December 1966
75¢

ICD

CQ

Merry Christmas

The Radio Amateur's Journal

God Jul

Feliz Navidad

Fröhliche Weihnachten

Joyeux Nöel

Merry Christmas!

Across horizons—to all corners of the earth—the wish goes out in many tongues as radio amateurs exchange friendly holiday greetings.

To this worldwide fraternity with its honored reputation for service to others, Collins would like to send its good wishes for a joyful season.

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FIXED STATION TRAP VERTICAL

Hustler quality and reliability with

ONE TUNING ADJUSTMENT TO COVER BOTH PHONE and CW

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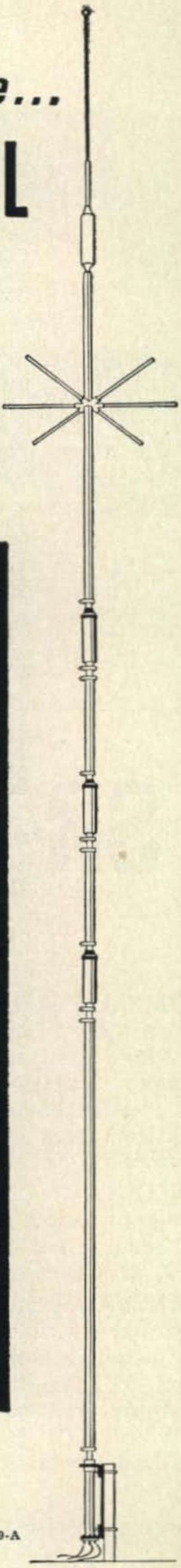

Here's why the Hustler 4-BTV is the best trap vertical for the money.

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See the new Hustler 4-BTV at your dealer today.

Ask about the complete Hustler line.

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NEW-TRONICS CORP.

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6439-A

For further information, check number 34, on page 104

SR-2000 "Hurricane"

5-band amateur transceiver

SPECIAL FEATURES: Patented Receiver Offset Control (RIT) permits ±2 ks adjustment of receiver frequency, independent of transmitter, for round-table, net or CW operation. Hallicrafters exclusive Amplified Automatic Level Control.

FREQUENCY COVERAGE: Full coverage provided for 80, 40, 20, 15 and 10 meters. All crystals provided for 28.0 to 30.0 mcs.

GENERAL: Dial cal., 1 kc. Linear gear drive with less than 1 kc readout. Adjustable IF noise blanker. Provision for plug-in external VFO/DX adapter. Built-in VOX plus break-in CW and PTT. Built-in CW sidetone. Hi-Low power switch useable in CW or SSB.* 2.1 kc crystal lattice filter. S-meter-RFO-AALC and final screen metering.* Two-speed blower, 100 kc crystal cal. VFO covers 500 kc.

TRANSMITTER SECTION: Two 8122 output tubes. Variable Pi network. Power input, 2000 watts P.E.P. SSB; 1000 watts CW. Carrier and unwanted SB suppression, 50db; distortion products, 30db. Audio: 500-2600 cps @ 6 db.

RECEIVER SECTION: Sensitivity less than 1 μv for 20 db S/N. Audio output, 2W.; overall gain, 1 μv for ½ W. output.

*Meters for final plate current and voltage built into P-2000AC power supply. Also Hi-Lo power switch.

amateur net:
$995.00
less power supply

For further information, check number 11, on page 104

the wild ideas are tamed at... **hallicrafters**

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CQ

DECEMBER 1966 VOL. 22, No. 12

The Radio Amateur's Journal

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DEPARTMENTS

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

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EIMAC

vapor-cooled high-linearity tetrode powers unique new 2000 watt PEP linear amplifier

The unique new linear amplifier shown here is powered by an EIMAC 4CV1500B tetrode. The ultimate in amateur equipment, this fine linear was designed by Jack Quinn, W6MJG, and uses the advanced concept of vapor-phase cooling for ultra-quiet operation. The amplifier runs cooler than most forced-air-cooled amplifiers, and because there is no extraneous noise from air blowers, your shack is quiet—ideal for receiving weak DX signals! On CW, the amplifier has an average input of 1 kW, with only 400 watts of plate dissipation at 60% efficiency.

High SSB performance of the amplifier is credited to the 4CV1500B's outstanding intermodulation distortion characteristics...better than −40 db third-order products at all drive power levels from zero to 2 kW PEP. The 4CV1500B—and its air-cooled brother, the 4CX1500B—are products of a four-year development study which included optimization of internal tube geometry by computer techniques. Because the tube has very low grid interception (typically less than 1.5 mA grid current) it is possible to drive the grid positive without adverse effects upon the distortion level of the driver. Both tubes are recommended for Class AB_2 linear amplifier service. For further information on advanced EIMAC power tubes, write Amateur Services Department or contact your nearest EIMAC distributor.

4CV1500B
TYPICAL OPERATION (Frequencies below 30 MHz)

DC Plate Voltage	2500	2750	2900	V
DC Screen Voltage	225	225	225	V
DC Grid Voltage	−34	−34	−34	V
Zero-Signal DC Plate Current	300	300	300	mA
Single-Tone DC Plate Current	720	710	755	mA
Two-Tone DC Plate Current	530	555	542	mA
Driving Power	1.5	1.5	1.5	W
Useful Output Power	900	1100	1100	W
Intermodulation Distortion Products				
3rd Order	−38	−40	−43	db
5th Order	−47	−48	−47	db

We have a new brochure entitled "Linear Amplifier and Single Sideband Service." Write for your copy.

EIMAC
Division of Varian
San Carlos, California 94070

For further information, check number 1, on page 104

ZERO BIAS

Columbus Gold Medal Award To W6MLZ

IN the presence of President Guisippe Saragat of Italy and other high ranking Italian officials, Ray E. Meyers, W6MLZ, received the Columbus Gold Medal Award for Humanitarian Service, in Genoa on October 12.

The Humanitarian Medal is one of several awarded by the International Institute of Communications to honor outstanding contributions in the field of communications. The awards are presented at public ceremonies held annually in Genoa, Italy, to mark the anniversary of Columbus' birth.

In awarding the medal to Ray Meyers, Senator Guido Corbellini, Italian Minister of Scientific Research and president of the International Institute of Communications, read the following citation:

> "The 1966 Columbus Gold Medal Award for Humanitarian Service is awarded to Ray E. Meyers, W6MLZ. He has been a well known radio amateur since 1910, and has been selected for this award in recognition of his contributions to amateur radio communications in his own country and internationally as well.
>
> "He has devoted, and still devotes a great part of his time to the teaching of radio telecommunication techniques to the physically disabled through the International Net of Handicapped Amateur Radio Operators, created and sponsored by him. Inventor of special radio equipment for the blind and those confined to iron lungs, he alleviates, with ingenuity and personal financial sacrifice, at least in part, the sorrowful loneliness and isolation, spiritual as well as physical, to so many unfortunate people."

The International Net, for which Ray received the Columbus award, has members in all four corners of the World. Many confined to a life in bed, wheelchair or iron lung, are now finding enjoyment and pleasure through amateur radio. Membership in the Net is made up of boys and girls, men and women, scientist or neophyte, without regard to race, creed or color, and who daily chat with fellow radio amateurs around the world. When not actually engaged in radio contact, most members monitor the emergency frequencies in order to be of assistance should disaster strike in the form of earthquake, fire, flood, hurricane, tornado or other catastrophe.

The Columbus medal isn't the first gold medal to be awarded to W6MLZ. He's also the proud holder of the Wireless Operators Association International Gold Medal, which was awarded to him several years ago in recognition of his heroic action as Communications Officer aboard a disabled submarine. Ray devised a unique method, using an oscillating receiver, for sending an SOS from the Wilkins Trans-Polar submarine *Nautilus,* when the craft lost all power and was in serious danger of foundering in mid-Atlantic.

Ray is perhaps best known to his fellow radio amateurs as the man who spearheaded efforts in persuading Congress to revise the Communications Act of 1934 to permit reciprocal operating agreements between the United States and foreign countries, for radio amateurs. He also is a newspaper columnist (*Los Angeles Herald-Examiner*), and master of ceremonies on a weekly half hour radio program devoted to amateur radio. Ray is presently Vice-Chairman of the Amateur section of FCC's National Industry Advisory Council, and he plays an important role in advising the FCC on amateur radio affairs.

Mrs. Margaret Meyers accompanied her husband to Genoa and witnessed the award of the Columbus medal to Ray. In true Italian style she received a standing ovation for the role she has played in supporting Ray's interest in amateur radio. After the ceremonies, Margaret and Ray visited Rome, Geneva (with a stop at 4U1ITU), and New York before heading back to their San Gabriel, California home. ■

Ray Meyers, W6MLZ, shakes hands with the Mayor of Genoa, Italy after receiving the Columbus Gold Medal Award for Humanitarian Service.

Our Cover

This month's cover is the work of Art Director Ruth Sokolow. Our reproduction of Ruth's original watercolor hardly does it full justice, but we think it's kind of nice.

Sincere best wishes for a happy and peaceful holiday season to all of our readers.

—K2MGA

OUR READERS SAY

Conical Monopoles

Editor, *CQ:*

With reference to the Conical Monopole antenna described by Loren Stroup, W4WEV/4 of Smyrna, Tenn., I am rather surprised that an originality is claimed by the Author and may I be permitted to point out that Conical Monopoles have been in use by Commercial Radio Services for a good many years.

As far as I know, both Granger Associates of Palo Alto, California as well as John Magnusson's Hy-Gain make these Antennas and they are available at quite reasonable prices.

Heights of the Granger line of Conicals varies from 82′ for 2 to 8 mc down to 24′ for 7 to 28 mc, whereas the Azimuth Plane Radiation pattern is approximately circular and the gain is claimed at 4 db over isotropic perfect ground whereas the Hy-Gain line features heights from 70′ for 2 to 8 mc down 59 23.5′ for 7 to 28 mc. Granger has 4 different models whereas Hy-Gain has 6 different models. Furthermore, Hy-Gain claim the Azimuth Plane Radiation Pattern to be circular within ±0.75 db whereas the gain is 4.5 db Minimum.

From the above you will undoubtedly ascertain that W5WEV/4 has not originated anything new—perhaps he brought to the attention of us Hams antennas which have been in use for quite a long time by the professionals.

Robert H. Avigor, 4X4CJ
Tel-Aviv, Israel

"FET's" Applauded

Editor, *CQ:*

Congratulations to you and the staff at *CQ* and especially to Harry R. Hyder for an excellent series on field effect transistors.

I feel that more articles written along Mr. Hyder's basic theory to application will benefit many amateurs in developing a good understanding of these new devices. Attention to the basic groundwork can make the difference between understanding what is written by a great many or having the article skipped or ending up in file 13.

I look forward to more features along the same line in other areas. *CQ* has a new convert. Many thanks.

Jon Q. Groth, K8AFN
Berea, Ohio

Deep Freeze Operators

Editor, *CQ:*

During Operation DEEP FREEZE 1966 many amateur radio operators made telephone patches for the personnel of Byrd Station, Antarctica, through the main amateur station at Byrd, KC4USB. The Byrd Operators, Stu Jeffrey, Larry Spitz, Dallas Heckman, Tom Huntington, Ron Sefton, Bobby Hunt, and Al Fischer, have praised the following amateurs for their consistent help:

Charlie Morgan, K1GZL; Ken Nokes, K1TWK; Bill Schiffrin, WA2IZU; Ike Roach, W3ABI; Doc Grinnings, W3CQ; Frazier Baldwin, K3WPE; Phil Craig, K4CRU; Millie Craig, K4JGU; Ted Wood, W4AH; Robby Robison, W4RQX; Special Services at USN Construction Battalion Center, Port Hueneme, Calif., K6NCT; Betty Gillies, W6QPI; Jerry Swank, W8HXR; Dick McClure, W8IJH; Jim Bennett, K8WQE; Steve Barnes, KØYKJ.

On behalf of all the personnel at Byrd Station I want to publically express my thanks and appreciation to all amateur radio operators who have helped Byrd Station personnel maintain contact with their loved ones.

Gordon W. Callender, Jr., LT, CEC, USN
Officer in Charge, Byrd Station, Antarctica

"OUR READERS SAY" welcomes letters about nearly anything of interest to amateurs, whether about *CQ* itself, the state of the hobby, or whatever else you have on your mind. The most interesting letters will be selected for publication each month; just keep them legible, keep them short, and above all, keep them clean! Something bothering you. We're not mind readers, OM, so drop us a line.

Contest Objectors

Editor, *CQ:*

It seems quite apparent that if everyone in ham radio were restricted to c.w. only they would scream their heads off. Since this is so, then it would also seem, quite reasonably, that there is no reason on earth why these asinine contests should be crammed down the throats of the hams who like to rag chew. When a fellow works hard for his living, and then wants a few moments in which to relaxe a little, then it ought to be possible to get on the various bands for a relaxing rag chew, but not when these contests are on, with everyone and his brother crawling out from under the rocks for a signal report, especially when they are not normally on this particular band.

If something worthwhile must be done for the ham bands, then an excellent first step would be in the direction of restricting these so called contests to a lesser range in the bands so that the operator with traffic or a serious rag chewer type ham could be just as at home on the particular band without bothering the contest nuts, and vice versa.

There have been times when a certain band would seem dead, for rag chew purposes, or for DX. When there is a contest on, just try to work any DX and see what happens. Or just try to have a message passed for example, to someone dear to you in the Armed Forces overseas, and, then see how much fun it is with these silly signal report seekers. Contests might serve some useful purpose, (not that I can see from here) but let's not be ridiculous. Leave a little room for those who have other desires, also.

M. L. Braun, K8IQB,
Dorothy Braun, WA8QQM
Bellevue, Ohio

I believe that the Braun's have been missing out on one of the most exciting of amateur radio's many facets: the contest. Actually, contest operators are not a different breed at all, but are the same ragchewers, DXers, traffic handlers, etc. who daily occupy the bands, but who crave a little excitement and competition. With only about three or four weekends per year during which the phone or c.w. bands in the US are seriously disrupted by major contests, it's hard to understand the intolerant attitudes of so many non-contest operators. My suggestion: Before condemning contests, get some first hand experience at what they're all about. In other words, work a contest; then let me know what you think about them.—*K2MGA*

The Willing Ham

Editor, *CQ:*

In response to reader Ted Banks' (WA ??) letter—I'm agast! Too bad I'm so far away. Maybe *CQ* and/or *QST* should assemble a list of hams willing to administer Novice Technician/Conditional exams.

I'm a big supporter of ham radio and always have been and always will be ready, able and willing to administer an exam any time of the day and night because I feel the applicant has, by his action, shown the necessary interest and drive just to get that far, and to not do my part would be like putting salt in an open wound.

J. Bradley Flippin
Falls Church, Virginia

[*Continued on page 91*]

Waters ...for happier hamming in the New Year

So now we make 2!

Model 374 $135.00

NEW DUMMY LOAD/WATTMETER
Reads to 1500 Watts!

We've added another Dummy Load/Wattmeter to the Waters line! It's the Model 374 and shows power output to a full 1500 watts over a frequency range of 2 to 30 mHz. Four calibrated scales (0-15; 0-50; 0-300; 0-1500) read watts to ±5% accuracy. Load Impedance: 52 ohms. VSWR: 1.3 : 1. Weight: 12 lbs. Over-temperature warning light.

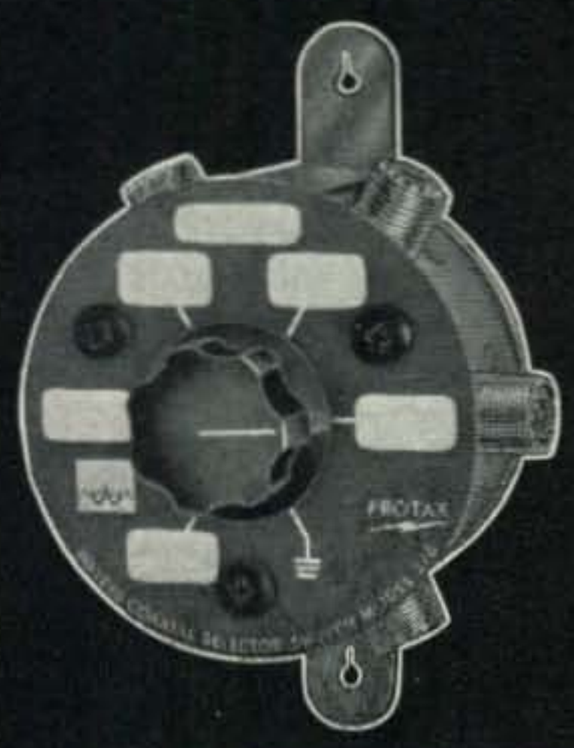
Model 369 $120.00

REFLECTOMETER

Measures both forward and reflected power simultaneously on unique double meter. Covers 3 to 30 mHz at 52 ohms on two separately set forward scales of 200 and 1000 watts, (20 and 200 watts reflected) to insure accurate readings. Comes complete with directional coupler.

Model 375
6-position with rear axial connectors
$13.95

Model 376
5-position with side radial connectors
$12.50



PROTAX™ ANTENNA SWITCHES
with Automatic Grounding

The Water PROTAX™ Coaxial Antenna Switch automatically grounds the entire antenna system when the shack is shut down. Readily handles a full 1000 watts and comes complete with knob and escutcheon plate with erasable marking panels. (Model 376 has mounting bracket.)

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WAYLAND, MASSACHUSETTS

Waters Quality Products Are Sold Only Through Waters Qualified Distributors

For further information, check number 5, on page 104

Announcements

Las Vegas, Nevada

The second annual Sahara Radio Operators Convention in Las Vegas will be from January 5-8, 1967. The event will again be hosted by the Southern Nevada Amateur Radio Club, and will be at the Hotel Sahara in their Sahara Convention Center South. Technical talks, manufacturers displays, big prize list, special events for the ladies, tours and other activities are planned. There is a special room rate for the convention at $10, single or double per day. A registration fee of $9.50 is charged for the convention which takes care of all events including three cocktail parties and special Sahara Hunt Breakfast on the last day. For more information write to John Romero, Hotel Sahara, Highway 91, Las Vegas, Nevada, 89109.

White Plains, N.Y.

The Westchester Amateur Radio Association is having their annual dinner meeting on Dec. 15th, 1966. They are having Bill Leonard, W2SKE, just back from Viet Nam, as a special guest speaker. For complete details write to Dr. Morris Rosenberg, M.D., WB2MOJ, 319 Summit Ave., Mount Vernon, N.Y., 10552.

Fairbanks, Alaska

Ira Haws, W8KNC/KL7 would like to set up schedules on six meters. He will shortly be operating on both c.w. and s.s.b. with a six element beam 50 high. He will be on 50.01 c.w. and 50.11 upper sideband. His available times are: 1 A.M. AST and 7 A.M. AST weekdays and to 9 A.M. Saturdays and Sundays. If you are interested write to him at: 320 Bentley Drive East, Fairbanks, Alaska.

West Paterson, N.J.

The Seven-Eleven Amateur Radio Club of N.N.J. will hold its annual Anniversary QSO Party from 0001 GMT January 7, 1967 to 2400 GMT January 11, 1967.

A certificate will be awarded to any amateur who contacts at least 5 club members. For stations only able to contact 3 club stations, a charge of 50 cents will be made.

Seven-Eleven Club members will be identified on fone by mention of the Club and on CW as "DE *SE*". The following frequencies will be used: C.W.—3555, 7030, 14075 and 21100. Phone—3900, 7200, 14300, 21130 and 145-147 mc.

All applications must include log data and be sent to: R. C. Petermann, W2LYO, 79 Pompton Ave., West Paterson, New Jersey.

Scholarship Award

The Foundation for Amateur Radio, Inc., with headquarters in Washington, D.C., announces its intent to make the third award of the John Gore Memorial Scholarship for either graduate or undergraduate study, full or part time. The scholarship pays $250 for the academic year, and is subject to renewal.

Licensed radio amateurs who intend making a career in electronics or related sciences may now apply for the academic year 1966-67.

To be eligible, applicants must have completed one year in an accredited college or university and must be enrolled in a course of studies leading to a degree. They must also be radio amateurs holding a valid FCC license of at least a General class rating. Preference will be given to applicants from the area served by the Foundation —the District of Columbia, Maryland and Virginia, although those living elsewhere are not excluded.

Requests for application should be made not later than December 30, 1966, and should be addressed to:

Chairman, Scholarship Award Committee
FAR, Inc.
10224 Farnham Drive
Bethesda, Maryland 20014

[*Continued on page 92*]

◀ For further informaton, check number 25 on page 104

What's **NEW** in Communication Antenna Systems?

"CHECK THESE CPC DEVELOPMENTS AS STARTERS!"

CAT.NO. 522-509

NEW!

CAT. NO. 522-509 DUPLEXER

CAT. NO. 522-509 Duplexer for 450-570 Mc is an entirely new duplexer providing isolation in excess of 100 db between the transmitter and receiver at the transmit frequency and in excess of 40 db at the receive frequency. This isolation is maintained for transmit to receive separations of 2 to 20 Mc.

NEW!

CAT. NO. 220-509 SUPER STATIONMASTER

CAT.NO. 220-509

is a second generation antenna growing out of 30,000 STATIONMASTERS and ten years of experience with this type array. The new antenna has all the qualities of its predecessor, plus new features not now available in any antenna made for the land mobile services.

Because of its exceptional bandwidth, the SUPER STATIONMASTER is produced in three ranges which cover the VHF band, 150 to 159 Mc, 157 to 166 Mc, 165 to 174 Mc. A 10 db—10 Mc wide version, CAT. No. 455-509, is available to cover 450 to 470 Mc in two ranges.

NEW!

WIDER ADAPTABILITY FOR THE POPULAR CAT. NO. 251-509 2.5 db VEHICULAR GAIN ANTENNA

CAT. NO. 551-509 consists of the radiating element of Cat. No. 251-509 equipped with a mounting stud to fit the standard GE, RCA, or IPC Roof Top Mounts.

CAT. NO. 554-509 consists of the radiating elements of Cat. No. 251-509 and an adaptor to fit the standard Motorola Roof Top Mount.

NEW!

Additional CPC antennas and accessories are being featured in the CPC Handbook now going to press. Watch for them!

CAT.NO. 551-509

CAT.NO. 554-509

Then, check this new 64-page Antenna Handbook for up-to-the-minute specifications and data covering the complete CPC line of base station antennas, vehicular antennas, railroad and aircraft antennas, accessories, cable systems etc. For installers and specifiers of two-way mobile radio equipment, there is a special laboratory and field-tested data section. Reserve your copy now!

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Communication Products Company

DIVISION OF

PHELPS DODGE ELECTRONIC PRODUCTS
CORPORATION

For further information, check number 10, on page 104

For further information, check number 26, on page 104

For many years the name Hashafisti Scratchi has been almost synonymous with confusion and consternation in amateur radio. It seems, too, that whenever the unusual or impossible is happening, Scratchi is there helping it happen. We were pleasantly surprised, recently, to receive a letter in reply to an early Christmas greeting to our old friend, and a hint that more letters will follow.

Feenix, Ariz.

Deer Hon. Ed:

Gracious to goodness, it certainly were nice to reseeving a Chrismus card from you, after all these yeers. I so happy to knowing Scratchi not forgotten that I not mind paying the three cents postage due on the card.

As you can seeing, I are now back in Feenix, staying with my Hon. Brother Itchi on his ranch. For last six yeers are working for a mining company in South America, and not being able to keeping up with amchoor radio. Just working hard and making lotsa bux.

Are reel glad I keeping subscripshun to your Hon. Rag, on acct. so many things happening in amchoor radio are unbelievabul. Itchi keeping all issues, so have been reeding all back issues since getting home.

Ham saddlelites circling Hon. Earth; bouncing signals off Hon. Moon; intergrated circuits smaller than hed of pin; automatic keyers; transistors working at a cupple hundred megahertz (what are hertz, Hon. Ed?) and so many things it being hard for old-time amchoor like me to understanding what going on.

Like take what happening to me last nite. Are desiding that should be getting on air again, so going in shack and looking things over. It are just like I leeving it, six years ago.

Turning on reseever and tuning across fone band. First impreshun are that single-sideband reely catching on. Hackensake! unless turning on b.f.o. can hardly understanding anybuddies!

Heer and there finding few signals using regular modulayshun, so thinking maybe having QSO. Turning filaments in rig on, making cupple quick checks, and after touching up newtralizayshun in triode final, are calling seek-you.

Rite on same freakwency as mine sum fellow are calling me—he must having same cristal freakwency as mine. He having nice loud signal, so are looking forward to interesting QSO.

We exchanging reports and I telling him my handle is Scratchi. He saying his handle are GX-19. (Hanging on, Hon. Ed., that not only strange thing happening). I think he making big joke, saying his handle are GX-19, so I asking him if it hokey-dokey to calling him "G" for short.

He not answering the questshun, but going on to telling me about his rig. Hon. Ed., you should heering him. He telling me about things I never heering of before. I getting out your Hon. Rag and looking through ads, thinking maybe I see things he talking about being advertised, but no luck.

I reel interested, so asking him to explaneing in more detale, but funny thing, he not answering these questshuns either. Matter of fackly, he not ever answering any questshuns as I thinking about it.

Next transmisshun he saying he having to QRT and hoping to see me again soon on air. I going back and saying ditto and 73. Then, as he sineing off with me, another reel strange thing happening. He saying "73 (click), 73 (click), 73 (click)," and keeping this up for cupple more times before carrier going off air. It sound like he repeeting himself when not meening to.

So I got thinking. He never telling me his QTH, and he not listed in Hon. Callbook. Also, he having funny kind voice. Not with accent, but not sounding like reel voice either. Another things. As he talking there sumthing like whirring noise in background.

What you thinking, Hon. Ed? The more I thinking about it, are only two possibilities. You supposing I having QSO with a computer? Are so many new things now in amchoor radio I not knowing. Can computer getting amchoor license? Are you QSO'ing any computers resently? Are you knowing any computer with handle GX-19?

You probably giving Scratchi big hee-haw for him thinking he talking to computer. Okey then, only one other possibility. What kind of fellow having handle like GX-19, and using equipment that nobuddies ever heering about, with call not in Hon. Callbook. Maybe sumbuddy from out of this world.

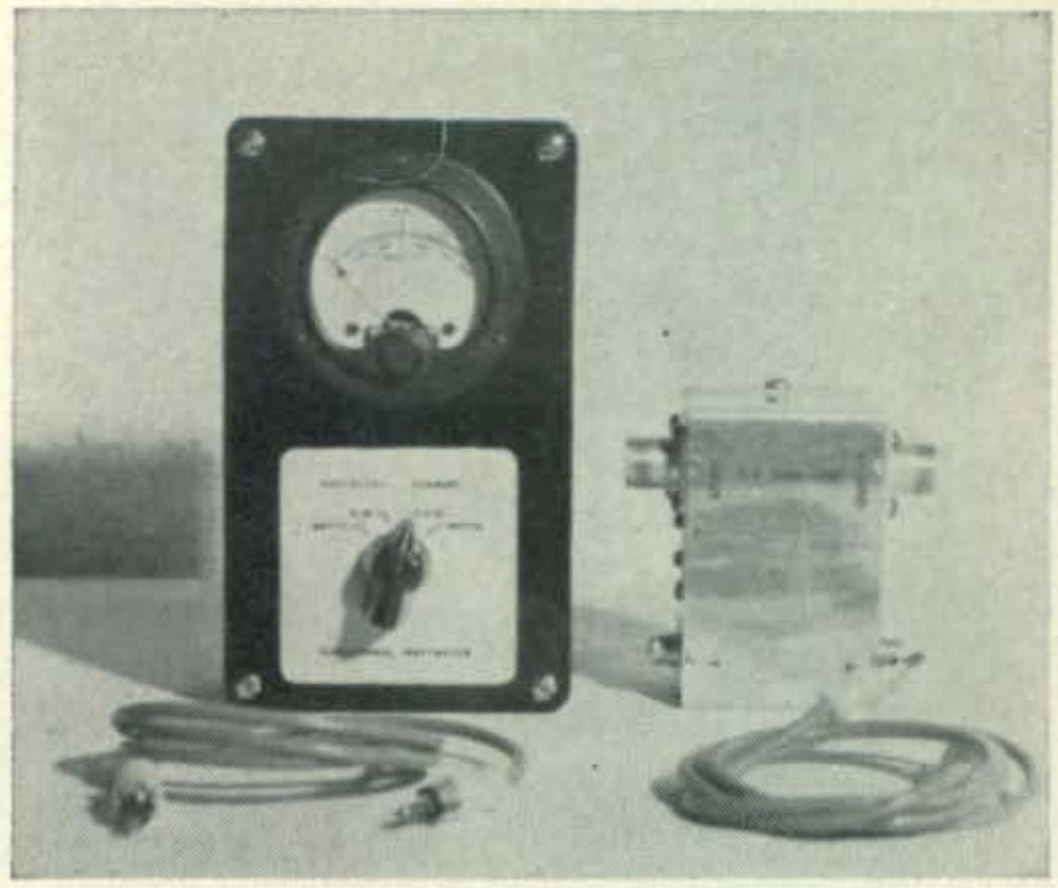
Hon. Ed., that gotta be it. Scratchi are talking to sumbuddy in Flying Sawser! You thinking that a Hon. First in amchoor radio? Or maybe this going on all times and I not knowing about it. Maybe everybuddy QSO'ing Flying Sawsers. Maybe you alreddy having award for WAFS (Worked All Flying Sawsers)?

Don't keeping me in suspense. Answering speshul delivery air male post hasty and letting me in on what's going on.

Don't forgetting to sending three cents you owing me.

Respectively yours,
Hashafisti Scratchi

Fig. 1—Front view of the direct reading wattmeter and reflectometer with their connecting cords.



A DIRECTIONAL WATTMETER

BY H. C. SHERROD,* W5ZG

The standing wave ratio indicator described below is calibrated to read forward and reflected wattages directly and maintains its accuracy over a range of 2 to 30 mc. The total cost of construction with all new parts is twenty dollars, a far cry from the cost of commercial equivalents.

A DIRECT reading, directional wattmeter is a very useful device for measuring radio frequency power in a transmission line and determining the accuracy of impedance matching of a transmission line to its load.

Such a device for use with 52 ohm coaxial lines is shown in fig. 1. This instrument renders very satisfactory service in the 2 to 30 megacycle range and construction cost is approximately twenty dollars.

Standing wave ratio indicators commonly employed effectively indicate the mismatch of transmission line and load impedances. The diagram of a typical device of this type is shown in fig. 2. While there are several variations of this basic circuit, all essentially consist of a reflectometer and a d.c. voltmeter. The reflectometer delivers d.c. voltages which are proportional to the forward and reflected power in the transmission line. The d.c. voltmeter indicates the magnitude of the voltages produced by the forward and reflected power in the transmission line and a switch is provided to selectively determine these values.

All devices of this type have certain common characteristics. One characteristic is that the values indicated are *relative*, not absolute. This is due to the arrangement of the reflectometer which is inherently frequency sensitive. Because the reflectometer is frequency sensitive, a given amount of power in the transmission line will

*4715 Crockett Boulevard, Galveston, Texas 77550.

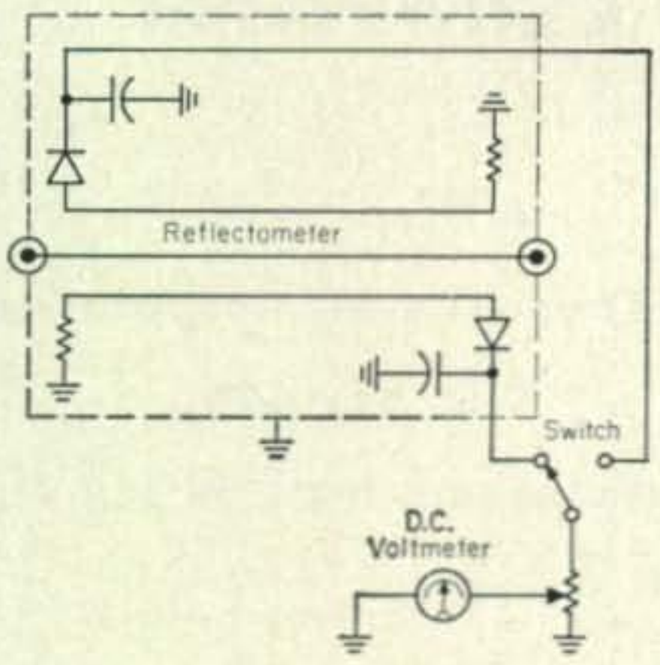


Fig. 2—Circuit of a conventional s.w.r. indicator.

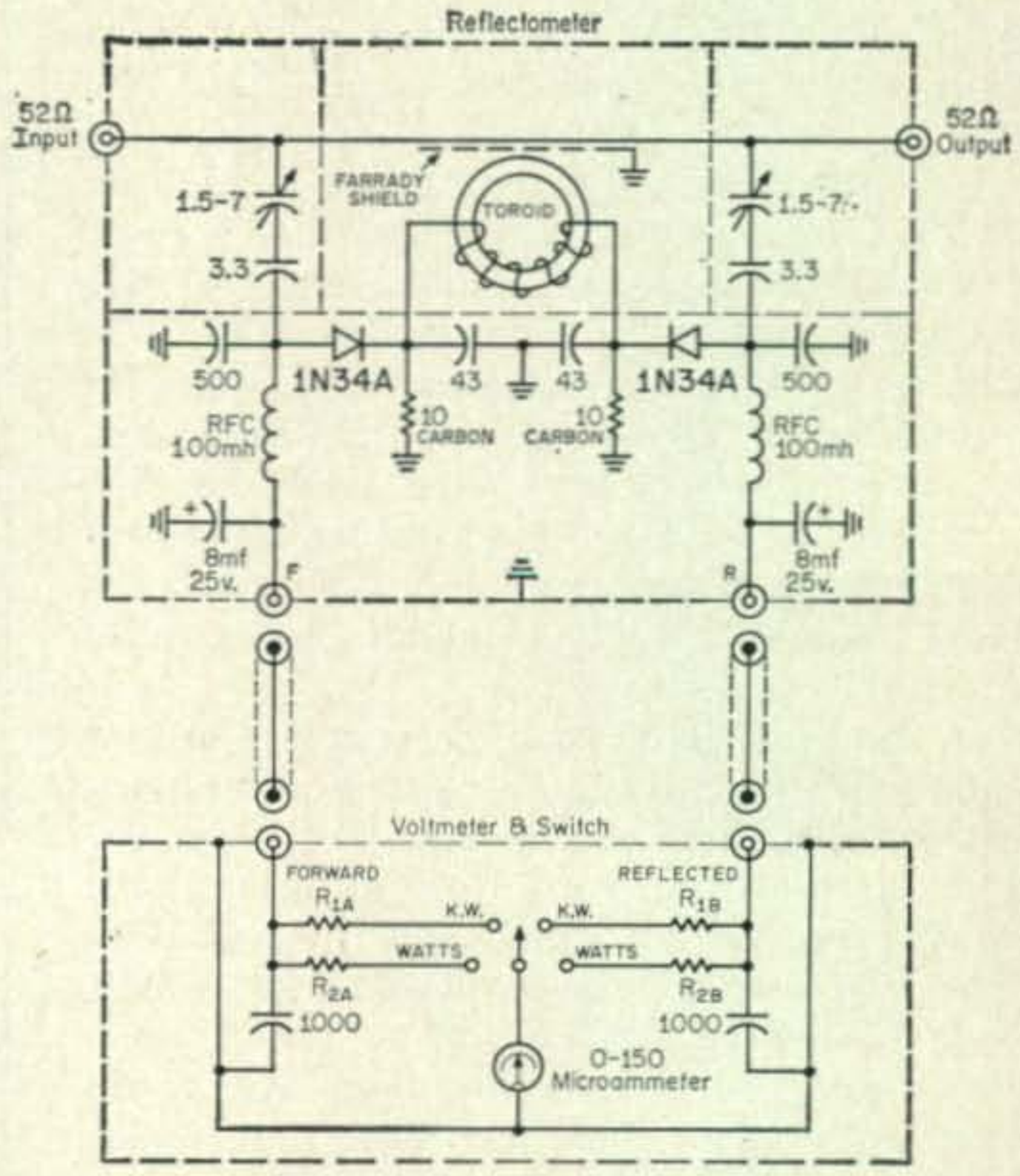


Fig. 3—Circuit of a directional wattmeter. Resistors $R_{1(A)(B)}$ and $R_{2(A)(B)}$ values are discussed in the text. All capacitors are in mmf and all resistors are ½ watt. The two 10 ohm units in the reflectometer must be carbon types

provide a much higher meter reading at 28 megacycles than at 3.5 megacycles. Consequently devices of this general type cannot be calibrated over any appreciable frequency range to indicate the power in the transmission line.

Direct Reading Wattmeter

While there is not presently available a single instrument that will directly indicate power in a transmission line at frequencies between the lower limit of the very low frequencies and the upper limit of the ultra high frequencies, single instruments are commercially available that provide very satisfactory direct indication in the frequency range between 2 and 30 megacycles. However the present cost of these instruments is one factor that restricts their general employment.

Because of the utility of a direct reading wattmeter, and to determine if such an instrument could be built at moderate cost, it was decided to attempt construction of such a device. It was apparent, however, that for calibration of this instrument three items must be available: First, a source of r.f. energy capable of delivering up to two kilowatts in the 3.5, 7.0, 14.0, 21.0, and 28 mc bands. Second, a dummy load capable of dissipating as much as two kilowatts and presenting a 1:1 s.w.r. from 3.5 to 30 megacycles. Third, a commercially calibrated r.f. wattmeter. The availability of these items made it possible to construct and calibrate a directional wattmeter with acceptably accurate indication in the 2 to 30 megacycle region.

The schematic diagram of the directional wattmeter is shown in fig. 3. Like the standing wave ratio indicators previously mentioned, this device also consists of a reflectometer, a d.c. voltmeter, and a switch. In this instrument the basic difference is in the reflectometer which is not frequency sensitive in the 2 to 30 megacycle range.

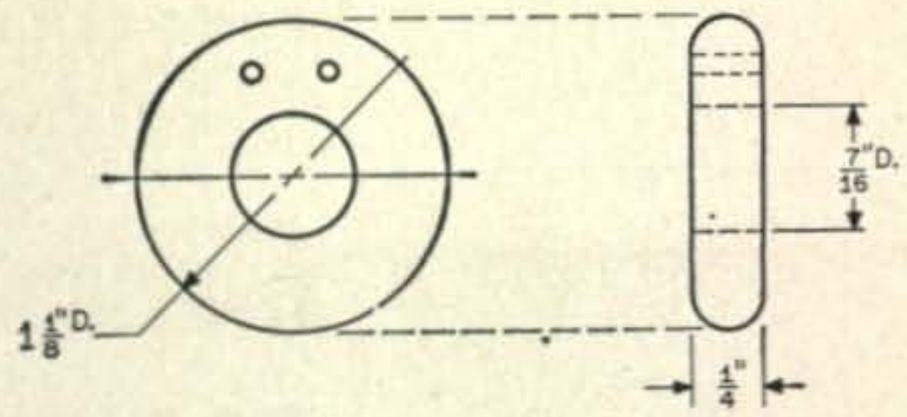


Fig. 4—Dimensions of the toroid core made from ¼" plexiglass or polystyrene. The two holes shown are for the start and finish of the winding. The winding consists of 70 turns of #28 Formvar wire.

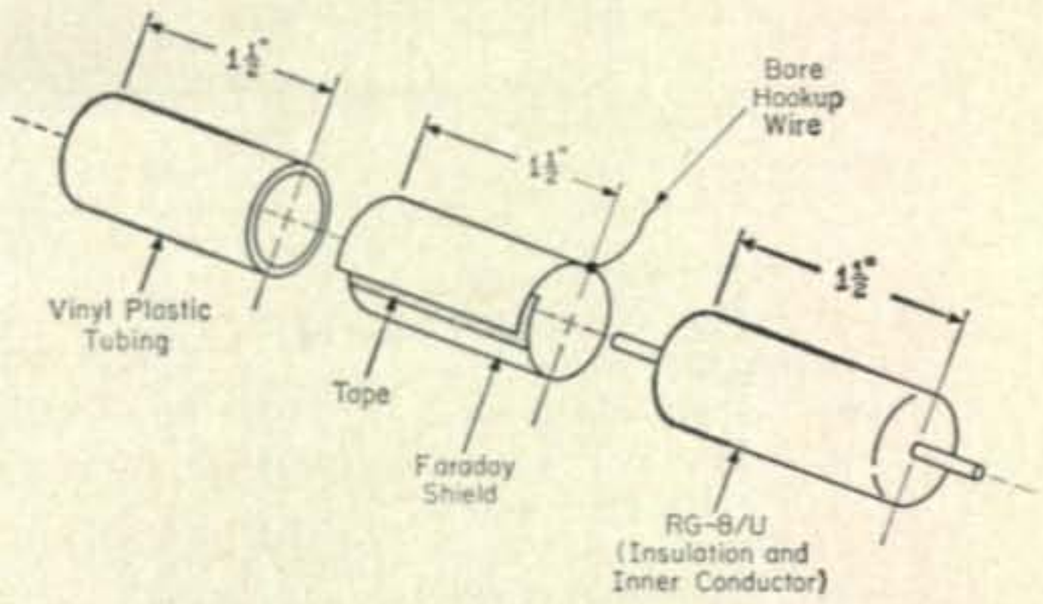


Fig. 5—Details of the Faraday shield assembly. The RG-8/U outer jacket and braid is removed. Thin brass is wrapped around the RG-8/U using tape at the lapp to prevent shorting. A single ground wire is used. A sleeve of 7/16" o.d. vinyl plastic tubing is slipped over the Faraday shield

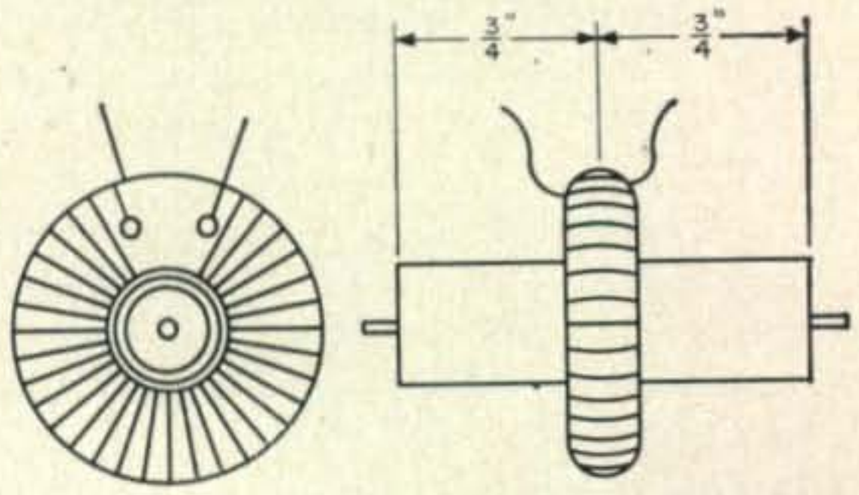


Fig. 6—View of the toroid assembly mounted on the RG-8/U.

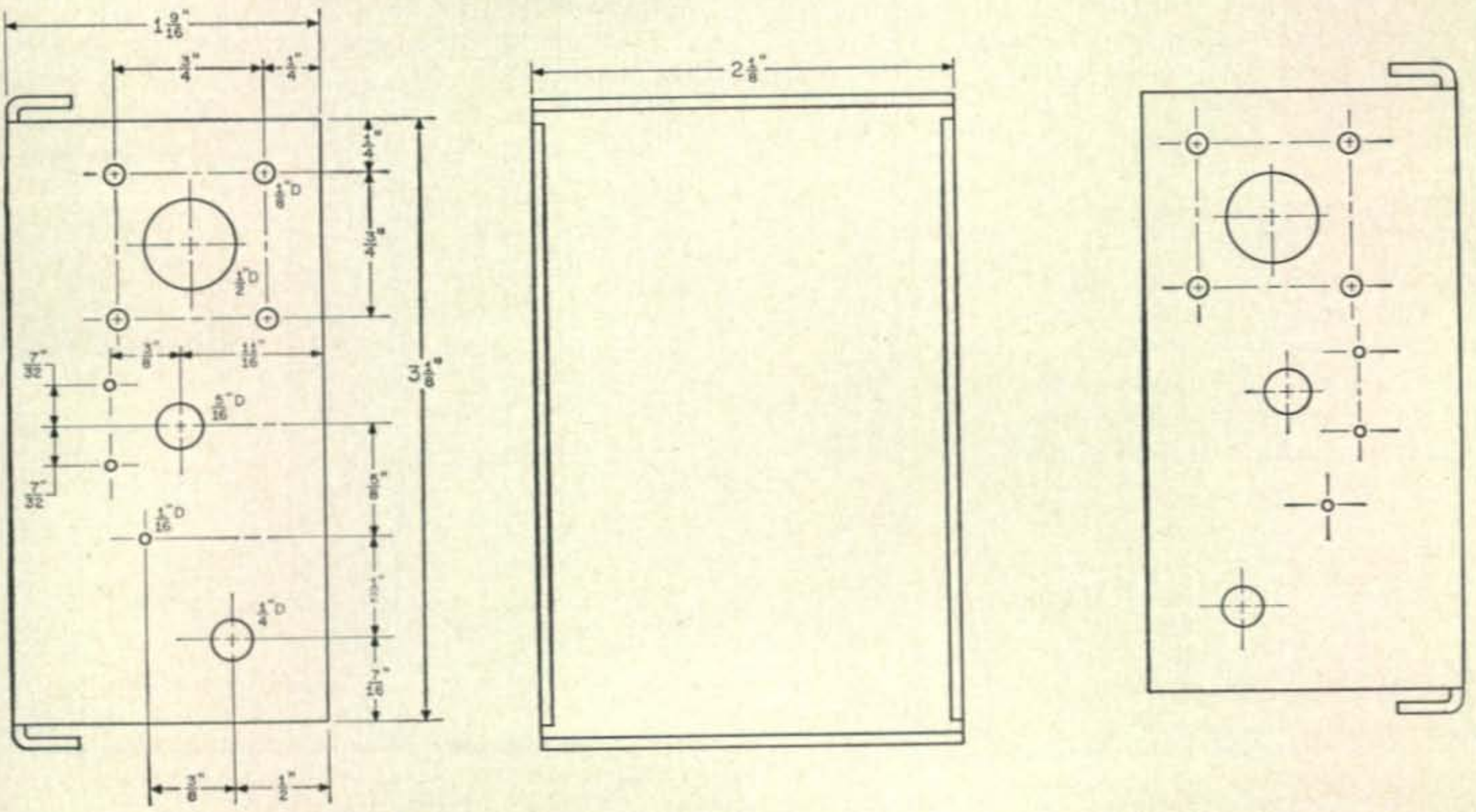


Fig. 7—Reflectometer housing drilling details. The box is an LMB #000.

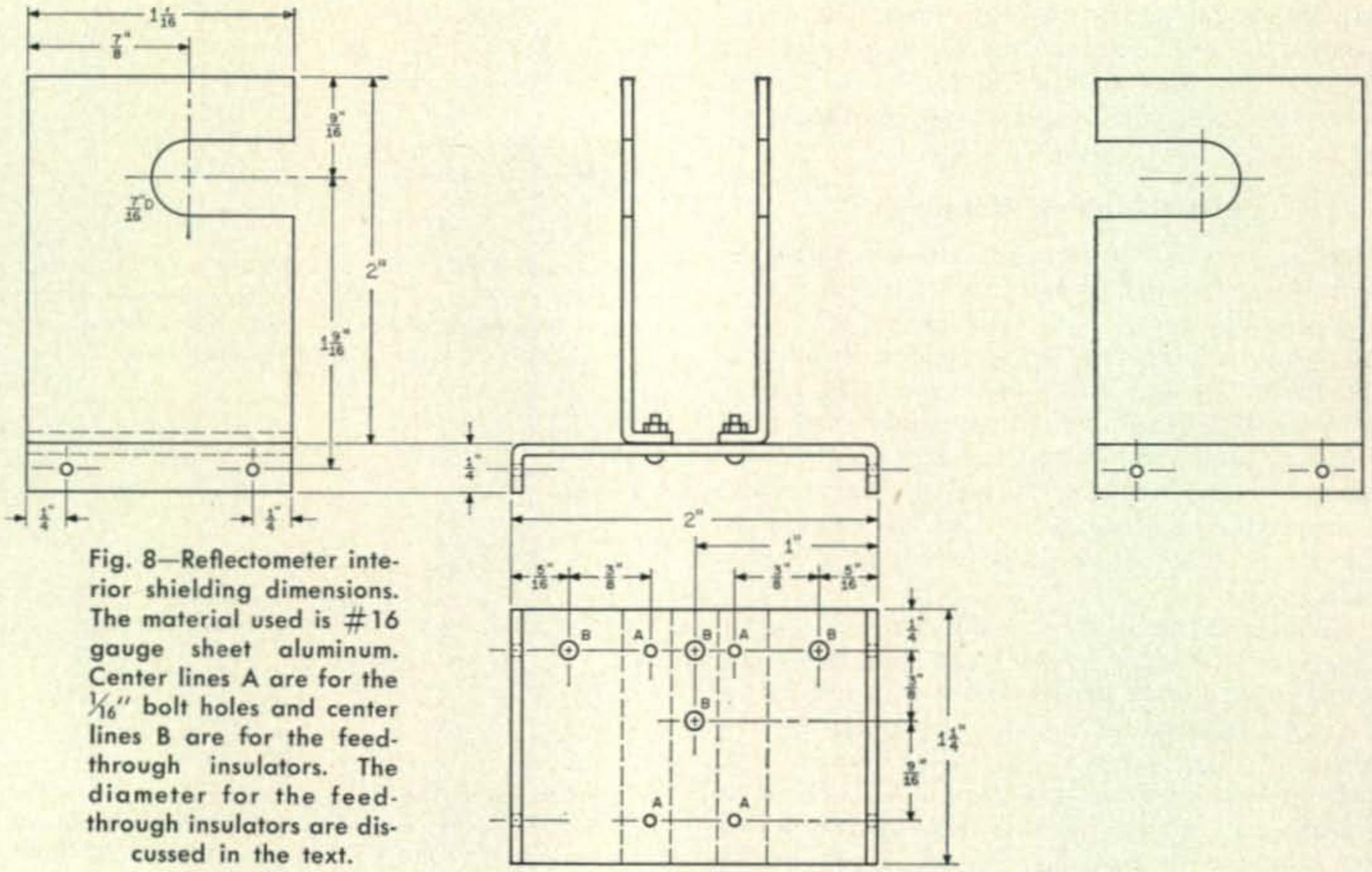


Fig. 8—Reflectometer interior shielding dimensions. The material used is #16 gauge sheet aluminum. Center lines A are for the 1/16" bolt holes and center lines B are for the feedthrough insulators. The diameter for the feedthrough insulators are discussed in the text.

Construction Details

If the subsequently indicated and described construction and adjustments are carefully duplicated, a satisfactory directional wattmeter for use with 52 ohm coaxial lines will result.

In the interest of brevity, only a general description of assembly procedure will be presented as the figures show all necessary detail.

Dimensions of the toroid core are shown in fig. 4. The material is ¼" thick plexiglass or polystyrene. This core can easily be made on a drill press by using a bar cutter.

After completing the core to dimensions shown, make a toroid winding on this core consisting of seventy turns of No. 28 Formvar enameled wire. Provide three inch leads.

Next, make the Faraday shield assembly shown in fig. 5. Carefully insulate the lapped area of the Faraday shield. This is mandatory to prevent the shield from forming a shorted turn. On the Faraday shield a single ground wire is shown. Do *not* ground this shield with more than a *single* conductor. Grounding shall be to the reflectometer housing. The inner portion of the Faraday shield assembly consists of the inner conductor and insulation from a piece of RG-8/U cable. Discard the jacket and copper braid shield.

Wrap the Faraday shield tightly around the inner conductor insulation and slip the vinyl plastic tubing over the Faraday shield. The vinyl tubing provides the necessary insulation between the Faraday shield and the toroid winding.

Slip the wound toroid over the vinyl plastic tubing and center the toroid on the Faraday shield assembly as shown in fig. 6.

The next step is to make the reflectometer. The reflectometer housing is an LMB #000 natural aluminum box 3¼ inches long by 2⅛ inches by 1⅝ inches high. Box drilling details are shown in fig. 7 and details of interior shielding are shown

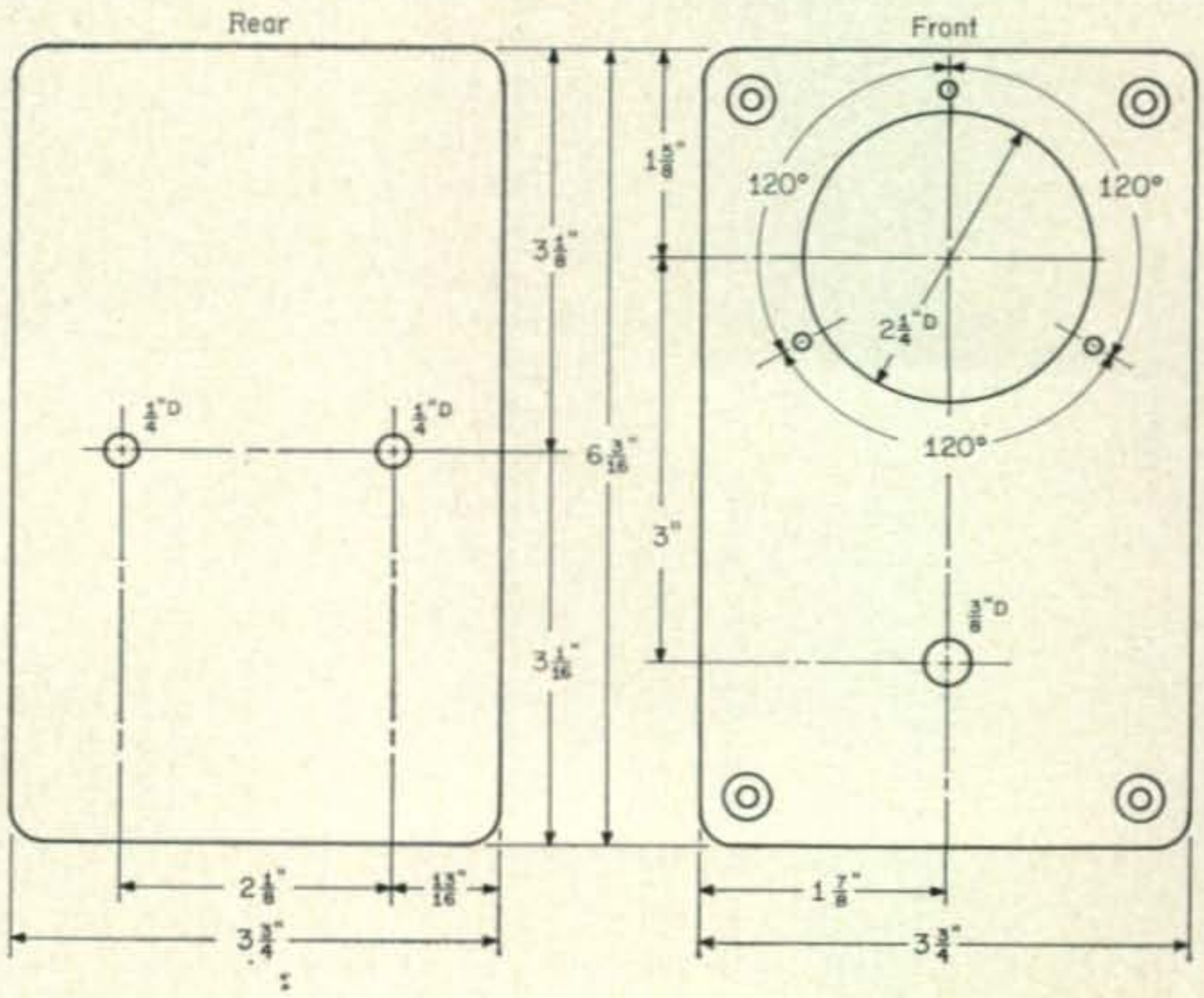


Fig. 9—Voltmeter and switch cabinet drilling details. The cabinet is black polished bakelite made by the Davies Co.

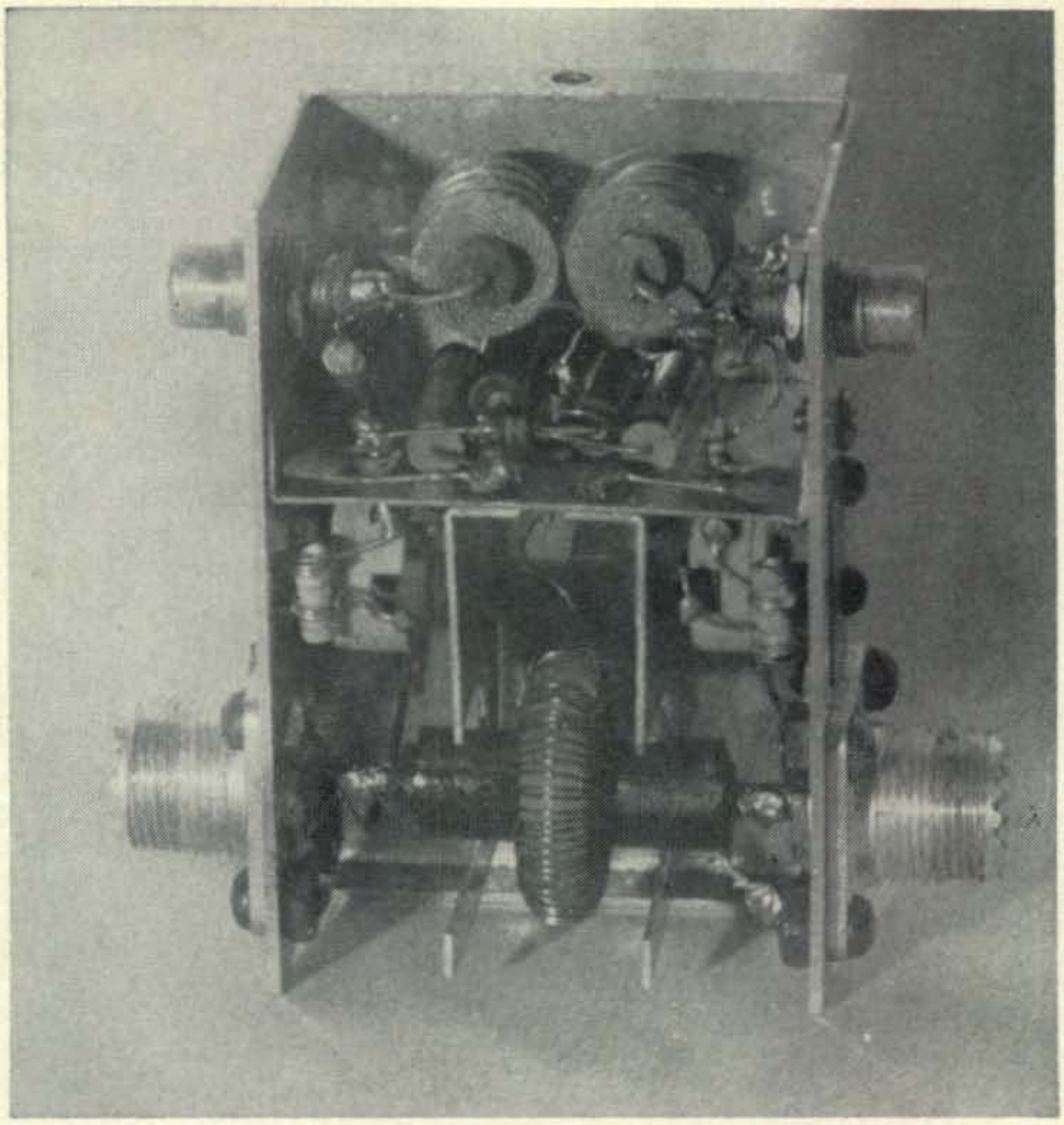


Fig. 10—Interior view of the reflectometer showing the shields and component arrangement.

in fig. 8. In fig. 8 it will be noted that no size is specified for the holes for feedthrough insulators. In the unit constructed these insulators were taken from a piece of surplus equipment. These were of Teflon and were ⅛" in diameter. The size of these holes will be determined by the diameter of the feedthrough insulators employed.

