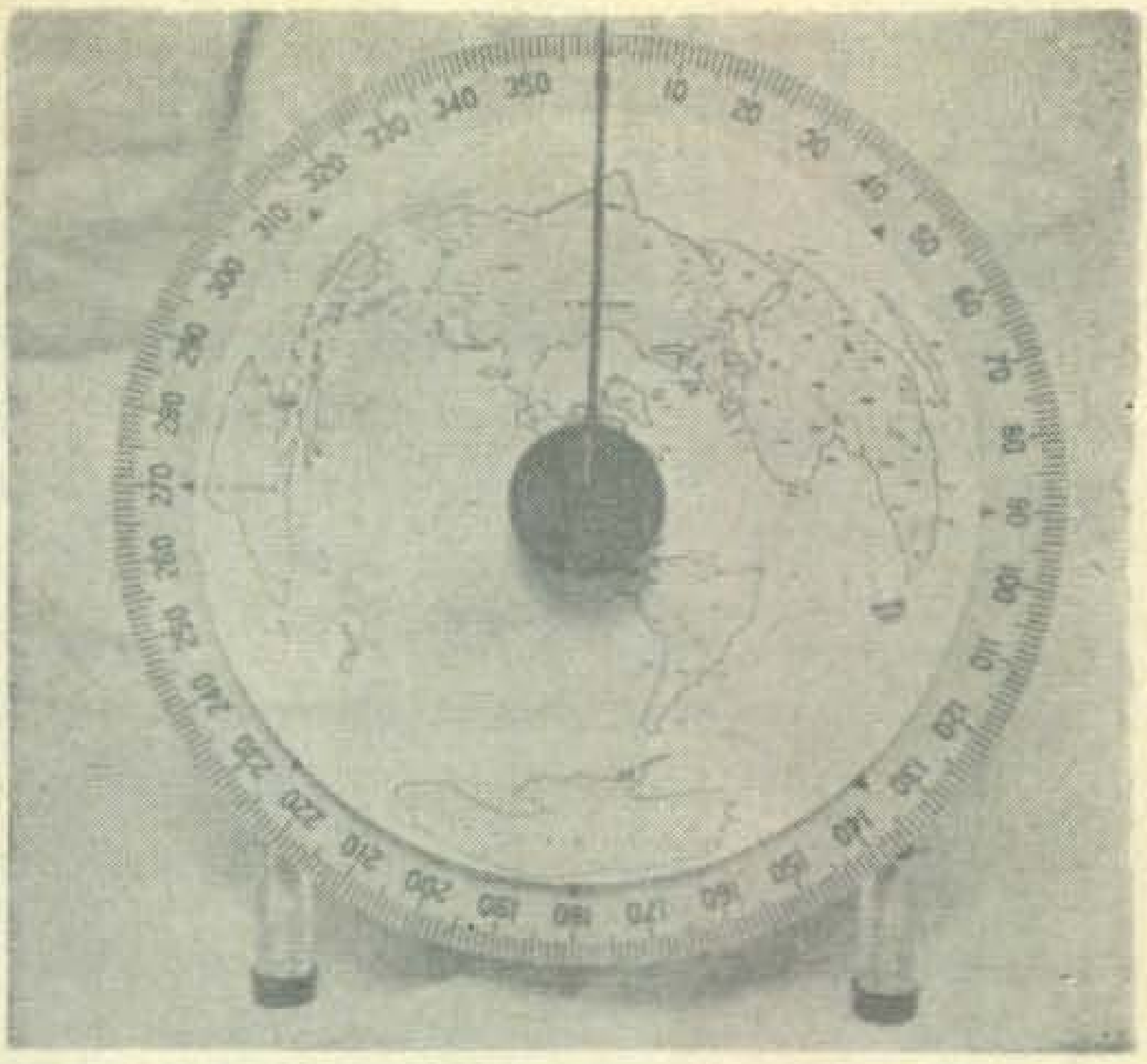


Fig. 1—Front and side view of lug or pointer showing how wire is attached.

With a tin shear or an old pair of scissors (not the XYL's new shears if you plan on using this gadget), cut the stock to resemble the original pointer, minus the ½" length of 1/16" wide tip. Reasemble the newly fashioned lug and brass sleeve into the aluminum gear by press-fitting. A couple taps of a hammer on the aluminum close to the hub, on the rear, will hold it securely. A touch of solder at the junction of the pointer and the sleeve may be necessary in some cases to prevent the pointer from slipping.

Next, take your copper wire and bend it as shown in fig. 1. Solder it in place on the pointer or lug. The wire should follow the shaft direction, but remain separated by about 1/16". If you so desire, now is the time to give the wire a couple fast coats of your XYL's favorite color of nail polish. If she uses only clear, or perhaps none at all, it would be wise to tell her why you are going down to the local pharmacy to buy nail polish *before* you actually buy it. It's little thoughts as these that keep marriage counselors from flourishing.

[2]Cornell-Dubilier Electric Corp., 118 E. Jones St. Fuquay Springs, N. C.; part No. ACU-8



Finished product makes an impressive and practical adjunct to any shack. The Great Circle map is not part of the pelorus plate but is added as explained in the text.

Replace the gear assembly in the control box, with the wire running along the top of the shaft, and secure again with the C washer.

Mounting The Dial

Using the original direction dial as a template, center it on the pelorus dial, with the N-S and E-W lined up on both dials. Mark the 2 screw holes on the pelorus dial and drill holes to pass #6 screws. Now enlarge the center hole of the pelorus dial to approximately ⅝".

Before mounting the dial, let's screw the rear feet back on the control box mounting plate. Drill and tap a 6-32 hole in one end and an 8-32 hole in the other end of each plastic rod. The holes may meet in the center. Screw the two remaining feet in the 6-32 tapped end and mount the rods with 8-32 screws in the front holes of the mounting plate.

Slide the pelorus dial over the shaft and projecting copper wire and secure with two 6-32 flat head screws, using the spacers between the control box and the pelorus dial. Using long pose pliers, hold the wire just at the dial and bend the wire up to *North*. Adjust the spacing from the dial so that it clears the two mounting screws. Make certain the wire does not drag on the dial or shaft at any place, or faulty operation will result. Put a pointer knob of about 1" diameter on the shaft and point it North.

That's all there is to it. With less than $3.00 worth of parts and a half hour of your spare time, you can now see the clack—clacks knocking off about 6° every clack. Now you can make use of those fancy Great circle bearing tables published in the Radio Amateur Call Book Magazine.

Trimmings

Should you want to really get fancy for no additional cost, you may do the following. Prior to mounting the pelorus dial, cut out one of

[*Continued on page 116*]

A High Output Linear Amplifier

DWIGHT BORTON*, W9VMQ

W9VMQ outlines his experiments with a screen grid driven linear amplifier possessing high plate efficiency and excellent linearity. The arrangement affords near maximum power tube utilization with moderate plate voltages. The circuit requires no bias or screen voltage and the low control grid current makes operation with tetrodes having low grid dissipation ratings possible in a manner more efficient than class AB-1.

THE increased use of single sideband transmission by amateurs has developed new interest in linear r.f. power amplifiers. The home brewed final, added to a commercially built exciter for increased output, has become a common amateur construction project.

Amateurs have constructed and used a wide variety of linears, employing many different tubes and classes of operation, and much has been learned that contributes to the data available for practical designs.

The circuits discussed here are the result of experiments made by the author some time ago. The interest at that time was in a simple circuit, using a tube as a variable d.c. resistance with a high peak-current capability. The initial experiments were made with an 814.

It was found that grid bias voltage could be eliminated, and very good control with a wide variation of plate current could be obtained by connecting the control, or number 1, grid to the filament and varying the screen, or number 2, grid voltage from zero to nominal positive potential.

Later the idea occurred to try this method of exciting the tube as a linear amplifier. The circuit worked, but the results were only fair. It was discovered accidentally that the performance improved greatly when a resistance of 10,000 ohms was connected between No. 1 grid and filament, and tests showed very good output and efficiency.

As had been expected, neutralization of the plate-to-screen grid capacitive feedback was found necessary, but the remaining simplicity of the circuit, with no critical grid or screen voltage required, encouraged further experiments. Several screen grid tubes of different types were tried, and all worked satisfactorily.

Tests were made and measurements taken for various excitation levels. The graphs of figs. 1 and 2 were made from such tests. These show

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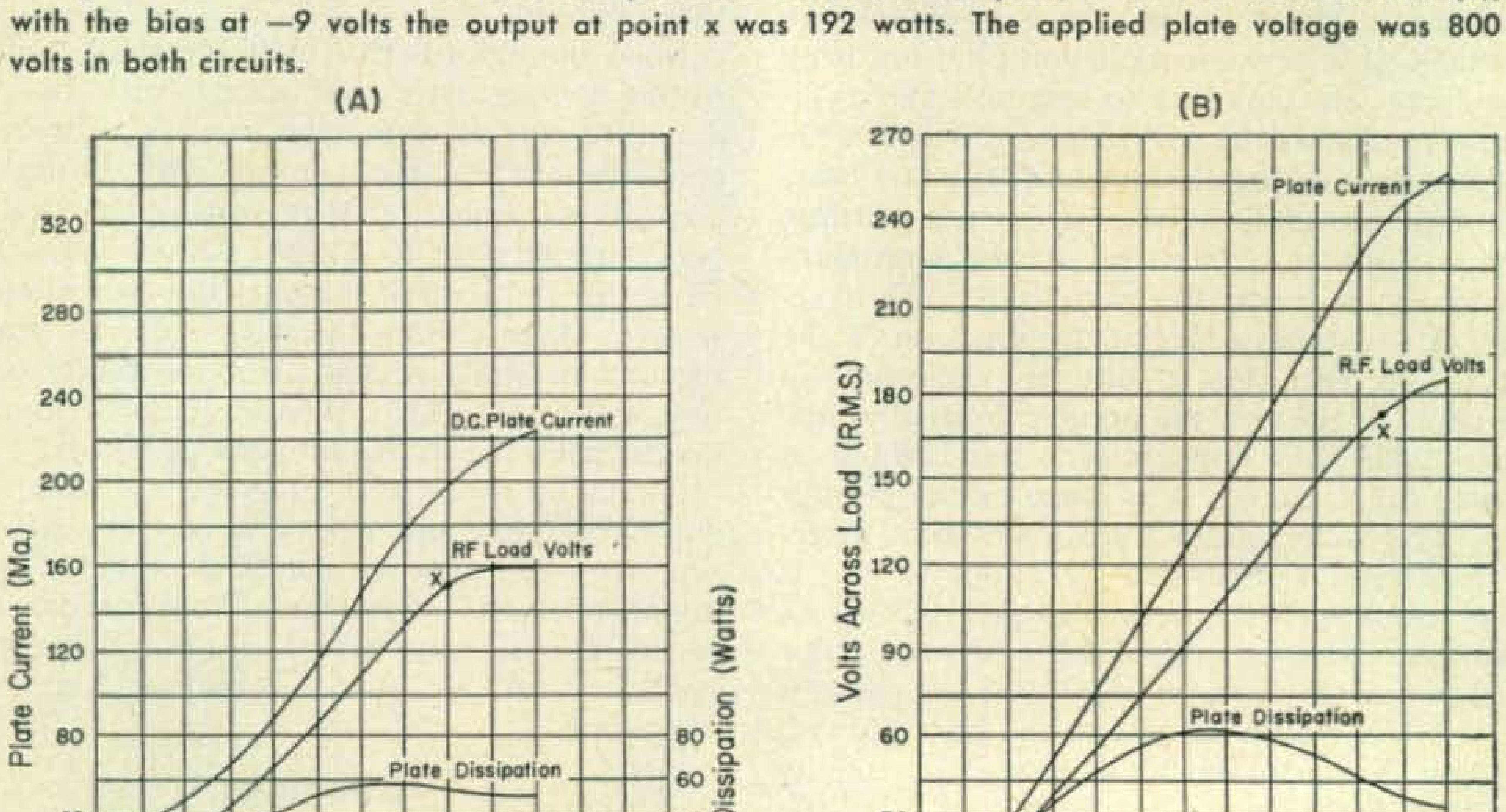
Fig. 1—Curves comparing d.c. plate current, r.f. plate voltage and plate dissipation for a single 6DQ5 in conventional class AB-1, (A), to a single 6DQ5 in a screen driven pentode circuit (B). The grid bias in (A) was −56 volts and produced an output (at point x) of 112 watts and in (B), with the bias at −9 volts the output at point x was 192 watts. The applied plate voltage was 800 volts in both circuits.



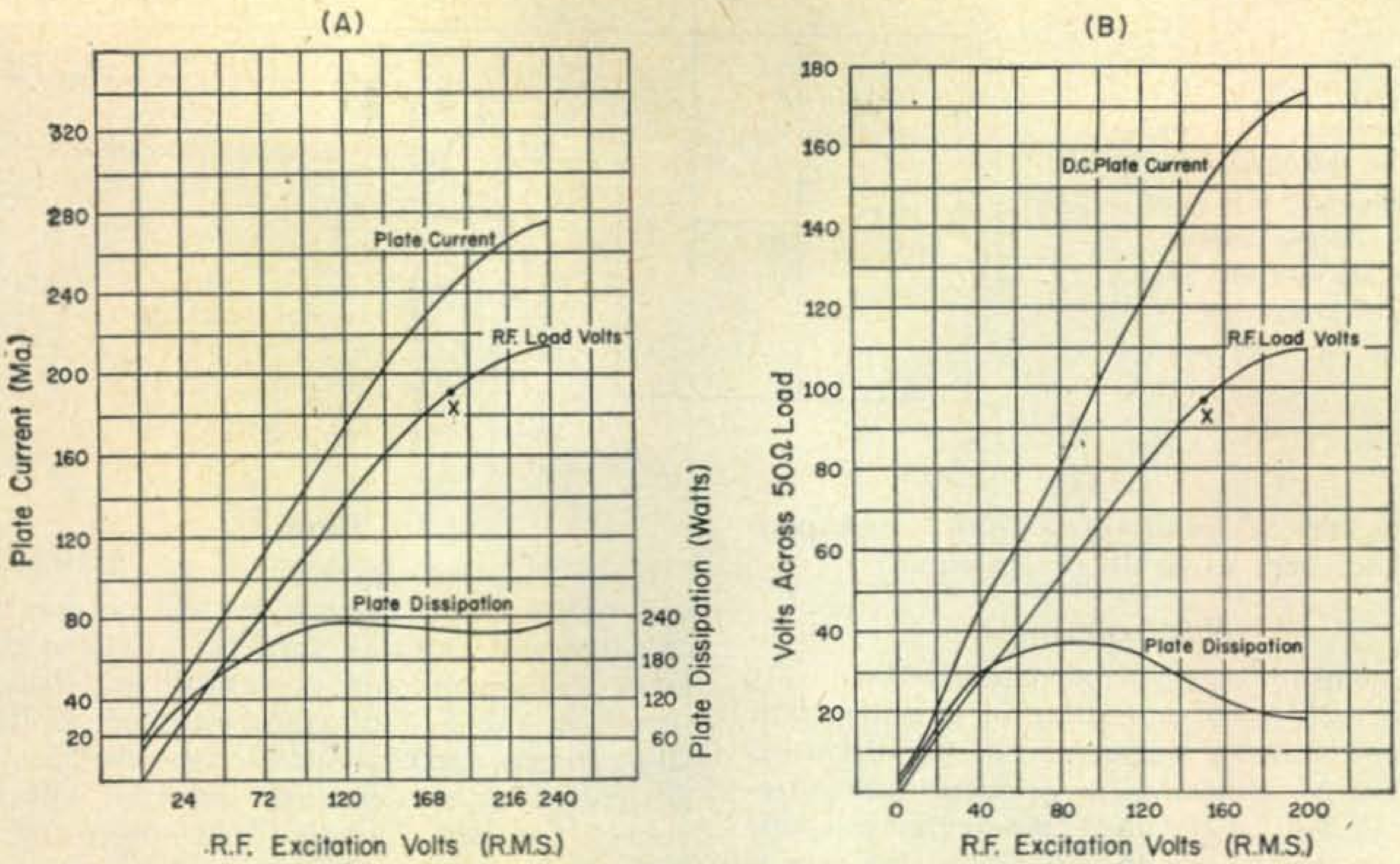


Fig. 2 — Comparison of performance of an 813 in, (A), triode grounded grid and (B) a screen driven pentode. In (A), G_1 was biased at −7.5 volts and G_2 was grounded. In (B), G_1 is biased at −9 volts. Output at point x in (A) is 414 watts and in (B) 584 watts with an applied plate voltage of 2,400 volts.

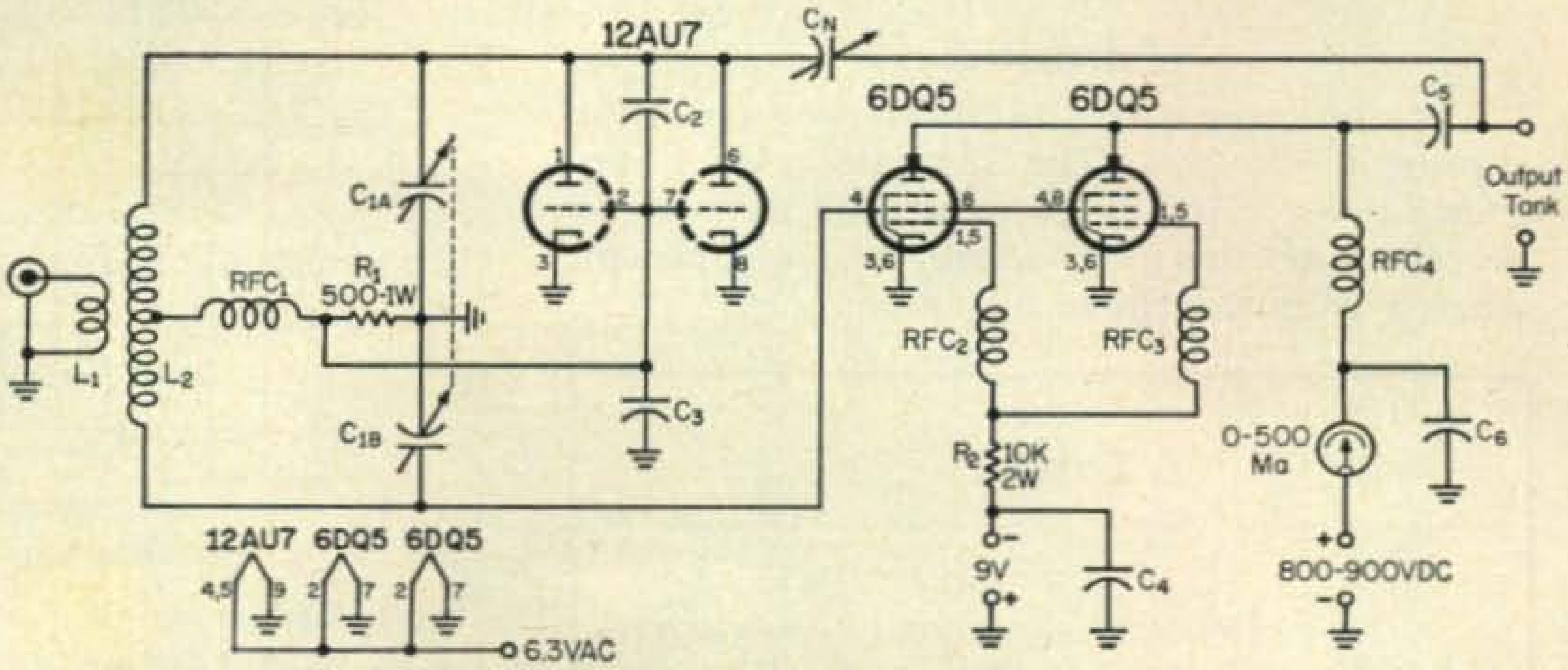
a comparison in efficiency and output between two screen-driven amplifiers and two standard linear amplifier circuits. Figure 1 shows a comparison between a screen-driven circuit (fig. 1B) and a class AB-1 circuit (fig. 1A) for the 6DQ5. Figure 2 shows the relative performance of an 813 in standard triode connected grounded-grid operation (fig. 2A) and in the screen-driven circuit (fig. 2B). The class AB-1 6DQ5 and the grounded-grid 813 were carefully adjusted for optimum operation to get a fair comparison.

The high efficiency, high output, and excellent linearity characteristics of the circuit are shown by the graphs. The equipment used for measurements was compared with other units of known accuracy, and care was taken to get as accurate readings as possible.

The input impedance of the tube when driven in this way is not linear. Where the driving stage has ample power, no appreciable degradation of the driver linearity appears. The circuit of fig. 3 includes a "linearizing" circuit using a 12AU7 as an automatic, variable swamping resistance. This has effectively corrected some nonlinearity which showed up in this case, due to relatively heavy loading of the output stage of the SB-10 exciter.

Figures 3 and 4 show two practical circuits used with very good results. Necessary component values are shown. The r.f. chokes in the No. 1 grid circuits improve results over those using the grid resistor alone. The values of the grid

Fig. 3—A practical screen driven circuit employing two 6DQ5s and a 12AU7. The 12AU7 is used to help maintain a linear input impedance by acting as a variable swamping resistor. All L_2 coils wound on 1" diameter lucite rod and center tapped.



$RFC_{1, 2, 3}$—.5 to 2.5 mhy
RFC_4—National R175A
$C_{1, A, B}$—Dual tuning capacitor 25 to 50 mmf per section
C_2—10 mmf 500 v mica or ceramic
$C_{3, 4}$—.002 mf 600 v mica or ceramic
$C_{5, 6}$—.002 mf 1200 v mica or ceramic
C_n—See text

L_1—75 m— 5t, 40 m— 3 t, 20 m— 3 t, 15 m— 2 t, 10 m— 1 t. All wound with #20 hookup wire.
L_2—75 m— 72 t #24 enameled, close wound.
40 m— 34 t #22 enameled, close wound.
20 m— 18 t #18 enameled, spaced 1⅞".
15 m— 13 t #18 enameled, spaced 1⅜".
10 m— 9 t #18 enameled, spaced 1½".

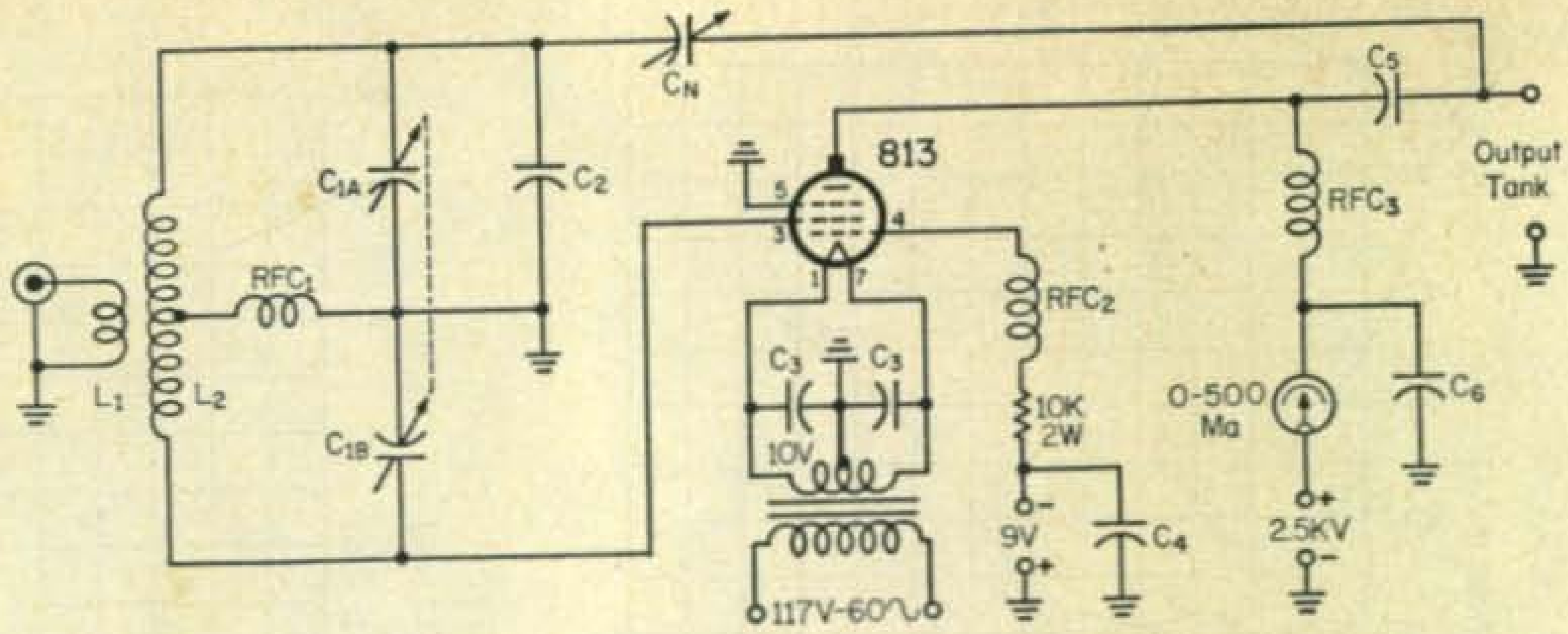


Fig. 4—Circuit of the screen driven 813 described in the text. As in fig. 3, no output tank data is given and the amplifier will operate well with link coupled or pi network circuits. See fig. 3 for parts list.

resistors in each circuit were arrived at by experiment and seem to be about optimum.

Neutralizing

The neutralizing capacitance required will vary from 1 to 8 mmf, depending on the tube type and on whether a single tube or parallel tubes are used. An indication of complete neutralization may not be obtained, but perfectly stable operation can be obtained if reasonable care is used to prevent coupling between the input and output tuned circuits. It was found that the amplifier could be neutralized on 10 meters and would remain stable on the other four bands through 75 meters with no further adjusting of C_N.

One "sure fire" method of neutralizing, suggested by W8YDR and used by him for 813s, by W8FIS with 4-125As, and by W9EHE with 6DQ5s, is the one of feeding signal from the exciter into the output terminals of the linear and adjusting C_N for minimum No. 1 or No. 2 grid current. (Be sure to remove the plate voltage.)

The Breune or bridge neutralizing circuit was tried with a 4E27A and worked satisfactorily, requiring only a single ended input tuned circuit, but did not work out with tubes not containing a suppressor grid. With tetrodes or beam power pentodes, the plate-to-screen capacitance is not small enough for application of the bridge circuit.

Parasitics

Very little parasitic trouble showed up in the various tubes tried. The separate grid chokes shown in the 6DQ5 diagram of fig. 3 were found necessary to squelch a parasitic that was present when a common choke was used.

Table I

Band	*Driving Power*	*Plate Input Power*	*Output Power*
75	20 Watts	750 Watts	583 Watts
40	20 Watts	750 Watts	577 Watts
20	25 Watts	750 Watts	570 Watts
15	28 Watts	750 Watts	540 Watts
10	32 Watts	750 Watts	520 Watts

Bias

Zero grid bias operation is practical except with 6DQ5 tubes. These tubes will run too high an idling current with zero bias. On the other tubes a slight amount of control grid bias, as shown in the 813 diagram, resulted in lower idling current and consequent lower average plate dissipation without spoiling linearity. The bias voltage required is small (5-10 volts) and not critical.

Input Circuit

Driving voltage may be coupled in capacatively or with a link as shown.

A high L/C ratio in the input tuned circuit broadens the tuning. An input coil for each band, with sufficient inductance to resonate with the tube input capacitance at the center of each phone section, will eliminate input tuning. With link coupling, the link on the input coil for each band can be adjusted to match the output impedance of the exciter being used.

Tests were made to determine the required drive power and performance on the bands 10 through 75 meters, using a single 813. The results are shown in Table I.

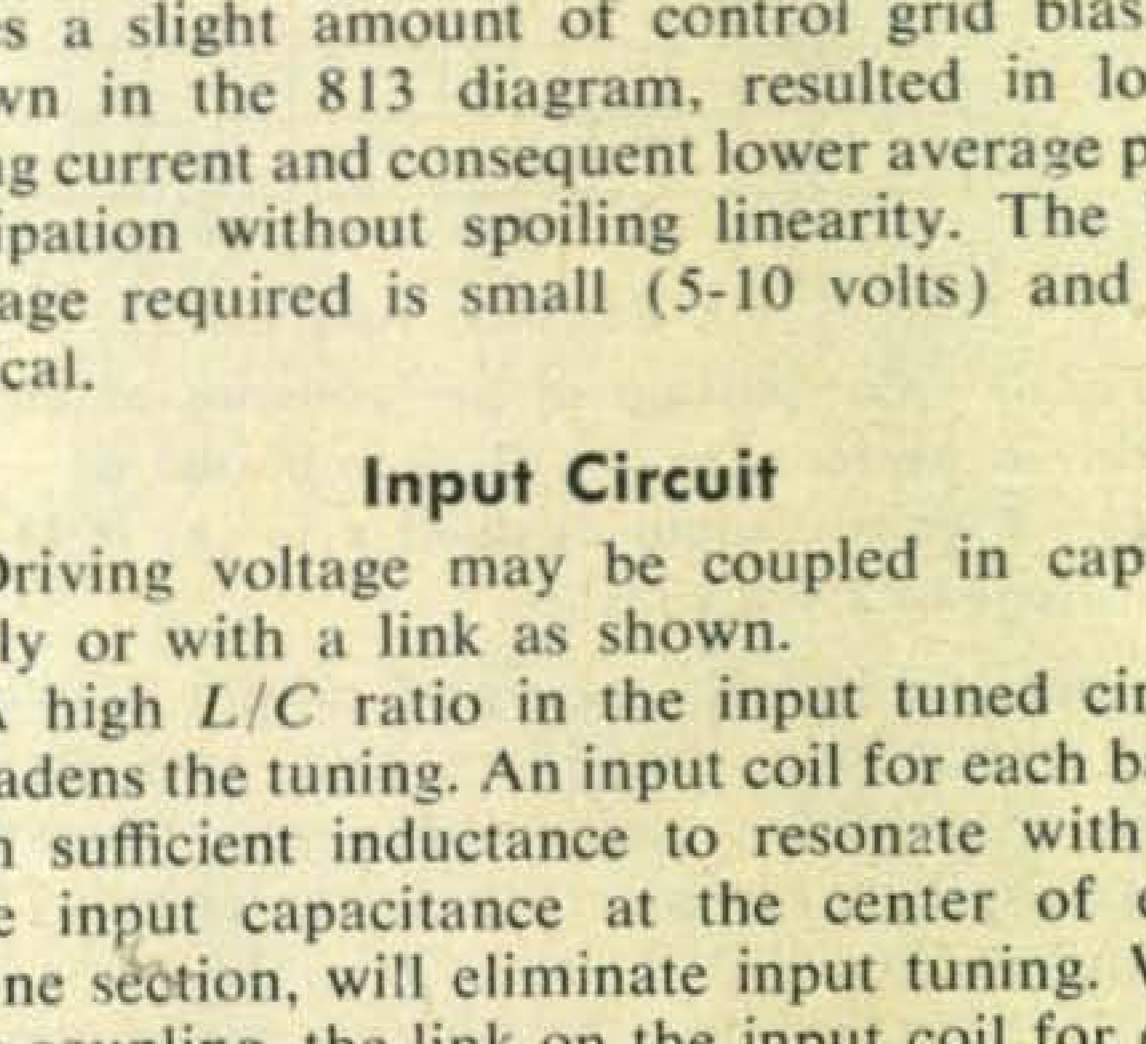


Fig 5—Comparison of the current flow in G_1 and G_2 of an 813 (screen driven) as opposed to the excitation voltage.

Figure 5 shows the measured No. 1 and No. 2 grid currents of the 813 plotted against excitation voltage and corresponding to the other curves of Figure 2-B. The negative voltage developed across the grid resistor is linear with drive voltage and varies at the audio rate when the amplifier is handling a speech generated sideband signal. W8YDR suggests that this current and voltage is the result of trapping of a considerable charge of electrons between the No. 1 and No. 2 grids during the negative half cycle of excitation, and discharging at a rate slow enough to hold the No. 1 grid negative into the next positive half cycle.

Tests with an r.f. voltmeter and an oscilloscope show an r.f. sine wave voltage on the No. 1 grid. Under optimum operating conditions, this voltage is about 1/6 the amplitude of the drive voltage on the No. 2 grid. The method of coupling between the two grids appears to be a combination of capacitive and electron coupling with the amount of coupling essentially the same on all bands.

A comparison between the negative d.c. and r.f. voltages at the No. 1 grid indicated an actual positive potential on the No. 1 grid (with respect to cathode) during part of the r.f. cycle. This grid is positive during less than 180 degrees of the cycle. It seems evident that plate current is flowing in the tube for less than 180 degrees. This would explain the high efficiency obtained. The function of the grid resistor and the choke seem to be 1) to isolate the No. 1 grid from ground for r.f. allowing it to swing positive in phase with the driven No. 2 grid, and 2) to develop a negative voltage on the No. 1 grid which acts as an automatic bias. This automatic bias, varying at the audio rate, results in true class C operation with linearity.

We can see reader's eyebrows raising at the efficiencies indicated by the input and output figures shown on the graphs. The efficiency can be easily checked by observing tube color.[1] For example, at 333 ma on the curve of fig. 2B or at an input of 800 watts, the color of the plate indicates a dissipation of about 125 watts. This works out to an efficiency of 84%. This is peak efficiency with some flat topping, but at the operating point X, well below flat-topping, the overall efficiency is 77.5% with an output of 583 watts to the load.

From a practical standpoint, this circuit has definite performance and economy advantages over any other linear amplifier circuit tried. As an example, at a plate voltage of 2500 and an input of 750 watts, an 813 will deliver almost as much output as two of the same tubes running class AB-1 at 1000 watts input, with the same average plate dissipation per tube in both cases.

A pair of 6DQ5s with a plate voltage of 800 to 900 will deliver in excess of 300 watts output with 400 watts of input and a driving power of 5 to 8 watts, depending on the band in use. The 6DQ5 amplifier is an especially good one for use with low power, home built, or commercial exciters in the ten to twenty watt class. An SB-10 driving a pair of 6DQ5s has been very effective, and W9EHE is using a similar amplifier, with a 20-A, to put a very robust signal in here at a distance of 100 miles under day and night conditions.

The 6DQ5s can be operated with plate voltages as high as 1250 volts with higher grid bias (approximately -12 volts) without sacrificing linearity or efficiency, giving the same input power level (400 watts for 2 tubes) with less driving power.

Performance of the circuit at lower than nominal plate voltages is exceptionally good. The following table shows results of tests with an 813 (Table II).

Table II

Plate Voltage	*Plate Current*	*Input*	*Output*
2000	295 ma	590 Watts	460 Watts
1600	288 ma	445 Watts	342 Watts
1200	270 ma	325 Watts	245 Watts

All figures for output are based on r.m.s. voltage measurements across a 50 ohm dummy load with steady carrier input of the desired level. The dummy load circuit included an r.f. ammeter and a series variable capacitor, as shown in fig. 6 for tuning out the circuit reactance, including that of the link. The ammeter readings were used as a check, at the higher power levels, when calculating power in the load. The load resistance consisted of twelve 115 watt, 600 ohm Globar type CX resistors, in parallel.[2]

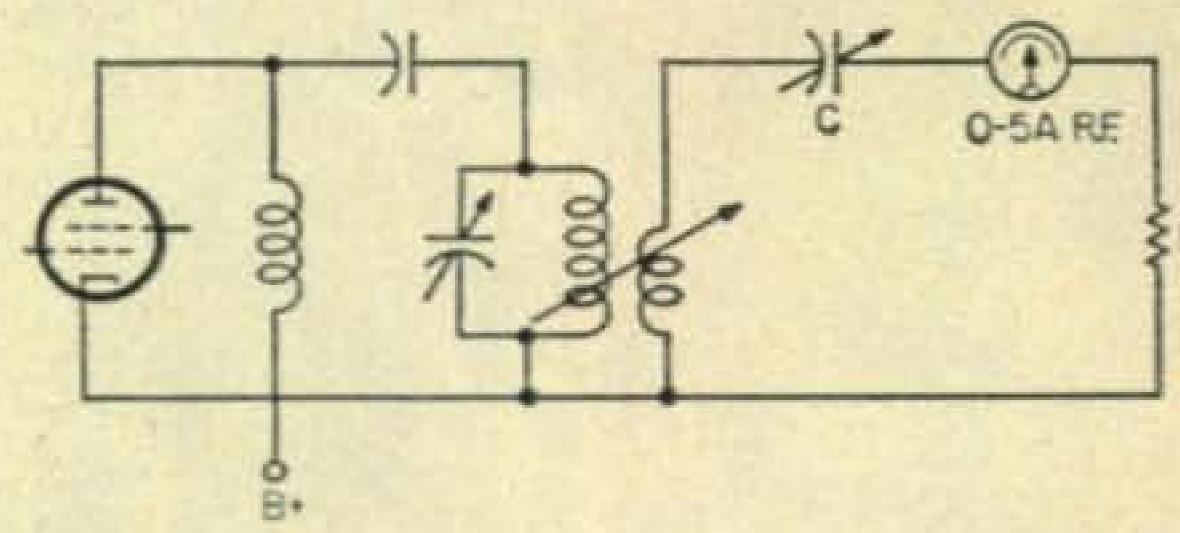


Fig. 6 — Circuit used to measure the power output.

Output tuned circuit values are not shown in the diagrams: standard values apply here as in any other circuit of similar power rating and indicated plate resistance. Link coupled-parallel tuned, or pi-network tank circuits can be used. Smaller diameter coils for the input tuned circuit can be used on the high frequency bands. The input circuit can be designed for band switching with a series of coils or with a single tapped coil.

[1]Plate dissipation as determined by color is rather loose, and it would be better if the proper color for a given dissipation were first ascertained. This can be done by hooking up the tube without drive, and in fact no tuned circuits either. Then use fixed bias to set the plate current for a power input equal to the maximum rated dissipation. Now note the color of the plate, which can be used as a reference. Plate color for other dissipation amounts can also be obtained in the same manner.—*Ed.*

[2]Glanzer, K., "A 1500 Watt Dummy Load", *CQ*, March, 1961, page 30.

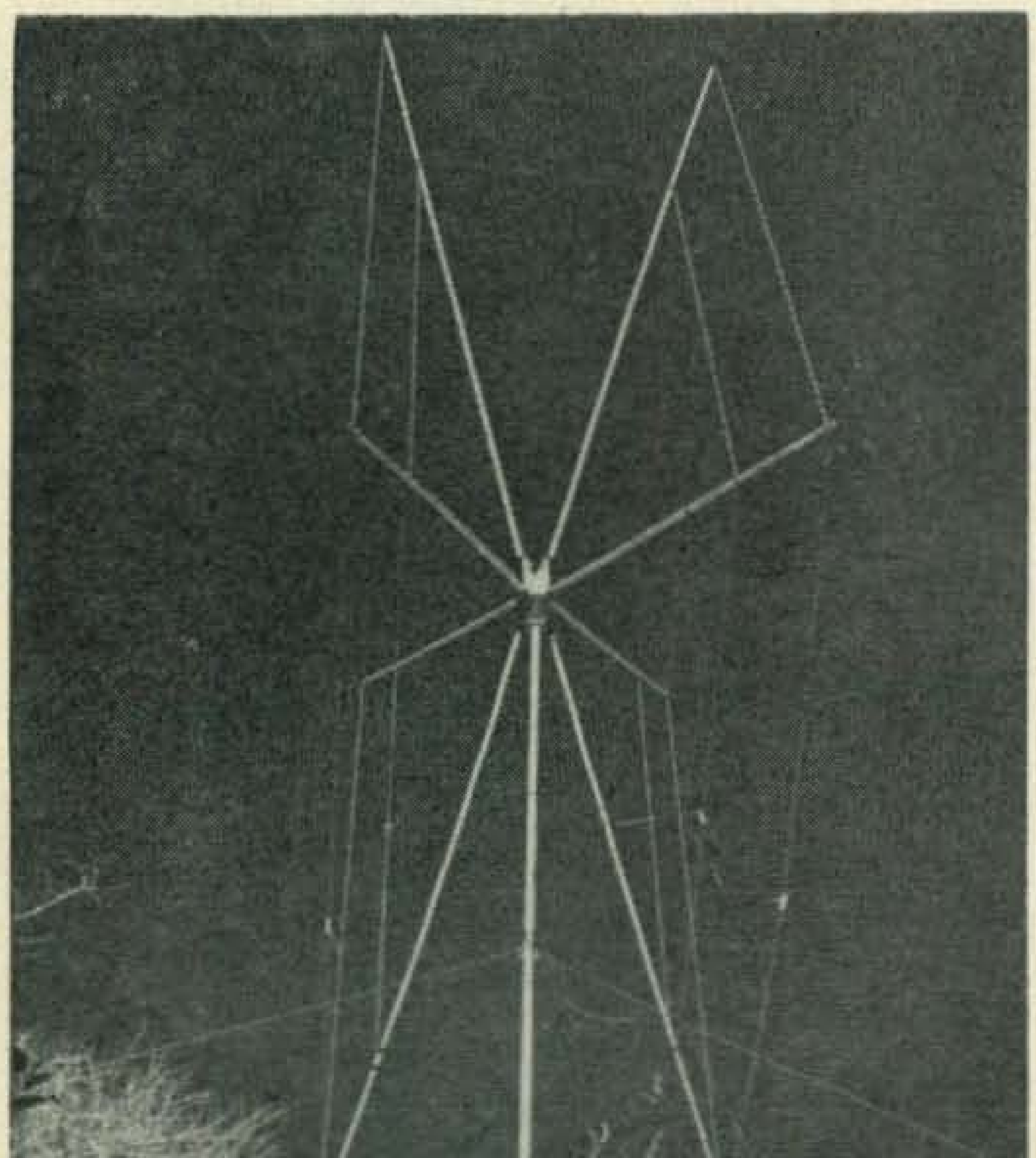
(*Continued on page 108*)

The Delta Quad

BY JOE WILLIAMS*, W6SFM

A one tenth wavelength spacing between the driven and parasitic elements is constantly maintained by the configuration of this quad. Therefore, an impedance of 50 ohms is derived for all bands. The unit is constructed for 10 and 15 meters but may be put on 20 by lengthening the bamboo poles and adding the two elements.

THE quad antenna has gained world wide popularity and this popularity has sound basis. The amateur operator using a quad has several good things going for him at the same time. A most obvious advantage is the fact that a quad is a two element parasitic array and will deliver almost an "S" unit of just plain gain. The top and bottom wires become phased to make a form of colinear antenna. The spacing from top to bottom creates a diversity effect and the low angle of radiation makes it a favorite with DX operators.



Overall view of the "Delta Quad". Single coax feedline handles both the 10 and 15 meter antennas. Parasitic elements are tuned by LC components but stubs may be used as listed in the construction data. Photo by Robert Jensen, W6VGQ.

*4150 Beck Avenue, North Hollywood, California

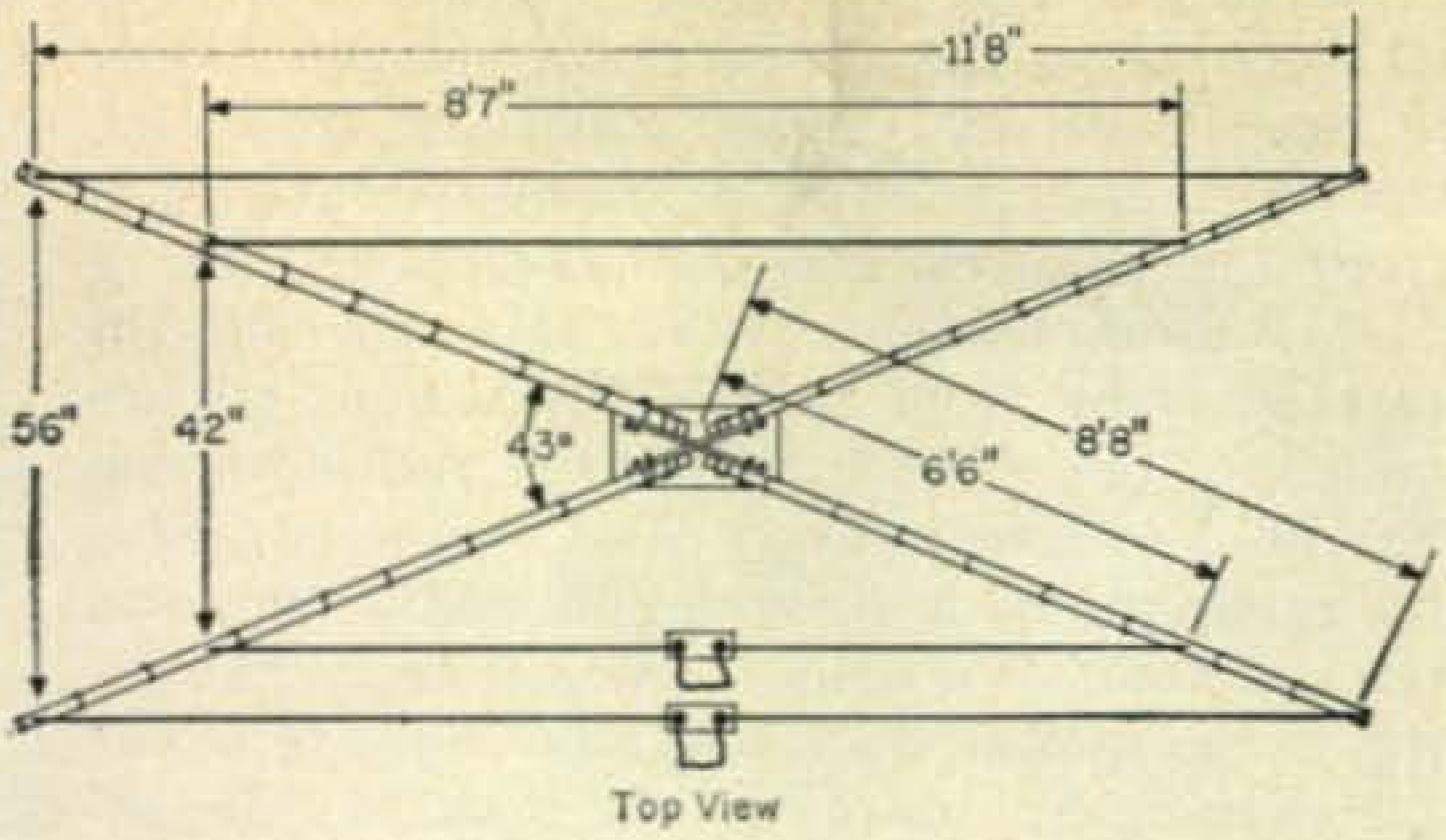
When a ham goes to the trouble of flying a batch of bamboo, he likes to get the maximum use from it. Mechanically, it figures that once a quad has been built for a lower frequency, say 14 megacycles, there remains wasted space that may be used for higher frequencies. So, we have the multiband quad. But, there is one persistent bug-a-boo which attends conventional cubical quad multiband design. It is the differences of radiation resistance of the respective driven elements. The Delta quad, based upon a configuration suggested by K6JT (ex W2OA), seems one solution to that problem.

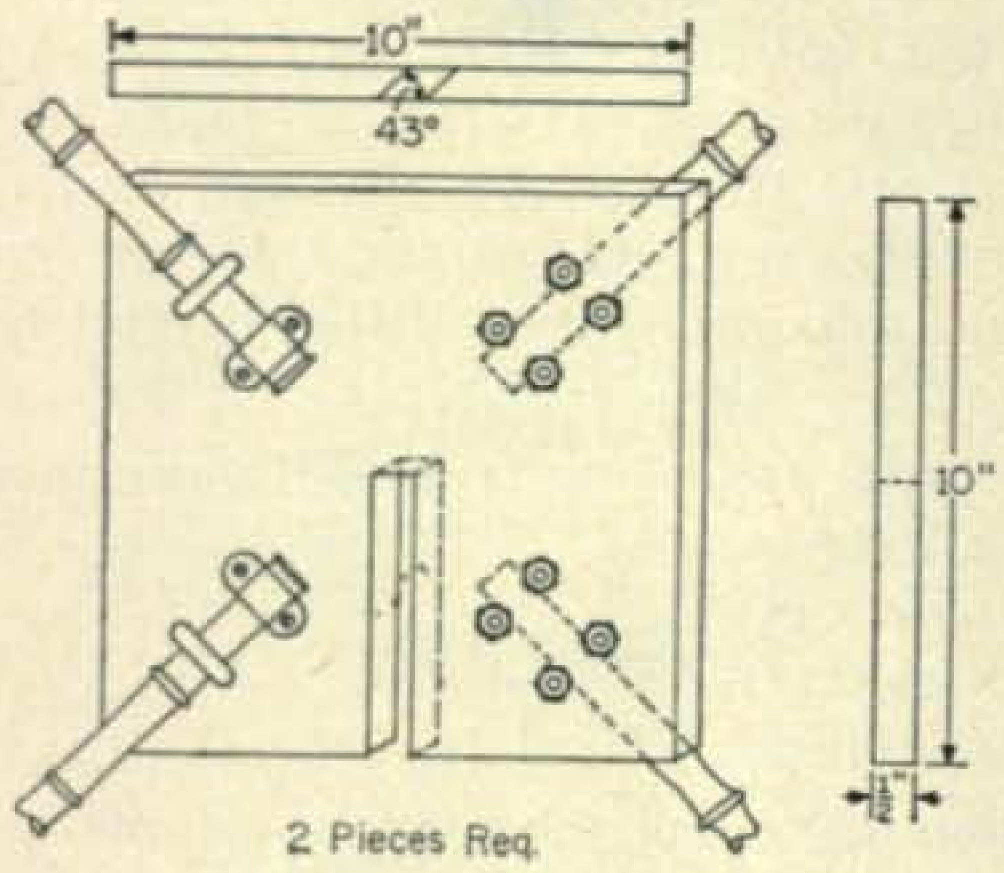
In addition to the 90 degree angular pattern familiar to the cubical quad, this antenna has an "X" shape when viewed from above. The supporting bamboo poles (9 feet long) which form the antenna-reflector relationships are mounted in a manner which produces a one-tenth wavelength spacing for each frequency band element pair. The lower frequency limit is determined by the lengths of the poles. (For a 3 band antenna covering 20, the poles would have to be 13′ 3″ long.)

One-tenth wavelength spacing in a quad antenna results in a radiation resistance of about 50 ohms if the array is situated ½ wavelength or more above the ground. Thus it will be seen that each antenna in such an arranged multiband combination should exhibit the same radiation resistance (50 ohms) if the family of antennas is high enough to provide ½ wavelength separation from ground at the *lowest* frequency concerned.

Once the shape of the Delta was realized, a close inspection of the literature[1] led to the

[1] Orr, W.I., "All About Quad Antennas," *Radio Publications,* Wilton Conn.
Jones, A.K., "Antennafax,", *CQ* July, 1960, Page 32.
Hess, M.G., "Single Line Feed for Tri-Band Quads," *QST,* August, 1959, page 20.
Adolph, E.H., "Three Band Quad for Field Day," *QST,* April, 1961, page 30.





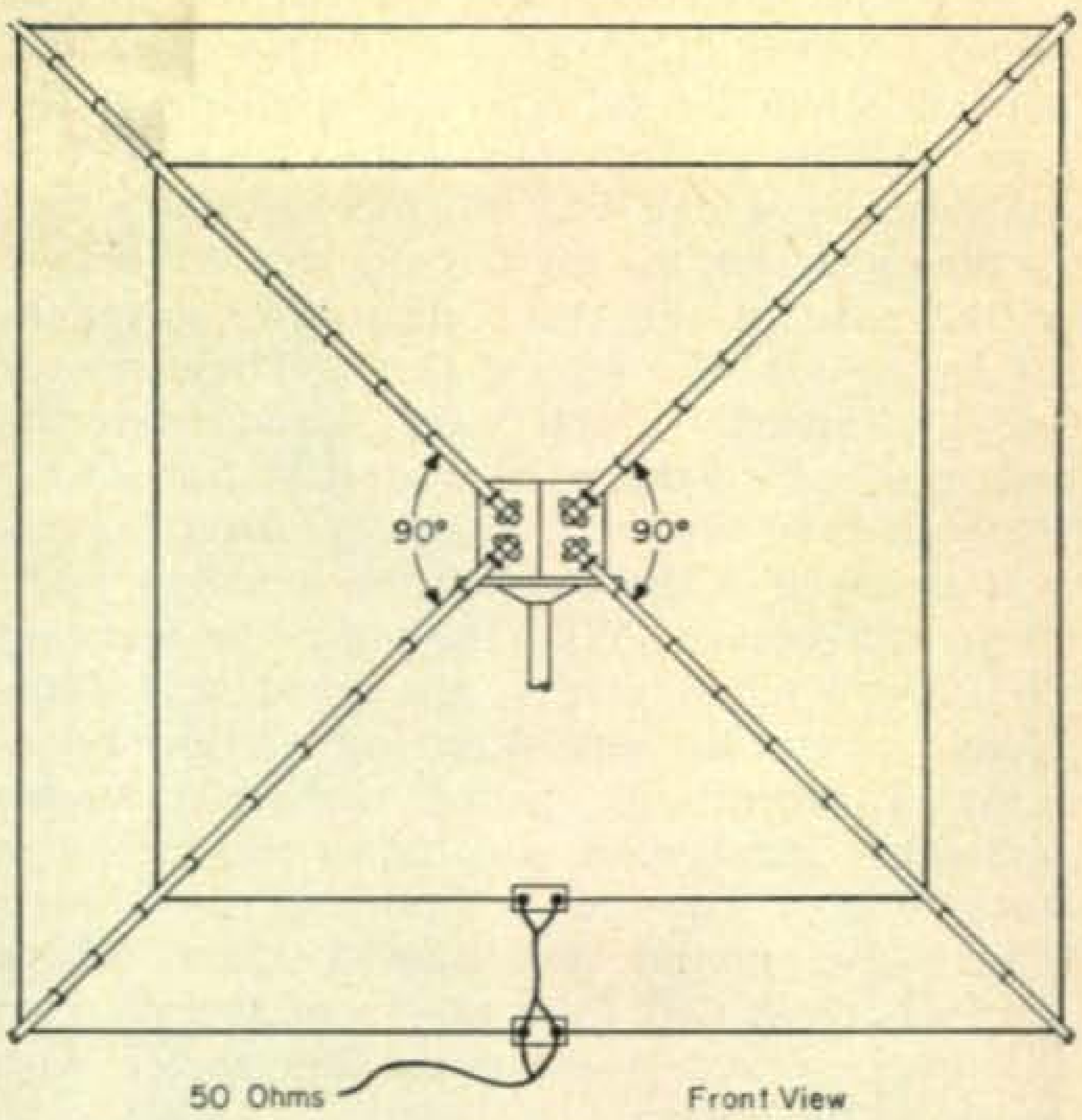


Fig. 1—Construction data for the "Delta Quad". A horizontal angle of 43°, as shown, will provide a one tenth wavelength spacing. The vertical angle should be 90°. A sketch of the support is shown and is elaborated on in the text. The stubs may be replaced by lumped *LC* constants. The rear bay is not shown as it is directly in line with the front bay.

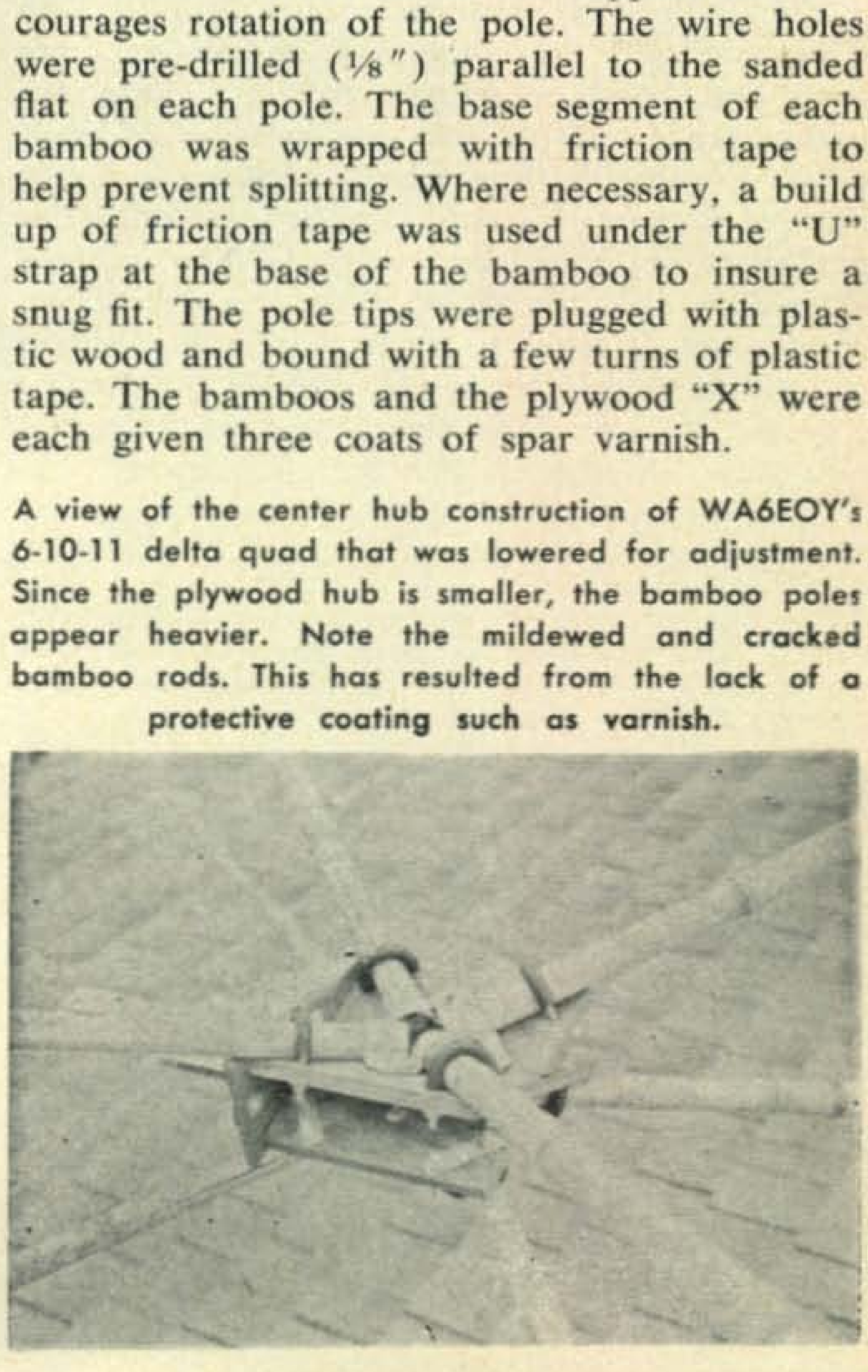
conclusion that simpler multiband quads could be devised. In order to employ the existing low pass filter and coaxial transmission lines, the radiation resistance of 50 to 52 ohms was the design hinge.

A practical Delta for 15 and 10 meters was built at W6SFM and is in current use. This compact beam has no boom, is very light, has excellent mechanical balance, requires little adjustment, uses an inexpensive mast and is fed with a single transmission line of RG-58A/U which is connected directly to the driven elements. A forward gain of 5 db is assumed. The measured front to back ratio of the 15 meter section is 24 db. The front to side ratio is 30 db. The angles of radiation should be 26 degrees at 21 mc and 18 degrees at 28 mc.

Construction

A support to provide the required 43 degree angles was made from plywood. Two 10″ squares of ½ inch ply were slotted to permit the construction of an "X". Another small piece of the same material was used as a bottom plate for the "X". Weldwood glue and long wood screws were used to join these pieces. The "X" provides four flat surfaces for the attachment of the eight poles. "U" bolts (1½″) and "U" straps (1″) were used to do this. Short pieces of rubber windshield wiper hose were slipped on each "U" bolt to prevent bamboo cracks. The "U" straps were attached with wood screws. A reinforced heavy duty TV mast clamp was bolted (¼″ galvanized) to the bottom plate of the "X" support. The bamboos were carefully measured and trimmed so that a knuckle ring remained at the base end of each pole. This ring was sanded flat on one side down to the level of the body of the pole. This made a better fit on the support and discourages rotation of the pole. The wire holes were pre-drilled (⅛″) parallel to the sanded flat on each pole. The base segment of each bamboo was wrapped with friction tape to help prevent splitting. Where necessary, a build up of friction tape was used under the "U" strap at the base of the bamboo to insure a snug fit. The pole tips were plugged with plastic wood and bound with a few turns of plastic tape. The bamboos and the plywood "X" were each given three coats of spar varnish.

A view of the center hub construction of WA6EOY's 6-10-11 delta quad that was lowered for adjustment. Since the plywood hub is smaller, the bamboo poles appear heavier. Note the mildewed and cracked bamboo rods. This has resulted from the lack of a protective coating such as varnish.



