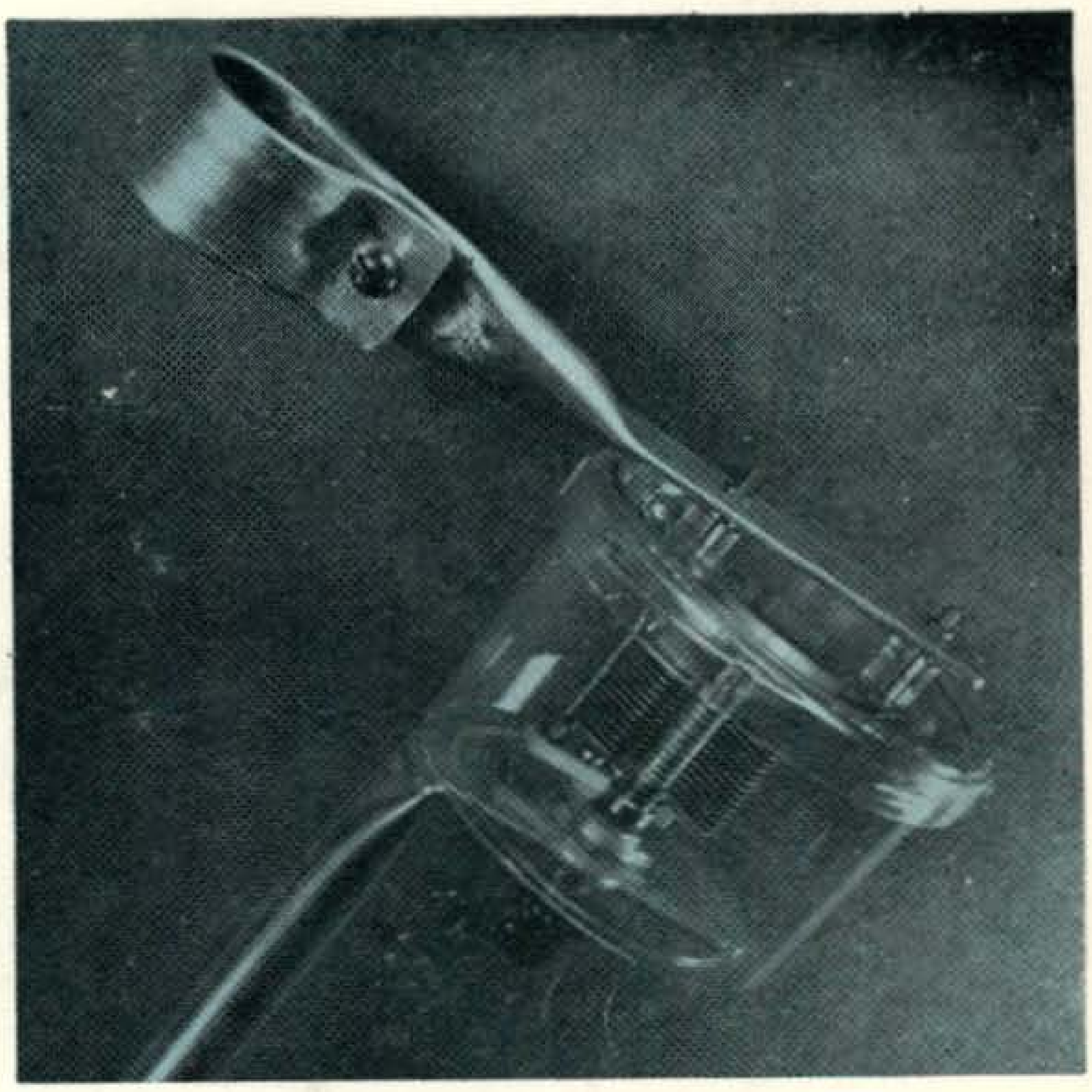
ICD

CQ

September 1966
75¢



ET's - Part II

60 M Contest Results

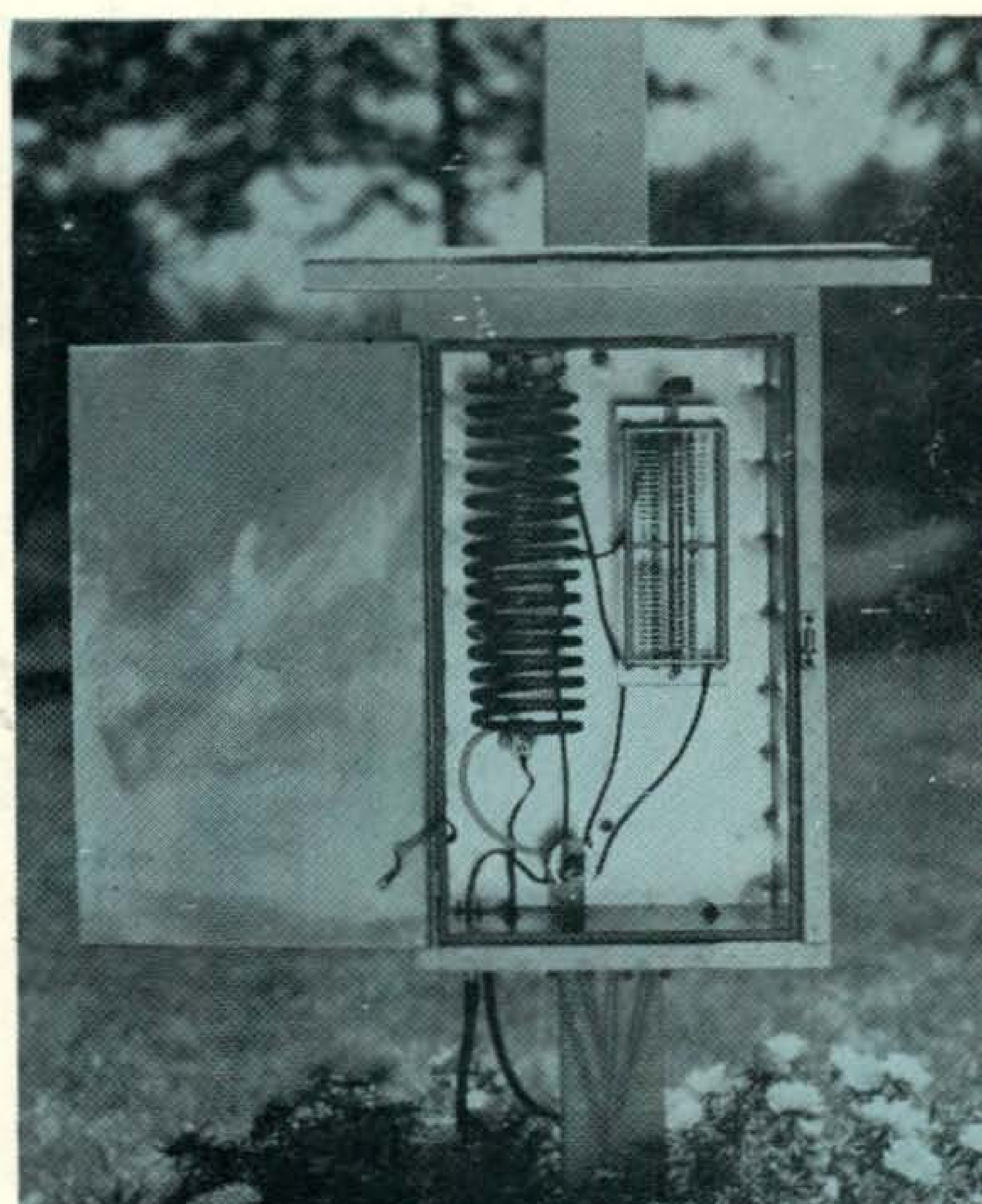
he W3JHR Four Band DX Antenna

1966 Version-page 76

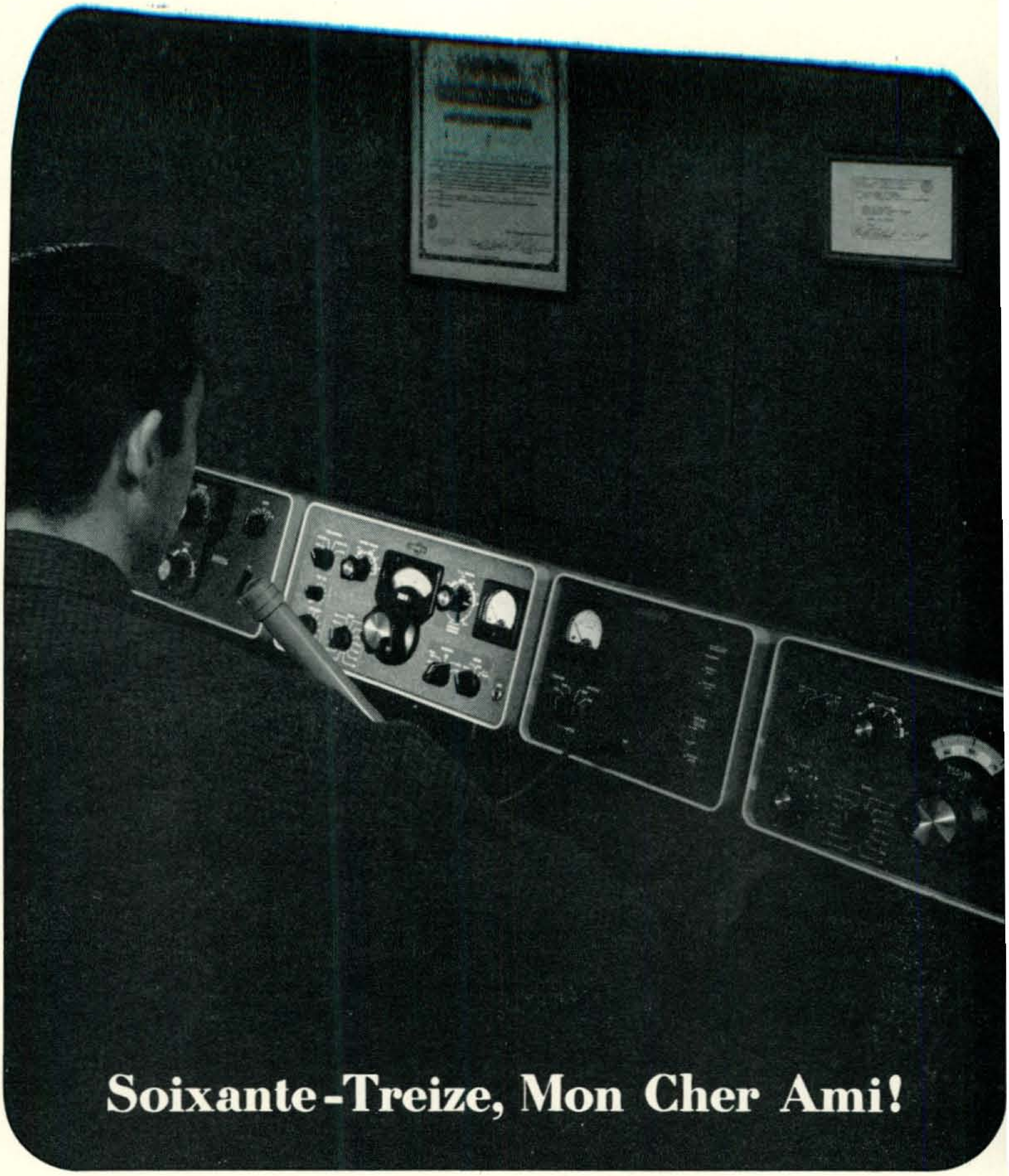
acsimile For Amateurs

mateur Color TV

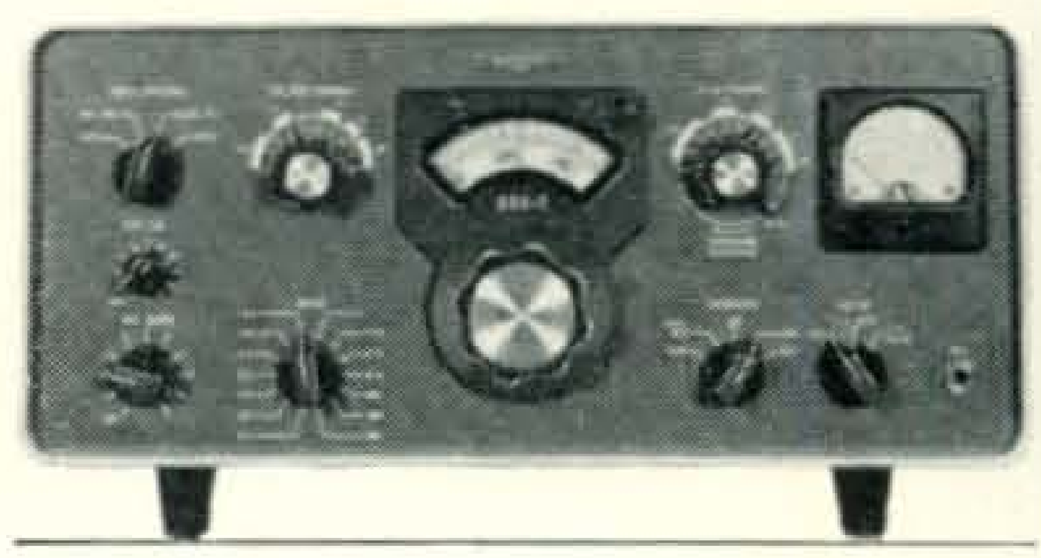
sing Integrated Circuits



The Radio Amateur's Journal



73, Old Man. You've worked another good one. With the clean voice signal of Collins 32S-3 transmitter. It gives you a lot to work with. Nominal output of 100 watts—175 watts PEP input on SSB and 160 input on CW. Gives you superior stability, transceive operation, mechanical filter sideband generation. And there's automatic load control, permeability-tuned VFO and crystal-controlled HF oscillator. With Collins 32S-3 there's no telling where you'll work your next QSO. See your authorized Collins distributor today.