Assemble the shielding and bolt it in the reflectometer box. Use #4 brass bolts and nuts. Either 4-36 or 4-40 will be satisfactory.

Install SO-239 coaxial fittings with 6-32 brass bolts and nuts and install the toroid assembly. Install all components in reflectometer housing and connect as shown in fig. 3. For additional details see figs. 10(A) and 10(B).

Now drill the cabinet as shown in fig. 9. Use sharp tools and cut and drill carefully. The cabinet material is quite hard and may chip.

Mount the parts and connect them as shown by the various figures. Omit resistors $R_{1(A)(B)}$ and $R_{2(A)(B)}$ as shown in fig. 3.

Name plates and the meter scale on the model shown were drawn on white plastic and sprayed with clear Krylon spray. The meter scale may be calibrated from the table shown in fig. 11.

Previously, when assembling the meter cabinet, resistors $R_{1(A)(B)}$ and $R_{2(A)(B)}$ were omitted. Determine the internal resistance of the 0-150 microammeter to be employed. From this value determine the values of R_1 and R_2, shown in fig. 3. The value of R_1 is 14,800 ohms minus the internal resistance of the meter. The value of R_2 is 3,600 ohms minus the internal resistance of the meter. After determining the values for the four resistors, R_1 *and* R_2, *(A)* and *(B)*, solder these in place. These pairs of resistors must be closely matched for accurate indication.

Adjustment

The next step is the adjustment of the two 1.5 to 7 mmf. capacitors shown in fig. 3. Set-ups for these adjustments are shown in fig. 12. In each of these set-ups r.f. forward power in the line, as shown by the commercial wattmeter, should be about 175 to 225 watts.

With the set-up shown by fig. 12(A), adjust the 1.5 to 7.0 mmf capacitor, as indicated, for a null.

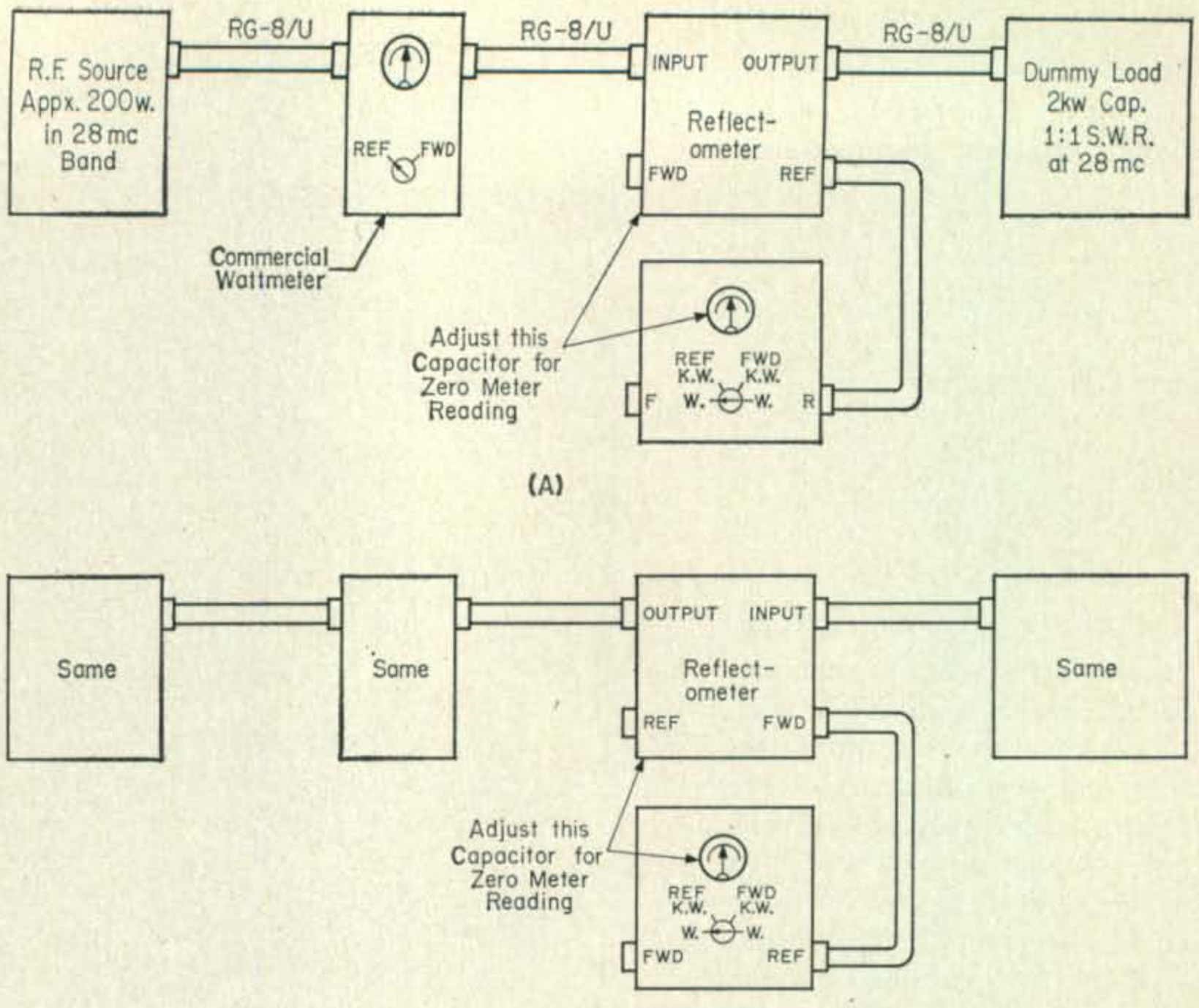
Next, *reverse* the reflectometer as shown by the set-up in fig. 12(B) and adjust the other 1.5 to 7.0 mmf condenser. Be sure to use a non-metallic tool for these adjustments. Next seal the holes through which the adjustment of the capacitors was affected as no further adjustment is necessary.

To check the calibration use the set-up shown

METER μA	WATTS	METER μA	KILO-WATTS
0	0	0	0
16.0	10	30	.1
27.5	20	45	.2
37.5	30	57	.3
46.5	40	67	.4
55.0	50	75	.5
64.0	60	83.5	.6
72.5	70	91.5	.7
80.0	80	97.5	.8
87.5	90	103.0	.9
95.0	100	109.0	1.0
102.0	110	114.5	1.1
108.0	120	119.5	1.2
113.0	130	124.5	1.3
119.0	140	129.5	1.4
125.0	150	134.5	1.5
130.5	160	138.0	1.6
135.5	170	142.0	1.7
141.0	180	145.5	1.8
145.0	190	148.0	1.9
150.0	200	150.0	2.0

Fig. 11—Table showing the calibration of the 150 microampere meter based on values of $R_1 = 14{,}800$ ohms minus the meter resistance and $R_2 = 3{,}600$ ohms minus the meter resistance.

Fig. 12 (A) — Set up for null adjustment of the reflected indication. (B) Set up for the null adjustment of the forward indication requires the reversal of the reflectometer and adjustment of the second capacitor. (C) Set up for meter calibration as described in the text.



in fig. 12(C). If the calibration does not agree with commercial wattmeter, small variations in the value of resistors R_1 and R_2 may be necessary.

If construction and wiring of reflectometer has been carefully done no difficulty should be encountered in obtaining a zero reading on the meter when the 1.5 to 7.0 mmf capacitors are adjusted as shown by figs. 12 (A) (B) and (C). I want to thank K5WYN for supplying the photos for this artticle. ■

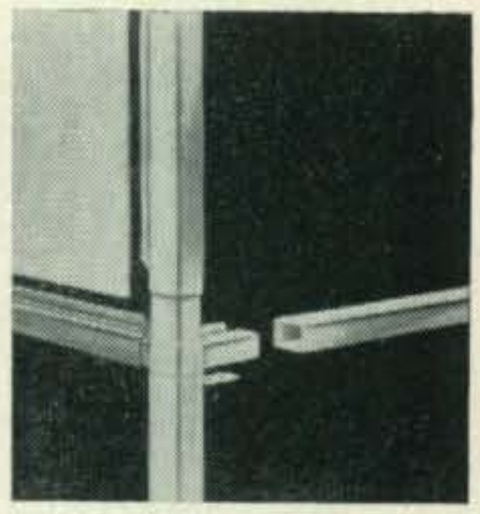
New Amateur Products

McCulloch

A new portable gasoline generator has been announced by the McCulloch Mite-E-Lite Co. The model Mark 5-20 is a 76 lb., 2 kw continuous duty 115 and 230 volt, 60 cycle generator. It has 4 outlets, metered output, switched 115 or 230 v.a.c., and is fully fused. The dimensions are 15" × 14" × 18" and the unit sells for $349.50. For a free catalog write to McCulloch Corp., Wellsville, N.Y., 14895, or circle 66 on page 104.

Amco

Amco is now offering a new system of aluminum tubing and self-locking corners for the amateur interested in designing and building his own enclosures and instrument cabinets. Also available are corner castings and locking clips to assemble any type of unit. For a complete catalog write to Amco Engineering Co., 7333 West Ainslie Street, Chicago, Illinois, 60656, or circle 67 on page 104.



Front view of the FD-30. The two mikes indicate its versatility in fixed or mobile service.

THE FD-30

BY DAVID F. PLANT,* K9LAJ/2

The FD-30 is a 30 watt 6 meter transmitter that was originally built to fill the need for a field-day rig. However, its compact size makes it an ideal unit for mobile service as well. It uses either 6 or 12 volts and all controls are on the front panel. Provision for Hi and Lo impedance mikes and operation from 8 mc crystals also allow the transmitter to be used in fixed station service.

THE FD-30, circuit shown in fig. 1, is quite straightforward using no gimmicks and doesn't require any hard-to-get components.

R.F.

The r.f. section consists of a triode section of a 6AW8A (V_{1A}) in an overtone oscillator configuration using an 8.3 mc crystal to produce a 25 mc output. Silver mica capacitors are used here for improved stability.

The pentode section of the 6AW8A (V_{1B}) is used as a doubler to provide 50 mc output to drive the paralleled 5763's (V_2, V_3). Two 5763's were used rather than a single larger tube so that a full 30 watts could be gotten from a 300 volt supply thus enabling the same plate voltage to be used for the receiver as well. Also, the 5763's are physically smaller than other tubes in the 30 watt class and as it worked out, required no neutralization. The 5763's are driven as straight-through amplifiers and no instability problems are encountered.

The output of the final is link coupled to the antenna and the 50 mmf capacitor in series with the link enables the operator to load a variety of unbalanced (coaxial) antenna systems.

Audio

The final of the FD-30 is plate modulated by a pair of push-pull 6V6GTA's (V_5, V_6). Speech amplification is provided by one half of a 12AX7 (V_4). The other half of the 12AX7 drives the push-pull 6V6's in Class AB.

A d.p.d.t. switch is mounted close to the 12AX7 to provide a choice of high or low impedance input for the microphone thus enabling a crystal or carbon type to be used. Voltage for the carbon mike is supplied by placing it in series with the 12AX7 cathodes.

Switching

A d.p.d.t. relay mounted within the transmitter serves two functions: first, it provides built-in antenna switching; second, it switches the B plus from the transmitter to the receiver, thus enabling the use of one power supply for both transmitter and receiver. If the receiver used has its own power supply the relay contacts can be wired for muting or control of the transmitter plate supply.

The mike push-to-talk switch lead (p.t.t.) is also brought out to the power plug at the rear of the FD-30. This was done so that extra equipment could be switched along with the transmitter.

By using a 6 v.a.c. relay it is possible to operate from 6 or 12 volts, a.c. or d.c. For 12 volt operation a suitable resistor is placed in series with the relay coil. For the relay used in the original, a 10 ohm 5 watt resistor was correct. A little experimentation might be necessary depending upon the relay resistance.

The tube filaments are wired in a series-parallel arrangement so they can be powered by 6 or 12 volts. The various connections are terminated at the male octal power plug on the rear of the chassis to provide automatic switching

*5 Weehawkin St., New York, N.Y. 10014

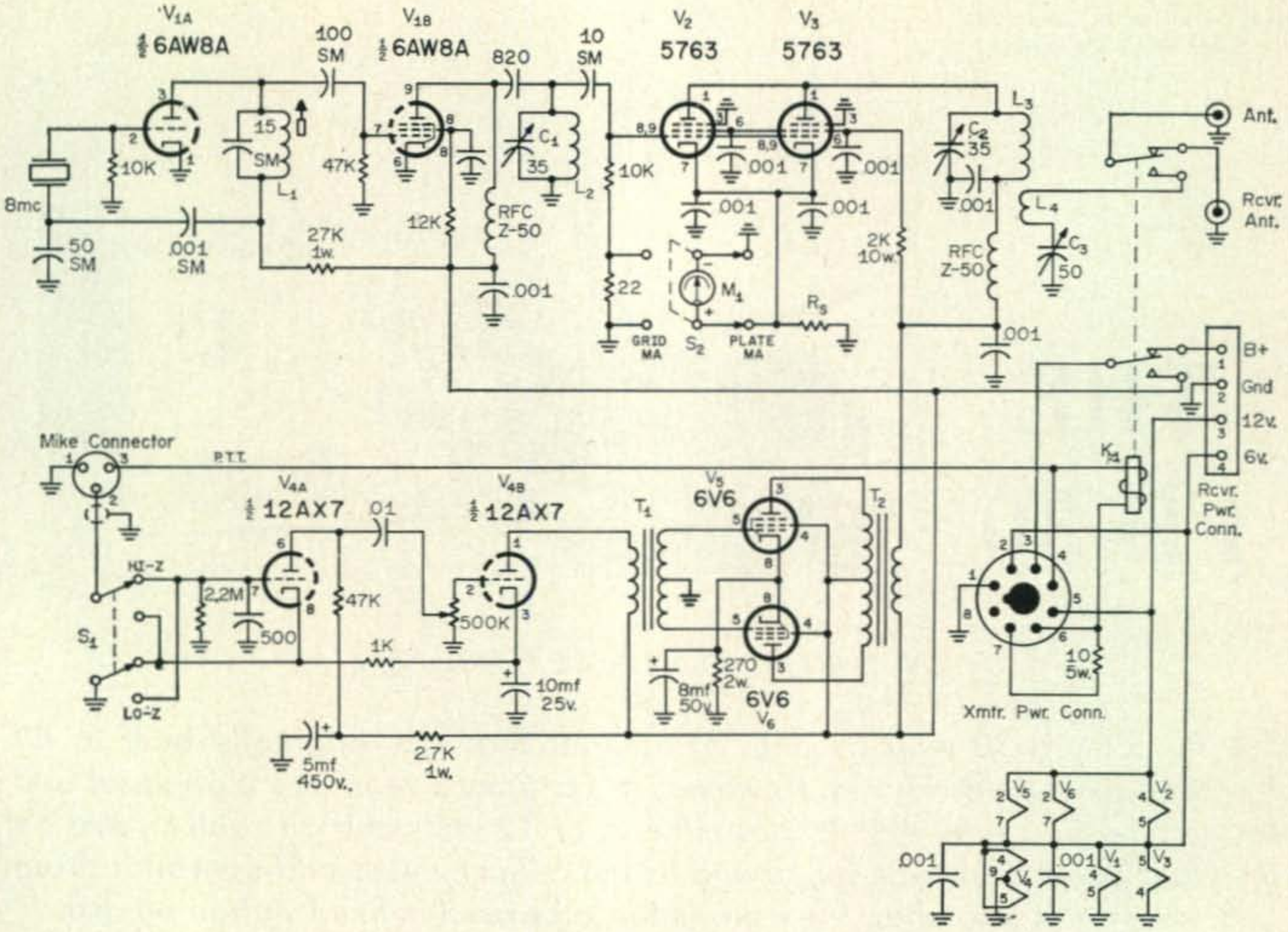
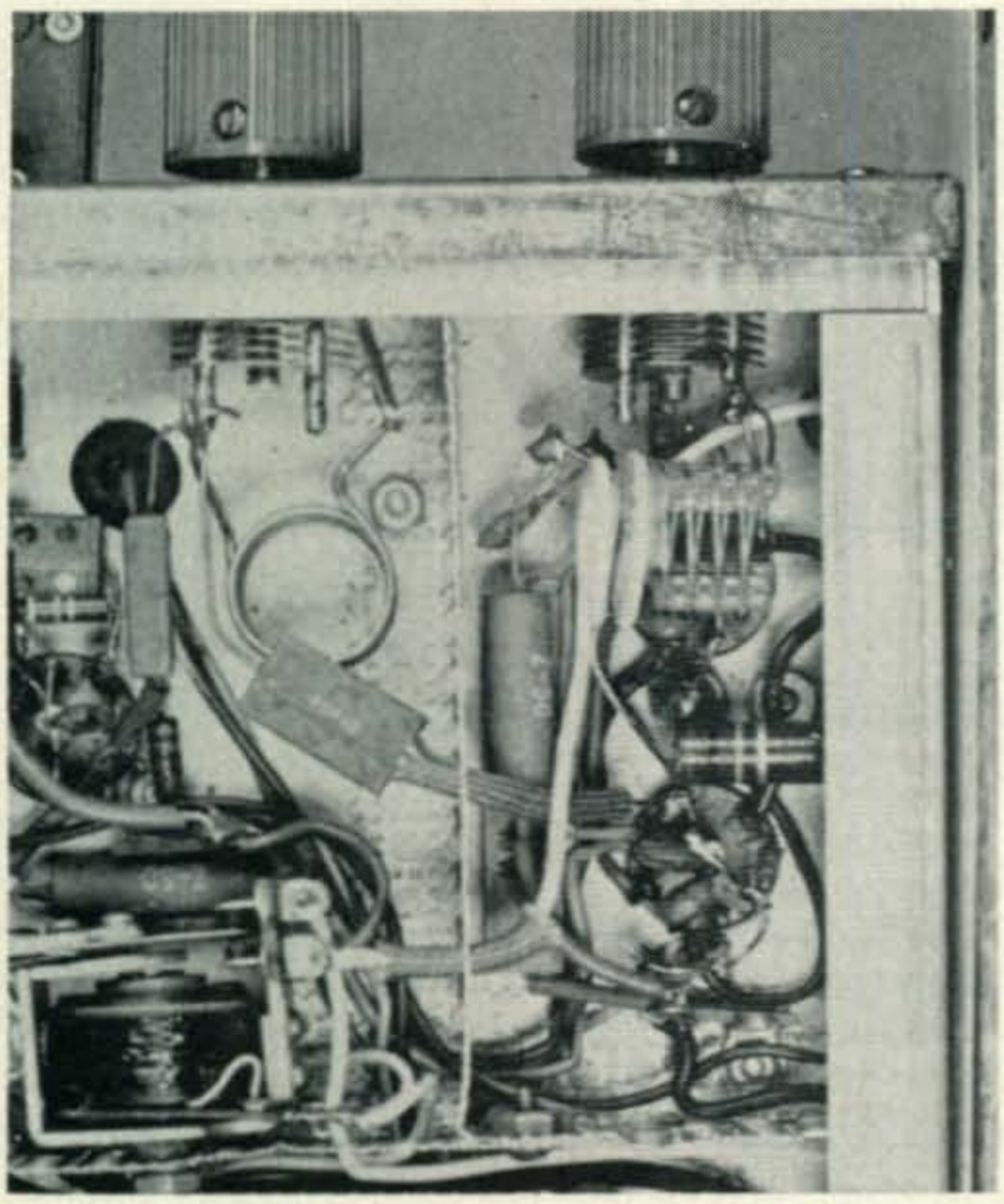


Fig. 1—Circuit of a 6 meter 30 watt input transmitter. All resistors are ½ watt and all capacitors are in mmf unless otherwise noted.

L_1—11 t. #24 c. on a Miller #4400 ⅜" dia. slug-tuned coil form.

L_2, L_3—4t. #18 tinned, ½" long, ¾" dia. B&W 3010, Air Dux 608T, or PIC 1740.



Closeup view of the driver and amplifier. Note the right angle mounting of the driver coil, L_2, to the tank coil, L_3. For best performance the disc bypass capacitors should be wired from the tube socket pins to the center of the socket as shown.

L_4—2t. Hookup wire, ¾" dia. closewound at cold end of L_3.

T_1—10K to 90K c.t. interstage transformer. Triad A-31X.

T_2—10K c.t. to 3K 20w. modulation transformer. Triad M-3X.

controlled by the selection of the proper power cable.

Metering

Metering is provided by an inexpensive imported milliammeter. These units cost about four dollars and work well. A 0-20 ma meter is used, as is, for grid metering and by suitable switching and shunting will read up to 200 ma for plate metering.

The meter originally had a range of 0-200 ma and when the internal shunt was removed the basic range of 0-20 ma was available. The old shunt (R_s) should be wired from the cathodes of the 5763's to ground. If a 0-20 ma meter is available a shunt will have to be calculated or arrived at experimentally and wired in as shown in fig. 1.

Housing

The transmitter is housed in a California Chassis cabinet model LTC-463, measuring 4½" h. × 7 3/16" w. × 9 3/16" d. This enclosure gives excellent mechanical protection and good cooling. The location of the various components can be seen from the illustrations. Basically, the chassis is divided in half with the audio portion to the rear and the r.f. section in

front. This layout allows the short leads so necessary in v.h.f. construction. A shaft extension is used on the audio gain control so that the potentiometer can be mounted in the audio enclosure.

Construction

The first step is to assemble the cabinet. Slide the chassis into the cabinet and secure it with the two screws at the rear of the enclosure. Then fit the front panel, making sure that the side with the lip is at the top. Now drill two small holes through the panel and chassis. These two holes, one lower left and the other lower right, will insure correct panel-chassis alignment.

Now disassemble the cabinet and do the necessary metal work for component mounting on the chassis. When this is completed mount the panel to the chassis with screws through the two previously drilled holes in the panel. Holes can then be drilled for the audio control, oscillator coil, driver capacitor, and final tuning capacitor.

Holes must be drilled along the chassis rear to accommodate the plugs and connectors to be used. For power there is the octal plug and a 4 prong Jones plug for receiver power take-off. For the antenna an SO-239 connector is used with an RCA phone plug for the receiver take-off.

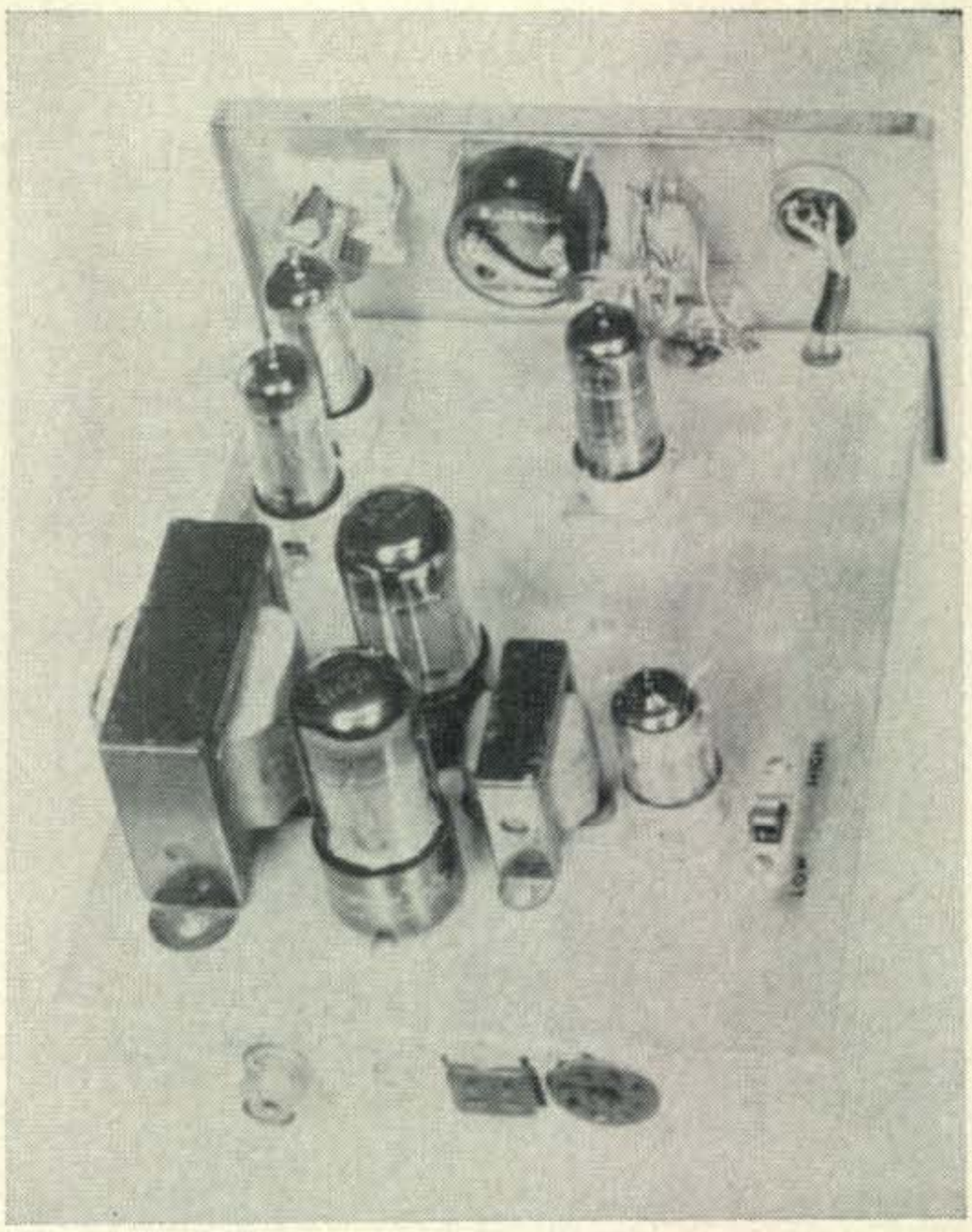
A shield is located across the chassis at the midpoint to keep r.f. energy from getting into the audio section. This shielding is made from a small piece of Reynold's aluminum and provides mounting for the gain control and p.t.t. relay.

Wiring

The filament wiring is completed first so it can be placed close to the chassis and out of the way. Filament wiring can be checked very easily by applying either 6 or 12 volts and visually checking the tubes. Make sure that the filament voltage is applied to the proper power plug pin and that pin 5 is grounded in the case of 6 volt operation, otherwise only half of the filament circuit will get power.

The relay coil should be wired at the same time the filaments are and operation can be checked from 6 and 12 volt sources.

When wiring the r.f. circuitry proper v.h.f. techniques must be observed if dependable performance is expected. All bypasses must go directly to ground with leads as short as possible. All signal wiring must be kept as short as possible. The use of ground lugs, for each stage, is preferred and the center lug of the tube sockets must be grounded. The two cathodes of the 6AW8A are grounded directly and the screws of the 5763's and 6AW8A are bypassed with disc capacitors wired at the tube socket lugs. The cathodes of the 5763's must also be bypassed in the same manner.



Top view showing the component placement. The crystal socket is mounted below the meter switch on the front panel. On the rear chassis apron from l. to r. are the antenna connector, the receiver antenna connector, the power plug for the receiver, and the main power plug.

Oscillator-Driver

The oscillator and driver portions of V_1 are wired next. The crystal socket is mounted on the panel above the chassis and the socket leads pass through a grommet in the chassis for connection to V_{1A}. One crystal lead goes directly through the grommet to pin 2. The two silver micas connect directly to the other crystal lead and the free end of the 0.001 runs through the grommet to the cold end of L_1. The rest of the wiring can be seen from the pictures and the diagram of fig. 1.

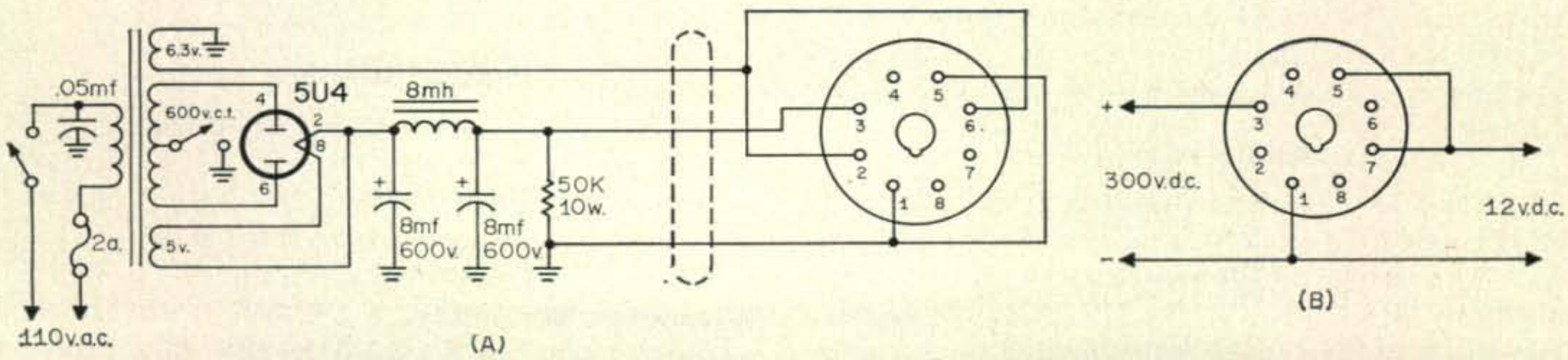
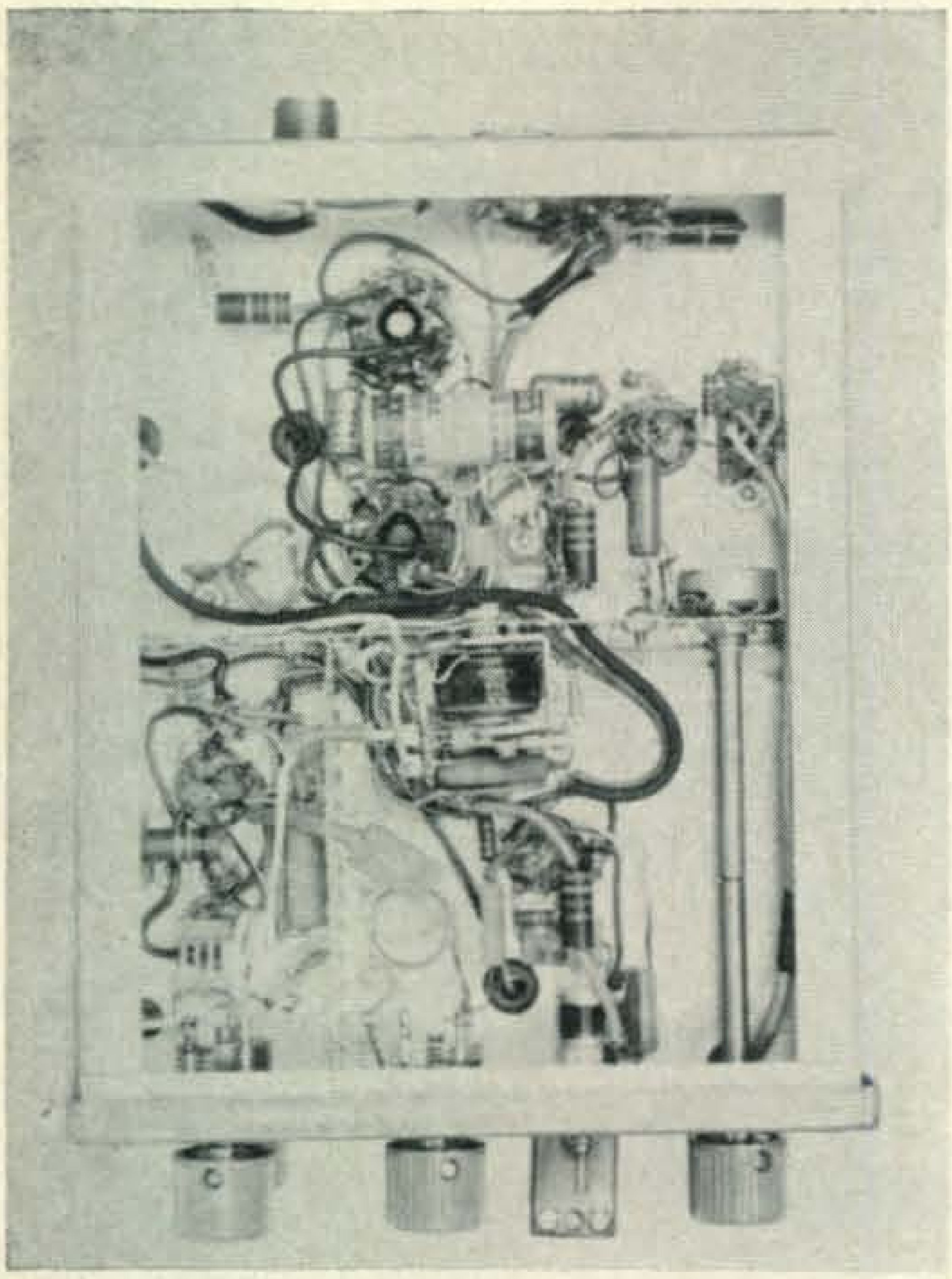


Fig. 2—(A) Circuit of an a.c. power supply suitable for operating the FD-30 6 meter transmitter. (B) Power plug wiring for 12 v.d.c. operation.



The location of the shielding between the audio and r.f. compartment. The shielding between the driver and final amplifier is also shown in this under chassis view of the FD-30.

When V_1 is completely wired, plug in an 8.3 mc crystal and apply power. A small neon bulb or a receiver can be used to indicate oscillation. Adjust the oscillator coil, L_1, for a compromise between maximum 25 mc output and best stability. Remove and reapply the B plus to be sure the crystal starts promptly.

The driver section is aligned by adjusting C_1 for maximum output with the receiver tuned to 50 mc. A neon bulb may also be used but will not indicate doubling.

As you wire the 5763's keep the components close to the sockets as a shield will be placed between the final and the oscillator-driver stage.

After wiring and rechecking the final wiring, connect a dummy load to the antenna connector. A 25 watt light bulb will do but a proper 52 ohm load is superior and will not radiate as much. Turn the loading capacitor C_3 to minimum capacity (plates open).

Now apply B plus to the entire r.f. section (V_1, V_2, V_3) and with the meter switch, S_2, in the GRID position, peak C_1 for maximum grid current, about 7 ma. Then switch S_2 to the PLATE position and rotate C_2 for a dip. Advancing capacitor C_3 should cause the transmitter to load.

Audio Wiring

In the audio section, the only tricky thing is the wiring of the mike *impedance selector* switch (S_1). The wiring on the switch is a little crowded so double check your work. The mike connector J_3 is wired to the switch with shielded mike cable or small diameter coax. Make sure both ends of the shielding are grounded.

The easiest way to test the audio is to modulate the final while using a dummy load. Upward modulation should be observed and the audio will sound crisp and clear when monitored in a 6 meter receiver. If the transmitter overloads the receiver (signal sounds distorted), pull the receiver r.f. tube to reduce the signal level. Also, make sure the mike impedance selector switch in the transmitter is in the proper position for the mike being used.

On the Air

However elaborate the bench testing can be, there is no substitute for on-the-air use to find out how well a rig is working. Connect the station antenna to the rig and load the FD-30 the same way as before. Adjust the AUDIO GAIN control so that the plate current meter just kicks upward slightly when modulating. The rig can be overmodulated, so get an on-the-air signal report.

Antennas

For mobile work one of the factors to consider is polarization. Before investing in a mobile antenna system, talk with the local 6 meter men and see what they are using, as some parts of the country are strictly horizontally polarized while others are vertical. Each type has certain advantages. Vertical whips offer simplicity of installation, look somewhat better, and are generally less expensive than horizontal systems.

The horizontal antenna (such as the halo type) is less susceptible to flutter and ignition noise. This system is also compatible with the majority of fixed stations.

The FD-30 has been used successfully with both systems as well as a 12 element array for field day operation. The capacitor in series with the link provides plenty of flexibility in matching antennas.

Receivers

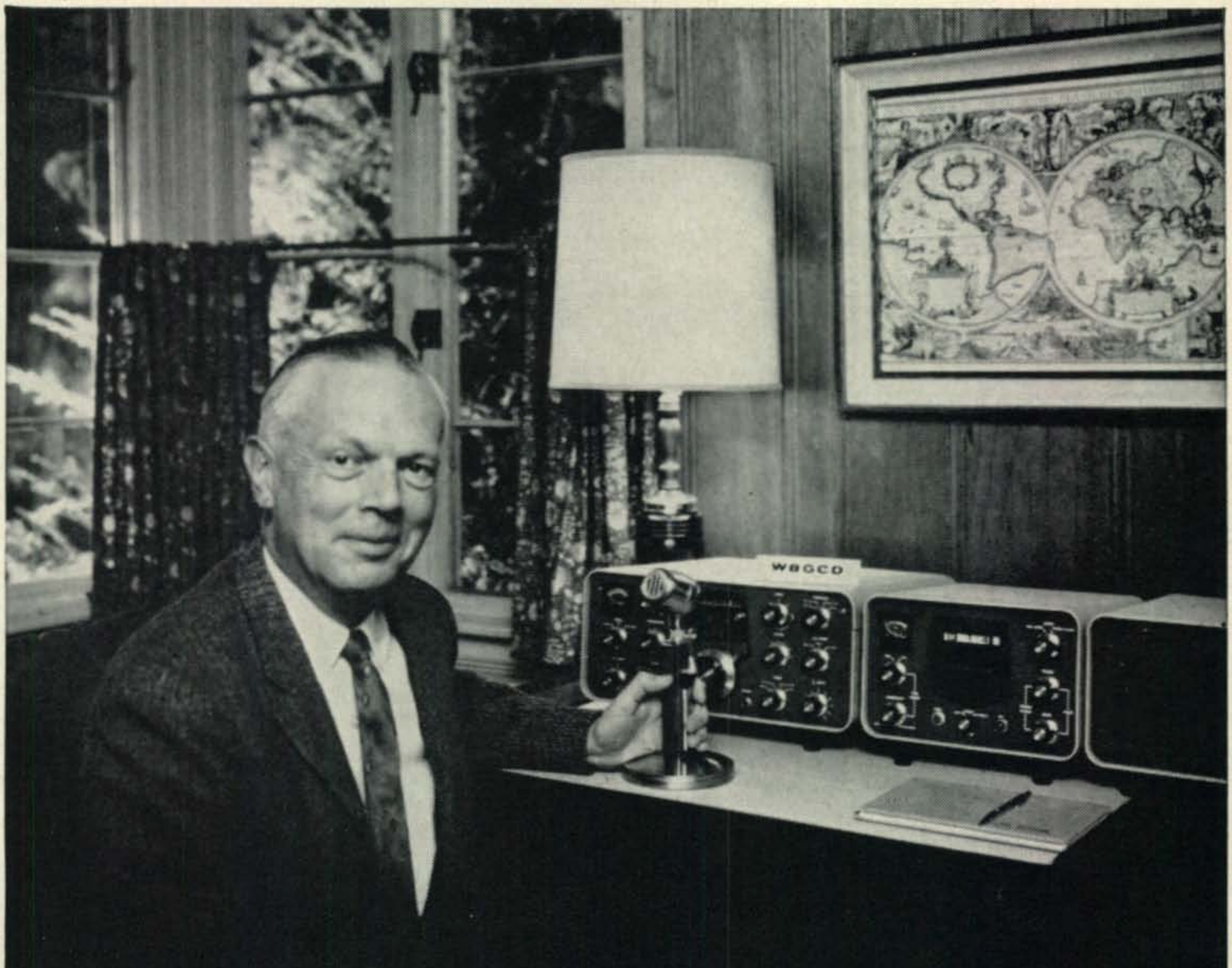
With variety of inexpensive converters on the market, receiving 6 meter signals shouldn't be much of a problem. The internal transmitter switching of B+ will automatically mute the receiver if it uses the same power supply. For mobile use the receiver should have provision for noise clipping in order to take advantage of the range possible with this 30 watt transmitter. Even if your automobile is completely noise suppressed, which is desirable, the other traffic is not, and the noise will blanket weaker signals thus impairing receiver performance considerably.

Power Supply

If you don't already have an a.c. power supply capable of 200 ma at 200 to 300 volts one can be constructed inexpensively by using a power transformer from a discarded TV set.

Figure 2 (A) shows the circuit of an easily built power supply using a TV type transformer. Capacitors C_1 and C_2 can be any value from 4 to 20 mf, whatever is on hand. The filter choke

[*continued on page 92*]



Goodwill towards men
is the essence
of amateur radio

David W. Nurse, W8GCD
President, Heath Company

THE BUTTERWORTH FILTER COOKBOOK

BY DONALD LANCASTER*

Part II

The design concepts of the Butterworth filters were presented in Part I. Presented below are the design techniques and several typical examples.

To design a Butterworth filter, just follow the step by step instructions given in the tables. Table I covers low pass designs, Table II the bandpass types, and Table III covers the high pass designs. The procedure for the low and high pass designs is quite simple. First the problem is specified in terms of load, source, cutoff frequency, and skirt steepness. From fig. 2 or fig. 3, the number of elements is determined. This defines a basic filter circuit which is selected from one of the tables, observing the proper source. This basic filter is then scaled in frequency and impedance by a simple multiplication and division. That is all there is to it.

The bandpass design is a bit more involved, but still quite straightforward. Again the problem is defined in terms of load, source, upper and lower cutoff frequencies, and skirt steepness. The bandwidth and center frequency are then calculated using the formulas given.

The next step may seem strange. After deciding which basic filter is to be used, we in effect form a low pass filter equal to the *bandwidth* and then resonate each element with a new L or C about the center frequency. This is the result of a mathematical technique called the transformation of a complex variable. In this case, we have designed a low pass filter and then *transformed* it into a bandpass one. Scaling impedances then completes the design.

To obtain these tables, we started with the Butterworth polynomial coefficients and realized ladder networks designed for a given number of elements and a specific type of source. We then normalized the results to one cycle per second filters with a one ohm load that perform as per figs. 2 and 3. The details of all this are in any good synthesis book. Fortunately, this need only be done once; the results in the tables are all that is needed for any practical design.

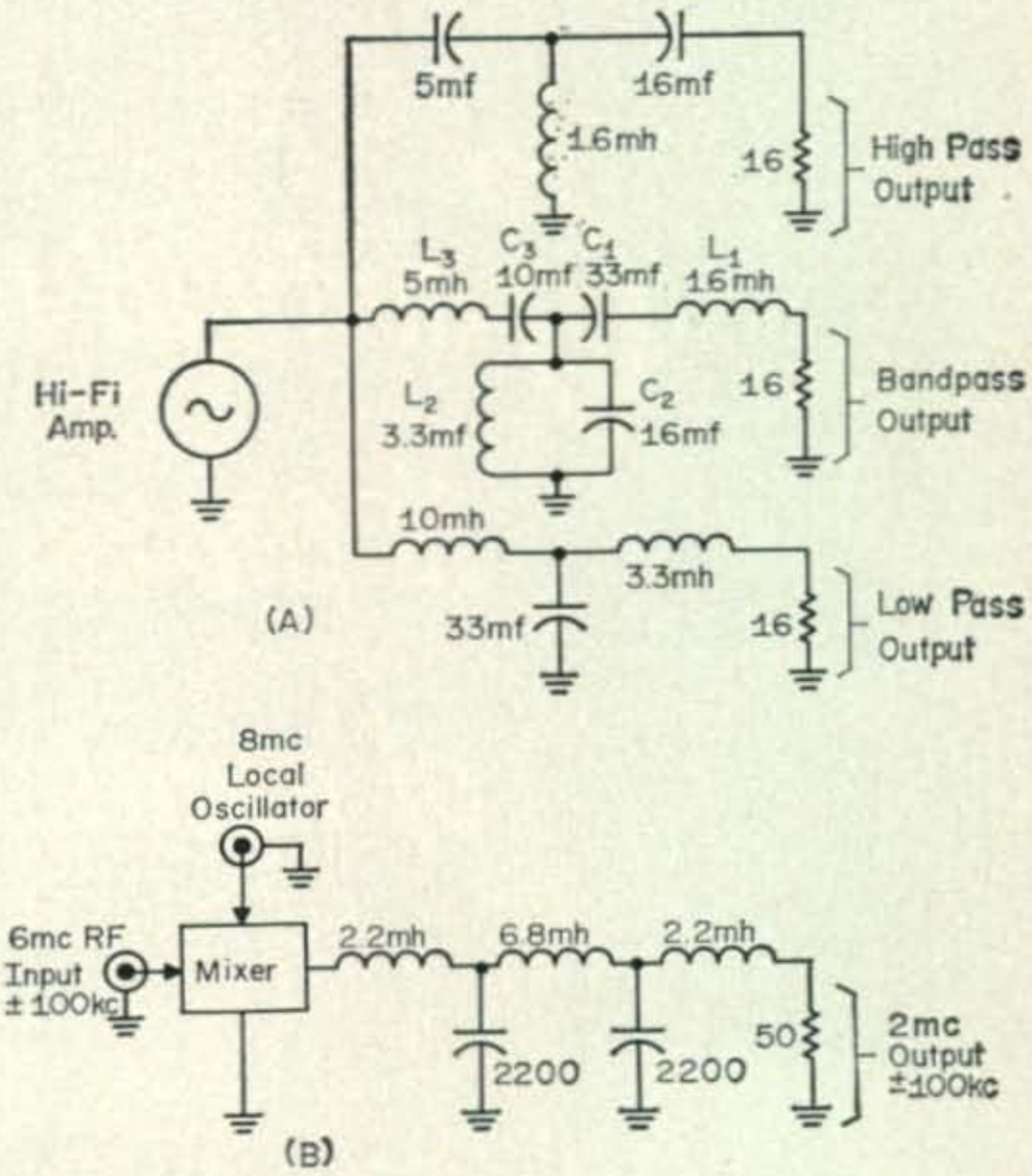


Fig. 6—Circuits and component values arrived at for the two problems illustrated in the text. Circuit (A), the audio crossover network and (B) the mixer output filter component values have been rounded off to available stockroom values.

*4229 North 23rd Avenue, Phoenix, Arizona 85015.

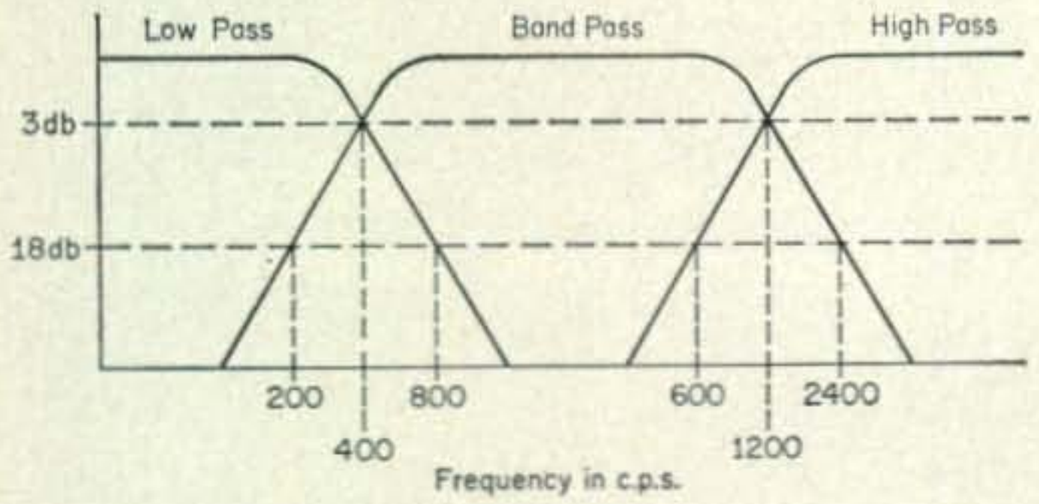


Fig. 5—Required curves for the audio crossover network design discussed in Problem #1.

Examples

Problem #1—An audio crossover network is to consist of a low pass, a bandpass, and a high pass filter with 3 decibel crossover frequencies of 400 and 1200 c.p.s. Each filter is to have at least 18 decibels of loss one octave beyond its cutoff frequency (both cutoff frequencies for the bandpass), and operate into a 16 ohm load when driven from a hi-fi amplifier with high damping. (See fig. 5.) Design the filters.

Low Pass Design—All filters will be the voltage source type. The low pass filter is to be a 16 ohm, voltage source driven type at 400 c.p.s. Looking at fig. 2 and $F = 2\ F_c$ (one octave above cutoff) we see that $n = 3$ will have 18.1 decibels of loss, meeting the attenuation requirement. We then remove basic filter #3 from Table I since it is a voltage source driven, $n = 3$, low pass filter. The inductors are scaled by dividing them by the cutoff frequency and multiplying them by the load resistance, or:

$$L_1 = 0.0795\ h \cdot \frac{16}{400} = 0.00318\ h \approx 3.3\ mh.$$

$$L_2 = 0.238\ h \cdot \frac{16}{400} = 0.00952\ h \approx 10\ mh.$$

Similarly, to scale C_1, we divide by both the frequency and the load impedance:

$$C_1 = \frac{0.212\ farads}{400 \cdot 16} = 0.000033.2\ farads \approx 33\ mf.$$

High Pass Design—This is largely similar to the low pass design except the cutoff frequency is 1200 c.p.s. Entering fig. 3 at $F = 0.5\ F_c$ (one octave below cutoff), we again see then $n = 3$ gives 18.1 decibels of loss. We might have anticipated this from the similarity of the filters and their skirt requirements. Basic filter #23, an $n = 3$ voltage source, high pass type, is removed from Table III. The elements are then scaled in frequency and impedance:

$$C_1 = \frac{0.318\ farads}{1200 \cdot 16} = 0.0000165\ farads \approx 16\ mf.$$

$$C_2 = \frac{0.106\ farads}{1200 \cdot 16} = 0.0000055\ farads \approx 5\ mf.$$

$$L_1 = \frac{0.119\ h \cdot 16}{1200} = 0.00158\ h \approx 1.6\ mh.$$

Band Pass Design—As directed in Step 1 of Table II, we can specify the following:

A—Load resistance: 16 ohms.

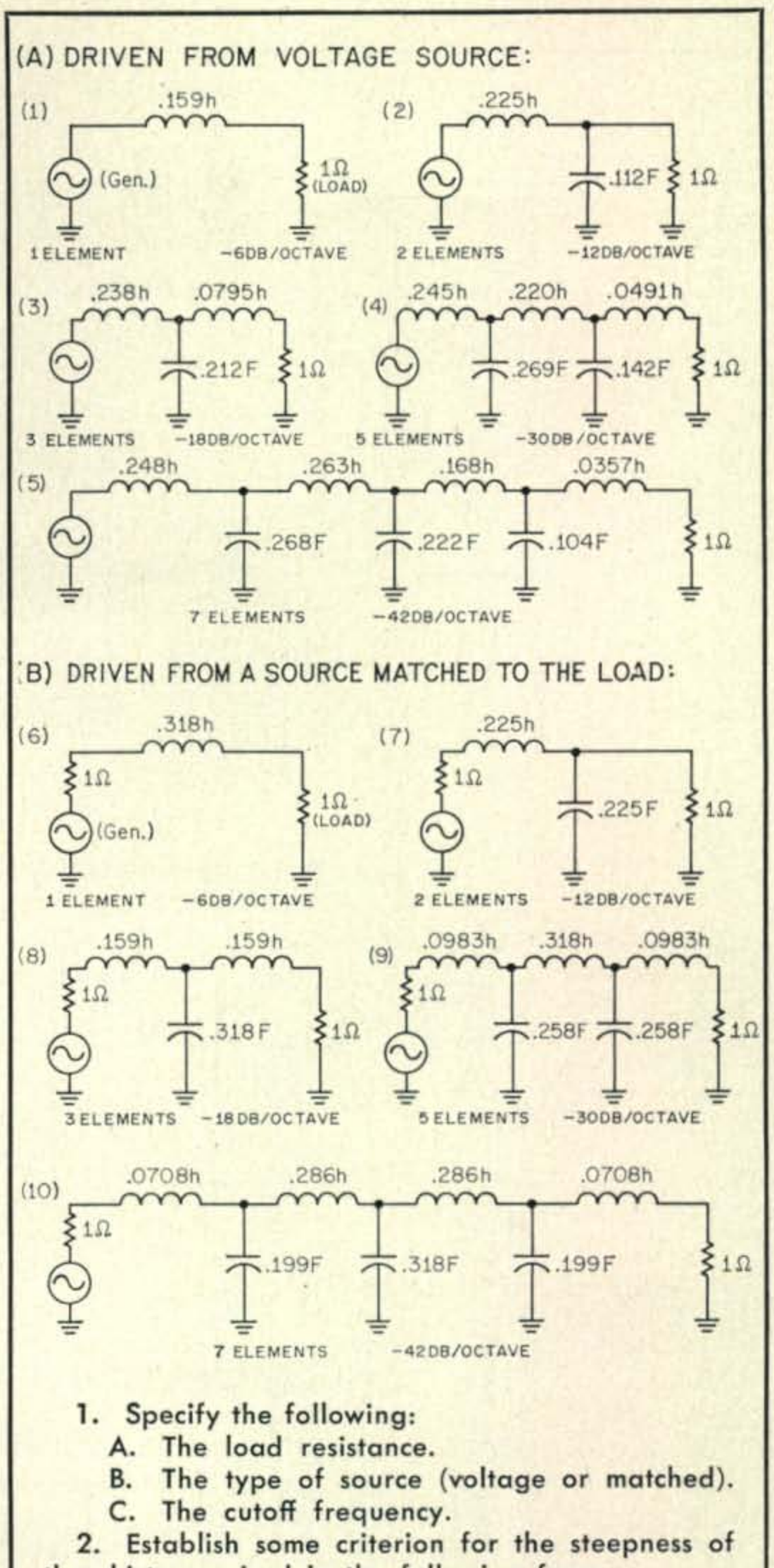
B—Type of source: voltage.

C—Upper and lower cutoff frequencies: 400 and 1200 c.p.s.

Step 2 indicates the calculation of the bandwidth and center frequency.

$$\Delta F = F_h - F_l = 1200 - 400 = 800 \text{ c.p.s.}$$

$$F_{cn} = \sqrt{F_h \cdot F_l} = \sqrt{1200 \cdot 400} = 695 \text{ c.p.s.}$$



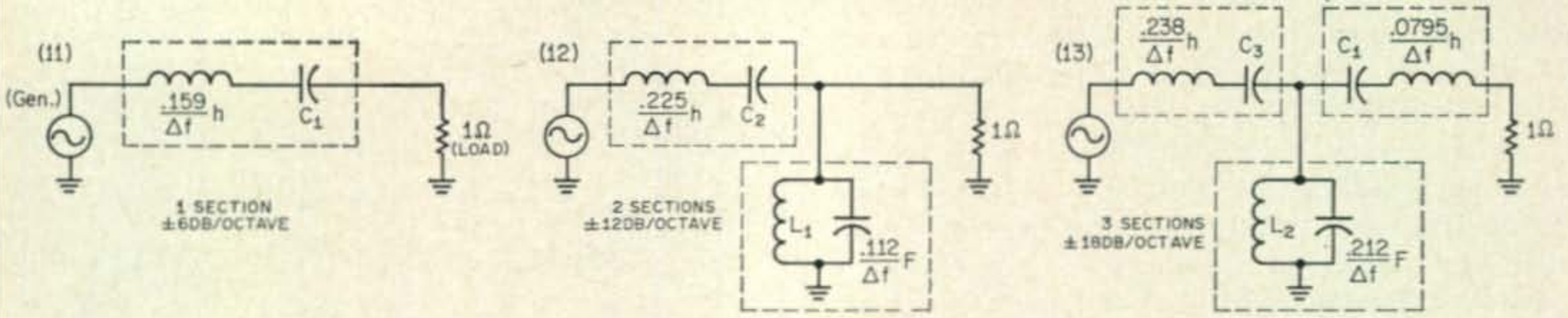
1. Specify the following:
   A. The load resistance.
   B. The type of source (voltage or matched).
   C. The cutoff frequency.
2. Establish some criterion for the steepness of the skirts required in the following form:
   The signal must be "X" decibels attenuated at a frequency of "Y" times the cutoff frequency.
3. From fig. 3, find the required number of elements. If the result lies between the curves, choose the higher number of elements.
4. From Table I, remove the basic filter having the right number of elements and the proper type of source.
5. *Multiply* each *R* and *L* by the load resistance. *Divide* each C by the load resistance.
6. *Divide* each new *L* and C by the cutoff frequency.

The design is now complete.

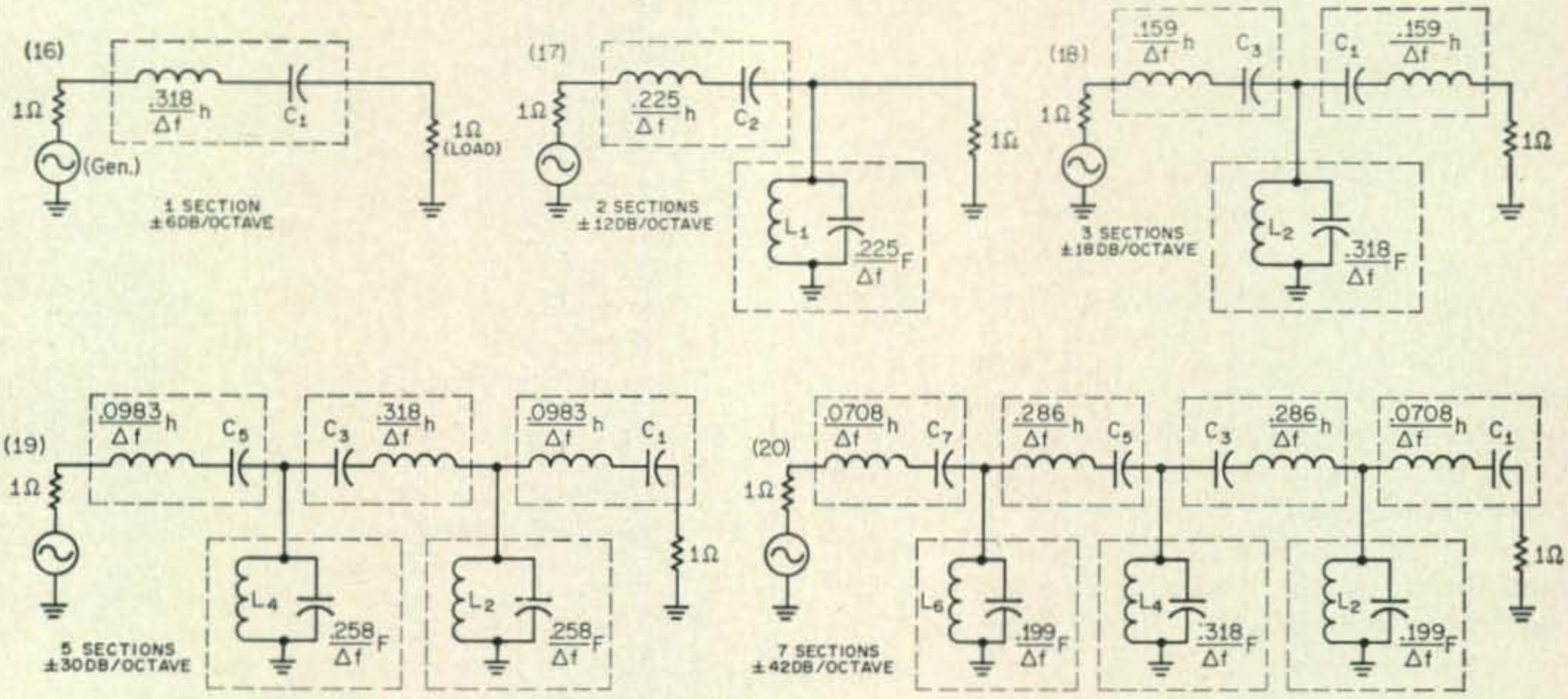
Table I—Basic circuits and the procedure for designing low pass filters.