The mast consists of 3 ten foot sections of thin wall steel (1¼" O.D.) TV masting. The mast is manually rotated and is guyed at the nine and the twenty foot levels. Supported at the base by a ball bearing race assembly and its pipe pedestal, the mast is slip sleeve clamped to the eave of the shack. It is wire guyed at 20' by the use of a second sleeve. These sleeves are 1½" pieces which were sawed from the swedged end[2] of the bottom mast section. Other methods may suggest themselves. An 18" slack was arranged in the coax at the wire guy point to permit rotation. With the aid of an assistant and two kitchen chairs, the quad was completely assembled and wired on the ground.

As a protection against canyon draughts and other local wind conditions, the spreaders were braced by the addition of cross-guys. Thirty five pound test monofilament fishing line was cross tied from the front spreaders to the back spreaders using the ten meter wire holes as tie points.

The top section of the mast, with its guy wire rig attached, then was securely clamped into the "U" bolt of the TV mast fixture on the bottom of the "X" support. The quad was then stood up and walked to the mast site. After we added the middle mast section, the assembly was hand over handed onto the waiting bottom mast section. From a scratch start the material cost of this beam, including mast and coax, should run to about $23.

Adjustment

The reflectors should require little or no adjustment if the suggested dimensions are used and good geometry prevails. These antennas were cut for the c.w. portion of each band. For higher frequencies within the bands all parameters become smaller if optimum performance is to be realized. The builder should consult the book if such construction is planned. If front to back ratio improvement is found to be necessary, the quad can be lowered by removing the center mast section and stub adjustments can then be made.

Stub adjustments are most easily made by setting the antenna for optimum front to back ratio. In this case the quad is oriented so that its *back* is to the transmitting station. Using a lamp cord "S" meter extension from the station receiver or using a headphone extension from the receiver, the stub is adjusted for a *null*. Variations in forward gain are difficult to read while front to back measurements are quite obvious. The transmitting station should be 500' or more away and *must* be using horizontal antenna polarization. (My check station is about 1½ miles away-airline. When using stubs, back-to-back alligator clips are handy for clipping up and down the stub. My dimensions include a stub length which is calculated to be adequate to the 'bottom' of each band. After the optimum F/B spot is found with the alligator clips, a strap is soldered across the stub and the surplus (if any) is removed. Incidentally, in a quad of good design; optimum F/B and maximum forward gain tend to coincide.

The stubs are made from 3" wide open wire and the lengths are:

20 meters: 38"
15 meters: 22"
10 meters: 17"

In lieu of stubs, lumped constants may be used. The basic idea is to use an *LC* combination which will cause the reflector to resonate at a frequency which is about 5% lower than that of its associated driven element.

These 'stub-substitute' coils are made of #12 enameled wire. Each coil is made by winding on a form which is 1⅛ inches in diameter. The coils have an *inside* diameter of 1⅛". The coils are wound with minimal (close) spacing and in that condition have maximum inductance. Increasing the spacing (by pulling apart) decreases the inductance. Adjustment is accomplished by extending or compressing the coil while measuring the F/B ration (as described above). A small insulator (like the little eggs used to break up guys) is situated inside the coil to take the suspension strain. The coil data is as follows:

20 meters: 9 turns
15 meters: 7 turns
10 meters:6 turns

Wire hole locations for additional frequencies may be determined by Pythagorean means. ■

[2] The swedged ends of the masts were designed for interlocking and have an inside diameter of 1¼". If other mast types are used an alternate method of guying must be employed.

Mars Bulletins

Air Force Mars Eastern Technical Net

Sundays 2—		4PM EDST 3295kc, 7540kc, 15,715kc
Sept.	10th	Business Meeting.
Sept.	17th	**Doing the Job with Photoelectrics.** Mr. John J. Larew, Mgr., Specialty Control Dept., General Electric Company.
Sept.	24th	**Communications Receiver Design Considerations.** Mr. Frank Roberts, Chief Eng., National Radio Company, Inc.
Oct.	1st	**Progress Report: Electric Power Generation in the Atomic Age.** Mr. 'Bud' Pratt, Ch. Eng., Niagara-Mohawk Power Co.
Oct.	8th	**SSB—Superiority and Specifications.** Mr. Al Robertson, Mgr. and Mr. Joe Shafer, Sr. Amateur Radio Development Engr., Heath Company
Oct.	15th	**SSB—Operating Techinques.** Mr. William Kaufmann, Martin Co.

Biasing Of Power Amplifiers

LLOYD A. BURROWS,* W6IMY

An unusual method of biasing class A, B or C power amplifiers is put forth by W6IMY. The system, adjustable, employs a transistor and a reference voltage from a Zener or gas regulator tube.

The purpose of applying a bias to an amplifier tube is to select the desired operating point. This is usually accomplished by furnishing a negative voltage to the control grid from a battery or power supply (see fig. 1(A)). In applications where this method is inconvenient, cathode biasing is used (fig. 1(B)). A limitation exists here, too, since cathode bias will produce severe distortion when used where the cathode current varies greatly from zero to maximum signal input.

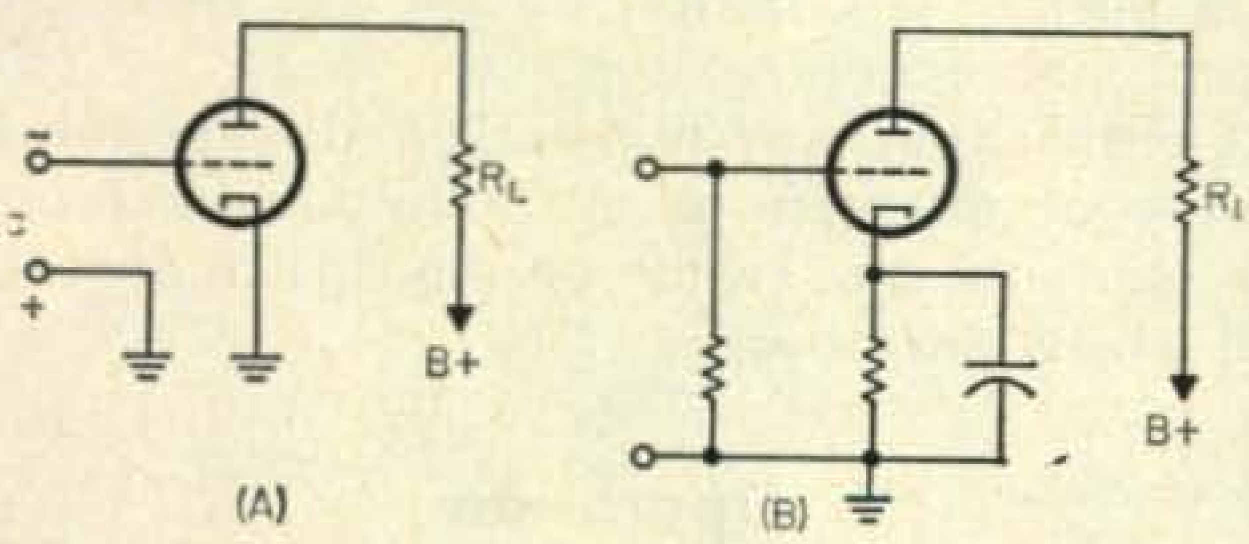


Fig. 1—(A) Basic fixed bias circuit. (B) Basic Cathode bias.

The circuit shown in fig. 2 resolves the problems mentioned above by using a silicon Zener diode in the cathode circuit of the amplifier tube. This type of diode exhibits a very low impedance while in the state of conduction, and maintains a nearly constant voltage over its operating current range. When using Zener diodes in this application, it is necessary to increase the plate supply and the grid #2 voltages (if using a tetrode) by the value of the Zener diode voltage in order to maintain the same operating point. The typical cost of a 10 watt silicon Zener diode is approximately ten dollars.

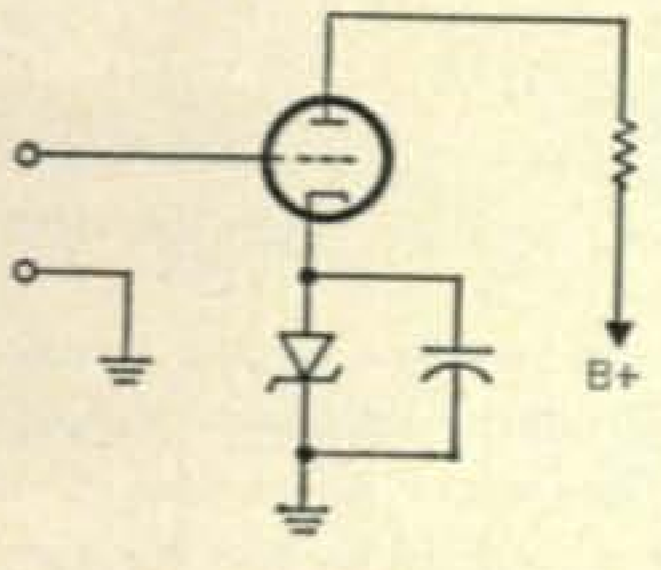


Fig. 2—In circuits where the cathode current swings over a wide range a Zener may be used for cathode bias.

Transistor Bias

This cost may be reduced by using the circuit shown in fig. 3. A small, low-current rated reference diode is connected, through a current limiting resistor, to an existing plate

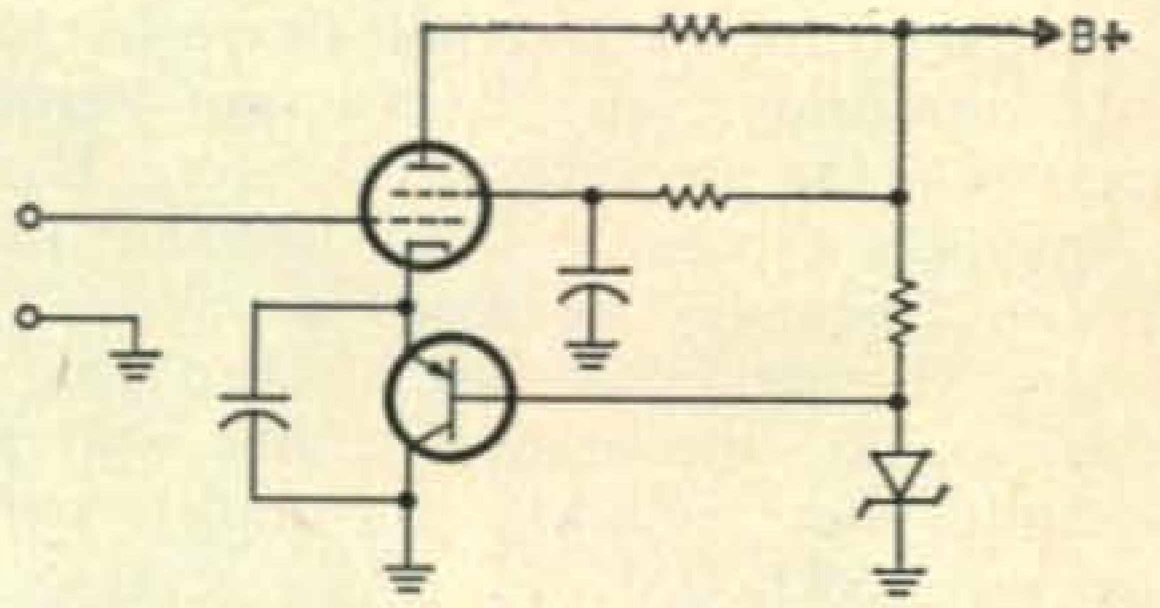


Fig. 3—To reduce the cost of the Zener diode this alternate circuit may be used. The low current rated Zener biases the transistor and this places the cathode at the Zener voltage.

or screen supply voltage. The regulated reference voltage from the diode is then applied to the base of a germanium PNP power transistor. The collector of the transistor is grounded and the emitter, which is connected to the tube cathode, is held at essentially the same voltage level as the base. Selection of a transistor is not critical, since the primary limiting factor is breakdown voltage. This rating for the transistor should exceed the diode reference voltage by 25 percent. Cost of the transistor and of the low-wattage diode is about 25 percent less than that of the high-current rated diode shown in fig. 2.

Adjustable Bias

The disadvantage of these circuits, a non-adjustable bias, may be overcome as shown in fig. 4. A pair of 807 tubes, operating in class

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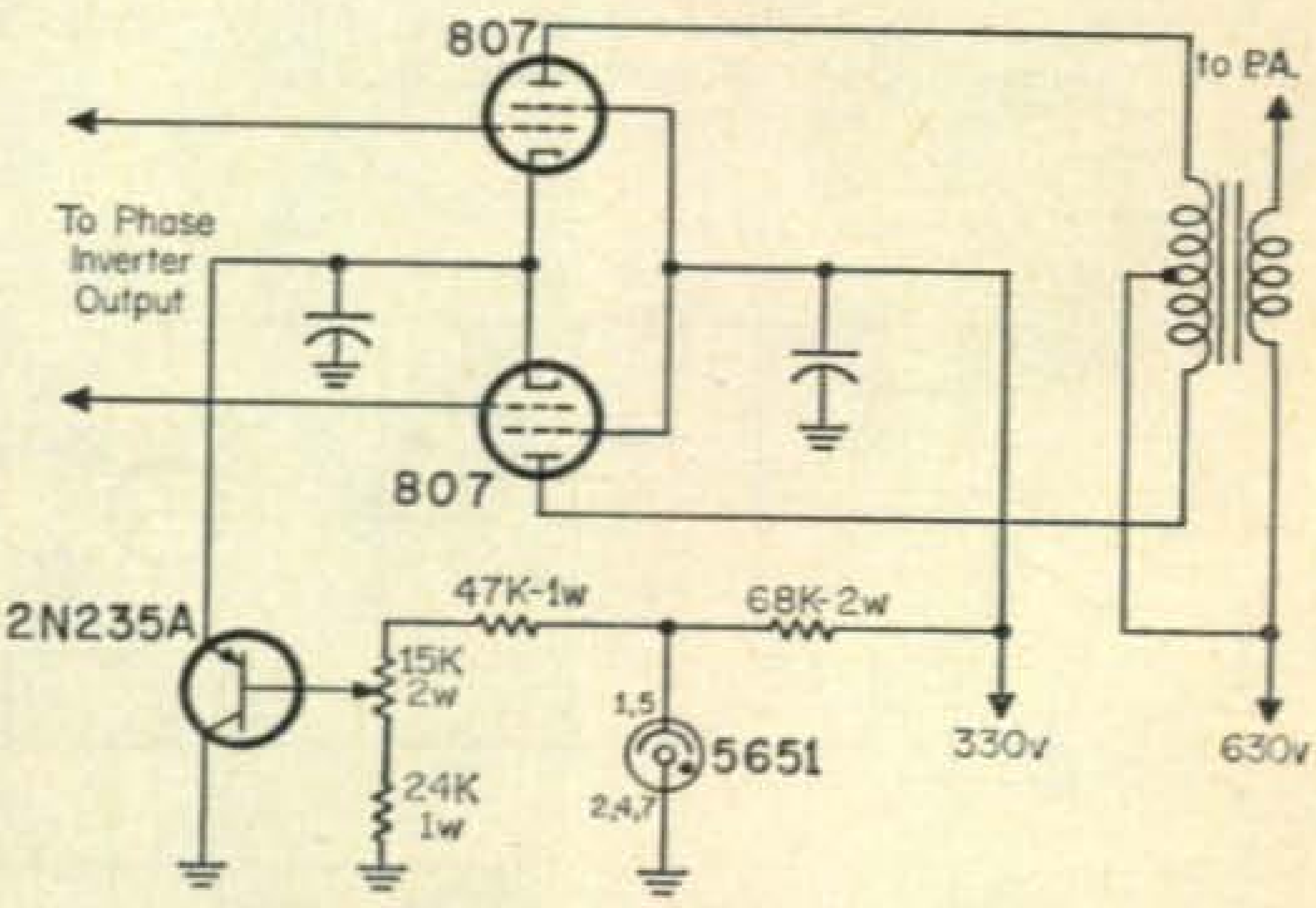


Fig. 4—Push-pull 807's are shown with a variable bias circuit. A Zener or a different regulator tube may be used with the necessary adjustment of the resistor values.

*22721 Eccles Avenue, Canoga Park, Calif.

Tattoo II, Automatic Station Control

RONALD C. GUNN*, WA6KLL

A simple device for semi-break-in operation featuring low voltages and low cost.

In every operator's life comes a time when the task of flipping a number of switches ranging from one to a half dozen to change the station from receive to transmit begins to detract from the pleasure of operating. For the c.w. operator especially it is desirable that a check on frequency be made occasionally to ascertain whether QRM has blocked your frequency, making the other operator wait helplessly until your remarks are complete only to return with "SRI, OM . . ."

Break-in operating alleviates the above conditions but is difficult to attain easily and usually requires a separate antenna for reception as antenna relays will not follow keying. To this end, therefore, it was decided to switch the author's station to semibreak-in operation where the station automatically returns to receive after a preset delay and goes to transmit whenever the key is depressed.

While in search of a station control unit to permit this type of operation a simple and effective unit was found.[1] This circuit employed a vacuum tube, a simple 120 volt supply and relatively expensive high impedance relays. It was decided to duplicate the functions of the original unit using a lower voltage, especially across the key; a transistor, and inexpensive surplus 24 volt, low impedance relays. The unit ended up with a maximum exposed voltage of 24 volts and the transformer, filters, and relays were obtained surplus at nominal cost.

The finished unit, as the original, permits a poor man's break-in by automatically turning the transmitter on, switching the antenna, and muting the receiver as the key is depressed, and holds this condition until a delay time, as selected on the front panel by the operator, has passed since the last character keyed. The delay can be set to drop out between characters, words, or complete transmissions as dictated by the station recovery time and the wishes of the operator, and a moment's pause is sufficient to check on frequency and listen for the other operator.

The name TATTOO has been preserved as "Transistor Automatic Transmitter Turner On-ner-Offer" and the unit retains the feature of being a complete station control, as substitution of a push-to-talk button for the key makes it a phone station control unit.

Construction was undertaken despite the inability of my wife to attribute such a project (to eliminate one switch on the rig) to anything but abject laziness.

Operation

When the key is closed on the first dot or dash, C_1 is charged thru CR_1. This causes a current flow from emitter to base of the transistor. As the transistor conducts, the resistance between the emitter and the grounded collector becomes virtually nil and the supply voltage appears across K_2, pulling it in. Relay K_1, which controls the keyed stage of the transmitter, follows the key directly since it is across the 24 volts.

When the key is opened C_1 begins to discharge through the R_1-R_2 bleeder combination and through the transistor emitter-base circuit. The latter is significant as it is the limiting factor on the time delay RC circuit and is the reason for the large size of C_1.

*358 Albatross Ave., Livermore, Calif.

[1] Campbell, L. E., "Tattoo-Automatic C. W. Transmitter Control", *QST*, August 1956, p. 18

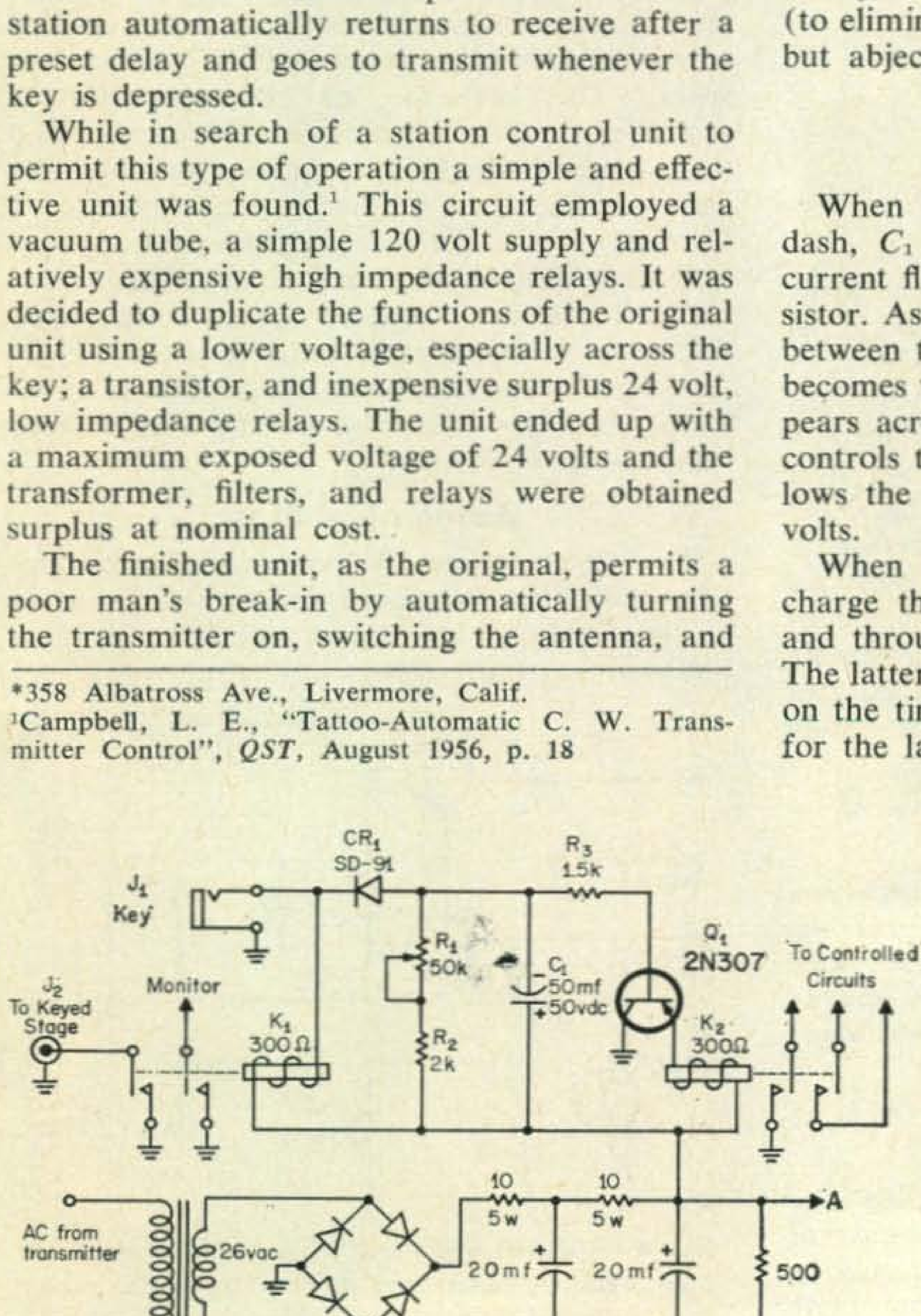


Fig. 1—Circuit of the semi-automatic break-in unit and its self contained power supply. The supply also energizes a monitor and with its ripple of about 10% can be very handy in the shack. Output is taken from point A.

As C_1 discharges, the drop across Q_1 increases from the very low value to a very high value and at about 1¼ time constants K_2 drops out.

If more than 2 seconds delay is desired the size of C_1 may be increased. Increasing the value of R_3 any significant amount will also effect a longer hold-in but causes a delay in turning on Q_1 which is undesirable. Resistor R_2 is incorporated to insure that the minimum setting of R_1 will not draw excessive current from the supply as the transmitter is keyed.

Normally, once one is accustomed to the unit, a delay of less than 1 second will be used by all but the newest operator, but there is always the time when slow keying is essential to get across to that marginal contact and the long delay in this case is really appreciated.

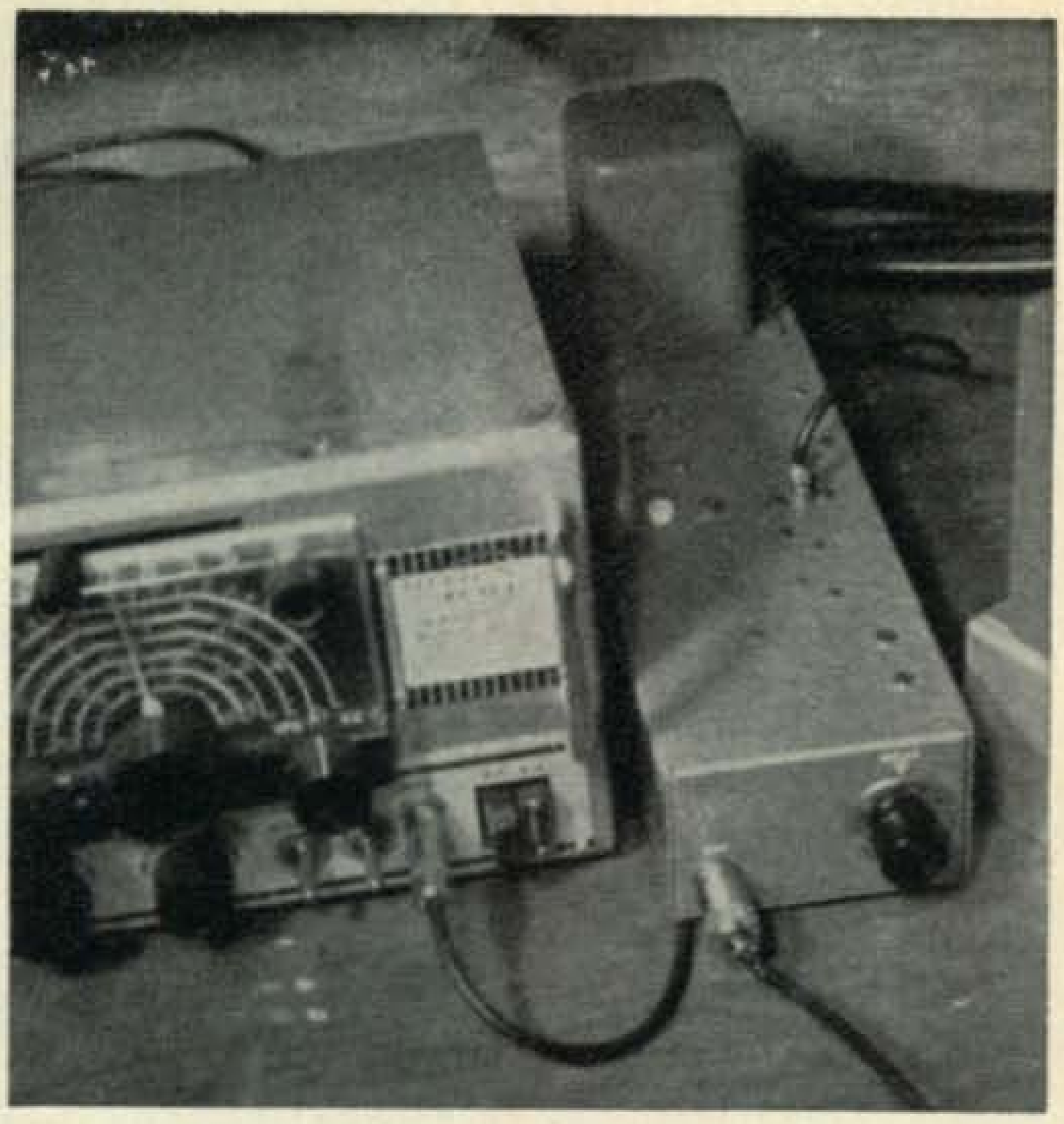
The Circuit

Any transformer delivering around 24 volts at 300 ma or more such as the Stancor RT-201 will do for power. The experimental circuit first used for the power supply was a half wave rectifier which worked satisfactorily. The ripple was a rather high 35 per cent. The bridge rectifier shown in fig. 1 was employed in the unit so that a purer d.c. would be available for other applications in the shack. A compromise supply (both in cost and ripple) might be a full wave if a tapped transformer is available.

Both relays used in the unit are from ARC-5 transmitters and were obtained surplus along with the transformer and filters for under $5. These relays have a d.c. coil resistance of 300 ohms and although any suitable 24 v.d.c. relay may be used, the change of current thru the relay produced by a different coil resistance will be reflected in the Q_1 emitter-base circuit and will change the delay time i.e.: a lower coil resistance may mean that C_1 must be increased in size somewhat. The change in C_1 will be inversely proportional to the change in coil resistance from 300 ohms.

A few different transistors were tried in the circuit and the 2N307 (I_{ce}= 1 amp) was finally settled upon since it costs a buck thirty-five and works (Hi). The 2N213 (I_{ce} = 100 ma costs about the same but overheats while the 2N277 (I_{ce}= 13 amp) works well and actually has a lower I_{eb} (which allows a smaller C_1) but costs in the neighborhood of $4.

To employ a suitable NPN transistor it is necessary only to reverse the polarity of all diodes and electrolytic capacitors in the circuit.



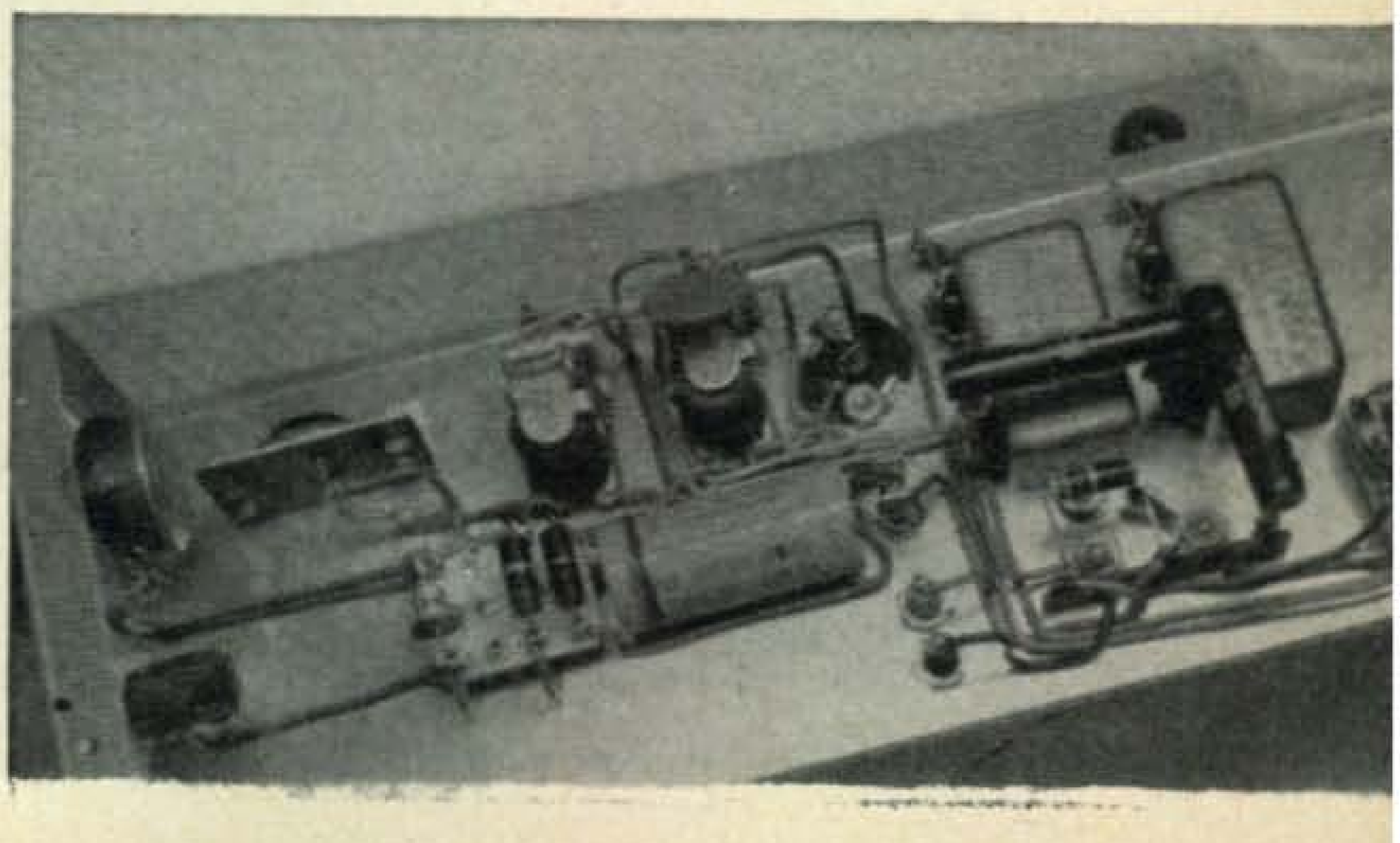
The unit in operation. Rear lead connects to transmitter key jack. The monitor is not shown.

Construction

The unit was built in a long narrow (2½×4×12) box to reduce the table width it would occupy and this has proven most satisfactory in practice. The power and transmitter control contacts were taken out through an octal plug to the power supply which is used in conjunction with the unit, and both are turned on together by the power supply switch. The keying relay contacts are taken out through a jack on the top of the chassis and run directly to the key jack on the transmitter thru a length of RG-58/U. The other set of contacts on the keying relay operate the monitor which receives its power from the 24V supply. If ARC-5 relays are used, the upper set of contacts are grounded on one side to the frame and care must be taken to insure that a permanent ground is not built into an otherwise intermittently grounded function. In particular, use the lower contacts of K_2 to operate the station switching functions unless a grounded contact is desired.

A terminal strip may be used instead of the octal plug if the functions indicated are not centrally located as in the author's unit. In particular, if a set of auxiliary contacts are available on the antenna switch these may be conveniently used to turn on the transmitter to prevent the

[*Continued on page 116*]



The time delay control (R_1) and key jack are mounted on the front panel. The transistor is mounted on the aluminum flange to the right of R_1. The collector, grounded to the case, should not be insulated. To the right of Q_1 are the two relays and to the right of the relays is the connector to the keyed stage of the transmitter. The jacks in front of the connector are for power to the monitor. The components to the right of the jacks form the power supply.

A Careful Look at S.S.B.

JAMES F. VAN DETTA,* WA2FQZ

The newcomer, particularly, will appreciate this mostly non-technical and slightly biased examination of the pros and cons of single sideband.

The tremendous increase in the number of amateurs, problem though it is, is but one jaw of a threatening vise. The opposite jaw of the vise that will soon snap shut (for the next few years) is the declining sunspot cycle. Minimum sunspot activity makes for generally poor propagation conditions, and we are now in a declining sunspot cycle that is expected to reach its minimum in the 1961-1963 period. In a sunspot minimum, of course, it is not unusual to find that the 40, 80 and 160 meter bands are the bands that are used most during the evening hours. It all adds up to a rather bleak picture, doesn't it? Well, have heart; there is a practical and an immediately available answer to this burgeoning problem: the single sideband mode of transmission!

The mere mention of s.s.b. sends some irrational a.m. men into an uncontrollable paroxysm of raging anger; therefore let me say, before we go any further, that a.m. has served amateur radio faithfully and well. It's just that a.m. has become an entity that amateur radio can no longer afford.

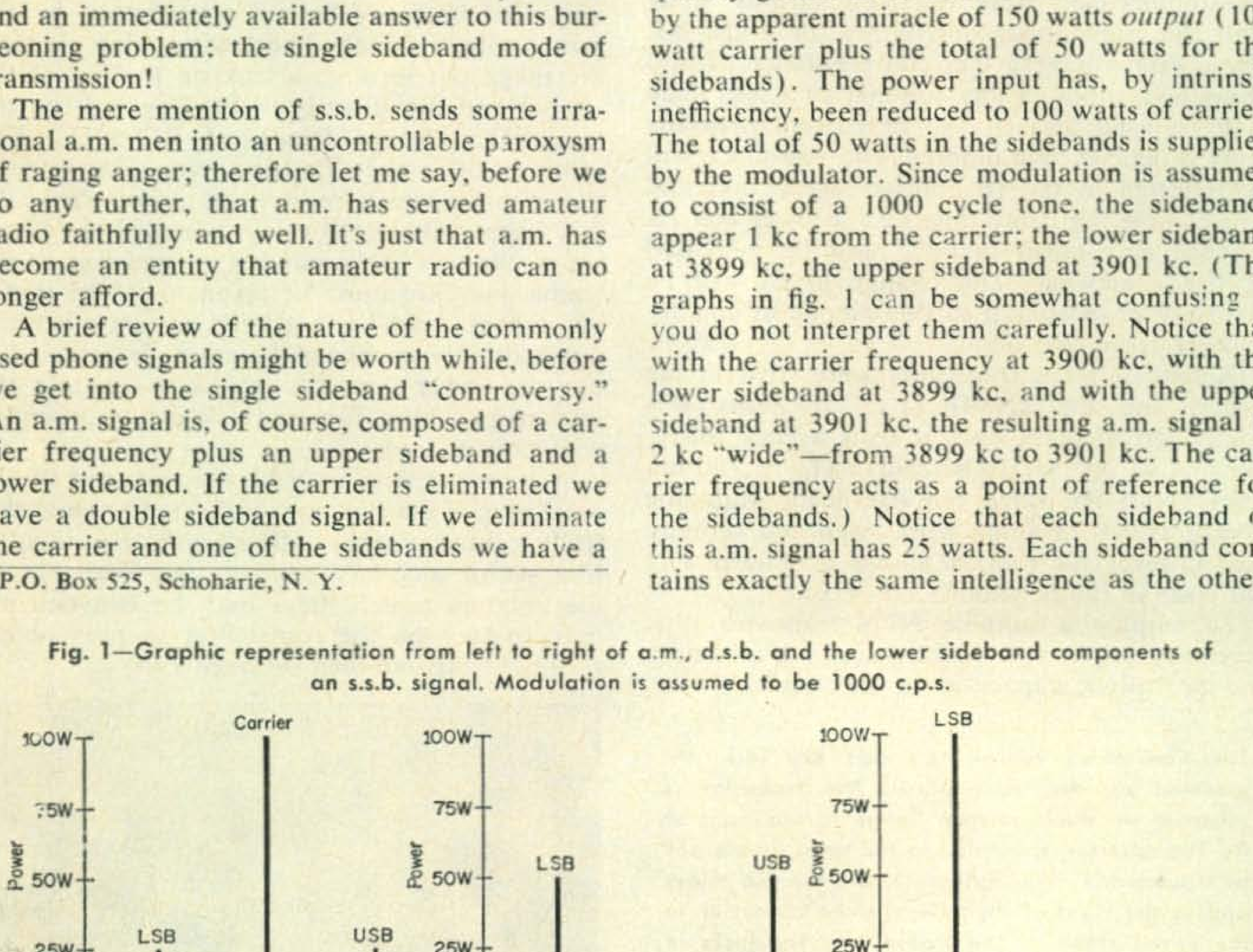
A brief review of the nature of the commonly used phone signals might be worth while, before we get into the single sideband "controversy." An a.m. signal is, of course, composed of a carrier frequency plus an upper sideband and a lower sideband. If the carrier is eliminated we have a double sideband signal. If we eliminate the carrier and one of the sidebands we have a single sideband signal. An s.s.b. signal can "bore a hole through" an a.m. signal. Why? Well, let's see.

*P.O. Box 525, Schoharie, N. Y.

Figure 1 shows the three different kinds of phone signals. A transmitter with somewhere around 130 to 140 watts of power input is assumed, for two reasons: 1) such power input is quite common on the bands and 2) even more important here, such an input would result in a carrier of about 100 watts—and 100 is such a nice round number to deal with.

Figure 1a shows an a.m. signal with its carrier frequency and both sidebands. As you quickly glance at it, don't be misled, of course, by the apparent miracle of 150 watts *output* (100 watt carrier plus the total of 50 watts for the sidebands). The power input has, by intrinsic inefficiency, been reduced to 100 watts of carrier. The total of 50 watts in the sidebands is supplied by the modulator. Since modulation is assumed to consist of a 1000 cycle tone, the sidebands appear 1 kc from the carrier; the lower sideband at 3899 kc, the upper sideband at 3901 kc. (The graphs in fig. 1 can be somewhat confusing if you do not interpret them carefully. Notice that with the carrier frequency at 3900 kc, with the lower sideband at 3899 kc, and with the upper sideband at 3901 kc, the resulting a.m. signal is 2 kc "wide"—from 3899 kc to 3901 kc. The carrier frequency acts as a point of reference for the sidebands.) Notice that each sideband of this a.m. signal has 25 watts. Each sideband contains exactly the same intelligence as the other;

Fig. 1—Graphic representation from left to right of a.m., d.s.b. and the lower sideband components of an s.s.b. signal. Modulation is assumed to be 1000 c.p.s.



they are "mirror images," so to speak, of each other. Sort of makes you hurt in the pit of your stomach, doesn't it?, as you look at fig. 1a and see that huge, useless carrier bar and then see those two little sideband bars that represent the intelligence.

Figure 1b shows a d.s.b. signal. The carrier has been eliminated. The amplifier of our transmitter can concentrate on amplifying the sidebands, since no carrier is present, so we now have doubled our effective talk power. We are now putting a total of 100 watts into the two sidebands. Quite an improvement, but even more improvement is possible.

Figure 1c shows an l.s.b. signal. You can see that this signal appears 1 kc below the carrier frequency, since modulation is assumed to be a 1000 cycle tone. The carrier has been eliminated and the u.s.b. has been suppressed. Our amplifier can now put its full output of 100 watts into the l.s.b.

By thoughtfully comparing fig. 1a with fig. 1c, one can conclude two highly significant facts about s.s.b.: 1) it increases the talk power of your signal, and 2) it requires only half the radio spectrum space of a.m.

The graphic representation in fig. 1c is really quite conservative. It shows a power increase of 4 times (over that of either sideband in fig. 1a). This is a 6 db gain. Actually, an a.m. transmitter, at peak power output (on voice peaks), must be capable of providing four times the carrier power. This is the p.e.p. (peak envelope power) that refers to voice peaks, as indicated on the modulation envelope pattern. Thus, in fig. 1c, our l.s.b. signal, on voice peaks, would have an output of 400 watts! Compared with one of the sidebands of the a.m. signal in fig. 1a, this is an increase of 8 times, which is a 9 db gain.

So let's compromise by saying that the exact gain experienced by anyone using s.s.b. is somewhere between a conservative 6 db gain (a power factor increase of 4) and a liberal 9 db gain (a power factor increase of 8). Please keep this fact in mind: that last statement is not subject to debate by the uninformed and the misinformed. The military and commercial services, by their adoption of s.s.b., have endorsed its superior efficiency and dependability for years. So, also, have some amateurs, of course.

The increased talk power that you get with s.s.b. is fine, but that's just an incidental bonus which the mode supplies. The most pertinent facet of the s.s.b. signal is its conservation of precious radio spectrum space on the bands. An a.m. signal requires about 6 kc of spectrum space —3 kc for the l.s.b. and 3 kc for the u.s.b. Obviously, an s.s.b. signal requires only 3 kc; so one communication channel is available on the l.s.b. and another communication channel is available on the u.s.b. Simply and undeniably, this means that by using the s.s.b. mode of transmission we double the available communications channels on the amateur phone bands. This fact is not subject to debate either.

In actual practice, it is possible to get even more than twice as many stations on the bands by using s.s.b. This is due to the nature of the s.s.b. signal. It has no carrier, and thus no annoying heterodynes are present. Stations can squeeze in closer and make more than twice as many communications channels available. Of course, the signals will not be hi-fi in quality! But you will be able to copy them. With crowded s.s.b. signals it's somewhat like being in a room full of talkative people, all of whom are chattering away. You can carry on a conversation with a person next to you with no great trouble, even though you are aware of the others talking in the background. You disregard the other conversations and you have no trouble at all in successfully carrying on your own. So, too, with crowded s.s.b. conditions. You can "hear" the conversations in the background, but you can still have your QSO.

Under similar a.m. conditions, it's like being in the same crowded room; but in this instance the room is teeming with a multitude of would-be operatic sopranos, screaming violently at the top of their lungs. You can't carry on a conversation under these conditions any more than you can carry on a QSO under crowded a.m. conditions with screaming heterodynes present.

Sideband Generation

Now that you are convinced of the superiority of the s.s.b. mode, let's consider the two basic methods of generating an s.s.b. signal—the filter method and the phasing method.

The filter method of generating an s.s.b. signal is exactly that; it employs sharp filters (crystal, *LC*, or mechanical) that pass one sideband and suppress the other. Since these filters work best at lower frequencies, the generated s.s.b. signal is heterodyned to the desired operating frequency. A balanced modulator is used to secure carrier suppression.

The phasing method of generating an s.s.b. signal is one in which the audio signal is split into two components with a phase difference of 90 degrees. The r.f. output is also split into two components with a phase difference of 90 degrees. Two balanced modulators are then used to a) suppress the carrier, b) suppress one sideband, and c) increase the magnitude of the remaining desired sideband.

Advocates of the filter method of sideband generation claim it is easier to adjust and retains its adjustment over a long period of time. Advocates of the phasing method answer that the phasing method requires no frequency conversion and suppression can be secured right on the operating frequency. The filter advocates retort that adjustment of the phasing method can be "tricky." Not if you take the time to become familiar with the theory of the phasing method, reply the phasing men. As a matter of record, not only are both methods used, even in commercial gear, but there are some instances where both methods are used in the same exciter —frequency conversion employed with the phasing method.

An adapter can be an economical and practical way to get on s.s.b. An adapter is a device that takes r.f. from your present a.m. transmitter and converts it to an s.s.b. signal. Since an adapter in no way detracts from the normal a.m. and c.w. capabilities of the transmitter, it is a simple matter to set up a switching arrangement that will permit an instantaneous selection of s.s.b., c.w., or a.m.

The d.s.b. signal that was previously discussed is sort of a hybrid, or in-between-mode. Like a.m., it has both sidebands; but like s.s.b., it has no carrier (a balanced modulator is used to suppress the carrier). It is a rather easy and inexpensive matter to convert an a.m. rig to d.s.b.; and while it does give you an opportunity to generate more talk power and eliminate heterodynes, it will *not* help alleviate the crowded band conditions, for, as we observed in fig. 1b, a d.s.b. signal occupies the same spectrum space as an a.m. signal.

Why The Arguments

"Why is it, you ask, that s.s.b. is such an anathema to some am phone men?"

To *some* a.m. men, the mythical complexity of s.s.b. theory presents a psychological block that is a mental attitude rather than an absolute fact. This peculiar attitude quite possibly came about in past years, when critical commercial components were not available at reasonable prices; no highly stable crystals, no sharp filters, no audio phase-shift networks. However it may have originated, this attitude constitutes a very prevalent and a very unfortunate misconception. S.s.b. theory is not more difficult or more complex than a.m., it's just a little different.

Some a.m. men detest s.s.b. because of a heart-felt devotion to a.m. This sentimental attachment is firmly welded with a bond of toil, sweat, tears and time. It is not easily broken—not even with facts!

Financial reasons cause some a.m. men to dislike s.s.b.; these are of two types. The first is composed of those who would like to go s.s.b. but don't have the money immediately available. Since they must operate a.m. phone, they think the wisest way to maintain an active log is to feign sympathy with the mumbo jumbo directed against s.s.b. The second type is composed of those who have a considerable, hard-earned investment in a.m. equipment.

Fantastic though it seems, some a.m. men dislike s.s.b. because it deprives them of their captive audience via b.c.i. It makes them feel twelve feet tall to be met on the way to work by a pleasant neighbor who gleefully remarks, "Last night, I turned on the radio to listen to the news on WXX; and then, all of a sudden, I heard you talking to some guy in the Sultanate of Yalldippi!" (Non-blasphemous b.c.i. neighbors like this *do* exist.)

"Yeah," is the reply with strained modesty, "I talk to that guy quite often—*he's the Sultan himself!*"

Some a.m. men know next to nothing about s.s.b., except that (they grudgingly admit) it does exist. Since they are so utterly uninformed about the mode, they find condemnation a welcome refuge, a convenient substitute for knowledge.

A small percentage of a.m. men express an uncompromising dislike for s.s.b. because they are plain contrary. These uncompromising fellows are perennial opposers. They are opposed to DX'ing, opposed to CQ'ing, opposed to QSL'ing, opposed to rag-chewing, opposed to QSY'ing, opposed to c.w., opposed to UFO's, opposed to phonetics, etc., etc.—about the only thing they do not oppose is their right to oppose!

Many of those who express the most dislike of s.s.b. have never heard a good s.s.b. signal. To receive s.s.b., one must have a highly stable, selective receiver; many a.m. receivers fail to measure up to the task where s.s.b. is concerned. The carrier that was suppressed must be reinserted at the receiver. This can be done with an external oscillator. Your transmitter v.f.o. may be used; or you may use the b.f.o. of the receiver.

Tuning Sideband

If your receiver has a sideband selector, keep in mind that it is customary (but, of course, not obligatory) to use u.s.b. on the higher frequencies (10, 15, and 20 meters) and to use l.s.b. on the lower frequencies (40 and 75 meters).

The general procedure is to tune the s.s.b. signal for maximum S meter indication. The r.f. gain is reduced and the audio gain is increased. With the a.v.c. off *and the b.f.o. on,* the pitch control is v-e-r-y s-l-o-w-l-y tuned until proper speech is attained. Tuning in an s.s.b. signal is a somewhat more critical matter than tuning in an a.m. signal. However, proficiency comes quickly with a little practice. A d.s.b. signal is tuned in a manner similar to s.s.b., although the presence of both sidebands may make tuning a little more tedious.

In the interest of a fair presentation, there is one rather obvious disadvantage of s.s.b. that should be mentioned. The mode is so very efficient and so very effective that you will need an absolute minimum of repetition and phonetics; therefore, you may run out of rag-chew material sooner than you would on a.m. You won't have to request repeats of repeats and devise clever phonetics to get across such a moderate bit of intelligence as your handle or your QTH. If this fabulous efficiency frightens you, you can always shut off the VOX, switch over to "manual control" and make like a.m. thus circumventing the rapid-fire, telephone-type conversation that is synonymous with s.s.b.

No attempt has been made here to provide a definitive-type technical treatise on s.s.b. No consideration has been given to product detectors with exalted-carrier injection, noise limiters,

[*Continued on page 108*]

Converting The Globe "Pocketphone" To Ten Meters

DONALD L. STONER*, W6TNS

Eleven meters was lost several years ago. One small compensation however, is the CB equipment mass produced at low cost and available for modification to 6 or 10 meters. Typical of these is the Globe "Pocketphone" modified here.

SEVERAL years ago the radio amateur fraternity was forced to evacuate the 11 meter band to make room for the stampeding hoards of Citizens Band stations. All has not been lost, however. The rapid acceptance of this new service by the American public has resulted in a flood of beautiful QRP equipment which can be easily modified for use on the amateur 10 and 6 meter bands. The equipment and the materials for conversion are very inexpensive.

Of particular interest are the new hand-held transceivers designed to comply with Part 15 of the F.C.C. regulations. This section of the rules (Subpart E, Section 15.205) specifies that the power input to the transmitter be less than 100 milliwatts (0.1 watts), the antenna be less than 5 feet in length, and the output frequency be confined to the band between 26.97 and 27.27 mc. This type of equipment may be easily modified to work on the 10 meter band for Civilian Defense, transmitter hunts, antenna testing and similar activities.

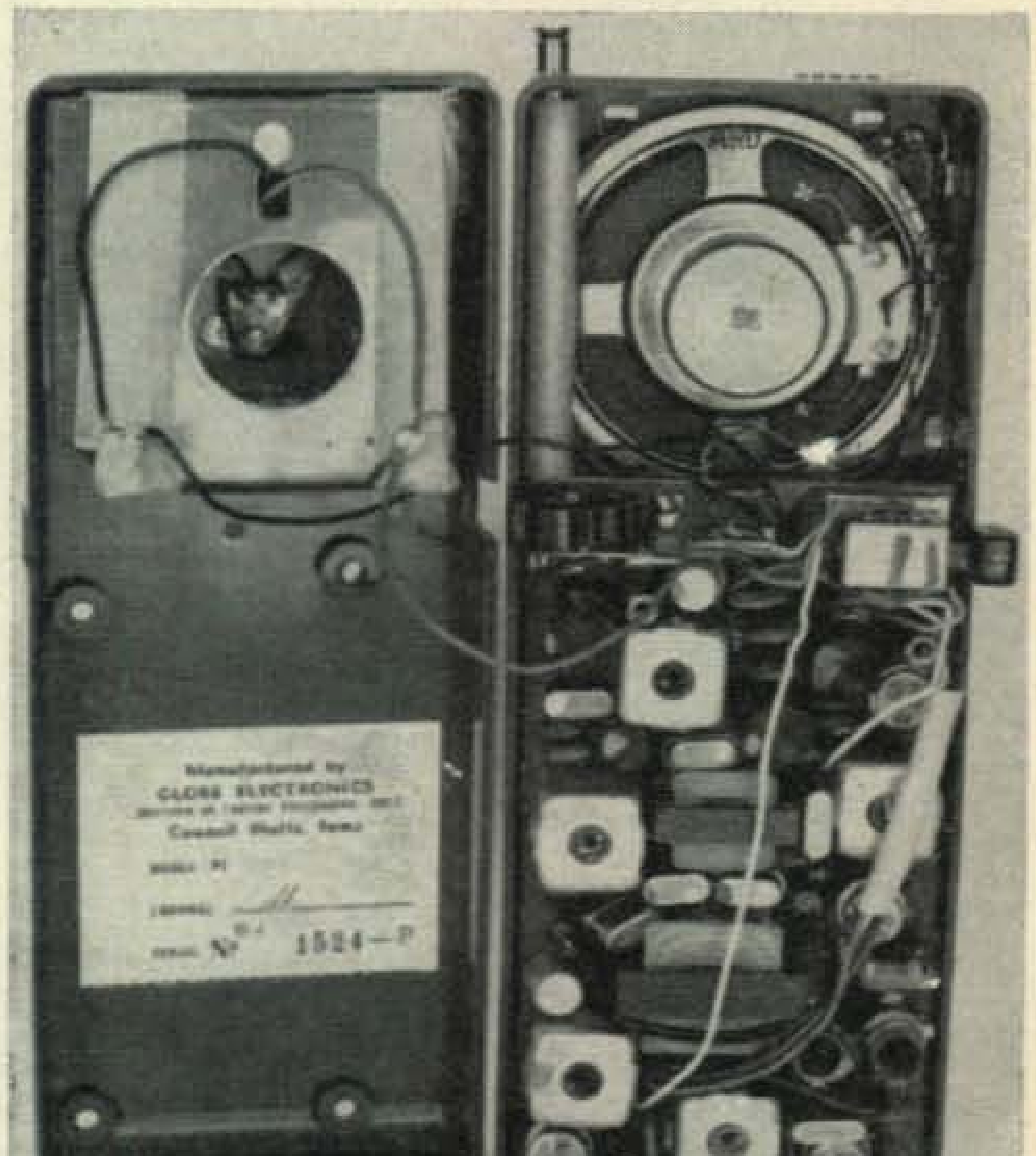
One of the first, and finest, QRP hand-held stations is the Globe "PocketPhone", manufactured by Globe Electronics, Council Bluffs, Iowa. The "PocketPhone" is a nine transistor transceiver consisting of a crystal controlled superheterodyne receiver. Several unique features, in addition to its small size (6½ × 2½ × 1½") have been incorporated to provide economical and reliable operation. Let's take a look at the schematic and then see how easy it is to convert the unit to 10 meters.

*Alta Loma, California

Circuitry

An SO-65 transistor, Q_4, operated in a common emitter configuration, is used as the receiver converter. Automatic bias is set by the 68K resistor (in T_4 can) and the amount of oscillator injection applied to the emitter through the secondary winding of T_3. The received signal is inductively coupled to the base of Q_4 through transformer T_2. A.g.c. is also applied through this winding. The base end of T_2 is bypassed, during transmit, by C_{18} through C_{22}. Capacitor C_{10} places the primary of T_4 at r.f. ground.

The local oscillator is crystal controlled to provide stable operation. An R-425 transistor, Q_3, is used in a circuit similar to that of the transmitter. Base bias is set by the voltage divider network R_5 and R_6. The oscillator coil,



Inside view of the Globe "PocketPhone" showing the various components mentioned in the text. The rechargeable batteries are in the plastic box at the top of the rear cover. The receiver crystal is located in the lower right and the transmitter crystal, center right.

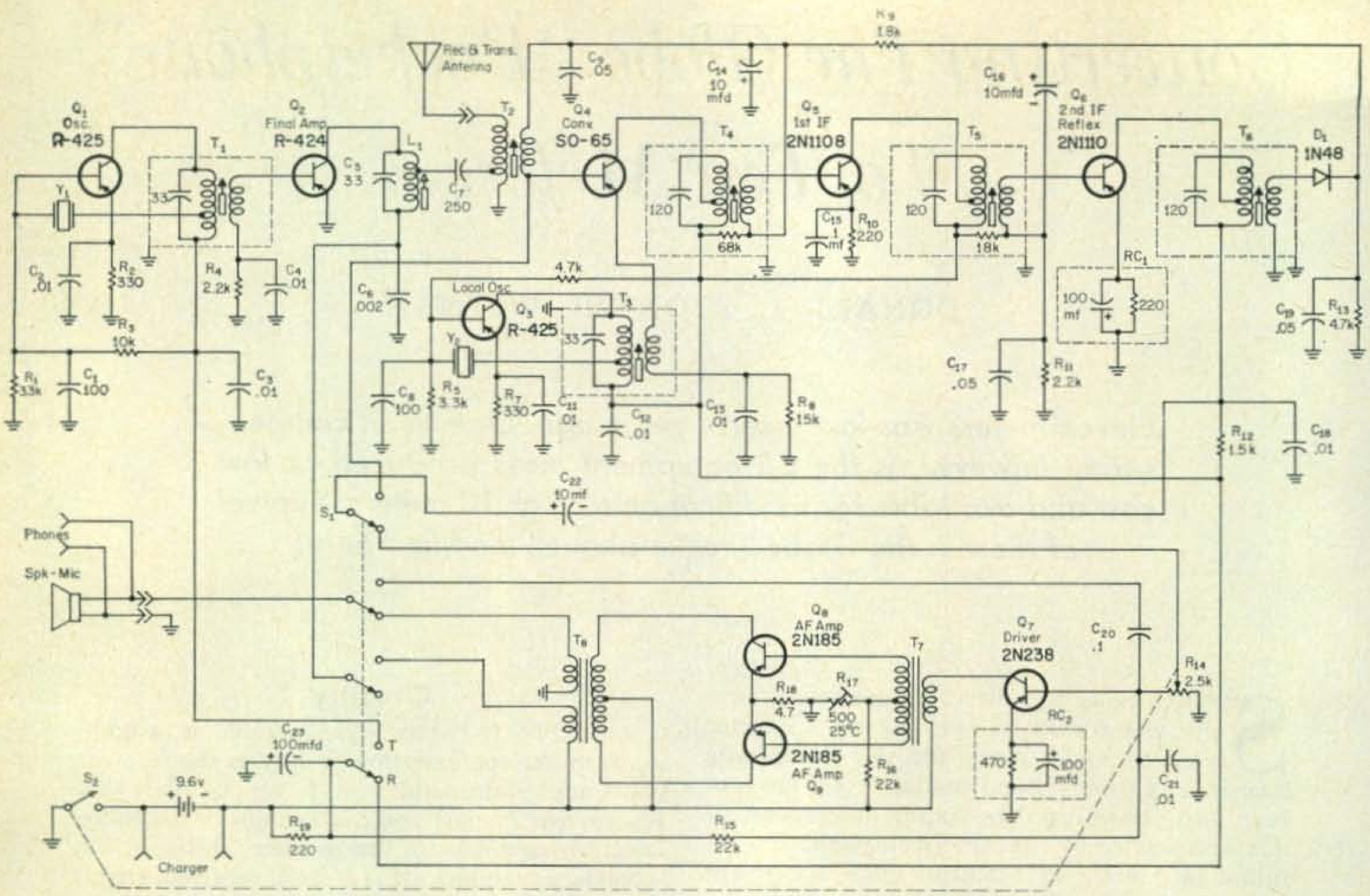


Fig. 1—Schematic of the Globe "PocketPhone". Transistor Q_6 is a reflex amplifier and serves as the last i.f. and first audio simultaneously.

T_3, is tuned to the third overtone of the crystal with feedback occurring between collector and base. The collector voltage is applied only during receive periods. The receiver oscillator operates at 455 kc below the transmitter frequency.

A 2N1108 transistor, Q_5, is used as the 1st i.f. amplifier. This stage is operated common emitter at 455 kc. Base bias is set by the 68K resistor in the secondary circuit of T_4. A.g.c. is also applied through this winding to the base of Q_5. Collector voltage is applied when S_1 is in the receive position.

The 2nd i.f. is a reflex stage and uses a 2N1110 transistor, Q_6, operated common emitter. Base bias is set by the voltage divider network (18K in T_5 and R_{11}). The d.c. operating point of the emitter is set by the 220 ohm resistor in RC-1. Due to the fact that this stage amplifies the i.f. and audio frequencies, the emitter bypass is larger than normally used in a straight i.f. amplifier. The i.f. signal is amplified by Q_6, then coupled to CR_1 through transformer T_6. The detected audio signal is developed across R_{13}. Capacitor C_{19} bypasses the 455 kc portion of the signal to ground. The audio signal is then reapplied to the base of Q_6 through C_{16} and the secondary winding of T_5. The audio output signal is developed across R_{12} which is bypassed for i.f. by C_{18}, and capacitively coupled to the audio driver stage Q_7 through C_{22}.