COLLINS

For further information, check number 13, on page 110

ALL NEW from NEW-TRONICS

SUPER HUSTLER T.M.

unbelievable mobile performance

The Super Hustler has . . .

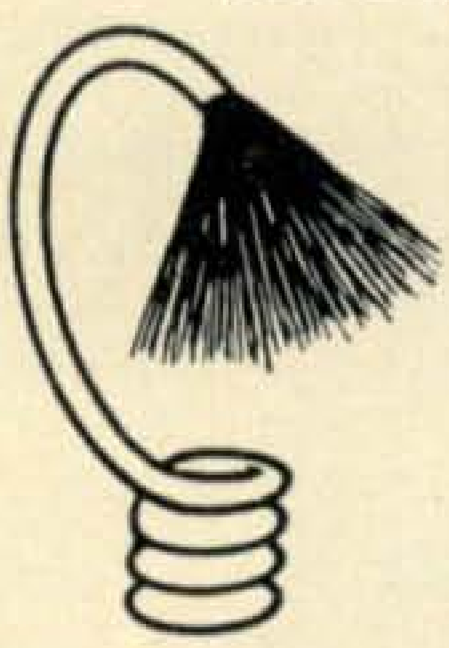
High Power Capability—Capable of maximum legal limit on SSB.

Widest Bandwidth — Better than ever . . . maintains minimum SWR over phone portion of 40, 20, 15, and 10, — 60 KC wide at 2 to 1 SWR on 75 meters.

Low SWR — 1.1 to 1 or better at resonance . . . no special matching required.

Proper Base Impedance — Nominal 52 ohms at resonance — no magic lengths of feed line or matching devices required.

Low Frequency Drift — Frequency drift from heat held to absolute minimum.



Here's 413 reasons for exceptional performance.

Coil wire contains 413 individual conductors insulated from each other for top performance value.

See the new Super Hustler at your distributor NOW . . . get the facts.

SWR chart and comparative information supplied on request.

"Another NEW-TRONICS Original"

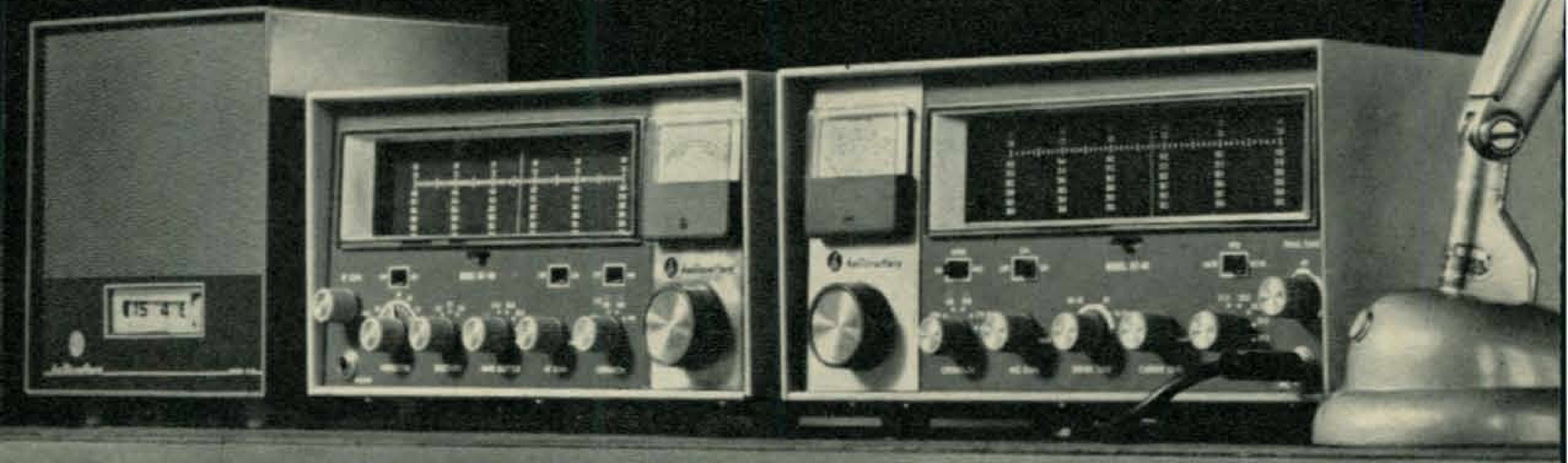
NEW-TRONICS CORP.

3455 Vega Avenue · Cleveland, Ohio 44113

5726-A

For further information, check number 1, on page 110

Hallicrafters advanced technology brings you a new breed of amateur equipment



SX-146 Receiver

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

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

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

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

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

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

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

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

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

Amateur net, $269.95

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

**Part of HA-19 calibrator.*

HT-46 5-band transmitter

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

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

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

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

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

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

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

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

R-51 Speaker,

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

"Quality through Craftsmanship"

hallicrafters

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

Available in Canada from Gould Sales Co.

For further information, check number 2, on page 110

CQ

SEPTEMBER 1966 VOL. 22, No. 9

The Radio Amateur's Journal

STAFF

TABLE OF CONTENTS

DEPARTMENTS

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

CQ—(Title registered U. S. Post Office) is published monthly by Cowan Publishing Corp. Second class postage paid at Port Washington and Garden City, New York. Subscription Prices: U. S. A., Canada and Mexico, one year, $5.00; two years, $9.00; three years, $13.00. Pan-American and foreign add one dollar per year. Please allow six weeks for change of address. Printed in the United States of America.

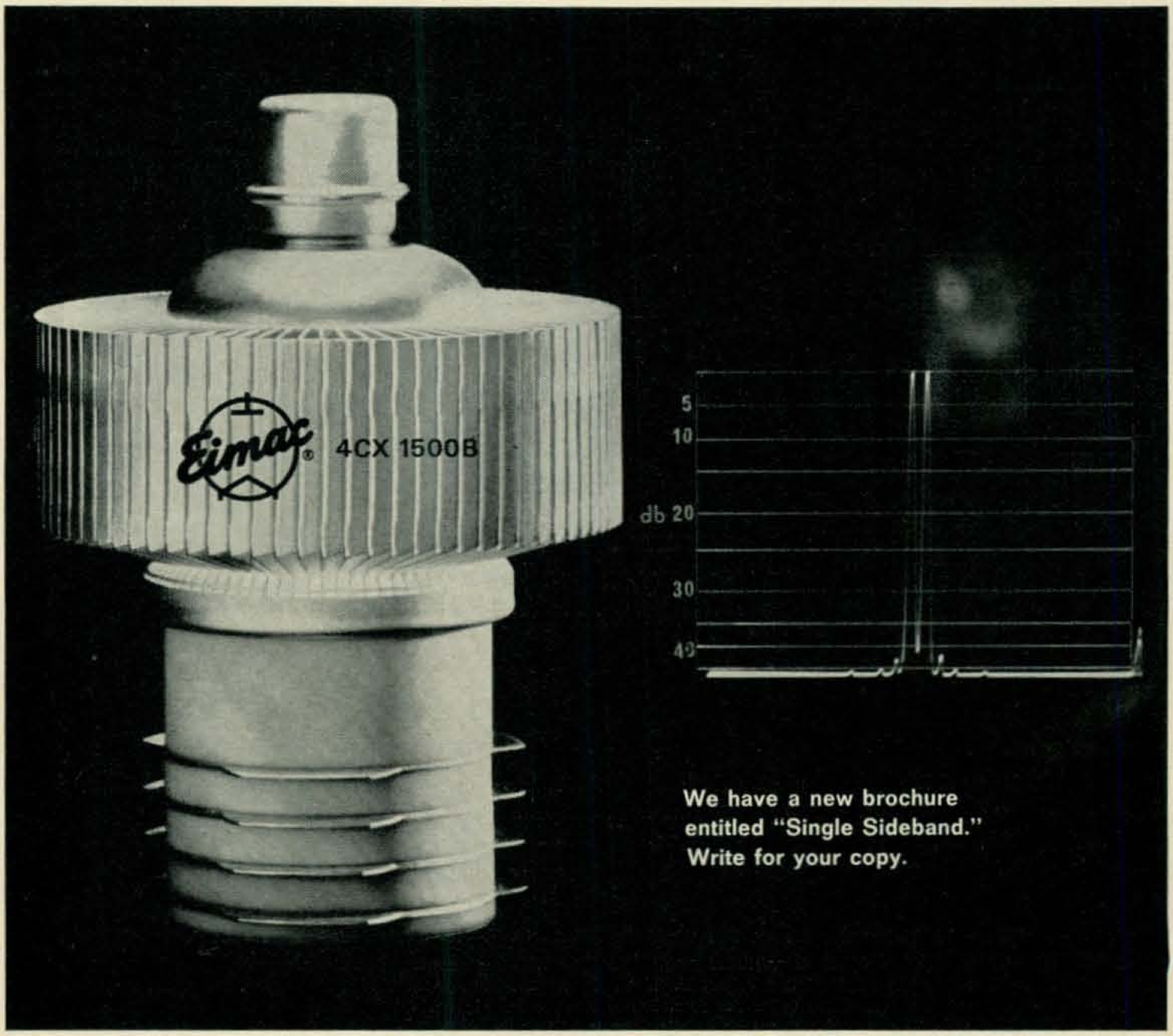
EIMAC offers new 1 kW PEP tetrode for SSB with highest linearity—at least -40 db in typical operation

EIMAC's new 4CX1500B power tetrode is the most linear tube on the market; intermodulation distortion characteristics under typical operating conditions are at least −40db at all drive power levels from zero to maximum. The new tube is ideal for advanced single sideband transmitters demanding high linearity to avoid channel-to-channel interference. The 4CX1500B is the product of a four-year development study which included optimization of internal tube geometry by computer techniques. Rated maximum plate dissipation of this radial beam tetrode is 1500 watts, and control grid dissipation rating is 1 watt maximum. Because the 4CX1500B 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; the tube is therefore recommended for Class AB_2 linear amplifier service. For further information, write Product Manager, Power Grid Tubes, or contact your nearest EIMAC distributor.

TYPICAL OPERATION (Frequencies Below 30 MHz)

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

EIMAC
Division of Varian
San Carlos, California 94070



For further information, check number 4, on page 110

ZERO BIAS

EATING crow is one of our least-liked obligations, but from time to time, like it or not, we must do just that.

Early this year we were largely responsible for creating quite a stir in DX circles by running an editorial or two voicing dissatisfaction with some practices of DXpeditions. Although I tried to shift responsibility for "less than desirable" practices *off* the shoulders of Don Miller, W9WNV, apparently our aim was off, and to many readers, Don became the inadvertent target of our brickbats. At the same time, our DX Department received word that seemed to indicate that Don *was* in fact engaging in improper procedures while DXpeditioning. A lively verbal brawl ensued, with everyone coming up thoroughly bruised and battered.

Well, the smoke has cleared, as has our view of the situation, and the time has come to set the record straight. The statement in the DX Column, January '66, p. 78, regarding Don logging contacts not actually made is simply not true, and resulted from a mis-interpretation of the information available at the time. Our personal apologies have been made to Don, and though I still frown slightly on some phases of DXpeditioning, I must acknowledge my newly acquired regard for the high ethical standards on Don Miller, DXpeditioner. We wish him good luck and smooth sailing in the months to come. —*K2MGA*

Late News: Jack Herbstriet, WØIIN, Elected Director of ITU's CCIR

ON July 15, 1966, Mr. Jack Herbstriet of the United States was elected Director of the International Radio Consultative Committee (CCIR) of the International Telecommunication Union. The election was one of the highlights of the 11th Plenary Assembly of the CCIR, which was held in Oslo, Norway, from June 20 to July 23. More than 750 telecommunication officials and scientists from 97 countries took part in the conference, and Jack was elected by a margin of 56 countries to 41.

The CCIR is the technical arm of the ITU for radio communications, and is responsible for developing international standards and operating techniques for all the radio communication services. A good part of the work of the 11th Plenary Assembly in Oslo was devoted to studies of color television systems, satellite communication systems, stereophonic broadcasting, ionospheric and tropospheric propagation, etc.