Step 3 requires the determination of the steepness of the skirts. To determine the skirt steepness of the bandpass filter the low pass curves of fig. 2 are used. However, these curves must be reexpressed as so many *bandwiths* above cutoff. Since cutoff occurs at F_c, one bandwidth *above*

(A) BASIC BANDPASS VOLTAGE SOURCE FILTERS:



(B) BASIC BANDPASS MATCHED SOURCE FILTERS:



1. Specify the following:
   A. The load resistance.
   B. The type of source (voltage or matched).
   C. The upper and lower cutoff frequencies.
2. Calculate the bandwidth and center frequency by

$$\Delta F = F_h - F_l$$

$$F_{cn} = \sqrt{F_h \cdot F_l}$$

3. Establish some criterion for the steepness of the skirts required in the following form:
   The signal must be "X" decibels attenuated at a frequency of "Y" *bandwiths above* the upper cutoff frequency.
4. From fig. 2 find the number of sections required for the filter. (Note that 2 bandwidths above the cutoff frequency occurs at $F = 3F_c$, etc. If the lower skirt is of interest, use geometrical symmetry to see what the upper skirt must do to satisfy the lower. Any two frequencies X and Y will have the same attenuation if $XY = F^2_{cn}$.)
5. From Table II, remove the basic filter with the proper source and the right number of sections.
6. Each box in the basic filter will have one inductor or capacitor value that is to be divided by the bandwidth. Perform this division.
7. Find the inductor or capacitor required to resonate each box at F_{cn}. Use a resonance nomogram or the formula:

$$LC = \frac{0.0253}{F_{cn}^2}$$

8. *Multiply* each R and L by the load resistance. *Divide* each C by the load resistance.
   The design is now complete.

Table II—Basic circuits and the procedure for designing a band pass filter.

cutoff would be at $2F_c$; two bandwidths above cutoff would be at $3F_c$, etc.

For the problem at hand the bandpass cutoff frequency is 1200 c.p.s. and the —18 db point must be one octave up or 2400 c.p.s. Thus, the number of bandwidths is equal to:

$$\frac{2F_h - F_h}{\Delta F} = \frac{2400 - 1200}{800} = 1.5$$

As previously explained, 1.5 bandwidths above F_c occurs at $F = 2.5\ F_{cn}$ in fig. 2.

At this point, $n = 2$ will have 15.8 decibels loss, 2.2 shy of the required 18, while $n = 3$ will have a more than adequate 24 decibels. We might be tempted to "cheat" on the skirt requirements to save two parts, but if the problem is to be satisfied as stated, $n = 3$ must be used. We chose basic filter #13 in Table II. Dividing each L or C by the bandwith gives:

$$L_1 = \frac{0.0795\ h}{800} = 0.0000991\ h = 0.0991\ mh.$$

$$L_3 = \frac{0.238\ h}{800} = 0.000297\ h = 0.297\ mh.$$

$$C_2 = \frac{0.212}{800} = 0.000266\ f = 266\ mf.$$

Each of these sections must resonate at F_{cn} which, for this problem, is 695 c.p.s. As directed in step 7 of Table II, the value of the component required to bring the section to resonance is determined by:

$$LC = \frac{0.0253}{F_{cn}^2} = \frac{0.0253}{483{,}000}$$

$$LC = 0.0524 \times 10^{-6}$$

We substitute in this equation to get C_1, L_2 and C_3 in terms of L_1, C_2 and L_3, respectively. The results are:

$$C_1 = \frac{0.0524 \times 10^{-6}}{L_1}$$

$$= \frac{0.0524 \times 10^{-6}}{0.0991 \times 10^{-3}}$$

$$= 529\ mf.$$

$$L_2 = \frac{0.0524 \times 10^{-6}}{C_2}$$

$$= \frac{0.0524 \times 10^{-6}}{266 \times 10^{-6}}$$

$$= 0.197\ mh.$$

$$C_3 = \frac{0.0524 \times 10^{-6}}{L_3}$$

$$= \frac{0.0524 \times 10^{-6}}{0.297 \times 10^{-3}}$$

$$= 176\ mf$$

All six elements are then impedance scaled by multiplying the inductors by 16 and dividing the capacitors by 16. The results, rounded off to stock room values, are shown in fig. 6.

Problem #2—A 50 ohm r.f. mixer is to produce a 2 mc output signal with a local oscillator frequency of 8 mc and an input signal of 6 mc having a 200 kc bandwidth. Design a filter that attenuates input, local oscillator, and the sum frequency by a minimum of 30 decibels, but passes the difference signal with less than one decibel of loss.

Solution—A single matched source low pass filter will do the job. Since the Butterworth low pass attenuation increases with increasing frequency, only the lowest frequency to be blocked need be considered, for all others will have higher attenuation. The lowest blocked frequency has to be 5.9 mc (6 mc—half the 200 kc bandwidth). The highest pass frequency has to be 2.1 mc (2 mc + half the 200 kc bandwidth). We cannot use a cutoff frequency of 2.1 mc, since the response will be down *three* decibels at this point, and only one decibel is allowed. Let us try a 2.4 mc cutoff frequency. The pass signal *as a fraction of the cutoff frequency* will be $2.1/2.4 = 0.88\ F_c$. The lowest frequency signal to be blocked *as a fraction of the cutoff frequency* will be $5.9/2.4 = 2.46\ F_c$. Consulting fig. 2, we see that $n = 5$ will have slightly over 30 decibels of attenuation at $2.46\ F_c$ and only 0.9 decibels of loss at $0.88\ F_c$, meeting both pass and stop requirements. We enter Table I for a matched source $n = 5$ filter, or basic filter #9. The L and C values are scaled to F_c # 2.4 mc, and the impedance is scaled to 50 ohms, just like the previous low pass design. The figures are shown below.

$$L_1 = L_3 = \frac{0.0983 \cdot 50}{2.4 \times 10^6}$$

$$= 2.05\ \mu h.$$

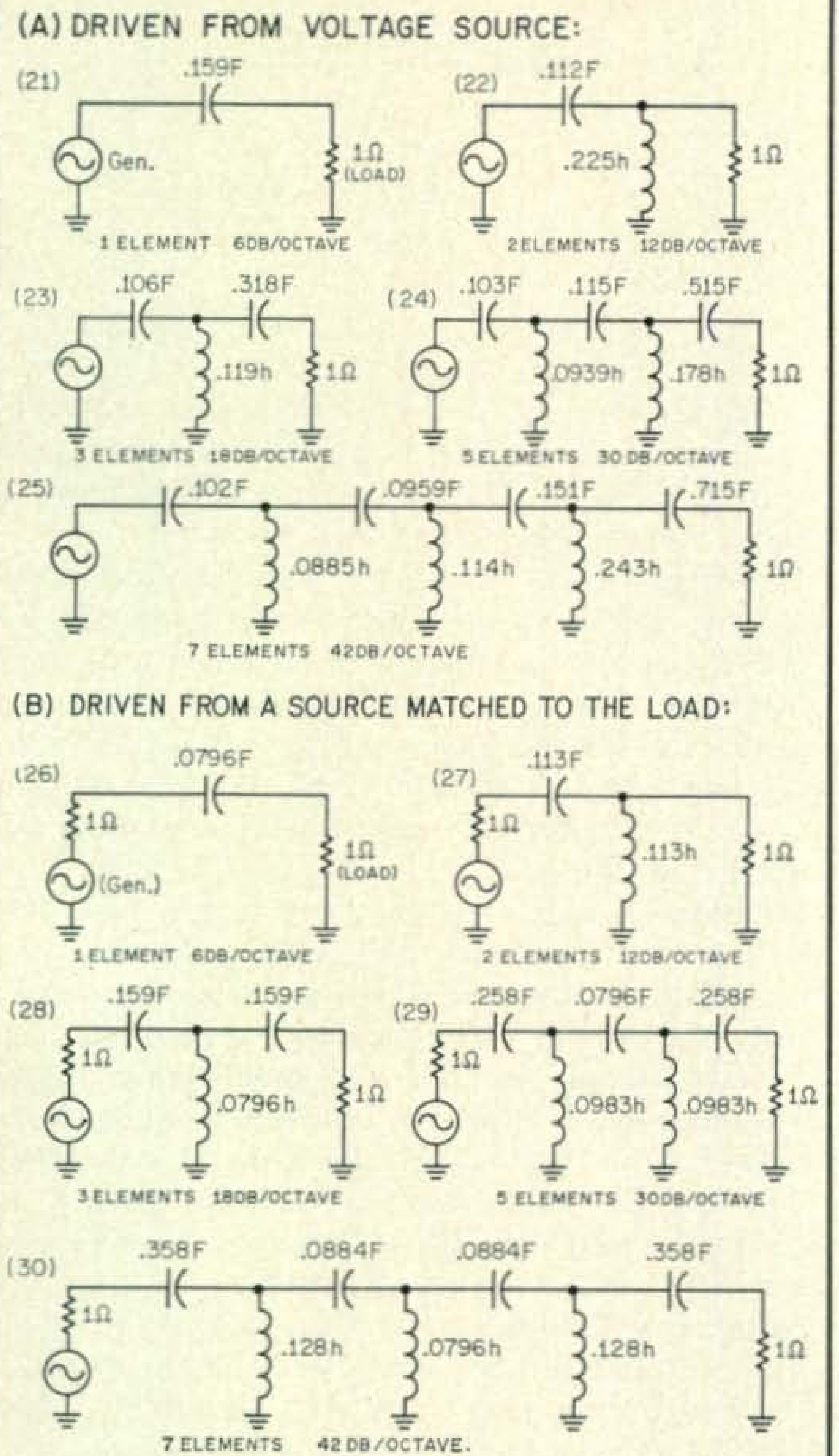
$$L_2 = \frac{0.318 \cdot 50}{2.4 \times 10^6}$$

$$= 6.62\ \mu h.$$

$$C_1 = C_2 = \frac{0.258}{50 \cdot 2.4 \times 10^6}$$

$$= 2150\ mmf.$$

The rounded off results are shown in fig. 6.



1. Specify the following:
   A. The load resistance.
   B. The type of source (voltage or matched).
   C. The cutoff frequency.
2. Establish some criterion for the steepness of the skirts required in the following form:
   The signal must be "X" decibels attenuated at a frequency of "Y" times the cutoff frequency.
3. From fig. 2, find the required number of elements. If the result lies between the curves, choose the higher number of elements.
4. From Table III, remove the basic filter having the right number of elements and the proper type of source.
5. *Multiply* each *R* and *L* by the load resistance. *Divide* each *C* by the load resistance.
6. *Divide* each new *L* and *C* by the cutoff frequency.

The design is now complete.

Table III—Basic circuits and the procedure for designing a high pass filter.

Performance

And how good do they work? The results are almost always in nearly perfect agreement with the design curves provided some rather obvious and invariably overlooked requirements are met. The circuit on the page and the one on the bench must be as nearly identical as possible. Inductors must have high Q (at the very least 15; preferably 75 or more). More important, *the Q must be specified and measured at the cutoff frequency.* The millihenry sized r.f. chokes in the distributor's catalog may have a very good Q at a few megacycles, but their d.c. resistance makes them ridiculously unsuitable for use as inductors in problem #1. (The Q will typically be less than 0.05 or so and the concept of Q is meaningless for $Q < 1$).

There must be no magnetic coupling between different inductors in the filter. This requires magnetic shields or else self-shielding inductors such as toroids and cup cores. Lead inductance must be allowed for on very small inductors. An eighth inch of wire has around ten nanohenries of inductance, enough to foul up a 0.1 microhenry coil if not allowed for. It is best to arrange the circuit so that the longest leads are in series with the largest inductors. Obviously, no inductor can be self-resonant anywhere near the frequencies of interest.

The same goes for capacitors. Some paper foil capacitors have considerable inductance and resonate at relatively low frequencies. Worse yet, some disc capacitors are radically temperature dependent. Worst of all are electolytics with their high dissipation and intrinsic polarity. The best choice in a small capacitor is the new monolithic glass ones, with ordinary silver mica capacitors being a close substitute.

The new polystyrene capacitors, (Mallory SX, etc.) are almost as good as silver micas for all filter applications, and at 21¢ each, are much cheaper. For large values of C, ordinary mylar capacitors will work fairly well, provided they are the type that have solid metallic ends on the foil wrap. For giant C values, back-to-back tantalums are the only economical answer.

In bandpass filters, each LC pair must be precisely resonant at the center frequency. Very narrow bandpass filters require extremely high Q inductors.

Finally, the circuit layout must be the same as the filter design. Short cut ground paths between input and output can drastically alter response. Ground and return paths should be heavy gauge or wide foil. The load should be placed directly at the output termination of the filter.

Any readers who want to look into the "why" of these filters might find the following synthesis texts of interest.

Accuracy

The author is quite confident of all element values given in Tables I, II, and III as they were verified twice by others using independent checking methods. The element values were obtained in normalized form from Table 2.1 a and 2.1 b of reference 3, above. These element values are renormalized to the 1 c.p.s. cutoff frequency instead of the 1 r.p.s. cutoff frequency given in Reference 3. For the high pass networks, the

[*continued on page 92*]

For further information, check number 29, on page 104

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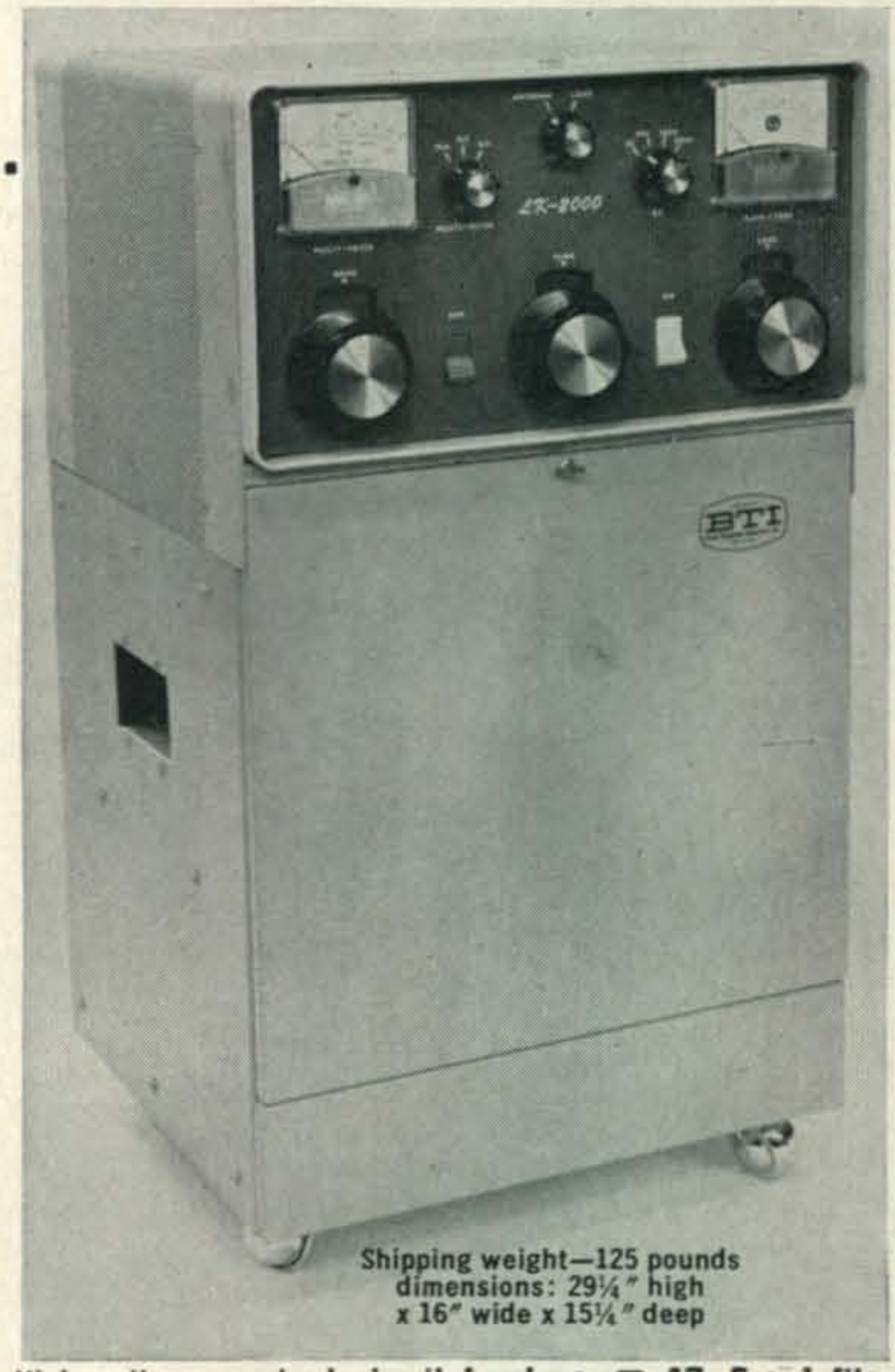

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For further information, check number 8, on page 104

T'was The Night Before Christmas

'Twas the night before Christmas
And all through the house
Not a creature was stirring
Not even a mouse.

The tree was all trimmed
With presents around
And outside lay a blanket
Of snow on the ground

I'd just gone to sleep
When a noise reached my ear
I sat up in bed
And listened with fear.

It seemed to come
From the shack in the rear
So I climbed out of bed
And crept quietly there.

I cracked open the door
Feeling quite bold
And the thing that I saw
Was a sight to behold.

The room was well lighted
I'll never forget
And Santa was sitting
In front of the set.

He had on the earphones
And mike in his hand
And was frantically tuning
All over the band.

His voice was pitched high
He was in quite a stew
"CQ!," he kept shouting,
"Confound it, CQ!"

At last he gave up
Then said with a sigh
"I'll bet this old rig
Even gives TVI!"

It's so obsolete,
Nobody can hear me
And a good spell of hamming
Would really have cheered me.

But this thing's so old
It creaks when I tune.
If it isn't replaced
It will fall apart soon!"

And then as I watched
He put the mike back
And quickly he started
To rifle his sack!

There were presents and candy
All over the floor
Till he got to the bottom;
The sack held no more.

Then wiping his brow
He sat back in the chair
And sadly exclaimed,
"Not one S-Line in there!"

If only I'd known
I could have prepared,
But they're much too expensive
To carry a spare!"

He looked for a moment
As though he would cry.
Then all of a sudden
He laughed and yelled "Hi!"

I haven't a rig
But I know what I'll do
I'll leave him a note
And my I.O.U.!"

He started to write
With the pad on his knee
And when he was done
Placed it under the tree.

Then he repacked his bag
And went out to his sleigh
And in just a few moments
Was well on his way.

But I heard him exclaim
As he drove out of sight
"73's, Merry Christmas, 88's
And goodnight!"

BY BEVERLY ELLIOT

NEW AMATEUR PRODUCTS

CRL

CENTRALAB is now offering a portable 9½ lb 12 volt rechargeable power source. The CRL-1200 is carried in a black leather case and measures 8½" × 2¼" × 9". The unit is rated about 70 watts and retails for $49.95. For complete details write to Centralab, P.O. Box 591, Milwaukee, Wisconsin, 53201, or circle 77 on page 104.

Lafayette

LAFAYETTE Radio Electronics Corporation, 111 Jericho Turnpike, Syosset, L.I., N.Y. 11791 announces a new low cost 7 tube general coverage receiver for the beginning shortwave listener or Novice. Stock No. 99-2564WX. Price: $59.95. For more information either write directly or circle 55 on page 104.

Semitronics

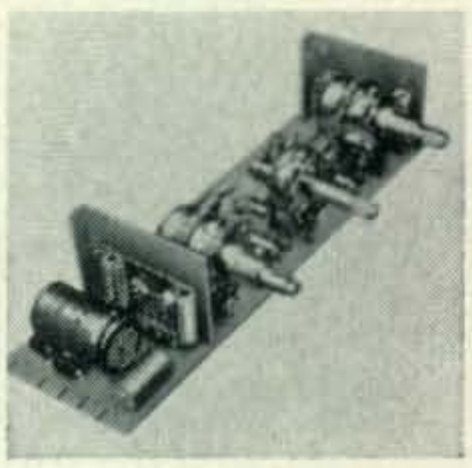
A carbon mike, (Dart M-100), available in kit form for $2.95, or as a completed unit for $6.50, has just been made available by the Semitronics Corp., 265 Canal St., New York, N.Y. 10013. It has a frequency response from 300 to 3,000 cps. The exciting voltage is 6 volts at 50 ma. For further information, contact them direct or circle 54 on page 104.

Heath

A new monitor scope kit has been added to the Heath line. The SB-610 visually displays both transmitted and received signal waveforms. It can be used with transmitters from 160 to 6 meters and with receiver i.f.'s. as high as 6 mc. It will handle up to a kw and sells for $69.95. For full specs, write to Heath Company, Benton Harbor, Mich., 49022, or circle 53 on page 104.

Knight-Kit

THE Allied Knight-Kit TR-106 is a self-contained 6 meter transceiver with built in a.c. and mobile power supplies. The receiver tunes 50-52 mc, and the transmitter is fully modulated with 15 watts r.f. input. The kit sells for $139.95. Full technical specifications are available from Allied Radio, 100 N. Western Ave., Chicago, Ill., 60680, or circle 52 on page 104.



Amperex

AMPEREX announces the availability of a full line of printed circuit assemblies. The units require merely the addition of a signal source and a speaker plus cabinet. For further information, write to Amperex Electronic Corporation, Hicksville, Long Island, New York 11802, or circle 51 on page 104.

Lafayette

LAFAYETTE introduces its model HA-1200 25 watt 2 meter transceiver (stock No. 99-2583-WX). It features a triple conversion receiver, built in v.f.o., a.c. and d.c. supplies. For full information write to Lafayette Radio, 111 Jericho Tpke., Syosset, L.I. or circle 50 on page 104.

Howard W. Sams

A new book by Howard S. Pyle, W7OE, put out by Sams Publications will prove beneficial to the newcomer and Novice. The book (cat. no. ASP-1) is called Building Your Amateur Radio Novice Station, and contains complete step by step instructions for building a first station. For more information on the book write to Howard W. Sams Co., Indianapolis, Ind., or circle 49 on page 104.

Lafayette

A new receiver by Lafayette is the HA-700. This is an 8 tube communications receiver featuring two mechanical filters, and sells for $89.95. For full specs write to Lafayette directly, or circle 48 on page 104.

Trans-Tek

A NEW variable speed control for use with all a.c.-d.c. motors up to 7½ amps has been introduced by Trans-Tek Manufacturing Co., 300 North Ave., Garwood, N.J. The device operates on 110 v. and is rated at 900 watts. It sells for $15.95. For more information either write direct or circle 68 on page 104.

Hash Husher

HALLETT Mfg. Co., is now producing Hash Husher kits which are designed to reduce the hash caused by ignition noise pulses. The kit consists of spark plug filters and a special filtered coil to distributor high tension lead. It can be installed in minutes and costs $12.95. Further details can be had by writing Hallett Mfg. Co., HH-75, 5910 Bowcroft Street, Los Angeles, California, 90016, or circle 69 on page 104.

Viking

VIKING Engineering has introduced a low cost transistorized zener reference regulated power supply model PZ-121. It supplies 0-15 v.d.c. at up to 250 ma. The unit is available in both kit and wired form, $13.95 and $19.95 respectively. For complete specs. write them at P.O. Box 9507, Minneapolis, Minn., 55440 or circle 70 on page 104.

EICO

EICO is now producing a line of packaged do-it-yourself solid state kits at popular prices. Called EICO-CRAFT TRUKITS they are good one night projects and will provide useful additions around the shack. For a list of all the kits write to EICO, 131-01 39th Ave., Flushing, N.Y., 11352 or circle 71 on page 104.

E. F. Johnson

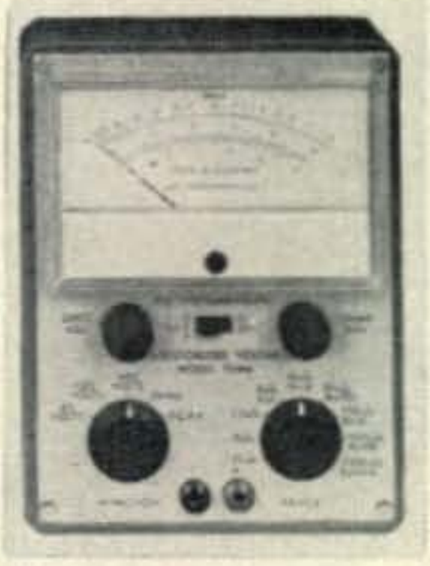
FOR a free copy of E. F. Johnson's new 26 page component catalog, write to E. F. Johnson Company, Waseca, Minn., 56093, or circle 72 on page 104.

E. F. Johnson

TWO new products from E. F. Johnson are the In-Converter (above) and its Voltage Regulator. They are designed to operate low powered gear from any d.c. source (6 to 32 v.d.c.). It will furnish an output of 13 v.d.c. at 14 watts. The voltage regulator sells for $17.95 and the In-Converter $22.95. For full details write: E. F. Johnson, Waseca, Minn., 56093, or circle 73 on page 104.

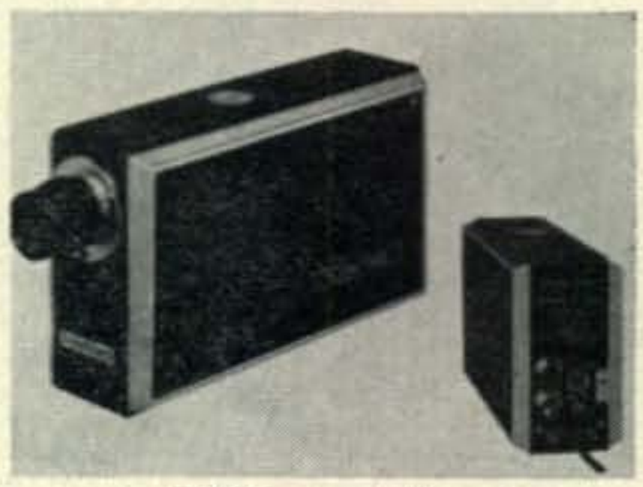
AUL Inst.

A NEW transistorized volt-ohm-milliammeter, model TVM-4 is being made by Aul Instrument Co. It has a high input impedance (2 megohms per volt on the most sensitive range) and uses a 4 inch taut band meter. It is priced at $55.00. For detailed specs write to Bob Saul, AUL Instruments, Inc., 47-29 36th Street, L.I.C., N.Y., 11101, or circle 74 on page 104.



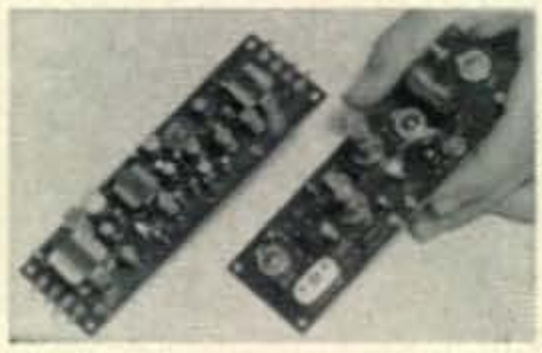
Concord

THE Concord model MTC-15 is a high sensitivity TV camera. It has a long life vidicon achieving 550 lines of resolution and lasting over 3000 operating hours. For detailed specs write to Concord Electronics Corp., Ind. Prod. Div., 1935 Armacost Ave., Los Angeles, Calif., 90025, or circle 75 on page 104.



Round Hill

Two new wired modules are available from Round Hill, the model AA-100 a 200 mw output amplifier-modulator using 5 transistors and one thermistor ($6.95) and a 27 mc trans. (model TR-100, $9.95) which can go on ten. Full data is available from Round Hill Assoc., 434 Ave. of the Americas, N.Y., N.Y., 10011, or by circling 76 on page 104.



For further information, check number 9, on page 104

ELECTRONIC BUGGING AND THE HAM

BY CHARLES J. SCHAUERS,* W6QLV

Fig. 1—Sets constructed by the author to show how wireless bugs can be made in different sizes and shapes. Note the magnet on the bug at the far left. This is used to fasten it behind a radiator. The cigarette package also contains a bug. Note the relative size of the bugs as compared to a recording mike, second from the right.

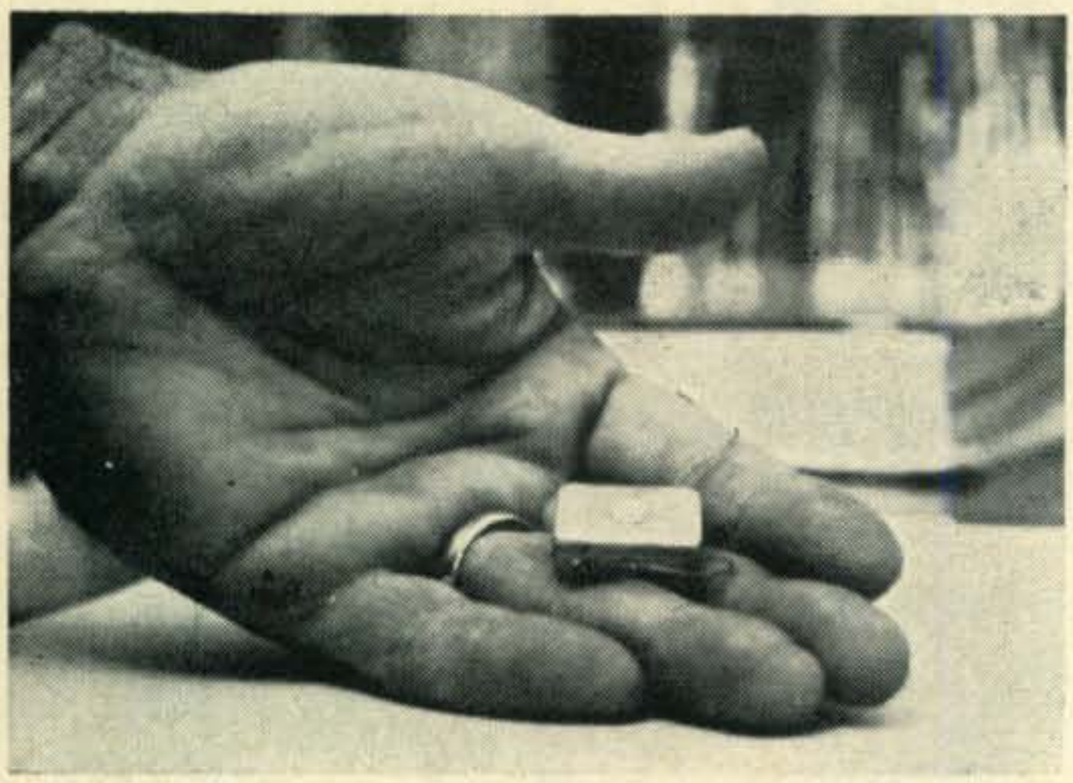


Fig. 2—Typical miniature microphone that can be used effectively as a pick-up device.

Fig. 3—A close look at the flowers reveals the microphone. Properly positioned the mike could not be seen through casual inspection in a normally lighted room.

DURING the last 4 years, the radio-electronic secret listening device business has grown into a multi-million dollar industry. All over the nation, these devices from the simple to the very exotic have been hidden in homes, factories, offices, public buildings, *ad infinitum*. Commonly referred to as *bugs*, they are used by law breakers as well as the police. Actually, no one is really safe from having his conversations monitored either in or outdoors.

Radio amateurs because of their knowledge of radio-electronics have often been called upon to look for suspected bugs planted in a friend's home, business or car. This article then was prepared for radio hams to give them some information on the bug business, with emphasis on how to locate bugs.

Types of Bugs

Space does not permit us to list every kind of bug available on the market today. However, the one bug that seems to be the most popular is the tiny radio transmitter bug (self-contained) that operates on an open channel on the f.m. broadcast band. It can be planted nearly anywhere. Some of the places: under a table, chair, book shelf, desk, lamp or radiator grill. It can be found in flower pots, behind clocks, behind drapes, under pictures and in electrical outlets. Figure 1 shows three typical bugs.

The bugs can be monitored from a parked car, an adjacent room or even in another building and the conversations picked up recorded.

Other similar radio bugs operate on nearly any frequency up to 800 mc. Some are permanently wired into 110 v.a.c. electrical outlets and get their power directly from the a.c. line. The two plug prong holes permit sound to impinge on a very sensitive microphone. Figure 2 shows such a mike.

Hidden microphones that are connected by wire to either a hidden radio transmitter or an a.f. amplifier are quite often used. Figure 3 shows how a mike can be camouflaged in a flower arrangement.

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*Editor, Ham Clinic.

The telephone is a popular bugging device in itself for it can be wired so that the phone transmitter is always "alive" and sound take-off can be accomplished via an amplifier hidden in an attic or basement near incoming phone wires or a telephone terminal box. Figure 4 shows how a small radio transmitter bug is installed in the base of a telephone. Pickup maybe either through the induction coil or through a direct connection.

Figure 5 shows how a microphone can be hidden in a brief case top and connected to a bug transmitter or a small transistorized tape recorder.

Most pickup amplifiers are transistorized as is the one shown in fig. 6.

A pickup coil that is merely attached by suction to a telephone is pictured in fig. 7. It can be located inside or on the side of a telephone.

A typical wireless mike of small size and capable of transmitting up to 100 feet or more is shown in fig. 8. The set will operate over 48 hours on mercury batteries.

Radio carrier transmitters that transmit monitored conversations over the 110 v.a.c. lines are also used. These transmit at very low frequencies and can be heard for distances up to a block away. They are usually hidden in electrical (wall) outlets.

Contact mikes are used on windows, walls and any other medium that will allow sound transmission. The contact mike looks like a phonograph pickup with a long needle (spike) for piercing a wall. Those used on windows would be placed right against the glass with tape. Either type would be connected to a bug transmitter or a.f. amplifier.

Sound guns are used for picking up conversations through open windows or outside over great distances. They consist of nothing more than a very sensitive mike mounted at the end of a series of long tubes. The mike is connected to a high gain amplifier. Conversations can be pinpointed up to 3 miles away.

Infra-red modulated pickup devices are too exotic to be discussed here.

Speakers in radio and TV sets can be wired for sound pickup. When the radio or TV is not in use the speakers work like microphones. A small relay device turns off the bug when the set is turned on.

Some bugs are sound actuated. That is, they do not operate until a mike picks up sound. Sound actuation devices are used frequently on tape recorders.

One device on the market today (which must be installed by an expert) permits one to dial a *particular* telephone (any distance) and then listen to what is going on in a room through the telephone transmitter.

Bug Location

To determine whether or not a radio bug has been planted, a ham can use his grid-dip meter set on the diode or monitoring position. The various coils are plugged in and the spectrum

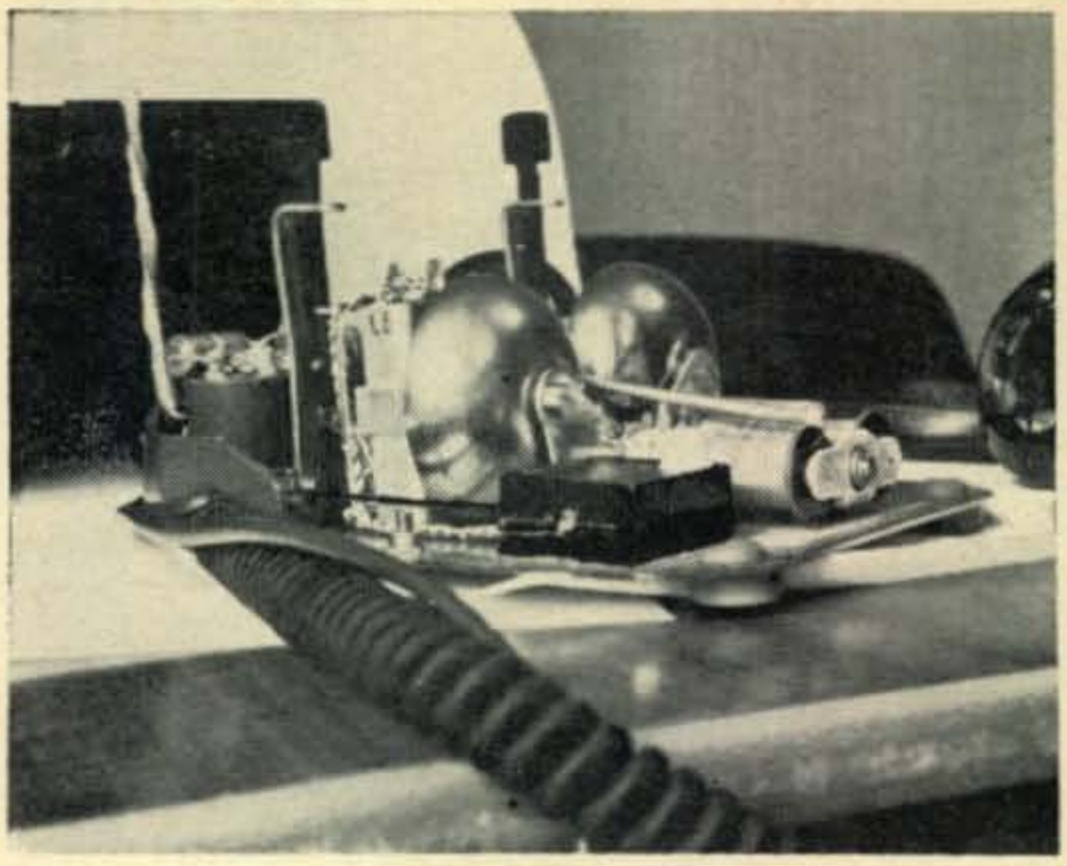


Fig. 4—It is pretty difficult to see the wireless bug connected to the a.f. circuit of this European phone. It is the black box with the knob on it located in the foreground.

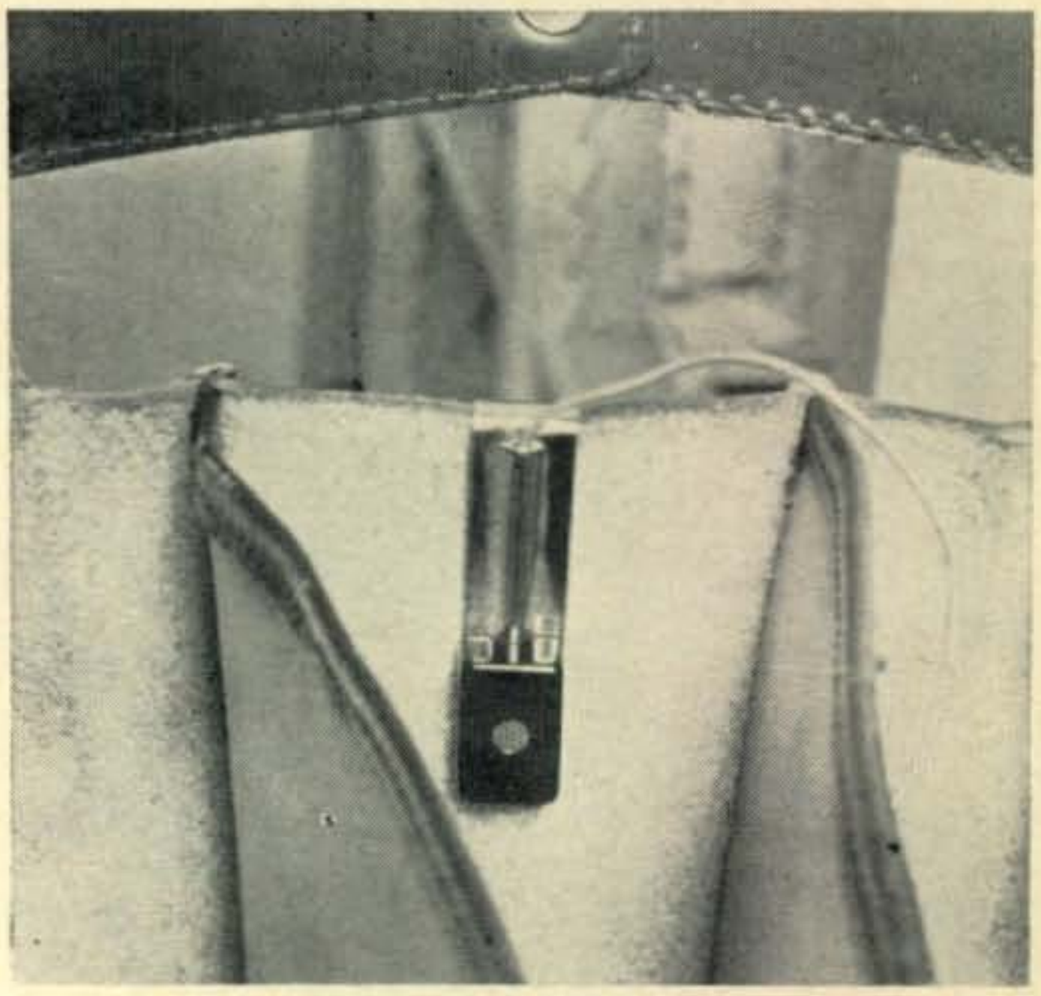


Fig. 5—Clip-microphone secured to the top of a leather brief case and connected to either a wireless bug or a small tape recorder.

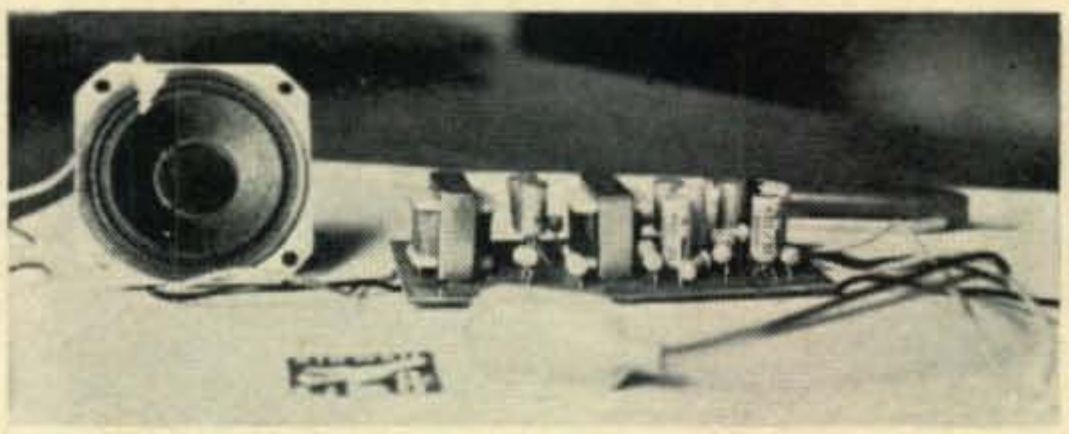


Fig. 6—A transistorized a.f. amp that can be used for listening in. It can use either a tiny mike or the small one inch loudspeaker as a pick up device.

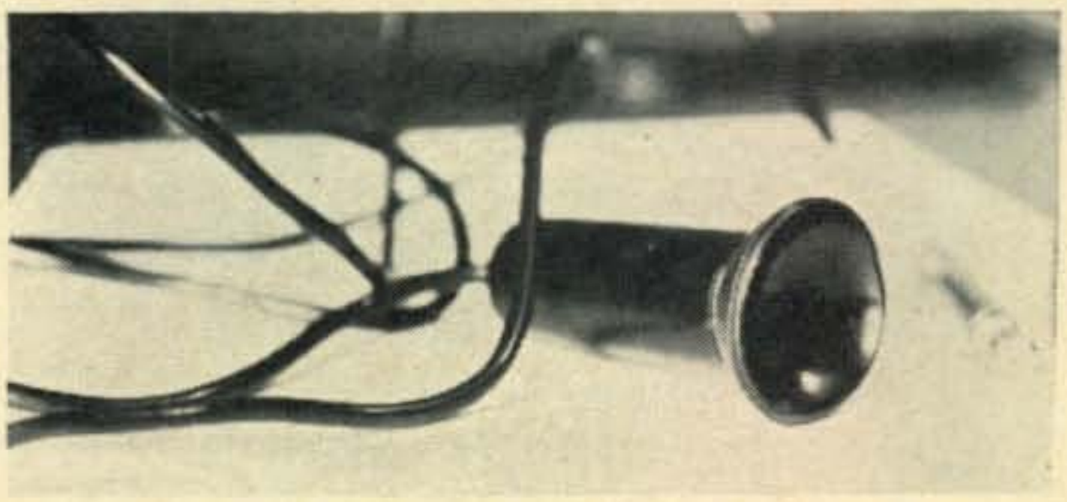


Fig. 7—An induction pickup device for a telephone. Suction cup holds it to the side of a phone.

Fig. 8—A typical wireless bug built for operation in the f.m. broadcast band.

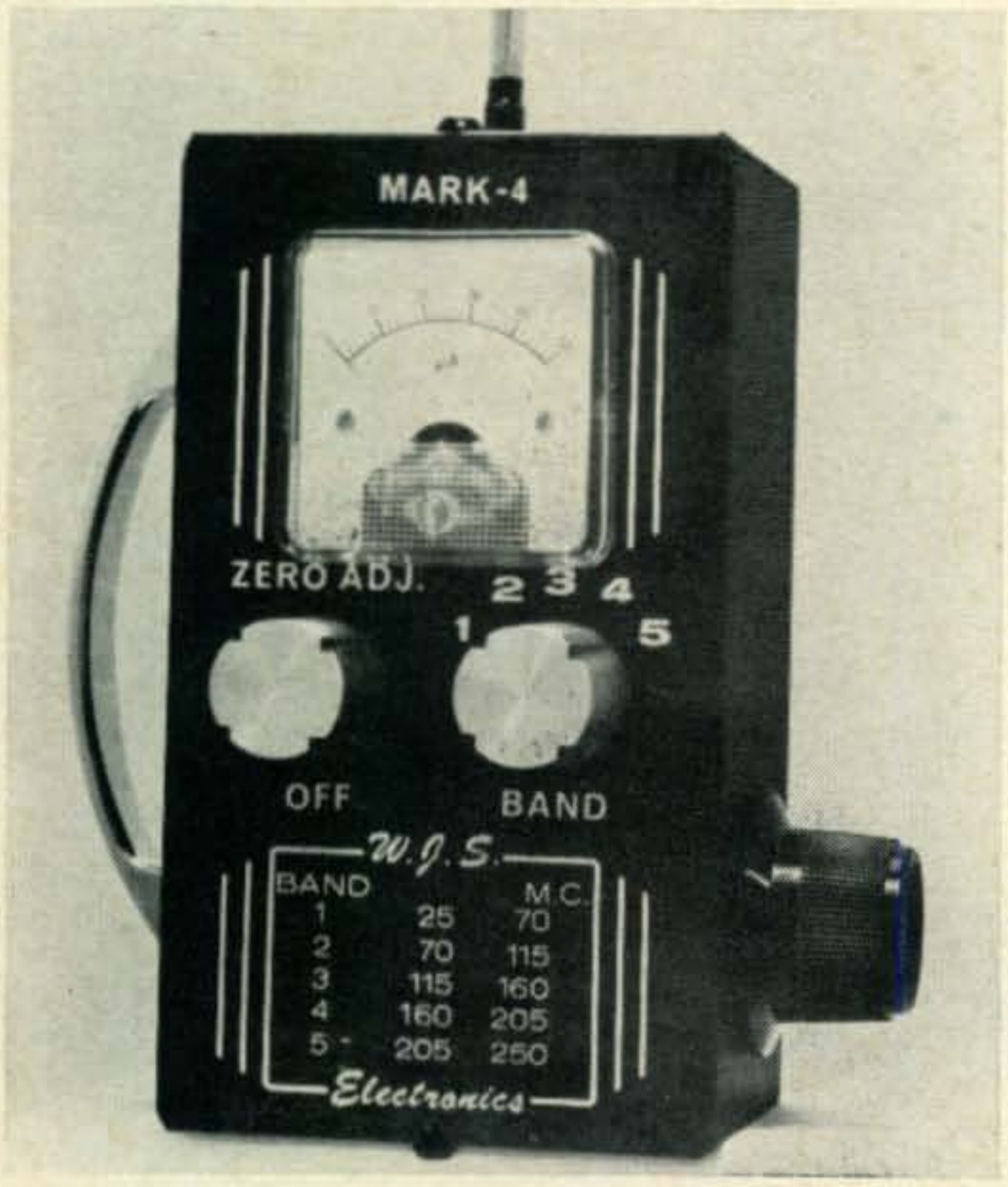


Fig. 9—A professional bug locater made by the W.J.S. Electronics Co. of Hollywood, California. This detector covers from 25 to 250 mc in 5 bands.

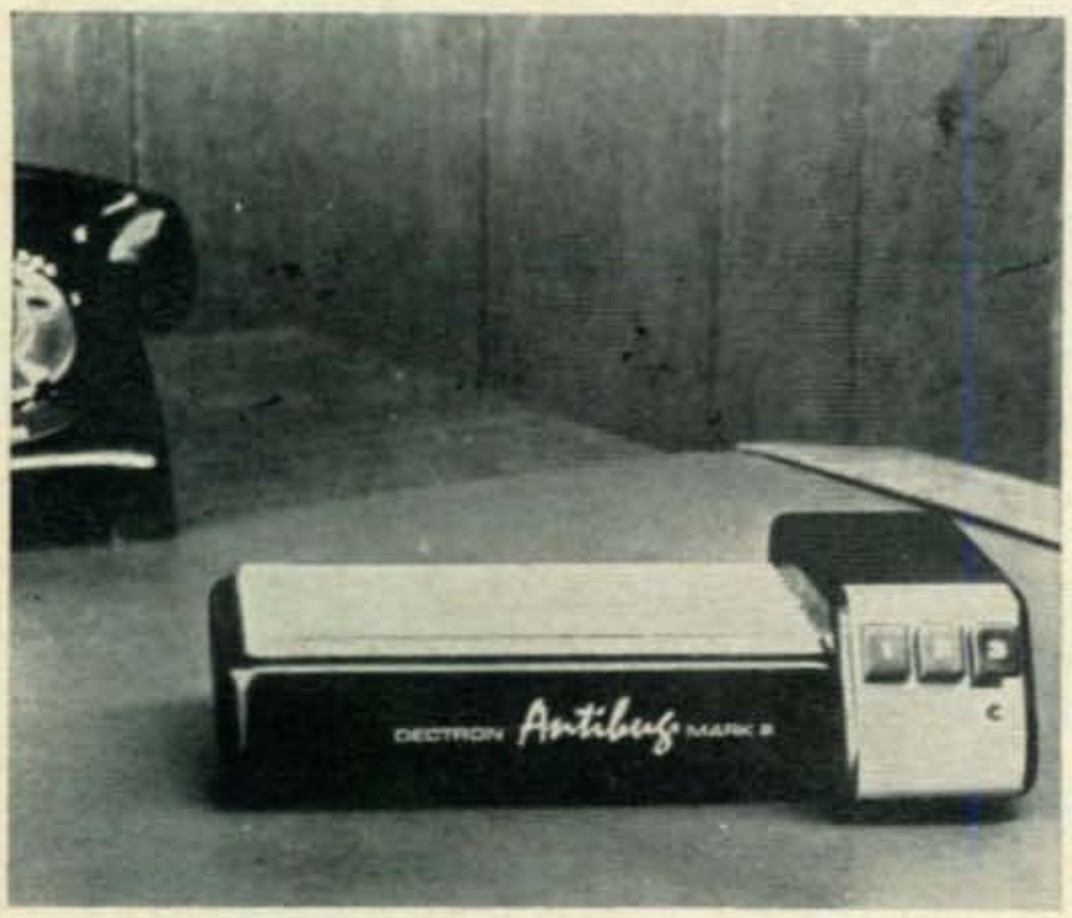


Fig. 10—An anti-bugging device made by Dectron Industries Inc., 726 Santa Monica Blvd., Santa Monica, Calif. This device jams the pickup unit and covers a wide range of frequencies. A pocket size model is also available.

searched in a suspected location. An accomplice can talk loudly while the search is going on—if there is a bug in the place one will hear the transmission (if tuned to the correct frequency). It is only a matter then of using the g.d.o. as a proximity direction finder. A battery powered meter is of course best for it enables one to move about freely.

Broadband search or sweep receivers are available from the same people who produce bugs. A professional bug locator is shown in fig. 9.

As a defense against radio bugs, sometimes a broadband jamming device is used. One such device is shown in fig. 10.

Bugs in automobiles are hard to locate because they can be mounted under the overhead fabric (in some cars), under the dash or under a seat. The regular car antenna (with a special coupling device) can be used to transmit to a following receiver equipped car.

A bug transmitter in a car can be so connected that it goes on when the ignition key is turned on. It can even be located in the trunk, but the favorite hiding place is under the dash amid all the wires now found in most cars. The mike can be under a steering wheel (on the column) or the radio loudspeaker can be used as a mike.

To "sweep" a room requires more than just a broadband receiver. Bugs planted in walls may require a metal location device. But the location of any bug requires patience and time, and above all, ones *eyes*.

Look in the seams of those expensive looking drapes; Always suspect air registers and the oversized pen holders usually found on desks. Examine book spines on library shelves for small (nearly invisible) holes which may admit sound to a planted mike. If you are not acquainted with telephone circuitry, have a telephone company man check your phone wiring.

Intercom systems in offices make good bugs, check these.

TV bugs are usually planted behind a "two-way" mirror or mounted so that the camera lense is "peeped" through a small hole in a picture or other decorative item hung on a wall.

Overhead lighting fixtures are often used for planting the tiny bugs.

Defense Against Bugs

The only defense against bugs is vigilance! A bug can be planted in seconds; so when a bug is suspected it requires a continuing and careful search. Turning on a radio or TV set and swamping a room with sound may or may not help thwart the planted bug but this does make the task of monitoring more difficult. Exotic systems use filters and loud music has little effect on them.

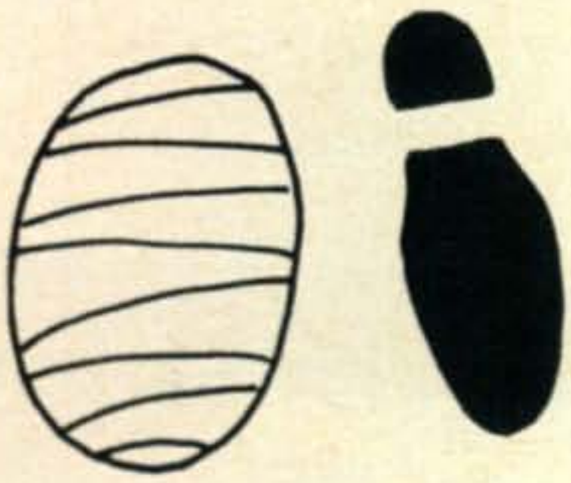
Bugging is generally against the law, except when used by law enforcement officials (in some cases). Hams can help stamp out the bugging menace by being knowledgeable about it. With over 285,000 hams on the job looking for bugs, the illegal bug planter will have a more difficult time. ■

"Footsies"

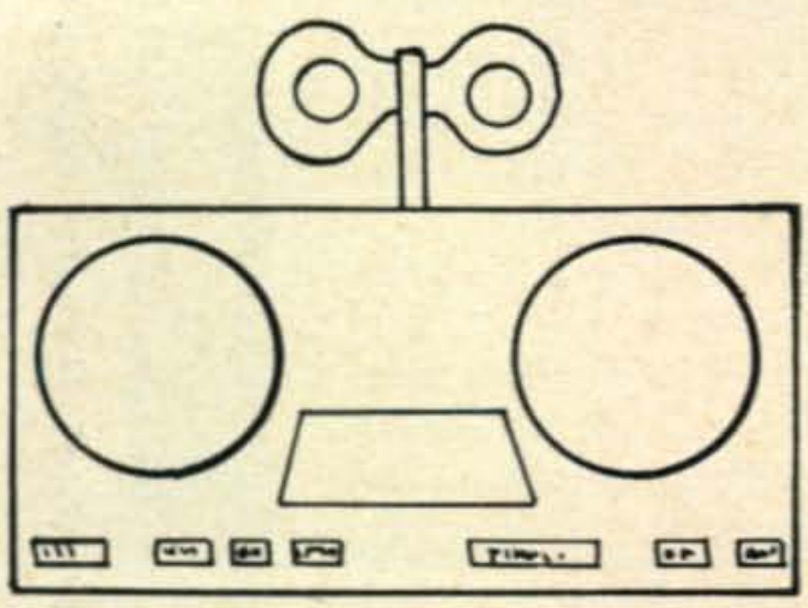
BY BILL SHELLY

"Say, aren't you the guy who invented the transistor?"

"But when you advertised some ham equipment for sale I thought. . . ."



"Then what happened . . . after you tried to repair your 100 foot antenna during a wind storm?"



"How come you want to sell me a beautiful big tape recorder like that for only $4.98?"

View of the modified linear with the homebrewed transceiver beneath it. The meter is used to indicate relative r.f. output.

THE LAFAYETTE HA-250 ON 40 METERS

BY LARRY WALROD, *VE7BRK

The Lafayette HA-250 linear is designed for operation on 15 to 6 meters. The author describes how to modify it for 40 meter operation and uses it for a compact 100 watt p.e.p. mobile rig.

THE Lafayette HA-250 is a compact linear amplifier designed for mobile operation on 15 to 6 meters. It requires no external switching and provides 100 watts p.e.p. input for 8 watts of drive, but according to its spec sheet will operate with as little as 1 watt of r.f. input.

The antenna is switched automatically by the presence of an r.f. input through a sampling circuit that controls the antenna relay, and the linear simply is inserted in series with the antenna line.

As soon as I saw the linear amplifier I thought it would be great for an application I had in mind. However, the frequency range did not cover 40 meters, the band I was planning to use, so I decided an operation was in order.

Converting to 40 Meters

Referring to the Photograph, you can see the location of the modifications described below:

1—The 1 mh r.f. choke in the output circuit was replaced with a 2.5 mh unit.

2—The 22 μh choke in the plate circuit was replaced with a single layer choke of about 1 mh inductance.

3—The antenna loading capacitor and the plate tank coil were removed. I did not particularly like the idea of removing the loading capacitor, which originally was a 365 mmf variable, but since I planned to work into a fixed 50 ohm load all of the time, a fixed 460 mmf ceramic was substituted with a view to conservation of space. It worked fine.

A coil of 24 turns of no. 14 copper wire was wound on a size "D" flashlight cell and then spaced to fit into slots filed in a lucite strip. It was later found that 20 turns would have done for the plate coil.

[*Continued on page 100*]

*Nasuli, Malaybalay, Bukidnon, Philippines.