The audio circuit consists of a 2N238 driving a pair of 2N185's in push-pull Class B. This circuit serves as both the receiver audio amplifier and the transmitter modulator, through the dual secondary transformer T_8. A section of the switch connects the speaker/microphone between the input and output of the amplifier.

The transmitter oscillator section uses an R-425 (Q_1) in a common emitter circuit. This transistor is the same as the SO-65, but is especially typed for oscillator service at 27 mc. The transmitter oscillator is switched off when receiving. Base bias is set by the voltage divider network R_1 and R_3. The tap on T_1, in conjunction with C_1, provides the correct phase angle feedback required to sustain oscillation within the Citizens Band frequencies. Resistor R_2 sets the d.c. operating point of the emitter and C_2 provides an r.f. ground. Coil T_1 is tuned to the third overtone of the crystal.

The final amplifier uses an R-424 transistor, Q_2, which is an SO-65 specially typed for amplifier service. Base bias is set by R_4 and drive from the oscillator. Modulation and the collector voltage is applied to the bottom of the final amplifier tank coil (L_1) through switch S_1. The transmitter output is coupled to the antenna loading coil, T_2, through capacitor C_7.

Modification

The only items required to convert the Globe "PocketPhone" to ten meters are the receiver and transmitter crystals. These are International Crystals, type FM-9, third overtone cut. Determine the frequency you wish to operate on and

[*continued on page* 110]

Some Thoughts On Reciprocal Licensing

CHARLES J. SCHAUERS,* W4VZO

IN THIS jet-electronic age, the world has been made "smaller" than ever before. Continents are now only a few hours apart by air and a micro-second by radio. Little wonder then, that no country can really consider itself isolated from its earth neighbors!

Today's era is a scientific one, and there can be no doubt that the future and well-being of any nation will depend in large part on how much energy is devoted to taking advantage of scientific progress.

With but few exceptions, the hobby of amateur radio is encouraged by most governments; for it is realized that the ham radio operator is much more than just a hobbyist—he is a *national technical asset!* No country realizes this more than the United States. For, if it were not for the trained pool of radio amateurs during World War II we would have been hard-pressed to find the communicators so sorely needed by our Armed Forces.

Seldom do we read a newspaper that we do not find some mention relative to the need for "people to people" action, student exchange programs and the cultivation of international friendship; but how much do we read concerning the activities of radio amateurs who, through their operating activities are actually conversing and creating good-will with the citizens of nearly every country of the world? Very little!

Amateur radio is a powerful voice that has not been given its *due!* It is too often looked upon by the *uninformed* as a "sparetime killer" devoid of any real significance—nothing could be farther from the truth!

Anytime that one country's citizens can converse with another's, there is an exchange of technical information; of heartfelt greetings; of sincere concern for the welfare of a fellow hobbyist. How better can international relations be cemented other than by a personal face-to-face visit?

As time goes on, more and more Americans will be traveling all over the world, and among them will be many radio amateurs. The same will hold true for the people of other nations, many of whom will come to America.

America today has the largest number of radio amateurs on the globe, and their technical achievements are second to none. No other country can make this boast! So it is only natural that we are concerned with reciprocal licensing.

What Is Reciprocal Licensing?

Reciprocal licensing means that the duly licensed hams of one country can operate in another—including the United States.

What are some of the arguments advanced against reciprocal licensing? Well, in my opinion, all that I have heard are absolutely *groundless!*

Let's discuss a few of the arguments and show how hollow they really are.

Security: Ah yes, this has been a "big" one. This "argument" goes like this: "well, what is to prevent some foreign amateur from transmitting important espionage information?"

Counter-argument: yes, and what is to prevent them from using *safer* channels? This applies to the non-ham or "casual" visitor too. Who is so dumb to think that a foreign visitor (not a ham) can not walk into any radio store, buy a transmitter and receiver, and operate it *outside* the ham-bands for espionage purposes This is a *free country* and no demand for identification is placed on a buyer of radio equipment. Furthermore, no spy would take the chance in transmitting espionage information on the ham-bands—there are too many people listening. Any deviation from authorized practices would surely be investigated immediately. Our FCC monitoring service is an effective service, contrary to what anyone thinks; and it need not be bolstered to handle the estimated 100 stations per year that would result if reciprocal licensing is instituted!

Remember this: there will be *more* American amateurs operating in other countries than foreign amateurs in the United States! Statistics do not lie!

Cost: Any ham who can travel to a foreign land can certainly afford the equivalent of $10.00. This money would be used for administering the processing of applications, etc. This *is* the weakest "argument."

Regulations: "Well, how can we license a foreign operator when he does not know our regulations?" What is to prevent each country participating in the program issuing a set of regulations in the language of the applicant? *Nothing!*

Please remember, that there are *more* foreign amateurs who speak English than American amateurs who speak languages other than their own!!

"Hams in other countries will resent the intrusion of American hams!" This statement is "hog-wash" —pure and simple! Why? Because radio amateurs the world over *are* for reciprocity. To prove this point, I have traveled in nearly every European country and have talked to local radio amateurs. They tell me that they would be happy to have American radio amateurs operate in their domain. This is especially true in Spain and the Scandinavian countries!

There are few other arguments that "hold water."

c/o *CQ*, 300 W 43rd St., New York 36, N.Y.

"What about Communist country participation?"

Well, I am inclined to think that most Communist countries would, because their ideology caters to the State instead of the citizen, veto any participation.

Ham operators in most Communist countries are very strictly controlled and will seldom discuss anything outside of the weather, equipment and QSL cards. However, I have talked to many hams in Communist countries who no doubt said more than they should have. But we must be fair and honest about the situation: sometimes the language barrier prevents long QSOs.

We should remember that the ham-bands are not made available for discussion envolving international politics, religious beliefs or any other controversial subject. But as pointed out in the fine editorial in the October 1960 *CQ*, we must not be afraid to speak the truth when "challenged" and we must make certain that we have the *facts*.

Most foreign amateurs do not realize that the American amateur can criticize anything American (including the President and other governmental officials) over the air without the slightest fear of punishment. Our speech is *free*, but we must respect the regulations governing hams in other countries of the world.

What Is Accomplished by Reciprocal Licensing?

First and foremost reciprocal licensing enables the dissemination of technical information about our hobby. It allows visiting amateurs a chance to keep in touch with loved ones at home and tell them about the fine and good points of the country being visited. (No ham, given operating privileges in a foreign country, would be fool enough to insult his host by talking about a country's bad points — remember, there is *no* country in the world that is 100% perfect! If there were, we would have angels for street-car conductors!)

The next benefit derived, is being able to contact more hams in any particular country and to visit their homes. (Most hams will invite foreign hams to visit them.)

A real "people to people program"? This is it!

The end-effects of reciprocal licensing are inestimable! The goodwill created, overshadows any bureaucratic objections and makes it plain to the world that the radio amateur is indeed an ambassador extraordinary!

Today, there are some countries where U.S. Forces are stationed that have granted operation privileges to U.S. hams, without the benefit of reciprocation. This is indeed, "paying off" in better understanding, goodwill and the exchange of technical information.

Every time an American amateur talks with the U. S. he is in effect "advertising" the country in which he is operating. I know for a fact that many tourist visits were encouraged by American amateurs operating on foreign soil.

What is the proper way to approach the granting of reciprocal operating privileges? Well, my personal idea (for Americans) is to approach your Congressman. You might even send him a copy of this article. For foreigners, stress the need for technical perfection, the real value of the radio amateur in terms of *National need* and international friendship.

You, who belong to the U. S. Forces stationed in lands which do not permit foreign amateur operation, should organize a joint radio club. Remember that every country has the power to grant operational privileges to foreign amateur operators of any other country, without having the sanction of the country to which the amateurs belong.

Reciprocal privileges cannot come about by "crying" against "unfair" treatment or governmental red tape. By actually showing the benefits derived (to the proper officials), reciprocity can be realized.

Controls

Controls are necessary, but we must not forget that the amateurs in a particular country are their best *monitors!* This is especially true in America where many of our amateurs speak more than one language.

Duplicate logs of course would be kept. One set would be for the operator's file and the other would be sent to the FCC or other regulatory body.

Applications would be made a month in advance and properly authenticated by a country's governing agency. As long as one has a duly authorized amateur radio license and has not been convicted of any crime, the requirements could be made very simple.

The $10.00 (or equivalent) license fee would cover operation for a one year period and could not be pro-rated. DX-peditions would still have to pay the $10.00 even for three days operation—this is only fair.

A Word About Tariffs

We all know that *some* countries require that radio amateurs pay a very stiff tariff on imported radio gear—this is absolutely foolish when one considers that ham equipment is for private use and benefits a country by enabling *self-training*.

In one very modern country, an American radio receiver costs the amateur about $200.00 more than it does in America. Perhaps a country does have the right to "protect" its manufacturers, but when that country produces little or no gear specifically for the amateur, it appears to me that those who want the tariff are in effect "cutting off their nose to spite their face."

Let us hams carry on then, and work for reciprocity and in the very process, contribute to world peace! Our voices cover the world!

While our diplomats are arguing at their conference tables, let us, who have direct contact with each other, build up our friendships, help each other technically and strive for better understanding and a world that knows peace with justice!

The opinions and statements herein are the writers and do not reflect passive or active endorsement by any governmental or civilian agency. However, those who deny the role that amateur radio can play for world good are in the minority and should be tolerantly excused—they are the uninformed. ■

The Second OSCAR Flyover

BY JEAN A. GMELIN,* W6ZRJ

AMATEUR capability in tracking the OSCAR, Orbiting Satellite Carrying Amateur Radio, was tested on April 9 when the beacon transmitter was flown around the San Francisco Bay Area in a "flyover" test. This test was highly successful, and to extend the tracking testing to more amateurs, the OSCAR package was flown in a second "flyover" from the San Francisco area, to the Los Angeles area and return.

The test was held on July 9 and *over 200 tracking reports* were received by the OSCAR group. The aircraft, a Cessna 190, was flown by Hugh McLean, K6SPK and Charles Metz, WA6LYZ. The plane contained a Communicator for ground communications purposes operating under the call WA6GFY (Lockheed Amateur Radio Club).

The communications aspects of the flight, under direction of Tom Lott, VE2AGF/W6, OSCAR director of Communications and Jean A. (Doc) Gmelin, W6ZRJ, alternate director, was split into two main areas, the communications to the aircraft and the traffic communications network to handle OSCAR reports sent direct by amateur radio.

In charge of the aircraft communications was Ed Peterson, WA6EIC, who acted as main communications control and who was in contact directly with the aircraft until it was over 150 miles south of the San José area. The aircraft communications was then turned over to K6OZL in Hanford and W6KGC in the Los Angeles area and check point information was relayed via a 75 meter link, part of the traffic communications system. In the San Diego area, K6BPI was ground communications control.

WA6EIC was in operation from 0757 when the plane off from San José California, until after 1557 when the OSCAR aircraft returned.

Ed was in operation from WA6EIC on 147.11 mc to the aircraft, and on 3.5 and 7.0 mc s.s.b. and c.w. throughout the operation.

In charge of the communications systems were Hal Whitfield, WA6HVN in charge of phone nets, and Lloyd Craford, K6KCB in charge of NTS and c.w. net operations.

On receiving information about the proposed flyover from W6ZRJ on July 2, both stations put general QSTs on all nets announcing the flight. When the final information on times and flight plans was received from the flover group on July 6, a second series of QSTs was sent giving frequencies, times and communications channels to be used. The OSCAR flover group requested that the communications team also supply stations for check points throughout all major areas of the flight. Amateurs throughout the State volunteered to act as area net controls to work under WA6HVN and WA6EIC. Stations which were selected operated on both 75 and 2 meters.

In order to extend the coverage of the main control in San José, a portable station, WA6-MGZ was set up on Black Mountain, near San José, to act as 2 meter relay for WA6EIC. When conditions made it difficult to maintain contact on 2 meters or to contact the Los Angeles area direct on 75 meters, W6AVZ at Idria, near the half-way point came on the 75 meter channel and acted as relay. K6OZL in Hanford, with the help of K6DYM and WA6IAY, also did good relay service on 75 according to WA6HVN.

W6KGC, the Los Angeles area NCS came in on schedule and with W6WOU also in Los Angeles, made contact with the plane on 2 meters and with WA6HVN on 3854 kc. They made progress reports and position reports as needed. These reports were relayed to WA6IEC on two meters, who kept a ground map record of the progress of the aircraft.

K6BPI, Point Loma (San Diego area NCS) and K6IQ, alternate NCS in Santa Ana also came in on schedule and did outstanding service in keeping the ground control in San José in contact with the aircraft via 75 meter relay. The plane landed at Long Beach airport at 1125 PDST for lunch.

A minor flurry occurred at the scheduled departure time of 1300, with no plane, no OSCAR signal and no relays. A few anxious moments extended until 1350 when W6WOU and W6KGC came back in and informed us that the aircraft was an hour late in taking off, according to WA6HVN.

W6KGC and W6WOU maintained contact with the plane and the OSCAR signal until it was 50 miles north of the Santa Barbara area. Contact was picked up by WA6EIC, directly 3 miles north of Hollister and was maintained until the aircraft landed at San José.

Traffic of OSCAR reports from the San Francisco Bay Area came, in great part, direct to the OSCAR group and some of this traffic was handled on the San José CD Net frequency with WA6HNE as control. While the c.w. nets did fine service in QST information and in

[*Continued on page 108*]

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A Neon Lamp A. C. Regulator

WILLIAM L. NORTH,* W4GEB

Line voltage fluctuations, resulting in receiver drift, were effectively cancelled by an a.c. voltage regulator using an inexpensive neon lamp.

EVER since the purchase of an HQ-160, over two years ago, a particularly aggravating problem of frequency drift with line voltage changes has made the reception of c.w. or s.s.b. very difficult and has required constant retuning.

Line voltage changes in the order of four or five percent are quite common at this location and it was found that changes of this order of magnitude caused the receiver to drift in frequency by about 300 cycles in the 3.5 mc band. This drift was proportionally higher on the higher frequency bands and amounted to about 2 kc in the 10 meter band. The problem was further aggravated due to the fact that a 1600 watt electric heater in the shack was on the same power circuit as the receiver and in the wintertime this heater, controlled by a thermostat, caused a line voltage variation in the order of five or six volts from the normal 115 volts.

An investigation of the problem revealed that it took the receiver approximately 30 seconds to stabilize after a 5% drop in line voltage. Returning the line voltage to normal caused the receiver to drift back to its original frequency in a period of about 15 seconds after which time it remained stable if the line voltage remained constant.

A BC-348 receiver was used to monitor the oscillator frequency of the HQ-160 and it was found that the frequency did not change with line voltage changes when the 6BE6 mixer tube was removed from the socket. This pointed to the mixer heater voltage variation as causing "pulling" of the oscillator.

By using a small 6.3 volt filament transformer as an independent heater supply for the mixer and by varying its heater voltage by means of an autotransformer, it was confirmed that the frequency drift was occurring primarily in this portion of the receiver. Apparently only a small change in the heater supply voltage causes a substantial change in the oscillator loading for this particular oscillator circuit. Substitution of several other 6C4 oscillator and 6BE6 mixer tubes failed to remedy the trouble. The oscillator tube socket was even rewired to take a 6AG5, a 6BA6 and 6AU6, but all of these tubes exhibited the same drift problem when coupled to the mixer.

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A.C. Regulation

A consideration of the characteristics of a three watt, type NE-42 neon lamp led to the belief that one might be used as an a.c. voltage regulator, so a breadboard setup was constructed as shown in fig. 1.

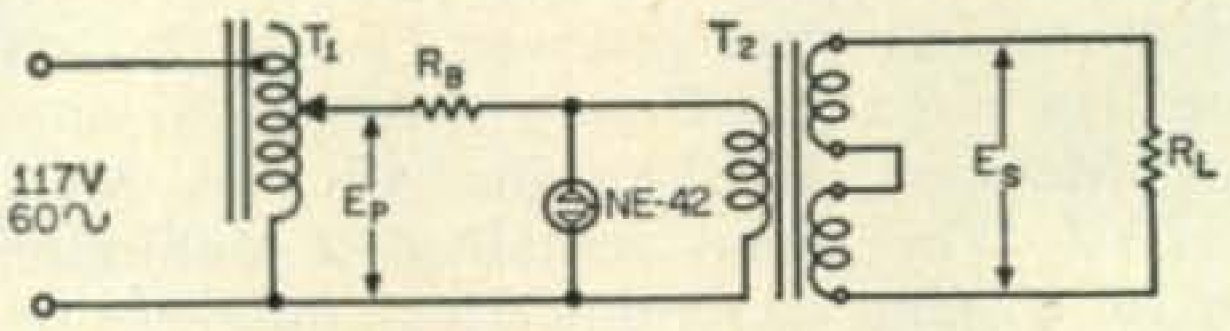

Fig. 1—Test set-up used to determine the regulating abilities of the NE-42. A ballast of 500 ohms (R_b) was satisfactory for the control of the 6BE6 filament. transformer T_1 is a Variac and T_2 is a 117 to 12.6 volt filament transformer.

Several values of ballasts were tried, and a resulting value of 500 ohms was determined, by experiment, to be satisfactory for the solution of this particular problem. If more load is placed on the secondary or if line voltages much lower than 106 volts are experienced, the resistance needs to be lowered. If less load is placed on the secondary, the resistance may be raised. However, the value of 500 ohms was found satisfactory for controlling secondary loads from 150 to 450 ma over the line voltage range of 106-120 volts.

Circuit Modification

The receiver modification consists simply of disconnecting the 6BE6 mixer heater circuit from the rest of the receiver and installing the regulator parts in a convenient location. In the case of the HQ-160, the additional 12.6 volt filament transformer is mounted on the end and underneath the chassis near the front panel. The NE-42 neon lamp and dropping resistor are mounted on top of the chassis between the b.f.o. can and the power transformer.

The results of this modification have been most gratifying. Line voltage changes of plus or minus 10% now cause only slight changes in frequency and no longer is it necessary to keep one hand on the bandspread or b.f.o. knobs.

Further Experiments

Since it appeared that this type of circuit might be useful for other a.c. regulation applications, a test setup indentical to fig. 1 was hooked up on the workbench and an investigation of practical systems was made. The results of these tests are shown in graphic form in fig. 2. It will be noted

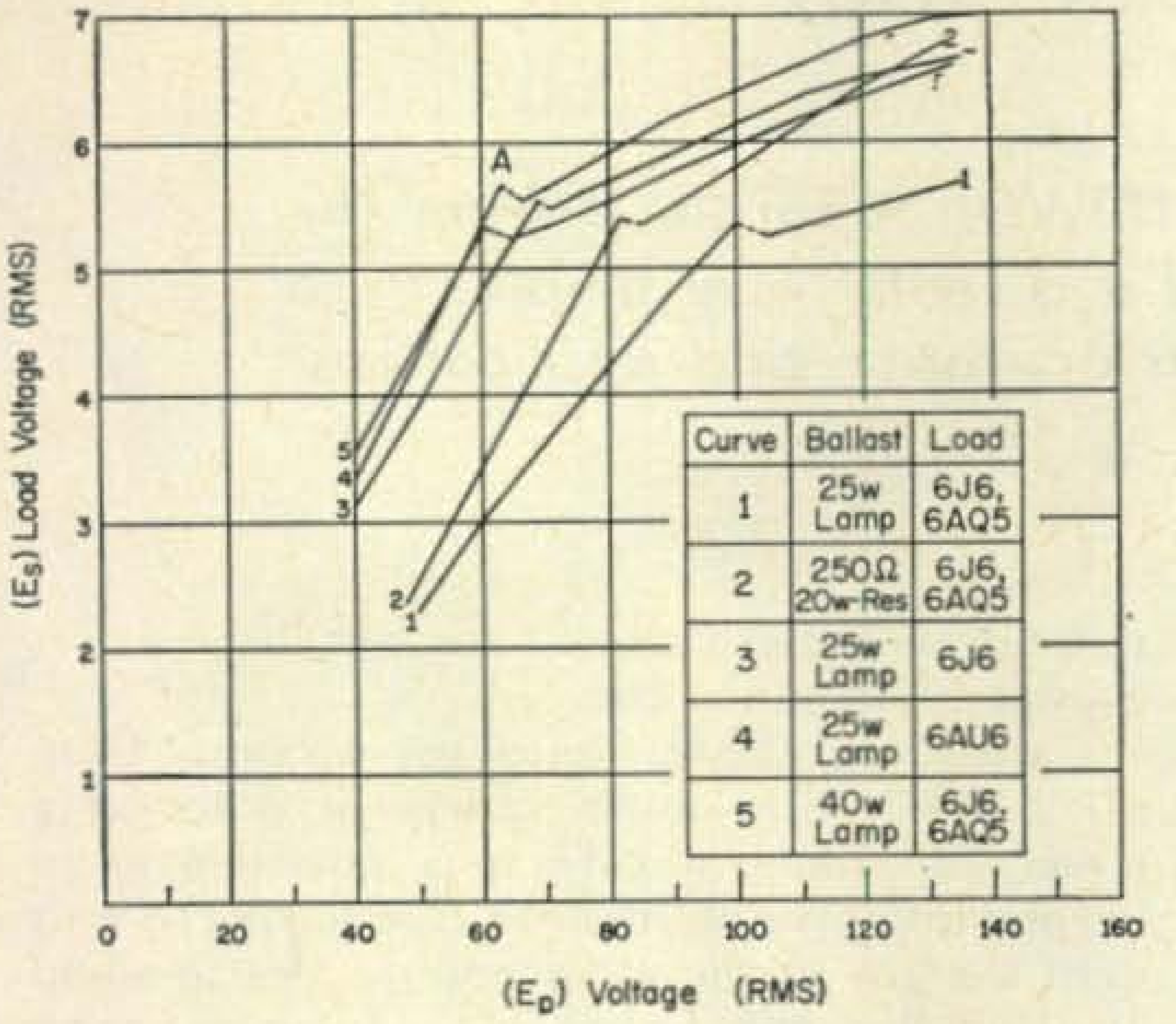

Fig. 2—Curves depicting the results of experimentation with various loads and ballasts. Point A is an area of instability because the NE-42 is on the verge of firing.

that 120 volt lamp ballasts appear to be somewhat superior to wire wound resistors. This is undoubtedly due to the fact that lamps increase in resistance with increased current and act as additional voltage compensation with increased line voltage. Figure 2 indicates that with a load of .9 amperes, a 25 watt lamp is approximately twice as effective as a 250 ohm resistor in compensating for line voltage changes.

The waveforms of the input to T_2, shown in fig. 3, are direct traces made from the face of an oscilloscope. The small "spikes" are due to the fact that before the neon lamp will ionize, a peak voltage of approximately 70 volts is required. However, after it ionizes, it becomes

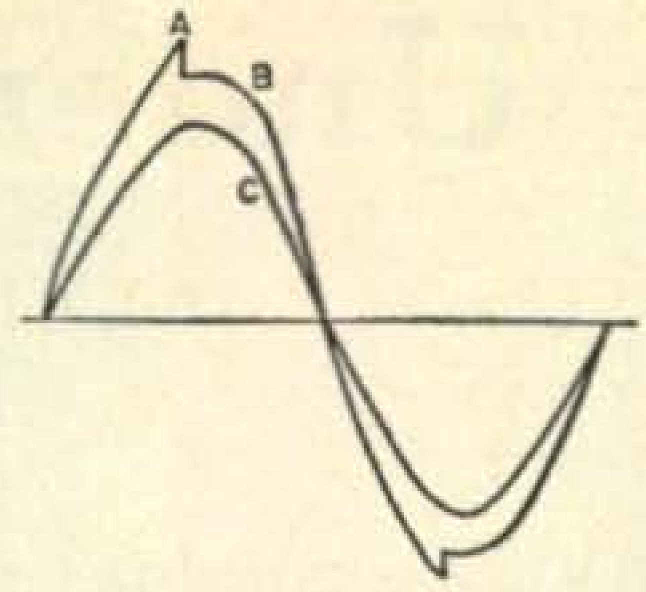

Fig 3—Waveform formed across the primary of T_2. The spike (A) represents the voltage required to fire the NE-42, and (B) represents the clipped level, approximately 50 volts r.m.s. Curve (C) is 10% below the clipping level while curve (A) is 10% above the clipping level.

essentially a constant voltage device with approximately a 50 volt drop across it as long as it stays ionized. When the instantaneous voltage drops to less than about 50 volts, ionization ceases and the rest of each half cycle is a continuation of the sine wave being supplied by the line.

Essentially the neon lamp may be considered to be a "clipper" and can regulate peak voltage almost perfectly as long as the instantaneous peaks remain above the ionization point. However, it cannot regulate "effective voltage" perfectly. With increased line voltage, effective voltage, after clipping, will always tend to continue to rise. Theoretically, with a perfect square wave source, "peak" and "effective voltage" would be equal. Nevertheless, with moderate amounts of "clipping," the neon lamp appears to be quite effective in a.c. voltage regulator applications and gives results which may be comparable to "zener" diodes at only a fraction of the cost.

It should be pointed out that voltage measurements shown in fig. 2 were made with a rectifier type meter. Consequently, the measurements may be somewhat in error for voltages measured after the start of clipping. ■

Time Adjustment in WWV and WWVH Broadcasts

On August 1, 1961, at 0000 UT, the National Bureau of Standards, advanced the phase of the time signals broadcast from WWV and WWVH by 50 milli-seconds. Such adjustments are made when necessary, to follow the variations in Universal Time (UT-2) so that the time signals remain within about 50 milli-seconds of UT-2.

The WWV time signals are maintained on a uniform basis by means of atomic frequency standards. Departure of the time scale from UT-2 reflects a small but perceptible fluctuation in the speed of rotation of the earth.

Similar changes are being made simultaneously by other foreign standard frequency broadcasting stations which have been coordinating their transmissions since early 1960 under an agreement between the United Kingdom and the United States.

This coordination helps provide a more uniform system of time and frequency transmissions throughout the world, needed in the solution of many scientific and technical problems in such fields as radio communications, geodesy, and the tracking of artificial satellites.

Participating in the project are the Royal Greenwich Observatory, the National Physical Laboratory, and the Post Office Engineering Department in the United Kingdom, and, in the United States, the U.S. Naval Observatory, the Naval Research Laboratory, and the National Bureau of Standards.

The transmitting stations which are included in the coordination plan are GBR and MSF at Rugby, England; NBA, Canal Zone; WWV, Beltsville, Maryland; and WWVH, Hawaii. ■

Understanding VOX

ALAN A. BORDEN*, W1OWD

Is VOX complex? No says W1OWD. Separate it from the complex transmitter circuit and it is really very simple. Here is a clear cut explanation of its operation and applications.

IN THE strange language of the ham-trade the letters V-O-X have come to mean far more than out ancestral Greek (or is it Latin) forefathers intended. Brought up to date VOX is something that would make dear Helen's (of Troy) head swim.

VOX is the ham's way of putting the whole science of communications electronics to work at his mere command, in fact, with VOX, he doesn't even have to say anything. A loud snap of the fingers and the whole system starts to function.

Basically VOX is nothing more complicated than a simple switch that can be used to turn something on and off. However, instead of having to push, pull, throw or otherwise close said switch, the ingenious (but lazy) ham merely speaks softly into a microphone, and millions of electrons march around doing the work for him. Thus, by voice, we turn the rig—ON.

For some mysterious reason, the use of VOX control for turning ham transmitters on and off has been largely confined to the single sideband gang. Anyone who listens to their snappy telephone-type conversations with four, five or even more stations in a round table, must realize that VOX is a fabulous time saver. It is by far the most efficient way to operate in our crowded phone bands.

There is absolutely no reason why the use of VOX should be the private property of the sideband gang. It can be used in all other modes of transmission too, (yes—even in c.w.).

Contest operators were the first to recognize the huge advantages that VOX brings to a.m. operation, too. Top scoring stations find that their average contacts-per-hour scores are considerably higher, and the fatigue factor quite a bit lower, simply because VOX makes operating nearly effortless. To call a station, start talking. When you are through, just stop talking. VOX throws the switches for you, changes the antenna from transmitter to receiver, and can even do a few extra jobs on the side if you want it to.

Traffic men are also using VOX to increase their efficiency. A phone traffic net equipped with VOX is a real joy to hear. Messages move faster, fills are obtained more quickly, and the QRM is reduced because carriers are on the air for shorter periods of time.

Casual rag chewers also get a bonus from using VOX. How much simpler it is to get a direct, immediate answer to a question, as in telephone conversation, instead of having to wait until the guy at the other end decides to stand by. Half the time, unless you take notes, questions asked in the early part of a transmission are forgotten before it ends. VOX puts a QSO on an entirely new basis.

The mobile gang uses VOX as a safety feature. How many times have you nearly had an accident because you were clutching a microphone in your hand when it should have been on the steering wheel, or were looking for a switch on the equipment panel instead of watching the road ahead? With VOX, and a breast-plate microphone you can keep both hands on the wheel, eyes on the road, and your mind on your driving.

Circuit

VOX is considered "too technical" by many, because most VOX circuits are buried in the complexities of schematic diagrams of intricate single sideband transmitters. Actually a VOX circuit is quite simple. In block diagram form, fig. 1, it boils down to a simple audio amplifier,

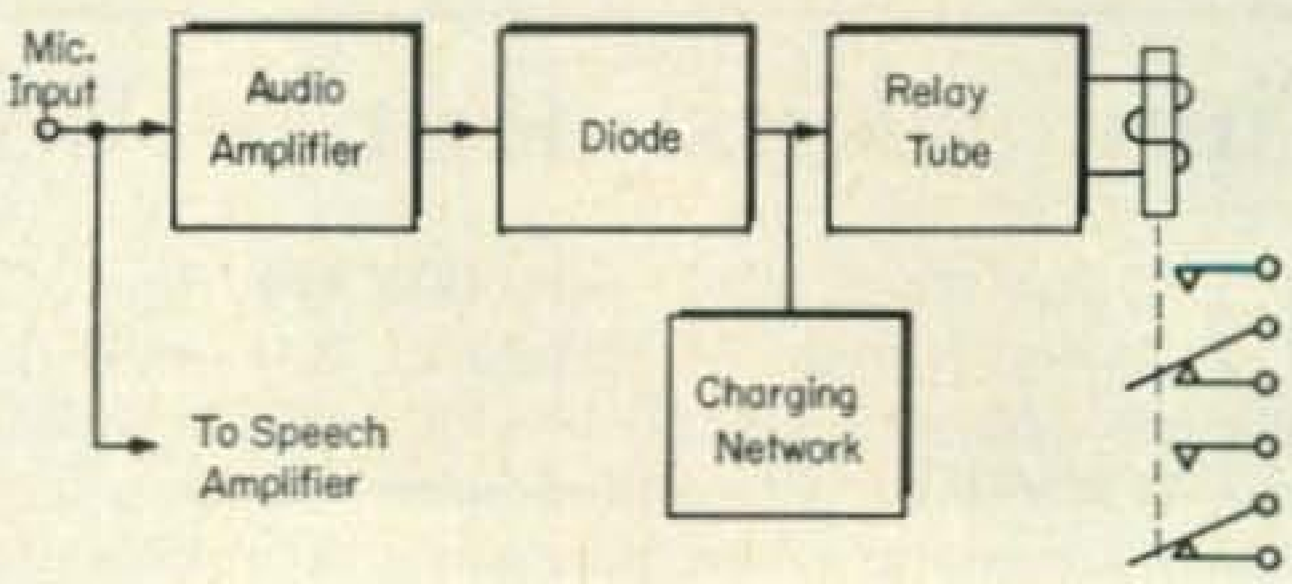

Fig. 1—Block diagram of a typical VOX operation.

followed by a rectifier to convert the audio into d.c., and a triode relay tube. The audio signal is converted to d.c. which then charges a capacitor in the control grid circuit of the relay tube. When the charge on the capacitor becomes great enough, the bias on the tube is overcome, the tube conducts, and the relay closes. How long it remains closed depends entirely on how long the capacitor remains charged *above the critical bias level.* This is controlled by two things: First; when you stop talking, no more audio

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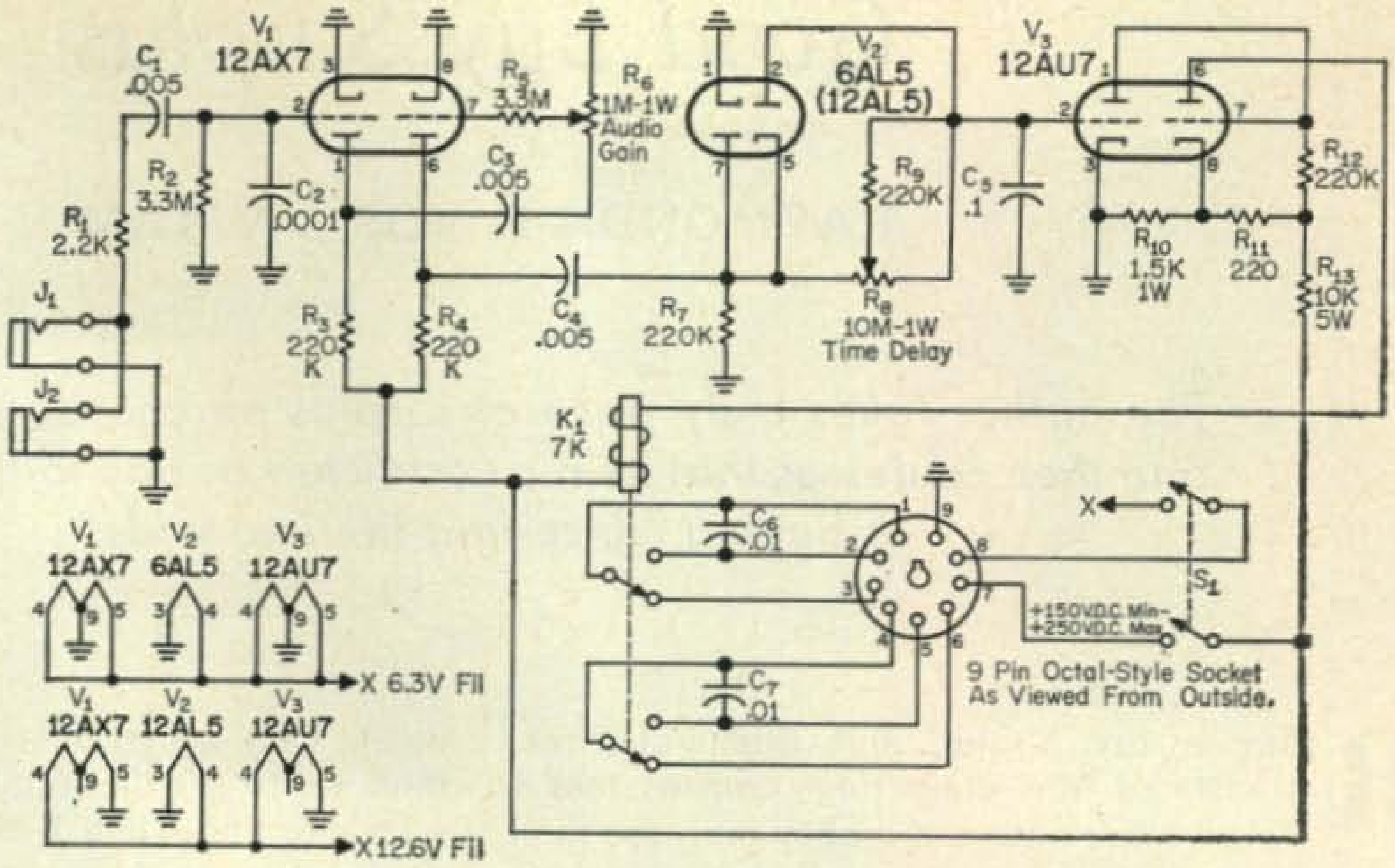


Fig. 2—A typical VOX circuit, available commercially, called the Voxbox.

voltage comes through the rectifier; Second; A high resistance path to ground is provided, to allow the charge to leak off slowly. This resistor is usually made variable so that the discharge time can be made great or small, to suit the operating habits, rate of speech, etc., of the operator.

Typical Unit

The schematic diagram of a commercially built VOX unit, the Transcon Voxbox, is shown in fig. 2. In this unit the audio amplifier is conventional, using the two triodes sections of a 12AX7 tube. This is followed by a 6AL5 dual diode, with the first section pins (7 and 1) acting to rectify the audio from the amplifier to develop a negative d.c. voltage. The other half, (pins 2 and 5) act as a charging diode which permits an immediate charge to be placed on C_5. The discharge path however is through R_7, R_8 and R_9. The negative pulses are applied to the control grid of one half of a 12AU7. This triode is operated at zero bias, but its plate is directly coupled to the grid of the other half of the 12AU7, (pin 7). Thus the first half of the tube acts as a d.c. amplifier. A 0.1 mf capacitor C_5 is connected from the gird of the d.c. amplifier to ground. This is the charging capacitor which eventually causes the relay tube to conduct. The relay tube itself is normally not conducting because its cathode is held positive with respect to the grid by biasing resistors R_{10}, R_{11} and R_{13}. However, when the d.c. level at pin 7 of the 12AU7 is raised above the positive cathode potential by incoming voltage from the rectifier-d.c. amplifier circuits, the tube conducts vigorously. The coil of the relay, which is a high resistance, being in the plate circuit of the tube, causes the relay armature to close as soon as appreciable plate current is flowing. Thus, we have succeeded in turning something on by voice.

Now how does it get turned off?

When the audio amplifier is no longer delivering a signal to the rectifier-d.c. amplifier, the charging action at C_5 stops. Across this capacitor a high resistance variable resistor is connected. Thus, the charge leaks off to ground through the 10 meg ohm resistor R_8. As soon as enough of the charge has leaked off, the relay tube cuts off because its cathode is once again positive with respect to its grid. This opens the relay. How fast this happens depends on how rapidly the charge on C_5 can leak off. This is controlled by the setting of R_{10}. When it is set for a low resistance, the capacitor discharges quickly, and vice versa. This DELAY, as it is called, is what prevents the relay from opening every time you pause in your speech to take a breath. It can be adjusted to hold the relay in for several seconds, if desired. Thus, your carrier will not go off until after you have *really* finished speaking!

A few misconceptions about VOX should be straightened out here. First of all it in no way affects the *quality* of your audio, or its amplitude either. The fact that you plug your microphone into it means only that you are supplying some audio from the mike, to both the Voxbox *and* your speech amplifier, because a jumper must go from the extra microphone connection on the VOX unit to your present microphone input. Without this, the VOX would be turning a dead carrier off and on! (Isn't this known as a c.w.?) Yes, by whistling the code, you can key the rig! This sounds humorous but it can be of great importance to handicapped persons who cannot manipulate a key, but who *can* whistle!

Another popular misconception is that you must also have provisions for what is called "anti-VOX," to prevent the received signal coming out of your loudspeaker, getting into the microphone and tripping the VOX relay. This admittedly does happen in stations operated by the unfortunate few who like to open up their gain controls full so that they can wander around the house while in QSO. They should hear what it sounds like at the other end, with Junior pulling the cat's tail out on the porch, the XYL's pots and pans crashing through, and a fist fight in the

[*Continued on page 110*]

Good Buy Surplus

RAYMOND DE VOS*, W2TAM

The author takes a sly poke at surplus purchases in general, and then confesses that he is as addicted as any to this method of buying "once-in-a-lifetime finds."

RADIO is my hobby, and this statement, translated into plain lingo, means that I spend more time and money on radio than I should. In fact, if I spent as much time at my job and worked as hard as I do at radio I could own my employer's company in a few short years. I must add here, that my work is totally unconnected with radio in any shape or form and as a result I miss out on the "fringe benefits" which some of the lucky ones get from their business associations. I have to pay for all I get and this reduces the take-home pay by a considerable amount. As long as the purchased items are small enough to fit in a coat pocket, or at most a small, brown paper bag, I can get by at home, with no more than a sidelong glance. Exceeding these certain dimensions usually generates a series of questions and answers which leave me feeling that the purchase was unnecessary, foolish, extravagant and that the money could have been used for something else, such as clothes and food. As you can see, it was no problem to gravitate toward surplus equipment. Surplus material comes complete with built-in reasons and excuses for buying. Think of the pleasure of being able to tell the better half that this particular piece of equipment (yours) cost the government $10,000 (your money) and that you were able to pick it up for only $100 (your money). This gives you an illusion of security which is marred only by a faint voice in the background muttering something about usability. Ordinarily, women cannot resist bargains, and surely there are no better bargains than surplus. So here we are, with both feet firmly planted in the surplus market. Oceans and oceans of rare buys; never to be repeated sales; hard to get components at ridiculous prices (your money); once-in-a-lifetime finds. No matter how you feel about it, the money still evaporates and the return, often of questionable value, is more a sense of psychological satisfaction than actual material gain.

Some time ago, during one of the many tours through the surplus marts, I spotted a receiver; Navy type, which really fascinated me. It had enough meters and dials to satisfy even the most sophisticated of amateurs. Without hesitation, I plunked down $35.00 and hoped that no one would beat me to it between the split second it took me to get the money into the hands of the salesman and when I said, "I do." Well, no one did, and we were wed, this receiver and I, all 580 pounds of us (my 180 and its 400). Four of us, the salesman, myself and two snickering bystanders (served them right) got the thing in the trunk of my car and with sagging springs and dragging rear bumper, I drove home. The remainder of the story is easily told and very familiar: *Inspection, Conversion and Demolition*—better known as the ICD Program.

All that is left of the unit is a few bits of wire (just the right length), a collection of obsolete tubes and several meters with odd scales and outlandish basic movements.

Sometime after, when I was able to straighten my back once more, I discovered amateur TV. Just think, not only can you hear your fellow ham, you can also see him! No matter how dreadful this possibility may seem, I was taken with it all the way. It didn't take very long for me to get equipped with monstrous cameras of various types, a transmitter and power supply components. After considerable effort and an estimated cost in excess of the price of a commercially built TV camera. I finally managed a grainy and slightly askew closed circuit picture. The transmitter never did work right, in spite of the published articles and advice from well meaning friends. The ICD Program all over again!

It's really not the fault of the surplus dealer if the customers buy unmarked components and useless equipment. He's there for a profit and isn't required to advise whether one should or should not buy a particular surplus item. He does, however, have the responsibility of not misleading prospective clients by false claims and misrepresentation. It is not unusual to see the same piece of gear advertised by several firms and given slightly different ratings. The motto, *caveat emptor*, "let the buyer beware," may be a good one in some instances, but it is hardly likely to enhance the reputation of a business concern. Dealers knowing that the price of a piece of equipment is in direct proportion to the degree of usefulness will try to peddle equipment, not by direct misrepresentation, but by intentional omissions. As an example; something in the order of a two-meter absorption-

*140 Summit Drive, West Trenton, N.J.

type frequency meter, described in glowing terms but in reality, the meter only covers one half mc of the two-meter band. The interpretation is as broad as it is long and it was never specifically stated that the meter covered *all* of the two meter band. Sometimes, no reference is made to the fact that certain receivers have the audio section missing; that the 110 v.a.c. input is for 400 cycle only; that the receiver is crystal controlled; that the tubes used are of special design and unobtainable; that the relationship of power output to weight is something in the order of 1 watt for each 100 pounds; that the 150 watt rating is *input* and not output. I could go on about this endlessly but I believe that the point is sufficiently clear not to be missed.

Now a word about conversion articles. Some of them are outright frauds, and no other words can describe them better. Instructions which start with a statement such as: "Remove unit from cabinet and remove all parts and wiring except the 25K pot in upper left hand corner," cannot be considered as applicable to conversion. It would be better to call them methods of transformation or better yet, metamorphosis, the hard way. Obviously, if all that is left is a used chassis and a pot, it probably would have been better and cheaper to buy them new. This type of alleged "conversion" was undoubtedly comissioned on a "split" or outright fee basis, by the possessor of the equipment, in the hope of getting rid of his iron at a good profit. Of course, if the "transformation" is completed, there is always a good chance that the unit will work as claimed, but the labor and expense involved hardly justify the end results. Fortunately for hamdom, most of the conversion articles are honest and genuine efforts to help fellow amateurs get some benefit from reasonably priced and available equipment. Whether conversion is worth the time and effort, is something which must be decided by the owner. It is unfair to deceive the buyer into believing that he will be the proud owner of a piece of gear which will outperform any other on the market. To be frank, the best surplus buys are those which will fulfill the buyer's need exactly, and require little or no alterations. These units are the highest priced, most desirable and the least available.

Tomorrow I have the day off and if it doesn't rain I may go to the purveyor of surplus goodies and drool a little. There are still some unexplored surplus fields such as radar, pulse, telemetry and range finding. When I looked last week I still had a few square feet of uncluttered space in my garage. It's a good thing I do not put the car there anymore. So off I go, wish me happy hunting! ■

Club Contest Ideas

PAT HAWKER*, G3VA

The special contests, popular in Europe, can provide many novel ideas for Club Contests. The types of contests outlined do not require large numbers of entrants for success nor do they occupy whole bands for weekends. However, they can provide interest and fun.

An amateur radio contest need not always be a high-power DX dog-fight, an SS shindig or a Field Day fracas. There is a lot of fun and technical know-how to be gleaned from small specialized contests which can easily be run by local clubs.

In Europe with amateur activity organized in relatively compact areas, there are many of these minor contests with 10, 20 or 30 entrants, generally run by the various National Societies but also often by local clubs. There are some good ideas to be picked up from a study of these competitions . . . ideas which could easily germinate into a new contest for your club to try out.

Low Power Contests

Low power portable and fixed c.w. work has always attracted steady support in Europe and provides QRP enthusiasts with opportunities to take part in some ingenious competitions. These range from straight forward QRP contests such as those run by the R.S.G.B. to the "Desert Island" type of competition which is thought to have originated in Sweden. The R.S.G.B. main QRP event is held on 3.5 mc and offers a sliding scale of points for powers between 0.5 and 5 watts; this is designed to encourage the use of the lowest power level but allows stations to "QRO" to 5 watts when the going gets tough, to stop interest from flagging. A variation of this scheme which has been tried out, is simply to see who can squeeze most contacts out of a single standard capacity B battery. The "Desert Island" event has a number of teams, each of whom is provided with a minimum of components for a simple transmitter/receiver and then the teams have to race to build the rig and make the first contact. Why not give this idea a tryout at your next ham-fest?

Another contest, calling for constructional as

*37 Dovercourt Road, London S.E. 22, England

well as operating skill is the R.S.G.B.'s "Low power national field day." The limiting factor in this 7 hour, 3 band affray is weight. The total weight of all the radio equipment taken to the operating site—including receiver, transmitter, power supply, 'phones, morse key, frequency meter, aerial wire, insulators, earth rod and spares—must not exceed 20 lbs.

Those seeking an even more energetic form of low power contest should find the "mountain day" contest of the Swiss amateurs to their taste. Typical rules for this leg stretcher specify a minimum height (about 3000 ft.) at which stations may be set up and make it necessary to climb the last 1000 feet or so on foot carrying all the gear.

V.H.F. and U.H.F. Events

V.h.f. and u.h.f. activity in Europe has always been closely linked with national and continental contests to promote intensive activity on about half-dozen days each year.

One difficulty with 2 meter events is that of devising a scoring system which does not unduly favor competitors in city centers (or those strategically placed to work into the main towns) at the expense of those in the more remote areas. After trying many scoring systems, the Contests Committee of the R.S.G.B. (a dozen or so hard-working volunteers) hit on a simple scheme that has proved very popular over a number of years and has since been adopted for European I.A.R.U. events. Each contact is awarded a number of points equal to the distance (in miles or kilometres) separating the two stations concerned. It thus takes a number of semi-local contacts to bring in as many points as a single good DX path. The scores also meet one of the important psychological requirements of good contest scoring—the final number of points can run nicely into the thousands and thus leave the contestant feeling content to submit his log!

U.h.f. contests present a special problem as activity is not always sufficient to justify a normal point-scoring event. A device hit on by R.S.G.B. when the 420 mc band was first released to British amateurs was to stage a "Test" with practically no rules other than a general time limit; a trophy was then awarded for a year to the amateur submitting the most "meritorious" log. This proved in practice, an extremely good way of encouraging activity on a new band and resulted in new distance records being set up during the first such test. Nowadays, more conventional contests are run on 420 mc, but the idea of a special day of "Tests" has been shifted to 1250 mc.

Hidden Transmitter Hunts

Direction-finding competitions—often known on the mainland of Europe as "fox hunts"—have been organized locally and nationally for many years, attracting a small but enthusiastic following. These are sometimes on 144 mc but generally, British amateurs have concentrated on the 1.8 mc band where all stations are limited to a power input of 10 watts. Each year a series of "Qualifying Events" are held by various local clubs to determine who will take part in the "National Final." While some European hunts have been on foot (or even on bicycles) most of the British ones cover up to a 10 mile radius and call for automobiles or motorcycles—though care is taken that the hidden transmitter is put in a spot which requires the final fixes to be made on foot. Because competitors became so adept at finding a transmitter quickly, the National Final usually requires them to find two separate transmitters, at each of which they are handed a slip of paper containing half of map reference number; the winner is then the first operator to reach this designated point.

In a recent final, the winner reached the finishing point—after traveling 53 miles, locating two transmitters (one in a ditch, the other up in the branches of a willow tree)—in only 2 hours 20 minutes. Over the years many cunning schemes have been thought up to puzzle and confuse the d.f. hunters. Dense woods, old bombed buildings and transmitters on opposite sides of streams to the antennas have helped to make the hunt more exciting. A trick which has been used on more than one occasion is to conceal one of the transmitters—using very low power—close to the starting point. The d.f. stations take their first fix and move off several miles to get a cross-bearing, only to find the transmitter is no longer audible.

Another year the hidden station was in the undergrowth by the side of a river close to a favorite spot for fishing. Competitors were soon challenging genuine fishermen on the supposition that their fishing rods were helical-wound whip antennas! Nor is G6HD likely to forget the year when, as a hidden transmitter operator, he was perched just above the differential gear of a small two-seater sports car, well concealed under tools, maps and coats. The only visible occupants were a young couple who did not appear to have their minds on radio. It took some time for a competitor to pluck up enough courage to challenge them.

Other Types of Contests

Club contests need not be concerned solely with actual operating. Several British clubs have regular competitions for "best built" items of equipment. An annual contest by the Scarborough Club is for the listener showing "most improvement in learning morse"—with a handicap system devised by G5VO to give equal chances to the experienced speed-merchant and to the complete beginner.

Contests of the types described in this article do not require large numbers of entrants. As few as six or ten keen competitors can make them entirely successful. Nor do they occupy whole bands for weekends. But they can provide plenty of interest and fun for those who take part—and can also help to develop new and unexpected skills. ■

Sheds I Have Known

BY SYLVIA MARGOLIS*

WX TURBINES and the pilot's love life being all that they should, it takes nine hours to travel between Britain and the United States. The Mayflower did the job in over three months; and quite right too, for to be whisked from one civilization to another in the time it takes to get a night's sleep is unrealistic. What can be right about taking a pill in London and leaving it to New York plumbing to sort out the result.

The contrasts between the continents are too vast to be bridged in a scornful flick of time. For example, Britain is on the right-hand side of the Atlantic. America is on the left-hand side. Conversely traffic over here keeps to the left, whilst in the States it keeps to the right. If you are anti-social and prefer to look at the atlas upside-down, you aren't my kind of man and please go away.

Again, you can't make tea. We can't make coffee. That's why it's fashionable to drink coffee in London and tea in New York. Your women wear the pants. Ours wear the trousers. You import our cashmere sweaters. We import your cashmere sweaters.

One feels compelled also to admit that the U.S. is bigger than Britain. It has been said that you could put the whole of Britain into the state of Texas. It has also been wondered why you should want to put the whole of Britain into the state of Texas.

But in one world both cultures meet—AMATEUR RADIO. How alike are the W's and K's and the G's! Same TVI problems, same XYL barrier, same lack of dollars or pounds when it comes to choosing between new shoes for the baby or the new call book. One difference of opinion occurs, though. When a W makes a radio appointment, he fixes a SKED. The G arranges a SHED.

The sched. is the acme of ham fulfillment. When he arranges to speak to Tokyo at 9 a.m. on Saturday, the amateur knows that he is truly master of the ether, that all that night school and those hours of Morse were worth it. He is convinced that his destiny and Marconi's are eternally linked in the ionosphere. Forgotten the sour face of the neighbour, whose enjoyment of Gunlaw was ruined by spurious. Forgotten that rigid and articulate back, irrevocably turned to him in bed when he finally creeps in at 2 in the morning, after a net with the boys.

Our first sched. was with New York. Such a nice man, whom we had met whilst he was on holiday in London. He was to contact us as soon as he got back home. But conditions were normal—IMPOSSIBLE. It would have been fun, though.

Once we fixed one of these things like a military operation. We made like NATO—nothing left to chance. Date, call signs, band, all checked and double checked. We even arranged buffer stations to pull us through in case conditions were normal. It was to be North Africa. The bands were wide open. The Americas, all of them, just pouring in. Signals from the Med. were so strong that the i.f. gain had to be turned down. One minute to sched. hour and ready to transmit—the p.a. anode current meter read zero! Even an 813 must go QRT sometimes!

India is a difficult country to work, but it can be done, especially if you fix a careful sched. A Sikh, whom we had known in London, was to contact us from his home QTH in Bombay. We had to be very accurate about this because, what with their being five hours ahead of us, and speaking English like Welshmen, and all those snakes and things—but the planning was well worth it. Call signs were exchanged—and then frantic shrieks from the nursery told us that it was something he had eaten after all. For all I know that VU, imbued with the traditional fatalism of the Orient, is still sitting at the RX, patiently waiting for his report.

There is talk of one G who spoke every morning for three years to a ZL, though what they can have found to talk about beats me. The WX here is always "not so good" and there are always sheep running around in South Island, so why bother? But there are–and it's still the envy of every DX-hound in Britain. Our ambitions are rather more limited and our sched. with New Zealand was really something.

It necessitated getting up at 3 on the only morning when the usual murky, mucky, rheumaticky WX of Britain in February had suddenly turned to the genuine article—a Montana blizzard. We loaded ourselves with sweaters, scarves, boots and flasks of hot coffee—more fuss than we ever made during the London blitz. We dug our way through the snow to the shack, only to find that the cat had had her kittens on the operator's chair. Scheds. went to blazes, whilst I played nurse. By the time mother and quins had been fixed up and the O.M. revived with brandy, it was morning, time to get breakfast and the local vacuum cleaner brigade had started work.

But one enchanted evening it actually happened. Our friends in Paris were standing by and everything was laid on. We called for just over an hour when we heard a familiar ringing. We answered. The operator said "I have a call for you from Paris, France." ■

*95 Collinwood Garden, Woodford Ave., Ilford, Essex, England.

DX DX DX DX DX DX DX DX

URBAN LE JEUNE, JR., W2DEC
Box 35, Hazlet, New Jersey

The following certificates were issued between the period from June 12th, 1961 to and including July 14th, 1961:

WAZ

1561	W8IQS	Stanley C. Reed
1562	K9CUY	C. L. Ray
1563	W5PSB	H. L. Parrish, Jr.
1564	W9NLJ	T. E. Pederson
1565	DL9YX	Volker Zeidler
1566	VE7BW	Jim Forsyth
1567	W6RKP	James N. Chavarria

ALL-PHONE WAZ

82	W6VFR	Marv Gonsior
83	GI3IVJ	Cedric J. Rourke
84	MP4BCC	Maj. M. H. R. Carragher
85	WØMLY	G. R. McKercher
86	PAØHBO	Henny P. J. Bouwme
87	G3DO	D. A. G. Edwards
88	W6USG	Paul T. Brogan

TWO-WAY SSB WAZ

5	G3AWZ	G. P. Pearson
6	4X4DK	A. Shami

CW WPX

186	W5WZO	David R. Blaschke
187	W5EJT	Eugene A. Jank

PHONE WPX

30	W6JCY	Bertha Watson

SSB WPX

67	K4JEY	Johnny Wood
68	VE3CIO	Harry D. Gray

It is with deep regret that we have to announce the passing of Horace Greer, W6TI, into the realm of the Silent Keys. Horace was one of the Founders and charter members of the Northern California DX Club—and perhaps was better known for his tireless efforts in managing the W6-QSL Bureau for 25 years until recently. Horace succumed to a heart attack on the evening of June 15th.

New Rules For WPX

Those of you who read ZERO BIAS last month have seen that we have made some rather drastic changes in the administration of WPX. I would like to thoroughly explain the new rules and our motivation for the changes.

The biggest single change, of course, is that QSL cards will no longer be required for either the initial certificate or any subsequent endorsements. The station submitting the application must have confirmations in his possession and the DX Committee reserves the right to request any or all confirmations. We realize that requesting a minimum of 300 cards makes it very difficult, if not close to impossible, for many stations to apply for the award, particularly in the case of foreign stations. We feel that the vast majority of stations who would submit an honest and sincere application should not be inconvenienced because of the few inconsiderate operators who would submit an illegitimate application.

Applications must be submitted on the special form which will be supplied free of charge from either *CQ* or this column editor.

Since ZERO BIAS appeared last month indicating an additional Honor Roll listing for mixed modes of operation, we have put our heads together and voted to also include a certificate

Djuro Borosic, YU1AG, 20 meter winner of the CQ W.W. DX Contest for Yugoslavia and holder of many certificates. That attractive layout is all homebrew.

for this type of operation. Any and all types and modes of operation may be used, however, 400 prefixes will be required for this certificate. Since WPX was initially announced in 1957 there has unquestionably been a great increase in sideband activity, therefore, the basic requirement for the S.S.B. certificate will now be 200 instead of 150 prefixes. All contacts must be 2 way S.S.B. The requirements for the phone and C.W. certificates still remains at 300 each. Any type of phone operation may be used for the phone certificate. It does not necessarily have to be only a.m. phone.

Once the basic certificate has been issued, endorsement stickers will be available as follows: One for each additional 50 prefixes.

Band endorsements will require the following number of prefixes to have been confirmed on a single band:

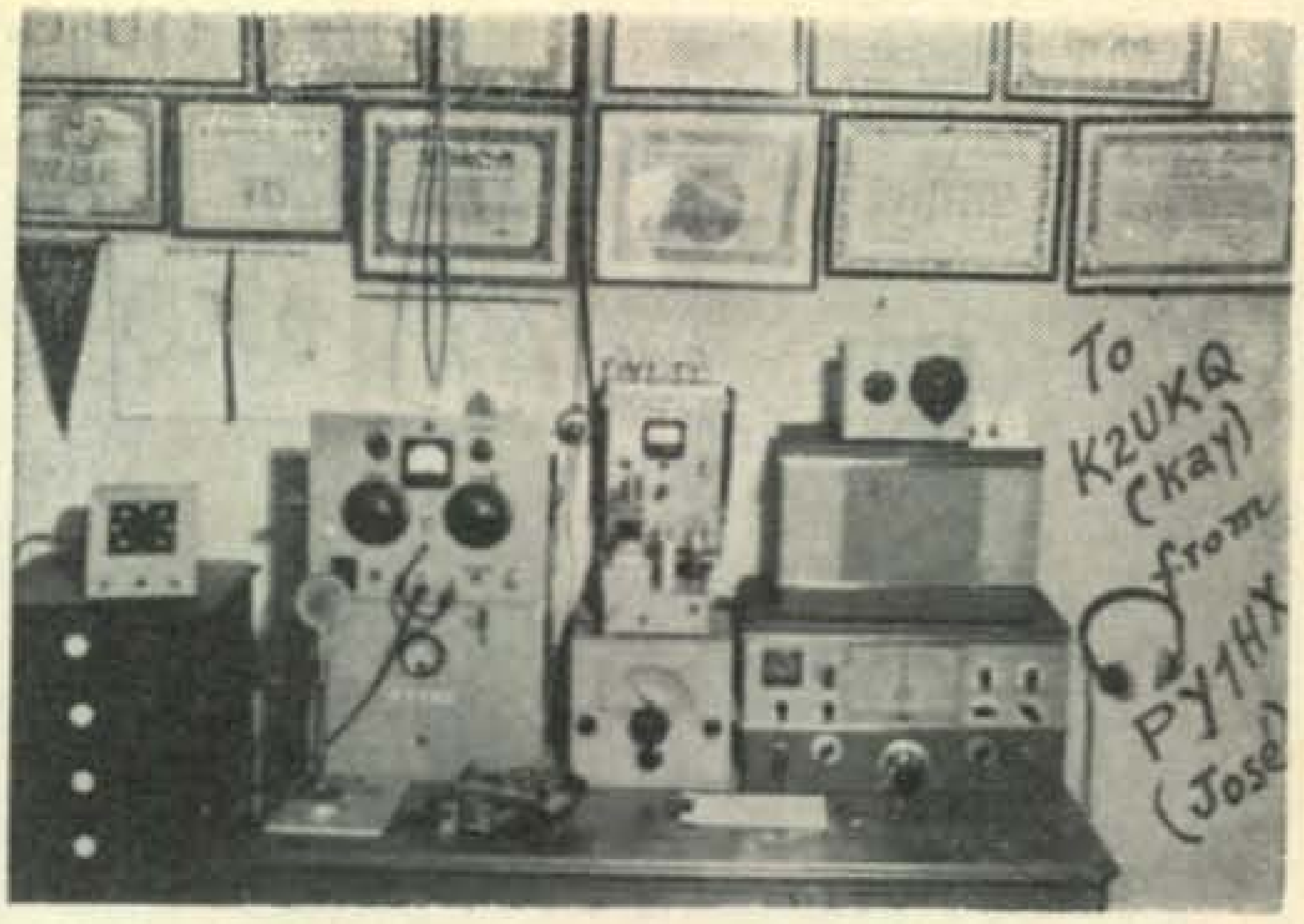
1.8 Mc	35 Prefixes
3.5 Mc	150 Prefixes
7 Mc	250 Prefixes
14 Mc	300 Prefixes
21 Mc	300 Prefixes
28 Mc	250 Prefixes

Continent endorsements will require that the following number of prefixes in the specified Continent be confirmed:

North America	126 Prefixes
South America	88 Prefixes
Europe	146 Prefixes
Africa	80 Prefixes
Asia	68 Prefixes
Oceania	51 Prefixes

Since its inception, only contacts after January 1, 1957 have counted for WPX credit. This gave the fellows a chance to start fresh on a new certificate, however, we feel that this purpose has already been served and that many of the fellows with much DX accomplishment behind them prior to January 1, 1957 are

This is the station of well-known CE3CB in Santiago, Chile. Eduardo may be found on all bands.