For the past twenty years Jack Herbstriet has been a leading engineer and scientist with the former Central Radio Propagation Laboratory of the Bureau of Standards, now called the Institute for Telecommunications, Environmental Science Service Administration. Jack, who now has a mountainside QTH near Boulder, Colorado, will make his home in Geneva, Switzerland for the next six years, and he'll have his office in the ITU building.

Jack Herbstriet has been a radio amateur since 1934, and for the past twelve years has been operating as WØIIN. He's been very active on 20 and 40 meters c.w., and as a member of several U.S. delegations to international telecommunication conferences in Geneva, he has often been heard operating 4U1ITU. During the recent CCIR conference in Oslo, Jack was very active, operating from LA1ITU.

In his new post, Jack Herbstriet will be the highest ranking American citizen in the ITU. Gerald C. Gross, W3GG and HB9IA, retired from the post of Secretary-General earlier this year, and John Gayer, another American formerly with the ITU (and radio amateur HB9AEQ) resigned this spring. Jack expects to keep active in amateur radio from his new QTH in Geneva, either with an HB9 call, or from 4U1ITU, which is only a few short steps from his office in the ITU building.—*W3ASK*

Jack Herbstriet, WØIIN, recently elected Director of the International Radio Consultative Committee (CCIR) of the ITU, Geneva.

OUR READERS SAY

Those Would-Be Amateurs

Editor, *CQ:*

Nuts to you! So what if 100,000 CBers would like to become amateurs. There are probably 200,000 citizens who are not CBers who would like to become amateurs too. Why isn't anyone who is not an amateur and would like to be one not an amateur? Just because they are lazy. The same reason I didn't get licensed any sooner than I did.

I don't see how you can say amateur radio has closed its doors on anyone. Any citizen, CBer or not, can become a radio amateur the same way you and I did. There is nothing so special about a CBer that should require any special enticement.

If you want to encourage them, why not include a copy of *CQ* along with the next issue of *S-9*. You could also convince the FCC to let any CBer give any other CBer the amateur code test. That should be enough of an enticement. The rapid growth of CB radio shows what the ham bands would be like if anyone with the price of a transmitter were allowed to transmit.

As the laws stand now, any individual can take the ham examination. There is nothing that excludes CBers from getting a call the same way that you did.

As I said before, nuts to you. Don't waste your postage sending letters asking why I didn't renew my subscription.

Bill Penhallegon, Jr., W4STX
Clearwater, Florida

It's always a pleasure to receive a cool, rational, well thought out commentary on an editorial, that tells you you've made your point. Isn't fan mail great?—*K2MGA*

Editor, *CQ:*

Continue the excellent discussion of CBers becoming amateurs in your ZERO BIAS column.

I am a CBer who became a ham through hard work and study on my own and for years I've been trying to "marry" the two together and show the advantages to both sides of an amateur club helping the CBers who are interested in acquiring their ticket.

The attitude of resentment toward the CBer is not the prevailing attitude and with a little encouragement, such as you have been giving, I think a better relationship can be established and some fine and beneficial operators can be obtained from the CB ranks.

Keep up the good work!!!

Joseph B. Abney, WA4THV/KDD1584
Augusta, Georgia

Editor, *CQ:*

Your editorial in the July 1966 issue of *CQ* presents some interesting questions about a timely topic. However, you give no clue as to the answers and hence your editorial falls a bit flat.

The topic that you began to approach is too big a one for an editorial. The answers depend upon too many different factors most of which are not well known to every reader, and certainly there must be little unanimity of thinking on these subjects.

There are undoubtedly many reasons why there is no larger number of newcomers to amateur radio—and not just one or two single answers. Amateur radio means different things to different hams; and not each one follows it for the same reasons. Some of us who became interested in ham radio in our junior high school days of forty-some years ago did it for the same reason that some do today; and some of these reasons may be the same as for the CBer who now becomes interested in radio.

Many hams and CBers have a commercial interest in radio and to them this is more than a hobby, for it is a way of life. Others become CBers or hams because they like people and this gives them membership eligibility with a local or even a regional group. Others are bed-ridden and shut-ins and they need people with whom to visit. Others select it as a pure hobby in the same way that others may elect golf or photography or fishing. Others like to tinker and to experiment and here is a challenge in which they can make their talents show off by the results that they get from the equipment that they build. Some, like myself, have administrative positions that we like to get away from for relaxation and we also like to have a hobby that can be demanding in terms of study if we want to keep up with the art and the science that is involved. There are others who enjoy the organizational work or association work involved; those who enjoy message handling, contests, DXing, collecting awards and diplomas, etc. There is no single "image" that portrays the "average ham of today". There is probably no single "image" that would describe an average CBer.

I believe that it is very unfortunate that a degree of animosity and misunderstanding has been built up between the ham and the CBer. To read some articles and letters to the editors, one would think that these are two competitive groups. How much better it would have been if our respective groups had from the start recognized the sincerity and the interest of the members and tried to do everything to help each group fraternize with the other.

The CBers with their continual monitoring of channels do a lot of good to the community; helps travelers who get lost on poorly marked highways; gets help quickly for accidents; and many other things. The CBer is not just a "junior grade ham" and is not even a potential ham in all cases—but here again comes the question, "just what is a ham today?".

If you and your colleagues are interested in "recruitment" of more hams, then I believe that you should go about it in the same, well organized fashion that many of the rest of us have had to go about recruiting of faculty, recruiting of professional students, etc. This is done by some analysis of the situation and a recognition of the problems involved. The "bull-session" that you speak about can produce some ideas, but most "bull-sessions" are too poorly organized and too poorly directed to do more than repeat hackneyed phrases and criticisms, light fuses to explosive rumors, and advocate complacent maintenance to the status quo. Few "bull-sessions" or "coffee breaks" ever get down to identifying what the problem is and even fewer ever come to grips with the possible methods of implementing some sensible action.

I would like to suggest that you and your staff prepare a real thought provoking article—NOT a short editorial —on this whole subject and render a real service to both the ham and the CBer.

In passing, I would say that I have both a mobile ham transceiver and also a CB unit in my car.

Dr. Shailer Peterson, K4UP/W9OMK
Memphis, Tenn.

Editor, *CQ:*

Re your editorial July 1966 *CQ*.

Do I want to do something to entice some of the 100,000 plus CBers to become amateurs? Yes, in fact I've already converted one to the adventure of amateur radio. How? Simply a matter of a few evenings code practice and a simple written test allowed him to get on the air. It's called the novice class amateur radio license.

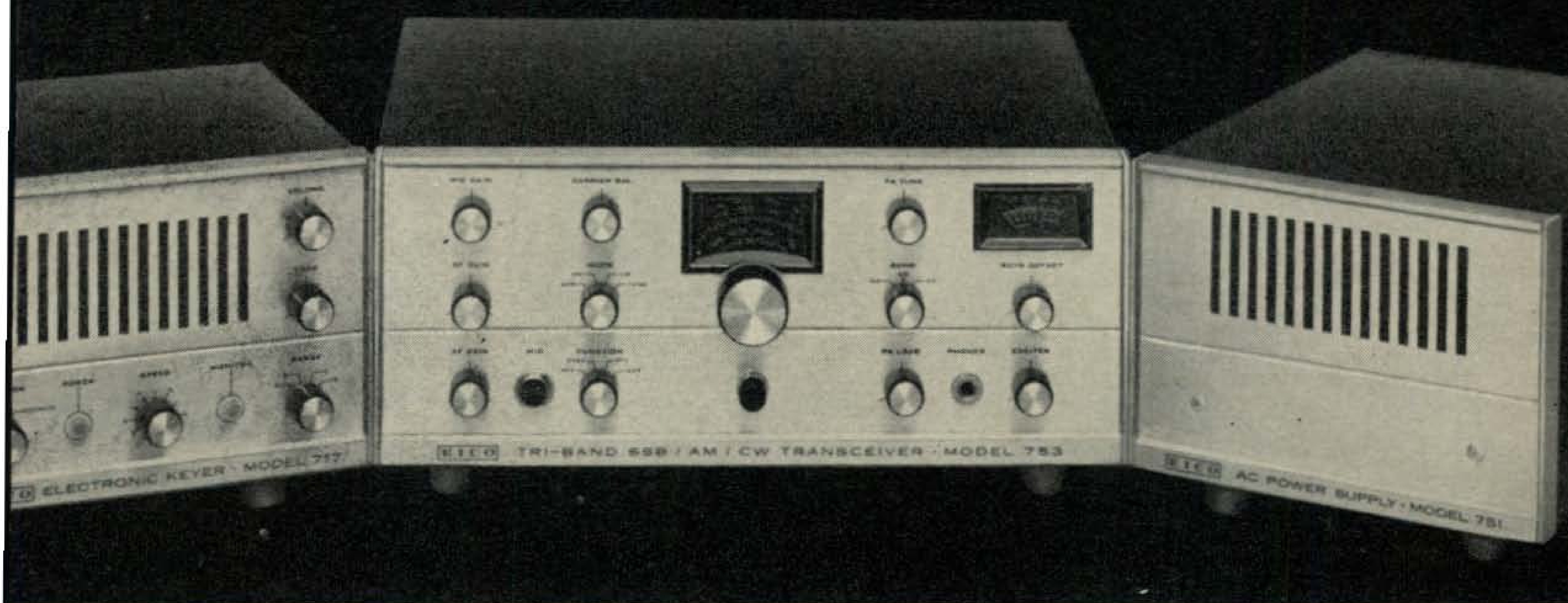
"OUR READERS SAY" welcomes letters about nearly anything of interest to amateurs, whether about *CQ* itself, the state of the hobby, or whatever else you have on your mind. The most interesting letters will be selected for publication each month; just keep them legible, keep them short, and above all,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

A 3-band SSB Transceiver Kit for $189.95

An Electronic Keyer Kit for $49.95

A Solid-State AC Power Supply Kit for $79.95

Who gives you ham gear so COMPLETE at prices so low?



Who else but EICO

***Pro* all the way, from concept to execution — that's what ham editors say about EICO. Critical customers agree, and like the low price, too. They've made the 753 kit, for example, the industry's hottest seller. And the new 717 Keyer seems headed for the same fate. Highlights of both give you some inkling why:**

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.

FEATURES: High level dynamic ALC prevents flat-topping even with extreme over-modulation. Automatic carrier level adjustment on CW & AM. Receiver offset tuning (10 kc bandspread) without altering transmit frequency. Front panel selected STANDBY, VOX, or P-T-T operation. Unique ball drive provides both 6:1 rapid band tuning and 30:1 vernier bandspread with single knob. The Model 753 is an outstanding value **factory wired at $299.95**

EICO Model 751 AC Supply/Speaker Console: Provides all necessary operating voltages for Model 753. Incorporates PM Speaker, conservatively rated components and silicon rectifiers for minimum heat and extended trouble-free life. Includes interconnecting plug-in cables. **Kit $79.95 Wired $109.95**

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.

Kit $79.95 Wired $109.95

The ideal accessory for the CW ham—the **fully automatic 717 Electronic Keyer.** It provides self-completing clean-cut dots, dashes, and spaces accurately timed and proportioned from 3 to 65 WPM in four overlapping switch-selected ranges with vernier control of all speeds within each range. Matches EICO 753 in appearance to make it a perfect tabletop companion unit.

FEATURES: Output Contacts — 25 volt-ampere dry-reed SPST relay. Built-in adjustable tone and volume oscillator with a 3 x 5 inch speaker for monitoring. Can be used as a code practice oscillator.

Kit $49.95 Wired $69.95

For FREE catalog and Amateur Radio brochure write to EICO 131-01 39th Ave., Flushing, New York 11352 EICO

For further information, check number 7, on page 110

OUR READERS SAY (Continued)

I'm proud to say he now has his General Class. Surely you're not suggesting anything simpler!!!

When I became interested in amateur radio 10 years ago, I thought it was a hobby for people interested in radio first and talking second. If you make it easier to obtain a license to operate the store bought kw, that's exactly what you're going to have, talkers, not radio enthusiasts. Tune across the ham bands some afternoon, you won't have to listen long to see we don't need any more appliance operators.

Let's not hold it against a person just because he started on CB. Let's help those interested enough to put forth a little effort and let those who want something for nothing rot on 11 meters, that's where *they* belong.

Perry Knight, WA5CTP
Miami, Oklahoma

Coaxial Connectors

Editor, *CQ:*

Your article, "A Close Look At Connectors" by Frank MacKinnis of the Amphenol Borg Electronics Corporation discussed a topic of great interest to hams.

The "article" was very one sided and should have been edited, and not allowed to appear in the form in which it did. A great injustice has been done to many other connector manufacturers.

Amphenol is not the only connector manufacturer in the United States, nor do they produce the widest range or series of coaxial connectors than do other connector manufacturers.

In discussing the SO-239 UHF connector without a flange, the author says, "Just make sure to use substantial lock washers between the chassis and the nut, . . .". Is he suggesting this to make up for a possible design deficiency?