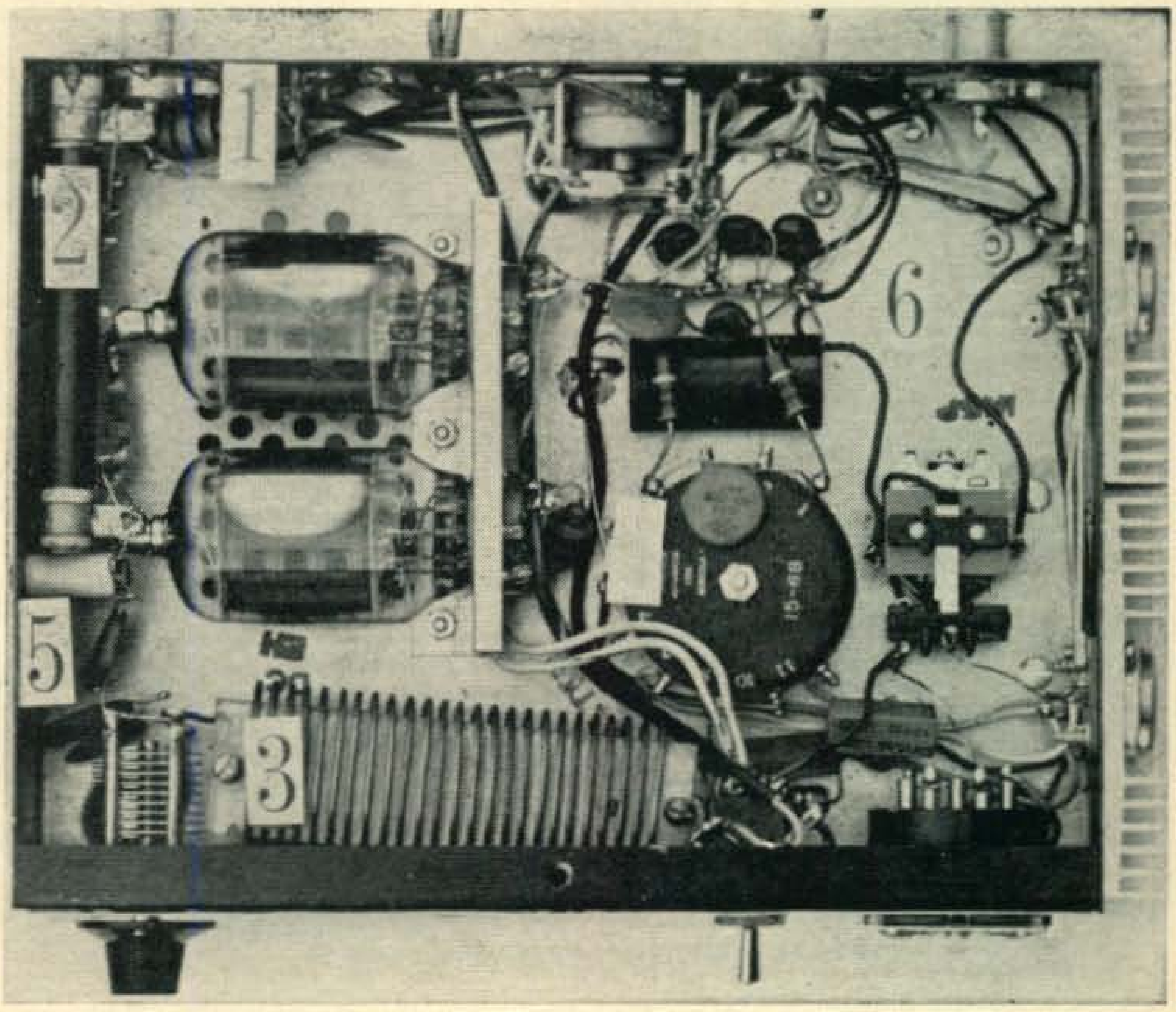
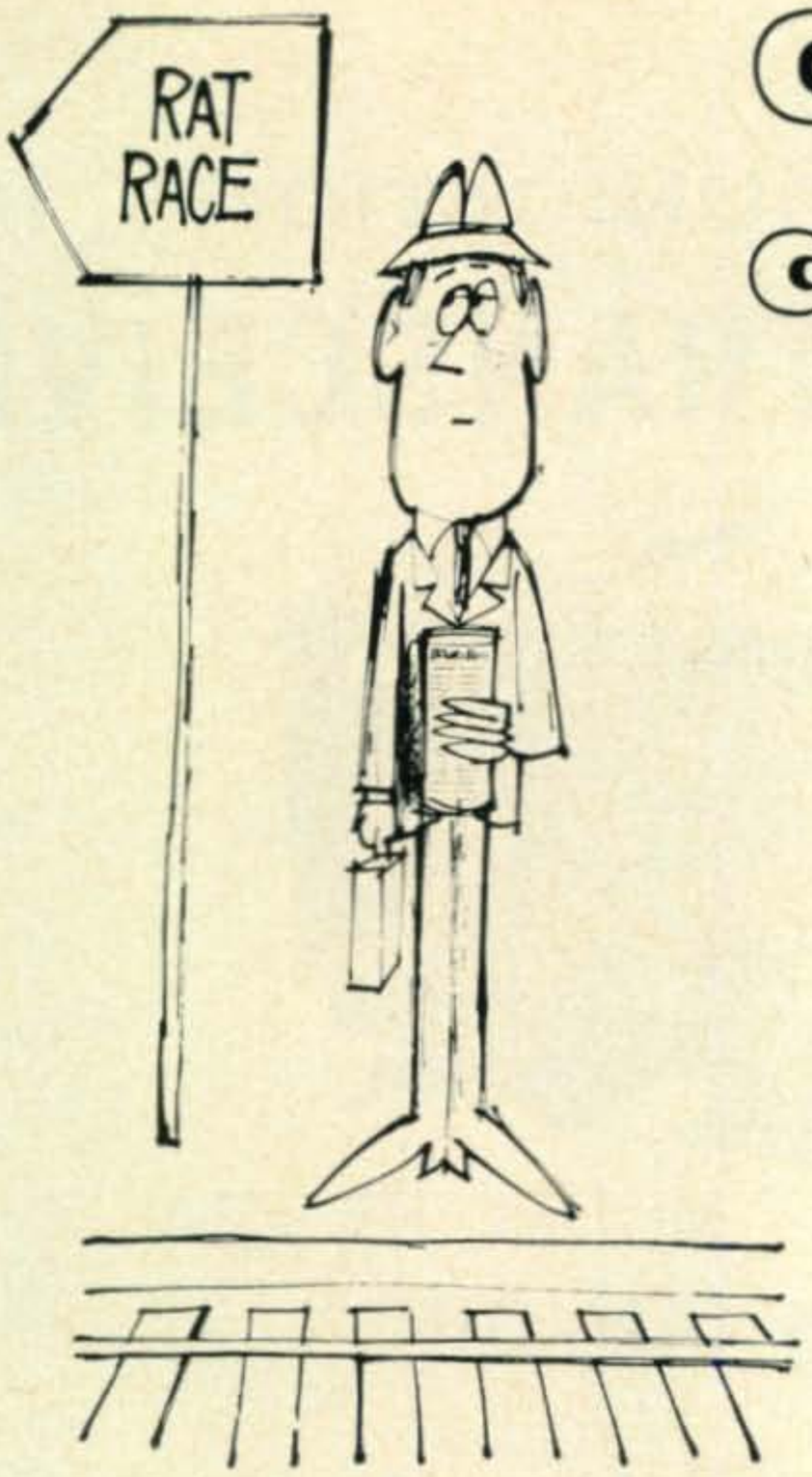


Fig. 1—Bottom view of the HA-250 modified for operation on 40 meters. The numbers are keyed to the modifications described in the text.

For further information, check number 2. on page 104

Quiet - and away from it all

BY SYLVIA MARGOLIS*



OUR poshest daily newspaper in U.K. is the *Times*. In its Personal Column there appears often a financial appeal for a venerable society which exists to provide "holidays for working horses." Even a horse needs a vacation.

Which is more than the wives of radio amateurs can expect.

Not that some women don't get exactly what they deserve, those who, in full consciousness, marry functioning radio amateurs. But they should know what they are buying and not complain about the bargain afterwards, even when Lover Boy postpones the wedding because it clashes with the *CQ* World Wide Contest, like the prominent European DX-er I met. He did find a date eventually which didn't interfere with anything vital, like contests, field days, hamfests or openings on two.

"It was a wonderful wedding;" he burbled, "there were several well-known DX-ers present and we all went up in the shack and worked lots of rare stations. . . . !"

It's fools like me, already roped and tied when the plague struck, who are the ones who need charity.

There was once that happy, peaceful time, when, because we always follow the sun on our vacations and leave Britain, vacations and amateur radio were incompatible. Those holidays were enriched with a special bitter-sweet nostalgia. If only we could get an amateur radio license. Enforced radio silence for a period made the return home all that nicer. With cries of joy I would greet the kitchen sink and the washing machine and the gardening tools. *They* would have a touching reunion with the rig. I would have 24 shirts to wash. They would have 24 skeds to keep.

Then there was the regular sport of badgering Authority about Reciprocal Licensing. Something good and natural and homespun and *clean* went out of amateur radio when Authority tossed its hat over the Moonbounce and Reciprocity became more than a dirty word.

There had been that brief break in the deadlock in 1963, when the Belgians and Dutch granted temporary licenses to foreigners for the Verviers Rally. How I laughed, innocent dupe, as the British contingent roared their cars off the Ostende ferry and lined the kerbside to tune up with those precious, new, sensational ON5 calls. How I chuckled, with no premonition of what it signified, at that enchanted W2, who must have thought it was Christmas and Thanksgiving and Rosh Hashanah rolled into one, when we said that ON5ZC would soon be PA9NMR, and he stalked us doggedly over the Belgian-Dutch frontier, to net that first-ever PA9 prefix.

I even enjoyed the weekend in Heidelberg, when we took in the DL4/5 Hamfest. It was fun meeting people who spoke English, more or less, a pleasant interlude after weeks of struggling with French and German. And the T-bone steaks were marvelous.

Then came 1965, the first year we were able to vacation with Belgian, Dutch and Austrian licenses.

Accordingly a certain new order of priorities had to be established, so that it took two weeks to install the mobile gear to perfection and all of two hours to pack luggage, car and trailer for four people for four weeks.

Now we travel decently equipped, with an s.s.b. transceiver covering 160 thru 10, a 2-meter transceiver, a pair of 28.5 walkie-talkies, a gasoline electric generator, with its complete kit of spare parts, s.w.r. meter, soldering iron, multimeter and signal generator, spare a.c. supplies in case the alternator or d.c. supplies blow up, morse keys, spare microphones, a small valise of documents, textbooks and schematics and a bundle of mobile antennas which, laid end to end, would go the length of Brooklyn Bridge, which would be just about the nicest possible thing that could happen to them.

I go along for the ride, to translate "solid state

*95 Collinwood Gardens, Clayhall, Ilford, Essex, England.

Resembling a tired war correspondent during a lull in the battle, CQ's harried author dashes off "Quiet Weekend With Uncle Sam" which appeared in the November issue.

switching" from Flemish to Italian and to reap the indubitable benefits of foreign travel. I have taken in a lot of scenery, history, art and culture, visiting the cities of Europe and I know full well what a lucky girl I am.

I know that Paris has the Eiffel Tower, the Mona Lisa, *haute couture, canard a l'orange* and F3DJ, who was the first winner of the Mobile Century Award.

Stockholm has a 17th century warship, smorgesbord, aquavit, SMØATN, who had a bit of trouble with his antenna, and SMØRQ, who has the highest recorded mobile country score.

Copenhagen has the Tivoli, the Little Mermaid, Carlsberg lager and OZ5KQ, who had a bit of trouble with his s.w.r., but we soon helped him get that sorted out.

Holland has windmills and tulips and Delft and cheese and clogs and Rembrandt and PAØZD, who is such a perfectionist that he had to have a helium-filled coaxial cable as the only possible dielectric.

Geneva has 4U1ITU.

Vienna has the waltz and wienerschnitzel and Sachertorte and Dancing Horses and the Opera and OE1RZ, whose array of antennas in the middle of the city is such a landmark that every Viennese taxi driver knows it.

Salzburg is a paradise of antiquity and music. But who wants Mozart when he can have Philips' Depot?

We had been travelling the autobahn, admiring the scenery and thinking what a fine QTH it would make, for the Germans hadn't yet come clean with full reciprocity, when we had a traumatic experience which, in less stalwart characters than my radio amateurs, could have caused all kinds of nasty conditions, like the QRT Syndrome. We switched on the receiver to listen around, when there was a very peculiar smell and the generator stopped charging. The battery lead was disconnected from the alternator, but the transistor supply and heater line were still connected. Although the fuse had blown, it had not blown quickly enough. Seventeen tubes had blown with it. Happy Fourth of July!

But in Salzburg, wonderful center of culture and history, Philips supplied all seventeen tubes and we were back in business.

Austria is our favorite vacation country. Prices are low, history plentiful, the people delightful, the cooking the finest in the world and the scenery stupendous. In the south, near the Yugoslav border, where Mediterranean climate combine with Austrian hygiene to give the ultimate in pleasure, is the lakeside resort of Klagenfurt, where we stayed two weeks. The excellent trailer park is unusual for Europe, in that there are a few electricity points for trailers. We were too late to grab one, so we had to rely on the generator for power supplies. To use the car's mobile supply would mean running the engine and some people object to the noise and carbon monoxide fumes, even if DXpedition of the Month is on, which is mighty unfriendly of them.

The Japanese generator ran beautifully for fifteen minutes, then it passed out and nothing would bring it back to life. Sadly we closed the logbook. There could be no more stationary operation from the campsite. Then a visitor arrived, DJ8UV, also vacationing in Austria with an Austrian callsign. We explained the catastrophe.

"But you should have mains electricity!" said Ernst and went into a blurr of German with the Direktion. Although all the pitches with electricity were allocated, considering the vital importance of the project, we would be permitted to draw power from the building nearest to the trailer, which was the men's toilet block. All this and Heaven, too!

Some piquant situations arose from this arrangement, like the time we were working mobile thru town and told a K3 to QRX when we arrived back at the trailer, while we hitched the car up to the Men's Room for power. Or the reaction of the fascinated audience who were listening to a PY contact when it was interrupted, in most unseemly manner by a Yahoo who plugged his electric razor in inside the building. These Europeans always were excitable. Poor guy never knew what hit him!

No matter what time of day or night, the

Sylvia's son, G3UML, stands on the car putting up the antenna. Note how closely packed European trailer parks are.

station could never operate without attracting a crowd of listeners. The weather was glorious and lots of girls in the audience wore bikinis, but such was the dedication and true ham single-mindedness of my radio amateurs that they never even noticed, apart from calling CQ-20 on 15 without a microphone.

The prefix for this area is OE8, which is rare enough for a pile-up every time we went on the air. There were even c.w. stations who deigned to work an s.s.b. station, so keen were they to log us. A QSO between a c.w. and an s.s.b. station sounds like a conversation between two of the Marx Brothers. One talks and the other hoots. My family had themselves a real ball, making like Gus Browning, "five-up-and-five-down."

It could be said that I enjoyed that vacation, too. There was the sunshine, so that I could relax while keeping to *CQ* Magazine's deadline for "Quiet Weekend with Uncle Sam" (see *CQ* Magazine, November, 1966.) Then I could practise my German, interpreting for interested bystanders who wanted to know all about amateur radio, *from first principles*. I was allowed the occasional break, to make coffee for yet another deputation of local radio amateurs, or the reporters who gave us a full-page spread in the local paper, so that small boys in the town would point rudely and chase after the car, with its Mark Mobile antenna, and asked for our autograph, as if we were short-wave Beatles.

On the local 2 meter net we announced open house and the whole ham population of Klagenfurt visited us next night, and a Dutch amateur and a Swiss amateur beamed in on us and we had a party. A four-berth trailer isn't equipped to cater for eighteen people, so I had to borrow chairs and glasses from the neighbors.

We had a party, too, in Spain.

That was going to be a lovely, lovely vacation. There was no reciprocity with Spain. We were flying, so luggage was limited, with no room for radio gear. Few Spanish amateurs have yet seen fit to stamp out carrier, so we had had little personal contact with them. It would be a blessed oasis of non-radio in a world gone mad with reciprocity.

With the eternal, cock-eyed optimism of the radio amateur's wife, I had reckoned without two things—nearby Gibraltar, that cocky British anachronism on the southern tip of Spain, and the homing instinct of the expatriate ham.

Maurice practised cautiously with the miniscule bug of a car we had hired. You could career along madly at 30 m.p.h., accelerator pedal flat on the floor. But the car was spunky and hugged those execrable roads like the boys following Don Miller around. There was no holding my husband. The moment he saw a donkey—and there were more donkeys than cars—he must overtake it, throwing caution and discretion to the soft, Andalusian breezes.

Overtaking donkeys by the score, we drove to Gibraltar, where we met the ZB2 gang, a roaring welcome of backslapping and why-don't-you-clean-up-that-lousy-signal and a good, English

Nothing could bring the generator back to life.

cup of tea. Most of the Gibraltar amateurs are British Servicemen. ZB2AM is in the Navy, which, he insists, is the Senior Service, although ZB2AJ and ZB2AO, in the R.A.F., challenged this premise in sturdy, vivid, British yeoman terms. But ZB2AM, Mike, is exceptional, one of the few people who can out-talk me. The only others are Stu Meyer, W2GHK, and Queen Elizabeth II. When I was presented to her at the Red Cross Centenary, I was, for the only time in my life, struck completely speechless!

At Gibraltar we rendez-vous-ed with my winter-cruising parents. They were so seasick that it took several cups of tea before my father was able to make his speech about hating amateur radio and loving radio amateurs. We escorted them back to the ship in great style. The other passengers had done the usual Gibraltar things, like paying respects to the greedy and indelicate Barbary apes on top of the Rock, and to the even greedier Gibraltar shopkeepers at the bottom of the Rock. My parents were the only ones who had been to a Hamfest and come back with full Naval and Air Force escort.

Some days later, wandering around Malaga, trying to fill the dead hours between the going-down of the sun and the coming-up of the Spanish dinnertime, Maurice said: "THAT'S A QUAD!"

Risking death or mutiliation from the evening traffic that swirled around thinking, maybe, he was a bull, *Olè*, he walked straight towards what had attracted him. The building was dark and deserted, but next door was a barber shop. Remembering the versatility of yet another Spanish Barber, we shouted at this one in English, which is the proper way to make foreigners understand you. He nodded when we yelled "RADIO AMATEUR?" but shrugged when we mimed "WHERE?" Then the President of the Malaga Amateur Radio Club arrived.

He spoke no English. I speak French and German and enough Italian to defend my honor, but no Spanish. So we spoke in French and invited the Club to visit us next day at our hotel. Seven of them came and we had us a party, Spanish-style, all hand-kissing and fried octopus.

Next night was New Years Eve. We were all dressed up for the party, status symbols showing discreetly, for the Spanish really go to town for New Year—mink castanets and all.

They were setting up the stage and rehearsing the orchestra and doing little experimental fandangos in secluded corners, when we heard, over the hotel's P.A. system: "CQ DX 20 meter fone."

Now, it was true we intended to go gay that night and show the Spanish that British *sang-froid* can be hotted up a bit. But it was early, we had drunk only one sherry and the virgin champagne bottles still rested, unsullied, in their icy beds. Yet there it was again: "CQ DX 20 meter fone."

This was ridiculous and this was impossible.

Or was it? The man installing the P.A. was a Spanish amateur who had missed last night's party. This was the only way he could identify the British radio amateurs who were staying in the hotel!

On mountain passes they find us. Once we were dragging the trailer up a one-in-eight in Switzerland, when, at the eighteenth hairpin, a Volkswagen with a mobile whip hurtled past, going the other way. At our frantic CQ on the horn, he stood on his brakes, made a boisterous U-turn and *what* a small world it was, with half a mile of furious traffic block behind us!

On battlefields they find us. We took part in a Belgian mobile contest, which involved visiting the field of the Battle of Waterloo, counting the steps that led to the top of the Memorial and sending the result back to Control on 2 meters. We climbed up, lost count half-way, climbed down and began again. By the time we'd got to the top and back to the bottom, we'd begun to wonder whether the Battle of Waterloo had been entirely necessary. Couldn't they just have left Napoleon to get on with it?

Back at the car, W6TRZ, was waiting for us. He had spotted the mobile antenna.

"What are you doing here?" he asked.

"Counting the steps up to the memorial," we replied.

"Oh, really?" he said, like Shelley Berman's air stewardess, when he told her the plane was on fire. "You going to put a beam up there?"

In sleazy dockside alleys they find us. Wandering around the back streets of Dubrovnik in Yugoslavia, my way was barred by a man, who stared at me searchingly, then held out his hand. I flinched, but it wasn't a gun he was pointing, only a camera. The fellow was British, dammit. "You are Sylvia Margolis," he said, "I heard you on the B.B.C. and saw your picture in *CQ*."

In tourist highspots they find us. Outside Notre Dame in Paris everybody else is accosted by vendors of souvenir postcards. We were hailed by an F2, who gave us his QSL, to the disappointment of a passing gendarme, who didn't understand why no money changed hands in this transaction.

Now we are planning our dream holiday, vacation of a life-time, a trip to the U.S. It would be the 21-day excursion. Dorothy Strauber promised to meet us at the airport. I hope she'll have mobile gear on board, so we can get on the air right away without waste of time. Then we must visit K2HLB, to see that fabulous antenna, and W3HQO, because he's Editor of the *XG Bulletin*. We must take a trip to the *CQ* Magazine offices, to get them organized a bit, and to A.R.R.L. H.Q., to finish off what the Redcoats left undone in 1775. There is Peterborough, N.H., to be bypassed, the North Jersey DX Association to be greeted, a quick pilgrimage to Cedar Rapids and Mars Hill. We must have a day browsing round Harrisons' and another at Fort Orange. George Jacobs and Chuck Schauers made me promise to call in when I was passing. And we must see W2CMM, who called us in London in 1959 to say we were interfering with his T.V., because at last I've thought up a clever answer to that one. Then there's the Swampscott Convention and the Dayton Hamvention and the Miami Hamboree. And a certain radio amateur offered to sell me Brooklyn Bridge, so I'd better give it the quick once-over.

That should leave just about 45 minutes for the Statue of Liberty, Empire State, Grant's Tomb, Washington, D.C., the Golden Gate, Grand Canyon, Yellowstone Park, Williamsburg, Jamestown, Disneyland and my Uncle who lives at Coney Island.

So how much time should we need? ■

And so they had a party with British, German, Swiss, Dutch and Austrian hams attending.

NEW from International

SINGLE SIDEBAND
9mc EXCITER-DRIVER
50-54mc MIXER-AMPLIFIER

The SBX-9 Exciter-Driver and the SBA-50 Mixer-Amplifier provide the perfect combination for 50-54mc SSB operation. Performance, versatility and reliability are incorporated into this new SSB pair. A tremendous value at a low price!

Model SBX-9

SPECIFICATIONS:

Exciter-Driver 9mc

Tubes:	6BH6 Oscillator 12AX7 Audio 7360 Bal Modulator 6BA6 RF Amplifier
Filter:	Four crystal half lattice Carrier Suppression 45db min. Unwanted SB Atten. 40db min.
Output:	Provides voltage drive for mixer such as SBA-50
Controls:	Carrier Balance Microphone Gain Test Switch USB-LSB Switch
Metering:	RF output for balance adjust. Two sensitivity ranges available with front panel switch.
Misc:	Relay included for push-to-talk operation. Crystals for upper and lower sideband included. Requires high impedance microphone. For operation on 117 vac 60 cycle power.

$125.00

Model SBA-50

SPECIFICATIONS:

Mixer-Amplifier 50-54mc

Tubes:	6U8A Oscillator-Mixer 12BY7A Amplifier 6360 Linear power amplifier
Drive:	Requires 9mc sideband signal from SBX-9
Output:	SSB single tone 10 watts
Controls:	On-Off Power PA Grid Tune PA Plate Tune PA Load Tune Metering Switch
Metering:	Oscillator 9mc Drive Buffer Grid PA Grid RF Out
Crystals:	Three positions, uses 3rd overtone 41-45mc range. Crystal frequency = final frequency —9mc
Misc:	Accessory socket provided for connecting keying circuit to SBX-9. Comes with three crystals. Specify frequency when ordering. For operation on 117 vac 60 cycle power.

$145.00

Order direct from International Crystal Mfg. Co.

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For further information, check number 4, on page 104

Fig. 19—The front view of the CQ-150 Mark II. The rig is capable of s.s.b. or c.w. operation on 20 or 80 meters.

THREE STEPS TO SIDEBAND

BY HARTLAND B. SMITH, *W8VVD

Part 3: The CQ-150 Mark II

The third and final part of the CQ-150 series describes the addition of the balanced modulator, carrier generator, and crystal filter to permit s.s.b. operation. Several other slight modfications are also made to the Part II circuitry and the final result is s.s.b. or c.w. operation on 80 or 20 meters.

THE bandswitching 150 watt s.s.b. or c.w. transmitter shown in fig. 19 is the result of the third and final series of steps to produce the CQ-150 Mark II, an s.s.b.-c.w. transmitter. Only one tube, a factory wired crystal filter and a few additional components are required to convert the c.w. transmitter described last month into the CQ-150 MARK II. This 75 and 20 meter unit is rated at 150 watts p.e.p. input for single sideband and 150 watts average input on c.w. The MARK II is the end product of a three stage construction project designed to put you on sideband in an economical, yet effective manner.

*467 Park Avenue, Birmingham, Michigan 48009.

Suppressing The Carrier

The grid, cathode and accelerator of V_4 act as a crystal controlled carrier oscillator which may be switched either to 8.9985 mc, 9 mc or 9.0015 mc. (See fig. 23) If V_4 were an ordinary tube, a strong carrier signal would appear on the input winding of T_1. The 6JH8, however, is

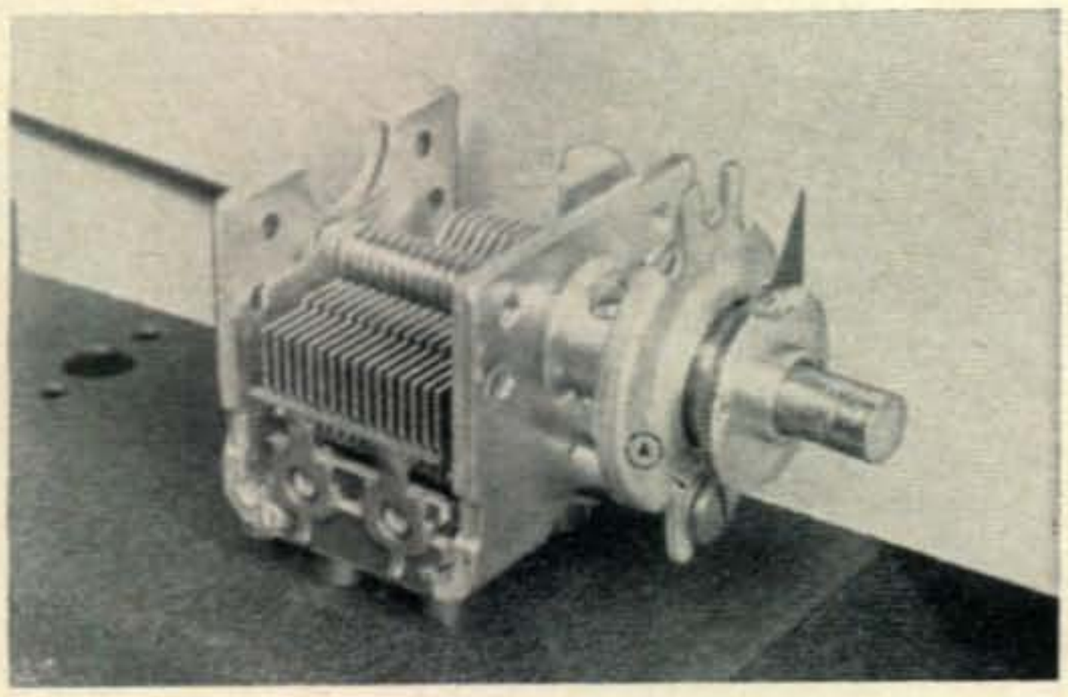

Fig. 20—The view of C_{76}, VERNIER TUNING, mounted in the v.f.o. compartment. All but one rotor plate is removed as shown. The planetary drive is secured by a screw and spacer at point A as described in the text. Note that the two solder lugs for the stator have been trimmed off. The pointer (mounted for the picture) should be soldered on after the v.f.o. compartment is mounted on the chassis.

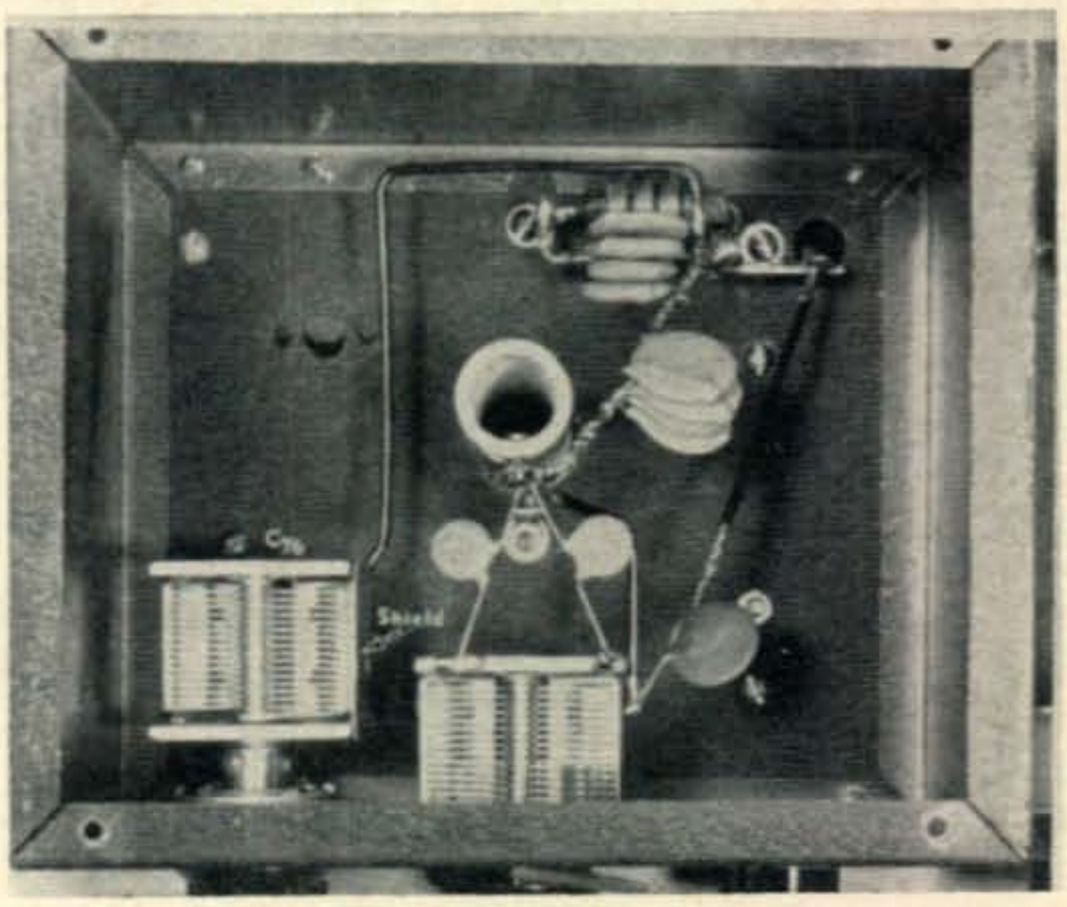

Fig. 21—The internal view of the v.f.o. compartment showing the location of C_{76}. Note the position of the ¾" × 1¼" shield plate on C_{76} and the #14 wire connected to the junction of C_{32} and C_{33}.

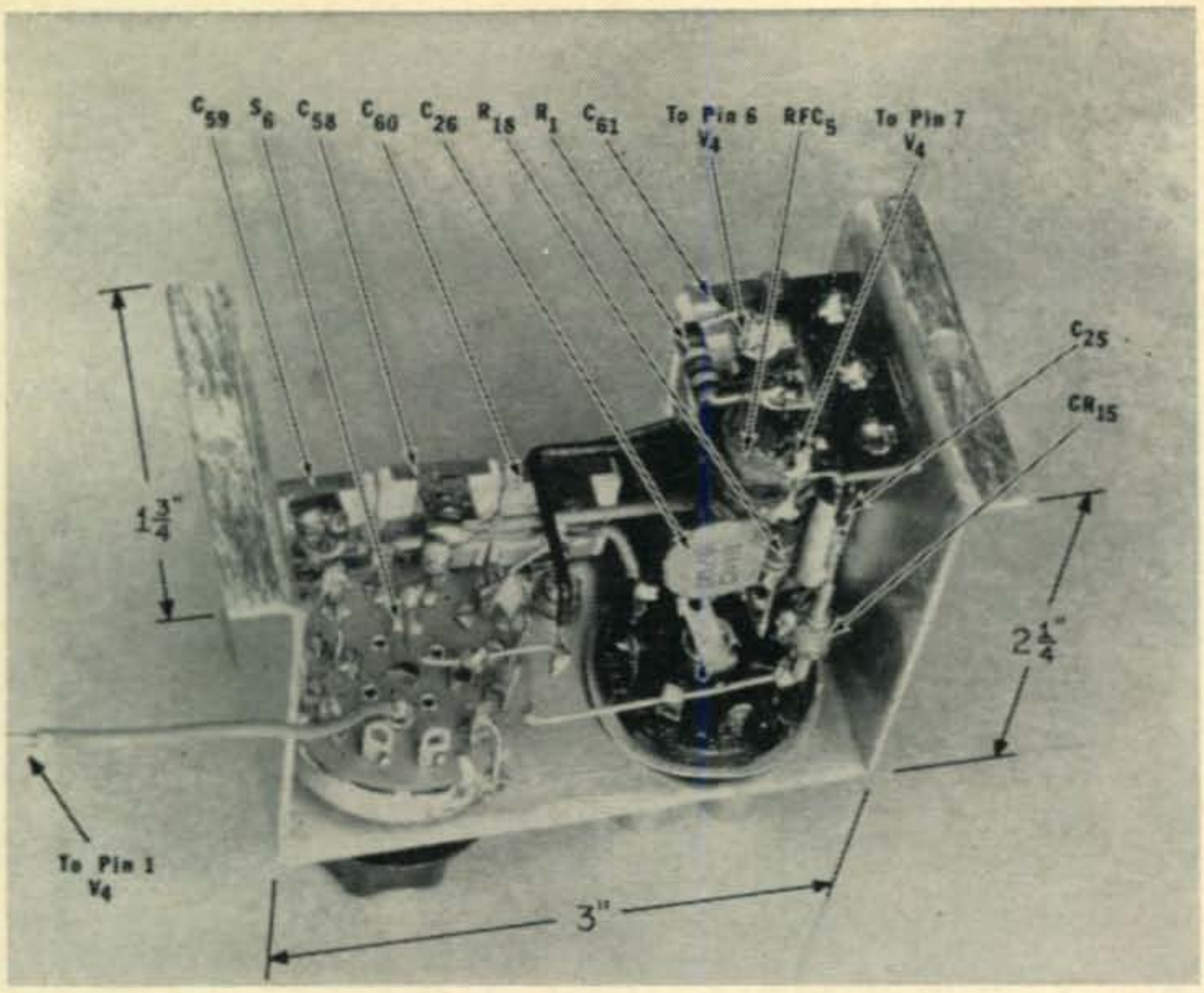

Fig. 22—The bottom view of the U-bracket containing the carrier oscillator components. Switch S_6 is the UPPER-LOWER S.B. selector.

definitely *not* an ordinary tube. Due to its sheet beam construction, it not only doesn't amplify, but actually suppresses the carrier.

You can visualize how this happens if you carefully examine the schematic symbol for V_4. A beam of electrons emitted by the cathode flows past the grid (pin 6), the focus electrodes (pin 5) and the accelerator (pin 3) on its way to the plates (pins 8 and 9). If the voltage *difference* between the two deflectors (pins 1 and 2) is approximately zero, the electron beam will remain centered within the tube and will divide equally between the two plates. That is, the same amount of current will flow through pin 8 as flows through pin 9, thus developing equal voltage drops across R_{42} and R_{43}.

If we introduce an alternating voltage on the grid, at 9.0015 mc, for example, the current flow through V_4 will vary in accordance with this signal. The voltage drops across R_{42} and R_{43} will rise and fall together at the same rate as the grid voltage rises and falls. Even though the voltages appearing on pins 8 and 9 fluctuate at the carrier frequency, at any particular instant, the voltage drop across R_{43} is the same as that across R_{44}. Consequently, the difference between these drops is always zero. Since a zero potential *difference* exists between pins 8 and 9, no significant carrier signal can reach the primary of T_1 via C_{65} and C_{66}.

Sideband Generation

Even though the carrier is out of the way, it is still necessary to suppress one sideband. This is accomplished by applying audio from the dual triode speech amplifier (V_{6A} and V_{6B}) to deflector 2 of V_4. The electron beam is now deflected toward first one plate and then the other. The previously equal plate currents are now unbalanced at an audio rate and, through a mixing process, sideband energy appears in the primary of T_1.

Both the lower sideband, which equals the carrier frequency minus the modulating frequency, and the upper sideband, which equals the carrier frequency plus the modulating frequency, reach the McCoy crystal filter. If a 1000 cycle (.001 mc) tone is fed to the microphone, the lower sideband will be at 9.0005 mc, while the upper sideband will be at 9.0025 mc.

The filter is designed to pass only signals from approximately 8.9985 mc to 9.0015 mc. Since the upper sideband is outside this range, it is rejected by the McCoy Filter. On the other hand, the lower sideband falls within the passband of the filter and reaches the grid of V_{6C}. After amplification by the pentode section of this 6M11 Compactron, a sideband signal of approximately 9 mc is fed to V_{5B} where it mixes with 5 mc energy from the v.f.o. to produce either a sum or difference sideband signal in the 14 or 4 mc bands. Further amplification at the operating frequency then takes place in V_1 and V_2.

If upper sideband transmission is wanted, the 8.9985 mc carrier crystal is used. The upper sideband will then be at 8.9995 mc, a frequency that will be accepted by the filter, while the lower sideband, at 8.9975 mc will be rejected.

To obtain a carrier for transmitter tuning purposes or c.w. operation, V_4 is unbalanced by grounding deflector 1 and the oscillator frequency is lowered to the center of the filter's passband with a small capacity (C_{60}) switched across the 9.0015 mc crystal.

Although we've been considering a single modulating frequency of 1000 cycles to simplify mental math processes, the speech frequencies required for communication purposes actually extend from approximately 300 to 3000 c.p.s. For this reason, the sidebands contain numerous components which appear in clusters approximately 3 kc wide above and below the suppressed carrier.

Push-To-Talk

Most sidebanders prefer short transmissions with quick replies rather than long winded a.m. style monologues. A push-to-talk switch located in the microphone of the MARK II makes possible rapid changeover from SEND to RECEIVE. The switch, wired in parallel with S_1 and S_2, controls K_1.

V.F.O. Conversion

A dual tuning arrangement combines the convenience of speedy band coverage with the ex-

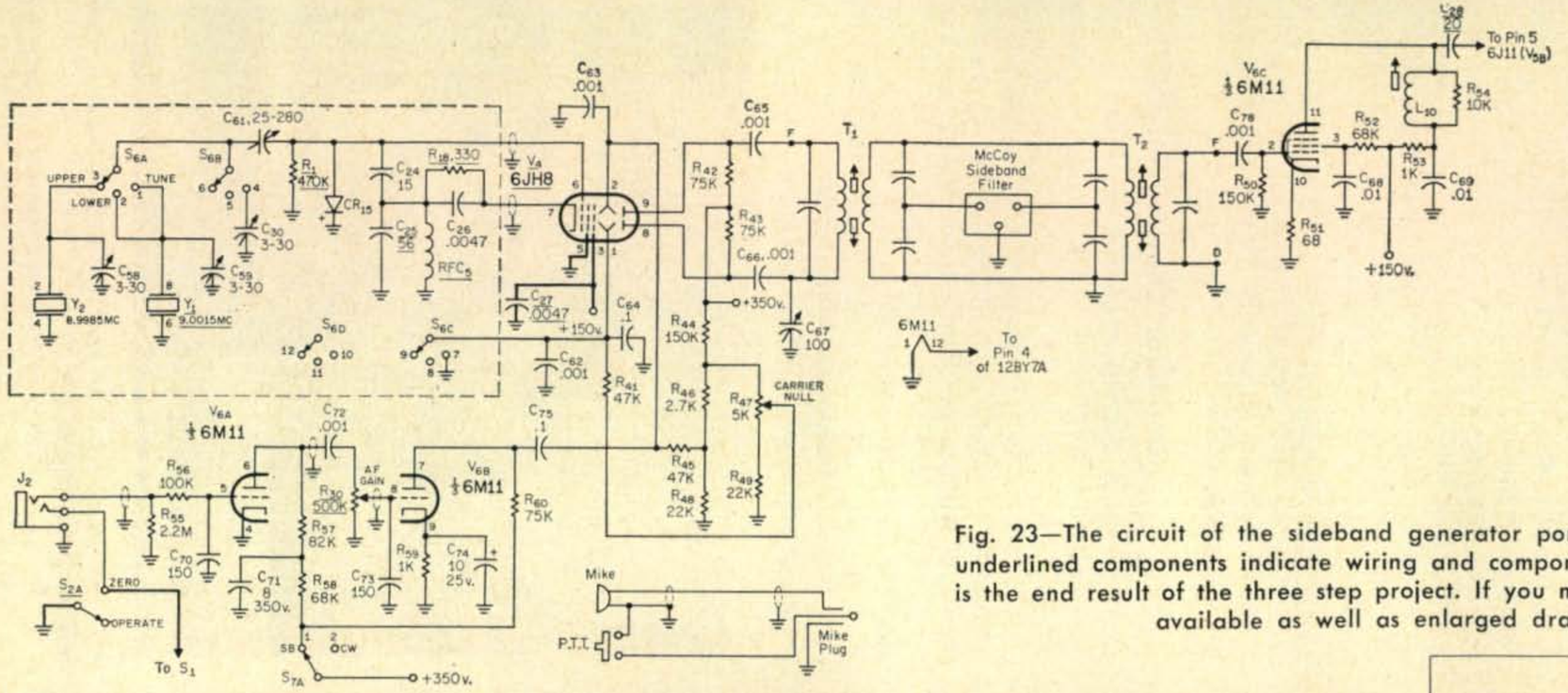

Fig. 23—The circuit of the sideband generator portion of the CQ-150 Mark II. Bold lines and underlined components indicate wiring and components retained from the CQ-150. To the right is the end result of the three step project. If you missed steps one and two, the back issues are available as well as enlarged drawings for the chassis layout.

Parts List

C_{58}, C_{59}, C_{60}—3-30 mmf mica trimmer capacitor.
C_{61}—25 280 mmf trimmer.
C_{62}, C_{63}, C_{65}, C_{66}, C_{72}, C_{78}—.001 mf disc ceramic capacitor.
C_{64}, C_{75}—.1 mf paper capacitor.
C_{67}—100 mmf air padding capacitor.
C_{68}, C_{69}—.01 mf disc capacitor.
C_{70}, C_{73}—150 mmf disc capacitor.
C_{71}—8 mf, 350 volt electrolytic capacitor.
C_{74}—10 mf, 25 volt electrolytic capacitor.
CR_{15}—1N34A germanium diode.
J_2—3 circuit phone jack.
L_{10}—38 turns, #28 enameled wire on a J. W. Miller 21A000RBI form. (Allied Radio 54D3909, 90¢).
R_{41}, R_{45}—47,000 ohm, ½ watt resistor.
R_{42}, R_{43}, R_{60}—75,000 ohm, 1 watt resistor.
R_{44}—150,000 ohm, 2 watt resistor.
R_{46}—2700 ohm, ½ watt resistor.
R_{47}—5000 ohm potentiometer, linear taper.
R_{48}, R_{49}—22,000 ohm, ½ watt resistor.
R_{50}—150,000 ohm, ½ watt resistor.
R_{51}—68 ohm, ½ watt resistor.
R_{52}, R_{58}—68,000 ohm, ½ watt resistor.
R_{53}, R_{59}—1000 ohm, ½ watt resistor.
R_{54}—10,000 ohm, ½ watt composition resistor.
R_{55}—2.2 megohm, ½ watt resistor.
R_{56}—100,000 ohm, ½ watt resistor.
R_{57}—82,000 ohm, ½ watt resistor.
S_6—4 pole, 3 position, non-shorting, rotary switch (Mallory 3243J).
S_7—4 pole, 2 position, non-shorting, rotary switch (Mallory 3242J See text).
T_1—J. W. Miller #1740 s.s.b. input transformer.
T_2—J. W. Miller #1741 s.s.b. output transformer.
V_6—6M11 tube.

Sideband Filter—McCoy 48B1 or 32B1 9 mc filter.
Microphone—High impedance ceramic microphone with push-to-talk switch.

Vernier Drive—Jackson Bros. Precision Planetary Drive. 6:1 ratio (Available from Arrow Electronics, Inc., 900 Broad Hollow Rd., Farmingdale, New York. $1.50).

Y_1, Y_2—Part of the McCoy crystal filter set.

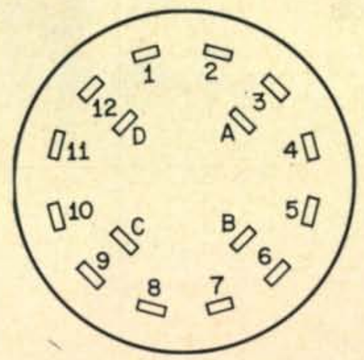

Fig. 24—The terminal identification of S_6, the SIDEBAND SELECTOR.

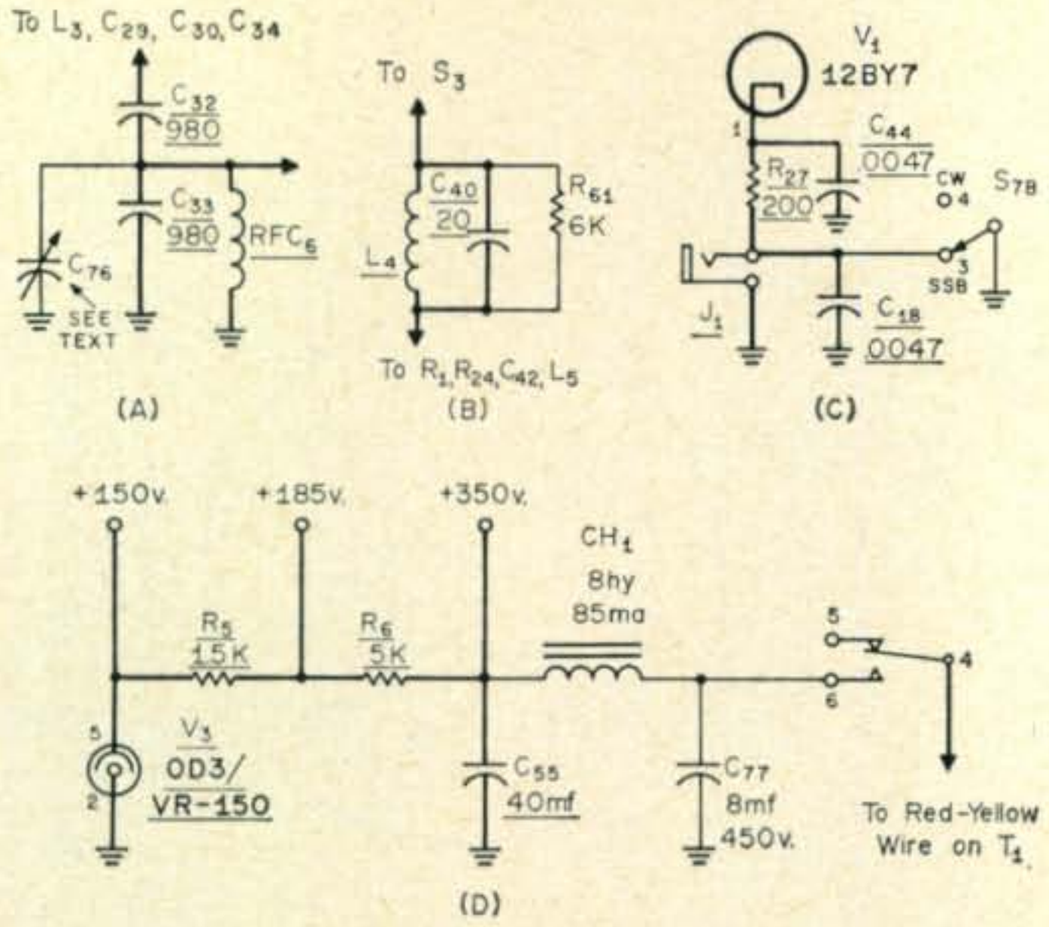

Fig. 25—The additional circuit changes that are required for the Mark II version of the CQ-150. (A) V.f.o. circuit; (B) V_{5B}, 80 meter mixer plate coil; (C) V_1, driver; (D) 350 v.d.c. power supply output.

Parts List

C_{76}—1 plate variable capacitor. Allied Radio 43A3524 modified as described in the text.
C_{77}—8 mf, 450 v. electrolytic.
CH_1—8 h, 85 ma, filter choke. Allied Radio 54A1485.
R_{61}—6K ½ watt composition resistor.
S_7—See parts list for fig. 23, and text.

treme vernier action ncessary for accurately zero beating other stations. A pointer knob connected directly to the shaft of C_{29}, the main v.f.o. capacitor, makes it easy to jump from one end of the band to the other, while a 6 to 1 planetary drive mechanism on C_{76} supplies plenty of bandspread for smoothly zeroing right down to the last cycle.

Figures 19, 20, 21 and 25A illustrate the method of adding a vernier capacitor to the v.f.o. Carefully remove all rotor plates except the one nearest the front of C_{76} and cut ⅜" off the end of the tuning shaft. Before attaching the planetary drive to the capacitor remove 11/16" from its shaft.

A 15/32" spacer, bolted beneath the bottom mounting ear of the vernier mechanism, prevents its ball bearing raceway from turning as the capacitor is tuned. Deepen the grove in the ear with a file so that a ⅝" 6-32 screw can pass straight through and enter the tapped hole in the frame at a right angle, thus preventing cross threading. A portion of the spacer will have to be filed away to clear the rim of the raceway.

A ¾" × 1¼" piece of coffee can tin, soldered across the open right hand side of the capacitor frame, as illustrated in fig. 21, effectively shields the stator plates of C_{78} from the field of L_3. Without this shielding, the v.f.o. frequency wobbles a tiny bit as C_{76} is tuned. With it, tuning is literally "as smooth as silk."

Run #14 or heavier solid wire between the stator of C_{76} and the junction of C_{32} and C_{33} to minimize microphonic problems with this rather long lead.

Drill a ⅞" diameter hole in the v.f.o. panel to provide clearance for the pointer disc of the vernier drive. Capacitor C_{76} should be positioned so that the face of the disc extends ⅛" beyond the front panel. A small triangular pointer, cut from tin and soldered to the disc will indicate the approximate position of C_{76}'s single rotor plate. When operating the rig, you will normally keep C_{76} around half capacity and then only shift it a little one way or the other to achieve perfect zero beat.

Support the capacitor on four ¼" spacers through which pass ½" #6 self tapping screws. A drop of oil on each screw will help cut threads in the untapped holes located in the bottom of the capacitor.

Additional Changes

Figure 25 illustrates several minor revisions required in the original circuit. First, parallel L_4 and C_{40} with a 6,000 ohm, ½ watt composition resistor. Then, mount S_7 and connect a wire from its terminal 3 to the junction of J_1, R_{27} and C_{18}. Ground terminal B. The author used a 4 pole, 2 position switch for S_7 because it was on hand in the junk box. A 2 pole, 2 position switch may be substituted when purchasing a new component.

Additional filtering of the 350 volt supply is provided by CH_1 and C_{77}. Connect these components between terminal 6 of K_1 and the positive terminal of C_{55}.

Oscillator Chassis

A separate oscillator chassis prevents undesirable stray coupling of 9 mc energy to stages beyond the balanced modulator. Follow the layout shown in fig. 22 as closely as possible when mounting the major components on the U-shaped piece of aluminum. Run shielded wire, preferably coaxial cable, between pins 6 and 7 of V_4 and the oscillator subchassis.

Balanced Modulator

Since you may find it necessary to retune T_1

Fig. 26—Rear view of the transmitter showing the bracket that mounts the carrier oscillator components. The McCoy 9 mc filter is located between the rear of the v.f.o. compartment and the U-bracket.

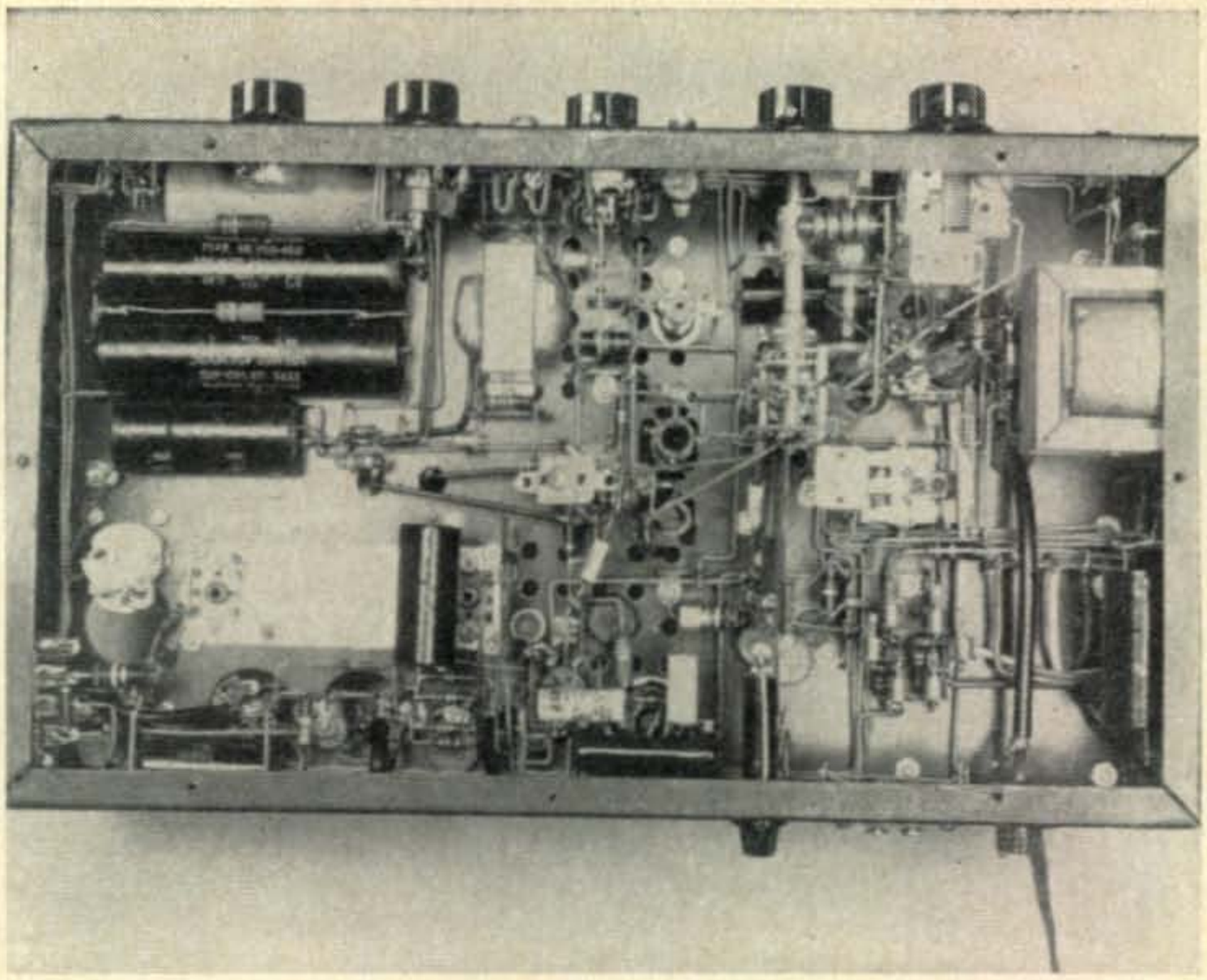

Fig. 27—Bottom view of the CQ-150 Mark II.

a number of times when first adjusting for maximum carrier suppression, it will pay you to lubricate the slugs in the transformer so that they will move as freely as possible. Before mounting T_1, carefully disassemble it. Slip off the top cap and unscrew both slugs. Apply Lubriplate, Vaseline or a little heavy grease to the threads.

Replace the slugs. Screw the bottom one all the way into the form. The top slug, on the other hand, should be positioned just inside the top of the form. Re-assemble the transformer and mount it, along with T_2 and the sideband filter, directly behind the v.f.o. box. Bolt the crystal oscillator sub-assembly in place. Position the socket of V_6 with pins 1 and 12 nearest the rear of the chassis.

The balanced modulator and speech stages may now be wired. Carefully follow the parts layout of figs. 27 and 28. Make the leads of C_{65} and C_{66} as short and direct as possible. Keep all wiring associated with V_6 as far from the sideband filter as possible. Twist the three leads to R_{47} into a cable and run them along the edge of the chassis.

Use shielded wire for the three long audio leads running between V_6, J_2 and R_{30}. Make certain that the bare braid does not short against the exposed terminals of other components.

9 MC Amplifier

Shield the grid and plate circuits of V_{6c} from each other with a 1½" × 3" piece of tin. Solder one end of the shield to pin 1 of V_6. Solder the opposite end to a ground lug bolted to the chassis.

Preliminary Adjustments

After you have completed all wiring shown in figs. 23 and 25, carefully recheck your work for errors! When you are satisfied that all is well, you are ready to begin the alignment process.

Attach a dummy load and r.f. indicator (Or a 100 watt bulb.) to P_1. Set R_{47} at mid scale, S_7 to SIDEBAND, S_3 and S_4 to 3.5 mc, S_6 to TUNE and C_{29} to 3.9 mc. Open up C_{58}, C_{59} and C_{60}. Tighten C_{61}. Set C_{67} at ⅔ capacity. Throw S_5 ON. After the tubes have heated, flip S_2 to ZERO. You should now hear a faint 3.9 mc carrier in your receiver.

With a hex head plastic alignment tool, adjust the bottom slug of T_1, both slugs in T_2 and finally the top slug in T_1 for maximum signal. Use only a plastic tool, not a screwdriver or Allen wrench! Peak L_{10}.

Slowly unscrew C_{61} as you flip S_2 back and forth. Use only enough capacity at this point to insure prompt starting of the crystal each time the rig goes on the air.

You should now be able to obtain almost full output or bulb brilliance when the transmitter is tuned and loaded in the normal manner with C_{49}, C_{15} and C_{16}.

Switch to 14 mc, set the v.f.o. at 14.3 mc and retune the final for maximum output. If the output is significantly lower than at 3.9 mc, peak L_5 and reduce the capacity of C_{37} until performance on the two bands is about equal.

Go back to 3.9 mc and throw S_6 to LOWER SIDEBAND. Tune C_{67} so that the bulb dims, but does not go out completely. Slowly increase the capacity of C_{59} until the bulb brightness peaks. Note the receiver's S-meter reading. If it's pegged, turn down the r.f. gain control until the needle is around S-9. Now, *reduce* the capacity of C_{59} until the meter drops 2 S-units.

Switch to UPPER SIDEBAND. Peak the output with C_{58}, note the S-meter reading and then *increase* the capacity of C_{58} until the output drops 2 S-units. The purpose of these two adjustments is to place the carrier approximately 12 db down the slopes of the sideband filter.

Switch back to TUNE and touch up C_{60} for maximum output, an indication that the carrier is near the center of the filter's passband, when S_6 is in this position.

Flip to LOWER SIDEBAND. Tune C_{67} for minimum S-meter reading. You are now suppressing the carrier. The lower you can get the S-meter to go, the less residual carrier you'll have on the air. The exact amount of suppression it is possible to obtain depends not only on the setting of C_{67}, but also upon the arrangement of components in the balanced modulator, the setting of R_{47}, the position of the primary slug in T_1, the sideband on which you are operating and on manufacturing tolerances within V_4, itself.