Another certificate hunter extraordinary is José, PY1HX. With 60 watts input, José has 267 countries worked and 256 confirmed. *(Tnx K2UKQ)*

being held back from their due credit. We are therefore, accepting credit for any confirmations for the entire post war period. If we are to establish an equality between the newcomers and the old timers, we must, at all times, keep the list competitive; that is to say, anything for which the old timer has credit, must also be creditable for the newcomer. In order to do this, any prefix which has become obsolete will not be eligible for WPX credit—some examples: ZD4, which is now 9G1 and VS2 which is now 9M2, etc. Anyone who has credit for these obsolete prefixes will have his totals reduced to bring him into competition. As a prefix drops from existence because of political and/or boundary changes, it will also be dropped from acceptable WPX prefixes.

The above rules will go into effect on October 1st, 1961. Any applications that are received prior to that time will be considered under the old rules. Do not forget that an application MUST be made on the special form which is available free of charge. The new rules are the result of four years experience with this certificate and also many letters of suggestion and constructive criticism which have been received from the DX gang. I hope the new rules will meet with acceptance and, as in the past, we will be very pleased to hear any comments on these new rules. I guess I better stop now and let you get to your dusty QSL files.

Letters

I have just received a letter from Ack, W4ECI, describing the new DXpedition of Gus, W4BPD of W4BPD/M1, FL9, 6O1, 3A2, MP4, etc. fame. Ack describes this most ambitious project as follows:

"W4ECI and W4BPD have gotten together and decided to have a DXpedition to end all DXpeditions.

"W4ECI will be the man back home (in the States) handling all of the details, QSL's, correspondence and the many other items that turn up as things progress. W4BPD [Gus Browning] will be the man overseas doing the operating.

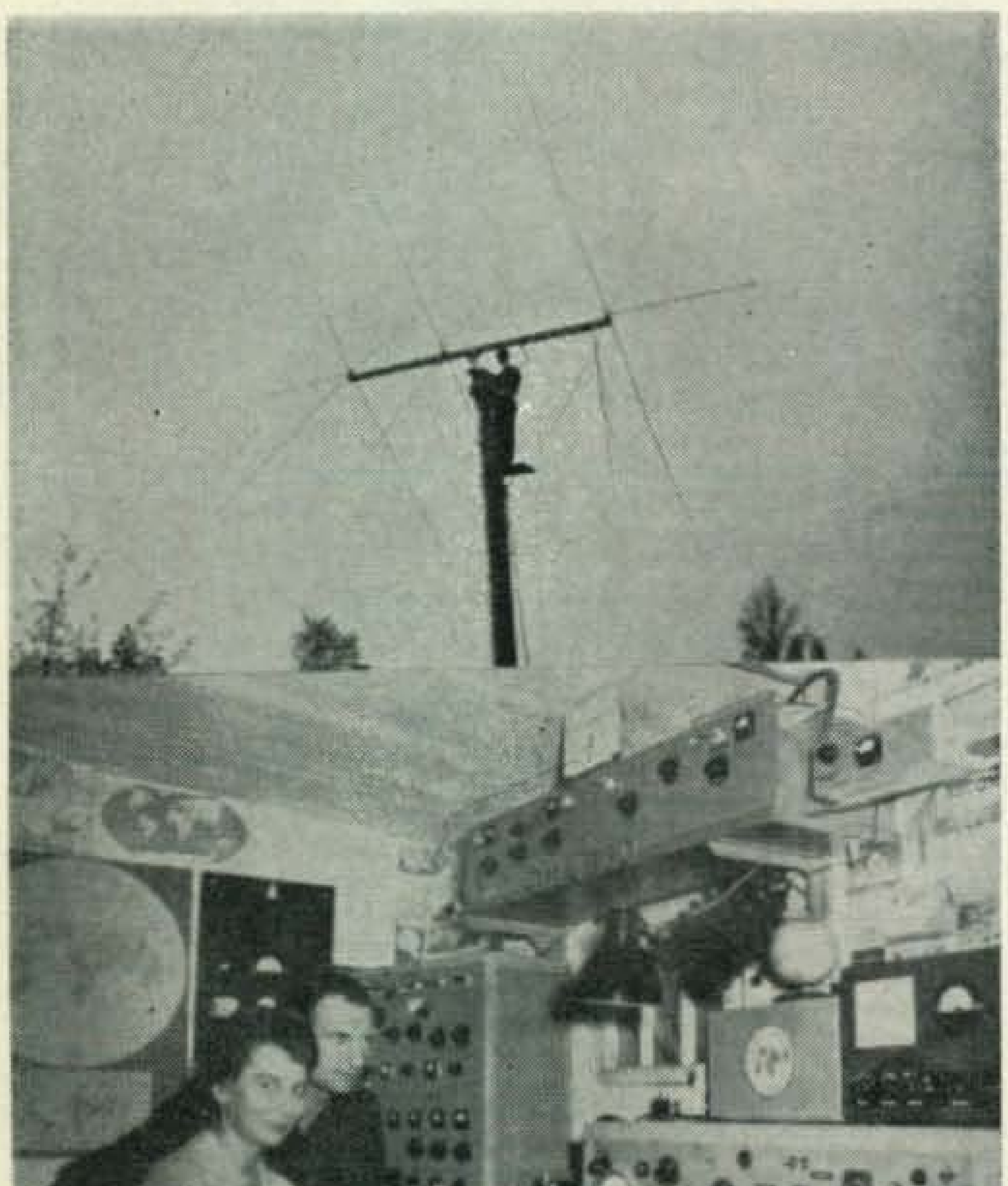
"If plans work out, Gus should be on his way sometime in January or February of 1962. The whole trip will require close to a year to complete.

"We all know it will be impossible to operate from every place as outlined in the proposed stops but you can rest assured that no stone will be left unturned in the strongest possible effort made to secure a license. We are looking for fellows who good connections with hams and other people of influence in as many of these countries as possible. We know just how important it is to have our foot in the door before Gus arrives there. So, we ask all of you to drop us a letter telling us what or who you know in the various places Gus will be going.

"We are open to any suggestions from the DX fraternity. You can depend upon the heaviest operating being done from the really *Rare Ones*. At least 50% of the time will be spent at each location using s.s.b. as the mode of operation. The other time will be sent using c.w. We know what the DX gang wants, but you might let us know what *you* want. There is no need of mentioning such spots as Aldabra, Tromilen, Agalega, Kamaran Islands, Mt. Althos, Diu Colony, Damon, Timor, etc. We know that mostly everyone needs these.

"Gus will go to most every spot on the list

This impressive rig and antenna belong to Horst, DM2BJO, and his XYL, Liane It looks as though the quad fever is really catching on. *(Tnx K6CQM)*



This impressive array of QSL cards belongs to Swen, SM3-3104 who, I believe, is the first s.w.l. in the world to have 300 countries confirmed. Swen is also the editor of the very fine *DXer*, which I think is one of the finest DX bulletins published. Swen also publishes a very fine Russian call book which lists almost 1,000 separate U-stations and they are listed by call, sign, name, QTH, oblast/region number and Zone number. This is available air mail post paid for $2.00 in U. S. currency. Swen will also be pleased to send a sample copy of the *DXer* to anyone who might be interested His QTH is Swen Elfving, Solgardsgatan 15, Ornskoldsvik, Sweden. Now that Swen has reached his goal of 300 countries confirmed as an s.w.l., he will shortly be on the air with his own license.

set forth below even though he may not have a license before leaving the states. He has previously demonstrated that he is a firm believer in pleading his case in person.

"We will have a regular "pile up" operating frequency on each band from 80 through 10 meters.

"Places Gus intends to visit include: Balearic Islands (EA6); Andorra (PX); Monaco (3A2); Vatican City (HV); Knights of Malta (?); San Marino (M1); Liechtenstein (HE); Albania (ZA); Compione d' Italia (IC1); Mount Athos; Rhodes (SV); Dodecanese Islands (SV); Turkey (TA); Syria (YK); Jordan (JY); Dead Sea (4X5); Rio de Oro (EA9); Infni (EA9); Republic of Mauritania (FF7); Mali Federation; Senegal (6W8); Portuguese Guinea (CR5); Dahomey (TD8); Togo (FD); Volta; Upper Volta; Niger (5U7); Cameroons (FE8); Spanish Guinea (EAØ); Gabon Republic; Republic of French Congo (TN8); Republic of Central Africa (TL8); Zanzibar (VQ1); Madagascar (FB8); Tromelin (FB8); St. Marie Is. (FB8); Glorieuses Islands (FB8); Comoros Islands (FB8); Isle Europa (FB8); Reunion Island (FR7); Mauritius (VQ8); Rodriguez Island (VQ8); St. Brandon (VQ8); Agalega (VQ8); Aldabra (VQ7); Seychelles (VQ9); Somali Republic (6O); Djibouti (FL); Kamaran Islands (VS9K); Yemen (4W1); Muscat (MP4M); Shiekdom of Dubai (MP4DU?); Sharjah (MP4S?); Abu Dhabi (MP4AD?); Ras al Khaima (MP4K?); Fujairah (MP4F?); Ajman (MP4AJ?); Um Alqawain (MP4U?);

Antonio, HK7ZT, in his shack in Bucaramanga, Colombia. After many years as an s.w.l. in LU land, he is very pleased to have finally received his ham license. He is looking for Vermont and Nevada for his WAS. Tnx to Antonio's effort and code classes HK7's, YB, YC and UL are now heard on the air. *(Tnx WØKJZ)*

Qatar (MPRQ); Bahrain (MP4B); Neutral Zone, Kuwait (9K); Neutral Zone, Iraq (9K); Diu (CR8); Damao (CR8); Goa (CR8); Nepal (9N1); Tibet (AC4) (maybe a sneak-in edge of); Sikkim (AC3); Bhutan (AC5); East Pakistan (AP); Timor (CR1Ø); and perhaps some Pacific Islands on the way home."

VP5CD

The following is the summary of the recent VP5CD operation as received from Tom, KP4AVQ.

"A trip was made to the island of South Caicos in the Turks and Caicos Group by four amateurs from Puerto Rico on 10, 11, 12 May 61. Trip was made from San Juan to South Caicos by U. S. Coast Guard Aircraft and was originally scheduled for 9, 10, and 11 May 61, however, on 9 May while at sea a small fire was detected in the cockpit of the aircraft causing it to turn back to San Juan and the flight to be rescheduled for the following day. All went well and the group arrived safely on 10 May 61. The stations were set up and were operational about 1900 GMT on 10 May 61. All equipment arrived safely and operated without difficulty for the 40 hours of the operation. The three complete stations were set up at the U. S. Coast Guard Station on South Caicos. The DXpedition was considered to be very successful, considering the fact that conditions were not very good. All bands (80 through 10 meters) were worked with a total of 915 QSO's being made with 33 countries. Operations ceased at 1500 GMT on 12 May 61 and the return trip to San Juan was made without incident. The operators from San Juan who joined "Chuck" VP5CD on South Caicos were: "Captain Tom" KP4AVQ; "Roger" KP4AOO; "Allan" KP4CGB and "Red" WA6QPE/KP4. There is only one other Amateur on the Island and he is "Jim" Basset VP5AB. The island is fairly heavily populated and the main industry is fishing and the production of salt.

"All cards go to the KP4 Bureau at Box 1061, San Juan, Puerto Rico. Cards should be accompanied by s.a.s.e., where a direct reply is desired. U. S. A. postage rates apply to Puerto Rico."

New African Republics and Prefixes
(Capital City In Parenthesis)

Mauritania (Nouakchoff)	FF7
Senegal (Dakar)	6W8
Mali (Bamako)	FF7
Niger (Niamey)	5U7
Tchad (Fort Lamy)	TT8
Somali (Mogadiscio)	6O1, 6O2
Ivory Coast (Abidjan)	TU2
Upper Volta (Ouagadougou)	TV8
Togo (Lome)	? (ex-FD4)
Dahomey (Porto Novo)	TD8
Nigeria (Lagos)	5N2
Cameroun (Yaounde)	? (ex-FE8)
Central African Rep. (Bangui)	TL8
Gabon (Libreville)	TR8
Congo (Brazzaville)	TN8
Congo (Leopoldville)	9Q5
Malagasy (Tananarive)	5R8
Comorro Islands	FH8
Ruanda-Urundi (Usumbura)	9U5
Guinea (Conakry)	7G1

(Tnx NCDXC)

Certificates

The United Nations Award and the 59 Radiotelephone Award are issued by WØIUB. These are attractive certificates and the different

Those hams are the leading team from the well known group of OSA (Antwerp CW-DX Club). All are c.w. DX operators. Front, left to right: ON4QX, chief 1960, also 3A2, ON4QX/LX; DJØBJ, ON4EX-aid chief 1959; and QSL Manager; officer ON4IT (DR-UBA), ON4GT (CM-UBA) OT 1921 and ON4FU ex-ON4FU/LX. Rear, ON4ES, ON4WB (DX news), ON4KU, ON4QJ, ON4NW (aid chief 1960); ON4SK, ON4JW and ONL744, Hon. Secretair of the WOSA awards. Anyone who needs an ON4QSL or wants to work WOSA, please call on 14.040. All QSL's for OSA via Antwerp P.O. Box Nr 331.

classes are issued in separate colors. The rules for each are as follows:

The United Nations Award

1. Award certificates are issued in five classes: Expert Class—85 countries; Class 1—70 countries; Class 2—55 countries; Class 3—40 countries; and Novice Class—10 countries. Countries contacted must be nations having membership in the United Nations at the time the QSO was made. The countries that have membership in the UN are listed below. Nations not on this list will automatically become eligible on becoming members of the UN.

This neat looking shack belongs to Doc, SM5BPJ. Although none of them are displayed, Doc is quite a certificate hunter and is a member of the Certificate Hunter's Club. *(Tnx K2UKQ)*

2. An alphabetical list of countries and calls is required with applications. Keep a duplicate list for yourself so that the issuance of further awards will be simplified. QSLs are required, but QSLs do not necessarily have to be sent. A statement signed by two radio amateurs or by an officer of a radio club saying that the applicant has the necessary confirmations will be accepted in lieu of sending the cards. This award is offered to s.w.l.s. on a heard basis.

3. Each certificate is different from the rest. Each is shipped in a mailing tube. The fee for each certificate is one dollar or 7 IRC.

4. The following countries may be worked for this award. The date indicates the beginning date for which credit will be allowed. The date following the country is the year that country joined the United Nations.

Afghanistan	1946	Cameroun	1960
Albania	1955	Canada	1945
Argentina	1945	Central African Rep.	1960
Australia	1945	Ceylon	1955
Austria	1955	Chad	1960
Belgium	1945	Chile	1945
Bolivia	1945	China (Nationalist)	1945
Brazil	1945	Columbia	1945
Bulgaria	1955	Congo (Brazzaville)	1960
Burma	1958	Congo (Leopoldville)	1960
Byelorussia (UC2)	1945	Costa Rica	1945
Cambodia	1955	Cuba	1945

Cyprus	1960	Mexico	1945
Czechoslovakia	1945	Morocco	1956
Dahomey	1960	Nepal	1955
Denmark	1945	Netherlands	1945
Dominican Republic	1945	New Zealand	1945
Equador	1945	Nicaragua	1945
Egypt	1945	Niger	1960
El Salvador	1945	Nigeria	1960
Ethiopia	1945	Norway	1945
Fed. of Malaya	1957	Pakistan	1947
Finland	1955	Panama	1945
France	1945	Paraguay	1945
Gabon	1960	Peru	1945
Ghana	1957	Philippines	1945
Greece	1945	Poland	1945
Guatamala	1945	Portugal	1955
Guinea	1958	Romania	1955
Haiti	1945	Saudi Arabia	1945
Honduras	1945	Senegal	1960
Hungary	1955	Somalia	1960
Iceland	1946	Spain	1955
India	1945	Sudan	1956
Indonesia	1950	Sweden	1946
Iran	1945	Syria	1945
Iraq	1945	Thailand	1946
Ireland	1955	Togo	1960
Israel	1949	Tunisia	1956
Italy	1955	Turkey	1945
Ivory Coast	1960	Ukraine (UB5)	1945
Japan	1956	Un. So. Africa	1945
Jordan	1956	USSR	1945
Laos	1955	Un. Kingdom	1945
Lebanon	1945	USA	1945
Liberia	1945	Upper Volta	1960
Libya	1955	Uruguay	1945
Luxembourg	1945	Venezuela	1945
Madasgascar	1960	Yemen	1947
Mali	1960	Yugoslavia	1945

Address all correspondence to: Tom Harmon, WØIUB, 5019 Gramar, Wichita, Kansas, USA.

The 59 Radiotelephone Award

This series of diplomas is issued for R5 S9 contact with each of the six continental areas. Contacts must be confirmed. Send the six QSLs with application. A statement signed by a radio club officer or by two amateurs that the applicant has the confirmations will be accepted instead of the QSL cards.

Ten separate awards are issued as follows:

Single Side Band	AM
10 Meter	10 Meter
15 Meter	15 Meter
20 Meter	20 Meter
40 Meter	40 Meter
Mixed Band	Mixed Band

Each certificate is different. Each of these awards is considered a separate award for the Certificate Hunters Club. All diplomas are sent in mailing tubes to avoid shipping damage. Fee: $1.00 or 7 IRC per certificate. Awards will be numbered serially. Address all correspondence to: Tom Harmon, WØIUB, 5019 Gramar, Wichita 18, Kansas, USA. There is no beginning date for these awards.

Okinawa

I have just received a letter from George Collins, KR6CR, the former president of the Okinawan Amateur Radio Club, who is now their QSL and Awards Manager. It seems quite

This is the gathering of the Hong Kong Amateur Radio Transmitting Society at their 13th anniversary dinner. In the center foreground is the President's trophy consisting of a gold plated post office type key mounted on a polished hardwood base which is to be awarded annually to the member performing the most meritorious service to amateur radio. The joint recipients this year are Pat O'Brien, VS6AE, and John Alvares, CR9AH.

a few of their certificates may have gone astray. Anyone who has not received his certificate, please drop George a line, c/o Okinawan Amateur Radio Club, QSL/Awards Manager, APO 331, San Francisco, California.

Here and There

AC5 Bhutan: From VU2MD the following: "I'm afraid AC5PN has not been heard for a long time. I wrote and asked him to come up at least during weekends from 1200 GMT. He did for a few weekends, but shortly vanished. However, AC5SQ, ex-AC3SQ, is now on the air."

FK8 New Caledonia: ZL3DX will operate from here Sept. 1st to the 4th. Frequencies will be 14306 and 14348 s.s.b. and 14040 and 21040 on c.w. (Tnx WGDXC)

FP8 Saint Pierre: Charlie, W2EQS, will put FP8AS back on again the last three weeks of September. Jan, DL9KR or FF8CW/6W8CW fame will join the trip. Charlie mentions that anyone who desires to obtain an FP8 license should get the necessary authorization from FP8AP ONLY.

KA Japan: The following note of interest was received from WA6BKQ, Sec. of the Yokota Radio Club: "The Yokota Radio Club has been active now for about 10 months. The club station is KA2YA. Most operating is done on 20 s.s.b. with occasional activity on other bands and modes. Since the club re-activated (it began in 1952 but ceased to exist) there have been thousands of QSO's made. I've been handling the QSLs so I can report that we QSL 100%. Cards to senders have been held up for about a month due to lack of QSLs. However, we are having 3,000 printed up so we'll be getting quite a few out soon. Our mailing address has been changed to MARS, 2127th Air Force Communications Squadron, APO 328, San Francisco, Calif. Most operation takes place after 1900 local time (1000) GMT when the local QRM level goes down."

KL7 Pribilof Islands: Here is some additional information, thanks to W4ARH/KL7 and K2YFE—The Pribilofs are located roughtly 225 miles from the Alaskan mainland, and are composed of St. Paul and St. George Islands. The Islands are not under jurisdiction of the State of Alaska, but are administered by the U. S. Fish and Wildlife Service as a game preserve.

As far as is known, there is no amateur activity on St. George Island, but St. Paul Island is represented by KL7AF, KL7DNE, and KL7AGX. DNE is on s.s.b. and c.w. daily. (USCG Loran Station) AGX is reported to be on c.w. only, and active on weekends.

As Bill, KL7DNE said, it's an interesting problem. Incidentally, he pleads guilty to being the originator of the whole idea.

KZ5 Canal Zone: Received a nice letter from KZ5SW and Ted complains that a great many W stations have been sending s.a.s.e. with US stamps for direct return of their QSL, unfortunately, they cannot be used as the Canal Zone has its own stamps. Ted mentions that most of the fellows there send their QSLs via the Bureau so make sure you have an envelope on file. In closing, Ted mentions that the KZ5's will soon have the new VE phone frequencies.

LA Jan Mayen: LA7IH/P is now on from this spot.

OHØ Aland Island: Nick Lassiter, OH2XZ, ex-W4KFG informs us that 8 mm films of the recent DXpedition to Aland Island (OHØA) are available for club showings. Nick can be found at the American Embassy, Helsinki, Finland.

PK Indonesia: It is now legal to work K3HVN/PK1 but not any station using a PK call such as PK1SX, which is actually the same station. Third Party traffic is also still illegal.

VK9 Nauru Island: VK9AM has been operating on a.m. phone between 14100 to 14200 kc about 0600 to 1200 GMT. (Tnx WGDXC)

VP5 Grand Turks Island: WA6CWM advises that VP5LG & VP5WM will be on all bands a.m. with a G-76 and a tri-band beam. Operations are expected to last 10 months. QTH of VP5LG is R.L. Gleason, CEW-2, Navy #104, c/o FPO, New York, N. Y.

YJ New Hebrides: Win McGee, ZL3DX, will operate s.s.b. and c.w. from this spot from August 28th-September 1st. Frequencies will be 14306 and 14348 s.s.b. and 14040 and 21040 c.w. (Tnx WGDXC)

ZM7 Tokelau Island: Pye, ZL3VH, well known for his Chatham Island operations of last year will soon be spending six months on Tokelau. He will have his rig with him. (Tnx WGDXC)

QTH's and QSL Managers

Harry, W2JXH, the QSL Manager for 9K3TL/NZ would like to thank the gang who sent unsolicited contributions to help with the cards.

CN8MB ....via K4VUR
CT3AV ....via W3KVQ
DL5FT ....Capt. Charles Knight, Box 102, 807th TAC CON SQ. APO 12, N. Y., N. Y.
F1SAP ....now F3KG
FP8BR ...K1MOD
HS1X .....via K8RFH
HS2M .....via K4JEY for W/K; DX direct to Mike Pioso SEATO-MPO, APO 146, San Francisco, Calif.
JY2NZK ..Box 35, Geneva 15, Switzerland
JZØPH ....Joop Hesp 1953 Hortensiaweg Biak, Netherlands, New Guinea
K3HVN/ PK1 and PK1SX ....Bob Burgess, 706 Mayo Rd., Glen Burnie, Md.
K6CQV/ KS6 ......Box 307, Pago Pago
KH6EDY (Kure Island Operator Jim)..via VE7ZM or USCG Loran Station Navy 3080 c/o FPO, San Francisco, Calif.
KJ6BJ ....USCG Loran Station, Johnston Is. APO 105, San Francisco, Calif.
KM6CE ...Box 23, Navy 3080, FPO San Francisco, Calif.
ex-KS6AK .via Norman Sparby, WA6BYC, 1014 Katrine Ct. Sunnyvale, Calif.
KX6BC ....Box 117, Navy 824 FPO, San Francisco, Calif.
KZ5SW ...S. P. Wilds, Box 2519, Balboa, C. Z.
PY4ADC ..Hipacio Gomes Marra, Rua Guaranesia 385, Belo Horizonte M. G., Brasil

Republic of Congo

TN8AA ....Guy Delas, Box 574, Brazzaville ex-**FQ8HY.**
TN8AB ....Auguste Castry, Box 2253, Brazzaville ex-**FQ8AC.**
TN8AC ....Charles Mayeux, P.T.T., Pointe-Noire ex-**FQ8AD.**
TN8AD ....Camille Duvaut, Box 467, Brazzaville, ex-**FQ8AE.**
TN8AF ....Constant Narolles, Box 138, Brazzaville, ex-**FY8AC/FQ8AG.**
TN8AG ....Jean Pierrat, Box 108, Brazzaville, ex-**FQ8AR.**
TN8AH ....Jacques Huguet, Box 173, Brazzaville, ex-**FQ8AM.**
TN8AI ....Pierre Guillard, Box 233, Dolisie, ex-**FF8PG/FQ8AQ.**
TN8AJ ....Lucien Gilbert, Box 2023, Brazzaville, ex-**FQ8AJ.**
TN8AK ....Louis LeCocq, Box 218, Brazzaville, ex-**FQ8AV.**
TN8AL ....Serge Besse, Box 298, Brazzaville, ex-**FQ8AW.**
TN8AM ...Serge Guye, Box 2070, Brazzaville.
TN8AO ....Michel Gorde, Box 898, Brazzaville, ex-**FQ8AZ.**
TN8AP ....Jacques Fees, Box 1132, Pointe-Noire, ex-**FQ8HB.**
TN8AQ ....Paul Pouebla, Box 298, Brazzaville, ex-**FQ8HC.**
TN8AR ....Raymond Robinson, Box 894, Brazzaville, ex- **FQ8HD.**
TN8AS ....Henri Josse, Box 170, Brazzaville, ex-**FQ8HJ.**
TN8AT ....Maurice Larrieu, Box 108, Brazzaville.
TN8AU ....Robert Lafond, Box 41, Brazzaville, ex-**FQ8HP.**
TN8AV ....Andre Gray, Box 2243, Brazzaville.
TN8AW ...Robert Blondeau, Box 2013, Brazzaville, ex-**FQ8HR.**
TN8AX ....Jean Rozier, Box 218, Brazzaville, ex-**FQ8AX.**
TN8AY ....Aime Hangard, Box 538, Brazzaville, ex-**FQ8AY.**
TN8AZ ....Albert Noger, Box 2012, Brazzaville.

QSL may be sent via P. O. Box 2238, Brazzaville.

Republic Gabonaise

TR8AA ....Andre Wailly, Box 13, Libreville, ex-**FQ8AH.**
TR8AB ....Jean Diore, S. G. C. F. G. Port-Gentil.

Republic Centrafricaine

TL8AB ....Francis Postel, Box 171, Bangui, ex-**FQ8HN.**
TL8AC ....Pierre Sevestre, Box 785, Bangui, ex-**FF8CE/FQ8HT.**

Republic of Tchad

TT8AA ....Henri Gondoin, B.A. 172, Fort-Lamy, ex-**FQ8AA/F8MQ.**
TT8AB ....Gabriel Brodard, Box 12, Ati, ex-**FQ8AT.**
TT8AC ....Pierre Stamm, Box 235, Fort-Lamy, ex-**FQ8HI.**
TT8AD ....Henri Pieredu, Box 449, Fort-Lamy, ex-**FQ8HL.**
TT8AE ....Guy Matheron, Box 460, Fort-Lamy.
TT8AF ....Robert Thiery, Box 138, Fort-Archambault.
TT8AG ....Louis Bucci, 20 Esima, Largeau, ex-**FQ8HW.**
TT8AH ....Barange, SMB Largeau.

UA2AO ....Anly Moskalenko, Box 77, Kalingradsk.
UA3CR ....Box 82, Moscow, USSR.
UA3FG ....Box 570, Moscow, USSR.
UA9KOG ..Box 44, Novosibirsk, USSR.
UA9PL ....Radio Club Novosibirsk, Michurina Str 36, Novosibursk, USSR.
UB5WF ...Box 41, Lvov, Ukraina.
UC2AA ....Box 41, Minsk City, White Russia.
UP2CG ....Box 17, Shaulay, Lithuanian, SSR.
UR2AR ....Box 137, Tallin, Estonia.

VQ8BL ....Box 467, Port Louis, Mauritius.
VR2BJ ....Malcolm Gray, POB 4, GPO, Suva, Fiji.
W4ARH/ KL7 ......Box 157, 4157th Combat Support Group, APO 937, Seattle, Washington.
YV3EC ....Box 445, Barquisimeto, Venezuela.
ZA1KFF/ KFA ......Verdsklash, Technical Institute of Culture, Box 888 Tirana, Albania.
ZB2AD ....via W3AYD.
ZK2AD ....via W9GFF.
5A3TR ....via W3ZZE.
5A5TF ....Box 638, Tripoli, Libya.
5U7AC ....via W9RKP.
9G1DT ....Box 16, Worawora, Ghana.
9K3TL/NZ .via W2JXH.
9Q5DQ ....2111 White Ave., Knoxville, Tenn.

PROPAGATION

George Jacobs, W3ASK
11307 Clara St., Silver Spring, Md.

LAST MINUTE FORECAST

The forecast indices for the month of September, shown in the Propagation Charts following the predicted times of openings, are expected to be related to day-to-day propagation conditions in the following manner:

Forecast Indices	Above Normal Sept. 16-17	Normal Sept. 1-5, 14-15, 18-22, 26-30	Below Normal Sept. 9, 12-13, 23-25	Disturbed Sept. 6-8, 10-11
(1)	C	D-E	E	E
(2)	B	C-D	E	E
(3)	A	B-C	D-E	E
(4)	A	A	B-C	C-D

Where:

- A—Excellent opening with strong steady signals.
- B—Good opening, moderately strong signals, with some fading and noise.
- C—Fair opening, signals fluctuating between moderately strong and weak, with moderate fading and noise.
- D—Poor opening, signals generally weak, with considerable fading, and high noise level.
- E—Opening very poor, or not possible.

General Conditions

SEPTEMBER is a month of changing short-wave propagation conditions. During the early part of the month, conditions are more or less typical of the summer months. By the end of the month, however, the beginning of "winter-time" conditions should be evident. Winter-time propagation conditions are marked by higher usable frequencies during the daylight hours, an improvement in the lower frequency bands during the hours of darkness, lower static levels and generally stronger DX signals.

Some ten meter DX openings are forecast for September, although they are expected to occur considerably less frequently than last year. Fifteen meters is expected to be the optimum DX band during the daylight hours, with openings forcast to most areas of the world.

DX conditions on 20 meters are expected to peak shortly after sunrise and again during the late afternoon and early evening hours. Fairly good openings to most areas of the world are predicted for these periods.

During the hours of darkness, 40 meters should be optimum for DX to many areas of the world, with some fairly good night time openings also predicted for 80 meters. With reduced static levels, some 160 meter DX openings are also forecast for the hours of darkness.

Meteor activity is at a low level during September, and sporadic-E propagation decreases considarably. Some v.h.f. ionospheric propagation may be possible, however, as a result of increased auroral activity which generally takes place during September.

This month's Propagation Charts contain DX predictions for the three main geographical regions of the USA to more than a dozen major DX areas. Short-skip Propagation Charts for the month of September appeared in last month's column.

International Quiet Sun Year

Most radio amateurs are probably familiar with the recent International Geophysical Year, or IGY, which was held during the period of maximum intensity of the present sunspot cycle. On an unprecedented basis, scientists representing all the major countries of the world and from many of the smaller ones as well, undertook a coordinated attack on many of the scientific mysteries concerning the earth and its surrounding atmosphere.

This world-wide program of scientific co-operation, which lasted from mid 1957 through the end of 1958, was so successful that plans are now being made to conduct a similar, but smaller-scale, program during the upcoming period of minimum sunspot activity. Preliminary plans for such a program have already been completed, and the period will be called the International Year of the Quiet Sun, or *IQSY*. The IQSY is scheduled to begin April 1964 and last through December 1965.

Although not intended to be as broad in scope, the IQSY will be modeled after the IGY. Many investigations conducted during the

SEPTEMBER & OCTOBER, 1961

TIME ZONE: EST

EASTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80* Meters
Western Europe	10A - 3 P (1)	7 A - 8 A (1) 8 A - 12N (2) 12N - 3 P (3) 3 P - 4 P (2) 4 P - 6 P (1)	5 A - 7 A (2) 7 A - 12N (1) 12N - 3 P (2) 3 P - 6 P (4) 6 P - 7 P (3) 7 P - 8 P (2) 8 P - 10P (1)	6 P - 7 P (2) 7 P - 11P (4) 11P - 1 A(3) 1 A - 3 A(1) 7 P - 9 P (1)* 9 P - 12M(3)* 12M - 1A (1)*
Eastern Europe	10A - 1 P (1)	7 A - 11A (1) 11A - 1 P (2) 1 P - 2 P (1)	6 A - 2 P (1) 2 P - 5 P (2) 5 P - 8 P (1)	8 P - 2 A (1) 9 P - 12M(1)*
North Africa & Southern Europe	9 A - 12N (1) 12N - 3 P (2) 3 P - 4 P (1)	7 A - 11A (2) 11A - 3 P (3) 3 P - 4 P (2) 4 P - 7 P (1)	5 A - 7 A (2) 7 A - 12N (1) 12N - 4 P (2) 4 P - 6 P (4) 6 P - 8 P (3) 8 P - 10P (2) 10P - 12M (1)	6 P - 8 P (2) 8 P - 11P (4) 11P - 12M(2) 12M - 2 A(1) 7 P - 9 P (1)* 9 P - 11P (3)* 11P - 1 A (1)*
South Africa	7 A - 9 A (1) 9 A - 11A (2) 11A - 1 P (3) 1 P - 2 P (2) 2 P - 4 P (1)	6 A - 11A (1) 11A - 3 P (2) 3 P - 5 P (3) 5 P - 6 P (2) 6 P - 7 P (1)	12N - 3 P (1) 3 P - 5 P (2) 5 P - 7 P (3) 7 P - 9 P (2) 9 P - 1 A (1)	6 P - 8 P (1) 8 P - 9 P (2) 9 P - 11P (1) 7 P - 9 P (1)*
Eastern Mediterranean	10A - 3 P (1)	7 A - 9 A (1) 9 A - 12N (2) 12N - 2 P (3) 2 P - 3 P (2) 3 P - 5 P (1)	7 A - 4 P (1) 4 P - 8 P (2) 8 P - 10P (1)	7 P - 11P (1)
Central Asia	NIL	9 A - 12N (1)	7 A - 9 A (1) 6 P - 10P (1)	6 P - 9 P (1) 5 A - 7 A(1)
Southeast Asia	NIL	12N - 4 P (1)	7 A - 9 A (2) 9 A - 11A (1) 5 P - 9 P (1)	NIL
Far East	NIL	4 P - 5 P (1) 5 P - 6 P (2) 6 P - 8 P (1)	7 A - 9 A (2) 9 A - 10A (1) 4 P - 8 P (1)	6 A - 8 A (1)
Pacific Islands & New Zealand	1 P - 5 P (1) 5 P - 7 P (2) 7 P - 9 P (1)	8 A - 10A (1) 1 P - 5 P (1) 5 P - 8 P (2) 8 P - 11P (1)	6 P - 8 P (1) 8 P - 11P (2) 11P - 3 A(3) 3 A - 7 A (2) 7 A - 8 A (3) 8 A - 9 A (2) 9 A - 12N (1)	12M - 2 A (2) 2 A - 5 A (3) 5 A - 6 A (2) 6 A - 8 A (1) 2 A - 3 A (1)* 3 A - 4 A (2)* 4 A - 7 A (1)*
Australia	5 P - 8 P (1)	8 A - 10A (2) 3 P - 5 P (1) 5 P - 9 P (2) 9 P - 11P (1)	7 A - 8 A (2) 8 A - 9 A (3) 9 A - 10A (2) 10A - 11A (1) 11P - 4 A (1)	3 A - 6 A (2) 6 A - 8 A (1) 5 A - 7 A (1)*
South America	7 A - 10A (1) 10A - 2 P (2) 2 P - 4 P (3) 4 P - 5 P (2) 5 P - 7 P (1)	5 A - 7 A (1) 7 A - 10A (3) 10A - 2 P (2) 2 P - 4 P (3) 4 P - 6 P (4) 6 P - 7 P (3) 7 P - 8 P (2) 8 P - 1 A (1)	2 P - 4 P (2) 4 P - 7 P (3) 7 P - 1 A (4) 1 A - 3 A(3) 3 A - 5 A(2) 5 A - 7 A(3) 7 A - 9 A(2) 9 A - 2 P (1)	6 P - 8 P (1) 8 P - 3 A(3) 3 A - 5 A(1) 7 P - 9 P (1)* 9 P - 3 A(2)* 3 A - 4 A(1)*
McMurdo Sound, Antarctica	3 P - 4 P (1) 4 P - 6 P (2) 6 P - 7 P (1)	1 P - 3 P (1) 3 P - 6 P (2) 6 P - 7 P (3) 7 P - 8 P (2) 8 P - 10P (1)	3 P - 6 P (1) 6 P - 8 P (2) 8 P - 10P (3) 10P - 11P (2) 11P - 12M(1)	12M - 5 A (1)

TIME ZONES: CST & MST

Central USA To:

	10 Meters	15 Meters	20 Meters	40/80* Meters
Western Europe	10A - 3 P (1)	7 A - 9 A (1) 9 A - 11A (2) 11A - 2 P (3) 2 P - 3 P (2) 3 P - 5 P (1)	6 A - 7 A (2) 7 A - 1 P (1) 1 P - 5 P (2) 5 P - 9 P (1)	8 P - 10P (1) 10P - 1 A (2) 1 A - 2 A (1) 10P - 1 A (1)*
Eastern Europe	9 A - 11A (1)	7 A - 8 A (1) 8 A - 11A (2) 11A - 1 P (1)	6 A - 12N (1) 12N - 3 P (2) 3 P - 6 P (1)	8 P - 1 A (1)

TIME ZONES: CST & MST, Cont.

Central USA To:

	10 Meters	15 Meters	20 Meters	40/80* Meters
North Africa & Southern Europe	9 A - 11A (1) 11A - 1 P (2) 1 P - 3 P (1)	7 A - 9 A (1) 9 A - 11A (2) 11A - 1 P (3) 1 P - 2 P (2) 2 P - 5 P (1)	5 A - 7 A (2) 7 A - 12N (1) 12N - 2 P (2) 2 P - 5 P (3) 5 P - 7 P (2) 7 P - 12M (1)	6 P - 8 P (1) 8 P - 10P (3) 10P - 12M(1) 7 P - 9 P (1)* 9 P - 10P (2)* 10P - 11P (1)*
Central Africa	9 A - 11A (1) 11A - 4 P (2) 4 P - 6 P (1)	7 A - 10A (1) 10A - 1 P (2) 1 P - 3 P (3) 3 P - 5 P (4) 5 P - 7 P (2) 7 P - 8 P (1)	12N - 3 P (1) 3 P - 5 P (2) 5 P - 8 P (3) 8 P - 10P (2) 10P - 12M (1)	6 P - 8 P (1) 8 P - 9 P (2) 9 P - 10P (1) 8 P - 10P (1)*
Eastern Mediterranean	9 A - 11A (1)	7 A - 9 A (1) 9 A - 12N (2) 12N - 2 P (1)	8 A - 2 P (1) 2 P - 5 P (2) 5 P - 10P (1)	7 P - 10P (1)
Central Asia	NIL	7 A - 11A (1) 5 P - 8 P (1)	7 A - 8 A (2) 8 A - 10A (1) 6 P - 9 P (1)	7 P - 9 P (1) 5 A - 7 A (1)
Southeast Asia	12N - 6 P (1)	10A - 1 P (2) 1 P - 6 P (1) 6 P - 8 P (2) 8 P - 10P (1)	7 A - 9 A (2) 9 A - 12N (1) 9 P - 12M (1)	5 A - 7 A (1)
Far East	3 P - 7 P (1)	7 A - 9 A (1) 2 P - 4 P (1) 4 P - 5 P (2) 5 P - 7 P (3) 7 P - 9 P (2) 9 P - 10P (1)	6 A - 7 A (1) 7 A - 9 A (2) 9 A - 1 P (1) 9 P - 12M (1)	5 A - 8 A (1)
Pacific Islands & New Zealand	12N - 2 P (1) 2 P - 4 P (2) 4 P - 6 P (3) 6 P - 7 P (2) 7 P - 8 P (1)	7 A - 10A (1) 10A - 12N (2) 12N - 4 P (1) 4 P - 6 P (2) 6 P - 8 P (3) 8 P - 9 P (2) 9 P - 11P (1)	4 P - 6 P (1) 6 P - 9 P (2) 9 P - 11P (4) 11P - 1 A (3) 1 A - 6 A (2) 6 A - 8 A (3) 8 A - 11A (2) 11A - 1 P (1)	11P - 1 A (1) 1 A - 6 A (3) 6 A - 7 A (2) 7 A - 8 A (1) 12M - 1 A (1)* 1 A - 6 A (2)* 6 A - 7 A (1)*
Australia	2 P - 3 P (1) 3 P - 7 P (2) 7 P - 8 P (1)	8 A - 11A (1) 2 P - 5 P (1) 5 P - 9 P (2) 9 P - 11P (1)	8 P - 10P (1) 10P - 2 A (2) 2 A - 7 A (1) 7 A - 9 A (3) 9 A - 11A (2) 11A - 1 P (1)	3 A - 4 A (1) 4 A - 6 A (3) 6 A - 8 A (1) 4 A - 5 A (1)* 5 A - 6 A (2)* 6 A - 7 A (1)*
South America	7 A - 9 A (1) 9 A - 2 P (2) 2 P - 5 P (3) 5 P - 6 P (2) 6 P - 7 P (1)	5 A - 7 A (1) 7 A - 9 A (3) 9 A - 1 P (2) 1 P - 4 P (3) 4 P - 6 P (4) 6 P - 8 P (2) 8 P - 1 A (1)	2 P - 4 P (2) 4 P - 7 P (3) 7 P - 12M(4) 12M - 2 A (3) 2 A - 5 A (2) 5 A - 7 A (3) 7 A - 9 A (2) 9 A - 2 P (1)	7 P - 9 P (1) 9 P - 3 A (3) 3 A - 5 A (1) 8 P - 9 P (1)* 9 P - 2 A (2)* 2 A - 3 A (1)*
McMurdo Sound, Antarctica	1 P - 3 P (1) 3 P - 5 P (2) 5 P - 7 P (1)	11A - 3 P (1) 3 P - 6 P (2) 6 P - 8 P (3) 8 P - 9 P (2) 9 P - 10P (1)	7 A - 9 A (1) 4 P - 6 P (1) 6 P - 8 P (2) 8 P - 11P (3) 11P - 12M (2) 12M - 1 A (1)	1 A - 7 A (1)

TIME ZONE: PST

Western USA To:

	10 Meters	15 Meters	20 Meters	40/80* Meters
Northern & Central Europe	NIL	6 A - 10A (1) 10A - 12N (2) 12N - 1 P (1)	5 A - 7 A (2) 7 A - 5 P (1)	7 P - 1 A (1) 9 P - 12M (1)*
Eastern Europe	NIL	6 A - 10A (1)	5 A - 7 A (2) 7 A - 4 P (1)	7 P - 12M (1)
Southern Europe & North Africa	9 A - 12N (1)	6 A - 8 A (1) 8 A - 12N (2) 12N - 2 P (1)	5 A - 12N (1) 12N - 2 P (2) 2 P - 3 P (3) 3 P - 5 P (2) 5 P - 11P (1)	6 P - 7 P (1) 7 P - 9 P (2) 9 P - 11P (1) 7 P - 11P (1)*
South Africa	7 A - 10A (1) 10A - 1 P (2) 1 P - 2 P (1)	6 A - 9 A (1) 9 A - 12N (2) 12N - 2 P (3) 2 P - 3 P (2) 3 P - 5 P (1)	11A - 3 P (1) 3 P - 6 P (2) 6 P - 12M(1)	6 P - 9 P (2) 7 P - 9 P (1)*
Eastern Mediterranean	NIL	8 A - 11A (1)	7 A - 9 A (1) 7 P - 9 P (1)	NIL

TIME ZONE: PST, Cont.

Western USA To:

	10 Meters	15 Meters	20 Meters	40/80* Meters
Central Asia	4 P - 7 P (1)	4 P - 5 P (1) 5 P - 7 P (2) 7 P - 8 P (1)	7 A - 9 A (2) 9 A - 12N (1) 5 P - 10P (1)	5 A - 7 A (1)
Southeast Asia	9 A - 12N (1) 3 P - 7 P (1)	8 A - 9 A (1) 9 A - 11A (3) 11A - 12N (2) 12N - 6 P (1) 6 P - 8 P (2) 8 P - 10P (1)	7 A - 9 A (2) 9 A - 12N (1) 9 P - 2 A (1)	2 A - 3 A (1) 3 A - 5 A (2) 5 A - 7 A (1) 3 A - 6 A (1)*
Far East	2 P - 6 P (1)	12N - 1 P (1) 1 P - 5 P (2) 5 P - 7 P (3) 7 P - 8 P (2) 8 P - 10P (1)	7 A - 9 A (3) 9 A - 11A (2) 11A - 7 P (1) 7 P - 8 P (2) 8 P - 10P (3) 10P - 11P (2) 11P - 1 A (1)	12M - 2 A (1) 2 A - 6 A (3) 6 A - 7 A (1) 3 A - 4 A (1)* 4 A - 6 A (2)* 6 A - 7 A (1)*
Pacific Islands	11A - 4 P (2) 4 P - 7 P (3) 7 P - 8 P (2) 8 P - 9 P (1)	8 A - 9 A (1) 9 A - 12N (3) 12N - 4 P (2) 4 P - 6 P (3) 6 P - 8 P (4) 8 P - 9 P (3) 9 P - 10P (2) 10P - 2 A (1)	4 P - 6 P (1) 6 P - 8 P (2) 8 P - 1 A (4) 1 A - 3 A (3) 3 A - 7 A (1) 7 A - 9 A (3) 9 A - 10A (2) 10A - 12N (1)	9 P - 10P (1) 10P - 6 A (3) 6 A - 8 A (1) 10P - 11P (1)* 11P - 5 A (2)* 5 A - 6 A (1)*
Australia	2 P - 5 P (2) 5 P - 6 P (3) 6 P - 7 P (2) 7 P - 9 P (1)	7 A - 9 A (1) 12N - 6 P (2) 6 P - 8 P (3) 8 P - 9 P (2) 9 P - 11P (1)	7 P - 9 P (1) 9 P - 11P (2) 11P - 1 A (4) 1 A - 4 A (2) 4 A - 7 A (1) 7 A - 9 A (4) 9 A - 10A (2) 10A - 12N (1)	12M - 2 A (2) 2 A - 5 A (3) 5 A - 6 A (2) 6 A - 7 A (1) 1 A - 3 A (1)* 3 A - 5 A (2)* 5 A - 6 A (1)*
New Zealand	11A - 3 P (2) 3 P - 5 P (3) 5 P - 7 P (2) 7 P - 9 P (1)	9 A - 10A (1) 10A - 12N (3) 12N - 4 P (2) 4 P - 7 P (3) 7 P - 9 P (4) 9 P - 10P (2) 10P - 2 A (1)	5 P - 7 P (1) 7 P - 9 P (2) 9 P - 2 A (4) 2 A - 4 A (2) 4 A - 6 A (1) 6 A - 8 A (2) 8 A - 12N (1)	9 P - 11P (2) 11P - 5 A (3) 5 A - 6 A (2) 6 A - 7 A (1) 10P - 11P (1)* 11P - 5 A (2)* 5 A - 6 A (1)*
South America	6 A - 7 A (1) 7 A - 12N (2) 12N - 3 P (3) 3 P - 5 P (2) 5 P - 6 P (1)	5 A - 7 A (3) 7 A - 12N (2) 12N - 3 P (3) 3 P - 5 P (4) 5 P - 6 P (3) 6 P - 7 P (2) 7 P - 12M (1)	2 P - 4 P (2) 4 P - 6 P (3) 6 P - 12M (4) 12M - 2 A (3) 2 A - 7 A (2) 7 A - 2 P (1)	6 P - 8 P (1) 8 P - 2 A (3) 2 A - 3 A (1) 7 P - 8 P (1)* 8 P - 1 A (2)* 1 A - 2 A (1)*
McMurdo Sound, Antarctica	12N - 2 P (1) 2 P - 4 P (2) 4 P - 7 P (1)	9 A - 11A (2) 11A - 5 P (1) 5 P - 6 P (2) 6 P - 7 P (3) 7 P - 9 P (2) 9 P - 11P (1)	7 A - 9 A (1) 4 P - 6 P (1) 6 P - 8 P (2) 8 P - 11P (3) 11P - 12M (2) 12M - 1 A (1)	12M - 7 A (1)

FORECAST INDICES

Circuits shown in the Propagation Charts are forecast to open:

(1) Less than 7 days each month.

(2) Between 8 and 13 days each month.

(3) Between 14 and 22 days each month.

(4) For more than 22 days during each month.

The reception quality expected during openings (signal strength and fading levels), as well as the specific days that each circuit is likely to open, are shown in the "Last Minute Forecast" appearing in the text.

*Indicates predicted 80 meter openings. The 160 meter band is likely to open during those times when 80 meter openings are rated (2) or better.

A - A.M. P - P. M. N - Noon M - Midnight

The CQ DX Propagation Charts are based upon a CW effective radiated power of 150 watts at radiation angles lower than thirty degrees. The Eastern USA Chart can be used in the 1, 2, 3, 4 and 8 amateur call districts; the Central USA Chart in the 5, 9 and Ø districts, and the Western USA Chart in the 6 and 7 districts. The Charts are valid through October 31, 1961. The Propagation forecasts contained in these Charts are derived from basic ionospheric data published by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

IGY will be continued through the Quiet Sun Year. Extensive international programs are being planned to study the sun and solar activity, to probe the ionosphere and outer space with high power radio waves, rockets and earth satellites, and to study auroral activity, cosmic ray radiation, geomagnetism, meteorology, and many other phenomenon upon which life may depend.

Much of the data to be obtained during the IQSY will complement similar data obtained during the IGY, and will enable valuable scientific comparisons to be made for the extremes of a solar cycle.

A special IQSY Panel has been established recently in the U.S. National Academy of Sciences to plan this country's participation in the Quiet Sun Year. The Panel has already announced that it is considering possible contributions to the U.S. program by radio amateurs. Amateur radio played an important role during the IGY. Under the auspices of the ARRL, a radio amateur IGY program provided information of considerable scientific value concerning trans-equatorial and v.h.f. ionospheric propagation. Many radio amateurs also contributed to IGY auroral studies, satellite tracking programs and other IGY activities. The IQSY will be another excellent opportunity for amateur radio to again take part in pushing forward the frontiers of science. Suggestions concerning the role radio amateurs might play in the Quiet Sun Year would be welcomed by the IQSY Panel and should be addressed to the Secretary IQSY Panel, Geophysical Research Board, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington 25, D.C. It would be appreciated if copies of letters sent to the IQSY Panel would also be sent to the Editor of this column, W3ASK.

The IQSY will be the topic of much discussion in this column as progress is made towards its implementation.

Sunspot Cycle

The mean sunspot number for June 1961 was 78, as reported by the Zurich Solar Observatory. This results in a 12 month running smoothed sunspot number of 83 centered on December 1960. *CQ* forecasts a smoothed sunspot number of 60 for September 1961, as the present cycle continues to decline.

Solar activity during the coming fall months is expected to be at about the same level as observed during the fall seasons of 1951 and 1955.

The Sunspot Story

"The Sunspot Story, Cycle 19; The Declining Years," which appeared originally as a three part special article in the April, May and June issues of *CQ*, has been reprinted and bound into booklet form. A limited number of these booklets are available directly from *CQ* for $1 each (75¢ each in lots of 10). The booklet contains the complete Jacobs-Leinwoll report on ionospheric conditions in general sunspot behavior and its influence on radio propagation.

Much of the information appearing in the report has not been published, and it is fast becoming a valuable reference on the subject of sunspots and radio propagation.

73, George

sideband sideband sideband

SIDEBAND

IRV and DOROTHY STRAUBER, K2HEA/K2MGE
12 Elm Street, Lynbrook, New York

SSB DX HONOR ROLL

T12HP	239	K6ZXW	191
W6UOU	234	W2LV	190
W8PQQ	233	ZL31A	186
W8EAP	225	K4TJL	186
VQ4ERR	218	W2VZV	182
PY4TK	215	K8RTW	180
WØQVZ	215	K2FW	177
W6RKP	212	K6LGF	175
W7VEU	210	W3LMA	169
W6PXH	210	PZ1AX	168
K2MGE	210	XE1AE	167
W2ZX	209	W3VSU	161
W6BAF	207	W2YBO	160
W6WNE	206	W5RHW	159
HB9TL	203	K2JFV	158
W3NKM	202	W3KT	155
W5AFX	202	W6EKZ	154
W4OPM	202	W1LLF	153
W2FXN	201	W2NUT	152
W2JXH	200	W2HXG	152
K9EAB	200	W2QKJ	150
W8YBZ	200	W6YMV	150
WØCVU	195	K1IXG	150
W5IYU	194	K6LMS	150
MP4BBW	192	W2VCZ	150

CQ SSB CERTIFICATES AND STICKERS

Worked 50
W7BPS KL7PIV
W6HPS K5AWR
DL4BS PJ2AF
DL1PM

Worked 75
KP4ATU W3CLP
DL4BS PJ2AF
KL7PIV

Worked 100
PJ2AA WØQGI
K6ZKH PJ2AF
K6CWS W9YMZ
KH6DLF EP2AG
G6UT

Worked 125
W6DLY K4ASU
W3VSU G8KS
PJ2AA G3DO
W3KPP

Worked 150
W6EKZ W3VSU
W2HXG

Worked 200
W5AFX W4OPM

Serial Numbers to be Included in WAS Contest Sept. 9-10

LATE FLASH! Serial numbers should be included in the reports exchanged during the Third Annual SSB "Worked All States" Contest to be held Saturday, September 9, 1961, 1500 GMT to Sunday, September 10, 1961, 2100 GMT. Thanks to a suggestion made by Bryan, W5KFT, 1960 Contest champion, we feel that the inclusion of serial numbers will promote greater competition and will help contestants keep track of their standing in the contest. So, your reports should be 59001 for the first signal (or whatever the readability and signal strength are) and 58069 for the 69th contact, etc., etc. Please spread the word around that we suggest the addition of serial numbers.

For all you newcomers to sideband, here is a marvelous opportunity for you to see what sideband really has to offer. With the ease of operation afforded by VOX and the greater signal punch, you'll be amazed at the number of contacts you can make. Be sure to utilize all the bands you can from 10 to 80; each band has its own devotees who will be glad to give you a point, when courteously approached, even though they may not be active contest participants.

Many of the "rare" states will have increased sideband activity during this contest. A card from John, W1SIP, brought the welcome news that he will operate from Vermont during the contest and you will, no doubt, find many other "portables" operating from such hard-to-get states as New Hampshire, New Mexico, Wyoming, and the Dakotas.

The complete rules for the Contest were included in this column in the August *CQ*. Look them over carefully and join us in the WAS Contest for one of the most enjoyable weekends of your ham life.

From Our Mailbag

A letter of great interest to all sidebanders was sent to us by Clif Evans, K6BX, who received it from Chuck, VK8TB, ex-W8DPF, the only s.s.b. station in Northern Territory, Australia. Dated June 28, the letter reads as follows:

"I do not know the exact date I will be leaving here but I have just finished the legal transfer of this s.s.b. station and all spare parts, including antenna, tower, rotator, etc., to Ed White, VK8OW, who lives here in Darwin, Northern Territory. He is a very keen amateur and active on 10, 15, and 20 meters. I don't think we could have picked a better man and were very lucky he lived here in Darwin, NT.

"Ed, VK8OW, works for the Dept. of Civil Aviation; he is supervisor of one of the air-to-ground international radio circuits. He is well informed on world radio conditions from day to day; I have found him invaluable in predicting High Frequency radio conditions between here and the States.

"It was through the very generous and well coordinated efforts of Golden Fuller, W8EWS, of Flint, Michigan, that the transfer of this station was made possible. Without the help of Golden Fuller, it would have been impossible and VK8-land would have been off the air. There was a legal agreement drawn up by an attorney here to the effect that, for a period of the next two years, the entire station shall be made available to any amateur holding a valid license and a working knowledge of the station for the purpose of going to some of the proposed DX locations listed on the agreement—Bathurst Island, Willis Island, Cocos Island, British Borneo, etc.

"So not only did Golden Fuller make it possible for the Northern Territory, VK8-land, to stay on the air but he also makes it possible to continue the DX program proposed for this section of the world.

"Also, if I have to leave here and return to America before we get permission to operate for 7 days on Portuguese Timor, Ed will proceed to Timor and operate CR1ØAA for the length of time authorized.

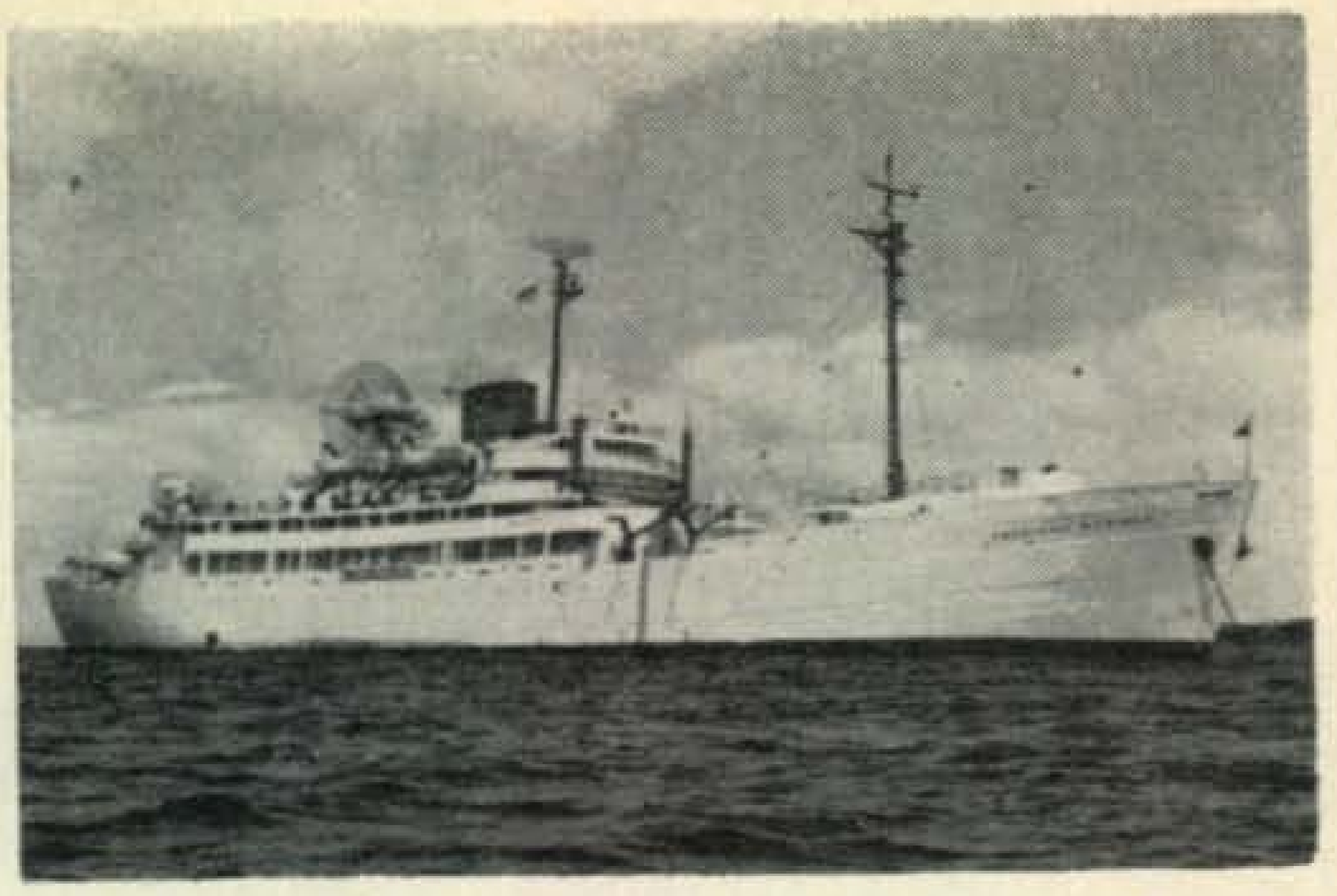
"I am very glad to see the credit for this operation given to the amateur who made it possible. Golden Fuller is a very modest person with very little fan fare about him and only a few realize the splendid efforts of his work. This letter should bring a bit of his efforts to the attention of the amateurs who really will appreciate it."