The Gremar Manufacturing Company in Wakefield, Mass., originally produced this connector with a "D" hole mount. They should have given some credit, especially in view of the fact that Amphenol, making a similar connector did not improve on Gremar's original design. Not only that, but Gremar supplies this connector with a finish that will not flake or tarnish. It has the conductivity of bright silver and the wearability of nickel. Gremar supplies this finish at no extra cost,—Gremar number 6804.

In the guise of an article for hams, Mr. MacKinnis produced what amounted to a four and a quarter page advertisement for his company. Particular connectors are described by Amphenol number. The Editors of *CQ* should have used the military or UG numbers for these connectors.

You mention in this same June issue that 41.4% of your readers are employed in the electronics field.—It is your responsibility to present a well balanced view of that industry. Certainly this article which is, in truth, an advertisement for one company, cannot present the full spectrum of the connector field.

Fred Hersh, W2JUW
Brooklyn, New York

Fred, your information about Gremar Mfg. Co. is most interesting, as is your criticism of the article itself. However, two very important points have been completely overlooked, and they are availability and familiarity. The Gremar products, as fine as they may be, are not available to the consumer, but are primarily for the OEM (original equipment manufacturer) market. To use military or UG numbers rather than the universally understood Amphenol numbers would serve only to complicate an already complicated situation. How often has a ham tried to purchase a "UG-372/U" from his local dealer only to be asked "What's the Amphenol number on that?" We're out to make things a little less confusing to the amateur, which is exactly why we haven't jumped on the "Hertz" bandwagon.—*K2MGA*

The F.M. Controversy

Editor, *CQ:*

I feel that *CQ* has done a disservice to radio amateurs in general and f.m.ers in particular by publishing W2JTP's f.m. article. W5EHC's letter in the July issue is justified based on the article in which the opinions are largely untrue except for a small closed group of amateurs and psuedo-amateurs that Byron operates with. (One of them thinks its extremely poor taste to use amateur calls at all!)

Technically Byron's article is fine but his procedures paragraph certainly is uncalled for. My experiences in the northeast area have been generally gratifying and pleasant. I have found that I can drive from Long Island to Lynchburg, Va. and maintain contact on 2 meters all the way.

W5ECH's feelings on the technical end I feel is wrong. It's the lack of technical knowledge that scares some hams away from f.m. It sometimes requires almost as much conversion as the war surplus that has been the mainstay of the experimenting amateur since 1946. It's the old story of ham ingenuity taking existing equipment, converting and improving on the original design.

F.m. should be looked on as just another facet of a many faceted hobby. There's nothing wrong with working DX on 20 meters and discussing in locally on 2 or 6 meter f.m. (Better and more legal than a crosstown kw QSO on 20!)

In summary the Why's of f.m. can be stated thus:

1. Cheap high power v.h.f. mobile.
2. Fixed frequency squelched monitor (*i.e.:* continuous net).
3. Useful intercom between club members (good club project too!).
4. Autostart RTTY monitoring.
5. DXers intercom.
6. Extended range mobile to mobile operation thru hilltop repeaters.
7. Safer driving—no tuning dials.

In conclusion let me say that any time anyone breaks or calls me on a channel I monitor, I will be happy to answer and new stations are welcome! I think you will find that this is the attitude of the majority of f.m.ers.

Van R. Field, W2OQI
Center Moriches, N.Y.

Editor, *CQ:*

I found the May issue's "F.M. Mobile Techniques" by Byron H. Kretzman (W2JTP) and Carl C. Drumeller's (W5EHC) subsequent letter most interesting. I believe there are many areas that have compromised on the philosophies of W2JTP and W5EHC, and arrived at a satisfactory and harmonious approach.

In this area, and several others with which I am familiar, this compromise has consisted of abandoning v.h.f. amateur a.m. equipment for commercial f.m. equipment *and* for the purpose of Civil Defense. Locally, both local government and Races members have acquired donations of 6 and 2 meter f.m. gear to service Civil Defense, and in-band repeaters have been put on the air to serve both bands. There is no use of any 10-code yet or any restrictions on transmission length, so the "fun factor" has not been lost. I must add, however, that this system does not appeal to the rag-chewer and DX operator and it is comprised, by and large, of those amateurs who are genuinely desirous of being available for emergencies with reliable equipment.

Races, if properly implemented, cannot possibly appeal to the casual, disinterested, or "windy." Since amateur radio is based on individualism, it requires an outstanding amateur to be able to switch from "ham" practices day-to-day, to commercial practices required in Races. Basically, what is Races? It is an alternate —and sometimes primary or sole—means of communications for and between *government jurisdictions.* If a Races system cannot provide relatively immediate and reliable communications in a *clear, correct, and concise* manner—it has failed both the amateur fraternity and the government jurisdiction it serves. Because of this, we must appreciate the reality that good Races operators can be only a relatively small percentage of the amateur population. The impression gained from W2JTP's article is that the older hodge-podge of a.m. equipment is relegated to civil defense, and the commercial-quality f.m. is only for a select, non-aligned few. I personally hope that the misunderstanding is mine. Races needs "terse" operators when the emergency arises, but let them have fun in between!

Stanly E. Harter, KH6GBX
State Communications Officer
Honolulu, Hawaii

Parabolic Antennas

Editor, *CQ:*

Anent Allen Katz's article, "Simple Parabolic Antenna Design," *CQ* August '66; the quality of the reflecting surface is of greater importance than the shape of the reflector, yet it is dismissed in a few sentences. Furthermore, no details are given regarding the manner of making the chickenwire conform to the shape of a parabola; it may be that it will stretch into shape, but it doesn't seem likely. What does one do: cut wedges, solder, or just pleat it (!) The author does say "recently we have heard some questions as to the usefulness (I would say efficiency) of chicken wire as a reflector material." To this I would say, it's about time.

Years ago Collins Radio rigged a large horn for the first moon-bounce experiment, and the reporter commented that they were somewhat dissatisfied with the efficiency, as it "leaked" considerably—no surprise to me, as the photo in *Electronics* showed it to be made of chickenwire. Now, what happens when you turn a reflecting rod out of the plane of the radiating member of a Yagi? It quickly ceases to function as a reflector. Obviously a reflecting surface must furnish current-flow paths in the plane of the radiating antenna, in a surface as well as in an array of rod reflectors. Chicken-wire is hexagonal in design, over half of the conductors (2/3, to be exact), at 45° angles to the reference conductors (wire). One-inch chicken wire will have continuous current paths in the plane of the antenna only 2/3 inch, in the most favorable orientation. The "conservative rule of thumb is to have the mesh opening less than 1/16" may even be completely false in concept in respect to chickenwire —it might be better to operate a 1" mesh at a wavelength of about 2/3 inch, as there, at least, a series of continuous current paths long enough to serve as individual reflectors do exist! Function will be irregular over the surface of the parabola, however, due to the misorientation to various degrees due to adaption of the plane-surface mesh to the curve. For the same reason, hardware cloth, which does have continuous current paths, will not maintain orientation in the plane of polarization when applied over the parabola.

Military parabolas are therefore usually solid surfaces, or when relieved for less wind-loading, perforated with holes arranged so as to maintain current paths in the plane of polarization. I have, however, seen military reflectors with perforations in stagger-pattern like the holes in chickenwire, which must degrade performance.

As a practical solution I suggest forgetting any attempts to make large ham full-parabolas, but rather to make corner-reflectors with the "corner" parabolized in shape—a parabola in one plane only—using hardware cloth. I suspect that one of the same aperture as Katz's parabola would prove to be far more efficient, as well as easier to construct and handle.

Charles C. Littell, Jr.
Engineering Associates
Dayton, Ohio

Though Mr. Littell's observations are probably valid to some extent, we feel that he is selling short the technical acumen of the amateur radio experimenter by dismissing his efforts as "inefficient" and urging him to steer clear of what he considers to be areas beyond the capabilities of the home constructor. With the spirit of the experimenter in such short supply these days, this discouraging attitude from an industry representative leaves us somewhat aghast!—*K2MGA*

Some of the People All of the Time . . .

Editor, *CQ:*

In regard to the article written by Sylvia Margolis in June *CQ;* come now, Dear Editor, don't you think that with a little more effort you could select better articles?

For further information, check number 9 on page 110

This and other stories written by Mrs. Margolis leave something to be desired.

George Kraus, WØEUQ
Grand Forks, N. Dakota

Editor, *CQ:*

What a fabulous gal that Sylvia Margolis is! Can we have more stuff from her pen? I am proud to have had the pleasure of an eyeball QSO with Sylvia at a loud ham exhibition in 1958, and just have to be a booster. Thank you.

Harold G. Austin, WØPI
Washington, D.C.

Any wonder that editors get ulcers?—*K2MGA*

Ode to a Transistor

Editor, *CQ:*

In reference to the article on page 74, July 1966 *CQ:*

"A Clipper Preamp for A.M."
Is what the title stated—
It hinted a.m. sent unclipped,
Was vastly over rated.

The whole idea was pleasant,
That of total modulation.
It seemed to be a natural
To add on to my station.

So I bought the disc ceramics—
From the junk box came resistors.
The diodes, they were easy . .
But you can't buy the transistors!

I had the r.f. choke at home,
And assured by a local critic,
I substituted for tantalums,
just plain electrolytic.

The Minibox is waiting,
But I am really browned,
Cause those two darn transistors
Simply can't be found.

I called all the distributors,
And all the stores as well,
But 2N2714's
They do not seem to sell.

One store said no—not one in stock,
Their warehouse was understaffed.
Another said just plain flat "No!"
And RCA just laughed

And one was kind enough to offer
(and here I almost blundered)
To order some, yes, right away—
If I could use two hundred.

I have the parts—and the battery.
And my feet are full of blisters . . .
And would you believe—in this whole wide town,
No one has those two transistors.

So may I offer, with heavy heart,
For one roll of the dice—
Almost all the parts you need—
On sale for half the price.

And I wonder if Gary Jordan,
WB6MOC
Quite realizes exactly
What is obvious to me . . .

For when he does—when the dawn bursts forth
It surely will delight 'im.
He has in those transistors,
What're called collectors items . . .

Jules E. Blitz, W3YZE
Baltimore, Md.

Well now, isn't that a nice way to be told that you've goofed! Actually we should have indicated that the transistors specified just happened to be on hand, and are not critical. Nearly any good NPN audio transistor will work, although the transistors specified are high frequency silicon planar types, which can be replaced in this circuit with 2N3414, 2N3711 or 2N2924.—*K2MGA*

◀ For further information, check number 10, on page 110

Announcements

St. Louis, Missouri
The Suburban Radio Club, Inc. of St. Louis County, Missouri, will hold a hamfest on Sunday, Sept. 4th, at the Creve Coeur Lake Memorial Park, St. Louis County. Admission is free with plenty of prizes, contests, etc. For further details contact Joe H. Owings, KØAHD, 10217 St. Daniel Ln., St. Ann, Mo., 63074.

York, Pennsylvania
The Four York County Clubs will sponsor the 11th annual hamfest at the Adams County Fair Grounds, 4 miles north of Abbottstown, Pa., rain or shine on Sept. 4. Registration will begin at 0900 hrs. For information write to Leroy Frey, 170 S. Albemarle, York, Pa., 17401.

Haddonfield, N.J.
A 50th Anniversary Banquet open to all hams will be held by the South Jersey Radio Association, Inc., on Saturday evening, Sept. 10th, at the Ivy Stone Inn, Route 130, Pennsauken (near Camden), N.J. Tickets are by advanced sale only at $7.50 each. Tickets and detailed information can be had by writing SJRA, Inc., attention Mr. Charles H. Jenkins, W2VX, P.O. Box 316, Haddonfield, N.J., 08033.

Findlay, Ohio
The Findlay Radio Club, W8FT, will hold its 24th annual hamfest, Sunday, Sept. 11, at Riverside Park, in northeast Findlay, Ohio. Advance info and registration from C. E. Foltz, W8UN, 122 West Hobart, Findlay, Ohio.

Peoria, Illinois
The ninth annual hamfest of the Peoria Area Amateur Radio Club will be held at Exposition Gardens, Sept. 18, (same place as last year). This hamfest was attended by 3000 in 1965 and promises to be bigger and better this year. There will be prizes, displays and activities for all. Check with Ferrel Lytle, W9DHE, 419 Stonegate Rd., Peoria, Illinois, 61614, for full information.

Uniontown, Pennsylvania
The 17th annual Gabfest of the Uniontown Amateur Radio Club will be held on the club grounds, Saturday, Sept. 17. Joseph M. Sofranko, 438 Braddock Ave., Uniontown, Pa., 15401, has full information, check with him.

Endwell, New York
The Central New York Chapter, of QCWA, chartered Jan. 1966, as N.Y. State's first chapter, is holding its first annual Chapter banquet on Sept. 17, at Schraffts Restaurant and Motor Inn, Binghamton, N.Y. There will be a social hour at 5 P.M. with dinner at 6 P.M. Noted speakers will appear and a pleasant get-together with good fellowship can be assured. For further information contact Bert Martin, K2LBB, Endwell, New York, 13760.