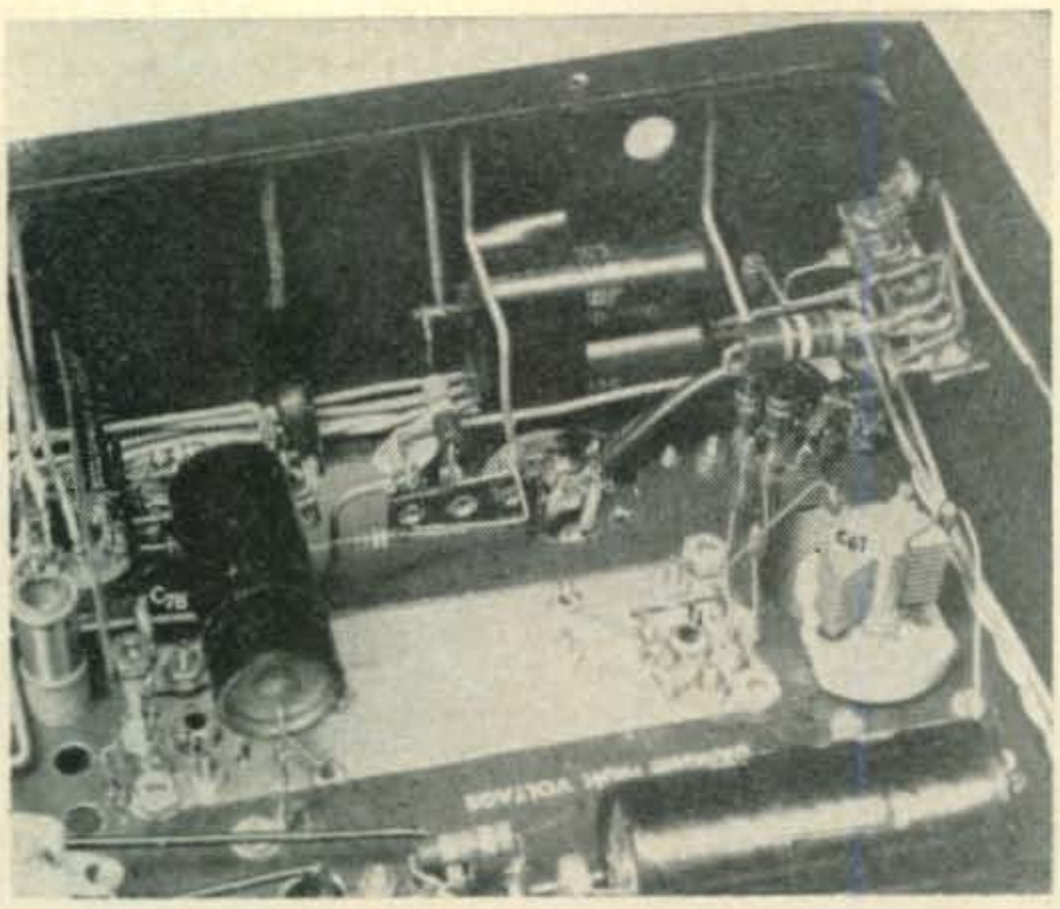

Fig. 28—Close up view of the balanced modulator and crystal filter components in the Mark II version.

The receiver S-meter should drop at least 6 S-units when switching from TUNE to either LOWER or UPPER SIDEBAND. With a little juggling of adjustments you can probably increase suppression by a worthwhile amount. In the prototype, a suppression figure of better than 50 db was achieved.

After each adjustment of the bottom slug in T_1, flip back momentarily to TUNE and re-peak the top slug. If no combination of adjustments provides a satisfactory carrier null, connect the stator lug of C_{67} to transformer terminal *F*, rather than to terminal *D*.

The carrier null point may shift slightly as the transmitter warms up. You can compensate for the change with a slight tweak of R_{47}, CARRIER NULL.

Set the transmitter to 3.9 mc, LOWER SIDEBAND and plug in the mike. Push the button and talk in a normal tone of voice. Advance R_{30} until the 6HF5 cathode current, when uttering a sustained "ahhhh", rises to about 100 ma, or half the reading obtained at maximum output in the TUNE position. Peak envelope power will now be in the neighborhood of 150 watts.

Do not advance R_{30} beyond this point! If you do, nearby hams will begin to make nasty cracks about your flat-topped, distorted signal.

Switch to 14.3 mc, UPPER SIDEBAND and make similar tests.

When the mike button is depressed, but no modulation is applied, the 6HF5 idling cathode current should run around 25 ma. Since it is difficult to read low current values on M_1, check this figure with an external meter temporarily connected into the circuit. Use a little more resistance at R_{39} (in bias power supply) if the meter indicates less than 20 ma and a little less if the reading is above 30 ma.

To work c.w. throw S_6 to TUNE and S_7 to C.W. Plug in a key and operate the rig as you did before conversion.

A Reminder

Don't forget to keep your hands out of the works while the power is on! Observe the precautions against amplifier overheating mentioned in last month's issue.

On-The-Air

Once you've lined up the early stages of the transmitter and have become familiar with the tuning procedure, you can put the bottom plate on the chassis, hook up the antenna and start working stations. Bear in mind that the operating frequency is slightly different at each position of S_6. Consequently, before attempting to zero beat another station, make certain that the switch is already set for the sideband you want to transmit on. In most cases, this will be UPPER on 20 meters and LOWER on 75 meters. ■

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than with a SWAN-250 6-METER TRANSCEIVER

eter Band Openings Increase! With sun spot activity now on increase, 6 meters is rapidly becoming one of the most in-sting bands to operate, and the next few years will un-ptedly see tremendous activity on this band. Sporadic E nings are occurring several times each week over all parts he country, making excellent contacts possible from Coast oast and over intermediate paths. With long F2 skip and s-equatorial propagation to look forward to, plus the con-ent ground wave and tropospheric scatter contacts made ible with the power of the Swan 250, there is practically imit to the operating pleasure you can find in the VHF d above 50 mc.

Swan 250 is at its best in the SSB mode, for which it was arily designed. With 240 watts PEP input and an average beam antenna, its talk power does an outstanding job. To work your AM friends you simply insert carrier to 75 watts input, and they will read you loud and clear. AM reception is provided for by the receiver function switch. Also, a noise limiting circuit is effective on both AM and SSB.

The Swan 250 is engineered to provide the same excellent voice quality which has become the trademark of all Swan transceivers. And, naturally, the same customer service policy, second to none, applies to our VHF models.

If you are seriously interested in working 6 meters, see the new Swan 250 at your dealer. We are delivering now, but the back order list is getting longer, and we suggest you place your order soon.

73 Herb Johnson W6QKI

SPECIFICATIONS:

240 watts P.E.P. input on single sideband, 180 watts cw input, 75 watts AM input with carrier insertion.
Two 6146B tubes in Power Amplifier.
Complete band coverage, 50-54 mc.
Velvet smooth vernier tuning covers 500 kc, calibrated in 5 kc increments.
Transmits and receives on Upper Sideband.
2.8 kc bandwidth with crystal filter at 10.7 mc.
Single conversion design for minimum image and spurious.
40 db unwanted-sideband suppression, 50 db carrier suppression.
Receiver noise figure better than 3 db.
6HA5 triode R.F. amp., 6HA5 triode mixer.

- ★ **Separate AM detector.**
- ★ **Automatic noise limiter.**
- ★ Separate AF and RF gain controls.
- ★ Audio response essentially flat from 300 to 3100 cycles.
- ★ Pi output coupling for matching wide range of load impedances.
- ★ Meter indicates either cathode current or relative output for optimum tuning and loading.
- ★ Provisions for adding 500 kc calibrator, or plug-in Vox unit.
- ★ Dimensions: 5½ in. high, 13 in. wide, 11 in. deep. Weight: 17 lbs.
- ★ **Price, amateur net: Swan-250 .....$325**

External VFO for separate transmit-receive control available soon.

117XC AC Power Supply.....$ 95.00
14-117 12 Volt DC Power Supply.....$130.00
500 kc Calibrator Kit.....$ 19.50
Model VX-1 Plug-in VOX.....$ 35.00

MARK VI 50 mc LINEAR AMPLIFIER
2000 Watts P.E.P., two 3-400Z tubes. Includes Power Supply.
Price, less tubes.....$475.00

SWAN ELECTRONICS
OCEANSIDE, CALIFORNIA

For further information, check number 35, on page 104

NEW YLRL OFFICERS FOR 1967

BY LOUISA B. SANDO,* W5RZJ

Edie McCracken, K1EKO, president of YLRL for 1967.

THE Young Ladies' Radio League (YLRL) has embarked on its 28th year of existence. Guiding its operation for 1967 will be the following YLs:

President—Edie McCracken, K1EKO. During 1966 Edie served YLRL as vice president and for three years prior to that she was editor of *YL Harmonics*. Edie has held her amateur license and been a member of YLRL since 1957. Her OM is Bill, K1GUU, and they have two jr. ops. Operating from Westwood, Mass., K1EKO is active on the Yankee Lassie Nets, on the YL Open House and is a member of WRONE and Denver Radio Club.

Vice President—Martha Wessel, KØEPE. Marte has served YLRL as Publicity Chairman for several years. Licensed in 1957, she joined YLRL in 1959. Her OM is Pete, WØJYW. Her present QTH is Liberal, Kans., but Marte expects they'll return to the Denver area within two years. She is a member of Colorado YLs and has served as president, secretary and editor. She participates in Tangle, LCL, TYLRUN, YL-ISSB, CHC, DRC and YL Open House nets. Marte is chairman of the Fifth International YLRL Convention being sponsored by the Colorado YLs. (Marte tells us the convention has been set for the *third weekend in June, 1968*, in the Denver area, so start saving up your dimes and dollars!)

Secretary—Maxine Hanberry, WA6AOE. Maxine served YLRL as Secretary during 1966 and prior to that was 6th D/C. Licensed in 1956, she has been a member of YLRL since 1958. OM Bill is K6MQT, and their son John, a college student, is WA6IYM-WA7FSY. Maxine's QTH is South Pasadena and she is a member of YLRC of Los Angeles, for which she has served as president, vice president, corres. secretary and DX-YL chairman. She is active on the Eyebank, Ironing Board, Tangle, Western Country Cousins and LAYL 2-meter nets. (For photo see *CQ*, Jan. 1966, p. 94)

Receiving Treasurer—Toni Chapman, K8PXX. Toni has served YLRL in this position during 1966. She has been licensed and a member of YLRL since 1959. OM Bob is K8PXY and they have one jr. op. Toni's QTH is Plain City, Ohio and she belongs to Columbus ARA and the Buckeye Belles, for which she has been president. K8PXX joins in the Buckeye Belles and YL Open House nets.

Disbursing Treasurer—Barbie Houston, K5YIB. Barbie has been serving YLRL as disbursing treasurer for two years. Prior to that she served as Treasurer, 5th D/C, Editor, Publicity Chairman and WAC/YL Custodian. Barbie has been licensed and a member of YLRL since 1948. Her QTH is Richardson, Texas. OM Dick is K5YIC and they have two boys.

Editor, *YL Harmonics*—Peg Harnois, K1GSF. This is an appointed position rather than an elective one, and Peg will be continuing the work she did in 1966. Licensed in 1958, Peg is active on the Yankee Lassie Net, Boston Region and Maine Post Office nets and Army MARS and is scrapbook custodian for WRONE. Her QTH is Westbrook, Maine, where she shares the radio room with her Dad, K1EFZ. (For photo see *CQ*, Jan. 1966, p. 94)

Serving YLRL as District Chairmen for 1967 will be these YLs: K1IIF, Ruth Barber; WB2JCE, Janice Fontana; K3TNL, Elinor Wendland; W4QBY, Dorothea Seavers; K5BNQ, Doris Anderson; WA6LWE, Madge Mason; W7NOB, Gwen Jackman; WA8KMT, Edith Best; K9ZLB, Mildred Bovee; KØJFO, Cleo Bracket; VE3BII, Jan Burgess.

Congratulations to these YLs, and may they have a successful and rewarding year ahead!

The Young Ladies' Radio League welcomes new members. Dues are $3.00 per year. Mail dues and request for membership to receiving treasurer, Toni Chapman, K8PXX, West 2nd St., Plain City, Ohio. ■

*4417 Eleventh St., N.W., Albuquerque, New Mexico 87107.

Marte Wessel, KØEPE, vice president of YLRL for 1967.

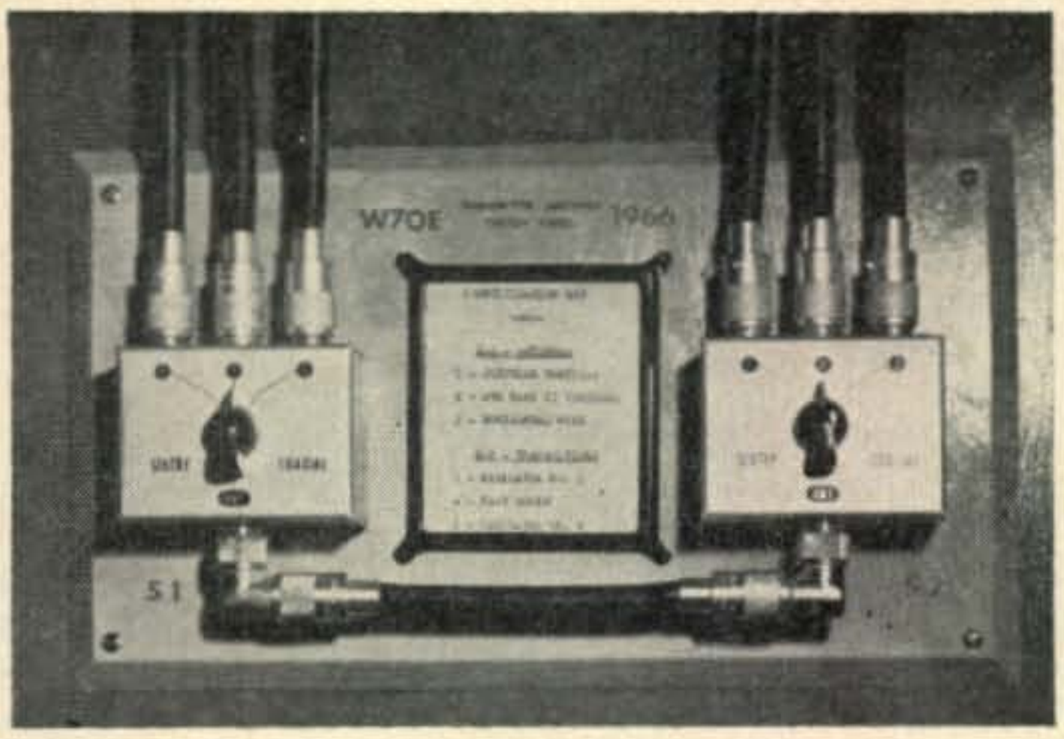


Fig. 1—Basic switching panel at the station of W7OE around which the final arrangement was designed.

FLEXIBLE COAX SWITCHING

BY HOWARD S. PYLE,* W7OE

The author presents a simple and inexpensive method of switching antennas and equipment in a low powered set-up to provide maximum flexibility.

In a recent modernization of my ham shack I came up with a final arrangement embracing three transmitters, three receivers and six separate antennas. While this combination provided an antenna for each piece of equipment, it offered no flexibility. In the past I had frequently had occasion to shift antenna feeders around to perform various evaluation tests. This always involved uncoupling various connectors, chasing down the proper feed lines and re-connecting to the equipment. This was inconvenient and often resulted in a somewhat tangled group of lines. Switching would provide the desired flexibility and greatly increase the convenience but a group of coaxial switches were, at the time, relatively costly. With the recent introduction of the low-cost, three position Sentry coaxial switch by Edwards Electronics of Lubbock, Texas, the thought was revived. I decided to make an initial set-up using the three transmitters and their associated antennas only. Two of the Sentry switches would take care of this and, if the results justified the modest cost, the same scheme could be applied to the receivers and their antennas as well by using two additional switches.

Figure 1 shows the initial transmitter/antenna switching panel; in the schematic of fig. 2 the inter-connections are clearly shown. It is obvious that choice of any one of three antennas for use with any one of three transmitters is instantly available through simple manipulation of the switch knobs. The convenience of this arrangement became immediately apparent.

*3434 74th Avenue S.E., Mercer Island, Washington 98040.

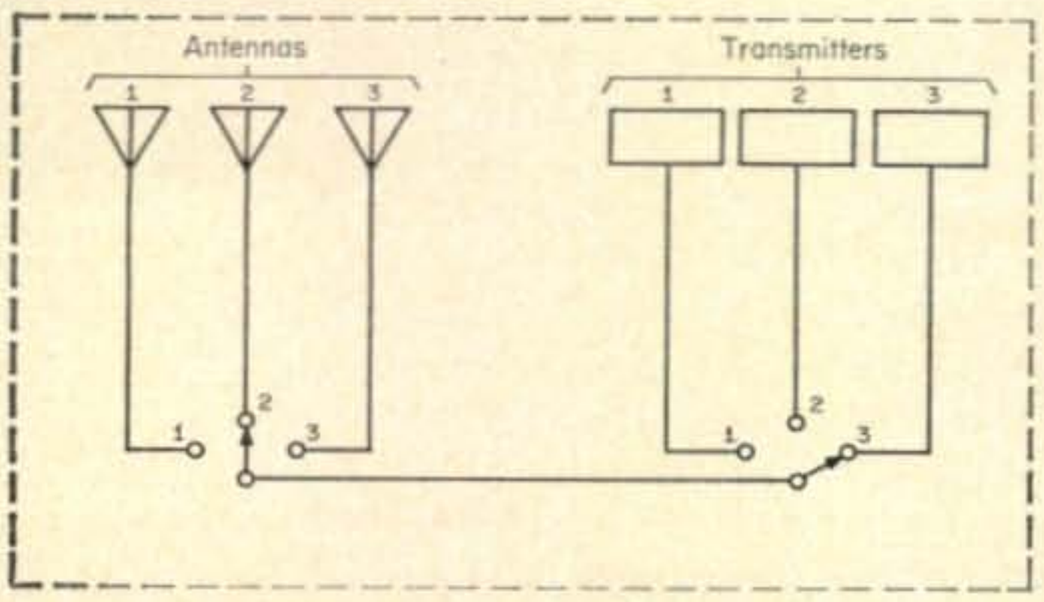


Fig. 2—Circuit of the basic transmitter panel shown in fig. 1.

Construction

The cost of such an arrangement is modest. Aside from the switches and a few coax connectors which you may not have on hand, there is nothing else to buy and if you're a good 'surplus shopper' a couple of dollars or less will buy you a handful of connectors.

For the mounting base I used a scrap piece of ½" plywood, 8×14". beveled the top edges and gave it two coats of enamel. Appropriate nomenclature was applied to the panel using the small Ami-Cal dry transfer decals. The metal card holder frame cost a quarter from an office supply store and contains a typed card identifying each switch position with its associated transmitter and/or antenna.

Receiver Switching

This arrangement proved so neat, convenient and flexible that I delayed no longer. I ordered two more of the Sentry switches and made up an exact duplicate of the transmitter panel for use with the receivers. Again its advantages were obvious; neatness, convenience and no involved

The transmitter/antenna panel and antenna group selector unit installed at W7OE. The transmitters are located below the panel and an identical receiver panel is located at the opposite end of the shack.

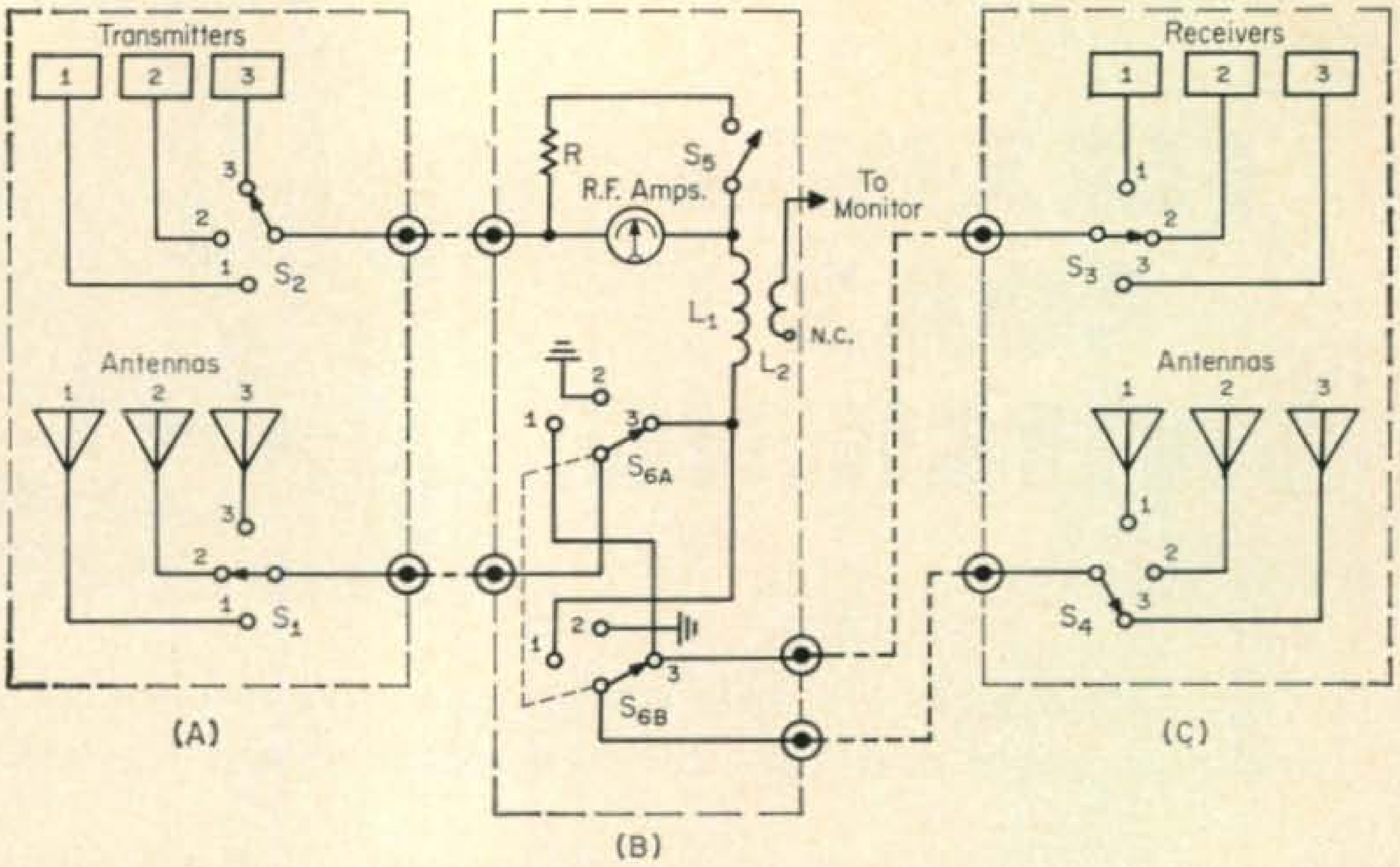
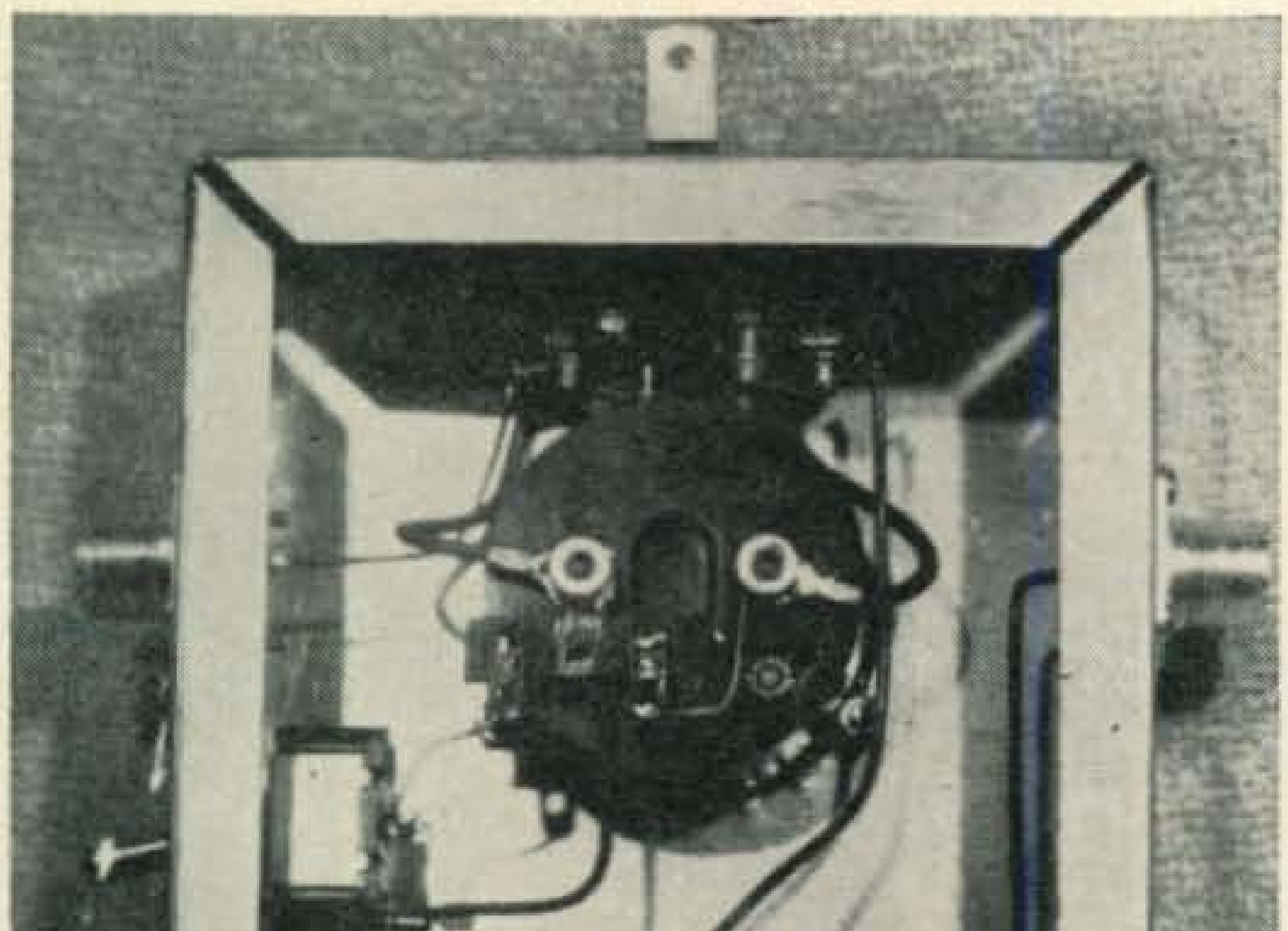


Fig. 3—Circuit of the final arrangement at W7OE uses two sets of coax switches and a reversing switch to permit any of six antennas to be used with any receiver or transmitter.

juggling of connectors and tangled feed lines. Also, like the transmitter panel, it provided for instant choice of the appropriate antenna for the communication in hand. This latter is really important and often enables a far better signal/noise ratio or a better directivity effect for improved reception.

Cross Over

The arrangement described, while providing an excellent measure of satisfaction still lacked the full degree of flexibility which was inherent in the equipment and antenna availability. Both transmitters and receivers were tied only to their own group of three antennas. Suppose we could carry this to the ultimate by using, through appropriate switching, the *transmitting* antenna group on the *receivers* and vice-versa? By doing so we would have a choice of any of *six* antennas on any one of the transmitter or receiver group.



Interior view of the antenna group selector shows the r.f. ammeter shunt and the selector switch which proved adequate for the low power at W7OE.

A little doodling with pencil and paper soon indicated that one additional switch connected in a conventional polarity reversal configuration would do the trick. This worked out to be a simple 2 pole, 2 position rotary type. While preferably ceramic, I had a phenolic type with 3 positions on hand and, as my transmitters all run with an input power of less than 100 watts, little chance of r.f. leakage across the phenolic wafers would occur. I used it and, having the third position available, found a use for that as well. I simply grounded the second contact of both switches and, as a glance at the schematic of fig. 3 will show you, this effectively grounds whichever two antennas may have been left in the circuit after an operating session thereby affording some measure of lightning protection to the equipment!

Refinements

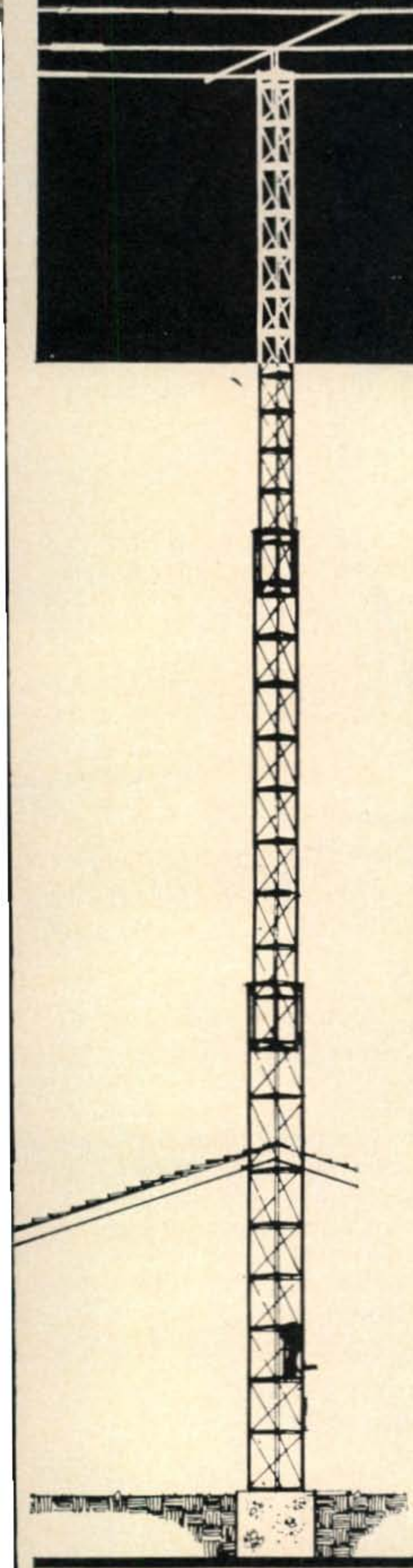
Meanwhile however, a couple of additional refinements were vaguely taking shape in my thinking. I have always been partial to a *visual* indication that r.f. was actually flowing to the antenna . . . not just taking the word of the dip point in the final amplifier plate current. Maybe it's nostalgic but I was indoctrinated early in radio transmitter adjustment using first a 'hot-wire' ammeter in early "wireless" days, later a thermo-coupled r.f. ammeter; I doggedly cling to it. I want a needle to show me that I am actually putting something *into* the antenna (or at least the feed line!); what comes *out* of it, my field strength meter will show me!

As the circuitry of my arrangement was such that the r.f. ammeter would appear in the common feeder from all transmitters and which ran to the antenna selector switch, the logical location for the switch and meter would be in the same enclosure. For this I used a 5×7×2" aluminum chassis pan as a cabinet, mounting it to the wall adjacent to the transmitter/antenna switching panel by three small angle brackets.

[*continued on page 95*]

Henry Radio presents

An Exciting New Beam Antenna Program!



For the average amateur located on a small city lot, the problem of an adequate low-cost beam antenna system has never been properly solved. Now Henry Radio has exercised its unique experience and buying capacity to break the antenna barrier. Here is a complete antenna program pre-engineered, pre-matched and pre-packaged to suit the average QTH and the average pocket-book.

Package No. HR-1
Tristao CZ337 New concept 40 ft. crank-up tower
100 ft. RG-58U Coax
CDR TR-44 Rotator
Hornet TB-500-B Three element tri-band beam
100 ft. control cable
The perfect answer for the station using a transceiver barefoot. Regularly $325 plus approx. $15 freight, a $340 value. Our package price **$290.00** (freight prepaid to your door).

Package No. HR-2
Tristao CZ454 New concept crank-up tower
CDR TR-44 Rotator
Hornet TB-500-4 Three element tri-band beam
100 ft. RG-58U Coax
100 ft. control cable
For the medium power DX'er who wants to work them barefoot. Regularly $500 plus approx. $25 freight, a $525 value. Our package price **$425.00** (freight prepaid to your door).

Package No. HR-3 ▪ **Tristao CZ 454 New concept 60 ft. crank-up tower ▪ 100 ft. RG-8U Coax ▪ CDR Ham-M Heavy duty rotator ▪ Hornet TB-1000-4 Three element tri-band beam ▪ 100 ft. control cable** ▪ Here is our masterpiece. The right combination of antenna and tower for full legal power and extreme DX. Regularly $600 plus approx. $30 freight, a $630 value. Our package price $495.00 (freight prepaid to your door).

Remember! You can buy on time. You can trade your used transmitter or receiver. You can rely on Henry Radio to supply the finest equipment and the best value.

Henry Radio Stores

CALL DIRECT . . . USE AREA CODE

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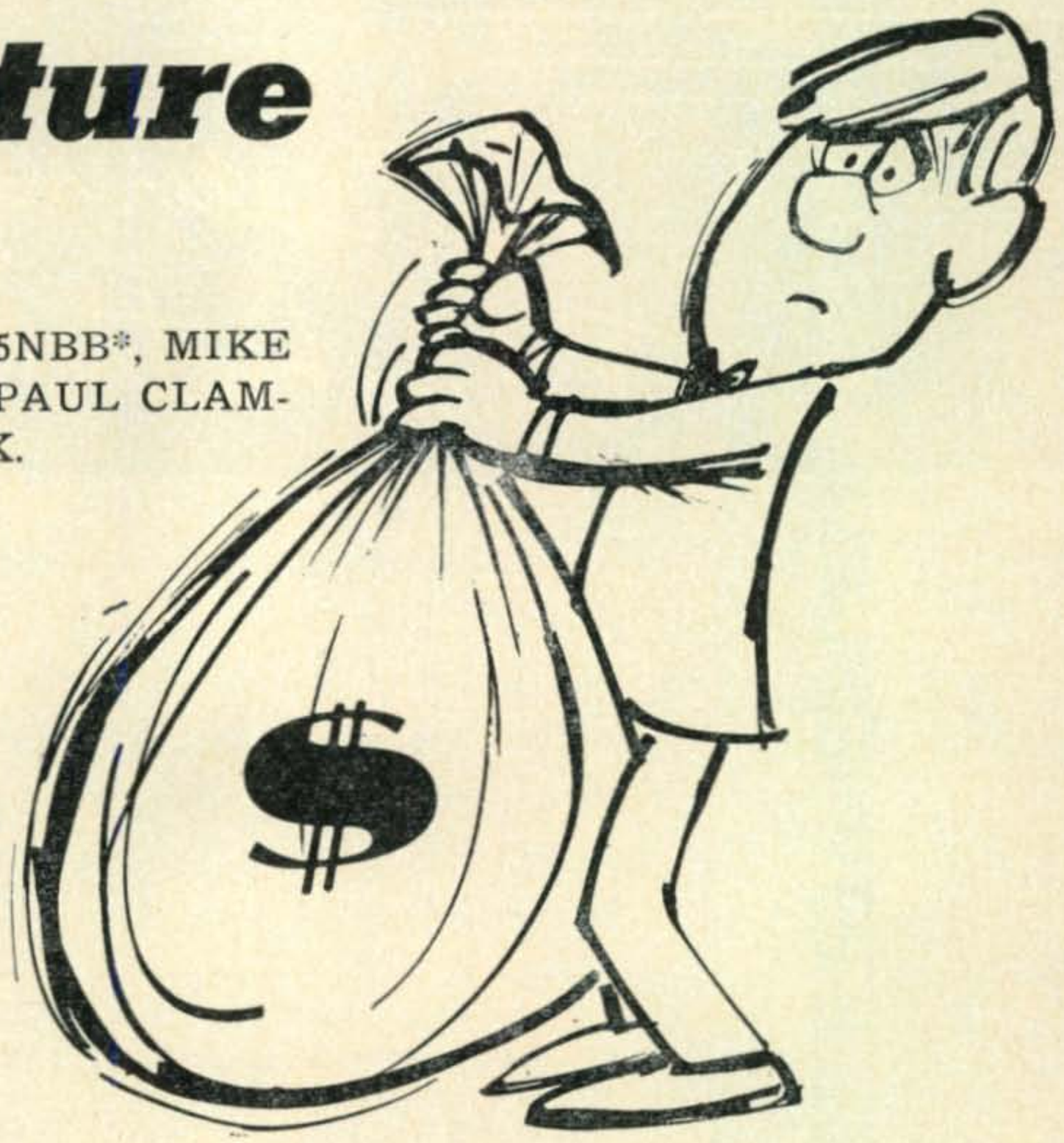
11240 W. Olympic, Los Angeles, Calif., 90064	213 477-6701
931 N. Euclid, Anaheim, Calif., 92801	714 772-9200
6116 N. 27th Ave., Phoenix, Ariz., 85017	602 AM 4-3895

"Worlds Largest Distributors of Short Wave Receivers"

For further information, check number 40, on page 104

$5000 For The Future

BY BOB ROGERS, WA5NBB*, MIKE WOODSIDE, WA5CSJ, PAUL CLAMPIT, K5TCK.



Here's an opportunity for the approximately 250,000 amateurs in the U.S. to put in their "two cents worth" towards a literal $5000 for the future.

In the United States there are essentially two representative organizations for the amateur radio operator. It seems to ARCUA (Amateur Radio Club of the University of Arkansas) that neither of these organizations represents a true cross section of the amateur's sentiments. In view of our beliefs, we feel that there may be a better method for determining the desires of the amateur regarding incentive licensing.

It seems apparent to us that the best method available to the amateur is a poll taken via amateur radio. Our proposal, therefore, is to operate an on-the-air poll for six consecutive days in which all amateurs will be allowed one vote on each of the issues involved in the incentive licensing question. The poll is directed towards those issues which involve questions relating to the General class amateur since he, in our opinion, is the most commonly encountered representative of amateur radio.

In short, we are going to make available for the approximately 250,000 amateurs in the United States the opportunity for each to contribute his "two cents' worth" toward the total of $5000. Anyone who can transmit a readable s.s.b., a.m. or c.w. signal on one of the three frequencies will be able to vote. If for some reason you cannot be available to transmit your vote, drop a QSL card in the mail to us with your vote on it.

This poll will be conducted from 0600 December 26, 1966 to 0600 January 1, 1967 GMT. At the end of this time the votes on each issue will be compiled and tabulated and the required number of copies will be forwarded to the FCC along with a letter of explanation. Our goal in this project is 8000 or more contacts, a rate of approximately one a minute. With your

OPERATING TIMES IN GMT AND FREQUENCIES

December 26, 1966
0600Z to 1400Z—3.900 mc. l.s.b.
1400Z to 1900Z—14.300 mc. u.s.b.
1900Z to 2400Z—7.250 mc. l.s.b.
December 27, 1966
0000Z to 1400Z—3.900 mc. l.s.b.
1400Z to 1900Z—14.300 mc. u.s.b.
1900Z to 2400Z—7.250 mc. l.s.b.
December 28, 29, 30, and 31 will be the same as December 27.
January 1, 1967
0000Z to 0600Z—3.900 mc. l.s.b.

* W5YM Amateur Radio Club of the University of Arkansas, Inc. Department of Electrical Engineering, University of Arkansas, Fayetteville, Arkansas.

assistance we may be able to exceed this number.

In order to expedite the voting a ballot is included in this article along with the operating times and frequencies for each day. We have attempted to condense the ballot so that maximum speed can be obtained. This condensation necessarily reduces the flexibility of the poll; however, we feel that all the important points are included. If you feel that you have a significant comment—inform us; it will be recorded on tape, transcribed and entered as an additional suggestion. However, please remember that comments take time and reduce the number of possible contacts; and numbers are of extreme importance. Also, multiple voting should be avoided since a cross sectional sample is desired and multiple ballots will be deleted from the final total.

Running totals will be kept and the final transmission before we leave the air will be the cumulative totals on each issue.

After deciding how you will vote, your transmission should be of the form: "W5YM, this is K5IIX; my vote is: alfa, charlie, bravo, alfa, alfa, bravo. W5YM, this is K5IIX, over." "K5IIX, this is W5YM, QSL and thanks." The transmission should be your selections given phonetically in the order in which they appear on the ballot.

The call to listen for is: CQ $5000 for the future, this is W5YM."

73 OM. See you at the polls!

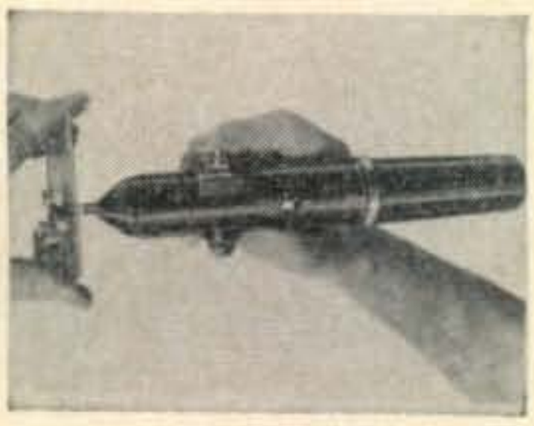
BALLOT

1. Code examination speed for General License
   - ☐ a. 13 w.p.m.
   - ☐ b. 16 w.p.m.
   - ☐ c. 20 w.p.m.
2. Theory examination for General License
   - ☐ a. same as present
   - ☐ b. more comprehensive but less than present extra class exam
   - ☐ c. equal to present extra class exam
3. Regulation examination for General License
   - ☐ a. same as present
   - ☐ b. more comprehensive

Requirements for first license renewal

4. Written
   - ☐ a. advanced theory exam
   - ☐ b. same exam repeated
   - ☐ c. no further exam
5. Code
   - ☐ a. advanced
   - ☐ b. same exam repeated
   - ☐ c. no further exam
6. Advanced license classes (above general)
   - ☐ a. advanced operating privileges
   - ☐ b. same as general privileges

New Amateur Products



Jensen

JENSEN Tools and Alloys announces a new hand-held in-circuit transistor tester. The model SC-4 is self-contained and will test NPN or PNP types. It has an indicating light and comes with a diode checker. The SC-4 sells for about $90.00. For complete details write to Jensen Tools, 3630 E. Indian School Road, Phoenix, Arizona, 85018, or circle 60 on page 104.

Electro-Voice

ELECTRO-VOICE announces publication of the new, fully revised edition of W9IOP's "Second Op" DX calculator. The unit tells beam headings, prefixes, geographic locations, time zones, etc. More information can be had by writing Electro-Voice, Dept. PR-4, Buchanan, Mich., or circling 62 on page 104.

Finescale

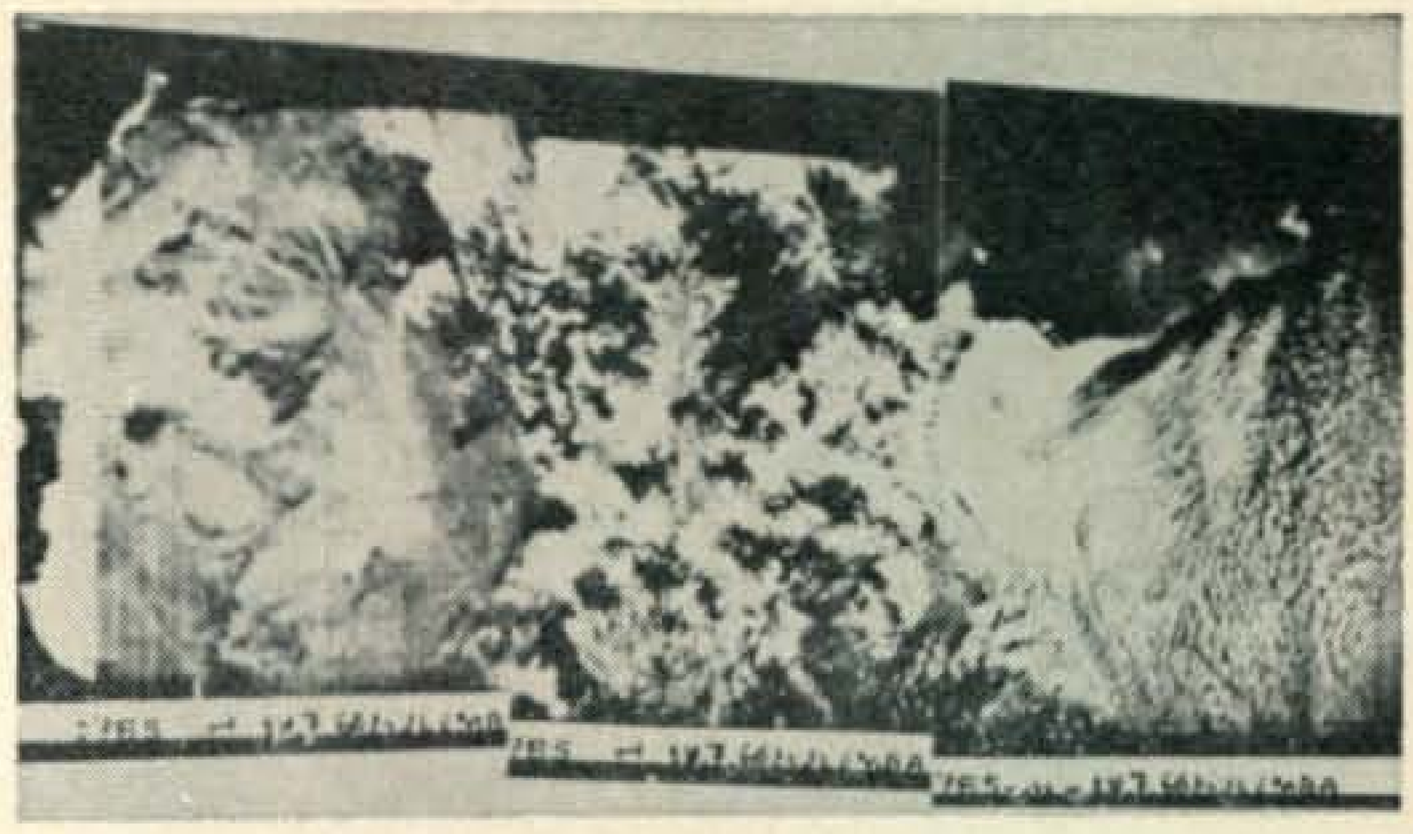
THE Finescale Company of 3258 West 6th Street, Los Angeles, California, announces a new case for their pocket model magnifying comparator. The unit which accurately measures small objects and dimensions on large ones. The new case permits the storage of 5 additional transparent scales. For more information and application either write direct or circle 61 on page 104.

Pocket Socket

POCKET SOCKET is a 4-in-1 patented telescoping nut and bolt driver that changes sizes with a single push on the palm of your hand. It comes in two popular size combinations. For full data write to Pocket Socket, Inc., 17237 Escorse Road, Allen Park, Mich., 48101 or circle 63 on page 104.

OSCAR and Weather Satellite News

BY GEORGE JACOBS,* W3ASK

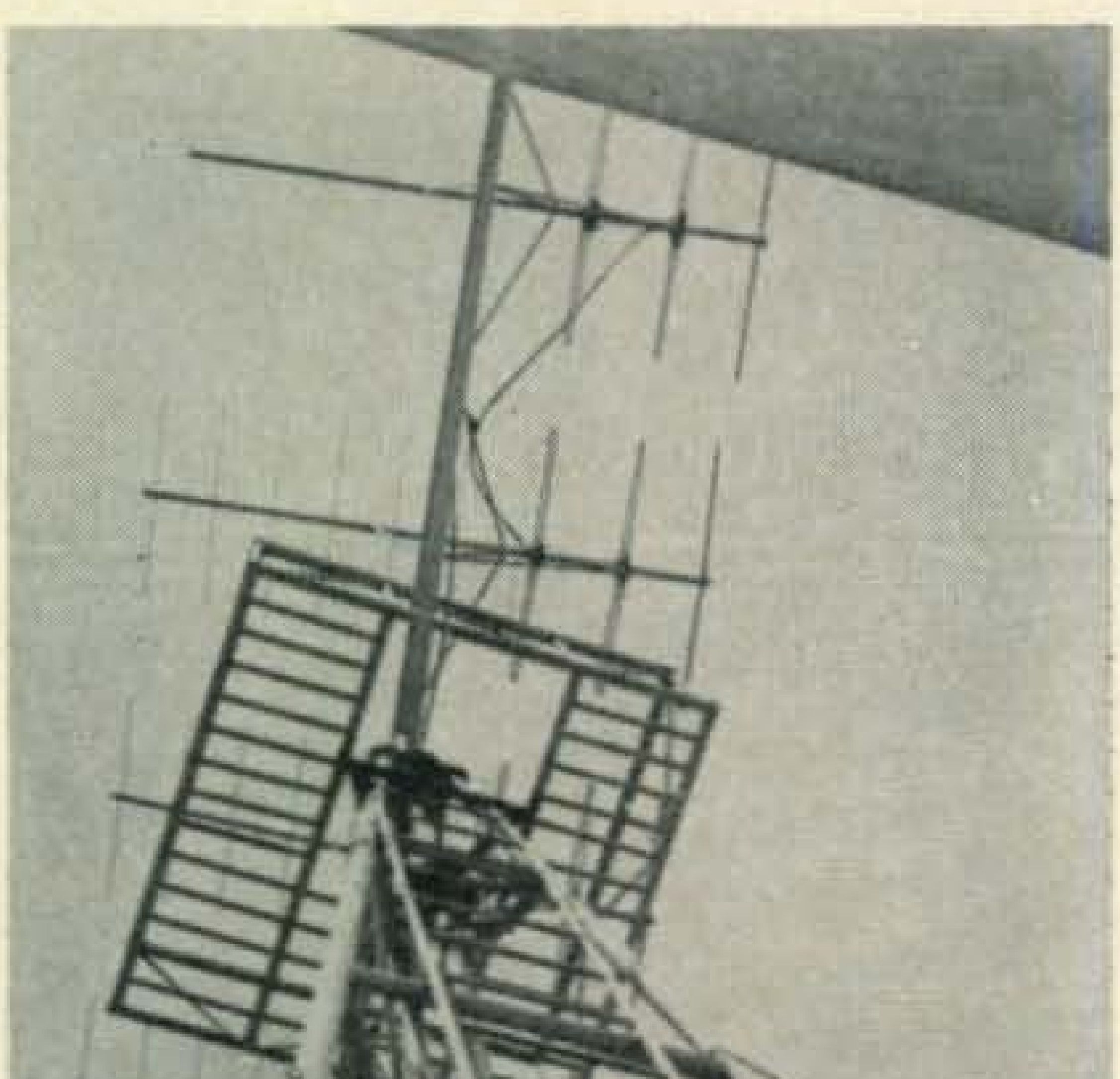


Cloud coverage photos received from the APT transmissions of the ESSA-2 satellite as it passed over the Angola, West African QTH of Carlos Bettencourt Faria, CR6CH.

WORK continues enthusiastically in the USA, Europe and Australia on the construction of amateur radio satellites for the Project OSCAR space program. Several relatively small technical problems have been encountered, however, which have delayed completion of these satellites to beyond the late fall launch date originally set for OSCAR-5. While this may be somewhat disappointing, it must be emphasized that communication satellites are complicated pieces of equipment which demand absolute perfectionism in their design and construction if they are to withstand the rigors of space. It is better to work somewhat slower on OSCAR satellites in order to turn out one that is perfect and will function reliably in space than to rush to complete one that might fail.

According to the latest information from Project OSCAR a completed OSCAR-EUROPA two meter translator satellite is expected to be delivered to Headquarters at Foothill College, Los Altos, California during late December, 1966.

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



The array of Yagi antennas used by CR6CH to receive ESSA-2 APT transmissions on 137.500 mc.

The OSCAR-AUSTRALIS ten and 2 meter beacon satellite is scheduled to arrive at Headquarters sometime during January, 1967. If the satellites arrive as expected, there is an excellent chance that at least one, and perhaps both, will be launched during the spring of 1967.

Meanwhile, European and African radio amateurs took a big step forward in the field of space communications at the recent Region 1 Conference of the International Amateur Radio Union, held at Opatija, Yugoslavia.

The Region 1 Division of IARU is made up of national amateur radio organizations of countries in the European and African area. The Conference approved a recommendation that the Region 1 Division sponsor the construction of a series of European OSCAR satellites. A sum of $120 was made available for the completion of the OSCAR-EUROPA-1 satellite, and a sum of $475 will be made available annually for the next three years (1967-1969) for the construction of at least one Region 1 satellite a year. In addition to the amounts made available by the IARU, individual Region 1 member radio societies, and interested persons also plan to contribute to the cost of building the Region 1 satellites.

The Region 1 Division also adopted a recommendation that the 148.85-145.95 Mc segment of the 2 meter band be set aside *exclusively* for amateur radio satellites and stratospheric translators.

Weather Satellites

Radio amateurs in various parts of the world have been successful in receiving picture transmissions from the ESSA-2 and NIMBUS-2 weather satellites launched earlier this year by the United States. Both of these satellites are equippd with Automatic Picture Transmission Systems (APT), which are intended for reception on relatively inexpensive v.h.f. receiving equipment. See SPACE COMMUNICATIONS, *CQ*, May, 1966 for more complete details concerning the APT system.

Orbital information for the ESSA-2 and NIMBUS-2 satellites can be obtained by telephone directly from local offices of the U.S. Weather Bureau. Their numbers can be found in telephone directories under *U.S. Government*. When call-

[*Continued on page 94*]

A front view of the Jimmy Machine with a look at its Chief Engineer "Jimmy".

THE JIMMY MACHINE

Here's an ideal Christmas present for a child that satisfies his curiosity and adds years to the life of your rig.

BY GEORGE COUSINS,* VE1TG

How many among us have a little boy to whom no amount of toys are as attractive as the array of knobs, dials and lights on the front of the OM's ham rig? Nothing can be quite as entertaining as to watch the expressions on his face as he twists knobs and throws switches, now serious as he works his way from one end of the band to the other, now delighted as he watches the S meter kicking away, now in startled shock as he spins the audio gain and almost blows the speaker apart, and so on. If there happen to be any colored lights, so much the better.

After watching this performance many times on my own rig, and growing a few more gray hairs at the same time, the thought often occurred to me that it would be a good idea to present the little lad with something like this for Christmas, in a much simpler form of course, but with the same entertainment potential. This thought gradually came to bear fruit in what I call the Jimmy Machine, which took shape out of the contents of the basement junk box and which became the star attraction at Christmastime.

Construction

I used an old chassis, about 11 × 14 × 3 as the basic unit, and sorted out as many old pilot lamp assemblies and old phone jacks as I could find. Next came a rotary switch, a few toggle switches, an old servo motor, a tube-tester transformer, a small filament transformer, and quite an assortment of old hook-up wire.

Looking at the circuit of this gadget, shown in fig. 1, the a.c. line is connected via two fuses to the on/off switch, which energizes a small isolation transformer. This transformer feeds a small code oscillator, but instead of a key, a small push button is mounted on the front panel (top) of the chassis. Pushing the button will cause the oscillator to "beep" into the small speaker which is mounted under a hole in the chassis. A phone jack is also connected across the output of the oscillator, and I provided my boy with a phone plug which had a shorting wire connected across its terminals. When he pushed the plug into this jack, of course he was rewarded with a very satisfying "beep" once again. Incidentally, this shorted phone plug is a mainstay of the rest of the unit as well as this part.

After marking out a pattern on the top of the chassis, I mounted all the phone jacks, and all the pilot lamp assemblies. I ended up with 16 of each, having at some time in the dim past stripped down a couple of old radar power supplies and an ancient cable company terminal box. The original neon lamps were removed from the pilot light assemblies, and #47 lamps installed. A small 6 volt filament transformer (home-wound, by the way) was mounted under the chassis, and one side of the 6 volts grounded. The other side was run to an old 8-position rotary switch. The switch then fed the 6 volts to 8 of the dial lights. However, I deliberately mixed up the pattern of lights so that as the switch was turned, lights flash on and off at random all over the chassis. Of course, the immediate reaction is to twist the switch faster and faster to get more "action" out of the lights—so luckily I had installed a rugged old wafer switch which could take it.

*Box 18 RR2, Lower Sackville, Nova Scotia, Canada.

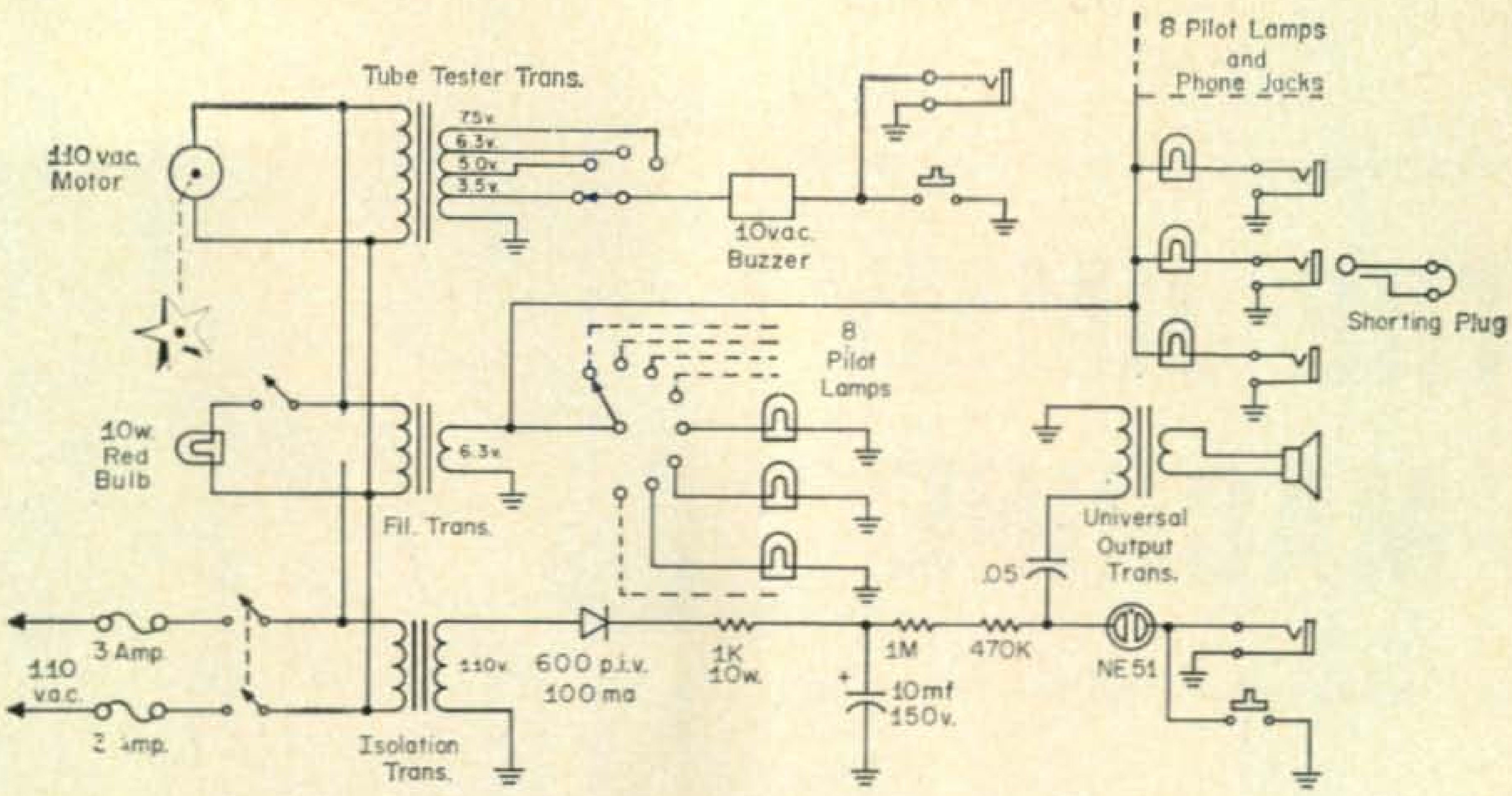


Fig. 1—Circuit of the Jimmy Machine. Layout is not critical and changes or additions can be included to fit what you have in your own junk box.