Frequency Utilization

You all probably recall the "oldie" about the father, who when asked what his son took up in college replied "Space." Tho' this may be an actuality today, the story still carries a meaningful point; a point which may be succinctly applied to the ham bands.

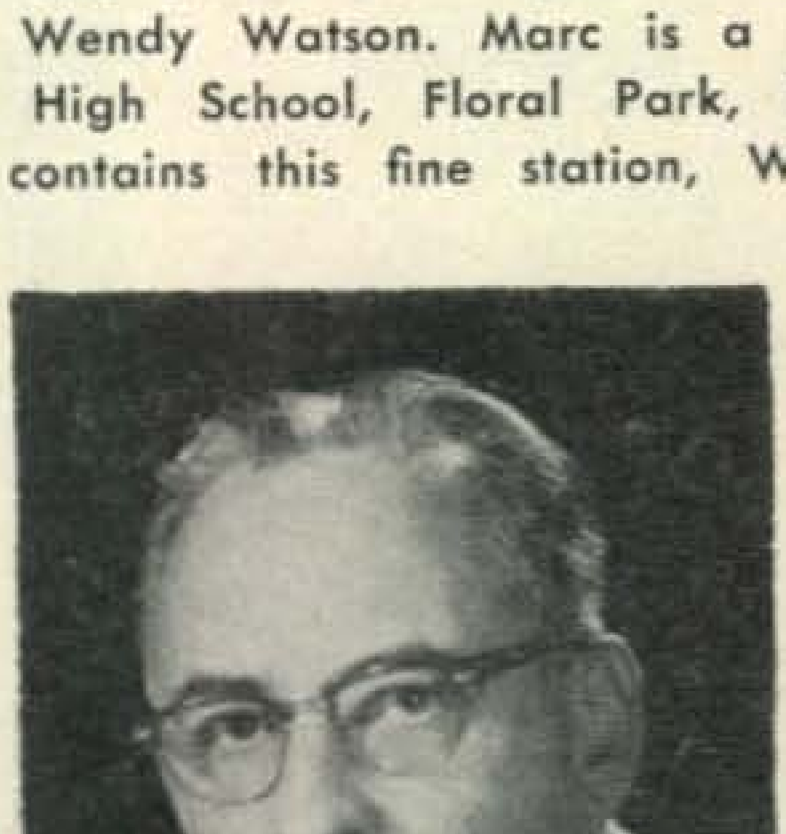
Sideband has been hailed by many as an effective way of permitting more stations to operate in the available spectrum. However, no matter what mode, overcrowding seems to be the order of the day and no single satisfactory solution has been found. To stop at this point and say that we have accomplished all that is possible is to adopt an "ostrich" attitude, because there is something we can do . . . and should do! !

We are faced with two problems . . . overcrowding and under-utilization of certain frequencies. Paradoxical? If you have tuned over the 10 and 15 meter bands recently you know that the sun spot cycle has and will continue to play havoc with these bands. The lull on these bands is heightened by the confused bedlam that often exists on the lower frequencies. Under-utilization, a word which could spell the loss of these frequencies through disuse, is not now a pressing problem, but like



Here is the *American Mariner*, the famous U.S. Army weather ship which carries 10 licensed amateurs aboard. Using Hallicrafters equipment, these sidebanders are champing at the bit to put Ascension Island, ZD8, on the sideband map since the Island is one of their frequent ports of call, but so far, permission has not been granted. The boys may be heard often from 1900 to 2300 GMT, using their individual stateside calls /MM.

Cementing international goodwill is Marc Felt, W2GYQ, right, putting a sideband station at the disposal of two British exchange teachers, Donald Testro and Wendy Watson. Marc is a teacher at Sewanhaka High School, Floral Park, New York, which contains this fine station, W2ZOT.



Chester B. Franz, WØNFA, of St. Louis, Missouri, who has endeared himself to so many sidebanders through his generosity, enthusiasm, and superior operating practices We inadvertently gave Chester's call to Clair, WØNKA, in the July column but this fine photo gives us a chance to correct the error.

Damocles' sword, it still hangs by a slender thread over our collective heads ready to descend to cut sections from our frequencies.

The thought occurs that we could help alleviate both problems with a minimum effort by an act which is simplicity itself; using these "dead bands" for short range "local" contacts instead of the overloaded bands being used for DX, traffic and long haul contacts.

In other words, if you can make your contact on 10, or even 15 meters instead of 20, 40 or 75 meters, switch to that band and you will find a wide open band with plenty of room for interference-free QSO's.

We have presented, briefly to be sure, an idea which is not unique nor has it been overlooked by groups who make use of 10 meters for local nets and as mobile listening frequencies. Here and there you will sometimes hear one ham telling another: "Meet me on 10 Saturday morning and we'll kick a few ideas around"... "The gang will be on 28.650 for a roundtable." These few are removing themselves from the QRM and at the same time utilizing ham frequencies which will stay "ham" only if they are populated by "hams."

With equipment in use today, it is a simple matter to tune up effortlessly; in a matter of seconds you can be in an interference-free area and lessen the QRM elsewhere. Won't you try it next time you have a schedule with a local friend?

Getting the Right Start on Sideband

Some time ago, we announced plans for the publication of a "Sideband Primer" but never found extra time to get this project off the ground. However, several sidebanders signified their willingness to be of assistance, notably Bob, W8BKO; Jim, K8RCQ; Joe, W4OPM; and Alan, VK3AHR, all of whom sent us some valuable tips on proper sideband operating. From Alan, VK3AHR, we recently received a complete outline of what he feels to be necessary as an introduction to sideband. So, bolstered by these suggestions, we are incorporating all the ideas advanced by these gentlemen into a series of articles which will appear in this and subsequent issues of the *CQ* SIDEBAND Column. This is being done with the hope that veteran and novice sidebanders as well as hams considering sideband operation will find them of benefit.

The following is directed primarily at the hams who are not yet on sideband or who have only recently purchased or built their first exciter. Before you transmit a sideband signal, it is necessary that you know how to receive a sideband signal. If you are fortunate enough to have a newer model receiver that is specifically designed for sideband reception, you flip the EMISSION switch to "SSB", turn your PITCH control, PASSBAND TUNING control (if you have one) or SIDEBAND SELECTOR to "USB" or "Upper" or 1½ notches to the left of center or to the right, for lower sideband. Turn back your RF GAIN control, open up your AF GAIN control and slowly tune in on a sideband signal. (Upper sideband is used on 10, 15, and 20 meters; lower sideband on 40 and 75 meters.) You will note that the signal is much sharper than an a.m. signal and must be tuned in *exactly* if you are to get the full benefits of good speech quality. Varying the pitch control from side to side of the received signal will permit you to tune out some of the interference from adjacent channels.

What if you have an older receiver? You can still receive sideband signals by switching in your b.f.o. as though you were about to receive c.w.; turning your pitch control 1½ notches to the left for upper sideband or 1½ notches to the right for lower sideband and adjusting your GAIN controls as indicated above. The older receivers do not have the stability that is built into today's receivers so you will probably find

KR6JR is now W5DKK—both calls assigned to John Hunt who is now operating from Barksdale AFB, Louisiana.

Turn your beam south, young man, and you may have the pleasure of contacting Anabella, YV5ALC, who's a 16-year old beauty on sideband in Caracas, Venezuela.

it necessary to keep tuning in the signal as your receiver drifts. This, of course, is the fault of your receiver and not of the received signal but a little patience will reward you with good sideband reception. With most older receivers, the S-meter is not operative when the b.f.o. is turned on so don't be perplexed when you hear S-meter reports being given when yours doesn't show a flicker. After a little practice in tuning in sideband signals, we recommend that you listen on the bands and get the feel of sideband operation.

Once you are able to receive sideband signals satisfactorily and, assuming that you have purchased a commercial rig, read, re-read and re-read the manufacturer's manuel. Tune up your exciter exactly according to instructions, using a Dummy Load. These days, it is impossible to find a clear channel in the sideband portions of the bands and you must assume that you will be interfering with other sidebanders if you tune up your rig on the air. Although it may be difficult for you to believe, the needle on the plate meter should not kick up to the same point on the scale as it does when you are tuning up with inserted carrier. As you modulate the rig, the meter should kick up to *no more* than two-thirds of the indicated full power during tune-up.

It is difficult for us to pinpoint exactly how much audio you should use because of the difference in rigs, microphones, and voices. By and large, you should keep your AUDIO GAIN control at no more than "2" for such rigs as the HT-32, HT-37, KWS-1, etc., and at no higher than "9-10 O'clock" for the 20As and KWMs. These settings should give you ample audio and eliminate the possibility of distortion and splatter.

If you are putting a homebrew exciter on the air, it is essential that you have a v.f.o. and that it be stable. VOX (voice operated emission) is preferable on sideband for quick break-in but push-to-talk can be utilized effectively. It is also necessary that *accurate* and quick zero-beating of the transmitter onto the receiver frequency be part of your sideband operation. But, above all, it is essential that your sideband signal meet the following standards: the carrier should be suppressed at least forty db below peak power output; the unwanted sideband should be surpressed at least 30 db below peak power output of the transmitted wanted sideband. The use of a scope is strongly recommended for adjusting and monitoring the output of your sideband transmitter.

Next month, we will discuss zero-beating the frequency; making a contact; holding a contact and other aspects of sideband operation. We welcome your questions and suggestions on this series.

Tristan de Cunha DXpedition

Here is a first hand account of the s.s.b. DXpedition to Tristan de Cunha (ZD9AL) as written by the operator, Barry, ZS5SG, to Wallace, K4TJL.

"I will skip the bit from Durban and Capetown that, believe it or not, is a two day train trip. If you could have seen the effect of one ham carrying a KWM-1 complete *and* a 3 element Mosley beam complete with a 27 foot mast, it makes your arms ache!!

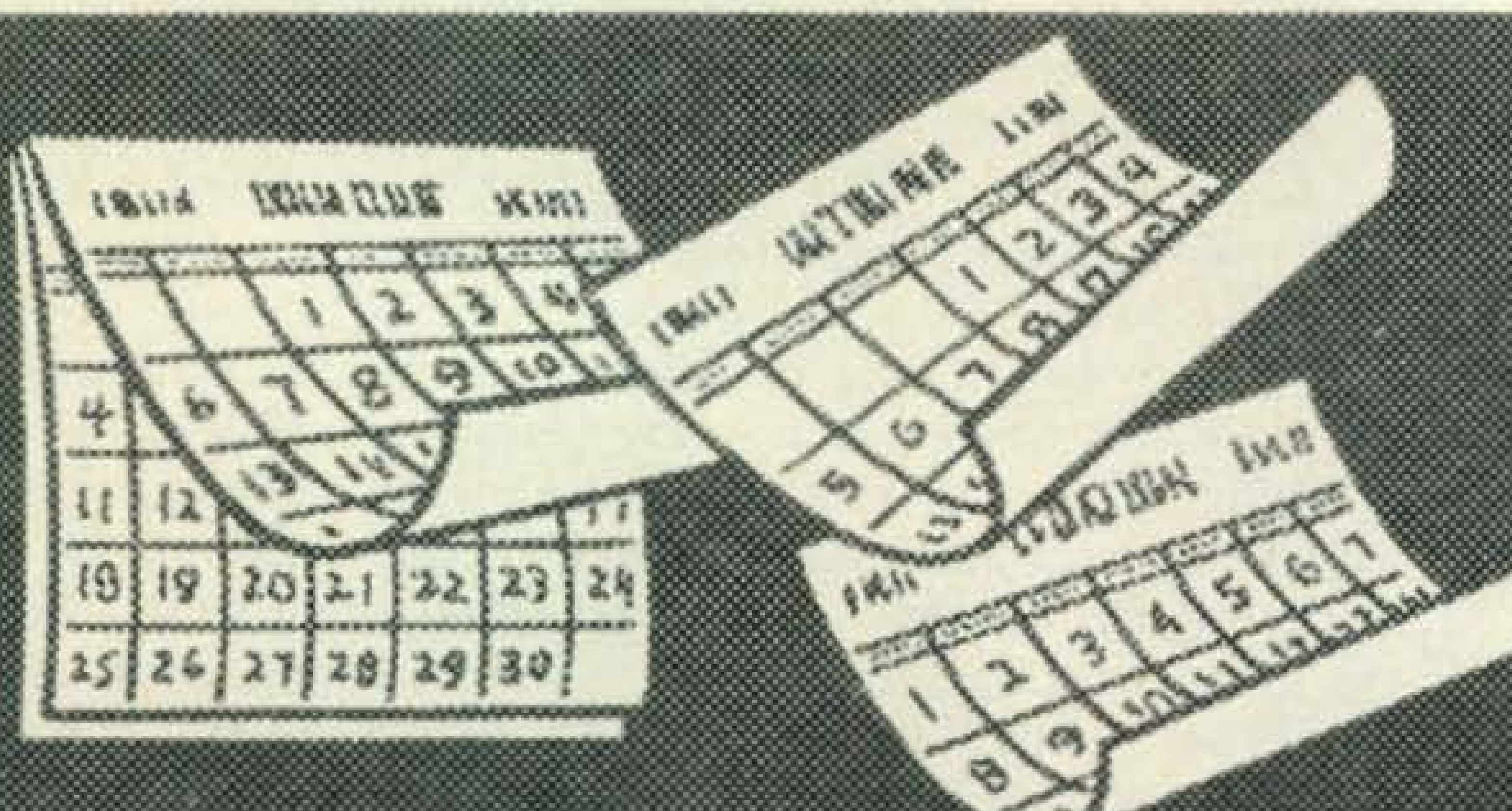
"Anyway, I left Capetown on the R. S. *Shackleton;* this vessel is a survey ship of 1000 tons belonging to the British Government. It was nice to renew acquaintances again with the members of the crew, as this was the second time down there. Well, after a roughish trip of six days, we arrived at Tristan; incidentally, the ship's radio op was all for going /MM but the skipper thought otherwise. It took about thirty minutes to get the rig up but not the beam. I couldn't get it ashore until early the next morning. I borrowed a trap dipole from an electronics firm in Capetown and used that for the time being. It can be seen in the foto strung from the small pole across to the step ladder; the only place to put the thing so as it would have best results to W-land.

"The shack is actually part of the power generator rooms. Next door was the battery room. Fortunately, the shack was on the right. Some trouble was experienced at first with batteries. Olliver said the M-1 took a fair amount of juice and he wasn't kidding. Every now and again, I had to dash into the battery room and tap down on the bank. Power generation on the Island is for our Dept. only and it is only during the late afternoon that the batteries are charged. There are two 4-cylinder diesels generating 110 v. to charge two banks of batteries. These batteries motor a converter for 220 v. a.c. for the station transmitters and receivers. This may sound rather antiquated but it has been done now since 1940.

The shack used by Barry, ZD9AL, on Tristan de Cunha, showing the beam and that immovable mountain through which the signals just would not pass.

"After getting the rig fired up and batteries sorted out, I gave a call on 20 and you can see the result (the Southeastern DX Club, of which K4TJL is President, handled the ZD9AL QSLs!—*Ed.*) but conditions were not at all good. I was expecting the same operating periods as are in the Republic; how wrong can one be anway? After I found the rig was OK, it was time to do some DXing, but it was not to be. I think it was probably the antenna that stopped me. I could just hear some W's but, after calling and getting no answer, I thought it

[*Continued on page 114*]



CONTEST CALENDAR

FRANK ANZALONE, W1WY
14 Sherwood Road, Stamford, Conn.

Calendar of Events

August	26-27	JARL DX C.W.
*September	2- 3	LABRE C.W.
*September	9-10	LABRE Phone
September	9-10	SSBARA WAS
September	9-10	PERUANO C.W.
September	16-17	PERUANO Phone
September	16-17	SAC C.W.
September	23-24	SAC Phone
September	23-24	MARC VE/W
Sept.	30-Oct 1	VK/ZL Phone
October	7- 8	VK/ZL C.W.
October	14-15	ARRL CD C.W.
October	21-22	ARRL CD Phone
October	25-26	YLRL C.W. Party
October	28-30	CQ WW DX Phone
*November	4- 5	(Open Date)
November	8- 9	YLRL Phone Party
November	11-13	ARRL SS
November	18-20	ARRL SS
November	25-27	*CQ* WW DX C.W.
December	2- 3	RSGB 21/28 Phone
*December	2- 3	OK DX C.W.
December	9-10	Kansas QSO Party

TROPHY ADDITION

The Israel Amateur Radio Club is donating a Trophy for the world highest score on 7 mc in the c.w. section of our World Wide DX Contest for 1961. The Trophy will probably be the same as the cups already awarded in other divisions. We agree with the 4x4 boys that this should encourage activity on 7 mc. Thanks a lot fellows.

*Asterisk denotes events that have not been officially announced.

JARL DX

Starts: 1000 GMT Saturday, August 26th.
Ends: 1600 GMT Sunday, August 27th.

Rules appeared in July's CALENDAR. Logs go to: The J.A.R.L. Contest Committee, P.O. Box 377, Tokyo Central, Japan. Deadline is postmark September 30th.

SSB WAS

Starts: 1500 GMT Saturday, September 9th.
Ends: 2100 GMT Sunday, September 10th.

Primarily, this is an all USA affair but overseas stations can take advantage of this activity to work some of those missing states for their WAS certificate. Check last month's SSB COLUMN.

PERUANO

C. W.

Starts: 1200 EST Saturday, September 9th.
Ends: 2400 EST Sunday, September 10th.

Phone

Starts: 1200 EST Saturday, September 16th.
Ends: 2400 EST Sunday, September 17th.

Activity in this contest is confined to the American continents only. How this is accomplished was explained in last month's CALENDAR. Mail your logs within 20 days of the ending of each section of the contest to: Radio Club Peruano, Presidente de Comision Concursos, Casilla Postal 538, Lima, Peru.

SAC

C.W.

Starts: 1500 GMT Saturday, September 16th.
Ends: 1800 GMT Sunday, September 17th.

Phone

Starts: 1500 GMT Saturday, September 23rd.
Ends: 1800 GMT Sunday, September 24th.

The Scandinavian Activity Contest is increasing in popularity each year. This year the contest is sponsored by the Norwegian Radio Relay League but the rules remain the same of course.

Use all bands and work as many of the Scandinavian prefixes as possible during the contest period. Awards to the two highest scoring stations in each country and each W/K call area.

Results of last year's contest will be found at the end of this column. Rules for this year's contest in last month's CALENDAR.

The mailing deadline for your log is October 20, 1961 and they go to: The N.R.R.L. Traffic Dept., Box 898, Oslo, Norway.

Colombia

During the "Festival Nacional del Tobaco" of Bucaramanga (Columbia) The Radio Club Santander (HK7) will sponsor a QSO party from 1700 GMT September 9th to 1700 GMT September 16th.

Contacts with HK7 stations during this period will be acknowledged by a special souvenir.

Use phone or c.w. but most of the activity will be found on c.w.

Send your QSLs to the Radio Club Santander, Apartado Aereo 222, Bucaramanga, Santander, Colombia.

The Radio Club Santander; front row: HK7GE, 7PH, 7UL, 7BX, 7QN (Pres.), guest, 7OL, 7YC. Rear: HK7PD 7XI, 7YA, 7BE (2nd opr.); 7BE (1st opr.); 7ZT, 7CM, guest, 7YB.

VK/ZL

Phone

Starts: 1000 GMT Saturday, September 30th.
Ends: 1000 GMT Sunday October 1st.

C.W.

Starts: 1000 GMT Saturday, October 7th.
Ends: 1000 GMT Sunday, October 8th.

This year's contest is sponsored by the Wireless Institute of Australia. Rules are somewhat similar to last year's contest.

Its the world working the VKs and ZLs and the following scoring regulations are for overseas stations.

1. Use all bands 3.5 through 28 mc.
2. One point for each contact and only one contact per band with the same station.
3. The multiplier is derived from the total number of VK and ZL districts worked on each band. ZL1 thru 5 and VK1 through Ø, a total of 15 for each band.
4. The final score—total contact points multiplied by the total number of VK and ZL districts on all bands.
5. The usual progressive five and six figure serial number, RS or RST report plus three figures beginning with any number between 001 and 100 for the first contact. (A good way to keep the opposition guessing.)
6. Only one operator is permitted to operate any one station under the owner's call. Should two or more operate the same station, each will be considered a competitor, and must submit a separate log under his own call as the operator.
7. Certificates to the highest scorer in each country and each U.S.A. call area. Additional awards may be made at the discretion of the committee.
8. Logs must show in this order: Date, time in GMT, station contacted, band used, serial number sent and received and underline each new VK/ZL district as worked on each band. Use a separate log for each band.
9. Also include a summary sheet headed by your call, name and address (BLOCK LETTERS) details of your equipment, etc. Indicate your total score with a break-down per band of the districts worked and the total points. And last but not least sign the usual declaration—"I hereby certify that I have operated in accordance with the rules and spirit of the contest."
10. There is also a receiving section in the contest for s.w.l.s. and their rules follow the same pattern as above.
11. Entries must be postmarked not later than one month after the close of the contest, and addressed to: W. I. A., Federal Contest Committee, G. P. O. Box 851J, Hobart, Tasmania, Australia.

YL RL

C. W.

Starts: 1200 EST Wednesday, October 25th.
Ends: 1800 EST Thursday, October 26th.

Phone

Starts: 1200 EST Wednesday,November 8th.
Ends: 1800 EST Thursday, November 9th.

This is the 22nd annual YLRL Anniversary Party. Louisa Sando, W5RZJ will tell you all about it in her YL COLUMN next month.

CQ WW DX

Phone

Starts: 0200 GMT Saturday, October 28th.
Ends: 0200 GMT Monday, October 29th.

C. W.

Starts: 0200 GMT Saturday, November 25th
Ends: 0200 GMT Monday, November 27th

The rules as published in last month's *CQ* have been sent to all the leading amateur radio magaines and DX Clubs of the world. Therefore everybody will be well informed and we promise a hot time come this Fall. That is if George Jacobs don't foul up the details again!

It is recommended that you waste no time sending in your request for log sheets and a report form, especially overseas contestants. Takes time via surface mail, you know. You are expected to foot the postage and provide a large self-addressed envelope. IRCs are accepted of course but don't forget the increase in foreign postage rates. As a guide, there are 52 contacts to the page on the log sheets and figure 5-sheets to the ounce, not forgetting that you will also need a report form for each entry.

To spare you the trouble of looking it up, our address is: *CQ*, 300 West 43rd Street, New York 36, N.Y.

R.S.G.B. 21/28

Starts: 0700 GMT Saturday, December 2nd.
Ends: 1900 GMT Sunday, December 3rd.

This is a phone contest only and still a long way off, therefore all the pertinent facts will be given at a later date.

A.R.I.

The Milan Section of the A.R.I. have a competition going since August 15th, and it will end on November 30th.

Its in connection with the National Radio TV Show over there. Fifty contestants will be eligible for certificates.

The rules are brief and not too explicit. However we got the impression that it is an international affair. Points vary according to your continental location as follows: Europe and countries on the Mediterranean shore—1 point; Americas—2 points; Africa—3 points; Asia and Oceania—4 points.

All band operation is allowed except for Europe and the Mediteraaean area which is limited to the 80, 40, 10 and 2 meter bands.

You can gain a multiplier of 5 by contacting the station operated by the Radio-TV Show. (Call?) That is the only multiplier provided.

If you are really interested I suggest you contact the: A.R.I., Via Vittorio Veneto 12, Milano, Italy.

Ed. Note

Latest one on our list of visiting overseas "hams" is Marty Cash, EL1C who is on a stateside vacation from Liberia. Marty handles the Pan-Am communication chores in Liberia and will be back there in time for the Fall activities. There are also good prospects of hearing EL1C on 160 this winter.

We received a request from Felix, UA3-80, for attractive colored QSL cards and also picture postcards of the United States, especially large sized cards of landscapes. Seems he is making a movie on amateur radio. Maybe some of you fellows can help him. Send your material via Box 88, Moscow.

73 for now, Frank, W1WY

Results of 1960 Scandinavian Contest

Scandinavian Scores

TOP TEN C.W.		TOP TEN—PHONE	
SM3VE	100,350	OH5SM	61,254
SM5BLA	96,798	SM3VE	49,500
SM5BFE	91,014	OH2NB	37,544
OH5RH	84,816	OH2SB	21,125
SM5BPJ	70,902	SM5BPJ	18,902
SM5AJU	48,000	SM5AJU	17,136
OH2YV	45,832	SM5BLA	13,892
OH3TE	40,651	LA5LG	12,816
OH2SB	39,468	SM5CZD	9,372
OH8PX	37,440	OZ4WR	8,400

Non-Scandinavian Scores

TOP TEN C.W.		TOP TEN PHONE	
UB5FJ	4,700	LX1DE	2,128
UA9AU	2,926	UB5FJ	1,938
UB5KED	2,502	DL3KT	1,648
F9MS	2,416	I1THR	1,265
UB5KBA	2,197	DL7GQ	1,008
HB9TT	2,175	PAØLV	936
DJ2KS	2,170	SP7HX	896
UA1DZ	1,988	DJ3CP	795
PAØLV	1,946	G3NFV	770
PAØVB	1,904	GM3OEV	720

U. S. A.—C.W.

Number groups after call letters denote the following: QSOs, Multiplier and Final Score.

W1VG	98	12	1176	W6KNM	14	4	56
W1WY	30	6	180	WA6AYF	3	1	3
W2EQS	97	9	873	W7LEV	39	7	273
WA2CCF	3	2	6	W7NRB	24	6	144
				W7ABO	15	4	60
W3AYS	39	9	351				
W3ARK	30	9	270	W8JIN	104	12	1248
				W8TTN	30	9	270
W4PLL	50	9	450	W8DWP	28	7	196
K4TEA	14	7	98	W8WWH	14	6	84
W5KC	64	9	576	K8ELF	14	5	70
W5ARJ	23	5	115	K9EAB	33	7	231
W5LGG	20	5	100	W9CCO	1	1	1
W5PM	6	3	18				
				WØBTD	59	10	590
W6CHL	20	4	80	KØUDQ	9	3	27

USA PHONE

K5MDX	6	5	30	K9ECE	13	6	78
W8WT	23	9	207	K9KQV	6	3	18

VHF

BOB BROWN, K2ZSQ
C/O CQ, 300 W. 43 St., New York 36, N. Y.

50mc. 144mc. 220mc. 420mc. and above

PERHAPS one of the finest 6 meter DX seasons has finally "bitten the dust," and here we are on the brink of our fall season. It is always a lot easier to look back, rather than into the future—maybe with just a wee bit of nostalgia—and remember only a few months ago when you first heard XE1OE, or worked VE8BY, or perhaps snagged KL7AUV for that 50th state. Maybe you were in that elite group that maintained regular schedules with K9KVV/KH6. Well, in any case our 1961 Spring-Summer Sporadic E season will surely go down in the records as being one of the greatest. Possibly another ten years will tell whether or not it was the best of the decade, but, regardless of what future anals might devulge, we must admit that our 1961 season will long be remembered. Here in W2-land, for example, we counted 78 days of straight openings with no exceptions. Undoubtedly the record is similar throughout the country. Now we can only sit and wonder: "What does the future hold for us?"

Second Place Winner

Prior to this issue I received a long-distance telephone call from Larry Moore, K9GFQ. Larry called all the way from Indiana to let us know that we had printed the 6 meter Indiana winner's call wrong in our July issue Contest Summary. Turns out that K9GXI, who we reported as taking the state of Indiana and nationwide second place with 3,030,720 points, is actually Larry, K9GFQ. We still don't know how the error occurred, but Larry mentioned that K9GXI only lives a few miles away, but that he wasn't in the February 1961 contest. Our apologies, Larry, it won't happen again!

Audio Rectification

Art Cavar, K8JHZ, wrote us recently regarding how to handle audio rectification problems caused by amateur stations being heard on sound channels of TV, record player, FM radio, tape recorder, etc. Since for one reason or another we 6 meter operators seemed to be unduly susceptible to this type of "I," we would like to present it for your benefit.

Figure 1 is familiar to radio and TV technicians, except for the suggested revisions shown in the broken circles. In general, it also concerns hi-fi and other equipment employing audio amplifiers.

Remove all leads connected to the control grid of the first audio tube. Insert an 82K resistor between these leads and the tube grid terminal. Replace R_1, (5-10 megs) with a 2 meg resistor. Connect a 500mmf mica or ceramic r.f. by-pass capacitor at the junction of the resistors as shown, if none is already in use. Keep leads short and shield any long grid leads. In conjunction with the grid-cathode capacitance of the tube, series resistor R_2 forms a low-pass filter, preventing any appreciable r.f. voltage from appearing on the grid. The resistor does not affect the normal operation of an audio amplifier.

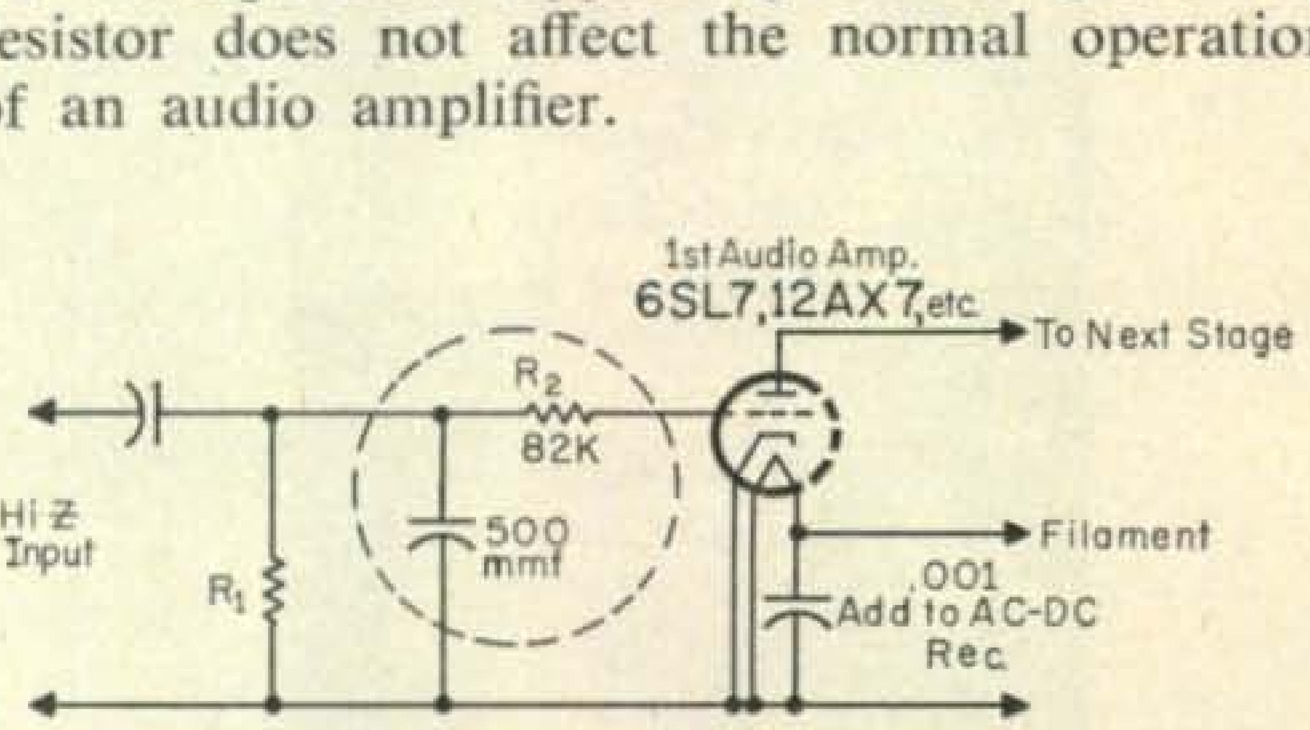


Fig. 1—Circuit showing suggested revisions in the input circuit of first audio tube in hi-fi amplifiers to eliminate audio rectification.

Considerable interference may be experienced on some so-called "hi-fi" amplifiers due to the operation of a nearby radio station. This is obviously a problem for the manufacturer of the hi-fi equipment since the purpose of such an amplifier is to amplify audio frequencies and not function as a radio receiver. Such interference can be reduced or eliminated by relatively simple means without changing the desired characteristics of the amplifier. Some care should be exercised so as not to reduce desirable high audio frequencies, while eliminating radio frequencies. By-passing either side of the power line with a .01 mf disc ceramic capacitor at the point where the power cord enters each piece of equipment is considered a necessity. Many hi-fi amplifiers lack such protection, in addition to being susceptible to reception of undesired radio signals through speaker leads and input wiring. Occasionally, it may be necessary to bridge cathode or plate lead electrolytic capacitor with a disc ceramic capacitor to act as an r.f. by-pass.

Most ac-dc or series string filament type receivers use a .05 mf by-pass condenser across the power line to prevent hum or power frequency modulation of received signals. When negative is above chassis ground, an additional .1 mf condenser is used between negative and chassis. These should be checked and replaced if necessary to make certain the power line is properly by-passed.

We hope the above will prove of some value to you. I have solved quite a few problems in this manner, and believe it to be of utmost importance.

VHF Friendship Award

The handsome certificate shown below is offered by the Sandia Base Radio Club, Albuquerque, New Mexico. In order to obtain this award, one must work five Albuquerque stations on 50 mc or higher. Send list of contacts, dates, times, call, names, etc., to: John C. Kanode, K5UYF, 408½ Cornell Drive S.E., Albuquerque, New Mexico.

Six Meter Pre-Amp

John Fredricks, K7GGJ, of Yakima, Washington, was kind enough to send in a diagram of his 6 meter preamplifier which he has used for the last two years with excellent results. John feels that the schematic is self-explanatory and the only tip worth relating might be to ground the grid and feed the signal into the cathode for coax feed.

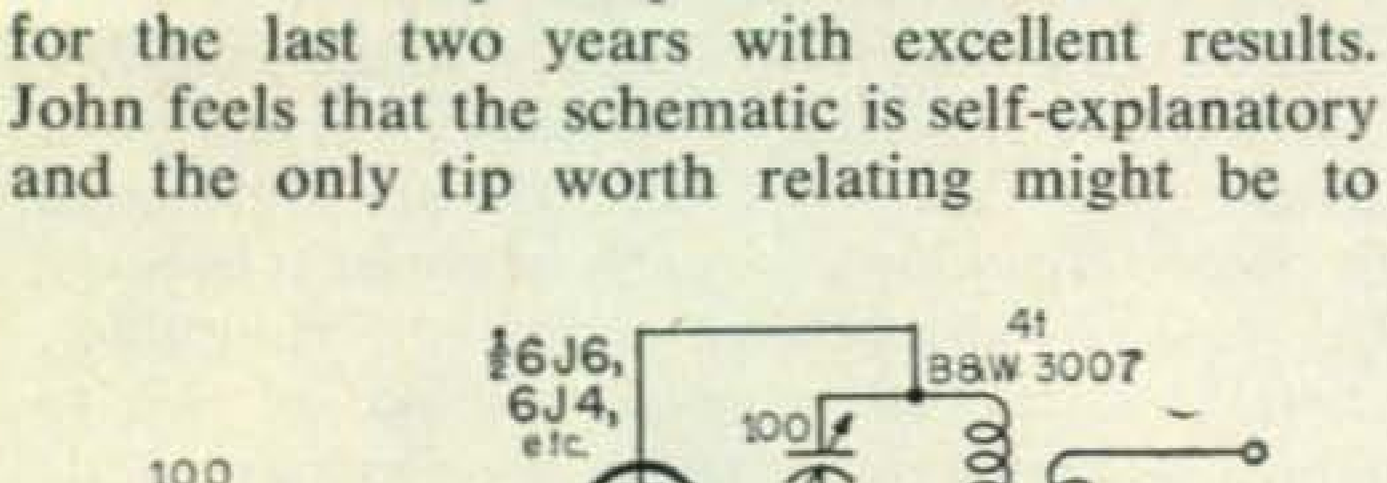


Fig. 2—Schematic of a 6 meter preamp using one of the common TV type triodes (½ 6J6, 6J4 etc.). Unit shown is for 300 Ω balanced input.

Unit of the Month

Not unlike our *Man of the Month*, this new section will be a diagram or schematic (with pictures if possible) of the best submitted item judged "top" each month.

TV DX'ing

Quite a bit has been said in the past few years regarding the reception of distant television stations on the receiver. Many non-hams and hams alike are enjoying many a pleasureable evening trying to pull in TV signals 100 miles or more away. This summer, to top off everything, was by far the best for TV DX'ers. Many fellows keep their TV antenna aimed at a distant station on a "clear" channel just to tell when six meters is open. It's also quite interesting to note that sometimes TV stations on Channel 7 or higher are also picked up at distances of well over 1000 miles. For those who say that the muf seldom goes above 50 mc, try TV Dx'ing! Here are a couple of letters regarding this subject:

From W2KVA, Dobbs Ferry, New York: "I wonder if any of your readers know what TV station (Channel 2) carries the *General Electric Theatre* at 10 PM on Friday nights? It seems that I was watching a local show when the picture kept going from bad to worse. (I expected to get a TVI complaint any minute, even though I wasn't on the air.) Towards the end of the show a very distinct "ghost" appeared which read, *G. E. Theater*. The show I had been watching was *Twilight Zone!* To make a long story short, a mad dash to the receiver revealed a band opening (6 meters) of phenomenal proportions, including at least one W6—W6BJI, Fresno. All this by way of proving that that *SEC. 12.157* thing is good for something, after all. 73, Tom, W2KVA"

And this one is from **Andy Rugg, Pointe Claire, Quebec:** "Your readers are probably enjoying the beginnings of Sporadic E skip and your mailbag is probably bulging with reports. I don't know if you get very many reports from the Montreal area, but believe that my info may help you determine the extent of some openings even though I don't have a v.h.f. receiver.

"I can't really get all the TV DX that comes in here as all channels here but 4, 9, and 11 are occupied by locals or nearby stations. On June 13 I noticed bars of interference on local Channel 6: CBM, and gave 4 a try and saw a CBS station which faded out right at identification time and didn't come back. It was in the Central Time Zone. The exact same thing happened on June 20, and the CBS one faded out, giving up the channel to an NBC station, possibly WDAF in Kansas City. Reception was best at 9:40 EDT but it had faded out by 9:50. Both nights I went to see if there was any DX on the FM band; there wasn't.

"June 19: A happy ending. After chow, someone shouted "come here." I found the TV set's dial on Channel 4 and a few stations in there. They later turned out to be WCCO-TV in Minneapolis, KMOX-TV in St. Louis, and KTIV in Sioux City, Iowa. KDLO in Watertown, South Dakota, overrode WCAX-TV for a while on Channel 3. FM produced the following: WKYB-FM, Paducah, Kentucky; WMIX-FM, Mount Vernon, Illinois; KCFM—St. Louis; KGLO-FM, Mason City, Iowa; WHSA, Brule, Wisconsin; WTBC-FM, Tuscaloosa, Alabama; KADI, St. Louis; and KTIS, Minneapolis. Of course, the nice openings always come the night before a big exam so I tore myself away from the dials and concentrated on the books. 73, Andy"

European V.H.F.—G2DHV

Our ole reliable reporter, George Haylock, G2DHV, of Sidcup, Kent, England, comes through again for us this month with some miscellaneous notes on some of the foreign v.h.f. gang: "VE3OJ writes that he is too busy to do much hamming anymore, but during the summer he got a chance to do some maritime/mobile operation in VE2/3 and W8 . . . not too much activity from home except for some 50 mc work. He is also on 144 mc. Two meters is really *the* v.h.f. band over here! Hundreds of stations are on all the time! Four meters includes GI3HKV, G3EHY, and G5FK. SM6PU is studying Sporadic E openings. GM8FM on 20 meters worked GM3ENJ/A on 2 meters crossband RTTY."

Sunspot Story in Book Form

Such enthusiastic response was received to the recent series "The Sunspot Story, Cycle 19; The Declining Years, by George Jacobs, W3ASK, and Stanley Leinwoll, that the series has been reprinted in the form of a 28 page booklet. This booklet is available from Cowan Publishing Corporation, 300 West 43rd Street, New York 36, New York, for $1.00. In quantities of ten or more (everyone at the club should have a copy), 75¢ each. This book is a *must* for every active v.h.f. man. Place your order today!

Mailbag

Auburn, Maine: From the pen of Richard Huntress, K1CXX, comes: "The 6 meter band has been open every day for the last 2 weeks. I've never heard anything like it since I've been operating the band (Fourth year now). I worked KP4AXC and KP4AAN back in May and VO1DW and VO1FM in Newfoundland in early June. Both new districts for me. Worked New Mexico, W5VC, on double hop! Also worked Texas and almost got a W7 in Arizona. This is all rare stuff for me here in Maine. [*And me here in Jersey, too! Bob*] K1HAV in Gardner worked a VE6 the last week in May. I had converter troubles that night (groan).

"This summer I operated at our camp in Winthrop, Maine, with better equipment on 6 meters. K1HAV and I put up a 5 element beam and rotor on the camp roof two weeks before I left for there. He built the 5 element beam after the Hy-Gain beam. It works much better than the old 3 element job with the "armstrong" rotor. The transmitter is a v.f.o. controlled 6146 with 1625's plate modulating it. (n.b.f.m. also). About 60 watts input on A3. Probably will use the 220 mc rig later, but still need an antenna for it.

"I'm completely set up on 220 mc here in Auburn, but have never had a QSO on that band. Channel 13 about 20 miles from here to the southwest is all over my converter. A filter does nothing for it. The ground wave has not been very good this year as yet so I didn't know what 220 mc will do from here."

Akron, Ohio: A new reporter, Barry McWilliams, K8LEF, writes . . . "I am writing because I think that there may be some amateurs who may be interested in the work that the Hill School Radio Club has been doing in the u.h.f. bands.

"The club is composed of a few radio operators who go to the Hill School, located near Philadelphia, Pa. In March of this year, the club station, W3MWL, made its first transmission over the microwave frequencies. The early tests were conducted over the length of the corridor in the science building, but near the end of May, we attempted our first "DX." Though our DX contact between W3MWL and W3MWL/3 was only five hundred yards, we were quite pleased that the equipment was working. We used no antenna, and just pointed the wave guide toward the receiver.

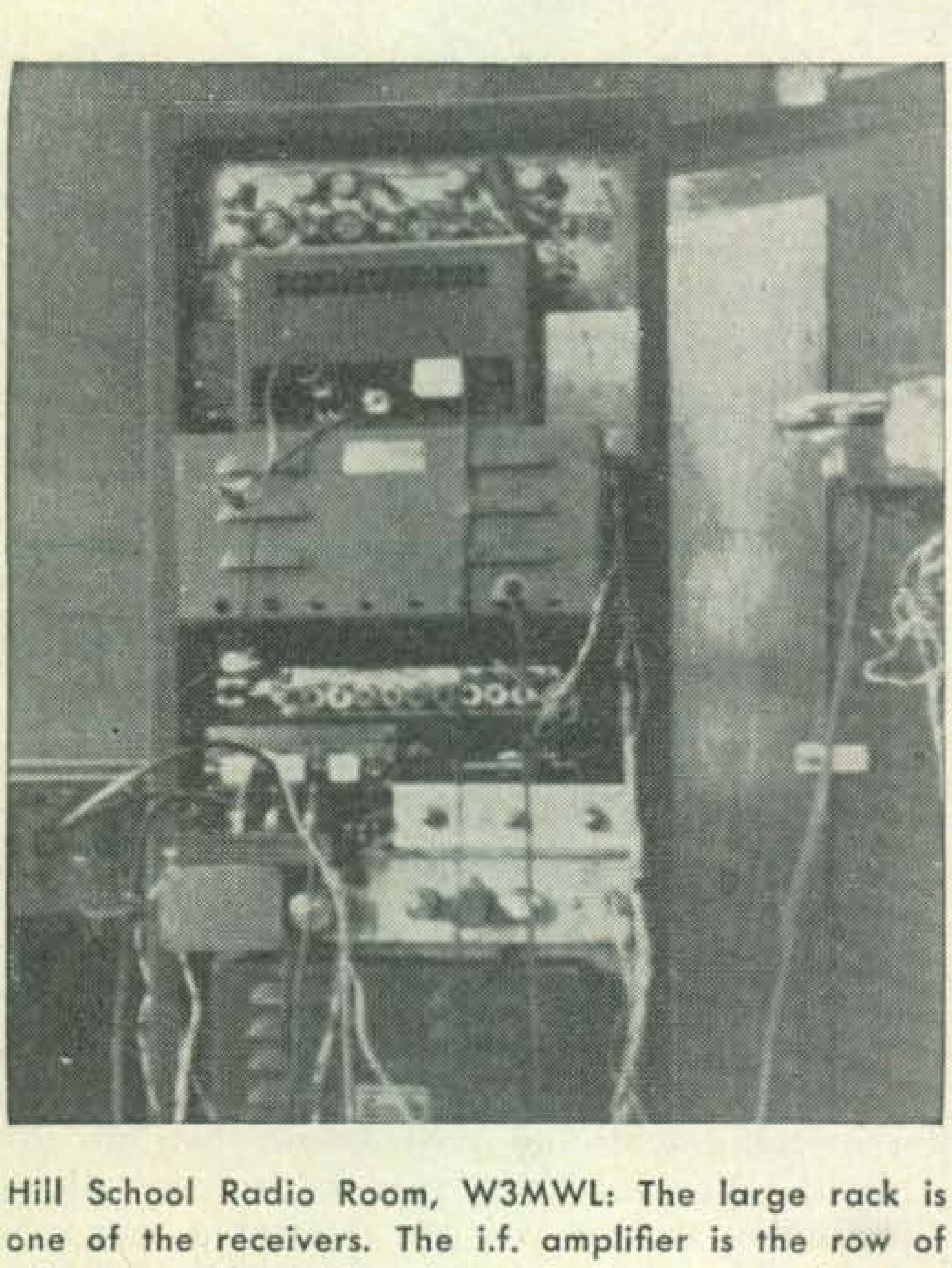
"Our frequency of 3450 mc isn't exceptionally high, but the main point of interest was that pulse code modulation was used. The 100 miliwatt klystron was modulated by one digit of the binary system.

"Since the school year was almost over at that time, the club made no other tests on this band. Next year we intend to spruce up our equipment and to transmit two or three digits. We will keep you informed with our activities, and, if you are interested, our members who are especially interested in this mode of transmission, can go into the technical aspects far more deeply than I can." *Most certainly, Barry! Your experiments are intriguing, and we'd like to know more about them.*

Lethbridge, Alberta, Canada: Dave Forster, VE6FF, sends us a letter just chock full of news . . . "I thought it was about time I reported in case you fellows down there were beginning to think we VE's had given up v.h.f.—u.h.f. for a bad job or something! I had better give you a run down of the v.h.f. activity in this area at present. There are now about 12 six meter stations on the air in the city of Lethbridge, six of which are quite active. These are: VE6DB, Bob Henry; VE6OH, Otto Meginbir; VE6IP, George Peat; VE6VN, Len Groves; VE6EF, Jim Strong; VE6FF, Dave Forster (me).

"There is no 2 meter activity as yet; just talk, but Bob, VE6D and I are working on it and should be on in a month or so, as soon as we get rid of some of this Hamfest work. Bob will use his Johnson 6N2 and converter with a two bay 5 element beam, while I'll use a semi-homebrew rig composed of a Geloso v.f.o.—exciter with a homebrew modulator. This will run about 10 watts. I later hope to build up a 150 or 200 watt final for same. The receiver will be an SCR-522 converted to a tunable front end (if it works) with a single 6 element beam.

"As of late, there are two of us on 1215 mc, these being VE6DB and myself. We are using APX-6 rigs which we converted with the able assistance of W6MMU and have had some real fun with 'em. So far our activity has been of an experimental nature at very short distances, mostly because of antenna and transmission line difficulties, but Gib, W6BJI, came to our assistance one fine day on 6 meters with the idea of surface wave transmission line, so we hope to be going full steam on 1215 mc. We are using 18" copper horn antennas with baluns built right on to the antenna and will probably use RG-8/U line for the SWTL. The ultimate goal of this 1215 mc work is to work Pete, VE8BY, in Yellowknife, North West Teritory, via aurora. Pete also has a couple of APX-6 rigs he is working on. Most seem to think this an outrageous undertaking, but we think it is possible and won't give up easily." *That's the spirit, Dave! be sure to let us know how you make out.*



Hill School Radio Room, W3MWL: The large rack is one of the receivers. The i.f. amplifier is the row of tubes near the middle. This rack also contained power for the pulse generator.

"Well, so much for the activity here. I imagine by now that you are getting reports from all over about the wonderful 6 meter openings lately. The band has been open via "E" skip here since May 23rd with only short lulls now and then. Since that time we have heard every state in the union *except* Utah. We have also heard or worked VE4's, VE7's and, of course, VE8BY. Some of the openings have been minor, but on May 28th, California came through in the morning about 9:00 MST until 1:00 PM with the skip then swinging east to Michigan and WØ-land. During this time I was able to work California, Nevada, and Iowa (heard Michigan, but VE6D worked W8ESZ). In addition, I got Kansas and Kentucky. Later, about 10:00 PM the VE4's, VE3's, and the northeastern states started coming in. I worked a number of VE4's, but nothing else. (Don't know where that r.f. of mine goes when it leaves here, but it sure doesn't go where I want it to!) George, VE6IP, worked a VE3, a couple of W2's and a W1 in New Hampshire that night. That day was only a sample of things to come, far too numerous to mention.

"Getting back to u.h.f., there are also tidings from yet another ham in the city of some moonbounce activity on 1296 mc. But said ham informs me that he doesn't want his name or details released until he has made a little more progress. All I can tell you is that he has his antenna up; and 18' wire mesh parabola on a 15' windmill tower with assorted motors, gears, etc., apparently destined to track the antenna with the moon automatically. I'll keep you posted in the future." *You do that, Dave. We'd really appreciate it. We've listened up your way during openings, but haven't heard you. Tell VE8BY, though, that he's been heard here in the N.Y.C. area!*

Thirty

We'll be hoping to hear from you next month, along with suggestions for the column. And before I forget—Don't forget about our Circuit of the Month $5.00 Award!

'Till Syracuse time, 73, Bob, K2ZSQ

DONALD L. STONER, W6TNS
P.O. Box 137, Ontario, Calif.

semiconductors

Reader requests for circuits have been piling up and therefore, this month's Semiconductor column is a potpourri of gadets, ideas and information.

George Jenner, Portland, Oregon, is a technician-airplane modeler and would like a circuit for a 6 meter radio control receiver. The schematic shown in fig. 1 is for the CG "Pioneer" receiver manufactured by F and M Electronics (153 Vermont St., N. E., Albuquerque, N. M.). The circuit was modified to 6 meters by Chuck Connors, K6IUK, a local flyer of great renown. The superregenerative detector, which originally used a Philso T-1324 surface barrier, is rather conventional but is the smoothest oscillating one I have ever heard. Feedback occurs between collector and emitter through C_1, a 10 mmf disc. Capacitor C_3, 500 mmf, determines the quench frequency, which is well above 20 kc. There are no squawks and squeals from too low a quench frequency. Resistors R_2 and R_3 make up the base bias voltage divider, while R_1 stabilizes the stage. Capacitor C_4, an electrolytic, bypasses degenerative audio components. Audio is coupled to the first stage through T_1, a 10 or 20K to 2 K transistor interstage coupling unit. A quench filter, consisting of C_6, C_7, C_8, and R_4, prevents the quench voltage from biasing the 1st audio stage. Resistors R_5 and R_6 provide forward bias while R_7 produces the necessary stabilization. The amplified audio signal appears across transformer T_2, another 10 or 20K to 2K inter-stage unit. Note, however, that the windings are reversed so that the low impedance side is connected to Q_2 while the high impedance side drives Q_3. This is done so that the audio component will initiate conduction in Q_3 (it has no forward bias). This, in turn, develops a voltage across R_8 which causes the switch transistor, Q_4, to saturate and trip the escapement. Capacitor C_{11} charges up to the peak audio level and stores the charge between cycles, providing near pure d.c. to the switch. Thus, when an audio tone is picked up by the antenna, it is rectified and causes the escapement to trip. This, of course, can be used to control a model, or any other device.

The six meter modifications are simple. The r.f. transistor must be changed to either an RCA 2N384 or Motorola 2N741 to insure oscillation up to 54 mc. Capacitor C_1 is changed to 20 mmf for the same reason. The r.f. coil, L_1 is modified by removing 2 turns (it should have 5 turns of #26 closewound on a ¼" form). Finally, C_2 is changed to 25 mmf to resonate this new coil.

With the information given you should be able to convert either the "Pioneer" receiver, or build one up from "scratch." Hams who enjoy flying radio control models will be interested in the R/C column of *Western Radio Amateur* (10517 Haverly St., El Monte, Calif.) written by Bill Kincheloe, K6OQC.

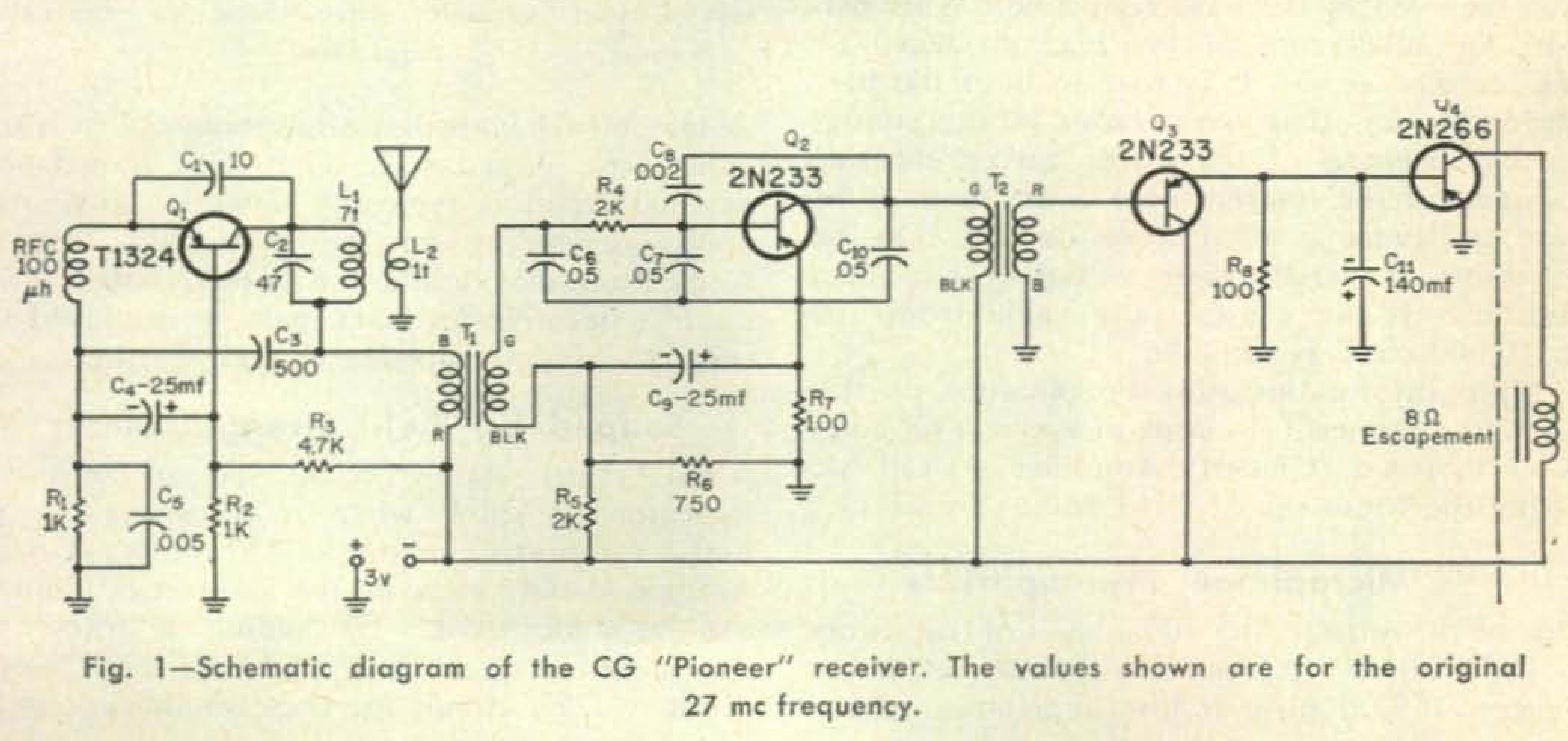


Fig. 1—Schematic diagram of the CG "Pioneer" receiver. The values shown are for the original 27 mc frequency.

The receiver shown in fig. 1 can also be modified to receive the six meter band (it will drive a speaker) by making the following changes: substitute a speaker for the escapement, remove C_{11}, reverse T_2, connect T_2-blue to −3 volts through a 2.7K resistor and connect a 470 ohm resistor from T_2-blue to +3 volts. The latter two resistors may have to be adjusted to prevent the dissipation of Q_4 from being exceeded.

Two Meters, Half Watt

Several readers have written requesting information on high power transistor amplifiers for two meters. The circuit shown in fig. 2 was developed by Motorola Semiconductor Products, Phoenix, Arizona. It uses the 2N1561 germanium mesa and will produce r.f. power in excess of 0.5 watts at efficiencies of about 50% in class C. Coils L_1 and L_2 are made of strip brass about ½" wide, 1/16" thick and 4 inches long. They are mounted about ¼" above and below a groundplate to which the emitter

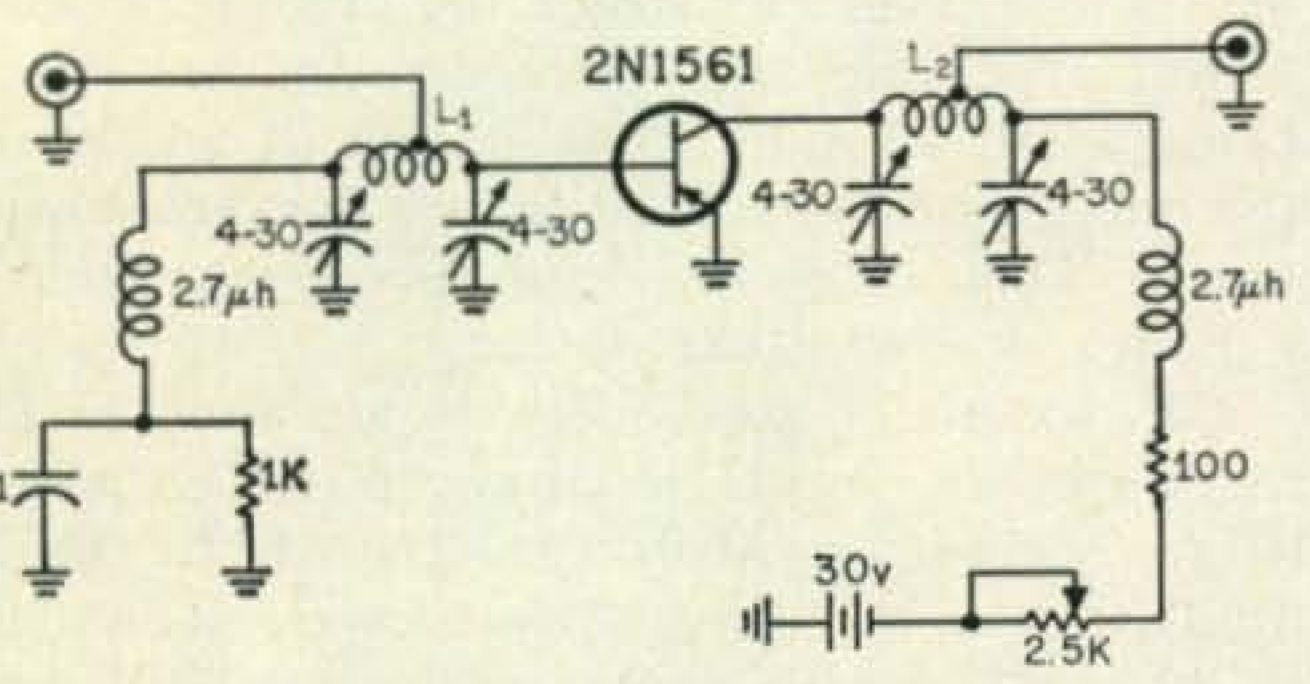


Fig. 2—A half-watt output 144 mc class C amplifier using the Motorola 2N1561 germanium mesa.

is connected. The strips are loaded on the far end with a matching capacitor and since they are much shorter than a ¼ wavelength (50 cm) they act as an inductance and form the coupling impedance in the pi-network. The taps for input and output are not critical because optimum matching may be achieved by adjusting the variable capacitors. An r/c circuit was included in the base connection. This permits an adjustment of the bias produced by the rectified signal. It is wise to limit the base current to less than one-quarter of the emitter current because of the lower current-carrying capacity of the internal base connection. If no base resistance is used, base current may be excessive at large drive voltages. The base resistance is not critical, any value from 100 to 10,000 ohms is suitable.