Lower Burrell, Pennsylvania
The Skyview Radio Club will hold its annual Swap and Shop hamfest at the clubgrounds, east of New Kensington, Pa., on Sept. 18. Contact K3ZCA for details.

Holcomb, New York
The Antique Wireless Assn. will hold its annual meet Sept. 24 and 25 at the Franklin Institute, Philadelphia, Pa. There will be talks and demonstrations and exhibits of old gear. Write for brochure and details to Lincoln Cundall, W2QY, 69 Boulevard Pkwy., Rochester, N.Y. 14612.

Walla Walla, Washington
The Walla Walla Valley Amateur Radio Club will hold its 20th annual all-family picnic and hamfest Sept. 24 and 25 at Jefferson Park in Walla Walla. For more information contact Pat Stewart, W7GVC, 1404 Ruth Ave., Walla Walla, Washington, 99362.

Wichita, Kansas
The combined clubs—The Wichita Amateur Radio Club, The Tec-ni-chat Club, and The Air Capital Amateur Radio Club will sponsor a hamfest on Sunday, Oct. 2 at the Osage Park Recreation Area, 31st Street South

[*Continued on page 107*]

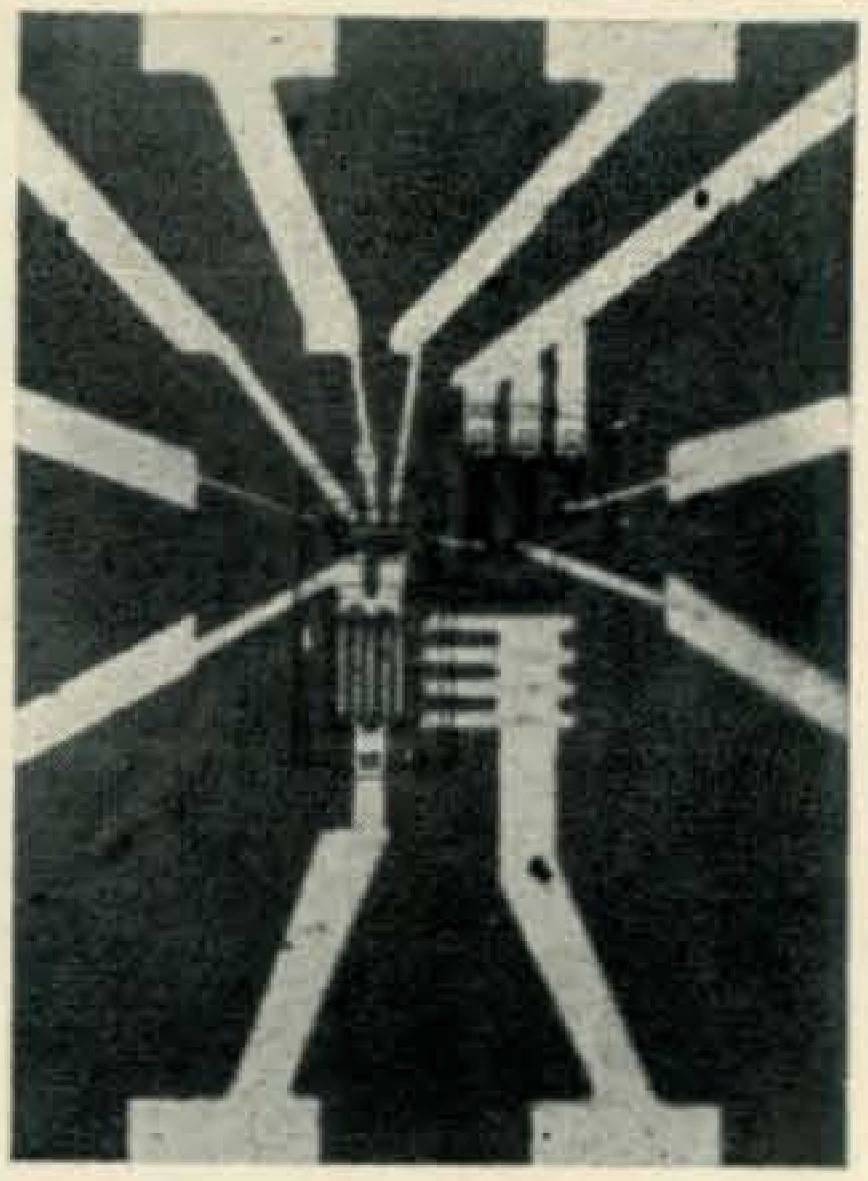


Fig. 1—Photomicrograph of a typical I.C. chip.

INTEGRATED CIRCUITS FOR AMATEUR RADIO

BY EDGAR A. SACK,* W3NRG

CLOSE on the heels of the transistor revolution comes another major technological innovation which is likely to have at least equivalent impact on modern electronics. This innovation is the integrated circuit or I.C. Nearly every branch of electronics, including amateur radio, will soon appreciate its benefits.

Basically, an integrated circuit is a chip of silicon, equivalent in size to a low or medium power transistor, which contains all of the circuitry required to perform a complete electronic function. Figure 1 is a photomicrograph of a typical chip. Transistors and diodes are formed in the I.C. by processes quite similar to those employed for diffused transistors; adaptations of these same processes add resistors, capacitors, zener diodes and interconnections to the solid structure. Research now underway may even make it possible to perform the function of an inductance in the I.C. although, at present, inductance and large value or variable capacitance are still implemented in their more conventional forms when I.C.'s are used.

The first major applications of I.C.'s have been in digital or switching circuits. They are now used extensively in computers for military systems such as Minuteman and are being incorporated in nearly every new system announced by companies in the industrial and commercial computer fields. Linear I.C.'s, which are of primary interest to the amateur, have lagged a bit behind the digital circuits, in part because they are somewhat more difficult to make and in part because the demand for any one circuit has been too small to bring about rapid production cost reduction. Fortunately for the amateur, this picture is now changing.

It is interesting to note that reduction in size and weight of electronic apparatus has *not* been the major reason for enthusiastic acceptance of the I.C. True, equipment built about these new components is often an order of magnitude smaller than its more conventional predecessor. The real factors behind the spectacular acceptance of the I.C. have been significantly reduced costs and demonstrably better reliability. The digital I.C. which contains perhaps a dozen transistors and several dozen diodes, capacitors and resistors now costs little more than two or three separate transistors of comparable quality. Because many of the external interconnections which are required in conventional circuitry are now built right into the I.C. silicon chip, tests prove that reliability is significantly enhanced.

Certainly, the amateur is interested in the reliability and weight of his gear. The real benefit which the I.C. offers him, however, is the promise of lower cost for equal or better performance than he now gets with discrete components. If the entire speech amplifier in his rig costs little more than one of the transistors (or tubes) he

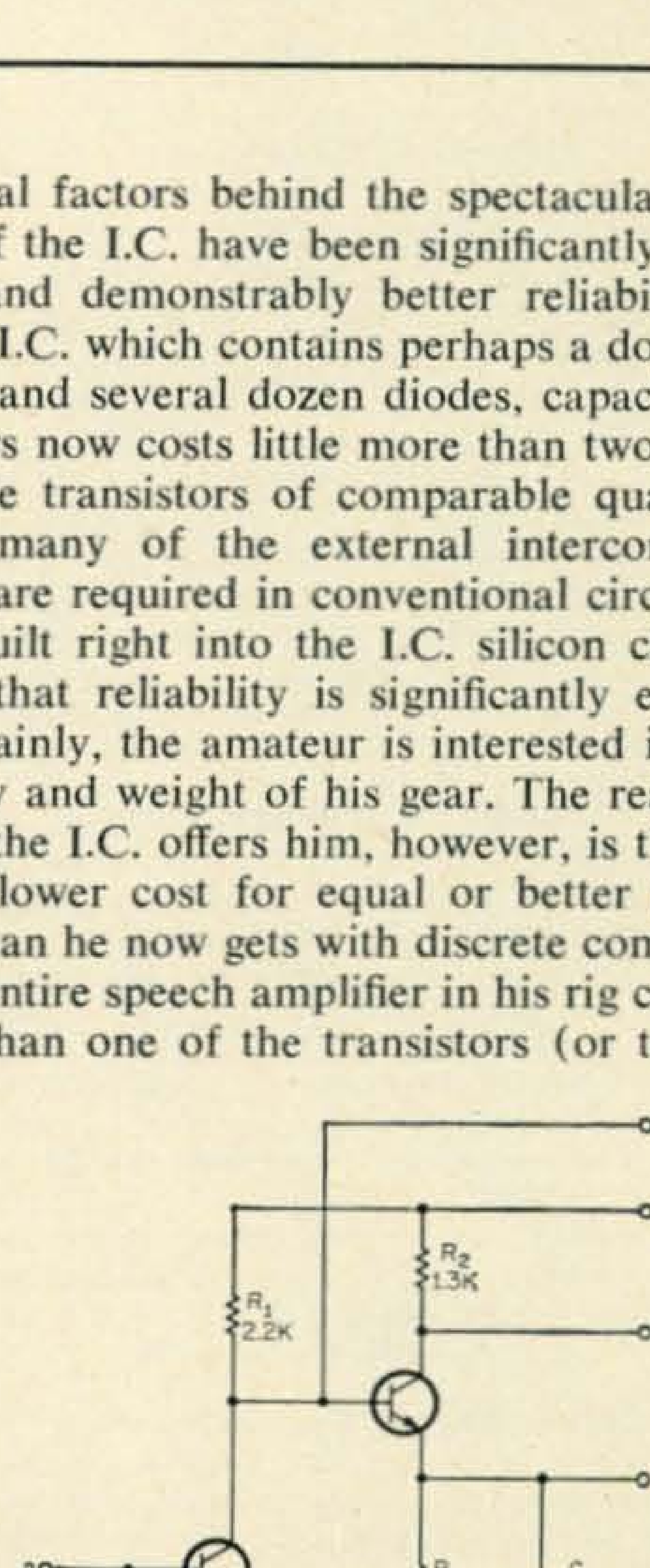


Fig. 2—Equivalent circuit and frequency response of the WC1146 video amplifier.

*48 St. Andrews Drive, Severna Park, Maryland.

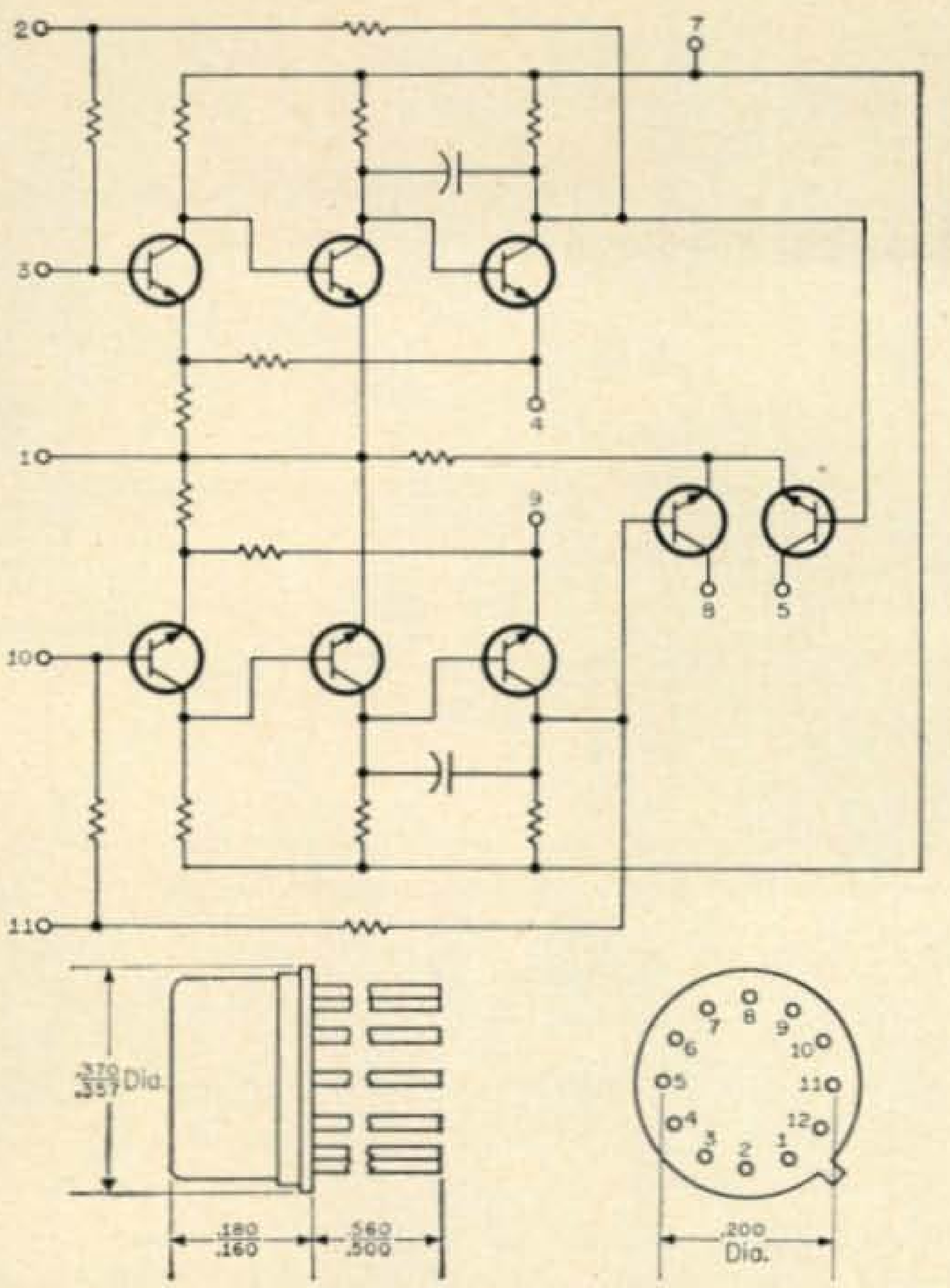


Fig. 3—Equivalent circuit and package of the WC183T Class B audio amplifier.

now uses, equipment cost must come down. The amateur can get more "electronics" for his hobby dollar.