The 6 volts is also fed to a number of phone jacks, in each case via another pilot lamp. Now, when the shorted phone plug is pushed into one of these jacks, one of the lights will come on. Here again, the idea is to push the plug into one jack but have a light pop on somewhere else in the chassis and not necessarily beside the jack in question. This becomes a game to try to anticipate which light will come on and in connection with which particular jack.

By the time all these lights and jacks are wired up and working, you may think its more wire than in the average receiver, and you would most likely be right. However, its quite a change to be able to wire in a care-free manner for once, no worries about feedback, frequency response, shielding, hum pickup—it can be a real busman's holiday!

Lighting

After getting along this far, I had quite a few holes in the chassis which I thought would look even more mysterious if outlined by red light, so under the chassis went a small 10 watt bulb originally used as a darkroom light, also many years ago. However, this filled the bill perfectly, a lovely red glow lighting up the interior of the chassis and shining out through cracks and holes. Of course, by adding a toggle switch this could be controlled and the lad had one more thing to capture his attention.

Buzzers

The next item from the junk-box was an old mechanical buzzer which probably was part of a door bell at one time. Thinking it should run off about 10 volts I dug up an old tube-tester transformer, complete with tap switch, and mounted this all inside. By having the switch tap off 3, 5, 6.3, 7.5 and 12 volts to feed the buzzer, the tone and loudness could be nicely varied. In fact, the lad had so much delight in blasting forth with this at its loudest pitch, I had to cut out the 12 volt tap and so save the buzzer coil from an early end. However, the other volttages still made a satisfactory racket.

Servo

The final touch came in the form of an old two-phase servo motor which was originally part of a radar local oscillator tuning assembly. By mounting this on end, the shaft faced upward towards the center of a large hole in the chassis. On the end of the shaft I glued a small cardboard disc, and on this also glued a star shaped reflector from a Christmas tree lamp. This star had pieces of mirror glass on the tips, and when the motor was turned on the results of the little star whirling around were quite delightful. When the red light was turned on inside the chassis, the star reflected the light rays and an even better effect was obtained. Realizing that little fingers can be too eager to explore, a piece of plexiglass was cut and bolted over the hole so that no danger was present.

After everything was found to be working OK, the chassis was turned over and a solid bottom plate was fastened in place with about a dozen self-tapping screws. Now the only point of danger was the line cord itself. After a lot of pondering over this, I decided the easiest solution was to plug the thing into an outlet which was too high for him to reach, or to teach him instead to always shout out for someone to plug it in for him. The latter policy was the one put into effect, and after a few reminders the first morning, we had no further problem.

Performance

The biggest question of all was answered on Christmas morning—would he like it or was all this in vain? Well, the house reverberated with beeps, buzzes and squawks for hours—intermixed with giggles and hoots of laughter which

[*Continued on page 98*]

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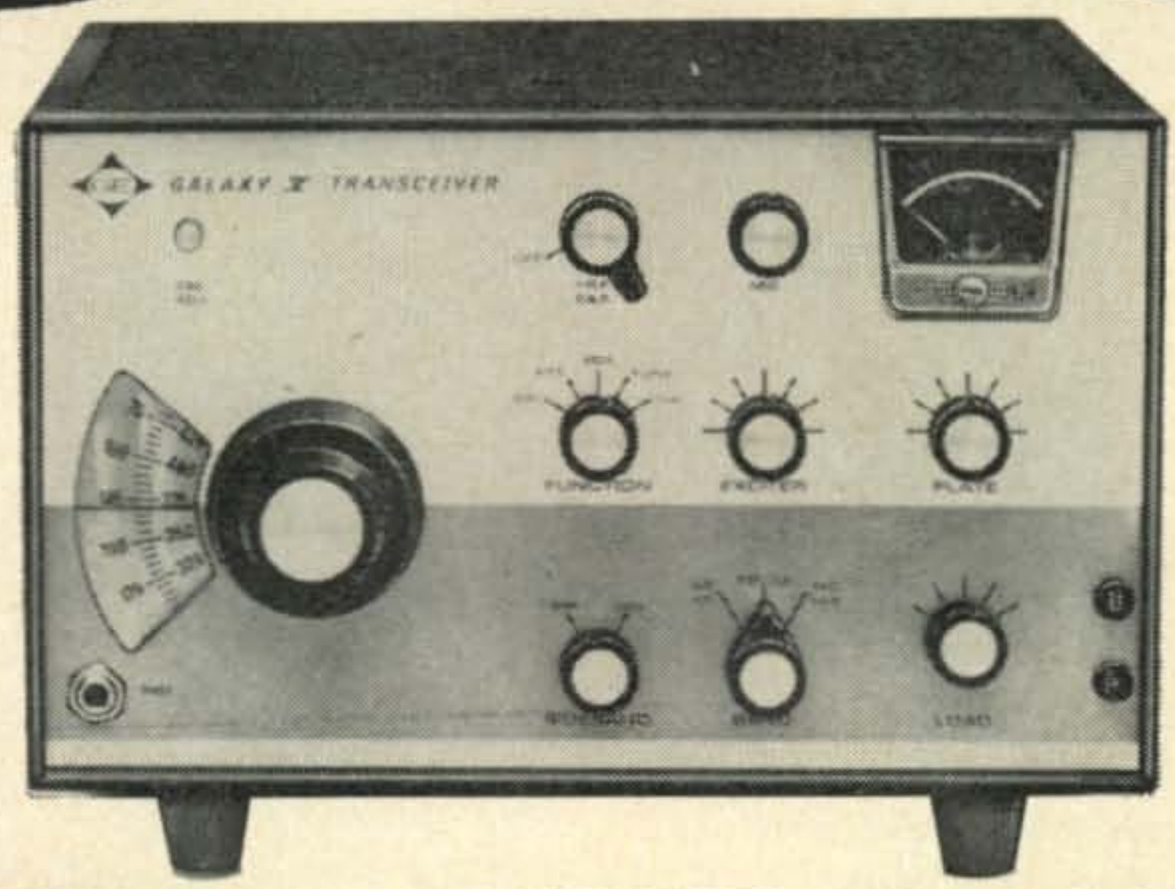

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The Davco DR-30 solid-state receiver. It is quite a small package that is neatly styled and arranged.

CQ Reviews:

The Davco DR-30 Receiver

BY WILFRED M. SCHERER,* W2AEF

It is not often that a piece of amateur gear turns up that is new and unique such as the Davco DR-30 receiver. This is an all solid-state dual-conversion job for use with s.s.b. (upper or lower sideband), c.w. and a.m. on the amateur bands 80 through 6 meters, plus WWV. It has three degrees of i.f. selectivity and of a.g.c. release time, a variable-notch filter, noise *blanker*, crystal calibrator, a.f. tone control, pre-selector tuning, the new field-effect transistors for minimum overload and cross modulation, and excellent frequency stability. These and many other features of advanced design both electronically and mechanically make it a lot of receiver packed into a very small package 4" × 7⅛" × 6" (H.W.D.).

Frequency Coverage

Coverage is in 550 kc segments starting at the low-frequency end of each amateur band from 3.5 to 21 mc and of each 500 kc section of the 28 mc band. On 50 mc there is only one range of 50-50.55 mc. An additional band also covers 9.5-10.05 mc for WWV on 10 mc or for 9.5 mc short-wave broadcasts. There are two extra band and crystal switch positions for other optional 550 kc segments.

Technical Details

A block diagram is shown at fig. 1 where the conversion frequencies may be found. Field-Effect Transistors (f.e.t.'s) are used in both the r.f. input stage and the 1st mixer. These transistors are one of the latest advances in solid-state devices; their greatest advantage over conventional transistors being much greater immunity to overload and cross modulation. In addition, they have higher input and output impedances, making it easier to obtain better selectivity for improved image rejection. Furthermore, their low inherent noise ensures a high signal-to-noise ratio for better sensitivity.[1] Circuitry for the f.e.t.'s and other front-end features are shown at fig. 2.

The r.f. input and output "pre-selector" circuits are gang-tuned with a dual-section capacitor. Toroid type r.f. inductors are used, providing high-*Q* circuits with little or no stray coupling that may introduce instability and they are very small, allowing a considerable saving of space. A single toroid is used in each of the two circuits for all frequencies below 17 mc, with capacitive padding switched in as needed at the lower frequencies. Shunt inductance is added for the higher frequencies.

For 50 mc operation, a special impedance-matching circuit with a separate antenna-input jack for this band is employed. It has a rear-apron trimmer for peaking up operation with the particular v.h.f. antenna in use. Back-to-back diodes, shunted across the r.f. input, protect the r.f. transistor from damage by strong r.f. pickup.

R.F. Gain

An unusual arrangement is that the r.f. gain simply is a continuously-variable attenuator connected at the antenna input to vary the signal levels applied to the r.f. stage. Unlike conventional systems, this allows normal operating voltages and full a.g.c. to be maintained at all times. The "gain" is reduced by *clockwise* rotation of the control instead of the customary counter-clockwise direction. Clockwise rotation *increases* attenuation which in turn *decreases* signal level.

Another unique feature is that the crystal calibrator is connected to the attenuator in a way that the calibrator signal cannot be heard until maximum attenuation is inserted. This allows the calibrator signal to be heard without interference from picked-up signals. Also, if the

*Technical Director, *CQ*.

[1] Hyder, H. R., "Understanding Field-Effect Transistors," *CQ*, Aug. '66 p. 38, Sept. '66 p. 51, Oct. '66 p. 36.

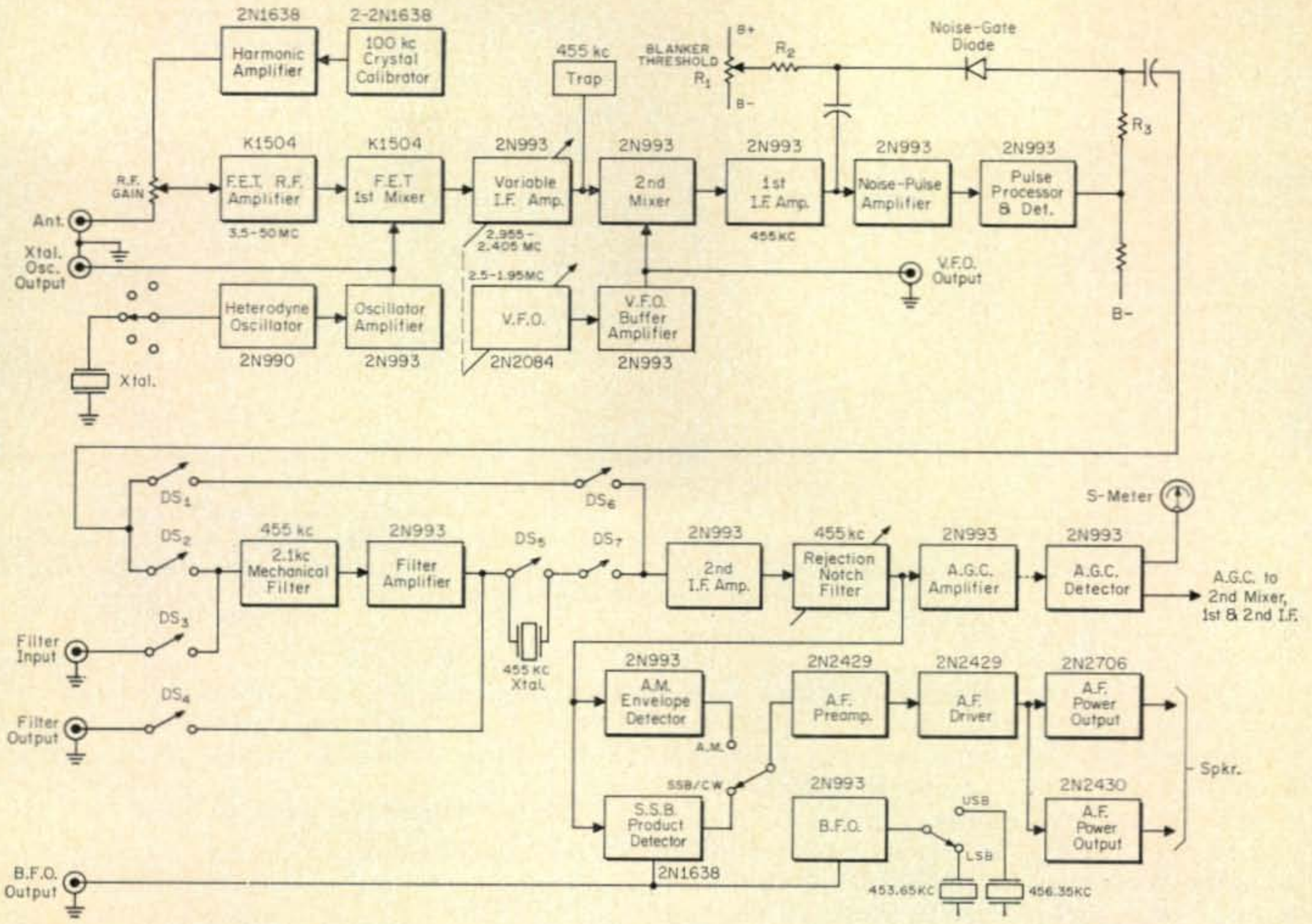


Fig. 1—Block diagram for the DR-30. The heterodyning-crystal frequencies are 2.955 mc *plus* the frequency for the bottom end of each band. DS_{1-7} are diode switches operated by d.c. voltages (see footnote 2). The selector-switch position for 5 kc selectivity closes DS_1 and DS_6. The other diode switches remain open. For 2.1 kc DS_1 and DS_6 open, DS_2, DS_5 and DS_7 close. For .5 kc DS_5 is opened, the others remain as for 2.1 kc. DS_3 and DS_4 can be operated separately to use the mechanical filter with external gear. A ceramic filter resonator is used for the 455 kc trap at the 2nd mixer input. The v.f.o. buffer-amplifier is an untuned affair.

calibrator is left on, it will not cause QRM when the r.f. gain is set for incoming signals.

Variable I.F. and V.F.O.

The 2.405-2.955 mc variable i.f. amplifier is gang tuned with the v.f.o. used for heterodyning at the 2nd mixer. The v.f.o. is operated at a relatively low frequency (1.95-2.5 mc) which, along with the use of a high-*Q* toroid inductor for the oscillator, a buffer amplifier and zener-regulated voltage, results in excellent frequency stability.

A conventional split-capacitance Colpitts oscillator circuit is used. The tank inductance consists of the toroid coil which is in series with a slug-tuned coil of much smaller inductance and which is used for trimming the circuit to frequency and for tracking. The r.f. output is taken from the junction of the two inductors which thus provides a low-impedance tap to match the input of the following stage and minimize loading effects on the frequency. The buffer amplifier is an untuned affair that is coupled to the emitter of the mixer.

Noise Blanker

The output of the 1st i.f. goes to a diode switch (noise-gate diode) which is in series with the feed to the succeeding i.f. stage. A forward bias applied to this diode, obtained from the noise-blanker threshold control, allows the diode to conduct and pass the normal i.f. signal on to the next stage. The i.f. also feeds a noise-pulse amplifier which increases the amplitude and accelerates the rise time of the noise pulses. These are then appropriately shaped by the pulse processor where they also are converted to positive-going pulses that reverse-bias the diode gate. The diode then ceases to conduct, interrupting the circuit and silencing the receiver for the duration of each pulse.

No deteriorating pulse-lengthening occurs before the noise blanker functions, because it is installed ahead of the highly selective i.f. filters rather than after them in which case the effectiveness of the blanker would be reduced. Elimination of noise pulses at the i.f. level prevents their activating the a.g.c. and desensitizing the receiver.

I.F. Selectivity

Three degrees of i.f. selectivity are provided: 0.5, 2.1 and 5 kc. The 5 kc step is obtained using three interstage transformers and ceramic filters in the i.f.'s. These filters are very high-*Q* ceramic resonators used as emitter bypasses that steepen the skirts of the response curve. For 2.1 kc bandwidth a Collins mechanical filter is *added* along with the filter amplifier. For 0.5 kc a single crystal

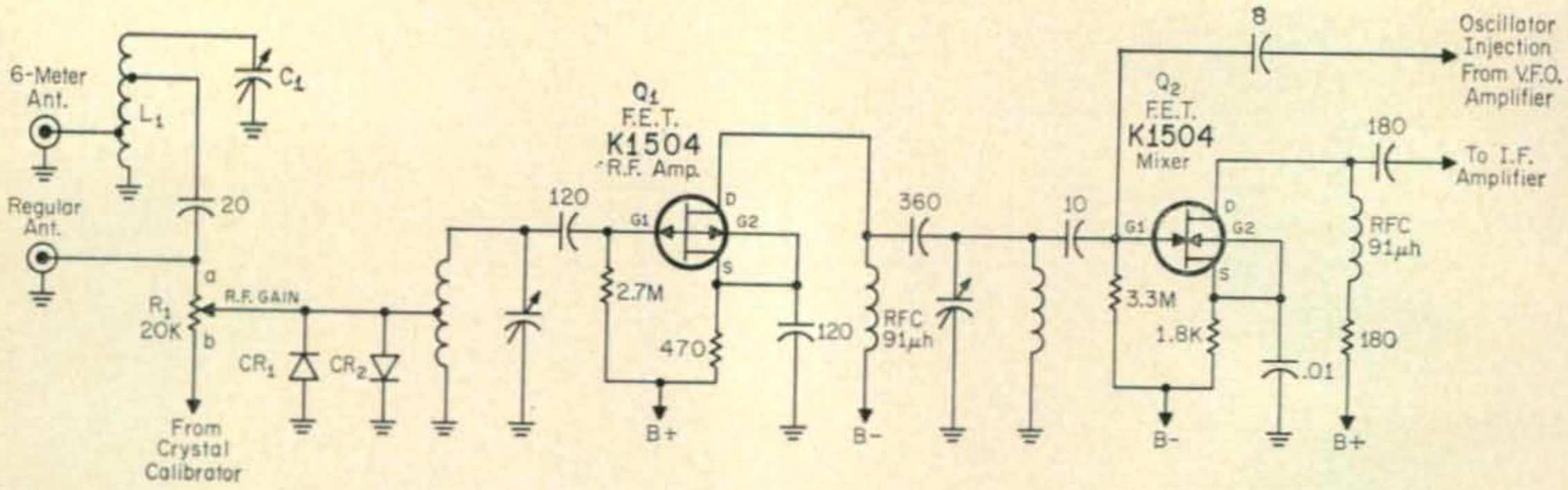
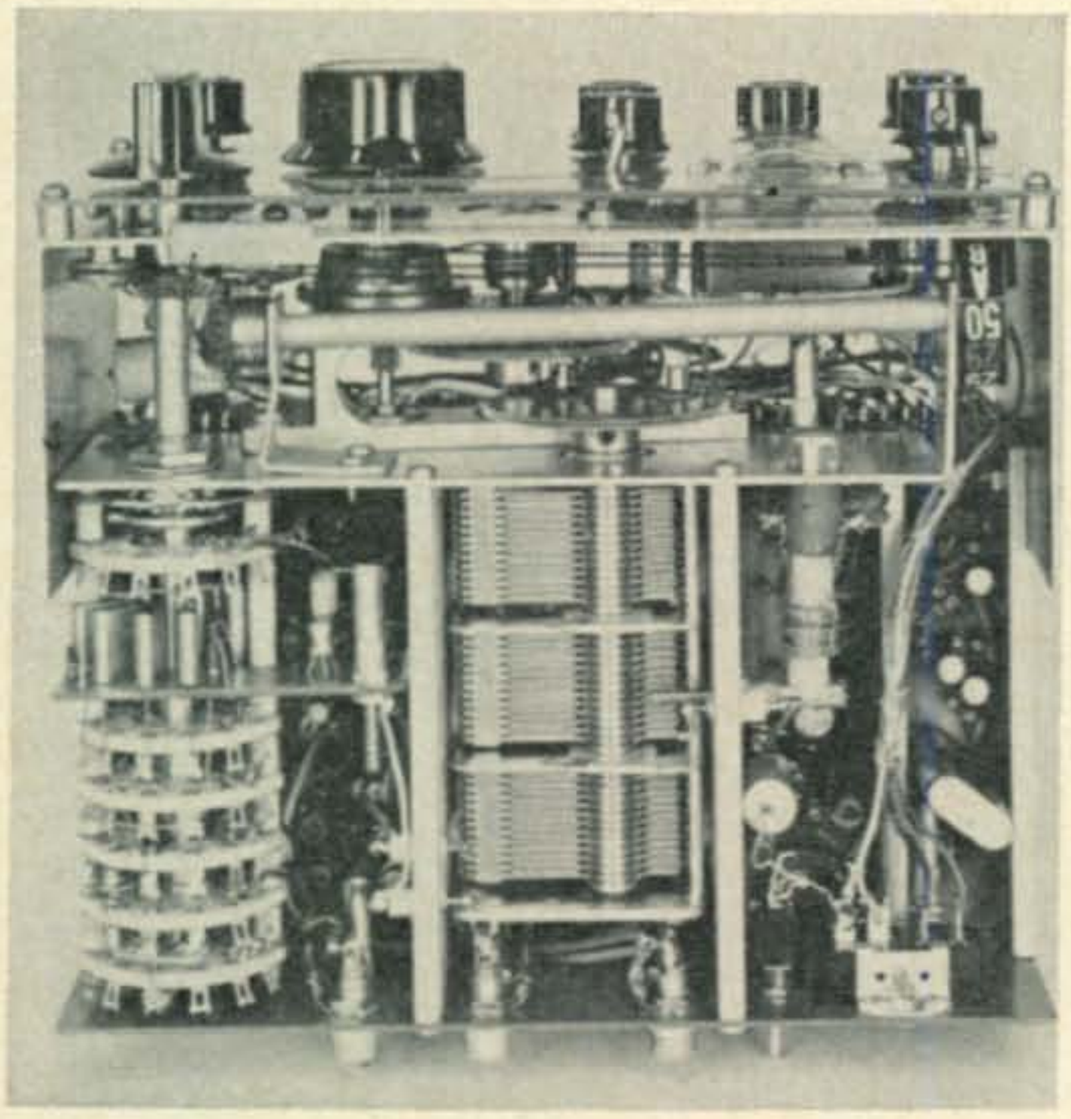


Fig. 2—Basic circuitry for field-effect transistors as used in the Davco DR-30. Both transistors are channel junction tetrode f.e.t.'s. Note that the polarity at the *source* (S) and *drain* (D) terminals of the two f.e.t.'s is reversed. Q_1 is a *P* channel, Q_2 is an *N* channel. The input transistor is protected with D_1 and D_2 from damage by strong r.f. pickup. L_1 and C_1 comprise the 6-meter antenna-matching affair. The R.F. GAIN, R_1, is an attenuator at the antenna input. The input-signal level is maximum when the arm is at *a*, the crystal-calibrator signal is maximum when the arm is at *b*.

is *added* in series with the output of the filter amplifier, effectively placing it in series with the mechanical filter. By superimposing one selective system upon another, improved skirt selectivity is obtained over that realized with each selective circuit engaged individually.

Switching between the various combinations is accomplished using diode switches[2] as explained at fig. 1. A potentially handy feature is that the mechanical filter and its associated amplifier are arranged to be connected to rear-apron jacks by means of diode switches to enable their use with external gear such as a companion s.s.b. exciter for which there also are phono jacks with v.f.o., b.f.o. and crystal-oscillator outputs.

[2] Stoner, D. L., and Earnshaw, L. E., "The Diode Switch," *CQ*, Feb. '61 p. 36.



Top view of the DR-30 showing the gearing mechanism for tuning and bandsetting. A string drive is used only for moving the pointer along the slide-rule scale. The heterodyning oscillator and crystals are mounted near the front end of the bandswitch (left). The v.f.o. and calibrator compartments are at the right. The v.f.o. toroid cannot be seen.

The variable-notch filter is a passive type that provides high attenuation at the notch frequency in the i.f. passband. The notch depth is adjusted by a trimmer control at the rear of the set.

Automatic Gain Control

The a.g.c. detector, preceded by a buffer amplifier that prevents i.f. loading, operates with bootstrap circuitry having a fast attack and three selectable degrees of release time: .015 sec. for a.m., 0.2 sec. for c.w. or 0.8 sec. for s.s.b.

Detector and A.F. System

The envelope detector for a.m. or the product detector for s.s.b. and c.w. can be switched in as desired with any one of the selectivity positions. The sideband switch changes the b.f.o. crystals and compensates the v.f.o. frequency at the same time. Retuning is not required.

The two a.f. power-output transistors operate with transformer-less output circuitry and will accommodate speaker impedances of 8-45 ohms. Where headphones are to be used, they should be magnetic types of 600 ohms or less. There is no phone jack, by the way. Power output is rated at 0.6 watts with 5% distortion.

High-frequency roll-off can be had with a tone-control switch that is a 3-position toggle type. The third position is wired to the power plug for controlling accessory gear such as transmitter relay, etc.

Power Supply

The DR-30 operates directly from a 12-15 v.d.c. source, either positive or negative ground. A three position toggle switch at the rear of the unit allows the case to be grounded to either side of the power source, or it may be left floating. A diode connected in series with the supply line will cease to conduct if the battery polarity is incorrect, thus protecting the transistors and components from accidental damage. Current drain for the receiver is 300 ma with the panel lights turned on, but they may be switched off to cut the current drain to 150 ma. Provisions are included for muting the receiver.

Construction

The mechanical construction of the DR-30 is a marvel to behold. The main body of the unit consists of a rigid solid-aluminum extrusion which is divided into a number of separate compartments that have milled slots to accept glass-epoxy printed-circuit boards on which the various sections of the set are assembled. As each board is slid in, it engages a slip-on terminal-connector block. On some boards a few extra connections are soldered to easily accessible terminal pins on top of the board. All interconnecting wiring is Teflon insulated, so there is no danger of melting or ruining insulation when leads are soldered or unsoldered. The whole arrangement facilitates maintenance and servicing.

Parts that require physical stability are attached to the main body and the tuning-capacitor drive mechanism is installed in a heavy-aluminum milled assembly with ball bearings for the drive shafts. Spring-loaded split-gears, for "backlash-free" tuning, are used to obtain the desired tuning ratio. The panels are stainless steel. The power plug is a Jones type. Phono jacks are used for other connections.

Calibration

The frequency is read from a 4½" slide-rule dial that is calibrated (slightly non-linearly) in 5 kc steps spaced at an average a bit less than 1/16." There are two scales, one calibrated from 0 to .55 mc, the other .5-1.05 mc. When the bandswitch is rotated, a red or white number appears at the left of the scale to indicate the megacycle range to which the scale calibration must be added for the particular range. When the megacycles are shown in red, you add the red dial markings for the frequency readout. The black scale readings are added when the mc numerals are white. Calibration may be set with a screwdriver-adjust control accessible through a hole in the panel.

Each complete rotation of the tuning knob covers an average of 20 kc. The knob is marked off in ten steps, representing about 2 kc. The knob divisions are not identified numerically, so you have to mentally note by how many marks the knob has been rotated for resetting back to a given frequency. An adjustable dial drag and lock is provided.

Performance

Although the sensitivity of the Davco DR-30 is rated at 1 μv for 10 db s./n., each receiver is supplied with an individual specification sheet giving the s.s.b.-c.w. sensitivity on each band for the particular unit. The average of the figures for two models on hand was .18 μv for 10 db s./n. on all bands, except on 50 mc the average was .42 μv. Our own measurements were virtually identical to the figures supplied by the manufacturer.

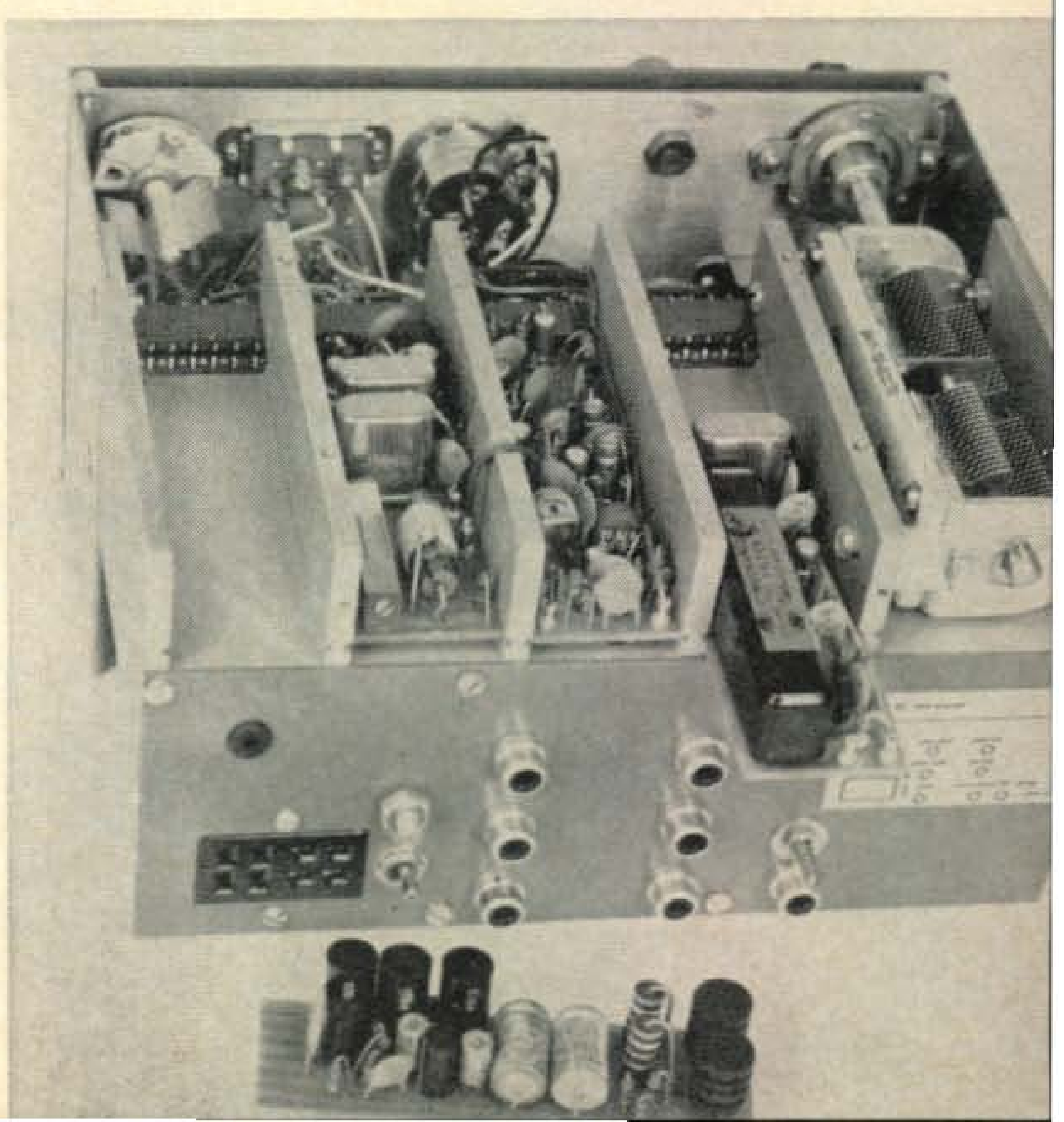
The maximum variation in gain between the bands was 4 db. At about 100 kc below the top end of each band a "suckout" was noted that resulted in a signal-level loss of near 6 db; however, there was no deterioration of sensitivity or signal-to-noise ratio.

Cross Modulation

Measurements of overload and cross modulation were made on a comparative basis against other transistorized and vacuum tube gear. The performance in this area was well up to expectations due to the attributes of the f.e.t. devices used in the front-end. Absolute values are not given, as we've yet to find a standard method or rating in this respect set forth by amateur-equipment manufacturers.

From an on-the-air operating standpoint an acid test here in the New York area is the effects caused by NSS on 4005 kc with the receiver tuned in the 3990-4000 kc region while using a 75-meter antenna, a test which the DR-30 withstood very well; except when the noise blanker was engaged to a large degree, desensitization and spurious signals were experienced. This evidently occurred because the blanker is installed ahead of the i.f. selectivity and thus is susceptible to triggering by pulses from strong nearby signals that would otherwise be attenuated by the i.f. filters.

[*Continued on page 94*]



Bottom view of the DR-30. The individual circuit boards slide into slots at the side of each compartment and engage slip-on terminal-connector blocks at the far end of the channel. The a.f. board, lying in the foreground, has been removed from the left partition. The section with the mechanical filter is shown partly inserted near the right. The installed board at left of center contains the b.f.o., product detector and the notch-depth control which is the "Trimpot" at the rear. The center board holds the 2nd i.f., a.g.c. and a.m. detectors. Four other boards are accessible when the panel with the connectors is removed.

For further information, check number 30, on page 104

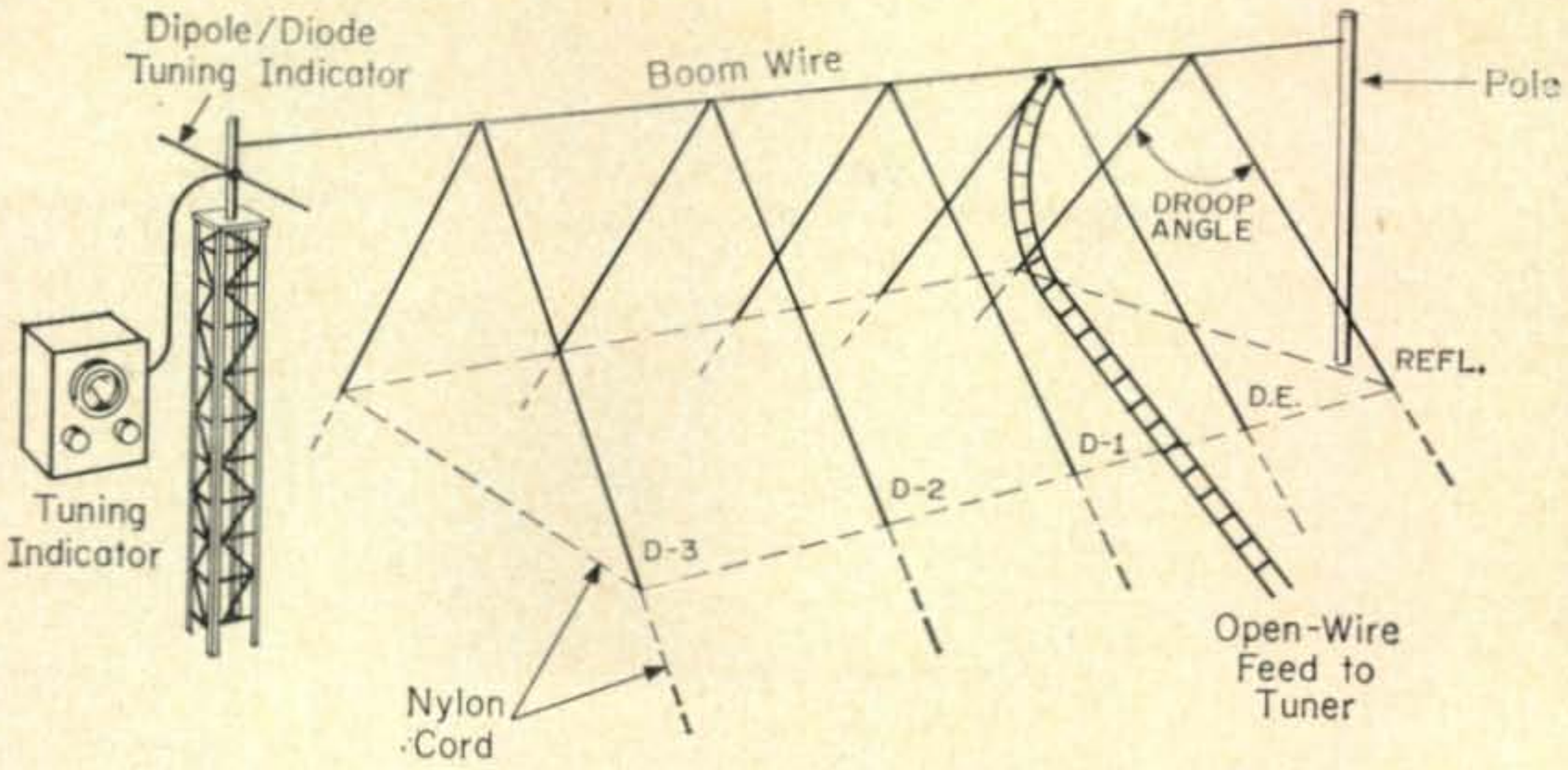


Fig. 1—Top view of the inverted vee fixed yagi antenna showing five elements. The dotted lines indicate nylon string used to maintain spacing and droop angle. Length and spacing formulas are given in the text.

THE INVERTED VEE YAGI

BY MERLE B. PARTEN,* W6ULS

THE popularity of the so called inverted vee antenna, and a desire to try a fixed Yagi for 7 mc long-path to Europe, led the writer into some experiments using this type of construction for a beam.

The limiting factors in constructing this type of array would be, first, two trees or poles, or TV type masts lined up in the proper direction to support the "boom-wire." Second, enough space between them to allow 0.15 wavelength spacing for 2 elements, plus 0.2 wavelength for each added director. This amounts to 20 feet for a 7 mc two element antenna, plus 27 feet for each director.

A 40 foot span would support a 2 element job for 80, or 47 feet would give you 3 elements on 40, or 74 feet between the supports would allow 4 elements on 40. In my case I was able to squeeze 6 elements into the 150 foot span between supports.

The third factor is the width. A generous half-wave should be available if you are to keep the ends far enough above the ground to prevent the kids from drawing two foot arcs. (?)

If the space requirements fall within what you have available, read on. But to prevent you from turning to the last paragraph to check results, they will be presented first.

Performance

The 6 element 7 mc array tested was 35 feet lower at its highest point (due to down-hill terrain) than the 2 element Hy-Gain Duo-band, which was up 75 feet. Coax switching was done with a relay, giving instantaneous comparisons. On days when conditions were poor, and a signal would be fading in and out of the noise on the high 2 element rotary, facing the same direction, it was solid copy on the "monster." The difference was not fantastic, but resulted in QSO's that otherwise would have been a failure. The added gain was just enough to take some of the QSB out of the signal, which is what we are after, during adverse conditions.

Feedline

If you are still interested, you might ask how do you get up to the center of the antenna to match it. No problem. You feed it with open-wire line, through a matching network. The coax from the rig or antenna relay is coupled to a parallel-tuned tank, and the feeders are tapped down to the point of minimum s.w.r., or best match. The light-weight open-wire line minimizes sag in the "boom-wire." Granted that standing waves on this line will result in a poorer front-to-back or side ratio, but the forward gain is still there.

The old story about putting up the beam by formula, then carefully tuning it, and finding that you wasted your time because the formula was close enough in the first place, does not apply in this type of antenna. The formulas I give should be used as a *starting* point only. Since a beam must be raised almost a half-wave before it stops being affected by ground capacity, and since this type of beam will probably not reach this height, tuning will be necessary if optimum gain is to be achieved. However, tuning is easily accomplished at one end of each element and will be described later.

Just to remind you of what you already know, if you take a half-wavelength of wire and support it horizontally, it will be resonant at a given frequency. If you maintain the same height at the center, but lower both ends until they are together, then it is no longer resonant at the original frequency, but is more nearly a quarter-wave, or twice the frequency. Consequently the in-

*920 Alston Road, Santa Barbara, California.

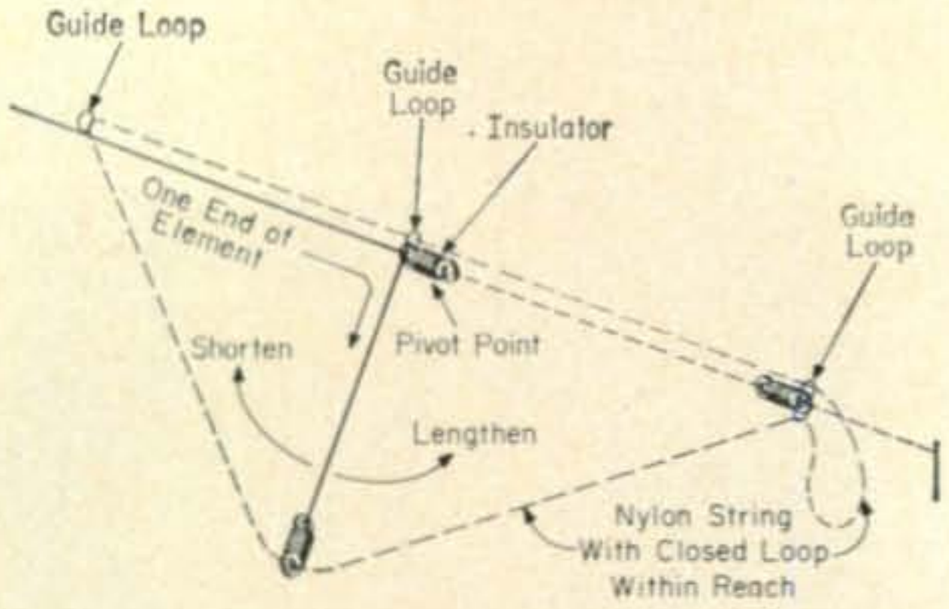


Fig. 2—Tuning is accompiished at one end of the element using this nylon loop adjustment system.

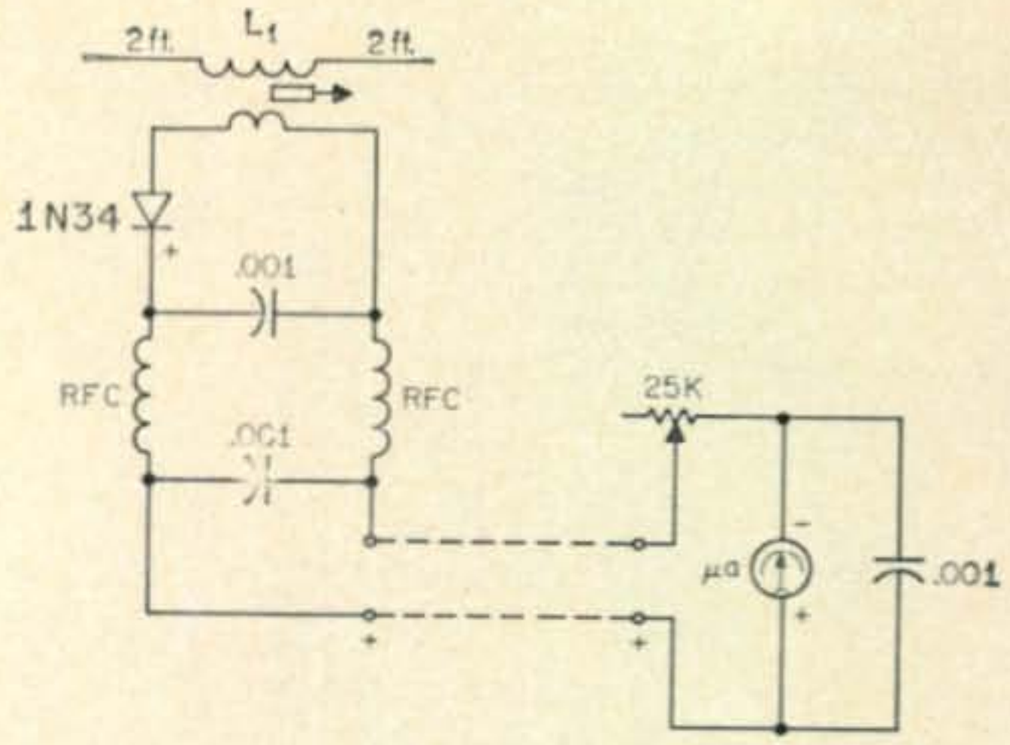


Fig. 3—Dipole tuning indicator. Coil L_1 is a slug tuned form with sufficient turns to resonate in the band the antenna is cut for. The secondary feeding the detector circuit consists of a two turn link.

verted-vee type of construction, with drooping ends, requires a wire to be longer than the straight, horizontal half-wave. For this reason, as well as the height-above-ground, no set formula can be given, since no two installations will have the same angle of droop at the center. The formulas given were derived *after* tuning the "monster," which had a 90 degree "droop-angle," and was installed over uneven terrain.

Nylon twine was used to maintain the spacing between element ends and the droop-angle. This angle, whatever it is, should be maintained. Bench experiments in the 700 mc region indicated that the most gain was achieved when the elements were horizontal, but if the angle of droop was the same on all elements, it still had gain. Please, no fan-mail from the antenna egg-heads. Try getting gain with a horizontal driven element and vertical elements. Maybe the spiral "non-polarized" arrays work. I don't know.

Construction

Figure 1 shows the layout of the inverted vee yagi. The element spacing may be determined as follows:

Reflector to driven element	$S=140/f_{mc}$
Driven element to director #1	$S=189/f_{mc}$
Director #1 to director #2 etc.	$S=189/f_{mc}$

Element lengths may be calculated as follows:

Reflector	$L=550/f_{mc}$
Driven element	$L=510/f_{mc}$
Director #1	$L=497/f_{mc}$
Director #2	$L=483/f_{mc}$
Director #3	$L=475/f_{mc}$

The element lengths are based on a droop angle of 90° with the ends about 20 feet above the ground.

Element Tuning

If the droop angle is less than 90°, add wire to the calculated length (or *vice-versa*) if you hope to hit resonance. The arrangement for adjusting the length for tuning is shown in fig. 2. Make a pivot point about 3 feet from the end of the element so that this 3 feet may be added or cancelled by pulling the strings.

Tuning the array was accomplished by mounting a small dipole-diode indicator on the support at the directional end, with a pair of wires long enough to connect to a microammeter that could be viewed as each element was tuned. Later the meter was extended to the shack as a constant field strength indicator. The circuit is shown in fig. 3.

Using the tuning indicator, adjust the 3 foot length to peaks. If the maximum field strength is within the added three foot length but does not tune through the peak, add wire to the other end of the element until a peak is obtained.

The driven element does not require this procedure as its length will be compensated for in the open wire line and tuner.

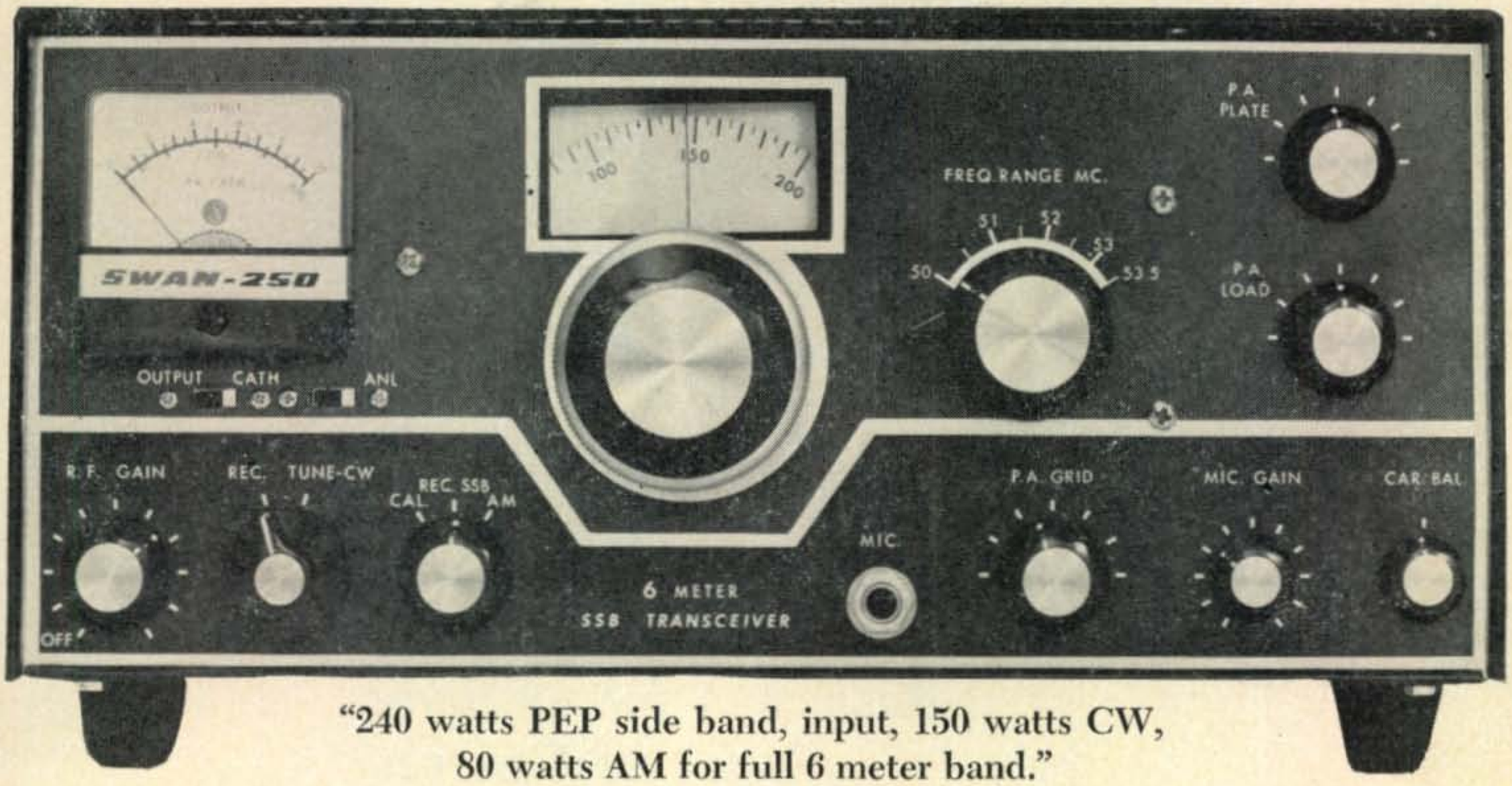
Variations

Many variations of antennas constructed in this manner are possible. If that tree is in the right spot, and is 0.15 to 0.3 wavelengths away from your present inverted vee, hang a reflector behind it, and get more zoom in one direction. The tilted wires make it slightly directional off the ends, and the pattern is broad.

With conditions on the up-swing, I plan to try 10 or 12 elements, fixed on the long path to Europe, either in the manner described here, or by insulating the two ends at the "boom-wire" and using a string of parasitic half waves in phase.

How many elements can you add before the beam width becomes so sharp that your QSO's are limited to the north side of that distant town? ■

Happiness is a Swan 250 on Christmas Morning!



"240 watts PEP side band, input, 150 watts CW, 80 watts AM for full 6 meter band."

The Swan 250 has been introduced to the market and has met with an enthusiastic response. Indeed, ever since August, we have been at least four weeks behind in our orders for this finely-engineered product. The Swan 250 provides the same degree of quality and performance on 6-meters that its older brother, the 350, does for the lower frequencies.

Although there have been three other contemporary products which provide sideband operation on 6-meters, one of these has almost negligible power; a second one covers only 0.5 MC; a third does not provide for AM. For these specific reasons, none of this equipment has met with the overwhelming response which the 250 has. Hams up and down the Atlantic seaboard and clear across to the Pacific are finding a new thrill with sideband operation on 6 a true reality every evening. Typical from the Massachusetts area, we talk with eastern Pennsylvania, southern New Jersey, and the Washington, D.C. area almost at will and this when skip is not in. In other words, our groundwave coverage is far more than doubled and the nice thing about the Swan is that it can be used with the regular 350 power supply so that if you already have Swan equipment and the chances are that you do, by merely buying this model 250, you can be on the air in a very short time.

Model 250 6-meter sideband transceiver	$325.00
Model 117-XC AC power supply and speaker console	95.00
6-meter Calibrator	19.50
VX-1 VOX attachment	35.00
Model 14-117 power supply for mobile operation	130.00

We have the microphones and halos and can make a complete package for you. Buy a Swan for 6-meters and have a new kind of amateur thrill.

HERBERT W. GORDON COMPANY

(helping hams to help themselves)

Woodchuck Hill Road

Harvard, Massachusetts 01451

617-456-3548

For further information, check number 6, on page 104

DRAKE 2-C RCVR & 2-NT CW XMTR

Basic pair for all Hams...
Novice or General

Receiver Model 2-C

$229.00

Excellent performance at low cost

● **Triple Conversion** ● **Crystal-controlled First Converter** ● **500 kc ranges** for 80, 40, 20, 15 and 10 Meters ● **Also any 500 kc range** between 3.0 mc and 30 mc by inserting an accessory Crystal ● **Temperature-compensated VFO Tuning** ● **Selectable Sidebands** without retuning ● **Three Bandwidths**—.4, 2.4, 4.8 kc at 6 db ● **Solid-state** Audio, Product and AM Detectors, AVC Amp and Xtal Osc ● **AVC Switch** (Fast, Slow and Off) ● **SSB, AM and CW** with AVC and S-meter ● **Works Break-in CW** with 2-NT Xmtr ● **19 Tubes and Semi-Conductors** ● **Dimensions:** 11 5/16"W x 6 9/32"H x 9 3/82"D. **Wt.:** 13½ lbs.
Accessories available: 100 kc Calibrator, Q Multiplier, Matching Speaker, Noise Blanker, Crystals for other ranges.

CW Transmitter Model 2-NT

$129.00

Built-in essentials and accessories

● **100 Watts Input** (can be reduced to 75 watts for novice) ● **Operates Break-in CW, Semi Break-in CW or Manual CW** with Drake 2-C or other receivers ● **Automatic Transmit Switching** ● **Side Tone Oscillator** built in ● **Antenna Change-over Relay** built in ● **Pi-Network output** with fixed loading ● **Lo Pass Filter** against TVI built in ● **Drop-out delay** of change-over relay adjustable ● **CW Coverage** on 80, 40, 20, 15, 10 Meters ● **Simplified Tuning** ● **Frequency Spotting** without xmtr output ● **Grid Block Keying** ● **Code Practice** in stand-by position ● 13 Tubes and Semi-Conductors ● **Dimensions:** 9 7/8"W x 6 9/32"H x 9 9/32"D. **Wt.:** 12½ lbs.
Accessories available: Antenna Matching Network, VFO, and Crystals.

All prices are Amateur Net. See your distributor or write for free brochure.

R. L. DRAKE COMPANY • MIAMISBURG, OHIO 45342

For further information, check number 7, on page 104

DX

BY URB LE JEUNE,* W2DEC

HARC DX Quiz

The following is a DX Quiz which was given at the Hudson Division Convention. The answers are on page 100. Bill Lipsky, WA2EFN, won with a score of 85. How well will you do?

1. KX6 land is East or West of the International Date Line?
2. Don Miller used what call while operating from Heard Island?
3. QSLs for 2-Way SSB QSO's with FB8WW may be obtained from .....
4. If only U prefix stations are worked, contact may be established with how many different zones?
5. Excluding Mexico and Canada, what is the closest country to the U. S.?

Answer 6 through 10 True or False

6. Clipperton Island is in North America.
7. Pakistan borders on Afghanistan.
8. Moscow is closer to New York City than Honolulu.
9. ZD8 is the prefix for Ascension Island.
10. GMT is 5 hours ahead of EST.
11. The country that uses the prefix UG6 is .....
12. The country between VP3 and FY7 is .....
13. The Andaman and Nicobar Islands are in zone .....
14. A station using a DK prefix would be in what country?
15. Portuguese Guinea now uses what prefix?
16. What exotic prefix was used for Christmas Island before the present VK9?
17. In addition to Russia, what country is in both Europe and Asia?
18. There are two land-locked countries in South America; name one?
19. Match the following DX stations and QSL managers.

a. AC4H	1. WB2FSW
b. VP6WR	2. RAEM
c. KS4CA	3. WA9OVE
d. VK9NT	4. W2GHK
e. UA1KED	5. W2CTN

20. Match the names and calls of the following DXers.

a. W1WPO	1. Harry Lilienthal
b. 4X4DK	2. Rasheed Jalal
c. CR7GF	3. Ami Shami
d. 7X2AH	4. Jose Guerra
e. YK1AA	5. Bob White

*Box 35, Hazlet, New Jersey 07730.

The following certificates were issued between the period from September 6th, 1966 to and including October 5th, 1966:

CW-PHONE WAZ

2237	JA1BJJS	2244	F8BQ
2238	SM5BHW	2245	W5DNL
2239	W4ZX1	2246	YU3BC
2240	KH6FJL	2247	YU3CG
2241	W3RT	2248	OK1BY
2242	I1BAY	2249	OK2YF
2243	WB6LFR		

ALL-PHONE WAZ

342	KH6FJL	344	EP3RO
343	W6ABA		

TWO-WAY SSB WAZ

421	KH6FJL	423	WA6ESB
422	W6ABA	424	VE3TB

CW WPX

744	W6CUF	746	K1GUD
745	GI30LJJ	747	K6PWR

PHONE WPX

134	VE3DYB

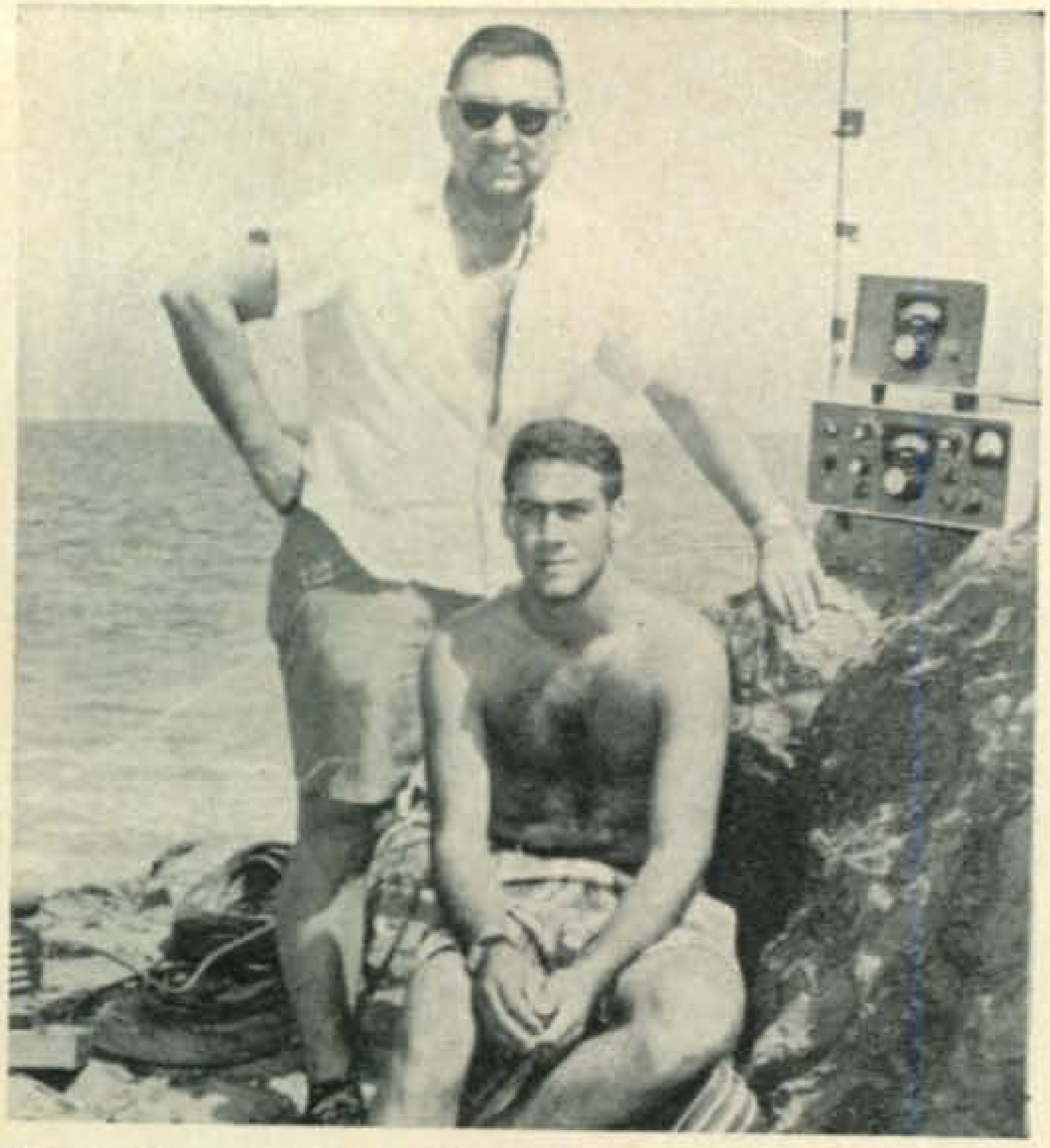
100 TWO WAY SSB

492	K4GXO	493	PY2CTL

Here and There

Gus: Gus Browning, W4BPD, has started a DX News Service. The details may be obtained from Gus at RFD 1, Box 161A, Cardova, S. C. 29039. The best of luck to Gus.