More information may be obtained on this circuit by requesting a copy of application notes AN110, titled "Class C Amplifier at 150 Mc Using the Motorola 2N1561 Mesa Transistor."

Microphone Preamplifiers

One of the outstanding advantages of transistors is their ability to match a variety of impedances. If you have a low impedance microphone and wish to match a grid or transistor base, the circuit shown in fig. 3 can be used. The base impedance is relatively low, while the collector impedance is many times higher. Because of the low power involved, no emitter

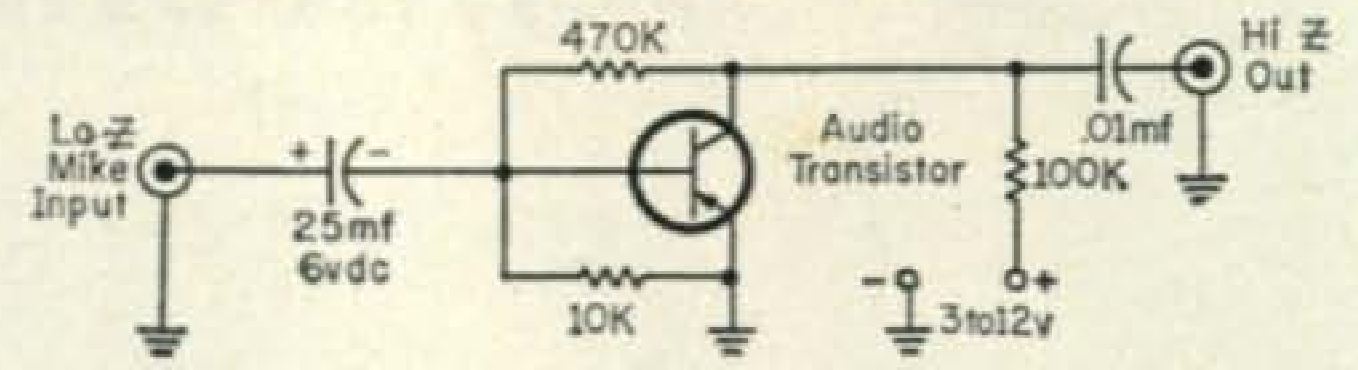


Fig. 3—A low to high impedance transistor matching stage. The transistor should exhibit low leakage for best results. The color code connections are shown for a Lafayette PA-77 mobile microphone.

stabilization is required. The stage is temperature and voltage stabilized by degenerating the d.c. bias, that is, obtaining it from the collector rather than the supply. If the transistor starts to draw more current (because of heating) the collector voltage drops. This, in turn, reduces the base bias and drops the collector current.

Transistors can also be used as impedance stepdown devices by connecting them in the common collector configuration. This is similar to the cathode follower. If a crystal or ceramic microphone is connected directly to the transistor base, the low impedance (1 to 5K) will load the mike and cause a marked reduction in the low frequency components. The circuit shown in fig. 4 is an emitter follower designed

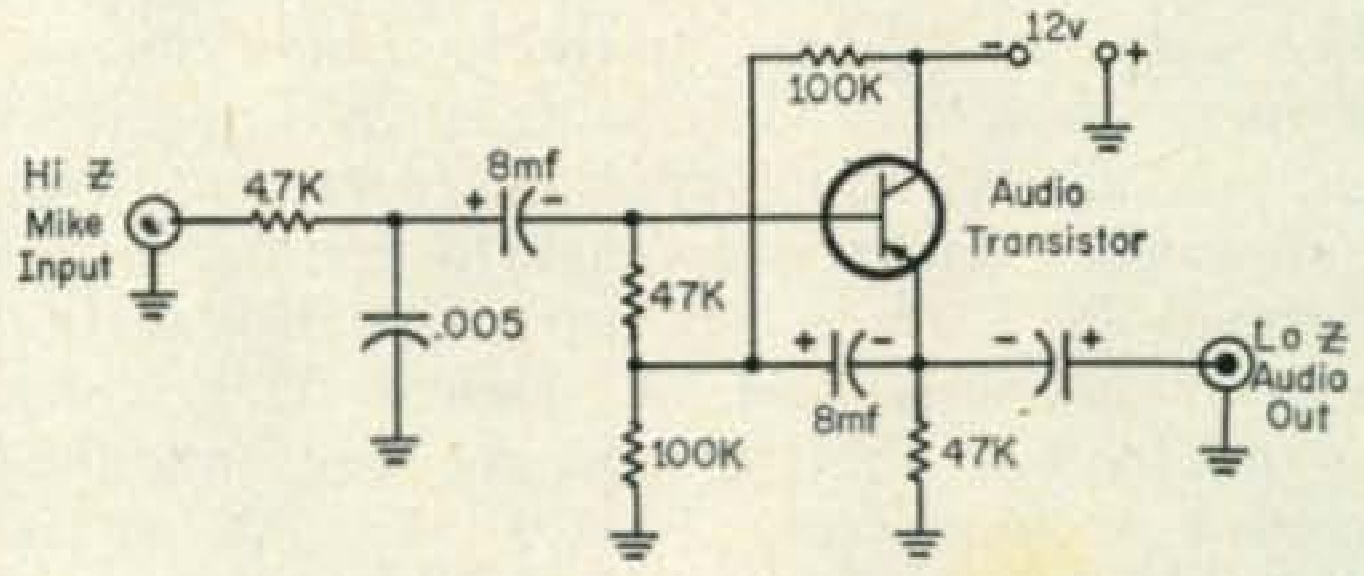


Fig. 4—A high to low impedance transistor matching stage. This circuit should be use to connect crystal and ceramic microphones to transistor amplifiers.

to match high impedance microphones to transistor base impedances. The input impedance of this circuit is typically between 100K and 300K, depending on the impedance that it feeds. Note that in addition to the configuration used, a negative feedback path is employed to raise the input impedance even further.

Souped Up Field Strength Meter

QRP fans require some sort of sensitive indicator to show when a transistor rig is tuned for maximum output. An all-wave field strength meter, such as the Lafayette TM-15, can be "souped-up" by adding a transistor d.c. amplifier to make it 15 to 20 times more sensitive. The circuit for these modifications is shown in fig. 5. Since the diode is connected to produce a positive rectified voltage it is necessary to use an NPN (such as the 2N170) for the d.c. amplifier. Modifications are made as follows: disconnect the diode and wire from the two meter terminals but retain the capacitor. Solder the 2N170 emitter to the wire removed from the meter, and connect the 2N170 collector to the meter terminal this wire was removed from. Connect the diode cathode terminal to the 2N170 base. Solder the negative battery lead to the emitter and connect the positive battery terminal to he remaining meter terminal (left one). Either a 1.5 or 3.0 volt battery can be used, with the latter providing substantially more sensitivity. Two penlite cells will fit in the left side of the case. Do not disturb the coil positions for this will change the dial calibration, which is quite accurate.

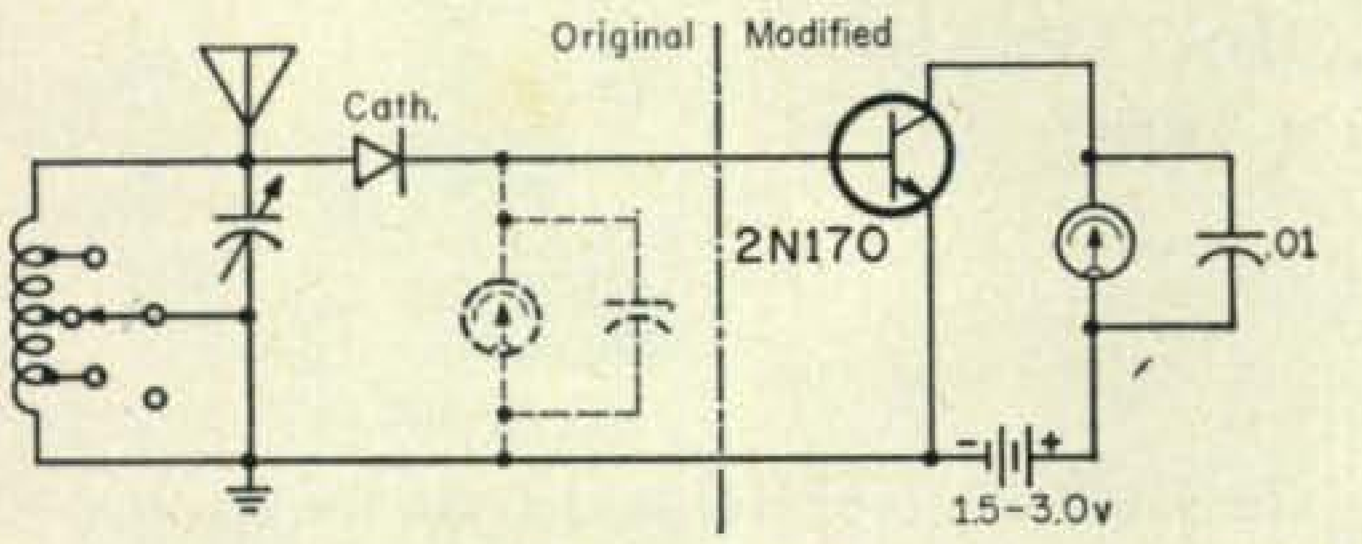


Fig. 5—Schematic of the modified Lafayette TM-15 field strength meter.

Semiconductor News

CBS Electronics, Danvers, Mass., has expanded their power transistor line to include several 30 watt industrial packages, types 2N538, 539 and 540. These devices occupy only 1/3 square inch of chassis space, and are described in bulletins E452 trhough E454.

General Electric, Auburn, New York, has just announced a new series of high current silicon controlled rectifiers with PRV ratings up to 1,000 volts. These double diffused, 100 ampere, rectifiers also have a 1300 volt transient rating.

The latest issue of Hoffman Electronic's *SPAN* contains articles on "Encapsulated Semiconductors," "Stability Characteristics of Silicon Tunnel Diodes" and the "Use of Uni-Tunnel Diode for Tunnel Diode Biasing." You can obtain *SPAN* by requesting this service on your company letterhead. Also new from Hoffman is a 9 transistor solar powered portable radio, their model 709. Batteries for night-time listening are also used. The 709 retails for $49.95.

Minneapolis-Honeywell have just announced a new series of high power transistors. The 2N574, 575, 1157 and DA3F3 are rated for 187 watts dissipation at 25°C and have a thermal resistance of only 0.4°C per watt.

New from International Rectifier, El Segundo, Calif., is a series of 250 mw glass zener diodes which range from 2.6 volts to 13 volts and are available in 1%, 5% and 10% types. A similar series is available between 3.9 and 33 volts and carries 5 and 10% tolerances. Glass diodes are also available in 400 mw packages which meet MIL-S-19500/-117. The various units are rated for operation between −55°C and +150°C and have low temperature coefficients +0.035 to +0.080%/°C) to assure maximum stability over the temperature range.

Lafayette Radio, Jamaica 33, N. Y., is marketing a compact 100 mw audio amplifier, complete with transistors, transformers and r/c components for $3.95. Looks like a real bargain, it's their stock number PK-522.

Pacific Semiconductors, Hawthorne, Calif., have introduced a group of zener diodes designed especially for 10 volt "full decimal readout" in differential and digital voltmeter applications. The units are available with stabilities ranging from 0.01% to 0.0005%. have a new family of diodes with guaranteed failure PSI rates. The PS4559 and PS4560 are silicon general purpose alloy diodes having a failure rate less than 0.008% per thousand hours. A fast logic switch, the PS4725 has a failure rate less than 0.004% per 1000. PSI has recently registered two new silicon planar high speed transistors in the TO-51 micropackage. The 2N958 and 2N959 are particularly well suited to "swiss cheese" assembly as well as other advanced techniques.

A new RCA transistor has made possible a hi-fi amplifier with amazing performance. The all-transistorized amplifier produces 50 watts, at ±0.1 db between 20 and 20,000 cycles, with an IM distortion of only 0.5%. Hum and noise are more than 90 db down from full output. The new transistors are a drift-field type which feature high gain well into the megacycle range. Other news of interest is their entry into the multi-cell high voltage rectifier field.

Of particular interest to hams and experimenters is an announcement by Texas Instruments, Dallas, Texas, of a group of new germanium r.f. transistors. The GAM-1 provides the highest gain, in the broadcast band of any commercial type. The GAM-2 series provides excellent high frequency performance for FM use. In FM applications the transistors will provide 30 db of quieting with a 3 microvolt signal and have a 100 mc noise figure of less than 6 db. A third series of economy power transistors, designed for audio applications, are in the TO-3 package and offer breakdown voltages of 30, 45, or 60 volts.

Before signing off this month, I should point out an error which occurred in the 1 Watt c.w. transmitter (July, *CQ* Semiconductor column). There should be a connection between the junction of the 270 ohm and 2.7 K resistor and the positive battery connection. Without this lead to supply B+, obviously, the oscillator cannot operate.

73, de Don, W6TNS

Space Communications

GEORGE JACOBS, W3ASK
11307 Clara Street, Silver Springs, Maryland

Space Catalog

BETWEEN January 1 and July 21, 1961, twenty new earth satellites were launched successfully into orbit. Fourteen of the successful shots were credited to the USA, six to the Soviet Union. This raises the total of man-made earth satellites placed in orbit since October 4, 1957 to sixty-two. Of this number, thirty-one were in orbit on July 21, 1961.

Credit for the most dramatic shot during the first seven months of 1961 goes to the Soviet Union for achieving the first manned space-flight. Utilizing a six-engine booster, with a reported 20 million total horsepower, Soviet Air Force Major Yuri A. Gagarin was thrust into orbit aboard the spacecraft VOSTOK (Sputnik XI) on April 12. After one complete orbit the ground-controlled spacecraft re-entered the earth's atmosphere and was recovered 400 miles southwest of Moscow. Major Gagarin, who apparently suffered no ill effects from his 108 minute ride in space, thus became the first man to successfully perform orbital space flight.

Table 1 is a complete catalog of satellites launched successfully during the first seven months of 1961 (up to July 21). The information appearing in this table has been compiled from data released by the National Aeronautics and Space Administration (NASA). For similar information concerning satellites launched prior to 1961, refer to the "Space Catalog" appearing on page 80 of the March 1961 issue of *CQ*.

Each successful space launching is designated officially in alphabetical order, in accordance with the Greek alphabet. Each year the designations begin over again with the letter ALPHA. Besides the official designation, which is recognized internationally, each satellite usually has a common, or project name given to it by the launching country. Sputniks and Luniks have been the common names chosen so far by the Russians for their satellites, while American satellites bear such project names as Discoverer, Explorer, Echo, Tiros, etc.

Also shown in Table 1 are some of the vital statistics of each shot, such as period, inclination, apogee, perigee, the purpose of the shot, and its present status. The *period* is the time that it takes for the satellite to complete its orbit around the earth. *Apogee* is the point on the satellite's orbit farthest from the earth, while *perigee* is the orbit's nearest point to earth. *Inclination* is the angle that the satellite's orbit makes with the equator.

Table 2 contains a full listing of those satellites that were launched prior to 1961 but re-entered the earth's atmosphere and decayed (burned-up) during the first seven months of this year.

The Score

As of July 21, sixty-two man-made artificial satellites have been blasted through the earth's atmosphere into outer space. Of these, forty-seven have been American and fifteen Russian. Thirty-one satellites are presently in orbit, twenty-seven around the earth and four around the sun. A Russian satellite rests on the surface of the moon. These figures are summarized in the following tables:

Successfully Launched Satellites
October 4, 1957-July 21, 1961

Country	Earth Satellites	Solar Satellites	Lunar Probes	Total
USA	45	2	0	47
USSR	12	2	1	15
Total	57	4	1	62

Satellites in Orbit as of Juy 21, 1961

Country	Earth Satellites	Solar Satellites	Lunar Probes	Total
USA	26	2	0	28
USSR	1	2	0	3
Total	27	4	0	31

Besides the 31 satellites in orbit at the present time, more than 70 other man-made objects have also been identified in space. These objects, referred to as "space-junk" in today's space-age lingo, consist mainly of spent rocket casings, platforms from between rocket stages that have separated, and metal fragments from either the booster or the payload, which often manage to accompany a satellite into space.

Space Communications

No new communication satellites were launched during the first seven months of 1961.

TABLE 1

Satellites launched successfully between Jan 1-July 21, 1961

International Designations 1961	Common Name	Launched By	Launch Date 1961	Period in Minutes	Inclination Degrees	Apogee-Perigee Miles	Purpose	Status
ALPHA 1	Samos II	USA	31 Jan	94.9	97.4	342 295	Reconnaissance	In orbit
BETA 1	Sputnik VII	USSR	4 Feb	89.4	64	186 120	7-ton spacecraft	Decayed 26 Feb
GAMMA 1	Venus Probe	USSR	12 Feb	Position Uncertain			Planetary Exploration	Missed Venus, but is in solar orbit
GAMMA 3	Sputnik VIII	USSR	12 Feb	89.7	65	198 123	Launch platform for Venus Probe	Decayed 25 Feb
DELTA 1	Explorer IX	USA	16 Feb	118	38.9	1566 431	Solid fuel booster evaluation & air drag measurements	In orbit
EPSILON 1	Discoverer XX	USA	17 Feb	94.4	80.9	428 176	Booster system evaluation, radiation measurements	In orbit
ZETA	Discoverer XXI	USA	18 Feb	96.0	80.7	745 154	Radiation, infrared & atmospheric measurements	In orbit
ETA	Transit III-B/Lofti	USA	22 Feb	94.2	22.4	511 117	Navigation/VLF Propagation	Decayed 30 March
THETA 1	Sputnik IX	USSR	9 Mar	(?)	65	155 114	Animal space survival experiments	Recovered animal container, 9 March
IOTA 1	Sputnik X	USSR	25 Mar	88.4	66	150 111	Animal space survival experiment	Recovered animal container, 25 March
KAPPA	Explorer X	USA	25 Mar	Position Uncertain			Magnetic Field data	In orbit
LAMBDA 1	Discoverer XXIII	USA	8 Apr	93.5	82.3	364 183	Booster system evaluation	In orbit
MU 1	Sputnik XI	USSR	12 Apr	89.1	65	187.8 .... 109.5	Manned spacecraft (VOSTOK)	Returned to earth 12 Apr
NU	Explorer XI	USA	27 Apr	107.8	28.8	1111 302	Detect and map gamma radiation	In orbit
XI	Discoverer XXV	USA	16 June	89.6	82.1	172 139	Capsule recovery test	Capsule recovered 18 June, payload decayed 9 July
OMICRON 1	Transit IV-A	USA	29 June	103.8	67.0	620 547	Navigation	In orbit
OMICRON 2	Injun/Greb III	USA	29 June	103.8	67.0	619 548	Radiation & aurora data/solar radiation	In orbit
PI	Discoverer XXVI	USA	8 July	94.7	82.9	483 142	Capsule recovery test	Capsule recovered 9 July, payload in orbit
RHO 1	Tiros III	USA	12 July	100.3	47.9	511 457	Weather	In orbit
SIGMA 1	Midas III	USA	12 July	161.5	91.2	2153 2129	Infrared detection	In orbit

TABLE 2

1961 Decayed Objects

Launched Prior to Jan. 1, 1961

International Designation	Common Name	Launched By	Launch Date	Burn-Up Date
1960 OMICRON	Discoverer XVII	USA	12 Nov 1960	29 Dec 1960
1960 TAU	Discoverer XIX	USA	20 Dec 1960	23 Jan 1961
1959 EPSILON 2	Capsule	USA	13 Aug 1959	11 Feb 1961
1960 SIGMA	Discoverer XVIII	USA	7 Dec 1960	2 Apr 1961

Echo I, the 100-foot passive communications satellite launched on August 12, 1960 is still in orbit. It has retained much of its original shape and reflectivity, and is still capable of reflecting high power u.h.f. signals.

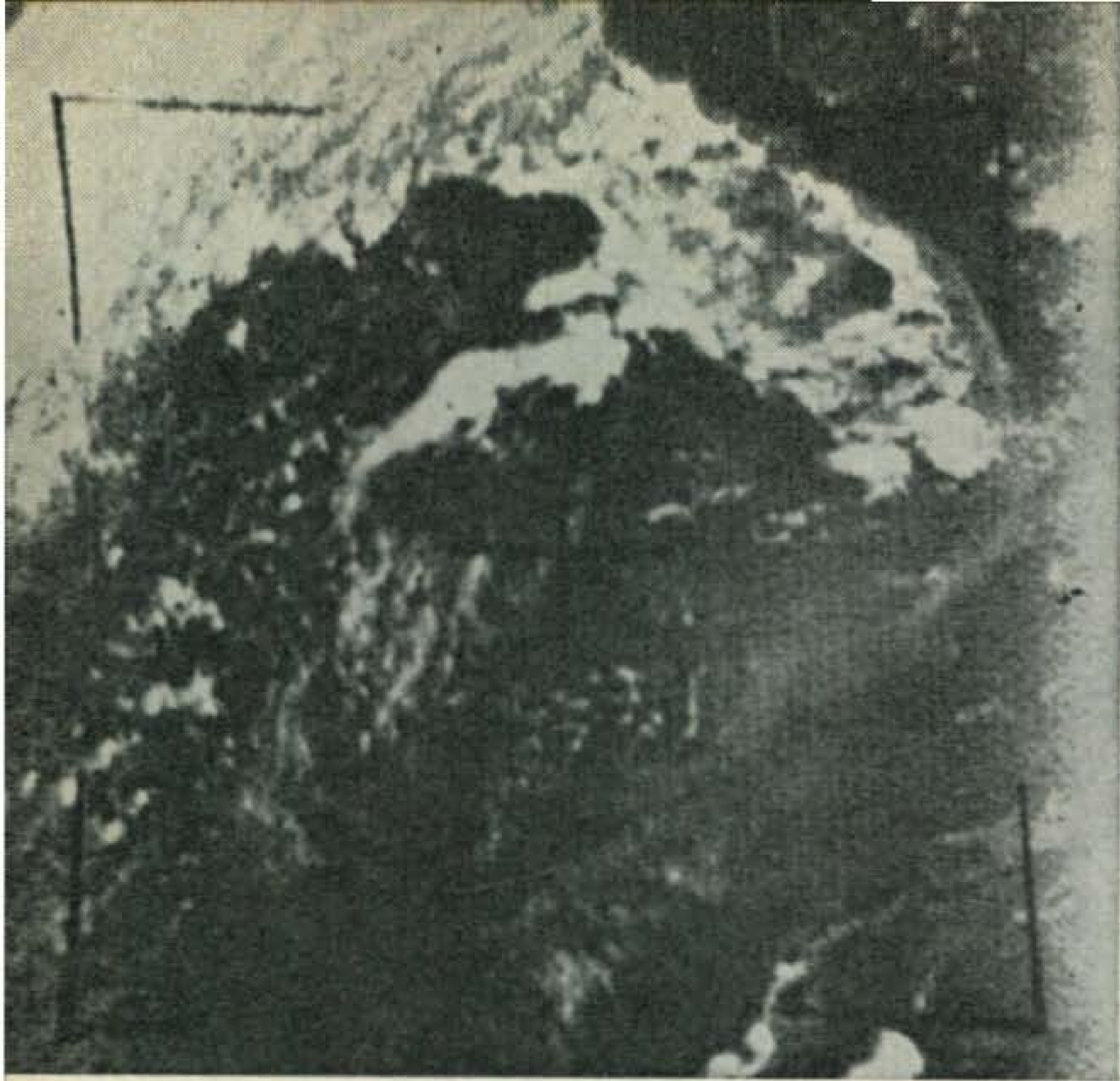
Courier 1B, the first active radio relay satellite, launched on October 4, 1960 is also still in orbit, but its relay facilities have been inoperative for many months. Courier's beacon transmitter, however, is still on the air for tracking purposes.

Tiros III

NASA's third experimental weather satellite, Tiros III, was placed in orbit on July 12, 1961. The satellite is equipped with instrumentation of considerable electronic and communication interest.

On board are two wide angle vidicon television cameras used for photographing cloud formations over vast areas of the earth's surface. Each camera is equipped with an $f1.5$ lens which photographs about 700 miles in two directions. The electronic heart of the camera is a half inch vidicon tube to which is attached a focal plane shutter. The shutter permits still pictures to be stored on the tube screen; the pictures are then converted into video signals by means of an electronic beam which sweeps across the vidicon's screen. The system has a resolution of 500 lines per second and a video bandwidth of 62.5 kilocycles.

Connected to each vidicon chain is a magnetic tape recorder. During each orbit, the magnetic recorders can store video information from as many as thirty-two pictures taken by each camera. When the satellite is within range of a ground station, the stored information is transmitted earthward upon command. Primary command and data readout stations for Tiros



This photo, taken from an altitude of about 460 miles by one of the vidicon television cameras aboard the Tiros III weather observation satellite, shows a thunderstorm in the Gulf of Mexico (irregular white area). This picture, stored as video information in the satellite's memory magnetic tape recording system, was released upon ground command over a v.h.f. radio channel as Tiros passed over one of its ground control stations. Note the clarity with which the entire state of Florida can be seen. Tiros III was launched from Cape Canaveral on July 12 (*Official NASA Photo*).

III are located at Wallops Island, Virginia and at the Pacific Missile Range, California. Backup stations are located at the Atlantic Missile Range, Florida and at Princeton, New Jersey.

NASA has announced that five transmitters are being used to relay data from the satellite to the ground stations. Each of the two television camera chains has a two watt ground command transmitter operating on 235 megacycles; one two watt 237.8 megacycle transmitter, also operated by ground control, relays experimental infrared data; and two 30 miliwatt beacon transmitters operate continuously on frequencies of 108 and 108.03 megacycles for tracking purposes. In response to ground commands, the beacon transmitters can also be used to transmit satellite environmental data such as temperature, pressure and battery charge level.

Power for the satellite is furnished by 63 nickel-cadmium storage batteries which are charged by more than 9,000 solar cells.

The U.S. Weather Bureau plans to conduct a joint program of international participation with the new Tiros satellite. The objective of this program will be to provide an opportunity for weather services in other countries to correlate their own ground-based observations with the cloud cover photographs taken from the satellite.

Pictures from Tiros III are expected to be of particular value in locating hurricanes. It was for this purpose, as well as general cloud data collection, that the satellite was launched at this time of the year. During the first few weeks of its life, Tiros III had located several large storm areas. (See Photo)

Transit IV-A, Injun and Greb III

On June 29, another experimental navigation satellite was placed in orbit by the United States. Dubbed Transit IV-A, it is orbiting at a higher altitude than earlier Transit satellites. Because air drag is less at higher altitudes, Transit IV-A's position is somewhat easier to calculate than earlier satellites in this series, and it is capable of giving navigational fixes of extreme accuracy.

Transit IV-A holds another distinction, it is the first known satellite to be powered by nuclear energy. On board is a nuclear battery containing the radio-isotope Plutonium-238, which is expected to supply the satellite's entire power needs for many years.

Transit IV-A is another in a series of experimental forerunners of an all-weather global satellite navigational system which will be capable of giving precise position reports to surface craft, submarines, and aircraft. Two more experimental shots are planned in the Tiros series, and if successful, they will be followed by a four-satellite operation system sometime during 1962.

Launched piggy-back with Transit IV-A were two other satellites, Injun and Greb III. Injun was designed and built under Navy contract by the State University of Iowa. It will be used for examining the intense radiation of the Van Allen belts which surround the earth, and for studying the Aurora Borealis. Greb III, built and designed by the Naval Research Laboratory, will measure solar radiations. The three satellites were designed to separate and follow similar but independent paths in orbit. Transit IV-A separated successfully, but Injun failed to disconnect from Greb, and both are orbiting together.

The frequencies used by Transit IV-A, Injun and Greb have not been announced. Transit III-A, which failed during launch on November 3, 1960 was to use 54, 162, 216 and 324 megacycles. The same frequencies were also used by Transit II-A and Transit III-B. The Lofti payload sent into orbit piggy-back with Transit III-B earlier this year was one of the first satellites to use the new tracking frequency of 136 megacycles. Reports from satellite listeners appear to indicate that Injun's and Greb's beacon transmitters are also close to this tracking frequency. (See Photo)

Frequency Info

According to reports received from satellite-monitoring radio amateurs, and from information released by the National Aeronautics and Space Administration, transmitters on the following satellites were still in operation during late July.

Name	*Period* (Minutes)	*Frequency* (Mc)	*Modulation*
Vanguard I	134	108.022	Continuous carrier.
Explorer VII	101	19.9904	A.m. carrier, with 4 f.m. sub-carriers.
Tiros I*	99	107.997	Frequency Modulation.
Transit II-A	102	108.06, 162 & 216	Continuous carrier, exceptionally high stability.
Courier IB	107	107.971	Frequency Modulation.
Tiros II	98	108.0 & 108.03	Frequency Modulation.
Explorer XI	108	108.058	Phase Modulation.
Tiros III	100	108.0 & 108.03	Amplitude Modulation.
		235 & 237.8	Wide-band Frequency Modulation.
Transit IV-A	104	†	
Injun	104	‡	
Greb III	104	‡	

*The transmitter on Tiros I was designed to be shut off from the ground. Efforts to silence it, however, have so far been unsuccessful.

†Frequencies not announced, but probably the same as previous Transit satellites (54, 162, 216 and 324 megacycles, with a beacon transmitter near 108 or 136 megacycles).

‡Frequencies not announced, but beacon transmitters are most likely on tracking frequencies near 136 megacycles.

The frequencies used on the Discoverer series and the Midas satellites are never announced because of security conditions.

Man In Space Frequencies

It has been reported that the transmitters on Russia's VOSTOK spacecraft, which carried the first human into orbit, operated on 143 megacycles in the v.h.f. range and on 9,019 and 20,006 kilocycles in the h.f. region. Transmissions of radio, television and telemetry were observed. It is very possible that the same set of frequencies will be used in future Soviet manned spacecraft.

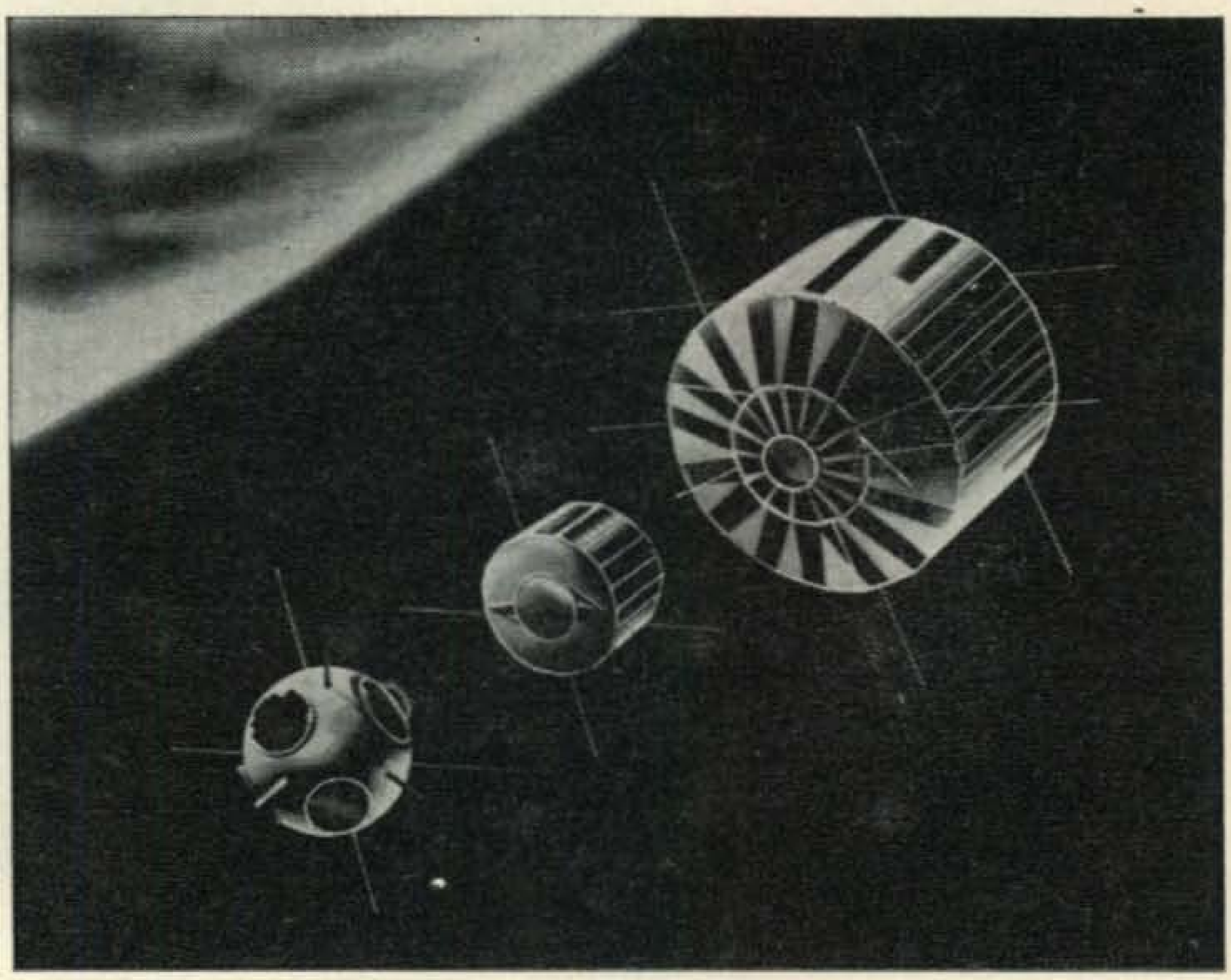
On May 5, 1961 Commander Alan B. Shepard became America's first man-in-space. Seated in a Mercury capsule mounted atop a Redstone missile, Commander Shepard was launched on a sub-orbital flight 115 miles into space, and approximately 300 miles down the Atlantic Missile Range. On July 21, America's second astronaut, Air Force Captain Virgil Grissom was successfully launched on a similar sub-orbital flight. The Mercury capsules used on both occasions were equipped with h.f., v.h.f. and u.h.f. communication and data transmission facilities, but exact frequencies were not made public. It is interesting to note that Captain Grissom's h.f. system failed during his ride in space, probably as a result of a severe radio storm which was in progress at the time. His v.h.f. and u.h.f. circuits, however, were A-OK.

S-45 Fails Again

The second, or back-up S-45 ionospheric propagation satellite failed during launch on May 24. The satellite, containing six transmitters which were to be used for propagation studies (see SPACE COMMUNICATIONS, April and July *CQ*), failed due to a malfunction in the second stage ignition system of the four stage Juno II booster.

The first attempt to launch S-45 failed under similar circumstances on February 24. This means that both the original and the back-up

[*Continued on page 106*]



Transit IV-A and its two piggy-back satellites, Injun and Greb III shown in an artist's conception moments after leaving the launch vehicle. During the actual launch on June 29, Injun failed to separate from Greb. (*Official U.S. Navy Photo*)

ham clinic

CHARLES J. SCHAUERS, W4VZO
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NEARLY every mail brings a letter or two asking us questions relative to vacuum tube voltmeters (VTVM) and volt-ohmmeters (VOM). Most of the questions are quite basic, but a large number of them deal with purchase recommendations.

So this month we thought we would start the column off by expressing *some* of our pent-up comments on the subject of the two instruments.

VOM

The most often used test instrument around the average hamshack is the VOM. This item is the "right arm" of the ham troubleshooter.

If you contemplate buying a VOM, keep the following points in mind: buy the best you can afford; make sure that it has a sensitivity of at least 1000 ohms per volt (Ω/v) preferably, it would be better to purchase one with 5,000 or even 20,000 Ω/v. For the more sensitive the instrument, the greater the accuracy (all other factors considered) will be.

When you measure voltage in a circuit, the meter will take some current for operation . . . this is a load factor. The lower the resistance the greater the current taken, and naturally, the less accurate the voltage readings will be.

For extreme accuracy, a vacuum tube voltmeter should be used. It takes very little current from a measured circuit because its loading resistance is in megohms rather than in thousand(s) of ohms.

Make certain that the VOM you buy has good range. It should accommodate voltages up to 1000 volts (preferably 2000) in both d.c. and a.c. ranges. Where voltages greater than the range of the unit are encountered, multipliers or voltage extending probes may be used in series for extending the range of the instrument.

The ohmmeter portion of the unit should be capable of measuring resistance to at least 1 megohm. Most pocket units however, only go to 100,000 ohms and this is no drawback for portable work.

Some hams complain that their readings when compared with manufacturers readings found in equipment instruction books are way off. A little digging will disclose the fact that most manufacturers either use VTVMs or VOMs with a sensitivity of 20,000 Ω/v . . . certainly one's readings will be "off" if say a 1,000 Ω/v meter is used! However, this should be no drawback if you are smart enoug.ı to measure a known voltage in a set and compare it with the manufacturer's readings . . . you can interpolate readings and come out quite close.

Before using a VOM in any set, make sure that capacitors are discharged if resistance readings are to be made. Be certain that the mode selection switch is in the proper mode before attempting to do any measuring. Check the range selector switch too.

When measuring resistance, frequently check the zero adjustment, otherwise your meter will read inaccurately.

High voltage checking can be dangerous, unless you *always* remember to clamp one test lead on a test connection and carefully use a prod for the other test connection. Examine test prods (and probes) for proper insulation. *Never, never* use the test prods in *both* hands when checking high voltage, even though the prods seem to be in good shape.

A VOM having low sensitivity *cannot* be used to measure voltages in some critical circuits, *e.g.*, grid input voltage—for this task a good scope or a VTVM is essential. Even with a VOM having a sensitivity of 20,000 Ω/v there is still too much loading effect which will throw your readings way off.

If possible, a VOM with a self-protecting overload circuit should be considered when buying one; far more VOM meter needles have been slammed to destruction by trying to measure 2000 volts with the unit connected for measuring resistance than anyone can imagine.

The switches used in most VOMs are of the self-wiping variety. However, it is a good idea at least once each year if you have used your VOM frequently (especially around the mobile installation) to check all switches for proper operation. A little electrical contact cleaner may be used to clean soiled switch contacts.

The VOM is the ham's utility meter and one should be in every shack. However, a hamshack without a VTVM is like a car without a backup light . . . when one is needed, it is really needed.

VTVM

A VTVM sells in kit form for less than a good VOM and is capable of doing much more as long as you have 117v. a.c. around to operate it.

In addition to measuring voltages at radio frequencies, it can measure voltages in critical electronic circuitry which cannot tolerate additional loading. For transistor circuits, the VTVM is ideal for this reason.

In most instances, VTVMs can measure resistance in megohms.

Using the VTVM is little different than using a VOM, but these points should be kept in mind: most VTVMs take at least 10 minutes to settle down. No final attempt to zero the meter should be made until the warm up period is over; then, re-zeroing may be necessary as the unit is used. A shielded (hot) input lead is necessary with the VTVM, otherwise (like the scope) stray electric fields will affect readings. The ground connection on the VTVM must be solid.

When a VTVM does not function, first check the tubes . . . 95% of the time, tubes will be the cause of mal-functioning.

When it is difficult to zero a VTVM, suspect the tubes first and then aging parts . . . especially resistors.

In choosing a VTVM, make certain that it will go to at least 1000 volts (without a probe). If possible, also obtain one which has a meter protect circuit; this "refinement" is well worth having and insures against a meter burnout when least expected.

VTVMs can be purchased for as little as $25.00 and as much as $1500.00 or more, but for strictly ham use the less expensive instruments are fine.

If you will tell HAM CLINIC how much you can afford for a VTVM and/or a VOM we will be glad to recommend a unit to you.

Observation

Some of the letters received start like this: "I wrote to the manufacturer but he did not answer, so I thought I would call on HAM CLINIC for the information I seek."

Holy shades of Ohm's law!

Recommended: If a manufacturer does not reply to a letter from you enclose a copy of that letter in an envelope and send it to us . . . we'll try to help you with your problem first and then remind the delinquent manufacturer that the word *service* should be spelled with a capital "S". Further, if the manufacturer will be kind enough to forward instruction books and service sheets on his equipment to us we'll be happy to help him out by answering his correspondence over-flow . . . as we have been doing for over three years now.

We again remind manufacturers that HAM CLINIC advocates authorized service agency modifications and equipment repair where this is feasible. On request we forward copies of correspondence relative to their equipment and our answers given readers. Our files now bulge with service tips submitted by hams who have *more* than field tested commercial equipment. These enable us to help others. We still need, however, issues of service instructions from Service Managers. Help us to help you!

Questions

Tuneup Indicator—"How about printing the diagram for a tune-up or relative output indicator for my home-made s.s.b. final?"

See fig. 1.

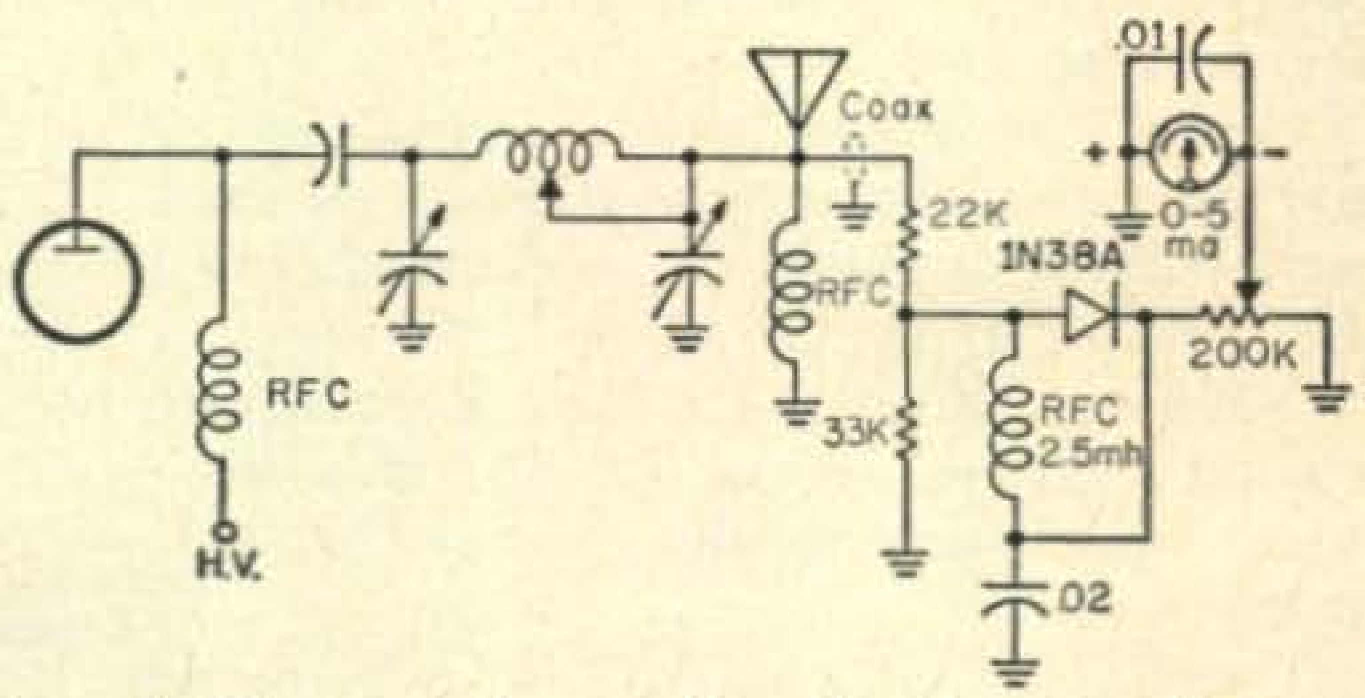

Fig. 1—Diagram of an r.f. voltmeter type tune-up indicator.

Simple Capacitor Checker—"I need a simple capacitor checker; the simpler the better. It should test capacitors from ½ to 100 mf."

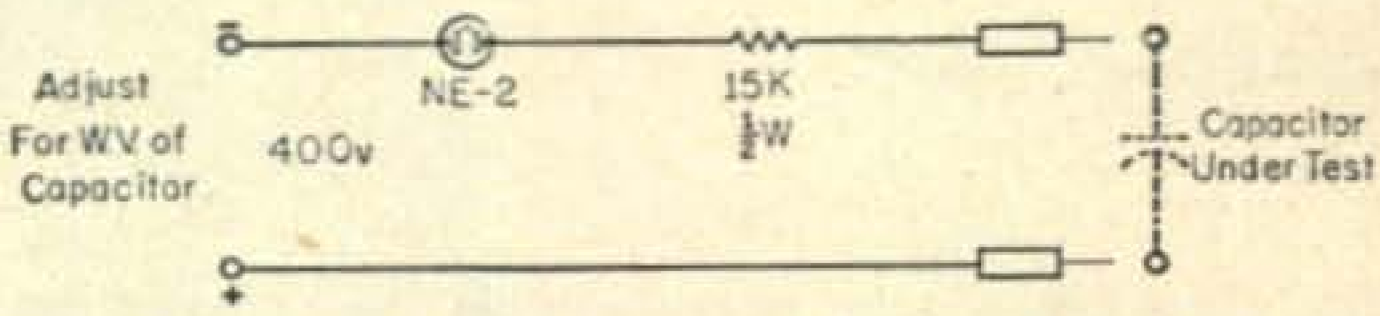

Fig. 2—A simple capacitor checker useful in checking for shorts, leakage and relative merit of capacitors.

See fig. 2. Shorts are indicated by a continuously glowing neon bulb; an open, no glow of any kind; a good capacitor, the neon bulb glows on application of the probe and then goes out, depending on leakage and size of the capacitor. If the capacitor leaks, the neon bulb goes on and very slowly goes out. A continued faint glow indicates a high resistance short. By shorting out the neon bulb and placing a pair of headphones in series with the capacitor under test and the test prods, clicks will continue to be heard on application of the prods if the capacitor has a slight leak. This checker is not suitable for electrolytic capacitors.

S.S.B. Linear Screen Voltage—"If a tetrode final linear in ABI is operated without stabilized (regulated) screen voltage, what results?"

Distortion, because of non-linearity.

Scope Tube—"How can you tell when a scope CR tube needs replacing?"

Generally, providing all voltages and tubes check okay, you will note that the image is dim and is not affected by the intensity control. Sometimes the spot will be hard to focus too. You may also note a need for increased vertical and/or horizontal amplifier gain.

Phone Patch Cross Talk—"Is it possible for a phone patch signal to feed into another parallel phone line?"

Yes, especially if the gain is up too high. Cross-talk can result in the best designed phone systems and not be due to r.f. rectification, as is usually the case when there is trouble.

Receiver Modifications—HAM CLINIC does not have modification info for "better results" on the following receivers: KP81, Breting 12, SX-24, SX-16, SX-71, HRO, BC-348, SP600, NC-101, AR-88 or SW-3! (Nearly every mail has at least one letter on one of these sets. Sorry fellows and gals.)

Socket Arcing—"What causes arcing at rectifier tube sockets?"

Using low grade, poorly insulated sockets and operating the supply without its load. For high voltage applications, sockets should be of the ceramic type.

NC-300 vs. NC-303—"I have a chance to buy a good used NC-300 or NC-303 at a very good price. Which one would you take if you were in my position?"

The NC-303 of course. It *is* a better set.

I. T. V.—"I have been experiencing I.T.V. on my receiver on 21 and 28 mcs. Can you suggest a set filter that might help?"

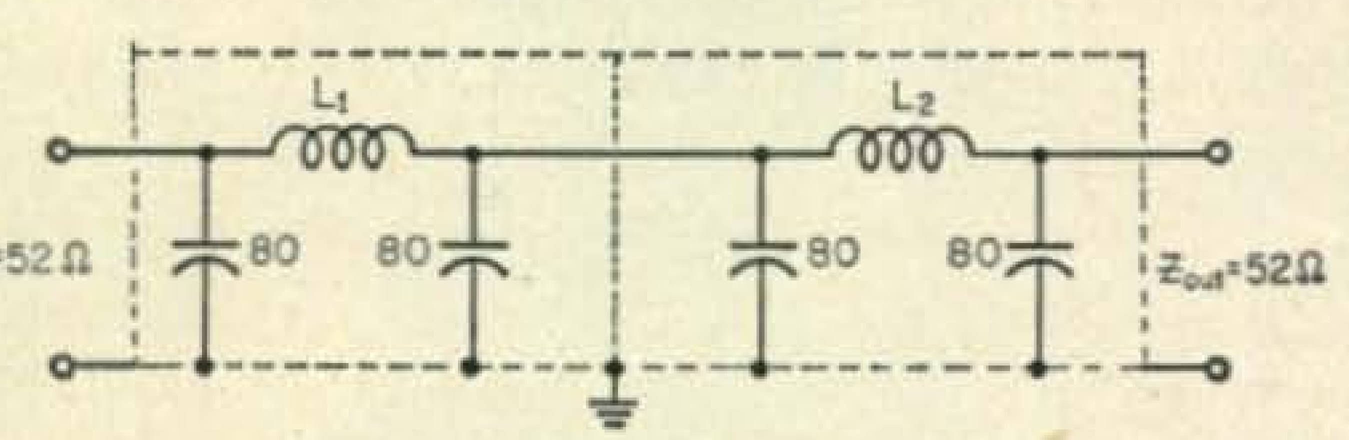

Fig. 3—A low pass filter suitable for eliminating "ITV" in an amateur receiver in the region below 35 mc. Coils L_1 and L_2 are 0.4 μh consisting of 10t #20 on a ⅜" form spaced ½".

Yes, see figure 3. Be sure that you have a good ground. It cuts off at 35 mcs. Thanks to National for the help.

Heath Probe—"I purchased a Heath 309-C r.f. probe. Catalog specifications say it extends frequency response to 250 mc. However, in the instructions it says it extends from 1000 cycles to 100 mc. Which is right?"

The diode determines frequency response. The diode used is good to 250 mcs.

HT-32 for Teletype—"Do you have or can you direct me to some information which will permit me to use my HT-32 on teletype?"

Yes. Write Hallicrafters Co. at 4401 West 5th Ave., Chicago 24, Illinois and ask them for their conversion data of the HT-32 for teletype operation. They'll be glad to help you out. Be sure to include the serial number of your set.

HQ-140X to HQ-140XA—"Tell me, can the Hammarlund HQ-140X receiver be converted to the HQ-140XA?"

No, not readily.

Crystal Control of HT-32, HT-32A and HT-37—"Can you tell me how to crystal control my HT-37?"

Hallicrafters will be glad to send you the complete modification sheet which covers the HT-32, HT-32A and HT-37. This adaptation is intended primarily to enable Novice band operations. Write them at the address given under "HT-32 for Teletype" above.

Tubes vs. Diodes—"It seems to me that replacing rectifier tubes with solid state diode rectifiers is a good step. What do you think?"

I concur. For information on diode plug-in sections for direct rectifier replacement (even the 866A), look in the Allied Radio catalog under Sarkes Tarzian rectifier replacements.

Vibrator Supply—"What part (other than the vibrator) fails often in a vibrator power supply?"

The buffer condenser. If fuses blow or vibrator points stick suspect this culprit.

HT-18 Modifications (Modulation)—"I have an HT-18 exciter containing a final 6L6. What's your suggestion for doing away with the f.m. circuitry and modulating it with a.m.?"

Get rid of the 6L6 and substitute a 2E26. Put a parasitic choke (6 turns #18e. wire on a high value ½ watt resistor) in series with the 2E26 plate lead and plate modulate the rig with the modulator shown in the *CQ* article "The VW Special" for December 1957. You can also use a commercially available screen modulator for simplicity if you prefer.

Crystal Headphones—"I have been told that I need to place a condenser in series with crystal headphones in circuits which have d.c. present. Is this true?"

You better believe it! Most good crystal phones already have the blocking condenser installed in them, but if there is any doubt, put one in anyway.

6 Meter Pre-amplifier—"Please, a pre-amplifier or pre-selector for 6 meter operation. The set should be transistorized. Can do?"

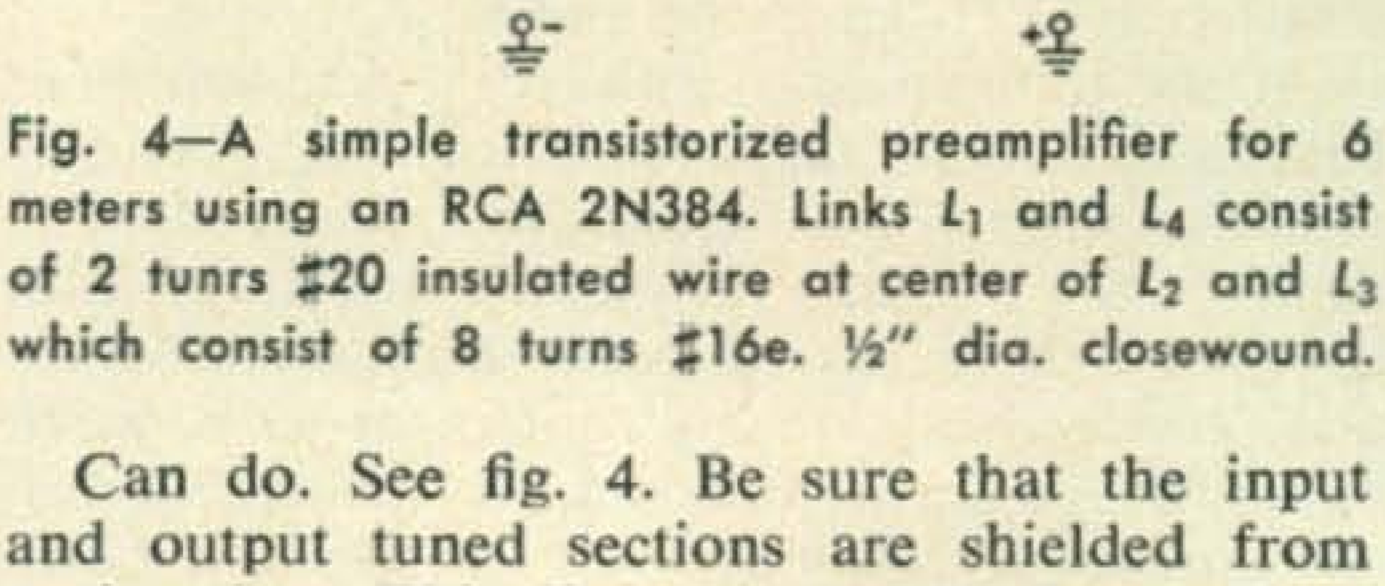

Fig. 4—A simple transistorized preamplifier for 6 meters using an RCA 2N384. Links L_1 and L_4 consist of 2 tunrs #20 insulated wire at center of L_2 and L_3 which consist of 8 turns #16e. ½" dia. closewound.

Can do. See fig. 4. Be sure that the input and output tuned sections are shielded from each other. This little rig works fine with a converter or a receiver which will tune through 6.

By the way, those of you interested in an antenna-receiver matching device for 6 meters, send a self-addressed envelope for the diagram. We have 500 diagrams to give away; when these are gone and if the response continues, we'll publish the diagram here.

[*Continued on page 106*]

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Novice

THIS month, let's discuss multi-grid and special purpose tubes. Under the heading of multi-grid types we could list the tetrode and pentode, among others. It would require the remainder of the column to list all the special purpose types, but a few tubes of interest to amateurs will be described in detail.

Tetrodes

A tetrode is a four-element vacuum tube. Essentially, it is a triode with the addition of a *screen grid* located between the control grid and the plate. The addition of the screen grid materially reduces the grid-to-plate capacitance, making the tetrode more useful for higher frequency work than the triode. The voltage applied to the screen grid is positive, usually somewhat less positive than the plate, and creates an electrostatic field within the tube. Because this electrostatic field is closer to the control grid than the plate, it exerts a greater influence than that of the plate on the number of electrons drawn from the cathode. Furthermore, since the screen voltage is held constant, the varying voltage at the plate only varies the electrostatic field between the screen and plate but does not affect electrons near the control grid. In general, increasing screen grid voltage increases plate current. While the screen grid, being positive, does share electrons with the plate, the construction of this screen is such that the majority of electrons pass through and on to the plate. The division of the electrons depends on the voltages applied to the elements. The higher the screen voltage, the more of the total number of electrons the screen takes. Up to a certain limit this increases the plate current, too, because the screen draws more electrons out of the cathode and increases the total amount. But when the maximum number of electrons produced by the cathode are obtained, the total current does not increase with higher screen voltage. At this point the plate and screen have to divide the available electrons between them. Higher screen voltage increases the screen current at the expense of plate current and the plate current actually decreases with an increase in screen voltage.

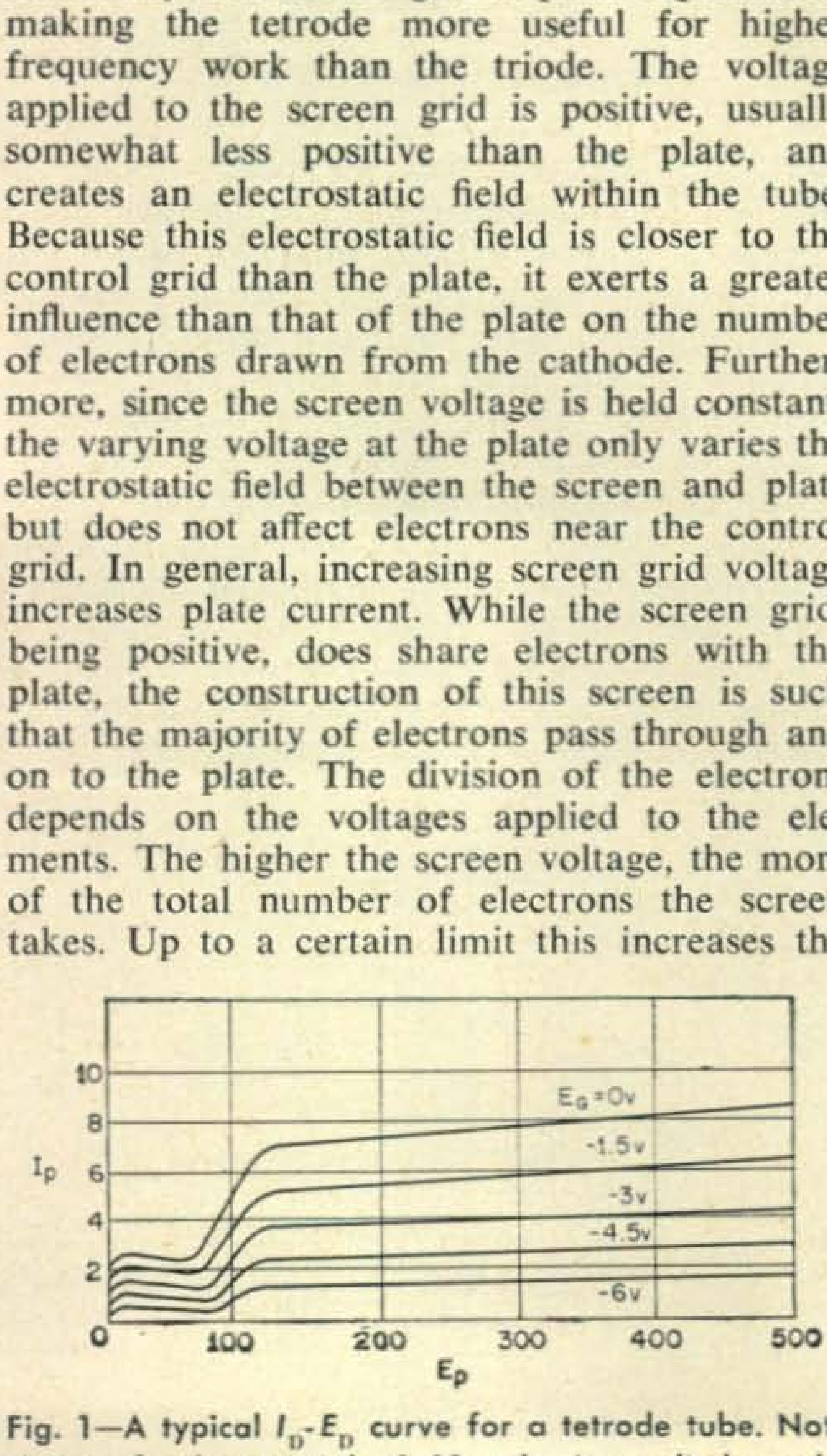

Fig. 1—A typical I_p-E_p curve for a tetrode tube. Note that a fixed potential of 90 volts is applied to the screen grid.