Linear I.C.'s Now Available

Two of the most interesting linear I.C.'s now available to the radio amateur or experimenter are the WC1146T and the WC183T manufactured by the Westinghouse Electric Corporation, Elkridge, Maryland.[1] The WC1146T is a wide band (video) amplifier which provides more than 23 db gain over a band extending from d.c. to 40 mc. The frequency response and equivalent circuit of the unit are shown in fig. 2. With the addition of a few external components, the unit can perform as an audio, i.f. or r.f. amplifier. It may also be used as an oscillator or an oscillator/mixer. Because of internal feedback in this I.C., it is remarkably stable with variations in voltage or temperature and two or more of the units may be connected together to achieve gains as high as 60 to 90 db.

The WC183T is a high gain audio amplifier with class B output; its equivalent circuit is shown in fig. 3. Using a single battery cell (1.5 volts) as a power supply, it can provide over 72 db audio frequency gain. With a 4.5 volt power supply, the unit achieves over 94 db gain and can provide 45 milliwatts output. Among the applications suggested for the WC183T are as a microphone or speech amplifier, low power modulator or as the complete audio section of a portable receiver.

[1]For a list of distributors who stock these I.C.'s write to Manager Marketing Services, Westinghouse Electric Corporation, Box 7377, Elkridge, Maryland, 21227.

Packaging

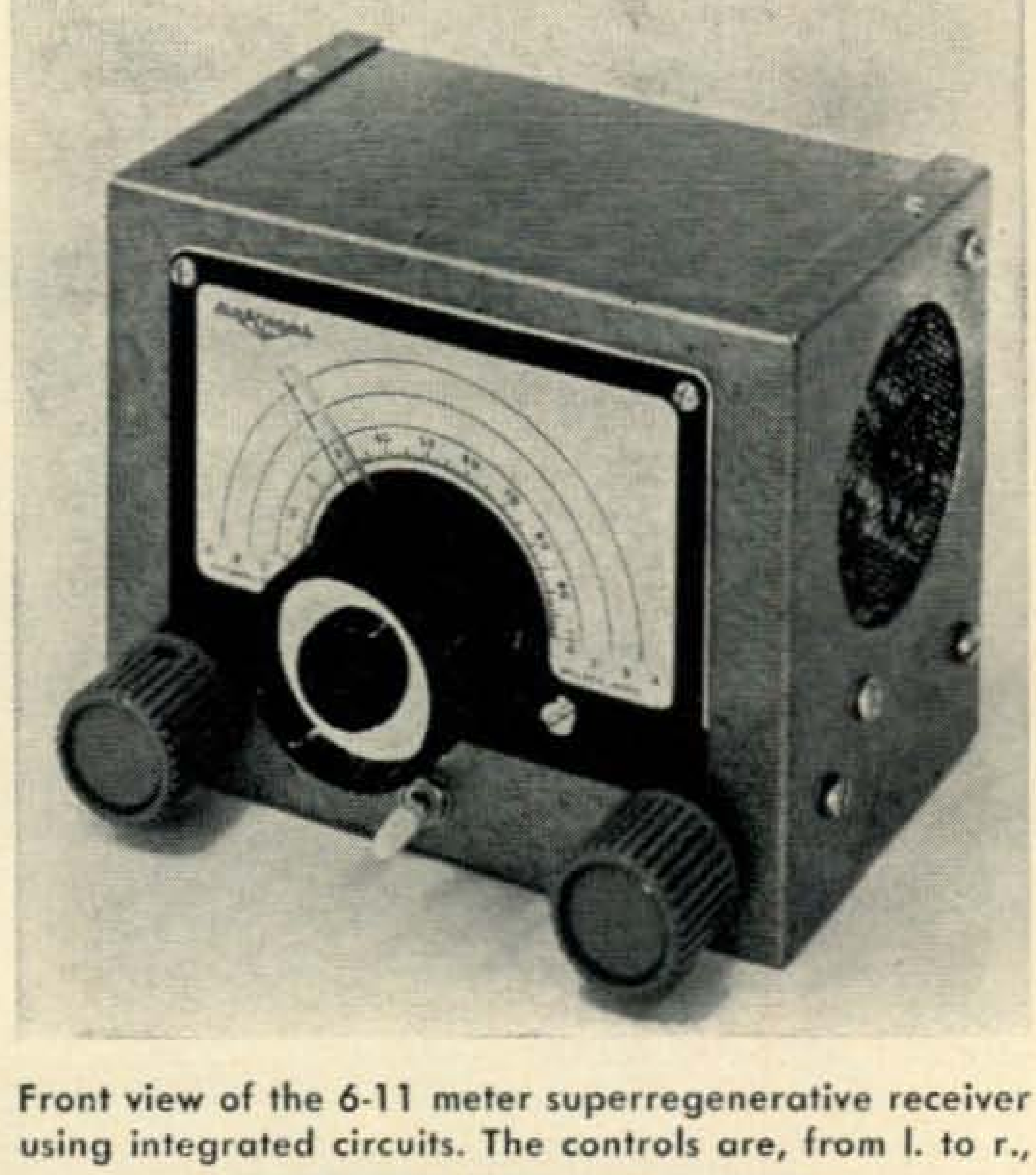
Both of these I.C.'s are packaged in a "can" quite similar to the type employed for conventional small transistors. The only difference is in the number of leads which are brought out; the WC1146T is encapsulated in an 8 pin "TO5" while the WC183T has 12 pins on the can. Sockets are available for these packages but most experimenters will find it more practical to solder the leads directly into the circuit using either a terminal strip, printed circuit board or other components for support.

It is interesting to note that many experimenters find that I.C.'s are actually easier to work with than transistors. First of all, because most of the bias and bypass components normally required in transistor stages are already formed within the I.C., the time consuming task of locating these components and soldering them together is largely eliminated. In addition, most of the transistors in the I.C. are connected to the terminals through current limiting resistors so that the inevitable accidents which might blow out transistors in conventional experimental breadboards are less likely to be fatal to I.C.'s. Of course, it is still necessary to observe maximum ratings with I.C.'s as with any component; these ratings are clearly noted in the data sheets provided by the manufacturer.

6-11 Meter Superregenerative Receiver

Figure 4 shows a simple schematic in which a WC1146T and a WC183T are combined to provide a superregenerative reception for the 8 to 11 meter range. By reducing the tuning capacitance in the input tank, the tuning range can be extended to cover the 6 meter band.

The WC1146T functions as an oscillating detector, tuned by tank circuit, L_1, C_4 and C_1. The



Front view of the 6-11 meter superregenerative receiver using integrated circuits. The controls are, from l. to r., REGENERATION, MAIN TUNING, VOLUME.

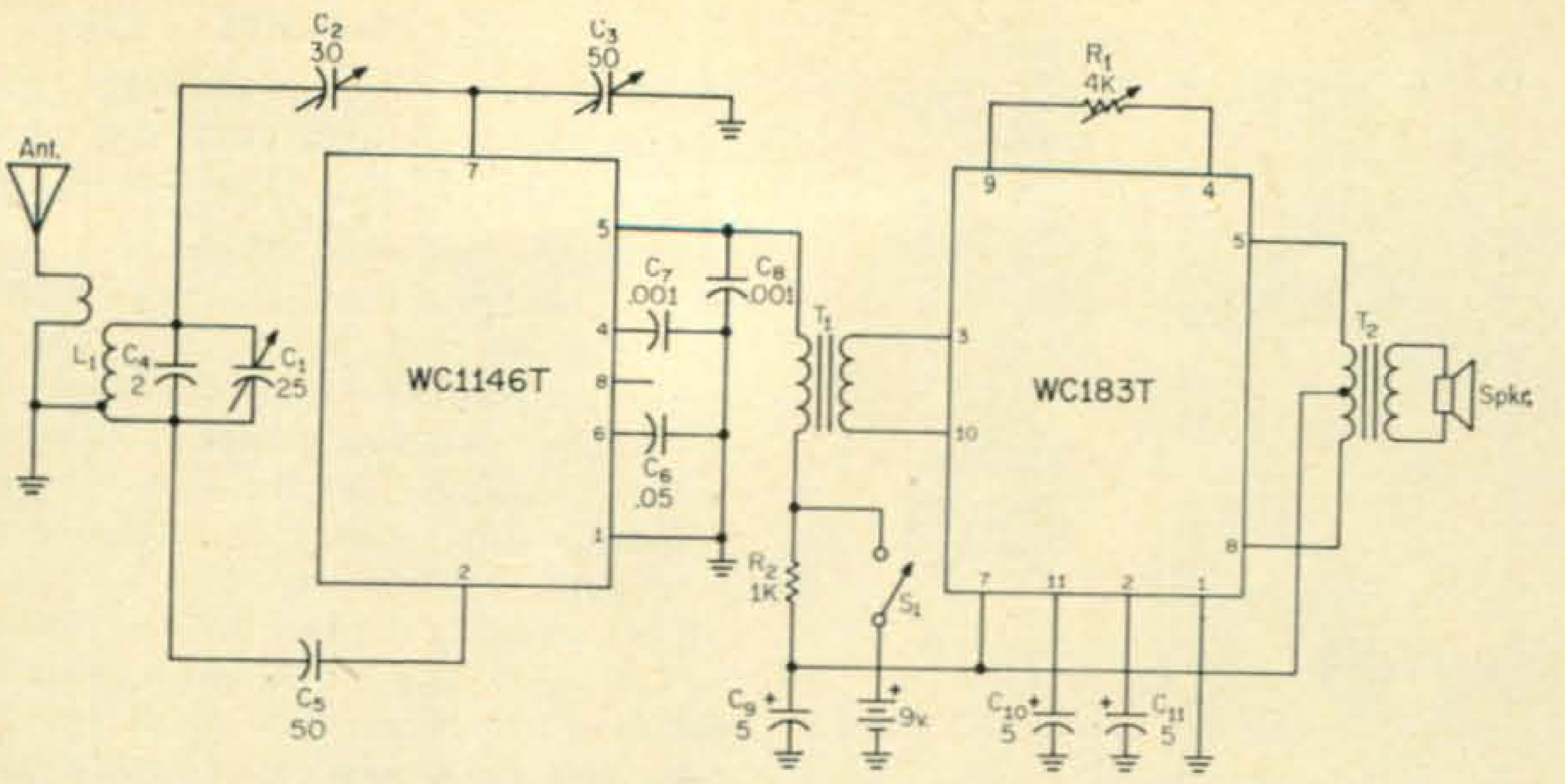


Fig. 4—Circuit for an 6-11 meter superregenerative receiver. All capacitors with values greater than one are in mmf; those less than one are in mf. Capacitors with polarities marked are electrolytics, in mf.

L_1—13 t #20, ¾" dia., tapped 2½ turns from base end. Ant. link is one turn loop on the collector end.

T_1—5000/7500, Thordarson TR2 or equiv.
T_2—500/8, Thordarson TR102 or equiv.

squelch frequency for this stage is set by emitter capacitor C_6. Regeneration is controlled by a small air-variable, C_3, operating in conjunction with r.f. feedback trimmer, C_2. The r.f. signal enters the amplifier through coupling capacitor C_5; capacitors C_7 and C_8 serve to bypass the r.f. to ground in the audio and power supply branches of the circuit.

The detected audio signal is applied to the WC183T through interstage transformer T_1. The center-taps on the transformer are not used. Audio output from the I.C. is coupled to the speaker through transformer T_2. The volume control, R_1, adjusts the degeneration in the emitter circuit of the WC183T driver stage; audio gain is maximum with minimum value of R_1. Capacitors C_{10} and C_{11} serve to decouple the d.c. feedback path in the I.C. and network R_2-C_9 provides power supply current.

Because both of the I.C.'s used in the receiver are high gain stages, normal precautions must be observed in lead dress and component placement. This is particularly true of the WC183T where output and input wiring should be well separated in the layout.