St. Peter's Rock (left) and St. Paul's Rock (right), site of the W9WNV/K1IMP operation as PYØXA.



Don Miller and Herb Kline, K1IMP perched high atop St. Paul's Rock operating PYØXA.

CEØ Easter Island: CEØAC has been active on 14013 kc or 7001 kc between 0445 and 0545 GMT. *(Tnx LIDXA).*

CR9 Macao: John, CR9AH, is active daily on 21275 kc SSB at 2300 GMT. *(Tnx NEDXA).*

FW8 Wallis Island: Robert, FW8RC, has a sked with some W7 stations most Saturdays and Sundays at 0600 GMT on 14244 s.s.b. He will work others after his sked but don't try to break during sked. *(Tnx LIDXA).*

KH6 Kure Island: K5QFH/KH6 is active from Kure Island on 14239 kc s.s.b. at 0800 GMT. *(Tnx DX-MB).*

SVØ Crete: SVØWL is now active and will be on for two years. *(Tnx VERON).*

TA Turkey: TA1AV has been quite active on Wednesday and Thursday between 1800 and 2000 GMT. He prefers 14030. *(Tnx NEDXA).*

TJ Cameroun: Hermann, HK1QQ (Malpelo, Baja Nuevo fame) is now in Cameroun, TJ1, for about two years. He will possibly operate from all prefixes in Africa. His primary goal is EAØ operation. Equipment is on the way to him and he hopes to be on the air very shortly using all bands. Hermann is an expert c.w. man, so clean up your key fellows. *(Tnx W4QVJ).*

TR8 Gabon: TR8AD is active on 21190 kc a.m. at 0830 GMT and 14225 kc at 2100 GMT. TR8AG is active on 14020 c.w. or 14195 kc phone around 2130 GMT. *(Tnx DX-MD).*

TY Dahomey: 5N2AAW and 5N2AAX have licenses to operate from Dahomey. They will DXpedition there weekends when possible.

UAØY Zone 23: UAØYP is active on 14212 kc s.s.b. between 1400 and 1500 GMT. *(Tnx DX-MB).*

VK Lord Howe Island: VK4SS and VK5XK are presently active on Lord Howe using 20, 40 and 80 meters. They QRT 10 December. *(Tnx LIDXA).*

VK9 Nauru Island: VK9AM has been reported on 21320 kc a.m. phone. *(Tnx Fla. DX Rpt.)*

VKØ Macquarie Island: Colin, VKØMI, can usually be found on 14170/180 weekends using AM phone. He is active between 0430 and 0600 GMT and listens on 14240/245. *(Tnx LIDXA).*

VP1 British Honduras: Ben, WB4EDD, will be operating as VP1DX in December. All bands will be used, mostly CW, but some SSB. Ben will be looking for novice QSOs.

VP2S St. Vincent: Washington, VP2SY, is now active using a SSB transmitter furnished by his QSL manager, K1IMP. *(Tnx NEDXA).*

VP8 Area: Currently active are the following stations:

- **Falkland Islands:** VP8HJ, VP8IQ, VP8JA on 14 mcs CW; VP8HZ 14 mcs AM; VP8CW 14 and 7 mcs SSB.
- **Antarctica** (and several islands around) VP8IY, VP8IU, VP8IK, VP8IN, all on 14 mcs CW.
- **South Orkneys:** VP8EG 7 & 14 mcs CW.
- **South Shetlands:** VP8IV, 14 mcs CW starting December, 1966.
- **South Georgia:** VP8HY 14 mcs CW and SSB. *(Tnx VERON).*

VP7 Aldabra: VQ7VY is with a BBC survey team on Aldabra. He will be there at least six months. He schedules ZD8RB Tuesdays and Fridays at 1200 GMT on 21310 kc. He is also active on 14310 kc at 1900 GMT. *(Tnx NEDXA & NCDXC).*

VR4 Solomon Islands: Steve, VR4LN, has been active on 14240 kcs around 0700 GMT. *(Tnx Fla. DX Rpt.)*

VS90 Muscat and Oman: VS90C on Masirah Island is quite active on 14195 kc SSB between 2100 and 0100 GMT. He usually listens on 14203 kcs. *(Tnx LIDXA).*

ZA Albania: ZA1BE ist ein Pirat. (Tnx DX-*MB).*

[*Continued on page 92*]

A very uninviting situation greeted W9WNV and K1IMP upon their arrival at Navassa Island. The vertical antenna in the background attests to their reaction.

Propagation

BY GEORGE JACOBS,* W3ASK

THE big propagation news this month is the re-awakening of the 10 meter band after a sleep of about four years. With rising solar activity, the band has been opening to many areas of the world almost daily during the hours of daylight since early October. Good world-wide 10 meter DX propagation conditions are expected to continue through December, with exceptionally strong signal levels forecast to many areas of the world. There's a good possibility that conditions may actually be better than shown in this month's DX Propagation Charts!

Exceptionally good DX propagation conditions are also forecast for the 15 and 20 meter bands from shortly after sunrise, through the daylight hours, and into the early evening hours. The 15 meter band is likely to be the optimum band for daytime DX openings, while 20 meters is expected to be optimum during the sunrise period, and also during the late afternoon and early evening hours. To some areas of the world, 20 meters is forecast to remain open well into the evening hours, and during periods of above normal propagation conditions, the band may remain open around-the-clock.

A considerable improvement is expected in DX propagation conditions on 40, 80 and 160 meters during the hours of darkness in December. Static levels on these bands should be at seasonally low values, and signal levels stronger than during other seasons of the year.

The 40 meter band is expected to open for DX during the early afternoon hours, and should remain open to one area of the world or another through the hours of darkness, and until shortly after sunrise. Eighty meters is forecast to open during the hours of darkness, and some 160 meter DX openings should also be possible during the hours of darkness.

Chart Change

Beginning this month, a column in the DX Propagation Charts will be devoted exclusively to the 10 meter band. Columns will also be devoted exclusively to the 15 and 20 meter bands, while 40 and 80 meter openings will be shown in a fourth column. While space no longer permits including 160 meter DX openings in the Charts, openings on this band are most likely to take place during the same hours that 80 meter openings are shown with a forecast rating of (2) or higher.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for December

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **1, 4, 8, 15, 22, 31**	A	A-B	B-C	C
Normal: **2-3, 5, 7, 9, 11-14, 16, 18-19, 23-24, 27, 29-30**	A-B	B-C	C-D	D-E
Below Normal: **6, 10, 17, 20, 26**	C	C-D	D	E
Disturbed: **25**	D	D-E	E	E

How To Use These Charts

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

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

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

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

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

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

6—The Eastern USA chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9 and Ø areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid through Jan. 31, 1967, and are prepared from basic propagation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

v.h.f. Ionospheric Openings

There is a tendency for sporadic-E propagation to reach a minor seasonal peak during December and early January (a major peak occurs during the summer months). This should result in a number of short-skip openings, between approximately 800 and 1400 miles, on 10 and 6 meters.

A major meteor shower, the *Geminids,* is expected to occur during the second week of December. Some short-skip v.h.f. openings, up to distances of approximately 1000 miles, may be possible as a result of the ionization produced

by the meteors as they enter the earth's atmosphere.

V.h.f. ionospheric openings over several hundred miles are also likely to occur during periods of auroral displays or ionospheric storminess.

Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are likely to be disturbed or below normal during December.

Sunspot Cycle

The sunspot cycle continues to rise slowly, but steadily. The Zurich Federal Solar Observatory reports a *monthly average* sunspot number of 49 for September, 1966. This number is based upon the daily observations taken throughout the month.

The sunspot cycle is based upon *smoothed sunspot* numbers. A smoothed number is an average of the monthly numbers recorded over a 13 month period. The latest smoothed number, based on the monthly numbers obeserved between September, 1965 and September, 1966 is 33.5. The number is centered on the middle month of the 13 month period, or in this case, March, 1966.

A smoothed sunspot number of 61 is forecast for December, 1966.

160 Meter Tests

Stew Perry, W1BB, points out that the occasionally good DX conditions that prevailed on 160 meters this past summer may be an indication of relatively good conditions on the "top-band" this winter. Stew also reports that the 1966/1967 160 meter test periods will be held on SUNDAY, between 0500 and 0730 GMT, December 4 and 18; January 1 and 15, and February 5 and 19. These tests have been held every year since 1932, except during World War II, and offer the opportunity for those interested in 160 meter DX conditions to experience the thrill of "digging them out" on this band. During the test periods 160 meter stations are expected to be in operation in several dozen countries, and on all continents, and special efforts will be made to establish new DX records for this band.

W/VE stations participating in the tests should call "CQ-DX-TEST" the first five minutes of the hour, and alternate five-minute periods thereafter, listening in between. DX stations should call "CQ-DX-TEST" during the second five-minute period, and alternate five-minute periods thereafter, listening in between. Authorized frequencies for the test periods are as follows: Eastern W and VEs, 1800-1825 kc; Western W and VEs, 1975-2000 kc; European stations, 1825-1830 kc; ZL and VKs, 1800-1860 kc; JAs, 1907.5-1912.5 kc; Africans, 1800-1825 kc.

These tests can be exciting, and all participants will be on the alert for unusual DX openings during the hours of darkness and at sunrise and sunset. DX propagation conditions often peak on 160 meters when one end of a circuit is in darkness and the other in dawn or twilight. W1BB emphasizes that these tests are *not* contests. There is *no* competition or scores. The main purpose of the tests are to encourage use of the 160 meter band, and to develop propagation information throughout a solar cycle. Send resumes of test period results directly to W1BB, 36 Pleasant Street, Winthrop, Mass., at the end of the final test on February 19, 1967.

This month's column contains DX Propagation Charts for December, 1966 and January, 1967. Short-Skip Charts for December appeared in last month's column.

The Editor of this column takes this opportunity to extend the warmest of wishes to everyone, everywhere, for a Merry Christmas and a very Happy New Year. 73, George, W3ASK

CQ DX Propagation Charts

DECEMBER, 1966 & JANUARY, 1967

Time Zone: EST (24 Hour Time)
Eastern USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	08-09 (1) 09-10 (2) 10-12 (1)	07-08 (1) 08-09 (3) 09-11 (4) 11-12 (3) 12-13 (2) 13-15 (1)	05-07 (1) 07-09 (4) 09-13 (3) 13-14 (4) 14-15 (3) 15-17 (2) 17-19 (1)	15-17 (1) 17-19 (2) 19-00 (4) 00-03 (2) 03-04 (1) 19-23 (1)* 23-01 (2)* 01-02 (1)*
Northern Europe & European USSR	08-11 (1)	07-08 (1) 08-11 (2) 11-13 (1)	05-07 (1) 07-09 (3) 09-12 (2) 12-16 (1)	16-19 (1) 19-23 (2) 23-03 (1) 19-02 (1)*
Eastern Mediterranean	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-10 (3) 10-13 (1)	01-03 (1) 05-07 (1) 07-09 (2) 09-11 (1) 11-14 (2) 14-17 (1)	19-00 (1) 20-23 (1)*
East Africa	08-09 (1) 09-11 (2) 11-15 (1)	07-08 (1) 08-12 (2) 12-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-15 (2) 15-18 (3) 18-20 (2) 20-22 (1)	19-00 (1) 22-00 (1)*
West & Central Africa	08-09 (1) 09-13 (2) 13-16 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	01-03 (1) 06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-21 (1)	18-22 (1) 22-01 (2) 01-02 (1) 00-02 (1)*
South Africa	08-09 (1) 09-13 (2) 13-15 (1)	07-09 (1) 09-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	05-14 (1) 14-15 (2) 15-17 (3) 17-19 (2) 19-23 (1) 23-01 (2) 01-03 (1)	18-19 (1) 19-21 (2) 21-00 (1) 19-22 (1)*
Central Asia	*Nil*	08-10 (1) 17-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 18-22 (1)	06-08 (1) 20-22 (1)
Southeast Asia	08-10 (1) 18-20 (1)	08-11 (1) 17-20 (1)	06-07(1) 07-09 (2) 09-12 (1) 18-21 (1)	06-08 (1)

* Predicted 80 meter openings. Openings on 160 meters are also likely to occur during those times where 80 meter openings are shown with a forecast rating of (2) or higher.

Far East	17-19 (1)	07-09 (1) 16-17 (1) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-21 (2) 21-23 (1)	05-08 (1) 05-07 (1)*
Guam & Pacific Islands	12-13 (1) 13-15 (2) 15-17 (1)	11-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-20 (1)	05-07 (1) 07-09 (3) 09-11 (2) 11-19 (1) 19-22 (2) 22-00 (1)	01-02 (1) 02-04 (2) 04-07 (3) 07-08 (2) 08-09 (1) 04-05 (1)* 05-07 (2)* 07-08 (1)*
Austra-lasia & New Zealand	09-11 (1) 16-18 (1)	08-12 (1) 15-17 (1) 17-19 (2) 19-21 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-13 (1) 13-15 (2) 15-19 (1) 19-22 (2) 22-23 (1)	04-06 (1) 06-08 (2) 08-09 (1) 05-08 (1)*
North-ern & Central South America	07-09 (1) 09-11 (2) 11-14 (3) 14-15 (2) 15-16 (1)	07-08 (1) 08-11 (3) 11-14 (2) 14-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	05-06 (1) 06-07 (2) 07-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-02 (2) 02-05 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-04 (2) 04-07 (1) 19-21 (1)* 21-02 (2)* 02-05 (1)*
South-ern Brazil, Argen-tina, Chile & Uru-guay	08-12 (1) 12-15 (2) 15-17 (1)	07-08 (1) 08-14 (2) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	01-06 (1) 06-07 (2) 07-08 (3) 08-09 (2) 09-15 (1) 15-16 (2) 16-17 (3) 17-19 (4) 19-20 (3) 20-01 (2)	19-21 (1) 21-02 (2) 02-05 (1) 21-03 (1)*
Mc-Murdo Sound, Antarc-tica	08-11(1)	08-15 (1) 15-17 (2) 17-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 15-18 (1) 18-20 (2) 20-23 (3) 23-01 (2) 01-03 (1)	22-00 (1) 00-02 (2) 02-05 (1)

Time Zones: CST & MST (24 Hour Time)

CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	08-11 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-14 (1)	05-07 (1) 07-09 (3) 09-11 (2) 11-13 (3) 13-15 (2) 15-17 (1)	15-17 (1) 17-23 (2) 23-03 (1) 19-23 (1)* 23-00 (2)* 00-01 (1)*
North-ern Europe & Euro-pean USSR	08-10 (1)	07-09 (1) 09-10 (2) 10-12 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-12 (2) 12-14 (1)	18-01 (1) 19-00 (1)*
Eastern Mediter-ranean	08-11 (1)	07-03 (1) 08-10 (2) 10-12 (1)	23-02 (1) 07-10 (1) 10-12 (2) 12-15 (1)	18-23 (1) 20-22 (1)*
East Africa	09-11 (1)	07-11 (1) 11-15 (2) 15-17 (1)	06-11 (1) 11-14 (2) 14-17 (3) 17-18 (2) 18-22 (1)	19-23 (1)
West & Central Africa	08-09 (1) 09-12 (2) 12-15 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	05-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-19 (2) 19-21 (1)	18-21 (1) 21-23 (2) 23-00 (1) 22-00 (1)*
South Africa	08-09 (1) 09-12 (2) 12-13 (1)	07-09 (1) 09-11 (2) 11-14 (3) 14-15 (2) 15-16 (1)	06-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-21 (1) 00-02 (1)	18-20 (1) 20-22 (2) 22-00 (1) 19-22 (1)*
Central Asia	*Nil*	08-10 (1) 19-21 (1)	05-07 (1) 07-09 (2) 09-11 (1) 19-22 (1)	06-08 (1) 19-21 (1)
South-east Asia	08-10 (1) 18-20 (1)	08-11 (1) 16-17 (1) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-12 (1) 17-18 (1) 18-20 (2) 20-21 (1)	06-08 (1)
Far East	16-18 (1)	07-09 (1) 14-16 (1) 16-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 17-20 (2) 20-22 (1)	03-09 (1) 04-07 (1)*
Pacific Islands & New Zealand	12-13 (1) 13-15 (2) 15-17 (1)	10-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (3) 09-11 (2) 11-15 (1) 15-17 (2) 17-20 (3) 20-21 (2) 21-22 (1)	22-00 (1) 00-02 (2) 02-06 (3) 06-07 (2) 07-09 (1) 02-04 (1)* 04-06 (2)* 06-08 (1)*
Austra-lasia	4-15 (1) 15-16 (2) 16-17 (1)	08-14 (1) 14-18 (2) 18-21 (1)	06-07 (1) 07-11 (2) 11-16 (1) 16-17 (2) 17-21 (3) 21-22 (2) 22-23 (1)	02-05 (1) 05-07 (3) 07-09 (1) 04-07 (1)*
North-ern & Central South America	08-10 (1) 10-13 (2) 13-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (2) 07-11 (3) 11-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-00 (1) 00-02 (2) 02-06 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-03 (2) 03-06 (1) 19-21 (1)* 21-01 (2)* 01-04 (1)*
South-ern Brazil, Argen-tina, Chile & Uru-guay	08-11 (1) 11-15 (2) 15-17 (1)	07-08 (1) 08-13 (2) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (2) 07-08 (3) 08-09 (2) 09-14 (1) 14-16 (2) 16-18 (4) 18-21 (3) 21-23 (2) 23-06 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-05 (1)*
Mc-Murdo Sound, Antarc-tica	08-11 (1)	07-14 (1) 14-16 (2) 16-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 15-18 (1) 18-20 (2) 20-22 (3) 22-00 (2) 00-03 (1)	22-00 (1) 00-02 (2) 02-05 (1)

Time Zone: PST (24 Hour Time)

WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	07-09 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-10 (2) 10-11 (1)	05-07 (1) 07-10 (2) 10-12 (3) 12-13 (2) 13-15 (1) 00-03 (1)	17-19 (1) 19-22 (2) 22-00 (1) 19-23 (1)*
North-ern Europe & Euro-pean USSR	*Nil*	07-09 (1)	06-08 (1) 08-10 (2) 10-13 (1) 00-04 (1)	17-00 (1) 19-23 (1)*
Eastern Mediter-ranean	*Nil*	07-09 (1)	06-07 (1) 07-09 (2) 09-13 (1)	18-21 (1)
West Africa	08-10 (1) 10-12 (2) 12-13 (1)	06-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-16 (2) 16-17 (1)	05-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-19 (2) 19-21 (1)	18-22 (1) 19-21 (1)*
East & Central Africa	08-09 (1) 09-11 (2) 11-12 (1)	06-11 (1) 11-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	05-11 (1) 11-13 (2) 13-17 (3) 17-19 (2) 19-20 (1)	18-21 (1)

[*Continued on page 98*]

HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV

AMATEUR television (ATV) is certainly a lot of fun for those hams who have been able to put a station on the air. However, the cost of camera equipment—especially the vidicon tube—has discouraged many hams from TV experimentation. But now that TV camera parts and even complete TV cameras are available at reasonable prices, the ham who wants to try his hand at ham TV can do so without going broke.

With ham TV it takes two to "TV." But some hams have put complete stations together with the hope that someone else in town would sooner or later go on the air so that a TV QSO would be possible. In the meantime these brave "loners" use their TV station for closed station work around the house.

Ham TV stations usually work on 420 mc so DX does not enter into their thinking—at least not at this stage—but who knows, the time may come when it will be possible to QSO thousands of miles using ham TV via satellites—this is an exciting thought.

The ham TV station is not complicated or expensive now when it is considered that one's h.f. station equipment may run as high as $1,000. A good ham TV station can be put together for as little as $275.00. This includes the TV camera (kit from Conar Instruments, 3939 Wisconsin Ave., Wash. D.C. 20016) for $209.50, plus a used TV receiver $15.00 to $50.00, and junk box parts for the transmitter and receiver converter. The antenna is no problem.

It should be remembered that any of the h.f. or v.h.f. phone bands can be used to carry the audio for the ham TV station and only 420 mc used for picture transmission. This simplifies the problem of putting a station on the air.

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

HAM CLINIC is a free technical question and answer service provided exclusively by *CQ*. Every attempt is made to answer each reader's question as promptly and accurately as possible. Occasionally, even HAM CLINIC is stumped, but it rarely happens. Readers are requested to enclose a stamped, self addressed envelope with their questions, to facilitate fast replies. For *extra* fast service, write directly to: Ham Clinic, c/o Chuck Schauers, W6QLV, 4 Lutzelmatte Str., Luzern, Switzerland. Enclose two IRC's. Normal inquiries: Ham Clinic, c/o *CQ*, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

Slow scan TV, a medium that can be used on the h.f. band is not as interesting as normal or live TV, although it may be less expensive to experiment with.

Most TV cameras designed for closed circuit work contain the necessary circuitry for direct connection to any TV receiver. Usually a clear channel is used for transmissions. For ham TV work, the ham must up-convert the TV camera signal to 420 mc, but this is not difficult to do. At the same time, the camera's *original* output signal can be connected directly to a TV receiver for monitoring purposes. If only one receiver is used, then a bit of the transmitter signal (as converted) can be fed to the 420 mc receiver converter for monitoring. If variable tuning is provided at the converter it is possible for simultaneous reception and transmission to take place.

The majority of questions relative to amateur TV received by HAM CLINIC concerned the sources for ham TV gear. There is no manufacturer as such for ham TV gear anywhere in the world, but there are a number of outlets which provide camera parts, used receivers, monitors, etc.

One caution! When buying camera tubes (vidicons) make certain they are new or have been tested and are guaranteed. Look for burned screens and loose elements. If you are a camera fan and have a number of good lenses laying around you can save money putting your TV station together by using these lenses on your camera.

Sooner or later video tape recorders will be available for a reasonable price, even if you do not use your TV camera for ham TV QSO's you can certainly have a lot of fun televising and recording activities of the family, etc.

Questions

HRO-500 Synthesizer Locking—"I have an early model HRO-500 and it is truly a wonderful set, but I note that the synthesizer now seems to fail to lock on one or more 500 kc frequencies. What should I look for?"

This type of difficulty generally may be traced to the crystal oscillator, spectrum generator, 4.75 mc mixer, 4.75 i.f. amplifier, phase detector or the d.c. amplifier control circuits. High frequency oscillator drift or misalignment *cannot* cause this difficulty. Write National and ask for their customer service bulletin dated June 15, 1965.

Frequency Converters—"I am looking for a converter (preferably solid state) that I can use to pick up aircraft signals on 123-124 mc and another for 155-156 mc. Know where I can buy them?"

Suggest you write Vanguard Labs, 196-23 Jamaica Ave., Hollis, N.Y. 11423. They make converters for the hambands as well as commercial, marine, fire, police etc. bands. It would be hard to build one for the price they charge, $16.95.

DX-40 Filter—"I bought a second-hand DX-40 from a well known supply house. After I received it I hooked it up but the tubes did not light. I

then checked the fused plug on the line cord and found both fuses gone. I replaced these fuses, turned on the set, I saw the tubes start to light up, a flashing in the rectifier tube and then the fuses went out again. What is my trouble?"

First check *all* tubes. Next, disconnect the filter capacitors in the power supply (*after* shorting them out with a screwdriver—and with the set disconnected from the a.c. line) and check them for shorts. This is no doubt your trouble. If the caps are okeh, then look for other shorted capacitors in the high voltage line. If no luck, then suspect the transformer. If this is okeh then check for a shorted choke (to ground).

SBE Service Tips

SB2-VOX—The microphone gain may be increased if necessary by changing R_5, the 220K resistor in the collector circuit of Q_1 to 100K. For chassis marked **O**.

SB2-LA—In units marked **3** and below, overheating of the parasitic suppression resistor in the grid circuit of the p.a. tubes may be caused by the *wirewound* 30 ohm resistor in series with the exciter input network. This should be replaced with two *carbon* resistors in parallel, 27 ohms 2 watt each.

SB2-XC—For chassis marked **O**, failure of the oscillator to start may be corrected by changing the 1K resistor in the collector circuit of Q_1 to 270 ohms ½ watt 10%.

SB2-v.o.x.—For chassis marked **1** and below, lock-in of the v.o.x. unit may occur under high ambient temperature conditions. This can be corrected by changing Q_4 to a silicon type 2N2431 transistor.

SB2-XC—For chassis marked **1** and below the calibrator output may be increased if necessary by changing the 1.5 mmf output coupling capacitor to 33 mmf.

SB-34 Transceiver Motorboating—"I own an early SB-34 and it worked fine until recently when it started to squeal when the transmitter was activated. The cause and cure please?"

Sure. As pointed out before no electronic part will last forever. In this case I suggest you replace Q_2 and Q_4 transistors with the same type (2N1305). This will clear up your trouble pronto.

Incidentally, the newer models of the SB-34 use the silicon type 2N3638 transistors (chassis numbered **22** or above). This change can be made in earlier units provided the following circuit changes are made: change Q_2 and Q_4 to 2N3638; change R_5 and R_{17} to 6800 ohms, and change the wiring of C_5 from base to ground and to base to emitter.

Gonset v.f.o.—"I own a Gonset v.h.f. v.f.o. that I bought with my used Communicator III. I have no diagram for the v.f.o. Each time I turn it on it blows the fuse. Any troubleshooting hints?"

Yes. Check the selenium rectifier, a 75 ma unit. Next, check the 50 mf filter electrolytic. If these are okeh, then check the two 6BJ6 tubes in the unit, and if these are operative and not shorted, then suspect plate and screen bypass capacitors as being shorted. Lastly (if all checks out), then suspect a shorted secondary winding on the trans.

HQ-170 S Meter—"No matter what I seem to do I cannot get the S meter correctly calibrated on my HQ-170 and have difficulty adjusting it according to the manual. What do you suggest?"

First, try a new 12AU7 (V_{13}) tube and then go through the adjustments as called for by the manual. If you have no luck, then check the components associated with the balanced bridge circuit and V_{13}. Check to see that R_{19} has not been mal-adjusted—this is a factory adjustment and normally does not require touching.

HX-500 Parasitic Chokes—"I have a used HX-500 that came to me with the new 6146B tubes installed. I noted that the parasitic chokes connected to the plate of the 6146's were burned, so I replaced them. A few days ago when tuning up the set, I saw smoke and I turned the set off. Examining it I found the parasitic chokes gone again. What gives here?"

Usually when parasitic chokes go it indicates either one of two things: a high s.w.r. (wrong antenna for the band) or lack of proper neutralization.

Cheyenne Modulation—"No matter what I do I cannot seem to get my Heath Cheyenne mobile transmitter to modulate properly. The reports I get are that I am overmodulating and the signal is raspy. I also get reports that I am FM'ing. Can you help me? I am using my own homebuilt power supply for the set."

First, I would suggest that you check the voltage coming from your power supply. You need 600 volts and 300 volts. The latter at 100 ma and the former at 150 ma. Check the 6DE7 tube and the voltage going to it. With carrier controlled modulation there is a tendency to overmodulate—so keep the mike gain *down*. Another thing, do *not* try to overload the final of the transmitter. Keep the loading somewhat under the maximum called for. FM'ing is usually caused by poor voltage regulation to the oscillator. Check the OA2 v.r. tube (V_7). Also, check the input voltage to your power supply with the car engine off and with it running at full throttle. Your generator output may be too high or just high enough to cause the f.m.'ing, even though the v.r. tube is supposed to take care of the voltage excursions. *But* your power supply may not have the dynamic current output capability either and it may "groan" on modulation peaks. Good luck.

SB-300 b.f.o.—How can I increase the output from the b.f.o. in my Heath SB-300 receiver?"

Why? There are two ways. First by increasing the voltages to the b.f.o. amplifier (V_{9c}) and/or increasing the coupling capacitor value in the output circuit (plate) of the tube.

BC-1060A Oscilloscope—"I have a surplus BC-1060A oscilloscope and have no manual for it. Can you give me the training manual number for it? Next, can I convert this set over to use a 5 instead of a 3 inch tube?"

The training manual number is TM 11-2526.

[*Continued on page 82*]

HAPPY HOLIDAYS

What better way to say "thanks"

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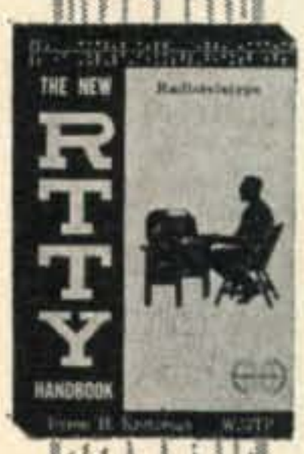

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ELECTRONIC CIRCUITS HANDBOOK

Cat. #121. Describes and discusses in detail 150 of the most often needed circuits around the shack. Novices and old-timers alike will find many valuable circuits here ideal for construction projects. Eleven great chapters cover a multitude of circuits for all.

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Ham clinic [*from page 79*]

There is not enough space in this set to install a 5 inch tube.

B&W 51SB Drive—"My 51SB s.s.b. generator has given me fine service, however, this was with a 5100 model transmitter. Now I have another transmitter and there is insufficient drive from the generator to the transmitter final grids. What do I look for?"

First check tubes V_{103} and V_{104}. Check the 5Y3GT rectifier tube. Check your transmitter for proper operation and sufficient drive *back* to the generator. Check both input and output coaxial r.f. lines for opens or shorts. Check resistors R_{113}, R_{117} and R_{118}. Also check capacitors C_{119}, C_{121}, C_{125} and C_{127}. Also especially check R_{101} and R_{102}. These are precision resistors and excessive drive will sometimes burn them out.

Matching Power Tubes—"I have been told that anytime one uses power (r.f.) tubes in parallel or even push-pull these tubes should be matched if possible. Now, not having ready access to a tube tester, how can I pick tubes that are 'closely matched'?"

Well, the way I have always done it is tune up my transmitter normally, then reduce power so that the dissipation of *one* tube will not be exceeded. I remove one tube and note the reading on the final plate meter, then I plug in tubes until I get the same or close reading. This is not an infallible method but it works. The best way of course is to check *all* paramenters including mu on a good dynamic tube tester.

NCX-5 Carrier Balance—"I purchased a second hand early model of the NCX-5 transceiver and I find that I have difficulty balancing out the carrier. I understand that this has been corrected in later models, but what I am interested in is fixing up mine. What's the answer?"

First of all try different 7360 tubes. Next degauss the hinged lid of the NCX-5 with a TV degausser (found in all color TV shops). Use a fiber screwdriver for adjusting the carrier balance control. The answer to your problem if the above do not work is to replace the present modulator circuitry using solid state components —as is done now with the newer models. The new NCX-5 is receiving terrific reports. As said before, one cannot blame a manufacturer for outside supplied components that do not work.

Book Review—(*Electronic Circuits Handbook* Vol. II) edited by Tom Kneitel, K2AES, contains a large number of circuits which would be of interest to hams. Many of the circuits which have appeared in HAM CLINIC also appear in Tom's book. This is the book for the ham interested in construction as well as the novel approach to circuit problems. It covers just about every area of circuitry with practical applications. Well worth the $3.00 asked for it, it can be obtained from the Book Division of Cowan Publishing Corp., 14 Vanderventer Ave., Port Washington, L.I., New York 11050. I recommend it.

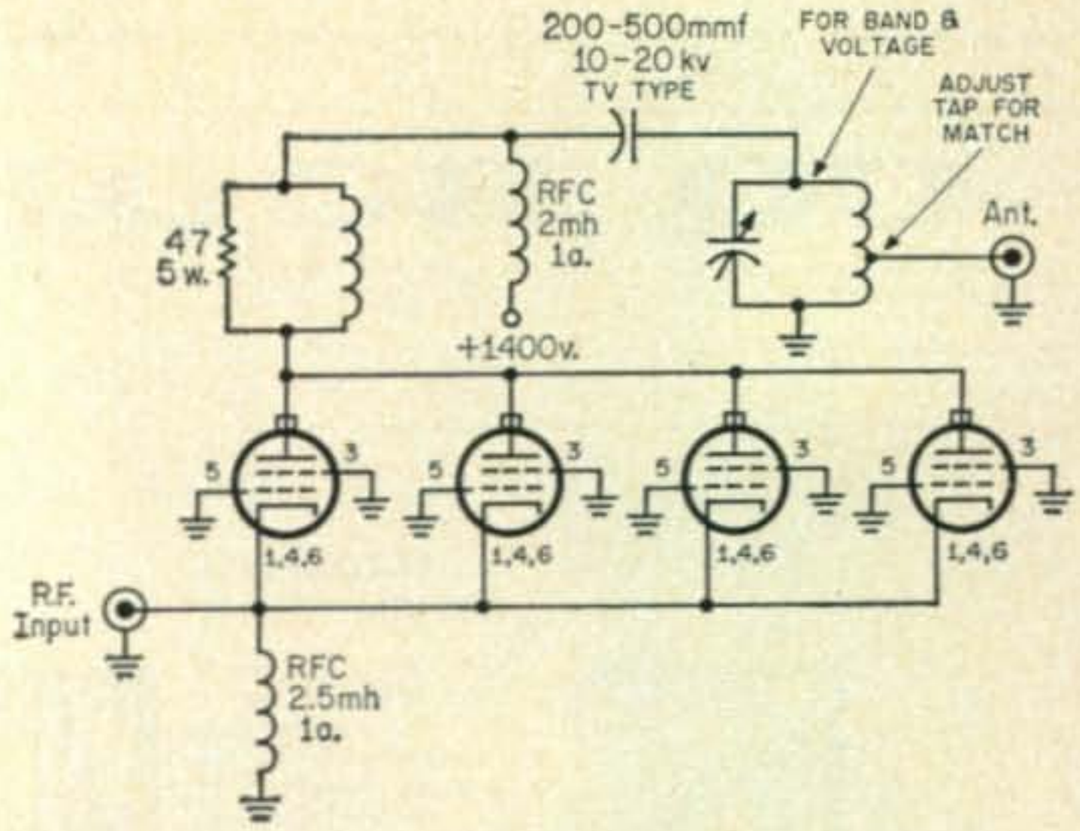


Fig. 1—A grounded-grid linear using 6146B tubes. A pi network can be used in the output but values must be calculated for all tubes. Link coupling can also be used for antenna connection, and the link tuned against ground.

6146 Linear—"Can you come up with a circuit using 4 of the new 6146B tubes in grounded grid that will work? Make it simple please."

See fig. 1. This is a circuit I put together about 5 years ago experimenting with 6146 tubes and it worked. However, the tubes should be matched as closely as possible and the voltage given not exceeded. Some experimentation will be necessary with the tuned circuit but this is left up to the individual. It can either be link or direct coupled as shown. Let me know how you make out. I drove the circuit with a DX-40 (single 6146), but it can be driven with such sets as the SBE-34, DX-60, etc.

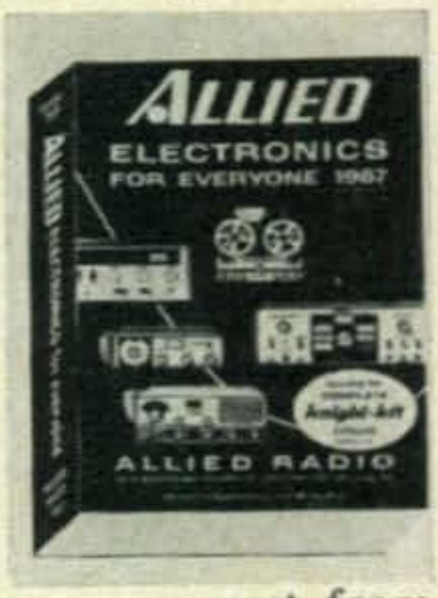
Thirty

Both my XYL (Elfriede) and myself wish our readers and friends all over the *world* a Very Merry Christmas and a Happy and Peaceful New Year. In these troubled times hams are contributing more than ever to peace, international goodwill and understanding and we are certainly glad to say that we are doing our small parts too. So for this year then, thank you for supporting HAM CLINIC and our efforts to help hams everywhere.

73, 72 and 75 Chuck & Elfriede

New Amateur Products

Allied's 1967 Catalog



ALLIED's 1967 catalog is now available. Marking the company's 46th year, the new 514 page catalog presents a wide selection of radio amateur equip. Thousands of products are listed including Allied's Knight-kit line of do-it-yourself kits. The catalog No. 260 is available free on request from Allied Radio Corp., 100 N. Western Ave., Chicago, Ill., 60680 or by circling 59 on page 104.

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

November 26-27	**CQ WW DX C.W.**
December 3-4	New England QSO Party
December 10-11	New Hampshire QSO Party
December 10-12	Zero District QSO Party
December 17-19	Ohio QSO Party
Dec. 21—March 20	Canary Islands Contest
January 7-9	Virginia QSO Party
January 7-9	Arkansas QSO Party
January 8-9	Saskatchewan QSO Party
January 28-29	**CQ WW 160 DX**
January 28-29	Louisiana QSO Party
February 4-5	ARRL DX Phone
February 11-12	QCWA QSO Party
February 12-13	Bermuda Contest
February 18-19	ARRL DX C.W.
February 25-26	YL/OM Phone
February 26-27	Bermuda Contest
March 4-5	ARRL DX Phone
March 11-12	YL/OM C.W.
March 11-12	RSGB BERU
March 18-19	ARRL DX C.W.
April 8-9	**CQ WW SSB DX**

New England QSO Party

Three operating periods. (GMT)
0000 to 0400 Sunday, December 4
1300 to 1600 Sunday, December 4
0000 to 0400 Monday, December 5

Stations in New England are permitted to work everybody, outsiders will work W/Kls only. Only single operator entries considered.

Exchange: QSO number, signal report and QTH. County and state for New England stations, state or country for all others.

Scoring: One point for each completed contact. N.E. stations multiply QSO points by number of different states and countries worked. (VE/VO counts as 1 multiplier, KH6 and KL7 as states. Outside stations multiply QSO points by N.E. counties (67 max.) and again by N.E. states worked. (6 max.)

Frequencies: 3520/3540, 3820/3840, 7020/7040, 7220/7240, 14060/14080, 14260/14280, 21060 / 21080, 21380 / 21400, 28020 / 28040, 28620/28640. Novices, bottom 10 kcs of each novice band.

Awards: Certificates to the top scorer in each U. S. call area and country. 1st and 2nd places in each New England county, and the top N.E. Novice, Tech. (CWA members not eligible.)

Logs: Should show date/time in GMT, complete QSO information, final score tabulation and call, name and address in BLOCK LETTERS.

Your entries go to: Connecticut Wireless Association, c/o Peter Chamalian, W1BGD, 111 Buena Vista Road, West Hartford, Conn. 06107. Mailing deadline for logs is January 11, 1967.

*14 Sherwood Road, Stamford, Conn. 06905.

New Hampshire QSO Party

Three operating periods. (EST)
7:00 P.M. to 11:00 P.M. Saturday, December 10
7:00 A.M. to 11:00 A.M. Sunday, December 11
7:00 A.M. to 11:00 P.M. Sunday, December 11

The 17th New Hampshire QSO Party is being sponsored by the Nashua Mike and Key Club this year. Separate logs must be submitted for c.w. and phone.

Exchange: QSO number, signal report and QTH.

Scoring: N.H. stations; 1 point for each N.H. contact, 2 points for out of stage QSOs. Out of state stations; 2 points for each N.H. contact. Final score for both; total QSO points multiplied by number of N.H. counties worked. (Max. 10)

Frequencies: 1805, 1815, 3530, 3842, 7030, 7220, 14100, 14250, 21100, 21350, 28100, 28800.

Awards: Engraved certificates will be issued to all participants reporting, with special endorsements for the highest scoring stations, both in N.H. and outside, in the phone and c.w. categories. Single operator stations only are eligible for the special endorsement.

Logs must be postmarked no later than January 25th and they go to: Nashua Mike and Key Club, P. O. Box 94, Nashua, N. H.

The WNH certificates will be awarded to stations working all ten counties during the party.

Introducing Mr. and Mrs. James Robertson. You might recall seeing Miss Bobbie's photo in this Column just a year ago. As you see, a change has been made. The happy event took place last August, right after she had typed all your certificates. (And to think, Jim is not even a Novice.)

Requirements for the WNH, a standing award, may be obtained from the Concord Brasspounders, P. O. Box 339, Concord, N. H.

The GSA Award may be also obtained, write Nashua Mike and Key Club for information.

Zero District QSO Party

Two operating periods. (GMT)
0200 to 0500 Saturday, December 10
2300 Dec. 10 to 0300 Monday, Dec. 12

All bands and modes may be used. A station may be worked once per band and mode. Stations in the 10th District may contact Ø stations as well as outside stations. Outsiders of course will work Ø stations only.

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

Scoring: One point for each QSO. Out of district stations will use states (max. 8) plus number of different counties worked, (max. 682) for their multiplier. (USA-CA in one week-end anyone?) Tenth district stations will use states, provinces, counties and Ø district counties as their multiplier.

Frequencies: 1815, 3575, 3950, 7075, 7230, 14075, 14300, 21075, 21290, 28600 and all u.h.f, v.h.f. bands. Novices, 3720, 7165, 21110. (Avoid traffic nets.)

Awards: 1st and 2nd place certificates in each state, province and foreign country. And to the top scorer in each Ø district county.

Include a s.a.s.e. with your log for a copy of the results. Mailing deadline is January 10, 1967 and they go to: Roosevelt High School ARC, c/o Gliff Davidson, 5200 Shriver Ave., Des Moines, Iowa 50312.

Ohio QSO Party

Starts: 2100 GMT Saturday, December 17
Ends: 0300 GMT Monday, December 19

This is the second annual party sponsored by the Upper Arlington RC. The same station may be worked both on phone and c.w. on each band. Ohio may contact in state as well as out-of-state stations. All others work only Ohio stations.

Exchange: QSO number, RS/RST and QTH. County for Ohio stations, ARRL section or country for all others.

Scoring: Ohio stations; 1 point for each Ohio contact, 2 points for out-of-state QSOs. Multiplier ARRL sections (including Ohio) and countries. Out-or-state; 1 point for each Ohio QSO, multiplied by number of Ohio counties worked. (Max. 88)

Frequencies: C.W.—3560, 7060, 14060, 21060. Phone—3940, 7240, 14290, 21390. Novices—3725, 7175, 21125.

Awards: In Ohio; 1st, 2nd and 3rd place stations. Out-of-state; To the top 3 overall scores, and 1st place in each country and ARRL section. (Multi-operator stations compete separately.)

Logs must be scored and include all pertinent information including the usual signed declaration.

Mailing deadline is January 20, 1967 and

they go to: Craig Nohl, WA8GYT, 2614 Brandon Road, Upper Arlington, Ohio 43221. (Include a s.a.s.e. if you wish a copy of the results.)

Canary Islands Contest

Starts: 0000 GMT on December 21, 1966
Ends: 2400 GMT on March 20, 1967

This activity is more of an awards opportunity rather than a contest. However there will be a drawing to select winners from among those who have earned a certificate. The 1st prize could possibly be a paid trip to the Canary Islands.

A certificate, "Tenerife Eterna Primavera (Eternal Spring) Award" will be given to those who submit confirmation of two way QSOs, any band, any mode, with EA8 stations. Your QSL *must* include the exchange of the previous day's min./max. local temperature. (Reason being quite obvious.)

Confirmations needed vary according to your location: 25 QSOs if located in Spain, Portugal or North Africa, 10 in the rest of Europe and 5 for rest of world, including USA.

Submit your QSLs to: Tenerife Eterna Primavera Award, P. O. Box 215, Tenerife, Canary Islands.

Virginia QSO Party

Starts: 1800 GMT Saturday, January 7
Ends: 0200 GMT Monday, January 9

A fine opportunity to earn credits for the Old Dominion County and also the USA-CA awards.

There is no power or time limit, and the same station may be worked once per band. Phone and c.w. are considered separate contests, therefore submit separate logs.

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

Scoring: One point per contact. Virginia will use states, provinces, countries and other Virginia counties for their multiplier. Out-of-state stations, number of Virginia counties worked. (Max. 98)

Frequencies: C.W. — 3560, 7060, 14060, 21060, 28060. Phone — 3830/3930, 7205/7235, 14240/14340, 21310/21400.

Awards: Certificates to the top scorers in each state, province and country. The top five Virginia stations will also be rewarded.

Mailing deadline for your logs is Feb. 15, 1967 and they go to: Roanoke Valley ARC, Box 2002, Roanoke, Virginia 24018

CQ WW 160 DX

Starts: 0000 GMT Saturday, January 28
7 P.M. EST Friday, January 27
Ends: 12:00 GMT Sunday, January 29
7 A.M. EST Sunday, January 29

We are keeping our fingers crossed on this one. According to Hoyle (or Jacobs) DX should be tapering off but maybe we will cross 'em up and come up with a good week-end. Even without the DX there will be plenty of activity state side.

One small change this year, the starting time has been advanced 2 hours. We feel there is more activity in the early evening hours at the start of the contest then the two hours at the end on Sunday morning. Length of contest still 36 hours.

Rules same as previous years.

1. This is a c.w. contest *only*. No c.w. to phone or cross band contacts allowed.

2. For W/VE/VO stations: Contacts with other W/VE/VO stations, 2 points per QSO. Contacts with all other countries, 10 points.

3. For all other countries: 2 points per QSO with stations in the same country, 5 points with stations in other countries. Except contacts with W/VE/VO stations, which will count 10 points.

4. For all stations: A multiplier of one (1) for each state, Canadian province or foreign country worked.

5. Final score: Total QSO points multiplied by the total multipler.

6. Exchange: RST report plus a three figure progressive contact number starting with 001 for the first contact, followed by your state or province. (Its not necessary for DX stations to send their country, that's quite obvious.)

7. Disqualifications: Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, or the rules of this contest, or unsportsmanship conduct, or taking credit for duplicate contacts in excess of 3 percent of the total number of contacts made, will be deemed sufficient cause for disqualification.

8. Awards: Certificates to the top station in each State, Canadian province and foreign country, 2nd and 3rd awards if participation warrants.

Hawaii and Alaska will be considered "foreign countries" for QSO and multiplier credit. The District of Columbia counts same as Maryland. And don't forget, VE1 is divided into three provinces, Nova Scotia, New Brunswick and Prince Edward Is.

Log sheets and United States Operating Regulations for 160 may be obtained from *CQ* upon request. A large s.a.s.e. please.

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

Editor's Notes

By the time you will be reading this, both sections of the 1966 World Wide DX Contest will be over and once again the Committee will be faced with the mountainous task of log checking.

Again we admonish all contestants that it is the duty of the contestants to score his log and check for duplicate contacts and other errors.

A summary sheet with the scoring and other pertinent information is also a *must*. We also request the usual signed declaration and your name and address in BLOCK LETTERS. Don't expect us to decipher your hieroglyphics.

The Christmas holiday season will soon be here. May yours be a very happy one, and may the New Year bring loads of DX.

73 for now, Frank, W1WY

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

KENNETH Wayne, K4VOF is highlighted in our "Story of The Month" which brings to mind the nice rag chew I had last night with a famous W5 in Corpus Christi, Texas who is the owner of a TV station. Yes, we do have people from *all walks* of life who share our wonderful hobby. In fact we nearly had a fellow amateur in the "White House"—wouldn't that be a big boost to see a USA-CA Award next to the photograph of George Washington on your next tour of Washington, D.C. and the "White House." When Owen, W5LFL lands on the Moon during our Apollo landings, we will have to issue some new certificate to him.

Kenneth Wayne, K4VOF
Winner of #9 USA-CA-3000 Award

Ken has been married for 34 years and will be 66 in January. Before moving to Florida in 1944, he owned and operated a theatrical agency in Kansas City, Missouri for 10 years. Prior to that, he was an actor on the dramatic stage, appearing in stock companies in theatres throughout the country. He worked for Pan American World Airways in Miami from 1944 until January 1963 when it became necessary for him to retire due to ill health.

On January 27, 1960, his 59th birthday, Ken was introduced to ham radio by Dick Servais, K4YLG, a fellow worker at PAA in Miami. During a discussion on Hi-Fi, Dick suggested that Ken try ham radio as a hobby. An explanation of ham radio sure sounded interesting to Ken, so after much help from Dick, Ken was able to get his Novice ticket on April 1, 1960, his Technician's ticket on June 1st and his General ticket on November 25, 1960. No, it was not easy as Ken knew nothing about electronics, but he realized that he had found an interesting hobby and he was sure it was well worth the terrific struggle for that General ticket.

*103 Whitman St., Rochelle Park, N.J. 07662.

LATE FLASH
Otts Beyer, K8CIR
Winner of #3 USA-CA-3079
All Counties Special Honor Plaque
(The story on K8CIR was in CQ Aug. '66)

With this new found hobby, his former hobbies of boating and fishing took a back seat. During 1961 and 1962 much time was spent seeking awards and running over-seas phone patches for military personnel. Ken has over 100 awards and can qualify for about another 50 for which he has not yet applied.

Since his retirement in January 1963, illness has kept Ken pretty well confined to his shack. In addition to county hunting, much time has been spent building kits and finding out what makes them tick. The present equipment includes a Collins KWM-2, 312B-5 console and 30L-1 linear. A monitor scope Heathkit HO-10 and a Knight compressor/preamp. The antenna is a Mosley TA-33 with the 40 meter modification on a 40 foot E-Z Way tower.

Ken became interested in county hunting in November 1963. In March 1964 he was issued USA-CA-500 Award #351 followed by #34 USA-CA-1000; #12 USA-CA-1500; #6 USA-CA-2000; #4 USA-CA-2500 and on September 6, 1966 #9 USA-CA-3000. A spell of sickness and a trip to the hospital slowed him up on the USA-CA-3000 but he did make it and Ken is very happy and proud of #9.

All counties in 36 states have been completed, including Texas and all east of the Mississippi River, except Wisconsin (4), Pennsylvania (3), and Michigan (1). Ken has been trying for a year to knock off these three states but just don't seem to find the needed ones. But as Ken explains, sometimes it becomes a bit discouraging to try so long for certain counties, but stick to it and the so-called "hard ones" will eventually

"DRAMA-TIC" shack of K4VOF. Foto of Ken page 82 CQ Jan. 66

COUNTY HUNTER NETS

1200-1800 GMT-7223 s.s.b.
1800-2400 GMT-14295 s.s.b.
0200- GMT-3947 s.s.b.

C.W.

Mon-Tues-Friday 1700-2000 GMT 7035
Tuesday and Thursday 2300- GMT 7035

QRA Award, La Ronde Award, News Award, Triple Crown Award.

pop up, and sometimes from the least expected sources. This is what makes county hunting full of FUN, EXCITEMENT, SURPRISES AND ENJOYMENT. And, you meet so many nice people participating in the USA-CA program. Ken wants to thank all the good folk on the Nets, and especially the mobile operators who have helped him get the USA-CA-3000 Award. Without their whole hearted cooperation this would not have been possible.

Remember, the next time you hear Ken, I'm sure he would love to rag chew about the theatre and the drama.

Awards *NOT* Available

Jack, W8AJW, writes: "The pictures and information about new and available awards are timely, however, there is a definite need for you to devote a few lines to awards (when this information is available) that have been discontinued.

Two for that list are: The Guernsey County (Ohio) award described in *CQ* Nov. '65 and the Idaho Counties award described in *CQ* Jan. '66.

Information of this nature saves award chasers time, effort, money and disappointment." *(Ed.—I would like to light a fire under some of you, so that you would send such information to me—this helps me to better serve my readers and your fellow county and award hunters.).*

Awards

Worked All Nevada Counties Award: A *new* award sponsored by the Nevada Amateur Radio Association. All counties (17) must be confirmed, send QSLs and $1.00 to Nevada Amateur Radio Association, County Award, P. O. Box 2534, Reno, Nevada. Your cards will be returned and a certificate sent.

Worked All Nevada Counties Award.

Here are 4 DX Awards that I am listing although this is not a DX Column, but they are most interesting in design and requirements.

The Korakuen Radio Club (Authorized by JARL) offers these beautiful and unusual awards:

1. QRA Award: Applicant must spell his *full* name (with or without middle initial) using the last letter of calls of Asian stations, three of which must be JA stations.

2. La Ronde Award (LRA): Calls of TEN Asian stations, three of which must be JA stations, are used to form a circle. The last letter of each call has to be the same as the first letter of the next call. Example: JA1ELL - 9M1LB - KR6BQ - UAØQS - JA1SCQ - VU2QC - JA7CEK - VU2KW - OD5WK - HL9KE - (JA1ELL).

3. News Award: Work seven each of JA1, JA5, JA6 and JA8 for a total of 28 contacts.

4. Triple Crown Award (TCA): Issued to anyone who has completed the requirements for the first three awards.

Each award has no band, mode nor date restrictions and is also available to s.w.ls. Each award costs 8 IRCs except for #4 TCA which costs 10 IRCs. Send GCR (QSLS not to be sent) to JA1ELL, Seiji Okada, 4-25-12 Hongo Bunkyoku, Tokyo, Japan.

Notes

As there were no significant changes in the Top Twenty-Five list nor a significant number of awards issued since last month, both lists were left out.

Regarding the new USA-CA Award mentioned on page 86 of July '66 *CQ*, I hope the error of one word *CARD* instead of *AWARD* did not confuse the story of a new USA-CA Award being issued for working *fixed* stations in U.S. counties. This to give the long time county hunters something new to shoot for, and this same idea can work in reverse for those who have awards for working *fixed* stations, I will be pleased to issue a new award for working all mobiles in U.S. counties.

In the October '66 story on Charles, WØJWD, I failed to mention that there was also a foto of Charles on page 84 of April '66 *CQ*.

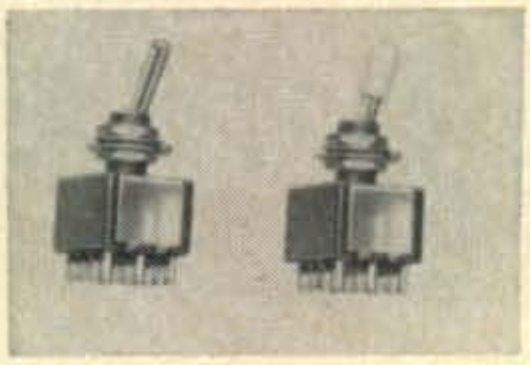
Most of you will be reading this before Christmas and some after Christmas, may I wish each and everyone of you a most wonderful Christmas and hope that Santa Claus helps fulfill all your fond wishes. How was your month?

73, Ed., W2GT.

New Amateur Product

C & K Components, Inc.

C & K COMPONENTS, Inc., announces the availability of its new model 7401 4p.d.t. subminiature toggle switches. Bat-handle operating levers are standard but plastic caps in ten color choices are available. The contacts are rated at 115 v.a.c. at 5 amps. For specific information write to Mr. Marshall M. Kincaid, C & K Components, Inc., 103 Morse Street, Watertown, Mass., 02172, or circle 56 on page 104.



SURPLUS sidelights

BY GORDON ELIOT WHITE*

For my third column on the Navy monster receivers of World War II I want to discuss the RDZ, a u.h.f. receiver which has been available on the surplus market for several years, and has gained a reputation chiefly as a hundred and fifty pounds of excess ballast. The RDZ, and its slightly updated version RDZ-1, are crystal-controlled receivers covering the 200-400 mc military aircraft frequencies. Most units operate on 115 volts, 60 cycle a.c. power, and thus can be plugged into standard power mains. They are heavy, but are quite stable, characteristics which seem to go together.

As the photo shows, these are relatively modern-looking sets by Navy standards, with gray, rounded-corners, spray-proof cabinets. They are not usually rack-mounted, being designed for table-top use.

Although the nominal frequency range is 200-400 mc, there is a 10 mc gap between 222 and 232 mc which is blocked by feed-through of a harmonic of the crystal oscillator which falls into the 15 mc i.f. passband. This seems like a hell of a way to build a receiver, but there it is.

But despite its drawbacks, the RDZ is a useful receiver for u.h.f., particularly if it can be made tuneable, and if it can be made to operate in the 220 mc amateur band. The conversion information below, while not the last word on an RDZ modification, will solve the first part of the problem, and can be used to solve the second.

Here I want to repeat my policy on conversion data: I feel that most people will modify equipment to suit their own needs rather than follow a precise wire-by-wire description of changes in surplus gear that I might work out, therefore I concentrate on giving information on the set and the outline of modifications that I have tried.

On the RDZ it is quite simple to convert the first crystal oscillator to a tuneable configuration: you add a little feedback from plate to grid by soldering approximately a 100 mmf capacitor between pin 4 of V_{101}, a 6AC7, and the plate circuit, in this case the center tap on inductor L_{101}, as shown in fig. 1.

The receiver will need to be peaked up, but will now take off on its own, with or without a crystal. You can use a crystal to simplify picking a spot frequency, or leave all the crystals out and tune the set manually. You might find the oscillator quitting on the top end of the band, but you can overcome this by varying the amount of feedback or by experimenting with the point of applying the feedback capacitor on L_{101}.

The blocking of the i.f. in the 222-232 mc area is caused by feed-through of the third harmonic of the oscillator in its 4.94-5.15 mc fundamental area. The harmonic, near 15 mc, overloads the 15.1 mc i.f. When using a tuneable oscillator you can avoid third harmonic trouble by eliminating V_{101} and converting the multiplier tube V_{102}, to act as an oscillator. It will tune roughly from 23 to 48 mc, with all frequencies falling *above* the i.f., and thus out of its range.

The succeeding harmonic generators will operate just as they did in the original circuit, with only the smallest bit of peaking required.

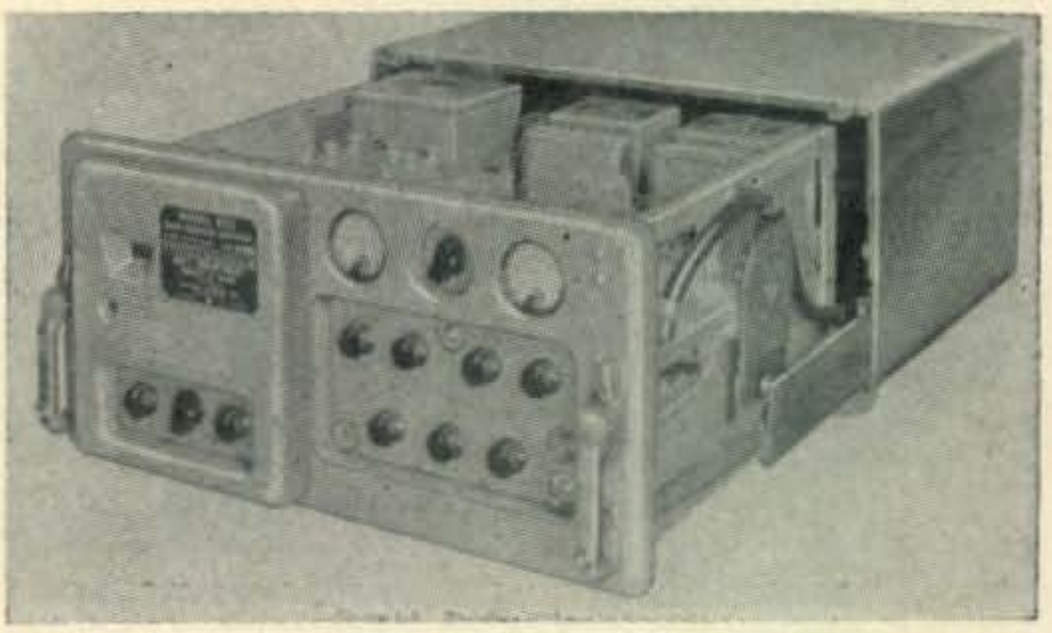
When you get through you will have a large, heavy, fairly stable u.h.f. receiver with a sensitivity of about 5 microvolts. You lose a microvolt of sensitivity in the input network ahead of V_{107}, which is used partly to reduce oscillator radiation which would be undesireable in radio-silence conditions. It also improves image rejection and helps eliminate other spurious responses, but might be modified somewhat with benefit to the sensitivity figure. Try attaching the antenna to L_{107} rather than L_{108}, or bypassing the input network entirely.