Secondary Emission

An effect called *secondary emission* is produced when electrons strike the plate or screen grid with sufficient force to knock other electrons from it. These electrons, thus freed, travel to the electrode exerting the force on them, that is, the electrode with the more positive potential. Flow of electrons from the screen to the plate due to secondary emission is negligible since they are liberated on the side away from the plate and must pass through the screen to get to the plate. On the other hand, the flow of electrons from the plate to the screen may become appreciable when the screen grid is more positive than the plate.

Tetrode Characteristics

When the plate voltage is less than the screen voltage, but not low enough to form a space charge in front of it, the plate current decreases as the plate voltage increases (see the characteristic curves of tetrode tubes in fig. 1). This is the method of producing a negative resistance characteristic. While the number of electrons that the plate receives is independent of the plate voltage, the number of electrons lost to the screen through secondary emission increases as the plate voltage increases since electrons will then strike the plate with greater force. A circuit utilizing this negative resistance characteristic is called a dynatron, a circuit sometimes used as an oscillator. The transition from this region of decreasing plate current with increasing plate voltage to the region where the plate current becomes practically independent of the plate voltage occurs when the screen and plate are at approximately the same potential.

When the plate voltage is appreciably more

Eric Wolffbrandt, WV2NZY, has an impressive wallpaper collection. Too bad we can't reproduce his photo in color. The ole "Sky Buddy" receiver helped Eric to a WAS of 37/36.

positive than the screen, the plate retains the electrons it receives from the cathode and in addition obtains a few secondary electrons from the screen grid. This results in the plate current being very nearly equal to the total space current and substantially independent of the plate voltage since the total current depends primarily upon the potentials of the screen grid and control grid.

To overcome the effects of secondary emission, the tetrode usually operates at a point where the plate voltage is high. In this condition the tetrode has high plate resistance and amplification factors ranging from 500 to 800. The transconductance is about the same as that of a triode operating with similar plate current. The plate-to-grid capacitance, however, is lower than in a triode.

The high amplification factor and lower plate-to-grid capacitance makes the tetrode particularly useful as an amplifier of radio frequency voltages.

Pentodes

To overcome the effects of secondary emission, there are tubes in which a third grid, called the *suppressor grid,* is added between the screen grid and plate. This type of tube is known as a *pentode,* or five-electrode tube. The suppressor grid is usually connected directly to the cathode in such a way that it repels back into the plate the secondary electrons emitted from it. The suppressor grid does not materially affect the flow of cathode electrons to the plate since their flow depends almost entirely upon the screen and control grid voltages.

Although the screen grid in either the tetrode or pentode greatly reduces the effect of the plate voltage upon plate current flow, the control grid (because of its closeness to the cathode) still is able to control the total current flow, and consequently the plate current. For this reason the tranconductance of a pentode (or a tetrode) is of approximately the same value as that of a triode of similar structure. On the other hand, since the plate voltage has relatively little effect upon the plate current flow in a pentode the values of R_p and *mu* are very high. This is obvious if you remember the definitions of these tube constants. The amplification factor of a pentode is in the neighborhood of 100 to 1500, and the plate resistance from one-half to one megohm. The high plate resistance makes it difficult for a pentode to utilize much of the advantage of its high amplification factor. Therefore, pentode amplifiers using resistance-capacitance coupling have gains of only 100 to 200.

Meet Dave Frick, KN8WCZ, who battles it out on 80 and 40 meters. Give a listen for him.

Pentode Characteristics

A typical set of characteristic curves is shown in fig. 2. The fact that the plate voltage is relatively ineffective in controlling the plate current is shown by the small slope of the curves beyond the point where the plate voltage is high enough to keep the electrons in the space between screen grid and plate from being attracted back to the screen grid. The plate voltage at which this occurs is less than the screen grid potential since the electrons enter the space with sufficient velocity to cause them to travel on to the plate, in spite of the higher screen grid voltage.

Pentodes are used mostly as radio frequency voltage amplifiers. They are also suitable as power amplifiers, having greater power sen-

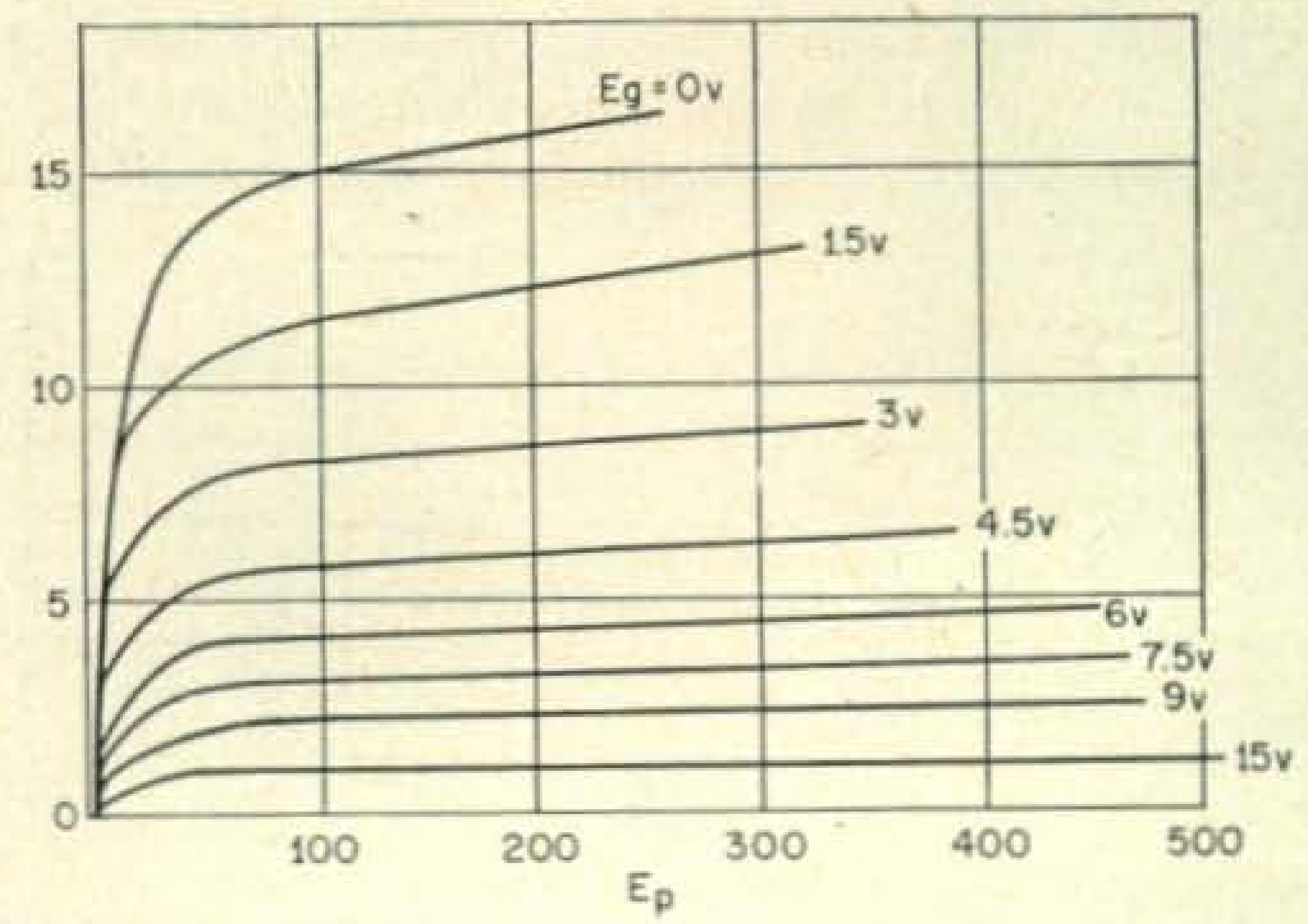

Fig. 2—A family of curves for the popular 6SK7 pentode.

sitivity than triodes. Power sensitivity is the ratio of output power to a.c. grid voltage. For a triode to develop the same power output as a pentode, the amplification factor of the triode has to be quite low and, therefore, a larger input voltage would be required to obtain power output comparable to that of a pentode.

Special Purpose Tubes

In addition to the types of tubes discussed thus far, there are tubes of special design intended to give optimum performance in a particular application or to combine in one envelope the functions normally requiring two or more tubes. Tubes of this type are called *special purpose* tubes. The most commonly used special purpose tubes are beam power tubes, remote cutoff tubes, multipurpose tubes, u.h.f. types and gas-filled tubes.

Beam Power Tubes

A beam power tube is a special form of tetrode with characteristics similar to those of a pentode. Although the tube has no suppressor, the same effect is achieved by using an electron beam forming plate and specially aligned grid wires. The characteristic curves for beam power tubes differ from pentodes in that the transition between the region where plate current is practically independent of the plate voltage and to the one where the plate current is controlled by plate voltage is more abrupt than in the pentode and occurs at a lower value of plate voltage.

Remote Cutoff Tube

A remote cutoff tube is a tetrode or pentode voltage amplifier constructed in such a way that electron flow trails off gradually at highly negative control grid voltages rather than quickly at a well defined cutoff point. This is accomplished by winding the control grid as a variable-pitch helix to provide a different amplication factor along its structure. Remote cutoff tubes are used in circuits employing automatic volume control and in circuits which control gain by varying the bias on one or more tubes.

Multipurpose Tubes

A multipurpose tube is one which contains two or more tubes in the same envelope. Frequently you will find two or three diodes, or two or three triodes and any combination of the two, in a single envelope. The recently announced *Compactron* is an example of a multipurpose tube.

UHF Tubes

U.h.f. (ultra high frequently) tubes are especially constructed for operation at higher frequencies where it is necessary to reduce interelectrode capacitances and to cut down transit time (the time electrons require to travel from the cathode to the plate). This is done by making the electrodes quite small and spacing them very close together. Because of these construction features, the power handling ability of this type tube is somewhat less than that of tubes used at lower frequencies. U.h.f. tubes frequently have no base. Connections to the electrodes are made through pins which protrude through the envelope in a way which keeps the leads short and minimizes the capacitance between them. Three special types of u.h.f. tubes, the acorn, door-knob and lighthouse tubes are so named because of their shapes and sizes.

Gas-Filled Tubes

Although the presence of gas in a high vacuum tube is usually objectionable, there are special purpose tubes which are gas filled. Common gasses for this purpose are neon, nitrogen, argon and mercury vapor. The gas filled tube is characterized by the fact that the voltage applied to the electrodes have little effect on the current flow once they reach a certain minimum value. This is due to the fact that the gas becomes ionized- that is, the molecules of gas lose electrons through collision with other electrons in the interelectrode space and become positively charged with ions which drift toward the cathode and attract more electrons out of the cathode, thus increasing

[*Continued on page 107*]

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Noteworthy Novice

Our Noteworthy Novice this month, Barbara Hamilton, WV6PWV, 5305 Verner Avenue, Sacramento 21, California received her Novice license on March 4, 1960. Barbara operates on 80 and 40 meters with a 75 watt homebrew rig, a converted BC-348 and a Knight receiver connected to an antenna farm consisting of a folded dipole and vertical. Since the beginning of her operating career she has logged more than 320 QSO's but only one DX station, a VR3. Barbara signs off by inviting skeds at any time on any frequently as she will be taking her general exam shortly. 73 and good luck to all, de WV6PWV. ■

RTTY

BYRON H. KRETZMAN, KØWMR
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RTTY Operating Frequencies

Nets centered on frequencies given; operation usually ± 10 kc.

80 meters	3620 kc
40 meters	7140 kc
20 meters	14,090 kc
15 meters	21,090 kc
6 meters	52.6 mc

One of the most lively topics of conversation whenever RTTYers get together is the subject of filters. Channel filters, of course, are *the* all-important components of an audio-type radioteletype converter. Now if you have been faithfully following the RTTY column, you read back in the February 1961 issue of *CQ* that you only need 20% of each of the 5 selecting pulses that make up a Teletype character in order to print it correctly. This leaves quite a bit of lee-way in converter or TU design. It is possible to build a real simple TU on this basis, as you can see by referring to the Twin City TU described in the March and April (1961) columns.

Simple TU's, naturally, are fine for the newcomer, but if you are the conscientious RTTYer that most of us become, you are constantly striving to better your converter in order to make copy from the weakest of weak signals under the QRM. Here is where you start digging into the theory of interference characteristics of f. s. k. systems. Don Wiggins W4EHU has discussed this theory very thoroughly in the November 1960 issue of *RTTY*, the monthly bulletin of the RTTY Society of Southern California, Inc. ($2.75 per year via W6AEE). It soon becomes obvious that we need something more than simple single-circuit filters for this *better* TU that we desire. We can show you how more effective filters may be built, but first we would like to emphasize the main point made by W4EHU: Interference rejection is *not* sufficiently improved by putting better filters *after* a limiter. In other words, the proper place for better designed channel filters is *before* limiting is performed.

An RTTY converter with the simple single-tuned circuits and direct or d.c. coupling also requires more careful tuning of the receiver in order to keep telegraph bias (unequal *mark* and *space*) at a minimum. This is graphically illustrated in (A) of fig. 1. Note that the output falls off as soon as the signal moves away from the resonant frequency, f_0. Telegraph bias results when this occurs unless the signal is equally removed from resonance of both *mark* and *space* filters by "straddle" tuning a signal that is slightly short on shift. Any drift, of either transmitter or receiver, can therefore result in a biased signal to the selector magnets of the connected machine.

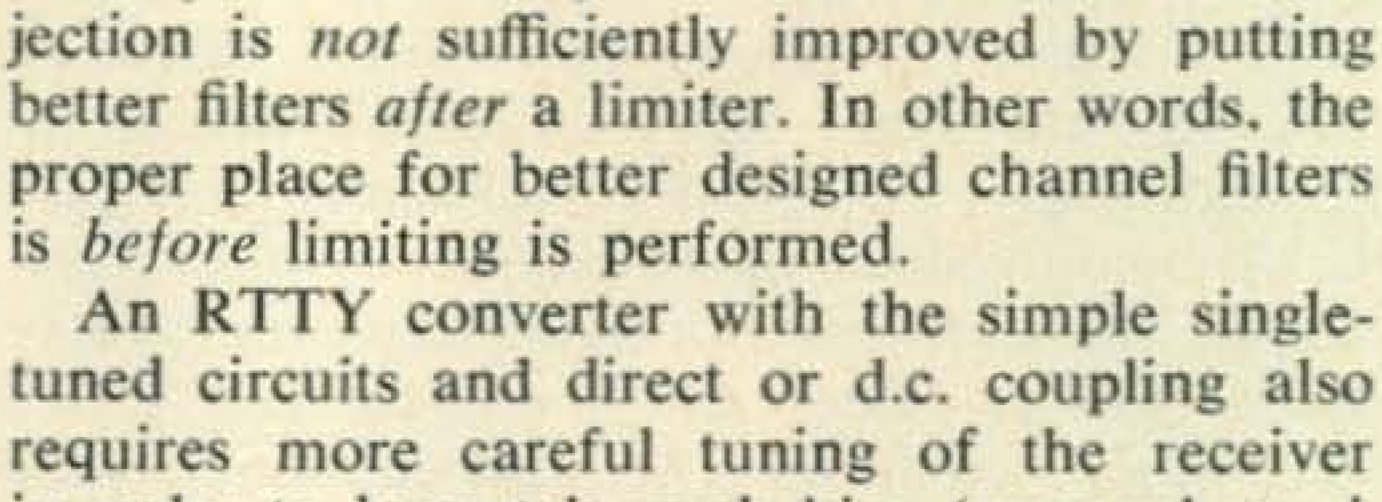


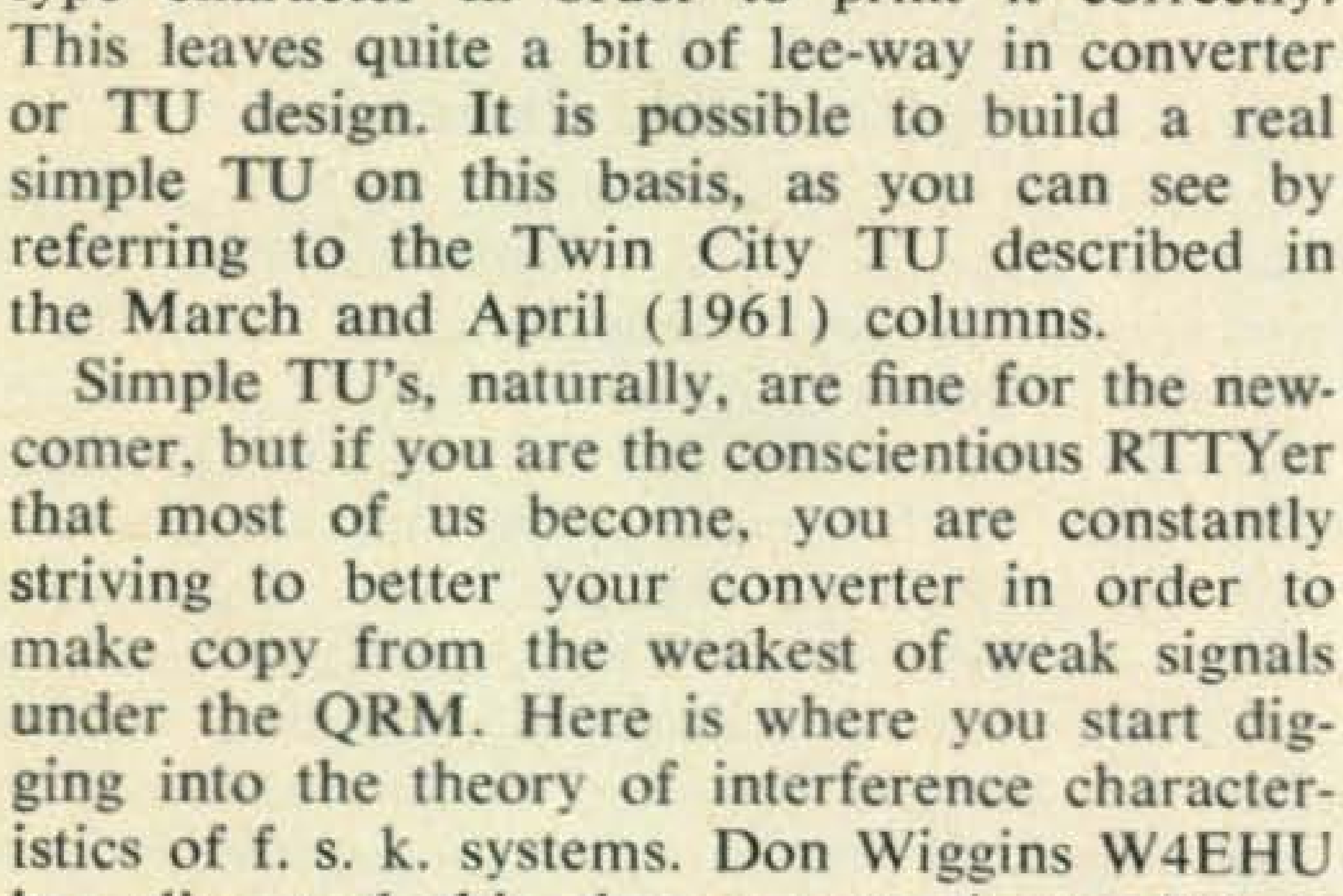
Fig. 1—Typical Channel Filter Response Curves

Band-pass Channel Filters

An improvement is apparent if we design our channel filters so that they have a response something like that shown in (B) of fig. 1 Note that the signal can be off-tune; that is, off the design center of the filter, 100 cycles one way or the other without losing response. Channel filters with this kind of performance were first described in amateur RTTY circles by Bob Weitbrecht W6NRM (then W9TCJ) in a paper back in September of 1956 and later published in *RTTY* in January 1957. Although a 200 cycle band-width is illustrated in the example, this type of filter can be designed just as well for 150 or 250 cycle bandwidth; similarly practical values. Naturally, the use of the narrower value of band-width requires more stability of both transmitter and receiver as well as a more accurate setting of the shift by every station worked. It must be decided, too, whether or not the reduction in adjacent frequency interference would be worth the use of the narrower filters. It should be noted, also, that tuning becomes more critical as the filters are narrowed.

Figure 2 shows two possible ways to drive this improved filter. Low impedance coupling is obtained in (A) by use of a link wound on

RTTY The Hard Way...No. 3



"I think it's stuck on 'line feed' . . ."

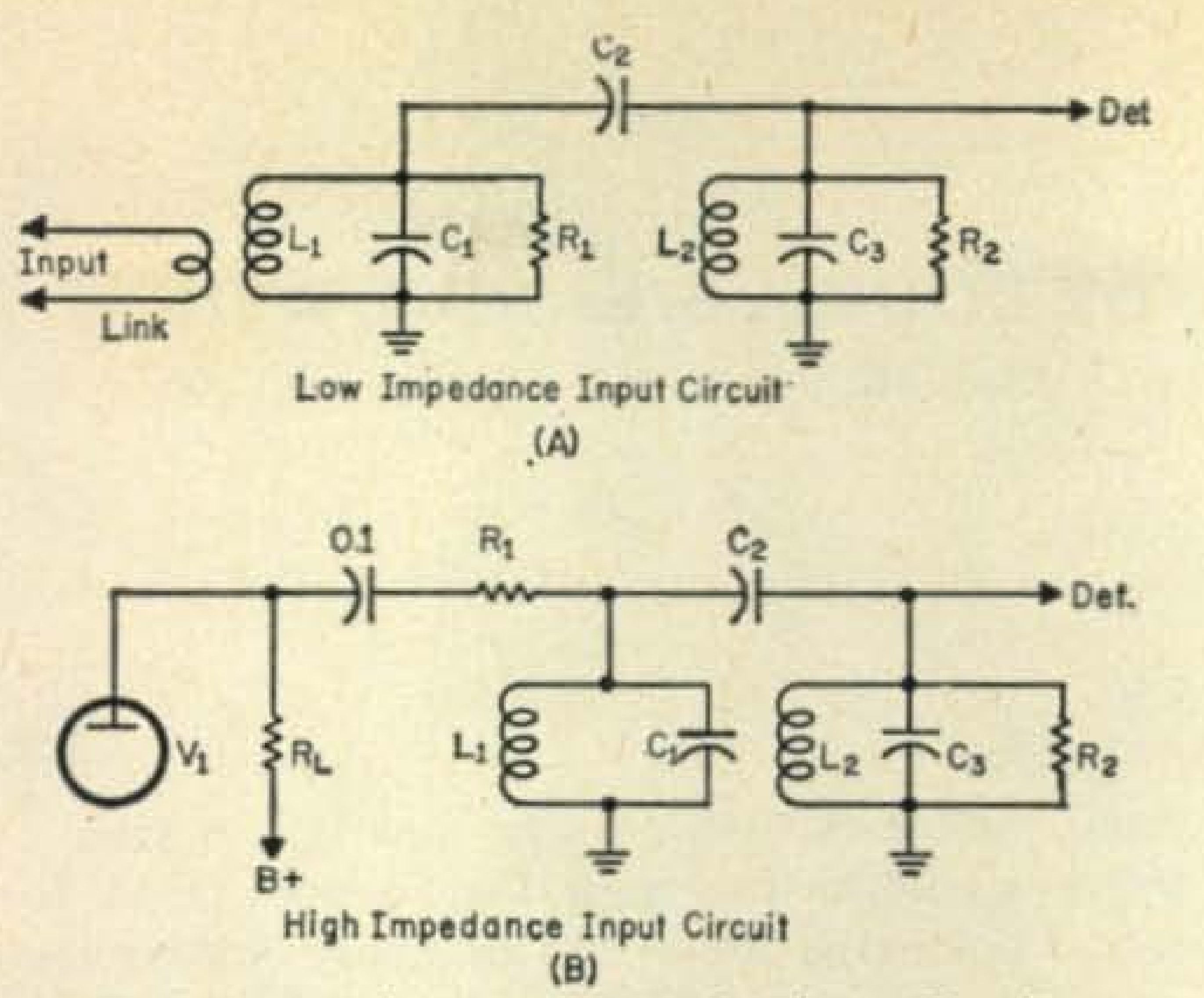


Fig. 2—Band-pass Channel Filter Circuits.

L_1. The links of both *mark* and *space* filters can be connected in series and fed from an output transformer. If a plate-to-30 ohm transformer such as the Thordarson TS-24S60 is used, about 15 turns of thin enamelled wire, number 20 to 30, are wound on the input toroid L_1. The same number of turns can be wound on each filter as a beginning, and turns are removed from the one in the channel having the higher output until the R.M.S. output voltages are equalized.

High impedance coupling is obtained in (B) from the plate of a driving/isolation amplifier V_1 through the 0.1 mf blocking capacitor. Equalization of output from the *mark* and *space* filters is obtained by gain controls, or a balance control, in the grid circuits of the driving amplifiers. R_1 is not an isolation resistor but is used, in conjunction with the plate load resistor R_L and the plate resistance of the tube to properly load the input to the filter.

Tune-up

Once the band-width has been decided upon, the tune-up procedure is begun by individually tuning each *L-C* pair to the *upper* frequency of the band-pass. For example, for standard frequency filters (2125 cycles for *mark* and 2975 cycles for *space*), if 200 cycles has been selected as the desired band-width, L_1-C_1 is tuned, without the resistors, to 3075 cycles for the *space* filter or to 2225 cycles for the *mark* filter. L_2-C_3 is then tuned to the same frequency as L_1-C_1. As with the procedure for tuning the simple single-circuit filters, a standard capacitor value is selected that will resonate the coil just below the desired frequency. For the 88 mh telephone loading coils used, this comes out to about 0.06 mf for 2225 cycles and 0.03 mf for 3075 cycles. Turns are then removed from the coil to put the circuit on frequency. When the two tuned-up *L-C* circuits are coupled together by C_2, the effect is to stretch the low frequency edge of the response curve, leaving the high frequency edge where it was. The result is that two peaks are produced, about 200 cycles apart, when the circuits are coupled together.

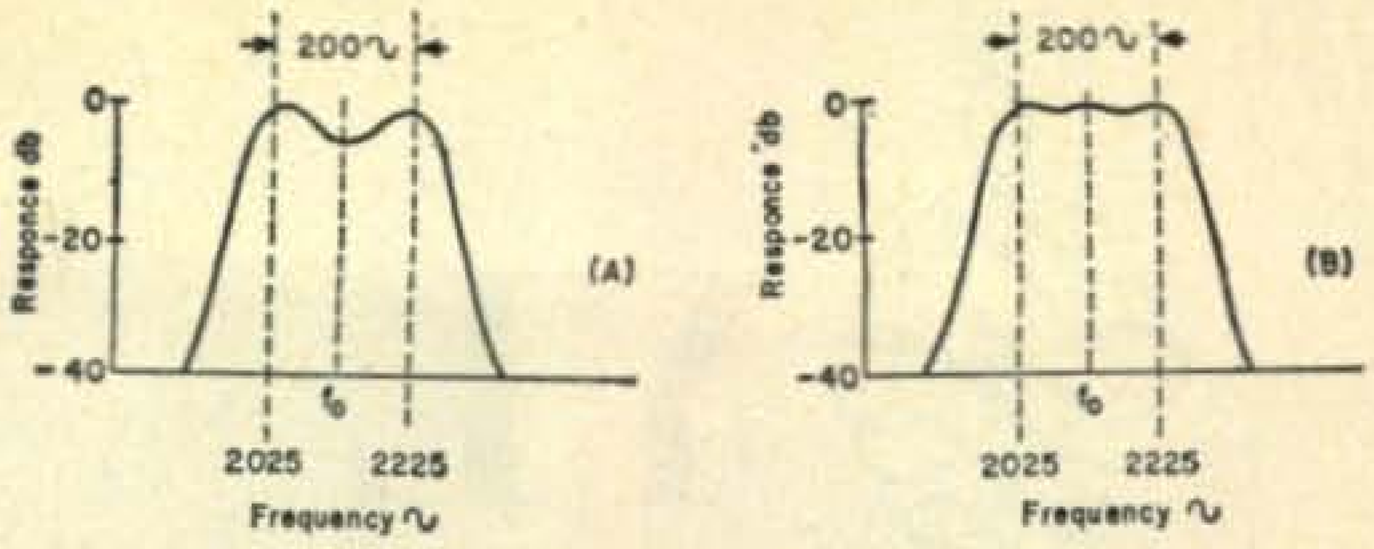


Fig. 3—MARK Band-pass Channel Filter Response Curves

Figure 2 (A) shows how the *mark* filter response curve looks at this point. The value of C_2 required to spread the peaks is found by experiment. A reasonable starting value for the *mark* filter is 0.003 mf, and for the *space* filter about 0.001 mf is a good starting value. The valley between the two peaks is flattened out by adding loading resistance across each *L-C* combination. The response curve then should look like (B) of fig. 3.

For the circuit shown in (B) of fig. 2, it should be noted that the *effective* resistance across C_1-L_1 is made up of the plate resistance of the driving tube V_1 in parallel with the plate load resistor R_L. Since this effective value of resistance, if placed directly across C_1-L_1, would load the circuit too much, resistance R_1 is placed in *series* to bring up the value of the effective resistance to the required value. Representative values for R_2 and the effective resistance across C_1-L_1 are the same roughly as those for the link coupled circuit. To find out where to start with for the series resistance R_1, compute the effective resistance of the parallel combination of the plate resistance of V_1 and R_L. This value, for most tubes used for V_1, will be lower than the representative value recommended, so subtract the computed value from the representative value to get R_1 or the series resistance.

Figue 4 shows the actual relative performance of both *mark* and *space* filters designed for 150 cycle band-width and adjusted in the manner described above. Note that the

[*Continued on page 107*]

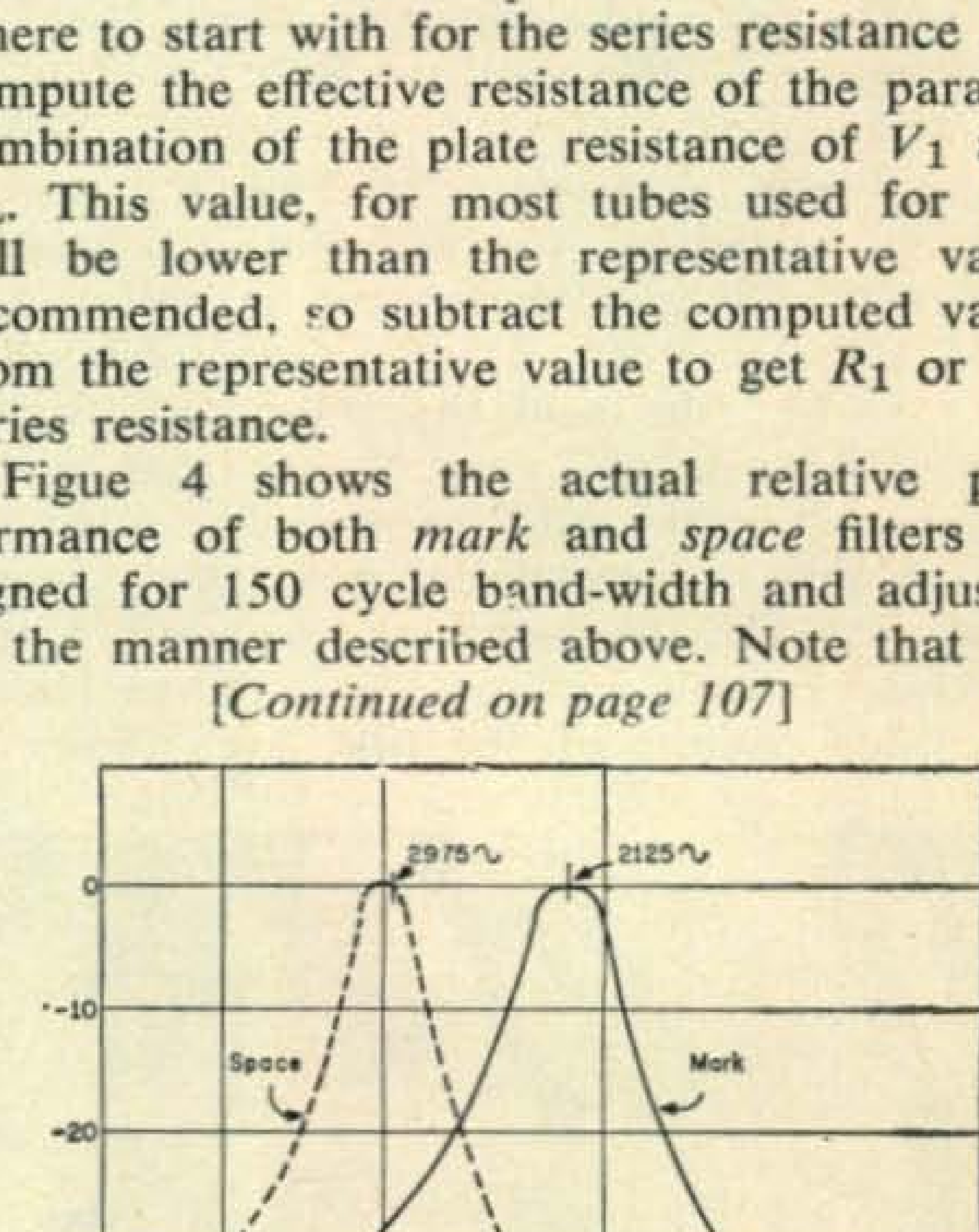


Fig. 4—Actual Performance of Band-pass Channel Filters

YL

BY LOUISA B. SANDO, W5RZJ
4417 Eleventh St. N.W., Albuquerque, N. M.

ASTRONAUTS have been so much in the news recently; did you know that one of them is an honest-to-goodness active YL Ham? She is Rhea Hurrle who operates as K5RDY at Houson, Texas.

Rhea hails from Minnesota (she earned her degree at the Univ. of Minn.) but has been in Houston going on eight years. Five years ago she learned to fly and now has over 1300 hours with single engine, land and sea, multi-engine, commercial, instructor, instrument and instrument instructor, Link instructor and some of the ground instructor ratings. Rhea flew a Piper PA-24 in the Powder Puff Derby in 1960, placing 43 out of 73 contestants (her TAR No. was #73). Her copilot was Alice Seaborn, also of Houston. Rhea did not take part in this year's race because of the astronaut program taking up her time. Rhea also holds down a full time job as secretary and pilot for Aviation Sales & Engineering at Houston and flies all over the country.

You may remember reading the article "Women in Space" by Jacqueline Cochran in *PARADE* (Sunday newspaper magazine section) for April 30, '61. Datelined Albuquerque, N. M., she said that "Women will fly into space just as certainly as men will—only not so soon." And she went on to describe the physical examinations given the women volunteers for the astronaut program at the Lovelace Foundation and Clinic. Rhea Hurrle was listed as one of the first five women to pass the tests, which are just the same as those given to the men astronauts. (OM Joe tested Rhea's hearing in the soundproof acoustics chamber.) On other details of the astronaut program, Rhea says they have been advised not to tell where, what, etc. they are doing, so we'll have to watch the general press for this.

Rhea Hurrle, K5RDY, is one of the first five gals in the U.S. to undertake astronaut training. Rhea works as a flying secretary and is a member of GAYLARKs at Houston.

As to her Hamming, Rhea became interested several years ago when she received a shortwave receiver for Christmas and started listening to the 40 and 80 meter bands. She passed her Novice and Technician's exams and then got her General in June '59. She uses a KWM-1 and enjoys running phone patches on 15 and 20. She's looking forward to operating aeronautical mobile one day and also wants to try RTTY. Rhea is a member of GAYLARKs at Houston.

Having gazed at her picture, you will note that this YL is beautiful as well as being talented and brilliant. We're mighty proud to have her among our ever-growing number of YLs and wish her all success in her adventuresome flying-secretary-Ham-astronaut career!

Ladies Day

YLRL V.P. W1ZEN, Onie, announces "Ladies Day." It is not a contest, no prizes—just one day each month when you can find YLs on the air. Beginning with Sept. the *2nd Monday* of each month will be known as "Ladies Day." If we make this our special day for Ham radio, finding YLs to chat with should be easy and fun. Onie comments that so many OMs have asked "Where do all these gals go after the YL/OM contest?" So let's make Ladies Day a speical day for operating.

New YL Net

At a hamfest at Salina, Kansas in June several YLs decided to start a net for YLs in Kansas and set the time for Tuesdays, 1000 CST on 3940. Acting NCS is KØHEU, Thelma, who invites all Kansas YLs to join them. Thelma says a check of the Callbook showed over 150 YLs in Kansas in 70 or more towns so they are hoping for a good net turnout.

Texas Bluebonnets

More details on the new Texas Bluebonnet Club mentioned here last month. Current officers are: Pres., K5TUP, Luciel; V.P., W5AWG, Thelma; sec-treas., K5RAE, Doris. Members are located in Beaumont, Orange, Port Arthur, Orangefield and Houston and in addition to regular meetings they get together on a v.h.f. net every Wed. on 50.4 mc, NCS of which is rotated every three months. The club offers a certificate displaying the San Jacinto Monument and the Texas State flower, the bluebonnet.

Bessie Jeans, W7DIC, won this Gonset phone patch at the All-California YL Convention held at San Diego in May. BAYLARC will host the 1962 convention in San Francisco and members are already busy with committees and plans.

Here and There

The annual Oregon ARA Convention held May 5-7 at Coos Bay was enjoyed by many YLs, as you'll note in the accompanying photo. On Saturday a luncheon was given for all the ladies by the Bay Area XYL Club, members of which dressed in clever pirate costumes. They presented each lady with a small myrtlewood bowl. Sunday breakfast brought many more prizes and each lady received a rhododendron, which were dug and potted by the XYLs of W7EUG and W7VPF. During a mid-morning YL Coffee Hour on Sun. each YL introduced herself and received a myrtlewood pin with call painted by K7COA, and polished agates set for a chain done by W7IGY and W7IRF. The crab feed Sunday with main prize drawing was the grand finale.

Congrats to W1YPT, Louise Guy, for earning her DXCC all on 10 phone. Congrats to Louise also for "cracking" *Reader's Digest*—get out your July issue and read p. 144, "Laughter is the Best Medicine. . . . Congrats also to KØIKL, Joy, first YL to hit CHC 100 awards.

Howdy Days Contest

Dates: Start Tues., Sept. 26, 1961, 1200 EST Wed., Sept. 27, 1961. End Thurs., Sept. 28, 1961, 1200 EST.

Rules: 1. Score will be based on licensed YL contacts only.

2. All bands and all modes of emission may be used.

3. Only one contact with each station will be counted.

4. Contacts on nets will not be counted.

5. No multipliers.

6. Contest opens 1200 EST Tues. Sept. 26, 1961 and closes 1200 EST Thurs., Sept. 28, 1961.

7. Scoring: 2 points for YLRL member 1 point for non-YLRL member.

8. Logs not required. Submit a list stating date, time, call, name, OTH and whether or not member of YLRL.

9. Awards: Top score, YLRL member: choice of pin, charm or YLRL stationery.

Top score, non-YLRL member: 1 year paid membership in YLRL.

10. Score sheets must be received by Oct. 15, 1961. Submit to YLRL V.P. W1ZEN, Onie Woodward, 14 Emmett St., Marlboro, Mass.

"Howdy Days"

YLRL is again sponsoring "Howdy Days" contest for all YLs. Is was iniatiated two years ago and found to be fun and worth continuing. Onie, W1ZEN, YLRL V.P., says "Howdy Days" are primarily to start the Fall and Winter season by chatting with old friends and finding new ones. She asks all to lend a hand to any new YLs, extend an invitation to join YLRL, acquaint them with

[*Continued on page 108*]

YLs enjoying the Sunday crab feed during the Oregon ARA Convention May 5-7, '61 at Coos Bay, l. to r.: K7DLS, KN7NJX, K7LFO, W7RIC, KN7OHT, K7AJB, W7IGY, W7IRF, W7DIF, W7GNC, K7BII, K7BED, W7SBS, W7DIC, KN7OEM, W7NTT, K7HKX, W7GLK, W7HHH, K7COA. Attending but not in the photo: W7SBX, W7DVH, W7ECC, W7EUU, W7ITZ, W7RAX, K3IEY.

Announcing [*from page* 22]

graph (2) are amended to read as follows:

§ 12.90 Requirements for portable and mobile operation.

* * * * *

(*b*) When outside the continental limits of the United States, its territories, or possessions, an amateur radio station may be operated as portable or mobile only under the following conditions:

* * * * *

(2) When outside the jurisdiction of a foreign governmment: Operation may be conducted within Region 2 on any amateur frequency band between 7.0 mc and 148 mc, inclusive; and when not within Region 2, operation may be conducted only on the amateur frequency bands 14.00-14.35 mc, 21.00-21.45 mc, and 28.0-29.7 mc.

NOTE: Region 2 is defined as follows: On the east, a line (*B*) extending from the North Pole along meridian 10° west of Greenwich to its intersection with parallel 72° north; thence by Great Circle Arc to the intersection of meridian 50° west and parallel 40° north; thence by Great Circle Arc to the intersection of meridian 20° west and parallel 10° south; thence along meridian 20° west to the South Pole. On the west, a line (C) extending from the North Pole by Great Circle Arc to the intersection of parallel 65° 30' north with the international boundary in Bering Strait; thence by Great Circle Arc to the intersection of meridian 165° east of Greenwich and parallel 50° north; thence by Great Circle Arc to the intersection of meridian 170° west and parallel 10° north; thence along parallel 10° north to its intersection with meridian 120° west; thence along meridian 120° west to the South Pole.

Space [*from page* 98]

payloads have been used, and no additional birds are available for this very important experiment, in which scientists and radio amateurs throughout the world were planning to participate.

It is hoped that similar experiments will be planned again by NASA in the near future, but there has been no announcement to this effect as yet.

Late Project OSCAR News

A large number of government agencies must give one sort of approval or another before the OSCAR I payload can be launched into space, piggy-back with one of America's planned satellite programs. At the time of writing (early August) slow, but encouraging progress was being made towards securing all necessary approvals and authorizations. If all goes well there is a very good chance that OSCAR will fly during the fall of this year.

As soon as the final green light is given, news of Project OSCAR's launching date will be flashed to radio amateurs throughout the world by ARRL's headquarters station W1AW, and by the Voice Of America through its weekly broadcasts to radio amateurs. Schedules for VOA's "Radio Amateur Notebook" program can be obtained by writing to:

Schedules,
IBS/EF
Broadcasting Service
USIA
Washington 25, D.C.

Ham Clinic [*from page* 28]

RCA 7094 For S.S.B.—"Can you suggest an all-band, bandswitched linear amplifier using the RCA 7094 beam power tube?"

Yes. A fine article on this appears in RCA *Ham Tips* for August 1959 by Claude Doner, W3FAL. I think it is tops! Write RCA Ham Tips, RCA Electron Tube Division, Harrison, N. J. for a copy. To save postage call your local RCA distributor, he may have an old copy in stock somewhere.

Thirty

Thanks to all you HAM CLINIC friends for writing to us. We appreciate your letters and help. By the way, anyone have information on converting an old 12 inch TV set to be used as a scope?

Let us hope the DX holds up a bit, for Europe anyway. 73, 72 and 75, Chuck

75 Meter Mobile [*from page* 95]

every thing is all right you should not draw over one amp. at this time. The oscillator should start at about nine volts. If the oscillator doesn't start immediately, start turning the slug of L_1 clockwise into the core. It should start oscillating if your circuit is correct. The total current will rise about 400 mills when it starts to oscillate. Now tune the buffer output coil, L_2, to resonance as indicated by maximum total current of the 12 volt line. Tune the final tank coil in like manner for maximum total current. At this time the neon indicator should light up. Go through the procedure again as there is a slight interaction. Adjust R_4 for one hundred percent modulation on a scope or by ear. You're now ready to connect an antenna.

Afterthoughts

The modulator could be used to double as a mobile P.A. system, by switching a speaker across the modulator output. It would also be necessary to switch the oscillator off.

The current price of the 2N1046 is $10.00. With the amateur in mind, Texas Instruments has come out with the 2N1907. This transistor is an improved version of the 2N1046 and sells for $9.00. A higher power 2N1908 sells for $13.00. Any of the above transistors will work in this rig. With the 2N1908 you should be able to get more power output. ■

Novice [*from page 101*]

the current flow. There is a certain minimum voltage difference between the plate and cathode which will cause the electrons to move with sufficient velocity to produce ionization. This is called the ionization potential or firing voltage. Once the tube is ionized, the plate voltage can be reduced somewhat without affecting the flow of electrons. There is a minimum value of plate voltage necessary to maintain ionization. This voltage is called the extinguishing or de-ionizing voltage.

Letters

David C. Frick, KN8WCZ, 941 E. Second St., Ottawa, Ohio, crams the kilocycles with a throttled back Viking I and an ancient Hammarlund Super-Pro. His equipment also includes a homebrew job using two 807's on 80 meters with both transmitters feeding a Windom. Dave's WAS stands at 19 states with DX of XE2KH and VE3BZE. David, who is 17 and belongs to the Ottawa ARC, would like to thank Ray, W8RJZ, for getting him started in amateur radio.

Terry Travis, K5WNH, 325 James, Kermit, Texas, goes by the phonetics "Worlds' Nicest Ham" and he might be right. Terry has had his ticket for 2 years, has WAS WAC, CP20, RCC, DXCC 65, with a DX-60, SX-99, Hy-Gain vertical and a dipole. Terry, who is 13, will sked anyone for any reason and particularly enjoys working Novices.

Help Wanted

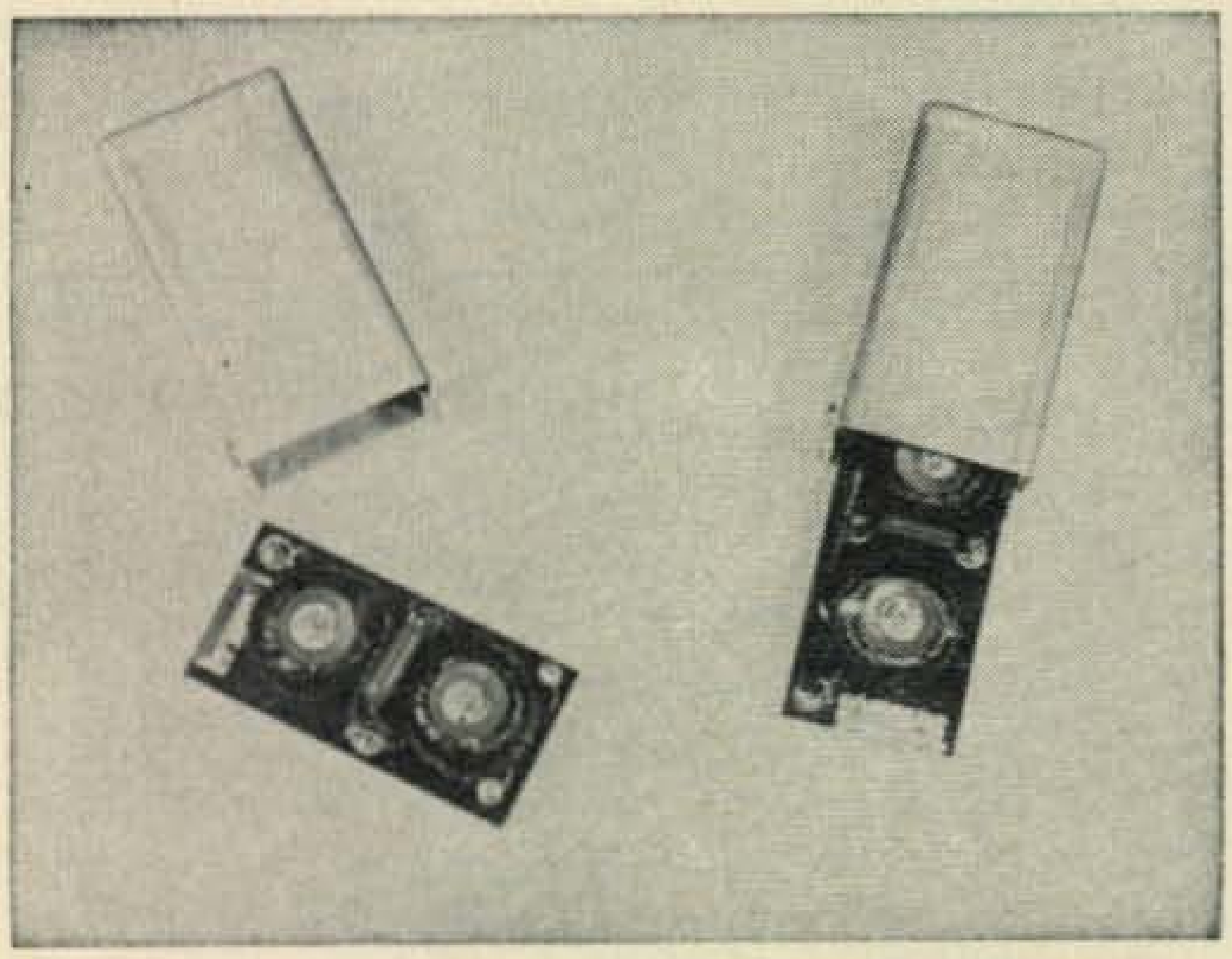
The following people would appreciate assistance with their Novice exams. Can you help them? Gary Dolan, Lincoln Hotel, Lincoln, Nebraska, phone GR 7-2154. Walter M. Paulick, 921 Peconic Street, Ronkonkoma, N. Y.

That's AR for another month. I'll be looking for you in the mail box!

73 de Don, W6TNS

RTTY [*from page 103*]

cross-over point between the two channel filters is 20 db down. It should be realized that this potential rejection of interference on or near the center frequency is not fully utilized in a terminal unit or converter with the usual limiter ahead of the filters, but is realized when post-detection clipping is used instead.



Band-pass Channel Filters

World-Wide RTTY Sweepstakes

The first *international* RTTY Sweepstakes will be held by the RTTY Society of Southern California, Inc. from 0200 GMT October 21st to 0200 GMT October 23rd, 1961. 80 to 10 meters will be used in this competition between stations through out the world to, ". . . determine their ability to exchange messages via two-way radio teleprinter." A detailed list of the Sweepstakes Rules can be found in the latest *RTTY* bulletin or may be obtained from RTTY, Inc., 372 West Warren Way, Arcadia, California.

East Coast RTTY Net

This net meets every Wednesday evening at 2400 GMT (1900 EST or 2000 EDT) on 3620 kc. The purpose is to stimulate RTTY activity on the Eastern Seaboard, make new friends via f. s. k., pass traffic, and to exchange comments. Roll call is followed by a general call for non-regular call-ins. The present net control station is K2SKK of Livingston, New Jersey.

Here and There

W4RRA wants to get KG6NAA on RTTY. W5JT of Dallas, Texas, is building a W2JAV TU to go with his Model 15. W6DIE is selling those WE 394A thyratron rectifier tubes used in the AN/FGC-1 for 95¢ each, postpaid. W6NRM is designing a transistorized version of his Mark III TU, to be called "Mark V." (*Wha' hoppen' to Mark IV??*) W7SMB is operating /6 from Yuba City, California.

W8SWC of Detroit, Michigan, is converting his s.s.b. CE 10-B for f.s.k. W8UUS reports two others also active from Kalamazoo, Michigan: K8DQE and W8SEY. Mel says, ". . . am very active on 40, 20, and 15, and have forgotten all about s.s.b., etc." (*!*) W8UUS would also like to hear from those interested in a Detroit RTTY Meeting.

W9NTV expects to activate DJØBX on 80 and 20. WØBHA of Bird Island, Minnesota, is building the Twin City TU. (March and April *CQ*) KH6ANR of Waianae, Oahu, operates around 14,090 kc.

G2UK reports that the British Amateur Radio Teleprinting Group (BARTG) became affiliated with the R.S.G.B. in April. BARTG now has about 106 members. G3CQE was just issued the first WAC-RTTY certificate, by RTTY, Inc., for Europe.

73, Byron, KØWMR

YL [*from page 105*]

the YL nets and other YLRL activities that go on throughout the year, and be sure to encourage non-YLRL members to send in their logs. Contest dates are Sept. 26-27-28, 1961; complete rules in separate box.

YLRL Anniversary Party

W1ZEN has set the dates for the 22nd YLRL Anniversary Party. Mark them now on your calendar: CW—Oct. 25-26, 1961; Phone —Nov. 8-9, 1961. All licensed YL and XYL operators throughout the world are invited to participate and all bands may be used. Complete rules will be published here in October *CQ*.

33, W5RZJ

High Output Linear [*from page 45*]

The plate dissipation figures for the grounded-grid curves of fig. 3 were obtained by subtracting the feedthrough power in the output circuit from the measured output, and subtracting this from the plate input power. The values for feed-through were arrived at by measuring the r.f. voltage from filament to ground (E_k r.f.) and dividing this by the output tank r.f. voltage (E_{tank}), then multiplying the measured output power by this percentage or:

$$\text{Feed through power} = \text{Output power}\,\frac{E_k \text{ r.f.}}{E_{tank}}$$

This method may not be strictly accurate, but it seemed to agree closely with dissipation estimates made at several levels by the plate color comparison method.

The question of harmonic generation and TVI, as a result of class C operation of the tube has no doubt occurred to the reader. It can be answered only by stating this amplifier seemed to be as free from harmonics and TVI as any other circuit tried here. ■

Look at S.S.B. [*from page 54*]

fast attack, slow-decay a.v.c., and many other topics that are quite appropriately part of the complete and detailed s.s.b. story.

And don't get the erroneous idea that every fellow who can split an infinitive runs a cool 2000 watts, p.e.p. My power input is about a pint and it will be for many years to come—not because I wouldn't like more, but only because it's all I can afford. I mention this in the hope that it will stress that this has been presented for all amateurs and not just a select segment.

Whether DX fiend or local rag-chew devotee, it is earnestly hoped that all a.m. men who have not "gone s.s.b." will give some serious, unprejudiced thought to doing so. Listen around on the bands to s.s.b.; note its effectiveness through QRM and QRN. If at all possible, go to a friend's shack and try out s.s.b. for yourself. Consider carefully the great saving in critical radio-spectrum space.

Last, but certainly not least, keep in mind that when too many hams have no desire to improve the state of the art and to add to their own knowledge through advanced modes and techniques, then amateur radio will, like the proverbial old soldier, slowly QSB away. ■

OSCAR Flyover [*from page 59*]

sending traffic on the proposed flight to the Southern California gang, the bulk of radio tracking reports were taken by W6KGC and sent to the OSCAR group. K6KCB kept a constant monitor on 80 meter c.w., 75 meter phone and 2 meters, and stood by on the NTS to receive any tracking reports on Sunday evening.

A great many amateurs took part in the OSCAR flyover and supplied key support at critical times. Some of the more notable "assists" were W6FON, K6YKG, K6VWV, W6DMN, K6QJZ, K6OZL, K6MYK and others. Also of great service was WA6OKK who acted as second operator at WA6HVN.

Results of the flight were most encouraging. Approximately 50 stations were worked by the aircraft, and these reported reception of the beacon directly to the plane. WA6GMZ reported reception of the beacon when the plane was over Gorman, California, a distance of nearly 280 miles from Black Mountain. In addition, K6BPI in San Diego heard the OSCAR signal when the plane was over Newhall, California, a distance of about 140 miles. It was apparent that the beacon could be heard over distances of this order without the need of exotic receiving equipment. It would seem that when OSCAR I is in orbit, hundreds of miles above the earth, the area of reception on each pass-by will be enormous.

Tracking results were encouraging. Using simple equipment, it was possible to provide correlation within 5 degrees at a distance of 200 miles. The best report checked within 2 degrees at 210 miles.

May we thank the following nets for their help in the OSCAR Flyover both before the test, when communications was being organized and QSTs were sent, as well as during the flight: Mission Trail Net, Sixth Regional Net, Northern California Net, Southern California Net, American Legion-Golden Bear Net, Northern California Traffic Net, Channel Cities Net, San José CD Net, and Santa Clara Operational Area Net.

A few interesting sidelights.

The large number of amateurs who stood by ready to help if required.

The speed with which the operation formed up with so very little advance notice.

The cooperation between the phone nets and c.w. nets on the flyover was little short of phenomenal and made the flyover successful. It could not have been done, because of the shortness of time, without this close cooperation. ■

NOW IN STOCK AT HARVEY

200V THE CENTRAL ELECTRONICS BROAD-BAND EXCITER/TRANSMITTER

ONLY ONE TUNING CONTROL — THE VFO

$795.00

Here at last is built-in frequency stability, so accurately compensated that drift is less than 25 cycles in any ten minute interval after a five minute warm-up. For effective, quick handling, a two-speed tuning knob of completely new design provides for fast, accurate tuning.

FREQUENCY COVERAGE

80 Meters	— 3.5 —	4.5 MC.
40 Meters	— 6.5 —	7.5 MC.
20 Meters	— 13.5 —	14.5 MC.
15 Meters	— 20.5 —	21.5 MC.
10 Meters	— 27.7 —	29.7 MC.

POWER INPUT

200 watts PEP on SSB
175 watts on CW, FSK, PM
100 watts on AM

200 V Design Features That Mean Extra Quality and Superior Operational Capability ■ 2" Monitoring Scope — gives instantaneous visual trapezoid check ■ New Double Heterodyne System — insures extreme stability at all times ■ Perfected RC Audio Filter — has the steep side response and rejection characteristics of a toroid filter ■ Power Output Control — adjusts to any level between 10 watts and full output ■ Silicon Rectifier Power Supply—results in considerably less heat and higher voltage output ■ Choice on Mode of Transmission — LSB, USB, AM, PM, CW, FSK.

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ESTABLISHED 1927
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For further information, check number 21, on page 126

Key Clicks [*from page 29*]

it is necessary for a ground return to be established between the keyer and the transmitter. The "make" characteristic of the keyer is established by the half meg pot between the 6AS7 grid and the key. The break characteristic is established by the 2 meg resistor between the bias supply and the key.

Power Supply

The power supply required with this unit is a very minimal supply. The greatest power drain is taken by the 6C4 when it is holding the T-R relay off. Transformer T_2 is only an isolation transformer to prevent line polarity problems. A single transformer, combining T_{2a} and T_{2b}, could be used, except that any unit capable of handling a 3 ampere filament drain has a high current rating for the 125 volt winding and is rather costly. It may be more economical to use two separate transformers.

For those who have a suitable T-R arrangement but who would like to build the monitor-click filter alone, the 6C4 and components solely associated with the T-R function are enclosed in dotted lines so they may be eliminated if desired. ■

Understanding VOX [*from page 63*]

apartment above, getting free air time! If you keep your receiver audio gain turned down to reasonable levels, and use close-talking microphone technique (which excludes all the horrible background sounds to the benefit of all concerned) you can set the audio gain on the VOX to a point where positive relay action is obtained only when you want it; namely when *you* talk into the microphone, and the anti-VOX complications will not be needed.

There are other uses for the Voxbox too. Because a double-pole, double-throw relay is used, you can turn things off automatically with one set of contacts while the other set is turning something on. You might want to kill the B+ to your receiver while your transmitter is on, or to turn a tape recorder off or on, or a dozen other odd jobs. It is even possible to use it as an automatic audio compression circuit, by using the contacts to switch added resistance into a volume control circuit when a certain level of signal is reached.

How much power can you control by VOX? Unlimited—as long as an auxiliary relay is handling the heavy current.

To use VOX it is only necessary to wire the contacts of the relay in parallel with whatever switch you use now to operate your rig manually. It is that simple. It will open up a whole new, more efficient mode of operation for you, and will help to reduce QRM by keeping your carrier off the air when it isn't needed. ■

Globe Pocketphone [*from page 55*]

order the transmitter crystal for that frequency. To determine the receiving crystal frequency, subtract 0.455 mc from the transmitter frequency.