Figure 5 shows a model of the receiver assembled in a chassis. The main tuning capacitor, C_1, and regeneration control, C_3, are mounted on the front panel as is volume control, R_1. The radio frequency portion of the receiver is to the right of tuning capacitor, C_1. Visible in the photograph are the WC-1146T integrated circuit, inductance, L_1, and trimmer capacitor, C_2. To the left of the tuning capacitor is the audio amplifier stage including integrated circuit WC-183T, and output transformer, T_2. Coupling transformer, T_1, and the various decoupling capacitors for the audio and r.f. stages are tied to terminal points below the circuit board. As is true with any high frequency equipment, r.f. wiring should be as tight as possible and the r.f. and audio sections should be separated. The input and output wiring of the audio section should also be spaced to avoid feedback around the high gain WC-183T amplifier.

[*Continued on page 102*]

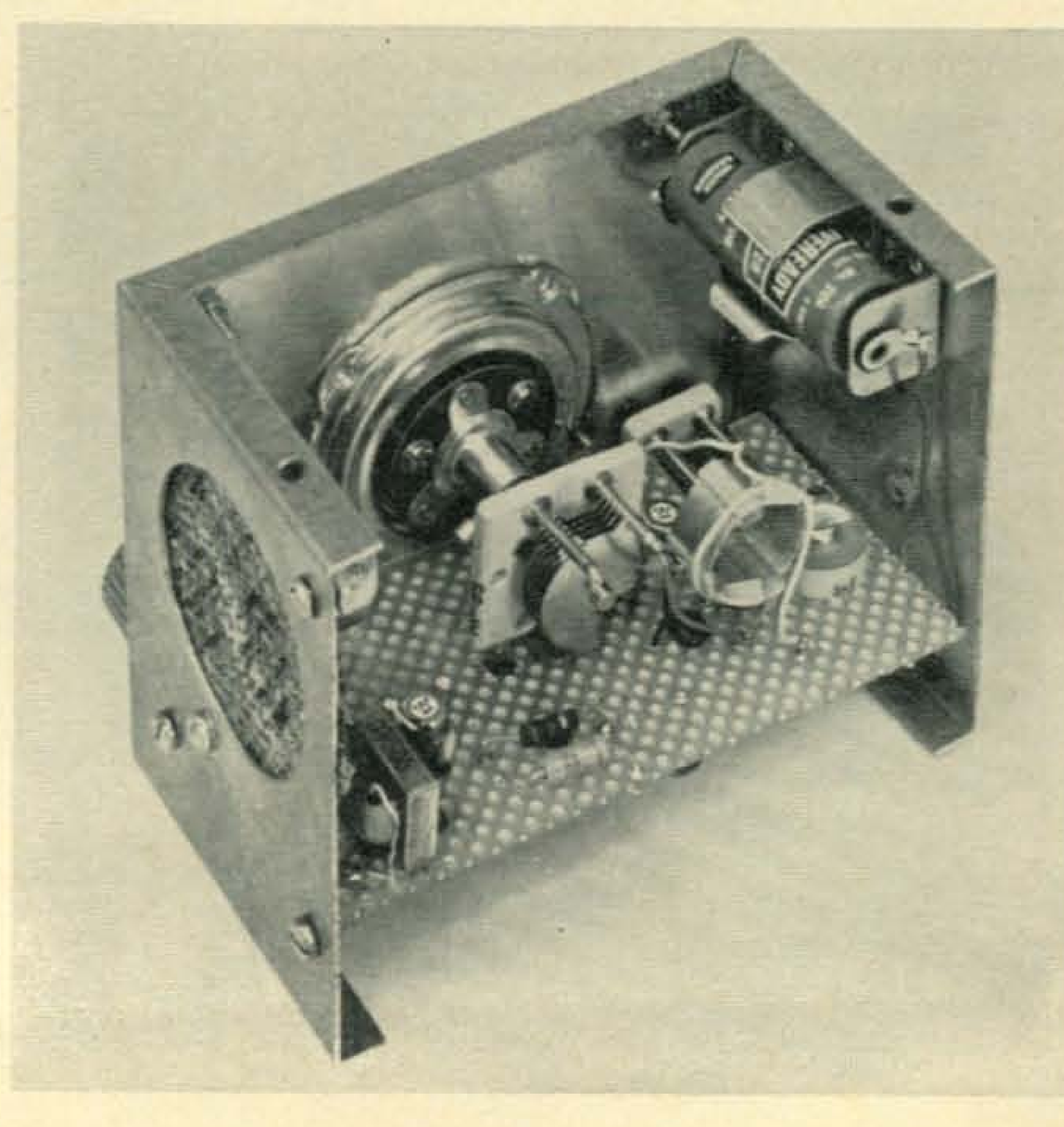


Fig. 5—Interior view of the 6-11 meter superregenerative receiver using I.C.'s. The r.f. I.C. is between the coil and the main tuning capacitor. The audio I.C. is alongside T_2 on the left.

S.S.B. PEAK POWER INDICATOR

BY DAVID S. HORSELEY,* W6GWS

When operating sideband, monitoring the final plate current, as indicated by the milliammeter, is very inexact. The current, integrated over a fraction of a second by the meter movement, will vary with the voice and also will change from meter to meter. This is even more so at stations where there are various audio inputs such as a microphone, phone patch or tape recorder.

Scopes can be used but their indications are fleetingly transient; they are awkward to connect and are usually bulky and not very portable.

I recalled reading in an electrical journal some time ago how a string of resistors with neon bulbs had been used to evaluate inductive surge voltages due to switching transients. This system is also used to indicate audio signal levels in many tape recorders. These two points merged into one idea.

The transmission line to the 75 meter antenna was bridged with four resistors, as shown in fig. 1, and two neon bulbs. The two outer resistors limit the current through the bulbs when they are ignited and the two inner resistors control the ignition point.[1]

The chart shown in fig. 2 illustrates the approximate voltages that will appear across the transmission line for various output powers and impedances. The computation is based on the formula, $W=E^2/R$.

The bulbs require about one watt of energy for proper operation. Like most hams, every erg of energy was being coaxed out of the final in the direction of the antenna. However, the absence of one watt we feel will go unnoticed by the suffering listeners.

Calcultaing the total resistance of the divider is fairly simple since the wattage dissipated will be one watt we have $R=E^2/W$ or $R=E\ /I$ or $R=E^2$. As an example, if we are using a 52 ohm line with a 400 watt output, the transmission line voltage will be 144 volts. Then R total equals 144^2 or about 21K to give us our starting point.

None of the four values need be known with precision as it is really a case of making the shoe fit the foot. The cut and try procedure is outlined below.

A thousand cycle tone is fed into the mike line from the phone patch (test tone, courtesy of Ma Bell) or from an audio oscillator. The A.F. GAIN CONTROL, previously turned all the way down, is now advanced slowly until the d.c. power input is between 75% to 90% of maximum (your choice). Adjust the values of R_2 (and R_1 if necessary) so that I_1 ignites. Kill the power while making the adjustments.)

Now advance the A.F. GAIN so that the maximum power input is obtained. Adjust the value of R_3 so that I_2 ignites. Be sure to recheck the ignition point of I_1 as a variation in R_3 could shift it.

As I work 75 now, I_1 lights. If I apply too much sibilance or articulation the other bulb lights revealing my goofing or the failure of the a.l.c. After years of practice on a.m. I can adjust my speech and the placement of the mike to hold down the level of the sibilant sounds.

When monitoring other voices the neon action is a good clue to the setting needed on the Waters Compreamp in use at this QTH. ■

*3929 Kentucky Drive, Hollywood 28, California.

[1]It should be noted that the insertion of this indicating device on the feedline may give rise to TVI. *Ed.*

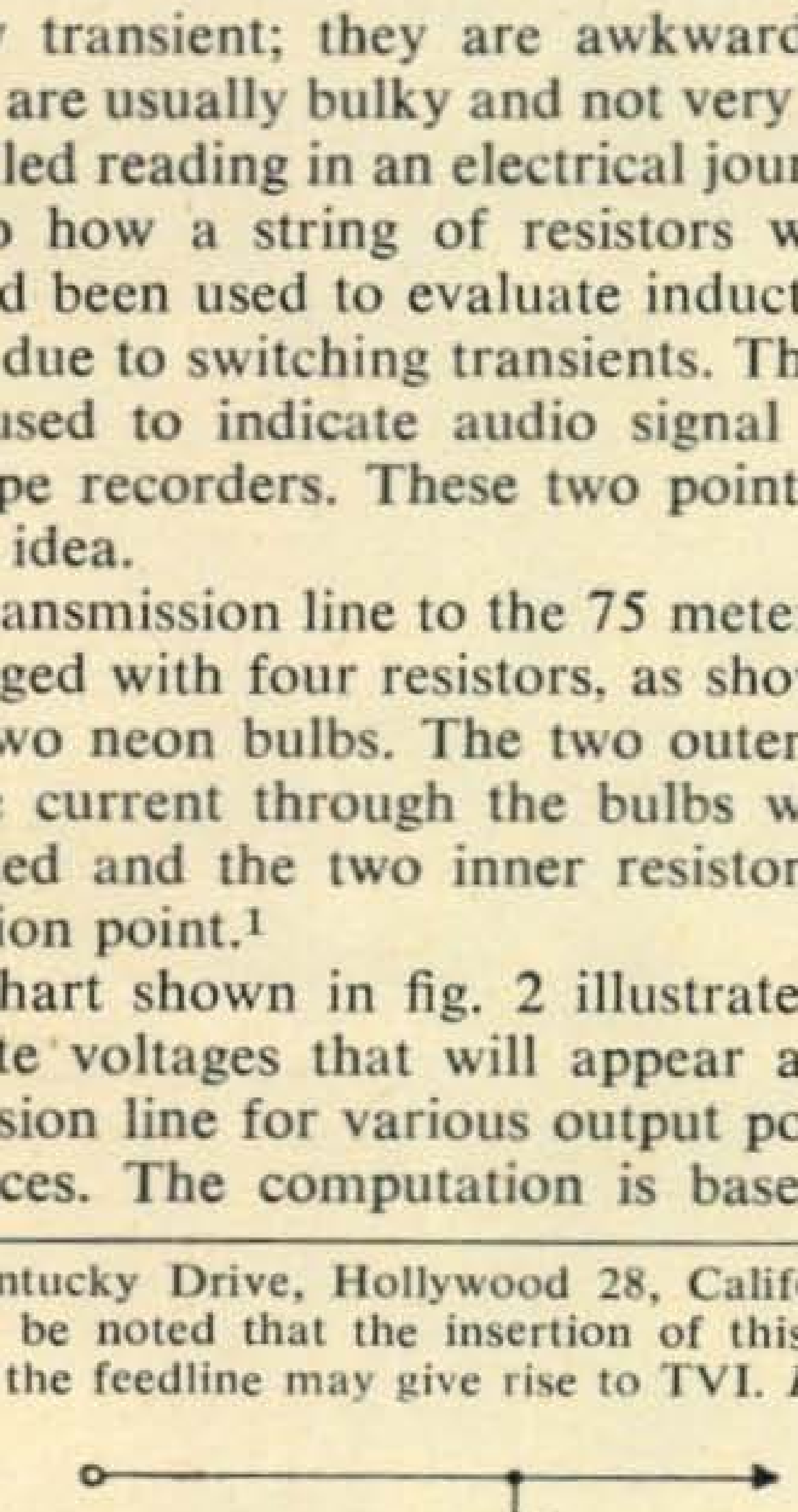


Fig. 1—Circuit of the peak power indicator. The neon bulbs are NE2 types. The values of the resistors are determined as indicated in the text.