After you have converted the oscillator section the only necessity is a tuning knob. You can remove the cover on the automatic tuning selector and tune the set with the knurled tuning knob in front of and below the frequency dial, but I have found it quite easy to drill through the cast aluminum cover and attach an external knob through a shaft coupling, thus improving the looks of the final product.

I mounted my RDZ to a workbench by drilling through the cabinet and bolting it under the working surface where it is pretty much out of the way yet is handy for quick operation. It is useful also to drill cooling holes in the case to extend tube life.

I find that it is possible to improve sensitivity of the i.f. strip by setting the i.f. coupling control midway between broad and narrow, setting it by ear on a received signal.

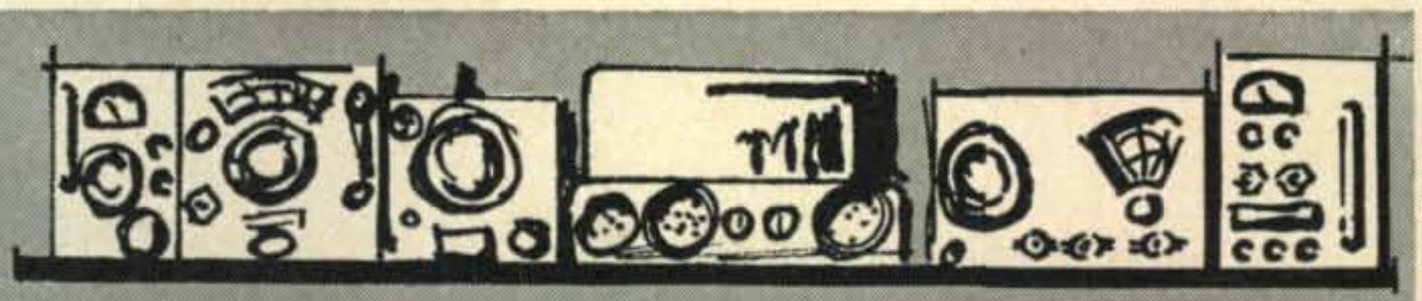
The RDZ uses 21 tubes in all, and consumes 175 watts of 117 volt a.c. power without the



The RDZ receiver, shown here partially withdrawn from its spray-proof cabinet in a u.h.f. unit covering 200-400 mc. The tuning section which can be modified for tuneable operation is behind the aluminum casting which protrudes from the left side of the set. Circuit alterations must be made in the compartment which is reached from access panels beneath the set. A tuning knob can be added to the front panel for tuneable operation.

*5716 N. King's Highway, Alexandria, Virginia 22303.

SURPLUS CORNER



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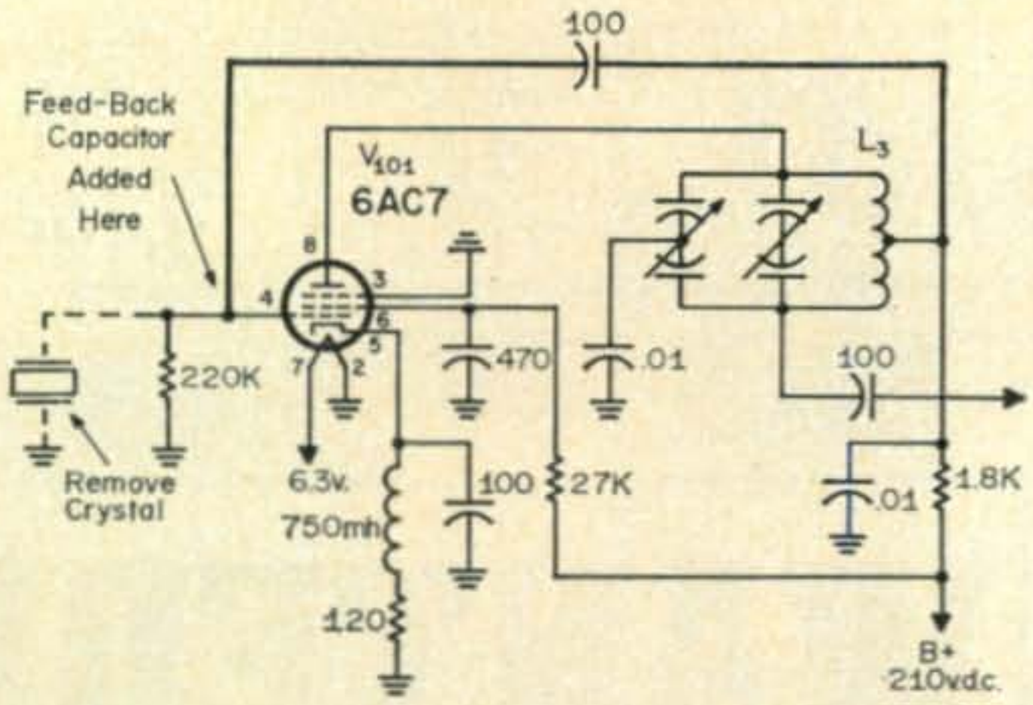

Fig. 1—The RDZ oscillator circuit, showing the feedback capacitor which can be added to make the receiver tune without the use of crystals.

automatic tuning device.

One connection must be made when using the set without its remote control unit: the squelch control line which is "E" on terminal board E_{201} must be grounded to the chassis. This is found on the i.f./a.f. unit at the right side of the set when it is withdrawn from the case.

The RDZ sets were made in 1944-46 by National and the Admiral Corporation. The NavShips manual is #900,617. An updated version, equipped for tuneable operation as a standard item was known as the R-289/URR-9. This set is virtually identical to the RDZ except for the tuneable feature. The manual on the URR-9 is NavShips 91201.

I have had so many requests for data on the AS-989 log periodic antenna described in the September column that we are running a diagram of it here. Fig. 2 shows a side view of one of the sections. As I indicated in the earlier column this antenna is made by joining two of these "beams" together at the small or forward end, which is a 180 ohm feed point. The beams are arranged in a "V" configuration which in this case puts the back sides of the beams about 75 inches apart. To lower the frequency coverage you can add elements on the long end of each beam, following the logarithmic progression, however since the next element would need to be 36 inches away, the next after that 58 inches and so on, you quickly get into cumbersome dimensions.

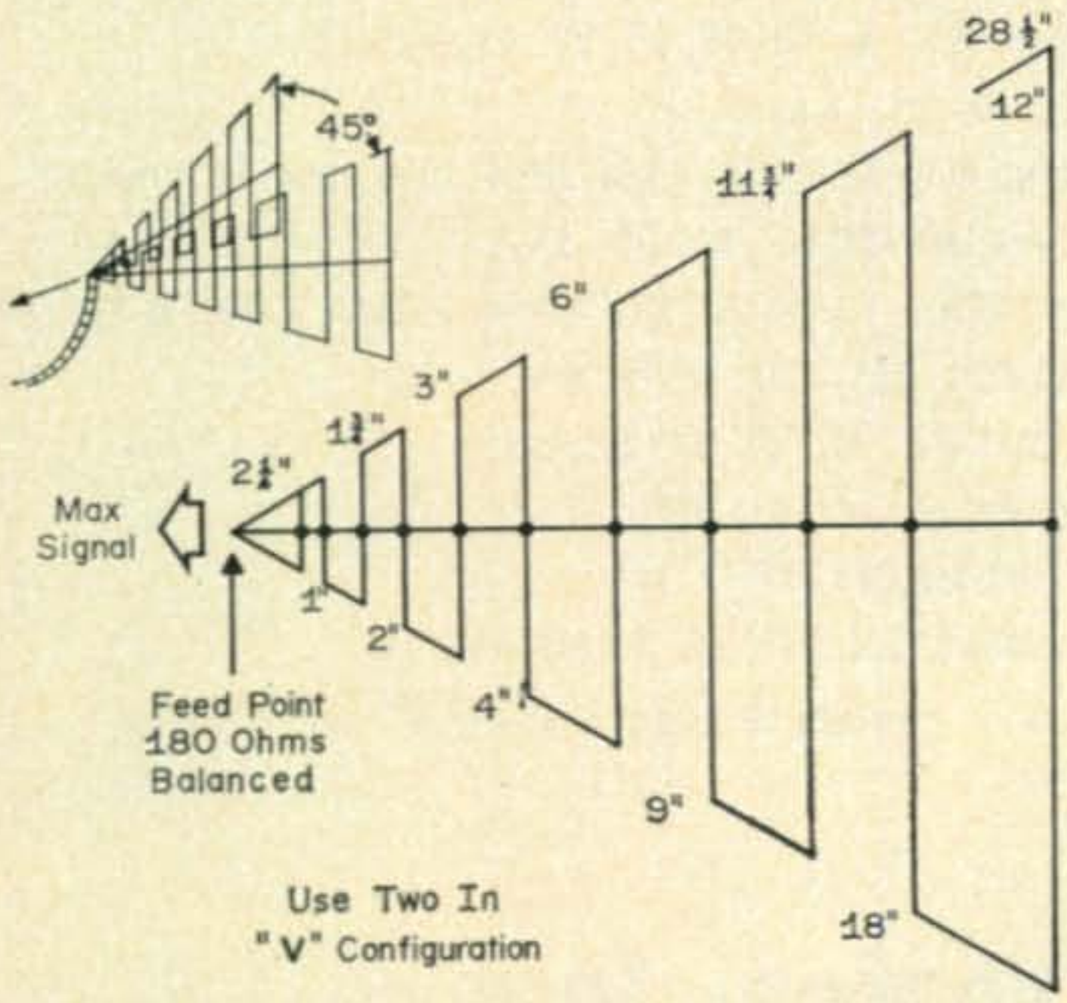

Fig. 2—The AS-989 antenna is made up of two beams made as per the diagram above, joined at the small end, which is a 180 ohm balanced feed point, and also the direction of maximum signal. This antenna can be made to cover a range of 50 to 1,200 mc with a v.s.w.r. below 1.7:1.

In the field of manuals, two or three other current Navy books might be of interest: NavShips 94200.4 is a five-volume index of test equipment. NavShips 93434(A) is the Navy index of teletype and facsimile equipment. NavShips 94201 is a list of experimental and inactive electronic gear. (The reason I list so many Navy books is simply that the Navy makes more of its manuals available to the amateur.)

CQ at this time is preparing a second volume of *Surplus Schematics*, to update the material that was published in the 1959 handbook edited by Ken Grayson, W2HDM. I would be happy to hear from anyone who has suggestions as to equipment that ought to be included in this new version.

Finally, next month we will deal in depth with the facsimile machines that are appearing in the surplus market. I have had a large number of inquiries about specific equipment, following my September article with Bill Tyrell on Fax for amateurs, and I will spell out what I can in the January *CQ*. This mode seems to have caught the fancy of hundreds of amateurs who are copying satellite, weather map and press photo transmissions. Who knows, one of these days some of the gang may actually get on the air with FAX transmissions.

New Amateur Products

E. F. Johnson

Two new series of tapered acrylic lens pilot light assemblies are now being offered by E. F. Johnson. The enclosed version (147-1182), shown, and the open horizontal type (147-426). Further information is available from E. F. Johnson Co., Waseca, Minn., 56093, or circle 64 on page 104.

Electronized Chemicals Corp.

A NEW heat-shrinkable rounded end cap for insulating wire terminations is available from E.E.C. It fits over the wire and will shrink when temperatures over 275°F are applied (a match). They come in several sizes to accommodate many jobs. For more details write to Electronized Chemicals Corp., Box 57, Burlington, Mass., or circle 65 on page 104.

Letters [*from page 6*]

High Cost of QSLing

Editor, *CQ:*

As a recent addition to the growing ham fraternity, and an avid reader of your fine magazine, please allow me to step upon the proverbial soap box for just a moment and vent my feelings about the QSLing practices of some DX stations.

Many "rare" DX stations use the services of a QSL manager, a great percentage of these managers residing in the United States, and a smaller percentag residing in various other countries. When a ham sends his QSL card to a DX station via his QSL manager, he is almost always certain to receive the DX QSL promptly, if he has the courtesy to fill out the QSL card in GMT and enclose a s.a.s.e. or IRC's as the situation may warrant.

I am concerned not with these DX stations, but rather the much larger percentage who do their own QSLing. I find myself in a situation, probably similar to that of many of your readers, where my DX QSL returns are very low. I QSL via airmail to these DX stations, with my card properly filled out in GMT. I usually include s.a.s.e., and always enclose the proper number of IRCs for an airmail return. For every 100 QSLs I send out to DX stations not using a QSL manager, I can expect a return of from 15 to 20 QSL cards.

Now, let me illustrate in terms of money, how much it could cost a ham in my situation to achieve a goal of confirming 100 countries, using my experience as an example. (I am working for my DXCC and WTW awards.) Let me use some "average" figures which will, of course, vary with the individual. I will use a figure of 50¢ for each QSL I send to a DX station, which will include the airmail postage to the DX country, the IRCs enclosed, and the small cost of the QSL and envelopes. If I work 100 countries, and each DX station confirms our QSO with his QSL card (has this ever happened?), then I am a very fortunate individual, for I will only have spent approximately $50.00 to acquire the QSLs needed for my award. In my case, however, only 20% of the DX stations I have worked are sending their QSLs to me. This means that I will have to work five times as many hams to collect the necessary QSLs. Ok, so I have to work 500 DX stations instead of 100. Being an individual who really enjoys hamming, I say "So what, that just means I'll have five times as much fun trying to get my award." The big blow comes when you multiply this new figure of 500 by the average cost per QSL, *i.e.* 50¢, and then come up with a new figure of $250.00, which could go much higher.

Now I must ask the question, "If these DX stations are receiving my QSL's and my IRC's, and are not sending their card to me in return, what are they doing with my IRC's?" Perhaps they are working for a WAS-IRC award or maybe they collect them like some of us collect stamps!

In conclusion, a word to other hams who may be having similar DX-QSL miseries. There are several methods of eliminating the high cost of QSLing available to we hams. We can QSL via the bureau, use the services of an outgoing QSL service, QSL direct without enclosing IRC's and hope for a return via the bureau, or enclose IRC's, but not the kind you pay 15¢ for at the local post office. There are some individuals who sell "used" IRC's at a cost of 10¢ each, which is a savings of 5¢ per IRC. These IRC's are valid, and have not been canceled. DX hams send these IRC's to the states to pay for products or periodicals, and they are accepted at the rate of 10¢ per IRC. These "used" IRC's are then made available to us at the reduced rate.

I hope that other hams, U.S. and DX alike, will provide more information about their experiences through your readers column, and perhaps shed more light on DX-QSL'ing problems and procedures so that we may all benefit by it.

George Fisher, WAØLHR
Minnetonka, Minnesota

PLEASE include your ZIP code number on all correspondence.

Announcements [*from page 8*]

Stolen Equipment

On Aug. 24, 1966 a Lafayette HA-650 6 meter walkie-talkie was stolen from the car of Reid S. Edles, WA2TBT, in Queens, N.Y. Anyone having information about this please contact Reid S. Edles, 31-21 54th Street, Woodside, N.Y., 11377.

A prototype linear amplifier bearing the trade mark BTI, model LK-2000 was stolen from a parked trailer at the Western Single Sideband Convention at the Newporter Inn, Newport, California. It has a serial number of 1743 on it. A reward of $200.00 has been offered for information leading to its return. Contact Brad Thompson, P.O. Box CCCC, Indio, California, 92201.

Correction

In the article Medical Aspects of Radiation which appeared in the October 1966 issue of *CQ* on page 62, one megacycle should be considered 10,000 centimeters not 10,000 meters as stated.

The FD-30 [*from page 20*]

should be at least 6 henries. The female plug on the end of the power cable automatically switches the filament and relay wiring for 6 volt a.c. operation.

Figure 2 (B) shows the plug wiring used for a mobile power supply. The 300 volts must also be developed from the 12 v.d.c. source. The most efficient method is a transistorized d.c. to d.c. converter. This type of supply has been used with the FD-30 for several years with no problems. A Triad #TY79 transformer (rated for 200 ma at 300 volts) is suitable and Triad includes the circuit of a d.c. to d.c. converter. If you build this unit make sure that the power transistors are heat sinked properly.

Conclusion

At the time of this writing there are 3 of these transmitters in the Chicago area and they have been used for mobile, Field day and fixed station use with no problems.

The ease of duplication makes it a project that can be built by the inexperienced amateur yet its versatility is such that it will not be obsolete. The writer wishes to thank W9DZM without whose help this article couldn't have been written. ■

A companion receiver for the FD-30 is in the works by the author and should be ready for publication very shortly. ed.

Butterworth Filters [*from page 26*]

elemental values are inverted and then scaled to 1 c.p.s. All necessary transformations and characteristics are given in any and all of the references. ■

Bibliography

[1]Balbanian, Norman, *Network Synthesis,* Prentice Hall, Englewood Cliffs, N.J., 1958, chapter 9.

[2]Weinberg, Louis, *Network Analysis and Synthesis,* McGraw Hill, New York, N.Y., 1962. Chapters 11 and 13.

[3]Weinberg, Louis, *Network Design by use of Modern Synthesis Techniques,* Hughes Research Laboratories Technical Memorandum #427, Culver City, California, April 1956, Chapters 1, 2, and 5.

DX [*from page 74*]

ZL4 Chatham Island: ZL4CH has been very active on Friday and Saturday evenings (US time). Has no set operating frequency and can be found all over the phone band. *(Tnx NEDXA).*

5R8 Malag Sy Republic: Chet, 5R8AS, is a new station active from here. He was on 15 meter SSB with a big signal and asked QSLs go via W6ZPX. *(Tnx LIDXA).*

EA8 Contest: This contest starts 0000 GMT on December 21, 1966 and ends on March 20, 1966. A certificate will be awarded to those who submit confirmation of two-way QSOs, any band, any mode that include the exchange of previous day min/max local temperature. The quantity of confirmations depends upon location, as follows: Spain, Portugal, North Africa—250 QSO's; Europe—10 QSO's; Rest of World—5 QSO's. Submit to: Tenerife Eterna Primavera Award, POB 215, Tenerife, Canary Islands. It is planned that at the end of the contest period, the sponsoring Canary Island civic groups will hold a drawing to select the winners from those who have earned certificates. First prize will be a trip to the Canary Islands.

QTHs and QSL Managers

For those of you who have not seen it, the W6GVS *QSL Managers and QTH Directory* is a welcome addition to any operating position. It is most complete and is brought up to date every three months. The cost is $3.00 per year in the U. S. and Canada, and $4.00 elsewhere. Send directly to W6GVS, Box 54222, Terminal Annex, Los Angeles, Calif. 90054.

CT2JJ	via W6LOA.
DU1BA	Box 1344, Manila, Philippines.
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HBØSJ	via W2CTN.
KB6CY	via W2CTN.
KB6CZ	via K4MQG.
KC4USB	via K1TWK.
KG6IF	via W6ANB.
KH6CH/KW6	Box 365, Wake Island.
KW6EM	via K6JAJ.
MP4DAN	via DJ4AB.
PA6AA	VERON QSL Bureau, Box 400, Rotterdam, Netherlands.
PYØAB	via PY1CK.
SVØWL	via W3CJK.
TA2AA	via W2RIF.
TA2AC	via K4AMC.
TA2FM	via DJ2PJ.
TF2WJU	via W4VBB.
TGØAA	Box 684, Guatemala City, Guatemala.
VK9TB	via WA8DXA.
VP1DX	via W4HGW.
VP2AZ	via WØNGF.
VP2GTL	via W5EZE.
VP2LS	via K6HZD.
VP2SY	via K1IMP.
VP5RB	via W1EQ.
ex-VQ1-GDW	via CX9AAN.
VQ7VY	via G3SUQ.
VS5JC	via W5VA.
W6BGT/KJ6	Box 444, APO San Francisco, Calif. 96305.
W6FHM/DU1	via W2GHK.
XW8AZ	Ben Stuart, c/o USAID, APO, San Francisco, Calif. 96352.
YA1DAN	Ed Daniels, c/o American Embassy, Kabul, Afghanistan.
ZD5M	via W2CTN.
ZF1EP	via W4PJG.
ZL4CH	via ZL2GX.
ZS8L	via W4BRE.
4S7DA	via W5VA.
5R8AL	Ralph Bolstad, M. D., c/o Lutheran Hosp. Ft. Dauphin, Malagasy Rep.
6O1PF	via WØOMM.
9H1AU	via W8QGP.
9M8II	via 9V1NT.
9X5AV	Box 63, Cyangugu, Rwanda.
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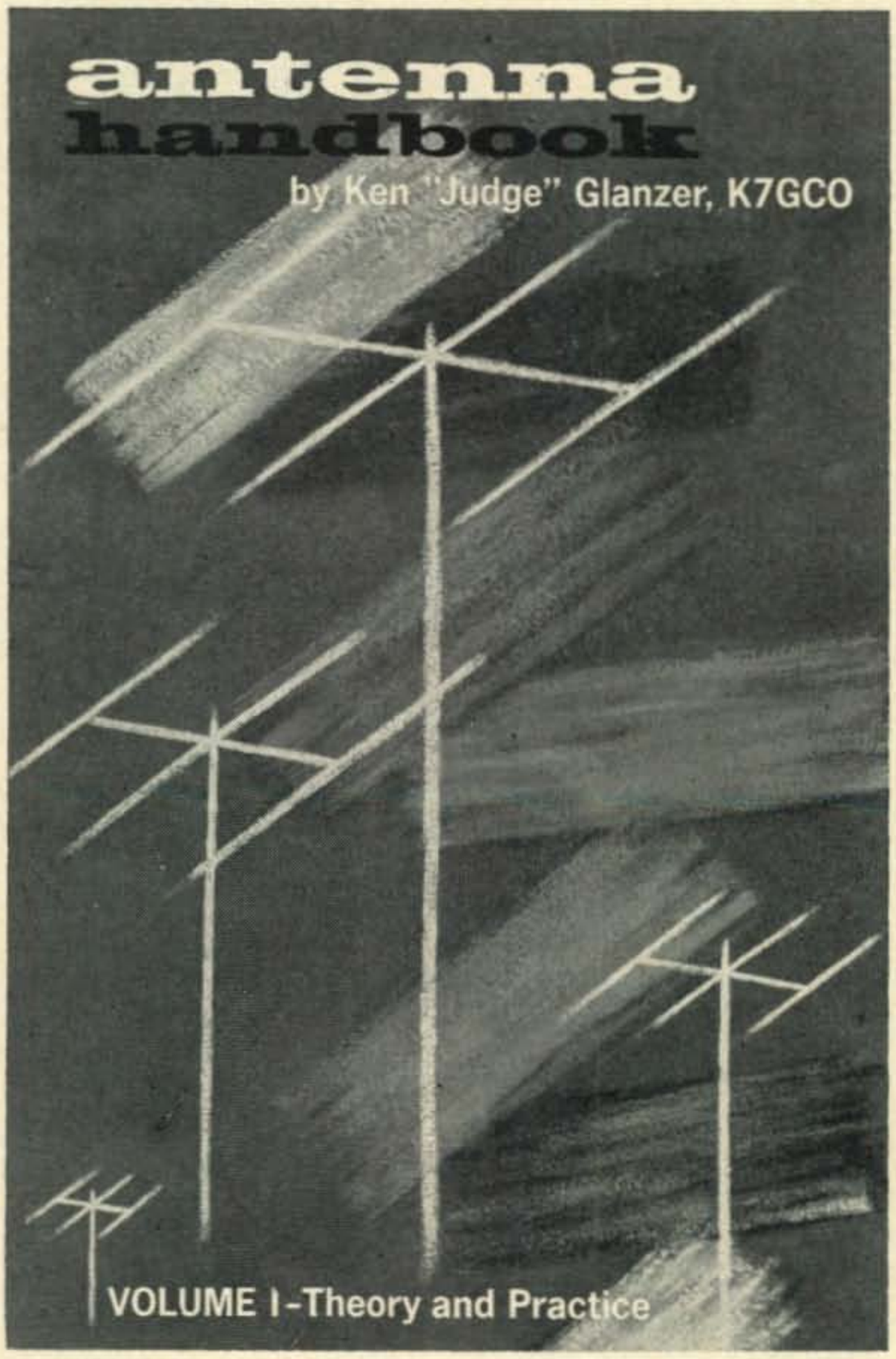

matching, devices, what happens to all that reflected power, which end of feed is more important to match, how to use open wire feed on beams, gamma matches, T-matches, feeding T-match with dual coax, transforming balanced 100 ohm coax lines to 200 or 50 ohms, capacitive match for balanced transmission lines, inductive (hair-pin) match, quarter wave and short bazookas for balanced feed, broad band baluns and effect on feedpoint current, effect of surrounding objects and power lines on feedpoint current, folded dipole matching for beams, feeding stacked beams individually or together.

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OSCAR News [*from page 58*]

ing, ask for the APT alert messages which local offices receive on the teleprinter network at 1900 GMT daily from the National Environmental Satellite Center in Washington, D.C. The TBUS-1 messages received on the net contain orbital information for ESSA weather satellites, while TBUS-2 messages contain data for the NIMBUS satellites. Orbital information is given in the form of predicted equator crossings in longitude and time. From this it should be relatively simple to predict overhead passes at any location. Additional information concerning weather satellites and APT transmissions can be obtained from Mr. David Holmes, National Environmental Satellite Center, Environmental Science Service Administration (ESSA), Washington, D.C., 20233.

As of early November, the following are orbital and frequency data for the ESSA-2 and NIMBUS-2 weather satellites.

	Period (Mins.)	*Inclination* (Degs.)	*Freq.* (Mc.)
ESSA-2	113.5	101	136.770 Tracking & Telemetry, On Command 137.500 APT
NIMBUS-2	108.1	100.3	136.5 Continuous Beacon 136.95 Tracking & Telemetry, On Command 136.95 APT

■

Davco Review [*from page 67*]

Image and I.F. Rejection

Images are rated at down 60 db below 22 mc and 35 db in the 22-54 mc range. Primary image rejection was found to be 50 db at the center of the 3.5 and 21 mc bands, 40 db on 50 mc and 45 db on the other bands. I.f. rejection at 2900 and 2500 kc was 45 and 55 db respectively on 3.5 mc, 55 db at both points with the other bands.

Selectivity

At the 2.1 kc selectivity position the bandwidth measured 1.8 kc at the 6 db points, 2.4 kc at 20 db and 2.9 kc at 40 db. The narrower bandwidth and steeper skirts than usual are evidently due to the super-imposed selectivity added by the ceramic filter resonators in the i.f. strip. Although the b.f.o. frequency is well-down on the skirt, resulting in unwanted-sideband suppression of 60 db at 500 c.p.s., the a.f. response with s.s.b. is pleasant sounding without the harshness one might expect.

The 0.5 kc step used for c.w. peaked at 1300 c.p.s. with a very steep skirt on the zero-beat side when the USB position is used. Bandwidth was 200 c.p.s. at 6 db, 1 kc at 20 db and 1.5 kc at 40 db. No loss of level was found at the peak frequency.

The 5 kc position had a 4.8 kc width at 6 db, 12 kc at 20 db. The resulting response produced good a.f. quality with a.m.

The rejection-notch depth was at least 50 db with a very sharp null, but with some loss of a.f. level in the remaining useful passband as often found.

Spurious Responses

Internal in-band tweets are rated at 1 μv equivalent. Those that were found were within the rating, except a 2 μv signal just out of the 75-meter phone band at 4001 kc. Also, 2 μv tweets between .21-.23 mc (or .71-.73 mc) on the scale with all bands, apparently caused by the 6th harmonic of the b.f.o. picked up by the variable i.f. Because of the excellent s./n. ratio of the set, any tweet above about 0.5 μv sounds like a larger signal. On the other hand, if you're in a noisy location or listening on a crowded band, these tweets will go unnoticed.

A.G.C. performance was 12 db a.f. output rise with 80 db input-signal increase (1-10,000 μv). The choice of the three different release times appeared to be quite suitable for the various modes of operation.

Noise Blanker

The noise blanker is extremely effective, even in the presence of heavy power-line noise in which case signals as low as 1 μv were readable. No noticeable distortion was experienced with it and although it is designed specifically for s.s.b. and c.w., it was found useful with a.m. too but with some distortion.

As pointed out previously, full use of the blanker can in effect deteriorate the selectivity (as far as desensitization goes), so in many cases it will be best not to advance the blanker control further than needed for a particular situation. Also, there is a noticeable loss in i.f. gain when the blanker is full on.

Frequency Stability

The stability was found within the ratings of negligible drift during warmup, less than 100 c.p.s. per hour and 25 c.p.s. with 20% power-supply variation. Warmup drift for first 30 minutes from normal ambients averaged close to the hourly rate. Drop tests indicated excellent electrical and mechanical stability. Shaking the unit forward and backward produced a slight frequency shimmy, making us a bit apprehensive about performance in mobile service; however, road tests indicated no adverse effects.

Miscellaneous Notes

Care must be taken to see that the case-grounding switch is set to connect the case to the *grounded* side of the 12-volt supply in mobile installations. Switching it to the hot side will

produce a short across the line when grounded antenna cabe is connected or if the case is fastened to metal parts of the car. The switch should be pushed *down* for *negative* ground, *up* for *positive*. The case floats in the center position. Once set, it might be well to secure the switch lever with masking tape to prevent accidental changeover.

The power-cable plug is a male with exposed pins, so if it is handled while connected to a live source, be sure not to accidentally short or ground the pins by contact with metal elements.

The r.f. gain-control knob works the standby-operate switch. It must be pulled *out* for operate, pushed *in* for standby. If the set fails to function, check to see if the knob has been pushed in inadvertently while the receiver was handled.

Although the DR-30 is a very small package, it handles nicely once you're accustomed to it and if you're not "all thumbs." It is quite a sophisticated job in spite of its little size which, by the way, is just about right to fit in your Christmas stocking.

The DR-30 is priced at $389.50 with all crystals and mating connectors. An inexpensive accessory a.c. power supply/speaker is also available. The DR-30 is manufactured and sold by Davco Electronics, Inc., P.O. Box 2677, 2024 South Monroe Street, Tallahassee, Florida, 32304.

—W2AEF

Coax Switching [*from page 54*]

Another innovation which I later introduced is an r.f. pick up probe for my keying monitor. You may not need this feature if you work phone exclusively or have a keying monitor which does not depend on sampling the radiated r.f. My monitor is a Viking Signal Sentry which does require a bit of r.f. I procured this by connecting a small coil (4 turns) wound on a ¾" ceramic form, in series with the r.f. ammeter. Over this I wound two turns, leaving one end unconnected and wiring the opposite end to a phono jack in the side of the housing between two of the coax chassis connectors. This arrangement appears in the schematic as L_1 and L_2.

A simple s.p.s.t. toggle switch between the other two coax connectors serves to switch a small resistance wire shunt across the meter should I ever increase power to a point sufficient to run the meter off scale.

Installation

All of the foregoing equipment is mounted on my shack walls. The transmitter/antenna switching panel and the antenna selector cabinet are mounted adjacent to the transmitter group and the receiver/antenna switching panel just above the receiver positions. I've finally achieved the complete flexibility and convenience I had long been aiming at in choice of antennas versus transmitters/receivers and it has added immensely to my operating pleasure and convenience. I'm sure that you'll find it so for you, should you choose to adopt the scheme either partially or in its entirety. ■

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QRNews

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The EICO 753 is a complete 3-band transceiver, offering SSB/AM/CW operation with conservatively rated 200 watts PEP on all modes (rated for maximum efficiency rather than maximum possible input power). A new Silicon Solid State VFO provides full coverage of the 80, 40, and 20 meter bands. Assembly is made faster and easier by VFO and IF circuit boards, plus pre-assembled crystal lattice filter. Rigid construction, compact size, and superb styling make this rig equally suited for mobile and fixed station use. The EICO 753 is at your dealer now, in kit form and factory-wired.

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SPECIFICATIONS: Output Voltages: 750 volts DC at 300ma, 250 volts DC at 170ma — 100 volts DC at 5ma, 12.6 volts AC at 4 amps. INPUT VOLTAGE: 117VAC.

EICO Model 752 Solid State Mobile Power Supply: (Not Shown). For use with 12 volt positive or negative ground systems. Full protected against polarity reversal or overload. Output voltages identical to Model 751. Input voltage 11-14 volts DC.
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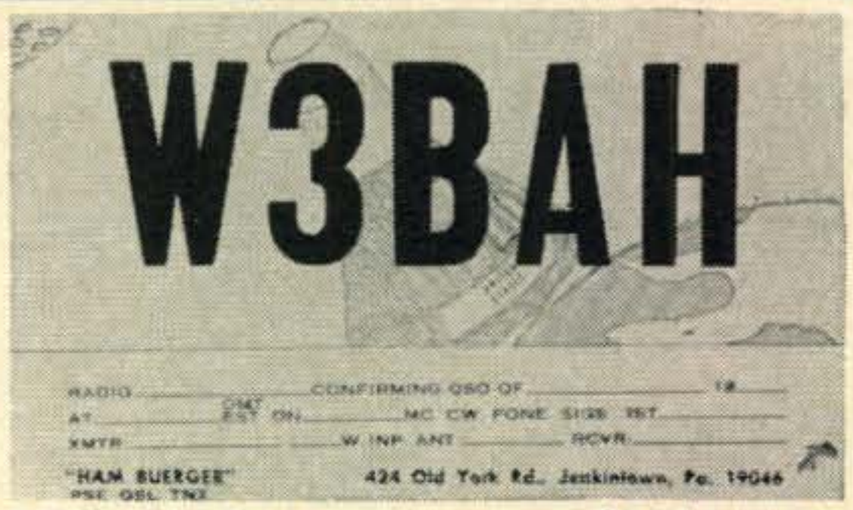

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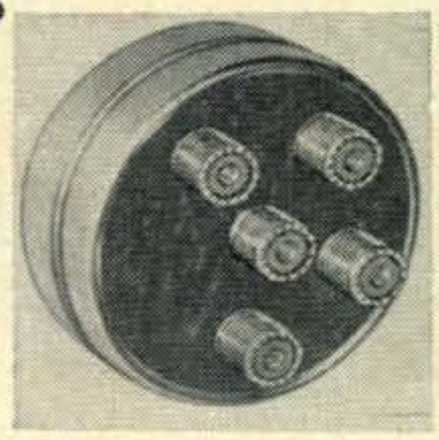

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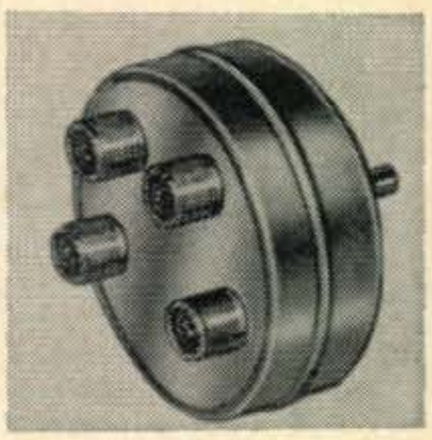
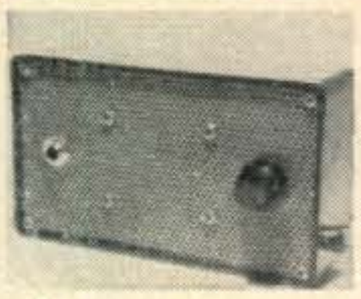


THE BEE LINE OF HAM ACCESSORIES

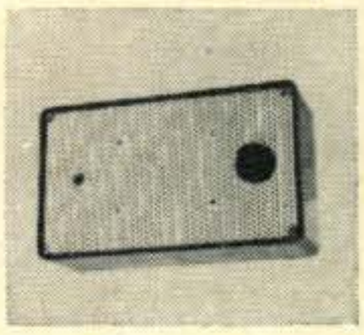


Model CMO RF powered CW monitor. No batteries required. Connect ground only. Earphone jack, variable freq. control, built-in speaker. 6" x 3½" x 2" wired only **$9.95**

Universal On-The-Air lite 6" x 3½" x 2". Lights when you transmit. Black plastic lettering. 110 VAC operation. Complete. **$2.95**

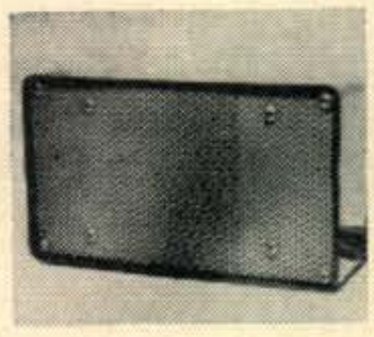
SJRA On-The-Air lite 6" x 3½" x 2". 110 VAC operation. **$2.95**

CPO and CPO kit. **$6.45** wired — **$4.95** kit. Earphone jack and variable tone control. 2½" speaker, transistorized. 6" x 3½" x 2". Operated on 9 volt battery.



Club on the air sign. Mt. Airy VHF club. 6" x 3½" x 2" black case. Operates on 110 volts. **$2.95**

S 3.5 remote or mobile speaker. 3" x 5" speaker. Black plastic case. 6" x 3½" x 2". Perforated steel front panel. Alnico 5 speaker. **$3.49**



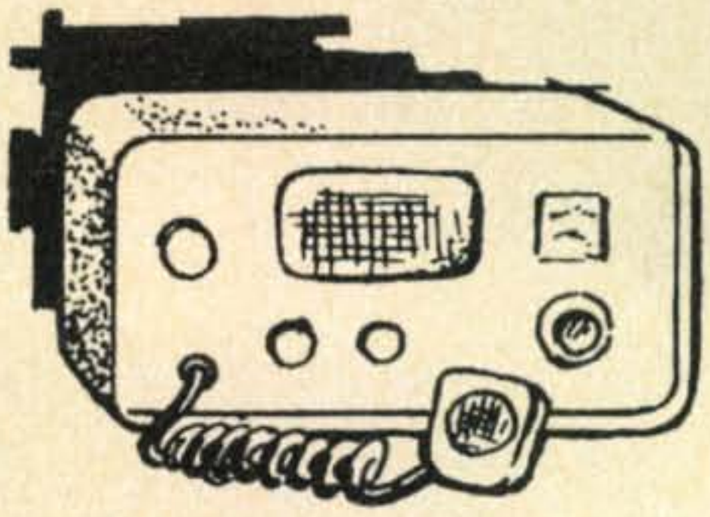
Propagation [*from page 77*]

South Africa	08-09 (1) 09-10 () 10-12 (2)	06-08 (1) 08-11 (2) 11-13 (3) 13-15 (2) 15-16 (1)	07-11 (1) 11-14 (2) 14-17 (3) 17-19 (2) 19-20 (1) 00-02 (1)	18-21 (1)
Central Asia	*Nil*	08-10 (1) 16-17 (1) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-20 (2) 20-21 (1)	05-07 (1) 18-20 (1)
South-east Asia	14-15 (1) 15-17 (2) 17-18 (1)	09-11 (1) 15-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-20 (1)	07-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-18 (1) 18-20 (2) 20-21 (1)	00-02 (1) 02-07 (2) 07-08 (1) 04-06 (1) *
Far East	14-15 (1) 15-16 (2) 16-18 (1)	13-15 (1) 15-16 (2) 16-17 (3) 17-18 (2) 18-20 (1)	08-10 (1) 13-14 (1) 14-17 (3) 17-19 (2) 19-21 (1)	00-03 (1) 03-08 (2) 08-10 (1) 02-08 (1) *
Pacific Islands & New Zealand	12-14 (1) 14-16 (2) 16-17 (1)	09-10 (1) 10-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	07-08 (1) 08-10 (2) 10-15 (1) 15-16 (2) 16-18 (4) 18-20 (3) 20-21 (2) 21-22 (1)	20-22 (1) 22-00 (2) 00-05 (3) 05-07 (2) 07-09 (1) 00-03 (1) * 03-06 (2) * 06-08 (1) *
Austra-lasia	14-15 (1) 15-16 (2) 16-18 (1)	08-12 (1) 12-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	07-08 (1) 08-10 (3) 10-12 (2) 12-16 (1) 16-17 (2) 17-19 (4) 19-20 (3) 20-22 (2) 22-23 (1)	01-03 (1) 03-05 (2) 05-07 (3) 07-09(1) 03-05 (1) * 05-06 (2) * 06-08 (1) *
North-ern & Central South America	08-10 (1) 10-15 (2) 15-16 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-07 (2) 07-09 (3) 09-10 (2) 10-13 (1) 13-15 (2) 15-18 (4) 18-20 (3) 20-22 (2) 22-06 (1)	20-22 (1) 22-01 (2) 01-104 (1) 01-04 (1) 22-06 (1) *
South-ern Brazil, Argen-tina, Chile & Uru-guay	08-10 (1) 10-14 (2) 14-16 (1)	07-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	05-06 (1) 06-08 (2) 08-14 (1) 14-15 (2) 15-17 (4) 17-19 (2) 19-20 (1)	20-22 (1) 22-01 (2) 01-04 (1) 22-06 (1) *
Mc-Murdo Sound, Antarc-tica	09-11 (1)	07-14 (1) 14-16 (2) 16-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 16-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-03 (1)	21-00 (1) 00-02 (2) 02-05 (1)

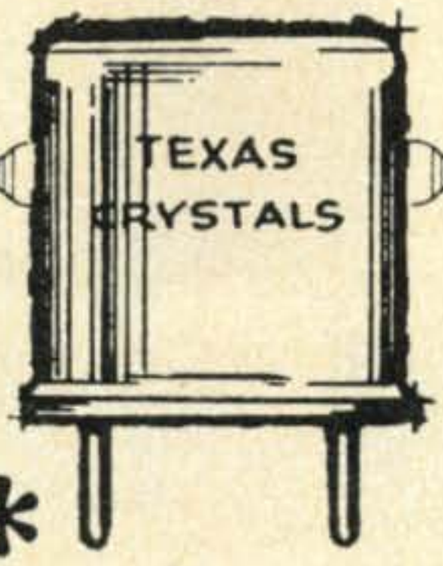
The Jimmy Machine [*from page 60*]

made it all worthwhile. The cost was really nothing—no parts were used except out of the junk box. Look in your own, and you will undoubtedly have old bits and pieces which can be put together in any old fashion to provide a lot of fun for the younger one—incidentally, this little box of tricks proved to be a lot more attractive than the knobs on the ham set, just one more advantage, but a practical one.

A plain old black chassis isn't very attractive, so, as a final touch, I took a little brush and painted a hap-hazard design in red and white all over the thing. It really dressed the thing up, and bright colors add a touch all their own. ■



The Heart of your Radio is Its



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DX Quiz [*from page 73*]

Answers To HARC DX Quiz

1. West
2. VK2ADY/Ø
3. K2MGE
4. Ten Zones: 13, 15, 16, 17, 18, 19, 21, 23, 25 and 40.
5. Russia
6. True
7. True
8. True
9. True
10. True
11. Armenia
12. PZ1/Surinam
13. Zone 26
14. Germany
15. CR3
16. ZC3
17. Turkey
18. ZP/Paraguay and CP/Bolivia
19. A-4; B-1; C-3; D-5; E-2.
20. A-5; B-3; C-4; D-1; E-2.

HA-250 on 40 [*from page 38*]

4—The 22 μh cathode choke was replaced with the 1 mh job that had been removed from the output circuit.

5—A 75 mmf, 3 kv ceramic was added in parallel with the plate tuning capacitor.

6—The r.f. sensing unit was removed as it was not needed in our application since a T-R switch was added.

Observations

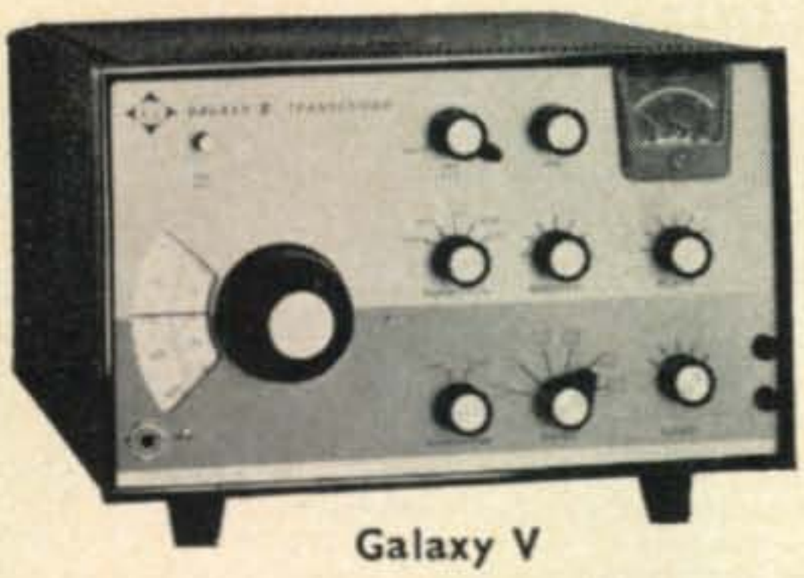
The unit worked fine the first time we tried it out. The same type of modification could very likely be adapted for 75 meter use by altering the inductance of the coil and adding more fixed capacity across the plate tuning capacitor. The size of the loading capacitor would also have to be increased.

It was found that the plate tank coil was a little too large in diameter as it's efficiency was affected by the proximity of the cover. On a subsequent model a coil of just over half this diameter will be used.

In conjunction with a home brew transistorized single channel s.s.b. transceiver, this outfit puts up a dandy signal over a 700 mile circuit it is being used on. It is not actually mobile but is operating in a remote area where there is no a.c. power and a 12 volt auto battery is used for primary power.

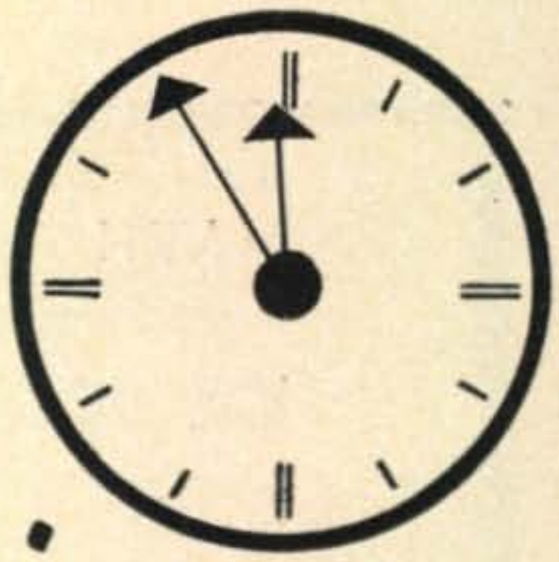
Transceiver

A transistorized transceiver was built into a case specially made to match the HA-250 linear and mounted directly to the linear. After the photograph was taken a SEND-RECEIVE switch was mounted on the front panel of the lower case. The small hole in the upper left hand corner is to permit the insertion of a screwdriver for fine frequency adjustment of a v.x.o. The complete unit weighs about five pounds. ■



Galaxy V

NOW is the TIME . . .



Terry Sterman, W9DIA
Proprietor

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Galaxy 2000 Linear	(16.06)	450.00
Galaxy COMM-1 Transceiver	(17.69)	495.00
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ZMM Hi-Angle Mobile Bracket		3.00
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AC Supply for Above		6.95
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Address _____

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State _____ Zip _____

☐ Send Reconditioned Equipment Bulletin

For further information, check number 45, on page 104

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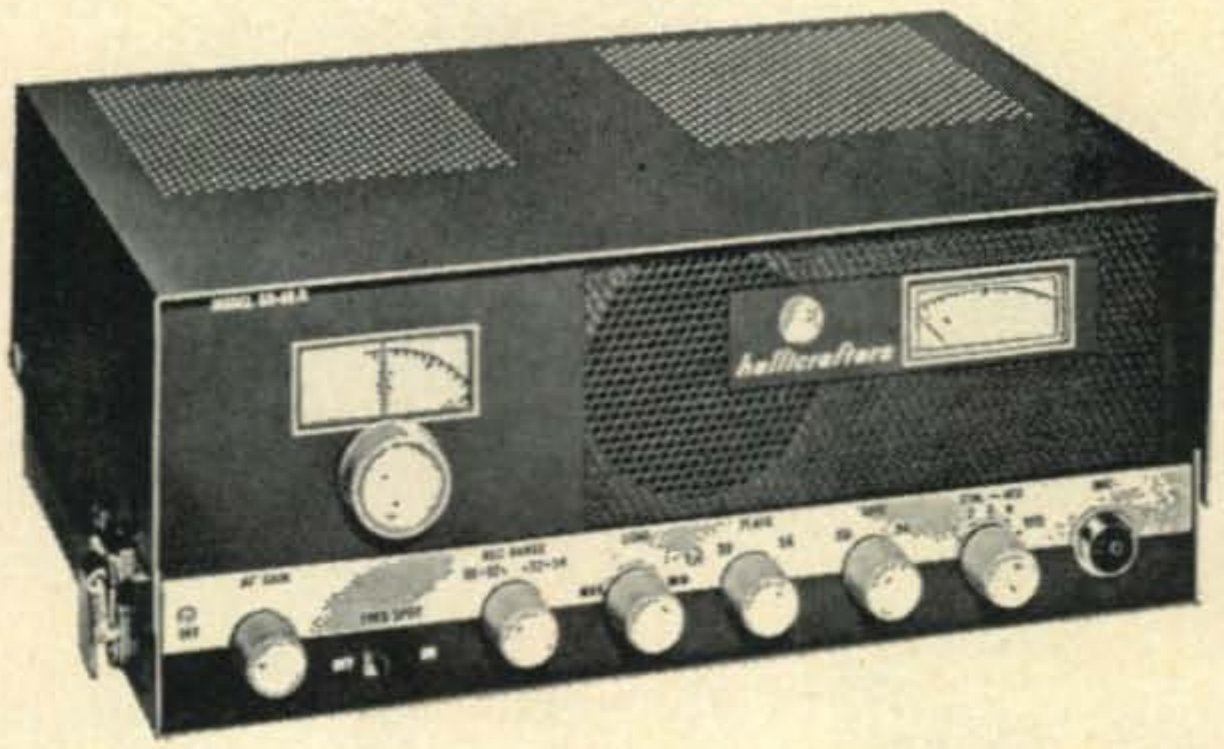

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NATIONAL

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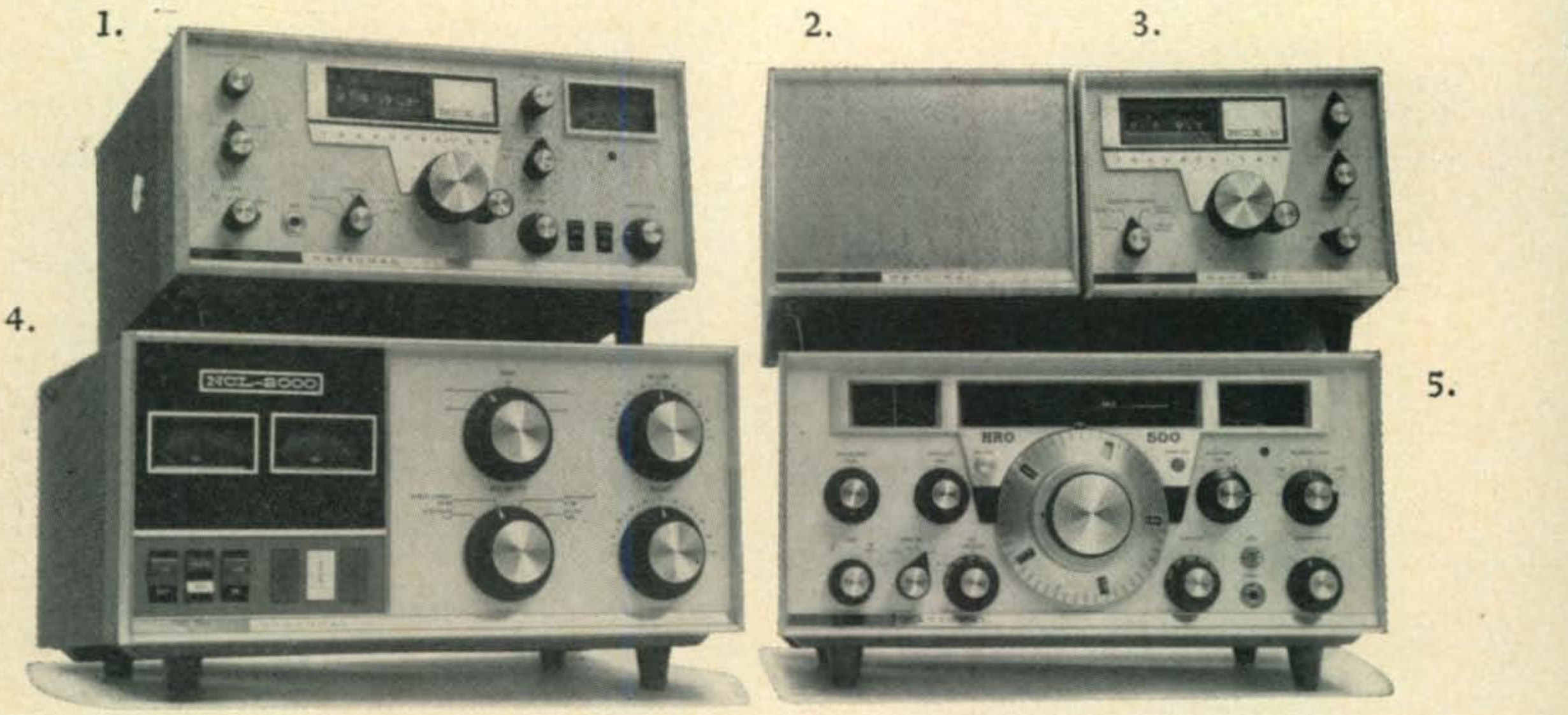


National's Super Station

1. This desk-top station for the advanced amateur includes the National NCX-5 all-band transceiver, with digital counter readout accurate to 1 kHz on each band and Transceive Vernier control to provide up to ±5 kHz separation of receive and transmit frequencies. Transmit-receive selectivity is provided by National's 8-pole crystal filter with superior 6-60 dB shape factor of 1.7 to 1. The NCX-5 provides operation on upper or lower sideband, compatible AM, or break-in CW. Now, only $549.

2. The NCX-A power supply/speaker console operates from 115/230 V.A.C. and provides all operating voltages for the NCX-5. $110.

3. The VX-501 VFO console provides choice of completely independent transmit-receive frequency control of the NCX-5, as well as transceive operation from either VX-501 or NCX-5 . . . and also offers five crystal channel positions for net or novice use. $249.95.

4. The NCL-2000 is a completely self-contained 2000-Watt SSB PEP linear amplifier for the 80 through 10 meter bands, with minimum peak output of 1300 Watts. It may also be operated for CW, AM, or RTTY at 1000 Watts DC input. $685.

5. The HRO-500 is a frequency-synthesized and phase-locked solid-state receiver covering the 5 kHz through 30 mHz frequency range with identical 1 kHz calibration, high stability from turn-on, and 10 kHz per turn tuning rate throughout. Passband tuning is offered for SSB and CW operation, and IF bandwidths up to 8 kHz are included. Operates from 115/230 V.A.C. or 12 V.D.C. sources. $1675.

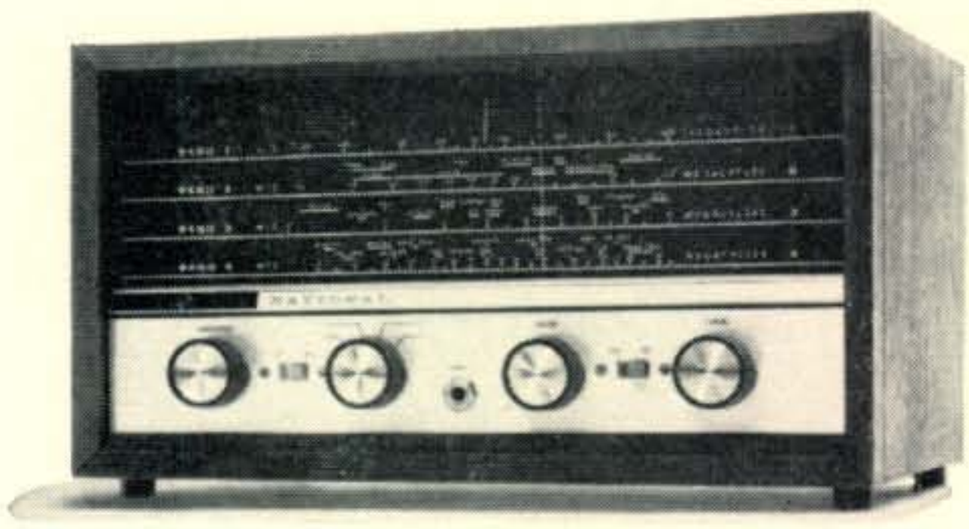
New National-200 Station

The new National 200 5-band transceiver gives you complete SSB, CW, and AM coverage of the 80 through 10 meter amateur bands . . . at the lowest possible price! Here is a fabulous five-band transceiver, with all of National's world-famous workmanship and performance, for less than the price of a kit . . . and check these terrific features: 200 Watt PEP input on SSB, grid-block keying on CW, and compatible AM operation *Separate product and AM detection plus fast-attack slow-release AGC in all modes *Crystal-controlled pre-mixing with single VFO for high stability, plus identical calibration rate on all bands. *Crystal lattice filter for high sideband suppression on transmit, and rejection of adjacent-channel QRM on receive. Only $359.

The AC-200 (not illustrated) operates from 115/230 V.A.C. and provides all operating voltages for the National 200. Only $75.

National Shortwave Station

Enter the wonderful world of shortwave listening with the National NC-77X. You'll hear foreign broadcasts, amateurs, and the Voice of America, ships at sea . . . even hear satellite signals from orbit! Here is the same time-tested conservative design that goes into the most sophisticated National communications equipment . . . plus these top-rated National features: *Continuous coverage from 540 kHz to 31 mHz in four bands, with separate electrical bandspread. *Giant easy-to-read dial with standard broadcast, civil defense, WWV, marine, aircraft, amateur, and foreign shortwave frequencies clearly marked. *Built-in 5″ speaker, and front-panel headphone jack. *Separate tuning coils on each band for exceptional sensitivity and selectivity. *Special bandspread charts for locating amateur and foreign broadcast frequencies. *Exclusive One-Year Guarantee against component failure.



Only $69.95 ($89.95 with hand-rubbed walnut case)

Try out the National line, at your dealer.

NATIONAL

NATIONAL RADIO COMPANY, INC., 37 Washington Street, Melrose, Mass. 02176

For further information, check number 44 on Page 104

AMERICAN RADIO RELAY LEAGUE

RADIOGRAM

VIA AMATEUR RADIO

NR	PREC	HX	STATION OF ORIGIN	CHECK	PLACE OF ORIGIN	TIME FILED	DATE
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AMATEUR STATION _____ PHONE _____

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To ALL RADIO AMATEURS
EVERYWHERE

THE HEARTIEST OF SEASONS GREETINGS MOST SINCERE WISHES
FOR HEALTH HAPPINESS AND PROSPERITY SOLID QSO'S
AND GOOD HUNTING

SENDER'S ADDRESS AND PHONE NUMBER FOR REFERENCE: RCA Electronic Components and Devices, Harrison, N.J.

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W1NLA	K2CXG	K2HR	K20AS	K2SAU	W2ZY	W3JYL	K3YAD
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K2CVS	K2HKT	WA2NDY	K2RVZ	W2ZXL	W3IGX	W3VDY	KØTYP/2