To align the receiver, with the new crystals installed, you will need a stable signal generator for 10 meters, and an a.c. voltmeter with a 5 or 10 volt range. Connect the signal generator, through a 0.01 mf capacitor, to the base of Q_4. Connect the ground lead to the coil along the edge of the board. The a.c. voltmeter should be connected between the speaker terminals. The output of the signal generator may have to be relatively high for a jump from 11 to 10 meters, since the front-end will be badly mis-aligned. The first step should be to adjust the local oscillator coil T_3 for maximum output. If this coil is too far from the crystal frequency, the oscillator will not work. Peak this adjustment counter-clockwise, then adjust it clockwise approximately ½ turn. Depress the push-to-talk switch several times to make sure that the local oscillator starts each time. If it fails to start, back the adjustment off a little more and recheck. When the signal generator is exactly zerobeat with the transmitter frequency, peak the output by adjusting T_4, T_5, and T_6, the i.f. transformers. Reduce the signal generator output as each coil peaks so as not to overload the i.f. amplifiers. Repeat the steps once again for some of the adjustments are interacting. This completes the alignment of the receiver section, with the exception of the antenna coil, which will be peaked in the transmit position.

To align the transmitter, with the new crystal installed, you will need a field strength meter or a stable receiver with an S-meter. Extend the "PocketPhone" antenna and keep it clear of nearby metal objects. Press the push-to-talk switch and tune the receiver (or f.s.m.) to the crystal frequency as indicated by maximum output on the meter. Peak the oscillator coil adjustment, T_1, by rotating counter-clockwise, then rotate clockwise about ½ turn. Operate the switch several times to make sure the circuit is starting properly. If the oscillator should fail to start, back the slug further from the peak. Next, peak the adjustment L_1 and T_2. You may find that these coils have no slugs in them. If this is the case, insert tiny *brass* or silvered cores in the coils. Once the position of maximum output is found, the slugs can be held in place with a few drops of wax. Don't worry about running the batteries down during these modifications, for the Globe "PocketPhone" has rechargeable nickel-cadmium cells for power.

The author's unit, shown in the accompanying photographs, was converted to operate on 29.155 mc. The range between two similar units is in excess of 1 mile. The distance spanned between the converted transceiver and a fixed station was better than 5 miles over gently rolling terrain. Range between the "PocketPhone" and mobile stations is subject to too many variables and the coverage was not evaluated accurately. It is several miles, however. ■

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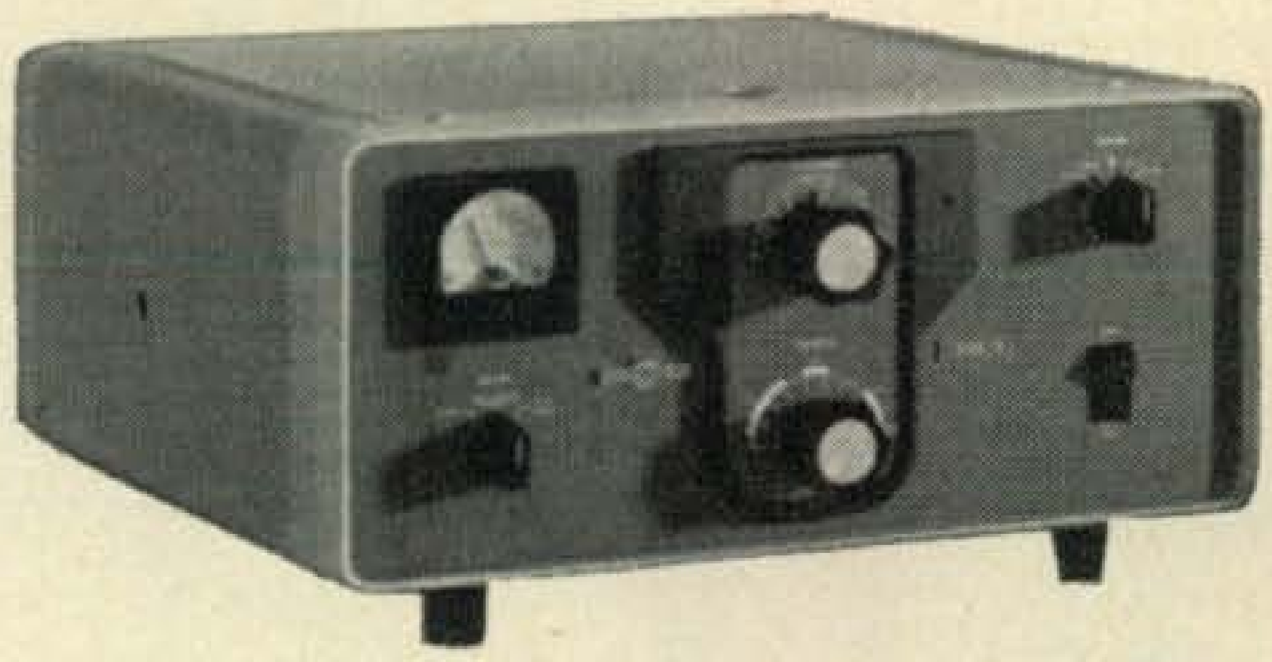

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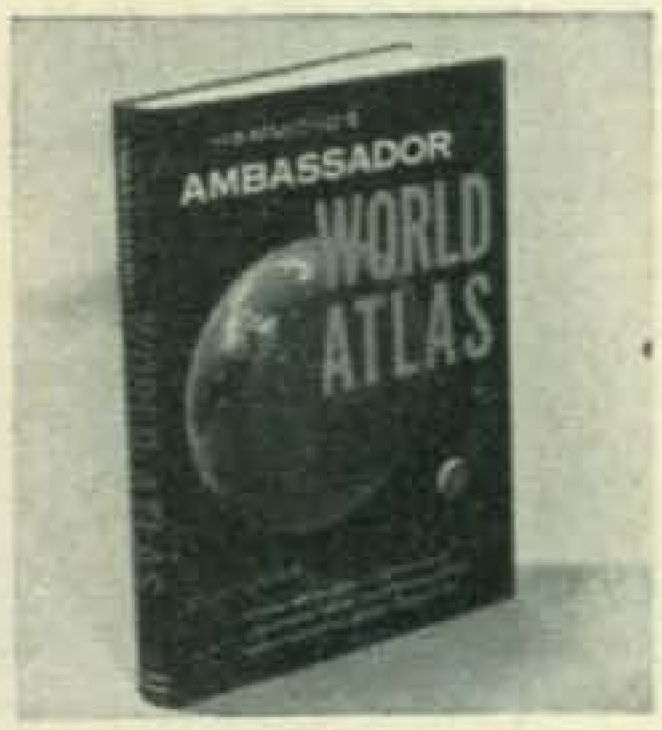

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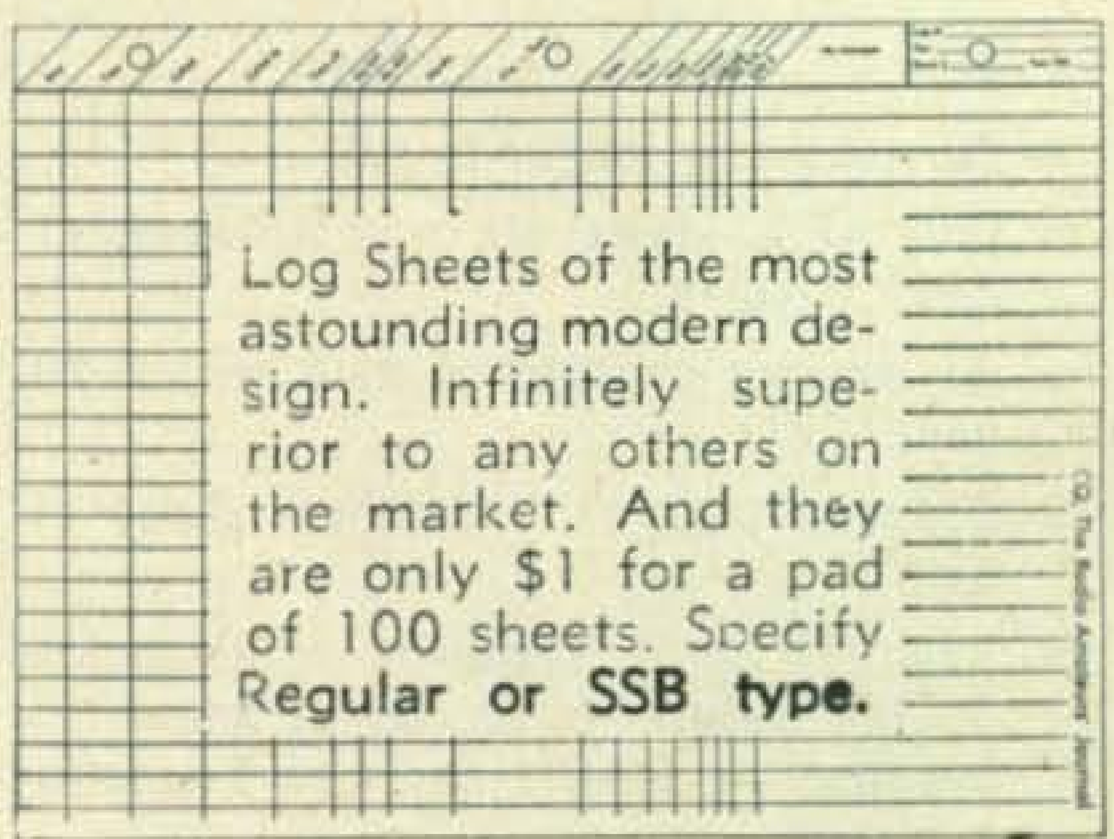

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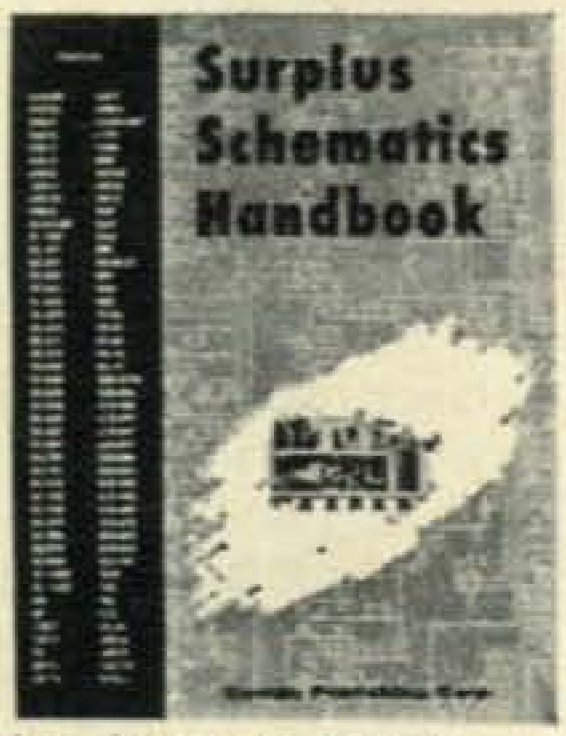

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Sideband [*from page* 81]

best to get the beam up from the beach first thing in the morning. We managed to get the beam up nice and early and had another go, but again nothing doing. VK-land was never heard during the whole stay. The site is located on the northern side of the Island and about a half mile behind is a cliff going up some 800 feet. It then goes up to a height of just 7000 feet. The site is about two miles long by ½ mile, so no matter which way the beam was pointing towards VK- or W-land on long path, the r.f. had to go through the mountain and of course, it couldn't. It took a couple of days to realize this from the results of calling. During all this time, it was evident that only the 21 mc band was going to do anything. I felt very sorry for all the boys that weren't on 21. . . .

"Only two evenings were good from an operating point of view but again conditions were very peculair. The band [21] would open up for twenty minutes and then go out for five; up again and out and so on. That accounts for the time lag every now and then. For the W-boys, I will say they were very good. Several times the going got heavy and I had to call them by call areas as suggested by Olliver. This worked fine and the boys stood and waited and I really enjoyed working them. A pity one can't stop to have a chat but there is always another time.

"Just as I was expecting to have big things happen on the fifth day, (the band had been staying open longer and better) they did! I was told, 'Pack your gear; the ship is halfway here!. . . .

"The exact purpose of the trip was to inspect the installation from the diesel and radio side. I work for the Gov't., at the L.B. Airport on Aeradio Staff and the Islands, Marion, Tristan, and Gough, are from the radio side only the interest of our Dep't. . . . My job down there was to inspect the installation and carry out any repairs if necessary. Fortunately, the whole outfit is in reasonable condition and that made it easier from the hamming point. Those old diesels are doing, and have done for twenty years now, a fine job.

"A few words on the Tristan Islanders. There are 273 of them, just about 50-50 of each sex. The oldest is 83. There are seven family names: Repetto, Javerello, Swain, Green, Glass, Rodgers, Hagan. They have been on the Island some 300 years now. Apparently the settlement was started by sealers from Boston who were shipwrecked there and the women were brought from St. Helena some years after. The main diet is fish and potatoes, although a fair amount of canned goods is consumed. Each Islander has a number of sheep, goats, and cows and the usual mode of transport is by donkey and cart. These carts still have stone wheels! There are no roads, and, of course, no motor transport. The Islanders are expert boatmen and to watch them launching their longboats in heavy surf is something to see. These longboats are wood ribbed with canvas hull and beautiful seaworthy little craft.

"Please make special mention of Olliver, ZS5JY, through whose generosity we borrowed the rig, and of the Southeastern DX Club for their help in getting the cards done and sent out."

Here again we have a fine illustration of dedicated hams extending themselves to give a "new one" to the fraternity. We should all be grateful to hams such as Barry, ZS5SG, and the many others who have provided thousands of sidebanders with the fun and frustration of chasing DX on sideband.

73, Irv and Dorothy

Know Where Ur Heading [*from page 41*]

those Great Circle maps centered on the locality nearest your QTH. The Call Books usually have several of them included. Using a compass, inscribe a circle around the map just large enough to include all the land areas. Cut around this line after you have pasted it on a thin piece of cardboard. Color the land areas if you so desire. Using the 'template' again, mark and drill out the two mounting holes in the cardboard; remember to also cut a ⅝" hole in its center. Now, pass the two flat head #6 screws through the map, then the pelorus, the spacers, and into the control box plate. A simple dust cover can be fashioned, or a plastic refrigerator dish cover can be placed over the works behind the dial.

Now, let's see, JA is at 330°; clack—clack—clack— . . . ■

Tattoo II [*from page 51*]

possibility of switching the relay with r.f. power applied. The author's unit employs a relay in the power supply that is energized at the same time as the antenna relay and applies the oscillator voltage at the same time. In effect this means that the first character employs oscillator keying and the possibility of an inordinate amount of chirp on initial keying should not be overlooked.

As in the 1956 unit, it is suggested that the relay frames be mounted on rubber grommets to minimize the noise.

A bracket was formed of scrap aluminum and drilled for the transistor, and since the circuit requires a grounded collector and the collector is connected to the case of this class of power transistor the bracket was directly grounded to the frame. ■

Biasing Amplifiers [*from page 49*]

AB1, are shown. A variable, regulated, reference voltage is supplied by the resistors and the 5651 regulator tube from the 330 volt screen supply. A fine adjustment of the transistor base voltage over the range of 25 to 40 volts is provided by the use of a 15K potentiometer placed between the other elements of the voltage divider circuit. The transistor passes the cathode current of the tubes while holding the cathodes at a constant voltage (33 volts).

The 5651 tube could be replaced with a Zener diode of any voltage rating from 40 volts on up and accomplish the same effect.

The type of circuit described may be applied to Class C amplifiers for any usage, as well as to Class A and B amplifiers for all modes of operation. ■

Spectrum Analysis [*from page 37*]

Many hams who use an oscilloscope to monitor the modulation of their sideband transmitters have observed the familar Christmas tree pattern as illustrated in fig. 25. To avoid any confusion of this pattern and those obtained by a spectrum analyzer, I would like to point out at this time that the Christmas tree pattern is a representa-

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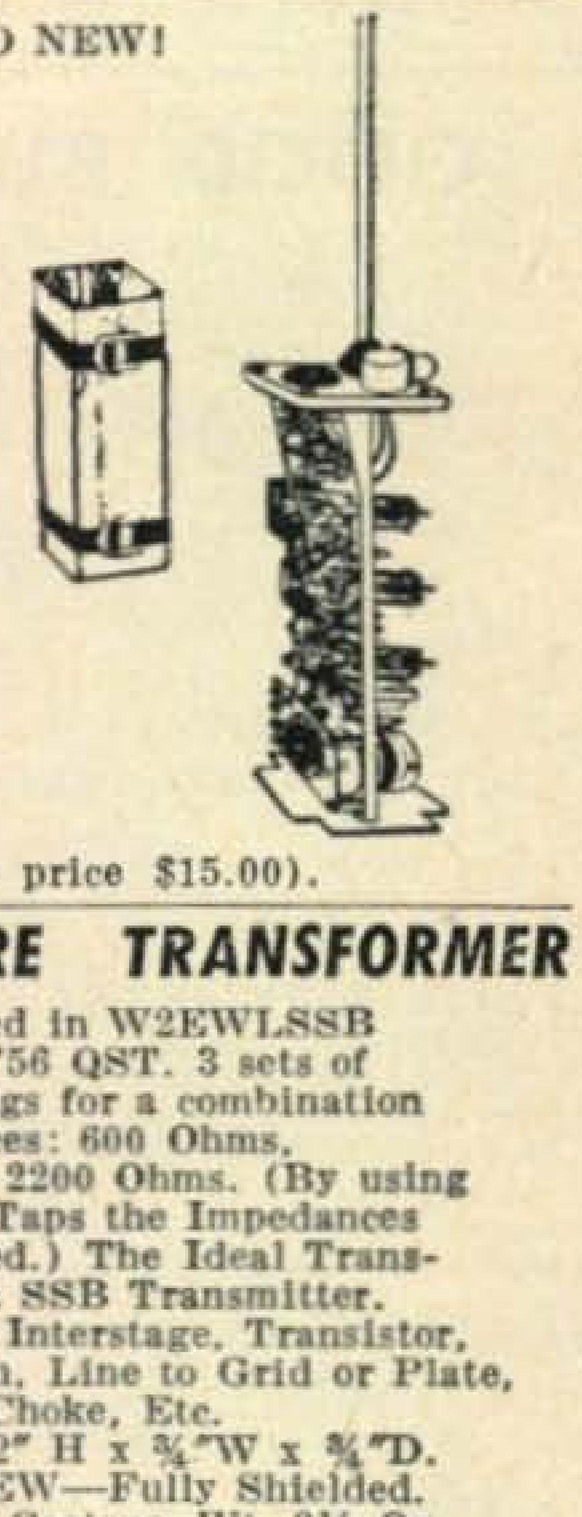

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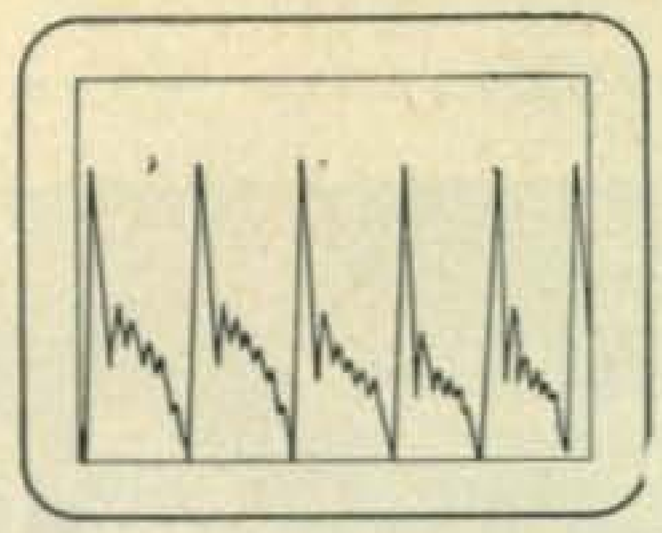


Fig. 25—By reducing the scanning width to zero and setting the resolution switch to the broad position it is possible to check amplitude versus time as with a conventional scope and thus obtain the pattern shown.

tion of amplitude versus time, while the pattern generally obtained on the spectrum analyzer is one of amplitude versus frequency. It is possible to obtain a Christmas tree pattern on the analyzer and in fact to use the analyzer as an ordinary r.f. oscilloscope merely by reducing the scanning width to zero and setting the resolution switch to broad position. Under these conditions the signal on the screen represents the instantaneous sum of the amplitudes of all the detected frequency components within the pass band of the analyzer's i.f. Scanning is accomplished along the time axis in exactly the same way as it is with a conventional oscilloscope.

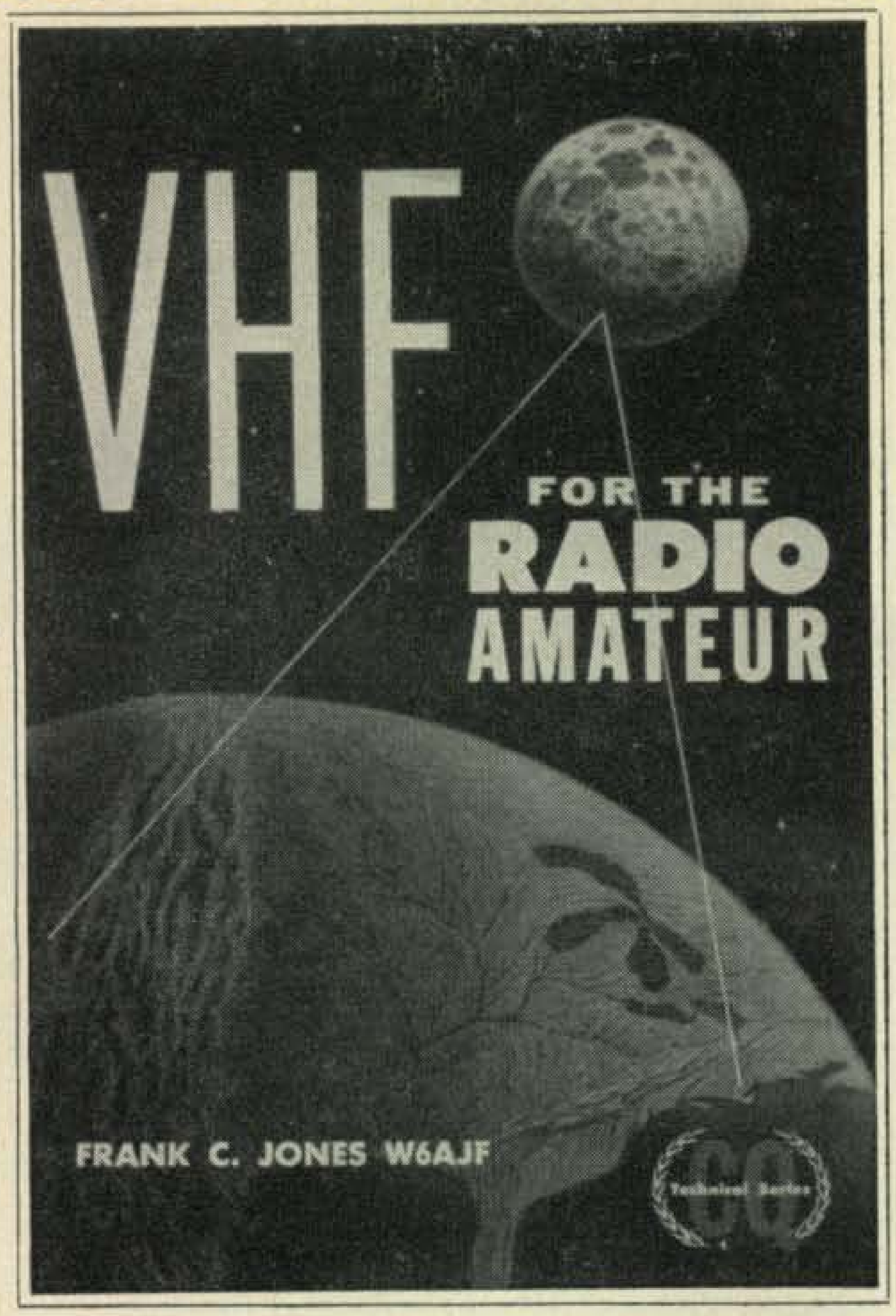
Reports

Now a few last words about the use of the spectrum analyzer. The analyzer like many good things can be of great assistance to brother and sister hams. On the other hand when used improperly it may do more harm than good. Many times I wish I could have called upon the wisdom of King Solomon in giving reports. To assume that all displays must necessarily conform to those of the highest priced transmitters is, I think, a good thing to hope for, but unfortunately not so. Many transmitters that are sold at moderate prices may not have as good suppression, but are designed with these limitations in mind so as to enable many hams to operate single sideband who ordinarily could not afford to do so. Unless their suppression is particularly poor for the type of equipment they are using, I would simply give them a report indicating that their suppression is quite satisfactory. As a rule it seems best not to offer reports but to give them only when asked.

In order to give a report a number of conditions must be met. One is that the peak signal must be at least 40 db above the noise. No adjacent channel interference can be present. Unless these conditions are met, the report will not be accurate.

Everything must have an ending and so does this article. If you wonder where you can get a high resolution spectrum analyzer, all you need is lots of money and I do mean lots. Before you despair however, there will be an article describing the construction of an analyzer in part 3 of the series. ■

To Be Continued



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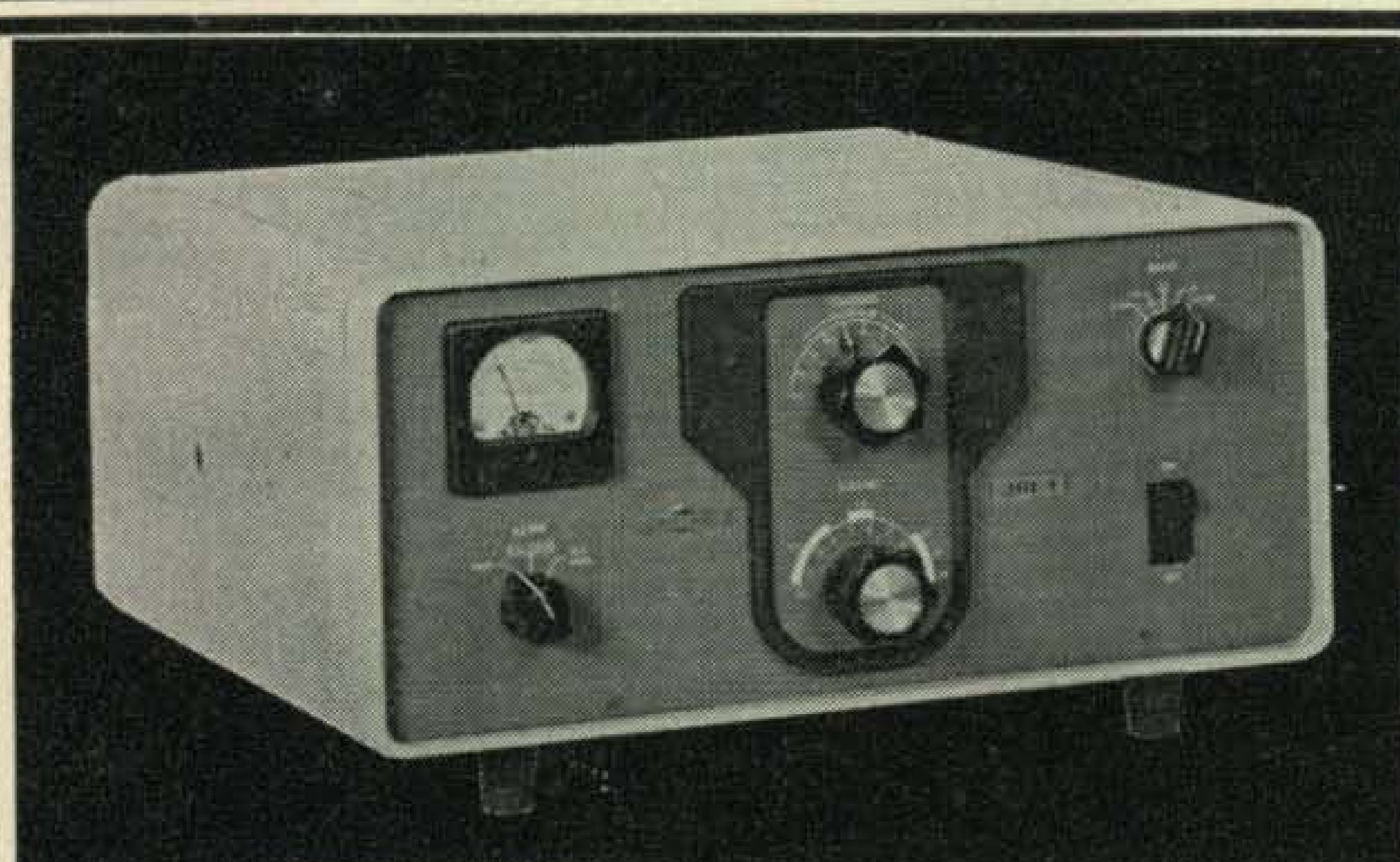

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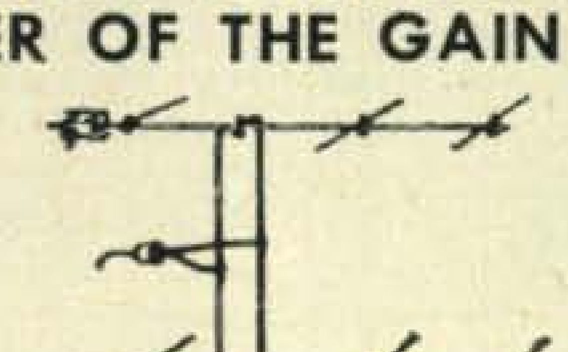
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MATCHED LINES MEAN BETTER POWER TRANSFER. USE OUR BALUNS ON YOUR 300 OHM MOBILE ANTENNAE. YOUR PRESENT ANTENNA BECOMES *ALIVE*. COMMERCIAL USERS: WE HAVE COMPLETE LINE UHF-VHF ANTENNA GEAR.

SEE YOUR DISTRIBUTOR OR WRITE DIRECT ● WILLIAM H. ROBERTS 7921 Woodlawn Ave. Chicago 19, Ill.

For further information, check number 30, on page 126

Ham Shop

Rates for the HAM SHOP are 5¢ per word for advertising which, in our opinion is obviously of a non-commercial nature. A charge of 25¢ per word is made to all commercial advertisers or business organizations.

Your copy should be preferably typewritten, double spaced on one side of the page only.

We do not bill for advertising in the HAM SHOP. Full remittance *must* accompany all orders.

Closing date is the 20th of the 2nd month preceding date of publication.

We reserve the right to reject advertising which we feel is not of an amateur radio nature.

Because the advertisers and equipment contained in the HAM SHOP have not been investigated, the publishers of *CQ* cannot vouch for the merchandise listed therein.

ATTENTION Mobileers! Leece-Neville 6 volt 100 amp system $50; 12 volt 50 amp system $50; 12 volt 60 amp system $60; 12 volt 100 amp system $100. Guaranteed no ex-police car units. Herbert A. Zimmermann, Jr. K2PAT, 1907 Coney Island Ave., Brooklyn 30, N. Y. Tel. DEwey 6-7388.

For Sale: TV Cameras, Teletype, Panadapters, Transmitting Tubes, Transistors, SSB gear. Write for list. Spera Electronics, 37-10 33 Street, L.I.C., N. Y. STilwell 6-2199.

ONE THIN DIME brings 50 page eye-popping war surplus electronics catalog. Fabulous bargains. Meshna, Lynn, Mass.

TOROIDS: Uncased 88 mhy like new. Dollar each. Five $4.00 P. P. DePaul, 309 South Ashton, Millbrae, Calif.

BEGINNERS: Code bothering you? Now learned in one hour. New Method. Quick approach towards your ham ticket. Used in Armed Services, Ham Radio, Scouting. Ketchum's One Hour Code Course $1.00 postpaid. MONEY BACK GUARANTEED—O. Ketchum, 10125 Flaro Vista, Bellflower, California.

WANTED: Teletype printers, perforators, reperforators transmitter-distributors test equipment: Model #14, #15, #19, #26, #28, etc. All types Collins receivers, 51J, R-388, R-390, 75A, etc. Cash, or trade for NEW amateur equipment. Write Tom, W1AFN, Alltronics-Howard Co., Box 19, Boston 1, Mass. (RIchmond 2-0048).

WANTED: Military and Commercial laboratory test and measuring equipment. Electronicraft. Box 399, Mount Kisco, N. Y.

"The VHF Amateur"—At last a magazine for VHF'ers! Don't miss a single issue! Send $2.00 for year or $1.00 for six big issues . . . 67 Russell, Rahway, N. J.

GARAGE DOOR OPERATORS $59.95. Rugged chain drive automatic units. Highest quality. Free literature. DEMSCO, INC., Sebring 22, Ohio.

Communications, Teletype, unusual surplus bargains. Free flyer, MDC, 923 W. Schiller, Phila. 40.

CALL LETTERS may be applied to any surface. 2" sets 60¢, 3" set 80¢. Send to C. Lee, P.O. Box 395, Times Square Station, New York 36, N. Y.

Wanted: R-388/URR receivers, any condition. Electronicraft, Box 399 Mt. Kisco New York.

Collins KW-1 like new many extras terms to responsible purchaser. Lloyd Norberg W7EHQ 2502 Jefferson Avenue, Tacoma, Washington.

SB-10 Owners: Modify your SB-10 for improved audio, better sideband suppression and greater talk power. Add high and low pass filter and peak limiter to audio system. Complete parts kit and instructions $19.95. W4KUV-W4NZS, Best Radio Service, 610 N. Madison Avenue, Goldsboro, N.C.

WANTED: TELETYPE TG-7, Models 14, 15, 19, 26, 28, printers & reperforators: Rcvrs & xmtrs: AN/GRC-3 & higher. RT-66, -67; -68; Collins 51J, 17L3, -4, 18S-2, R-388, -390, -391; ARN-14 and -30; APR-9, -10, ARC-21, -27, -34; APS-10, -31, -33, -42, etc., and TEST EQP'T, TS or AN/URM. We pay freight. Amoer Industrial Corp., 75 Varick St., New York 13, N. Y.

Have DX-100 as new not modified $160, GPR-90 & spkr $390, Model A slicer any reasonable offer, BC 248 110 v.a.c. and Q multiplier, $70, 4-125 A, $20, 813, $7, 8020, $2 860, $2. Will ship all or any part first check has preference. W8QJR Box 546 McComb, Ohio.

Syracuse VHF Club 7th Annual Roundup October 7, 1961 Three Rivers Inn Speakers, Awards, Floorshow, Steak dinner, many prizes. Write K2TXX 233 Ester St., Minoa, N.Y.

SP-600 JX26 Hammarlund receiver .54-54 mc, $295.00. SP-600 JX17 $395.00. Collins 51J-2, 51J-3, R-390A etc. Teletype, Kleinschmidt printers. RTTY converters. Alltronics-Howard Co., Box 19, Boston 1, Massachusetts (RIchmond 2-0048).

Peoria Hamfest, Sept. 17, Peoria Area Amateur Radio Club. Tickets $1.00 until Sept. 9. Write Steve Perry, K9AXG, 505 E. Jefferson St., Washington, Illinois.

6 Meter Tecraft Transmitter 12VDC Transistorized power supply, receiver, halo antenna, all $110.00. 12VDC transistor mobile power suppy, 450-225VDC at 150MA—$30.00. New tubes: two 7094—$12.00 ea. Two 6146—$2.50 ea. PL177—$5.00. Others. Cleaning House. WA2FKZ P.O. Box 571, Hewitt, N. Y.

QSL's-SWL's samples 10¢. Malgo Press, 1937 Glendale Avenue, Toledo 14, Ohio.

QSL's. SWL's XYL-OM's (Sample assortment approximately 9¾¢). Covering designing, planning, printing, arranging, mailing, eye-catching, comic, sedate, fantabulous, DX-attracting, protoypal, snazzy, unparagoned cards. (Wow!) Rogers, KØAAB, 961 Arcade St., St. Paul 6, Minnesota.

QSL's—"Brownie" W3CJ1, 3110 Lehigh, Allentown, Pa. Samples, 10¢, with catalogue, 25¢.

QSL's-SWL's: 100 2-color glossy $3.00: 100 QSO file cards $1.00; Sample 10¢. Rusprint, Box 7507, Kansas City 16, Missouri.

QSL's four colors glossy stock forty design send $5 for 200 and get surprise of your life. 48 hour service satisfaction guaranteed. Constantine Press, Bladensburg, Md.

GLOSSY 3-color QLS cards 100—$4.50. Free sampler. Rutgers Vari-Typing Service, 7 Fairfield Road, Somerset, N.J.

QSL's SWL's. That are different, colored, embossed card stock and "Kromekote." Samples 10¢. Home Print, 2416 Elmo, Hamilton, Ohio.

QSL's Samples 15¢. Rubber stamps: Name, Call, Address $1.35. Harry Sims, 3227 Missouri Avenue, St. Louis 18, Missouri.

QSL's-SWL's. Samples free. Kolor Kard Press, Box 9445, Austin 17, Texas.

QSL's—Outstanding—Original—Reasonable prices. Samples 10¢. Super Quantity 25¢. Refundable VYS QSL's, 1704-C Hale, Ft. Wayne, Indiana.

QSL's, SWL's samples 5¢. Nicholas & Son Printery, P.O. Box 11184, Phoenix 17, Arizona.

QSL's. Large selection styles including photos. Lowest prices. Fast service. Samples dime. Ray, K7HLR, 679 Borah, Twin Falls, Idaho.

QSL's. Samples, dime. Print Shop, Corwith, Iowa.

QSL's??? Samples 20¢. Sackers, W8DED, Holland, Mich.

QSL's . . . Outstanding . . . Priced Right . . . Dime. . . . Filmcrafters . . . Martins Ferry, Ohio

C. Fritz for QSL's that guarantee better DX returns! Samples 25¢ deductible. Box 1684 Scottsdale, Arizona. (formerly Joilet, Illinois)

Will swap: Radio control rig (complete for boats, planes, cars) For Heath DX 20 or similar 50 watt transmitter. Will sell. Any other trades? Write Bill Tharp, 254 Sherman Avenue, Ashland, Ohio.

For further information, check number 32, on page 126

Sell: 2000 VDC 500 MA power supply $30, 275 watt modulator and supply $35, Simpkins speech amplifier for modulator $20, Heath VFO $15, Millen 807 driver and supply $25, PP 813 final $25, or all for $120. K4LXT Conetoe, N.C.

Highly effective home-study review for FCC commercial phone exams. Free literature. Wallace Cook, Box 10634, Jackson 9, Miss.

Wired & tested Heathkits and Knight-kits: "Pawnee" or "Shawnee" Transceiver, $289.95; "Seneca," $210.50; "Sixer" or "Twoer" Transceiver, $69.95; and others. Write C-V Electronics, 3138 Bougainvillea Street, Sarasota, Florida.

Wanted CQ for February and December 1945. K8BFI, P.O. Box 953, Battle Creek, Mich.

Premium Quality Used Equipment—Over 1,000 units—reconditioned with trial plan and full 90 day guarantee—terms available—write for free lists and top trade in offer on your present equipment. World Radio Laboratories, Box 919, Council Bluffs, Iowa.

Collins 75S-1, used 5 months, perfect, $385.00; Drake 2-A, factory warranty, $225.00; Also new Collins 75S-1 with warranty, $425.00. W8WGA.

Apache transmitter—new $240—H. Stinger, Mendenhall, Penna. Main 8-6019.

Wanted: Teletype Model 15 typing unit, Model 19 keyboard, MXD-10 for cash or may trade TTY, Hi-Fi items or brand new LM-20 frequency meter. Sell Model 12 typing unit $5.00. W4NZY, 119 North Birchwood Avenue, Louisville 6, Kentucky.

Western Electric 34-A Transmitter, 500 watts, adjustable frequency shift keying, or CW, Deck available for Modulator, 813's Final, clean $200. R-28/ARC-5 2 mtr. receiver, clean, $15. T-14/TRC-1 Transmitter 70-100 mc. FM Transmitter, good, $20, R-316/ARR-21 Anti-Sub. 2 mtr. receiver with Oscillator unit, $20. Pioneer Genemotor, 12V. to 350V. .230 Amp. New. $10. RCA 500 watt audio modulation transformer, good, $20. Many tubes, advise wants. Want—R-388, 75-A4. Dick Haskin, W6KEC, 154 N. McKinley Pl. Monrovia, Calif.

Polaroid camera kit, like new. I will swap it for any of the following: home or mobile ham gear, citizen gear, 110 volt gasoline generator, tape recorder, or camping equipment. Peter Boudreau, 10 Forbes Ave., Burlingotn, Mass.

Like new HT-30 SSB transmitter in original carton $260. Excellent Condition Model A SSB slicer $35, 4 1625 GG linear $30. K9GSY. 1033 Lincoln, Park Ridge, Ill.

Final, pair 811's 500W $30; DX-35, VF-1, $50; BC-342, Heath Q-Multiplier, $50; Excellent condition; 38 Mead Lane, Westbury, N. Y.; ED 4-5816.

Trade or Sell: 2 G.E. Transformers with bridge rectifiers, 2000 volts, 500 Ma. 2 BC-611's cased, and Western Electric TRC-109C boat transmitter and receiver converted for 75 meters. Want 35 mm camera. Write: D. Galbreath, 124 Columbia Hts., Brooklyn, N. Y.

Sell SP-600 JX28 with custom cabinet. First $350. cashier check takes it. Will ship. Have some new 813's at $10. QB3-300 (4-125A) at $15. ea; pr TB3-750 at $25. ea. W5AST 3319 Ovnand Blvd. Montague Vil. Killeen, Texas.

Through roving, want to settle down. Will trade vy FB 1960 Zundapp Super Sabre motorcycle, 250 cc displacement, for amateur station: XMTR factory wired and in 20A, Ranger, Viking II class and RCVR in HQ-110, Drake 1A or 2B, HRO-50, NC-270, SX-111 class; or for either XMTR or RCVR in "S" line, SP-600, HQ-180, HRO-60, GPR-90, Pacemaker, HT-37 class, or what have you? All inquiries answered. K9KHU, 1408 Dial Court, Springfield, Illinois.

Hammarlund SP-400 perfect $110. 20A with 458VFO and spares $165. Will ship. Don Hutchin 835 ½ Cache La Poudre, Colorado Springs, Colorado.

Sell: HQ-140XA Receiver with speaker. Exlnt. Condx.—$150. Robert Gordon, 166-25 89th Avenue, Jamaica 32, N.Y.

Good buys: Excellent Viking II with VFO, $190. DX-35 with xtals, $35. Two meter transceiver, $5. Brookes, Williston Academy, Easthampton, Mass.

Buried Treasure Fans! I have seventeen copies of Karl Von Mueller's Treasure Hunter's Manual, 6th Edition (1961) with the metal detector circuit in them. 200,000 words, 25 chapters, nearly 400 pages. This is a Special Edition that contains the roster of treasure hunters, ghost town directory, and each copy is numbered and autographed. While they last, will trade for good ham gear or sell for $5.00 per copy postpaid or $6.60 airmail. Dean Miller W4TRQ/7, 1281 Hyland Lake Drvie, Salt Lake City 17, Utah.

Radio and T.V. tubes jobber boxed R.C.A. G.E. Sylvania, Westinghouse 65% off list price, 25% deposit, on all orders, balance C.O.D. F.O.B., N.Y., Sutton Electronics Box 503, Hicksville, N.Y.

DX 100B SSB Adapted $175.00 75A2 latest Collins modification and selectable sideband product detector $225.00 (a steal). BC614E speech amp. for BC610 $15.00. You pay freight W5BWA, 1015 Ida St. Alexandria, Louisiana.

KWM-2, Blanker, AC-DC Supply, Mobile mount, Speaker. FB $1195.00. Will take 50% Trade. F.O.B. Gill, 1305 Lum, Corpus Christi, Texas.

For Sale: 6 meter Bandhopper Transceiver $75.00, 6 meter Homebrew Transmitter with Eico Modulator and ac power less cabinet $85.00, BC 603 receiver with ac power supply $25.00, Lafayette Receiver HE 10 $60.00, HQ 110C receiver best offer over $175.00, Globe DSB 100 transmitter best offer over $65.00, B-W t/r switch $10.00, 2000/500ma ac power supply $100.00, will trade any of above. send for list of other items. R. Greene, Box 3035, Stn. 1, McAllen, Texas.

For Sale: Two BC 1000 Walkie talkies converted to Six meters, each complete with wet battery, vibrator power supply, antenna, and handset—$100.00 for the pair. Also, pair of Citizen's Band walkie-talkies on 26.975 mc/s—$35.00 pair. SX-100 excellent condition $170.00. K9ESE: 19D University Houses, Madison 5, Wisconsin.

Wanted: KWM-2 State condition price first letter C. Bort, P.O. Box 422, Somerville N.J.

Patterson Receiver, Preamp $60. Transistors 4 for $1. Precision Resistors 50 for $5. Sola 2000W Transformer 2319 East Indianola, Phoenix.

For Sale: SX-99 in very good condition, $95. F.O.B. Norwood or Deliver within 75 miles. Also Knight "Ocean Hopper," all coils, $9. Need, 15MTA HRO 50TI coil or 20 MTR coil to be modified. Jim Dionne, K1MEM, 35 High Rock St., Westwood, Mass.

QST's, good to perfect condition, 1956 except August, 1947 to 1956 inclusive complete, well-packed ready to ship, what are they worth to you? W6HOZ, 5218 Onaknoll, Los Angeles 43.

Trade—HQ-110C rcvr. Top condx. for same in Cheyenne xmtr. an Comanche rcvr. Sell Apache xmtr. $200 F.O.B. D. Hunter WA6NBT R#1 Box 168 Paso Robles, Calif.

Sell: KWS-1 with 4X250Bs, like new, $895. W6GDJ, 70 Annette Ct., Walnut Creek, Calif.

Sell: Heath DX-100B $170, SB-10 $70 (Both Expertly Wired, 1 year old). Will pay shipping expense anywhere in U.S.A. K8DIO Lloyd A. Korb, Box 265, C.M.R., Holloman A.F.B., New Mexico.

For Sale: Compact Triode Kilowatt Amplifier ala G.E. Ham News. All mechanical work completed, including shielding, ready for wiring. Two new 810s included. Parts cost $170.30 without tubes. Sacrifice for $125.00. Larry Kleber, K9LKA, Belvidere, Illinois.

Wanted: Complete set CQ's 1950 thru 1958. State condition and price. W2ELW, 71 Southampton Drive, Levittown, New Jersey.

For Sale: Thordarson 500 watt modulation transformer $25. Four new Jan 810s $10 each. Three new Jan 805s $7.50 each. Four new Bendix 110V, 60 cycle selsyns $10 each. cased portable Variac $10. Heath In-Circuit Capacitestor One used Eimac 4-250A $15. General Radio 200CM 5 amp. $4.95. Heath R.F. Signal Generator $14.95. Include postage. Larry Kleber, K9LKA, Belvidere, Illinois.

For Sale: 75S-1 Recevier and SSB Exciter, perfect condition very reasonably priced, write for details. WØAEP, 2723 B Avenue N.E. Cedar Rapids, Iowa.

75A4 Collins, like new and HT32-A in carton. Both $1000.-00. M. Swedgal, K2HAM, 211 Albermarle Rd., Bklyn 26, N.Y.

NEW P&H LA-400-C LINEAR AMPLIFIER NOW 800 WATTS PEP FOR ONLY $164.95

PANORAMIC SPECTRUM ANALYSIS
Odd order distortion products (1kc, separation) using popular 100 watt SSB exciter and LA-400C.

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EXCITER ONLY	-37 db.	-47 db.
EXCITER AND LA-400C	-37 to -40 db.	-47 to -50 db.

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The 80 thru 10 meter band-switching pi network is designed for 800 watts PEP SSB, 400 watts CW, FM or FSK and 230 watts Linear AM (controlled carrier) or 185 watts (constant carrier) with 50-70 ohm output. Popular 100 watt SSB exciters require no swamping or matching networks to drive the low Z untuned input. Grounded grid circuit uses four 1625's or 837's on customers request. Meter reads RF drive, plate current, RF amps output. New modern compact 9" X 15" X 10½" gray cabinet also contains power supply using 816's. TVI suppressed, Parasitic Free.

One-Year Warranty on all Parts and Tubes

SEE THE NEW LA-400C AT YOUR DEALERS

LA-400C Kit Complete with tubes $164.95
LA-400-C Wired and tested $219.95

P&H ELECTRONICS INC. 424 Columbia Lafayette, Ind.

For further information, check number 33, on page 126

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Phone TU 6-5749
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Watertown, S. Dak.

For Sale: The ideal combination of SSB-RTTY Equipment: Eldico SSB-100F Hundred Watt Exciter, factory adapted for RTTY, together with Eldico M-104 frequency shift keyer and Eldico M-117 terminal unit. The M-104 and M-117 are military units comprising the latest advances in RTTY station equipment. In fact the Eldico SSB-100F represents the utmost in station equipment, affording effortless and rapid shift from ten to eighty meters with sufficient power to work anywhere or drive any KW final in upper and lower sideband SSB, AM, CW, and RTTY. This combination of equipment (which is offered only as a package) affords the utmost flexibility available to the amateur. This is an opportunity to purchase a set of professional equipment which allows trouble-free operation in every mode on every frequency at minimum cost. Now on the air in perfect condition. Available for immediate delivery at $750.00 FOB NYC, or to the next best firm offer. W2CQA, 130 East End Ave., NYC 28, N.Y.

For Sale: RME 4350 a receiver mint condition $175.00. I. J. Sprawka, 612 So. Lincoln, Park Ridge, Illinois. TA 3-7798.

Send specifications and we will design and send a schematic along with appropriate assembly instructions for any circuit you desire. For information write, Custom Design, P.O. Box 63, Roslyn, Pa.

Aluminum for every ham need. Write to Dick's, 62 Cherry Avenue, Tiffin, Ohio, for list of tubing, angle, channel, castings, plain and perforated sheet, and complete beam kits.

Must Sell—National NC-88 Receiver, Heath Mobile Tranmitter, Heath A.C. power supply, Heath VFO. All like new. Save money by writing to Ernie Woodard, K4PZK, Valdosta State College, Valdosta, Georgia.

Opportunity to volunteer service to a non-profit scientific research project. Object: investigation of electromagnetic phenomena such as radio astronomy, scatter propagation, and moon-bounce. An administrative staff of 25 people with knowledge and skills in electronic and related fields is needed. For details write Radiometric Research, Ltd. Box 4335-Annex, Las Vegas, Nevada.

Must Sell Entire Rig to meet college expenses. DX-100 with SSB modification, $165.00; SB-10, $90.00; immaculate, exceptionally hot SX-101, used very little, $325.00; R46B speaker, $13.00; hybrid phone patch, $20.00; DK-60G relay $8.00; B & W 75 ohm low pass filter, $12.00; bug, $10.00; JT-30 mike and telescoping stand, $12.00; 48 ft. self supporting tower, 20 ft. drive mast, $75.00 HAM-M rotor, $100.00; 15 mtr. Hy-gain 3 element beam & 100 ft. RG-11U coax, $35.00; Military earphones with pads, $10.00; or entire station for $800.00. KØLRT, 715 Pine, Crookston Minn.

DX-100 Owners: Increase power by 50%. Run 240 watts AM-300 watts CW or SSB. Complete kit and instructions for adding another 6146 to final only $19.95. Similar kit for TX-1. Order or write. W4KUV-W4NZS, Best Radio Service, 610 N. Madison Avenue, Goldsboro, North Carolina.

Moon-Bouncers, APX-6 Transceiver for 1215MC. Just removed from obsolete F-86 jets and in excellent condition. Complete with all tubes, no broken or missing parts, price $18.50, with schematic, F.O.B., shipping weight 45 lbs., Bill Slep Company, Drawer 178CQ, Ellenton, Florida.

Wanted: SW Coils for older HRO using 6D6, etc. tubes. Hohl RD1, Huron, Ohio.

Tech Manuals, New Original Maintenance Books, APA-10 $5.00, APA-38 $8.00; APN-1 $6.50; APN-4 $8.00; APN-9 $10.00; APR-1 $7.50; APR-4 $7.50; ARC-1 $9.50; ARC-2 $8.50; ARC-5 $8.50; ARC-27 $8.50; ARR-2 $7.50; ARR-5 $8.50; ARR-7 $8.50; ARR-15 $100.00; ART-13 $12.50; BC-312 $8.50; BC-342 $8.50; BC-348 $8.50; BC-603 $7.50; BC-610 $10.00; BC-620 $6.00; BC-659 $5.00; BC-669 $8.00; BC-683 $6.00; BC-799 $6.00. Thousands in stock. Free Catalog, Bill Slep Company, Drawer 178, Ellenton, Florida.

Cleaning out shack. Write for list, K9IBZ, 311 Ridge Avenue, Evanston, Ill.

A-5—One-inch Vidicon Deflection Components. 5-piece Model VK-100 Tube Type or Transformer Type Kit: Has Deflection Yoke, Focus Coil, Alignment Coil, Horizontal and vertical Output transformers. $99 net.—Also, 3-piece model VK-200 direct drive or transistorized kit: Has deflection Yoke, Focus Coil and Alignment Coil. $89 Net. Components available only as above kits. Send check or money order. 10 day unused-undamaged return privilege. Cleveland Electronics, Inc., Deflection Components Div., 1974 E. 61 St., Cleveland 3, Ohio.

For further information, check number 34, on page 126

DID YOU KNOW
HAM SHOP ADS ARE NOW 5¢ PER WORD?
(See Page 120)

READER SERVICE

CQ Magazine, Dept. RS

300 WEST 43rd STREET
New York 36, N. Y.

Coupon I
Void after
September 25, 1961

Please send me more information on your ads in the September 1961 CQ keyed as follows:

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11	12	13	14	15	16	17	18	19	20	B
21	22	23	24	25	26	27	28	29	30	C
31	32	33	34	35	36	37	38	39	40	D
41	42	43	44	45	46	47	48	49	50	E
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(Please Print)

Call ____________________ Engineer ☐

Type of work (specify) ____________________

ADDRESS ____________________

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ADVERTISING INDEX

For further information, check number 35, on page 126

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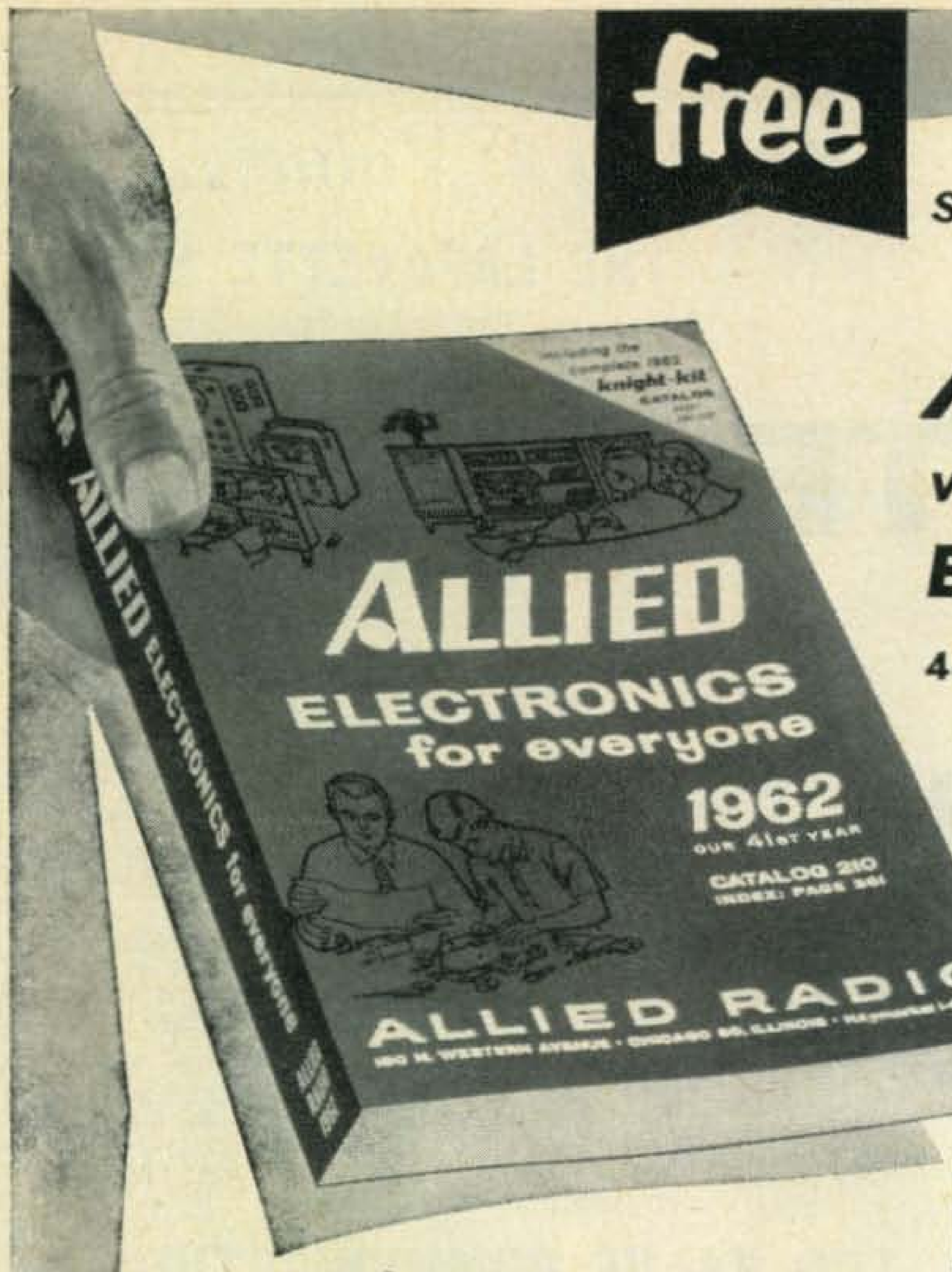

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FOR THAT BEST DEAL on all the new equipment you want, write or call Jim Sommerville, W9WHF, c/o Allied, or stop in at our Ham Shack and meet Joe Huffman, W9BHD; Joe Gizzi, W9HLA; Lowell Warshawsky, W9NGV; John Chass, K9LOK...

HAM-TO-HAM HELP—Our staff of more than 30 Hams goes all-out to give you the help you want, whether you write, call or visit us in person. You'll like the friendly attention and interest you get *all-ways* at ALLIED.

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For *everything* in electronics, get the 444-page 1962 ALLIED Catalog now!

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100 N. Western Ave., Chicago 80, Ill.

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PLEASE PRINT

*Address*________________

*City*________ *Zone*____ *State*____

For further information, check number 36, on page 126

NATIONAL'S NC-303
HIGHEST MECHANICAL STABILITY
LOWEST THERMAL DRIFT
MAXIMUM SSB/AM/CW VERSATILITY

Three decisive reasons why National's NC-303 outperforms all other receivers in its price class:

HIGHEST MECHANICAL STABILITY—solid chassis and component construction, pre-loaded double-spaced tuning gang and positive detent bandswitch assure stability under extremes of shock and vibration.

LOWEST THERMAL DRIFT—National's exclusive "high-zero" temperature compensation, carefully engineered oscillator circuitry and ceramic coil forms provide thermal stability unequalled by competitive receivers.

MAXIMUM SSB/AM/CW VERSATILITY. For The SSB User: "IF Shift" selectable sideband / SSB noise limiter / Product detector / Fast attack, slow decay AVC / "Q" multiplier with separate depth control. **For The AM Man:** 3.5 Kc phone bandwidth / 8.0 Kc bandwidth for net or VHF operation / Automatic AM noise limiter / Tone control / AM AVC. **For The CW User:** 500 cycle CW selectivity / "Peaking" audio filter / External CW muting for break-in. **For Everyone:** 1 microvolt sensitivity / "X" band and 12" dial scales for VHF converters / Accessory socket /2 Kc dial calibration and vernier tuning control.

Only $44.99 down*

Suggested cash price: $449.00 (slightly higher west of the Rockies and outside the U.S.A.). *Most National distributors offer budget terms and trade-in allowances.

For further information, check number 2, on page 126

NATIONAL RADIO COMPANY, INC.
A WHOLLY OWNED SUBSIDIARY OF NATIONAL CO., INC.
MELROSE 76, MASS.

Export: AD AURIEMA, INC., 85 Broad St., New York, N. Y. Canada: TRI-TEL ASSOC. LTD., 81 Sheppard Ave. W., Willowdale, Ont.

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