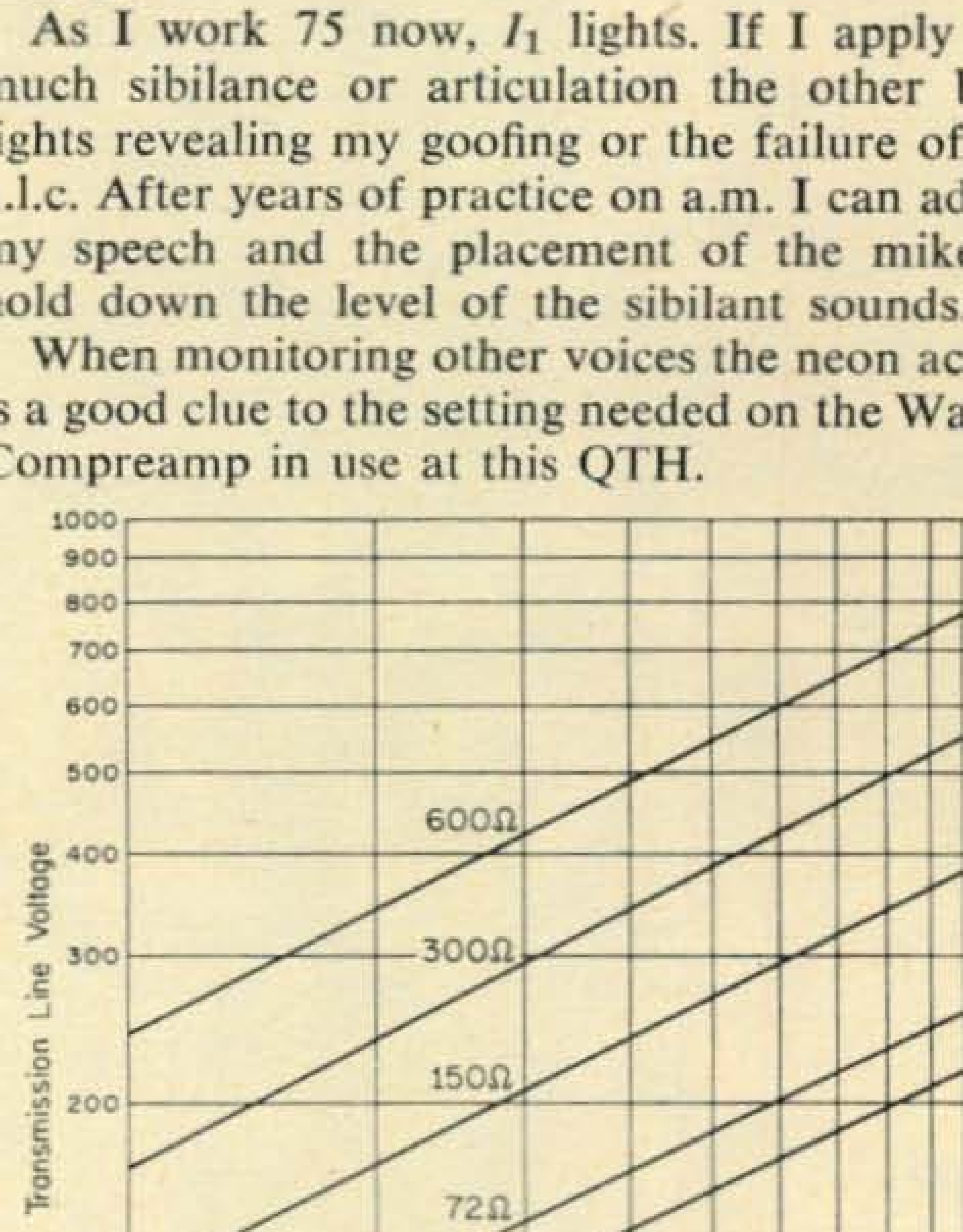
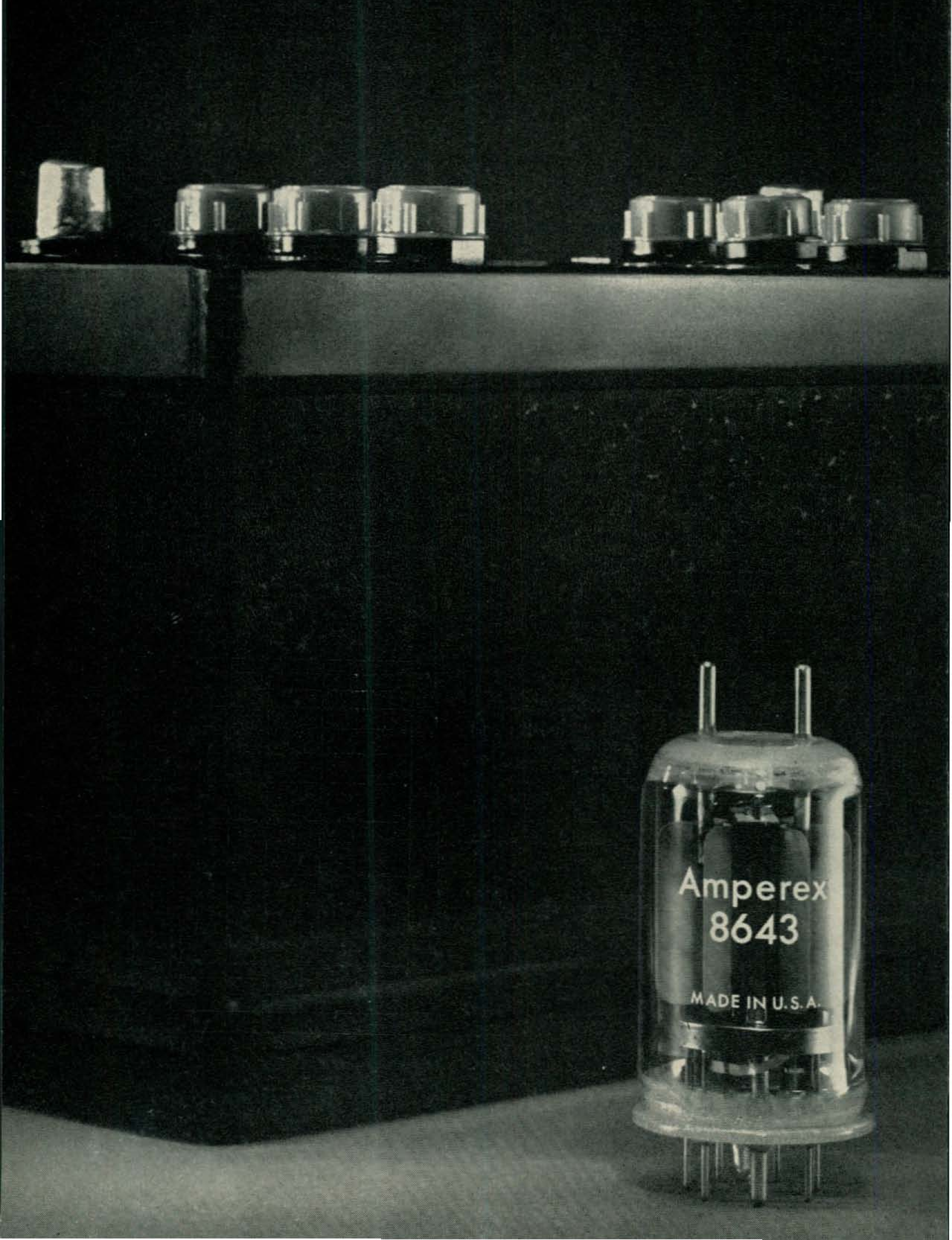


Fig. 2—Table indicating the voltage to be expected across transmission lines of various impedances for different output powers. The power output for s.s.b. operation is approximately 50 to 60% of the d.c. power input.

...and to take the curse out of fluctuating battery voltage in mobile communications, there's the new Amperex 8643...

with a new, wide-range cathode



There's a new Amperex cathode in a new Amperex tube, which was specifically designed to handle variations in power supply voltage.

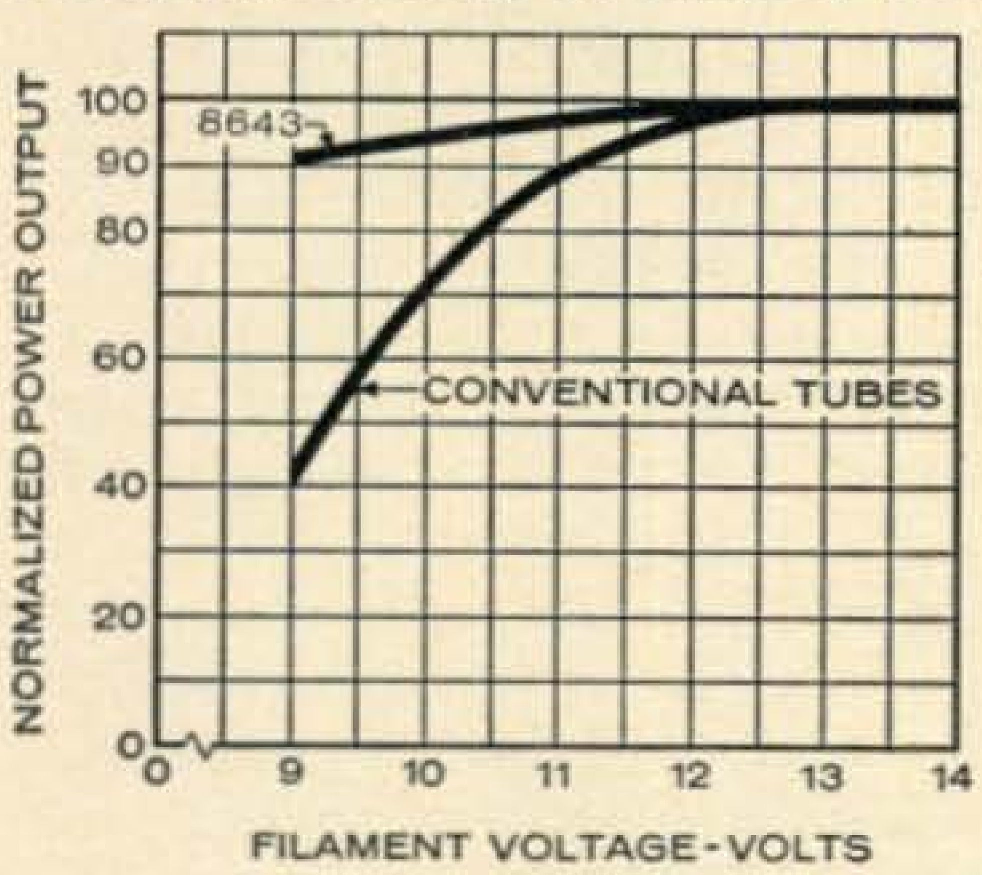
At its high end, this revolutionary, wide-range cathode is immune to high temperatures, and hence, to sublimation; at its low end, it insures adequate talk-power for any emergency!

Now, whether the battery delivers as little as ten volts or as much as sixteen—(all other parameters constant) the end result is the same—never less than 90% of full talk-power and no danger of damage to the tube!

The new cathode is being made available for the first time with the introduction of a new Amperex twin tetrode, the 8643, forerunner of a family of wide-range cathode tubes for mobile equipment.

The 8643 was designed for use as an RF power amplifier, oscillator and frequency multiplier up to 175Mc. It is rated for Push-To-Talk Service, capable of producing 135 watts from less than 4 watts drive as a 175Mc amplifier under PTTS conditions.

POWER PERFORMANCE vs. CATHODE VOLTAGE



PUSH-PULL FM AMPLIFIER (HEAT SINK OPERATION)

	ICAS (175Mc)	PTTS* (175Mc)
Plate Voltage (Volts)	750	750
DC Plate Current (ma)	240	264
Drive Power (Watts)	3.5	4.0
Useful Power Output (Watts)	123.0	135.0

*PUSH-TO-TALK SERVICE, MAX. DUTY CYCLE 1 MIN. ON, 4 MINS. OFF.

For data on the 8643 and other Amperex twin tetrodes for mobile communications, write: Amperex Electronic Corporation, Tube Division, Hicksville, L. I., New York 11802.

Amperex®

For further information, check number 17, on page 110

Results of the

7th Annual *CQ* 160 M. C.W. Contest

BY CHARLES M. O'BRIEN,* W2EQS

WOULDN'T it be just plain wonderful if Top Band conditions were to remain constant and not vary to the degree they did during the past season? Yet to hear some of the boys complaining you'd think conditions had been so bad that no one with the exception of the most confirmed optimist would bother going on. But, aren't many of us optimists to some degree? We look for that dark cloud with the silver lining . . . we turn on the rigs with hopeful expectation that conditions are just right. Many times those hopes come true; other times . . . utter frustration. It's all in the game, though, and if things aren't right today, well, tomorrow is another day.

We missed out on the most terrific DX opening ever heard on 160 by one week (week-end January 22/23) when the Gs were like locals and QRMing each other so as to make it difficult to identify not only many of them but other countries as well. Last year the peak conditions came but two days after. What would it have been like were we to have hit this 1966 opening right on the nose? The conditions to Europe/Africa were very poor Saturday but fine to the Caribbean area, South and Central America and the west coast of the United States and Canada. At local sunrise here on the east coast signals from W6/W7/VE7 peaked to terrific strength. Saturday night/Sunday morning conditions were very poor. Then, suddenly, Europe started coming in at 0200Z (an odd hour for the most part) and remained until 0430Z. Under normal conditions they stay with us until 0730Z or later. In this sector of the country we were getting a snow storm with resultant heavy QRN. Nevertheless, the west coast signals again came through in good shape but nothing like the previous morning. Their signals gradually QSB out *before* sunrise and never did peak as the previous morning. By 0900Z practically everyone on the band had worked each other. CQ after CQ was to be heard with very few takers. Many short rag chews were to be heard comparing notes, etc. Where did all the gang go? Guess the poor conditions had many of 'em saying, "Why waste time and lose sleep?" So, off to bed they must have gone. Oddly enough, though, regardless of conditions, 9L1HX had a good signal both nights.

Tommy, G6QB, the late DX Editor of *Short Wave Magazine*, had this to say: "I was wondering what on earth went wrong with conditions when I read in the paper about the earth having an immense solar storm—probably a prelude to increased sunspot activity, first of the new cycle. Expect that accounts for it."

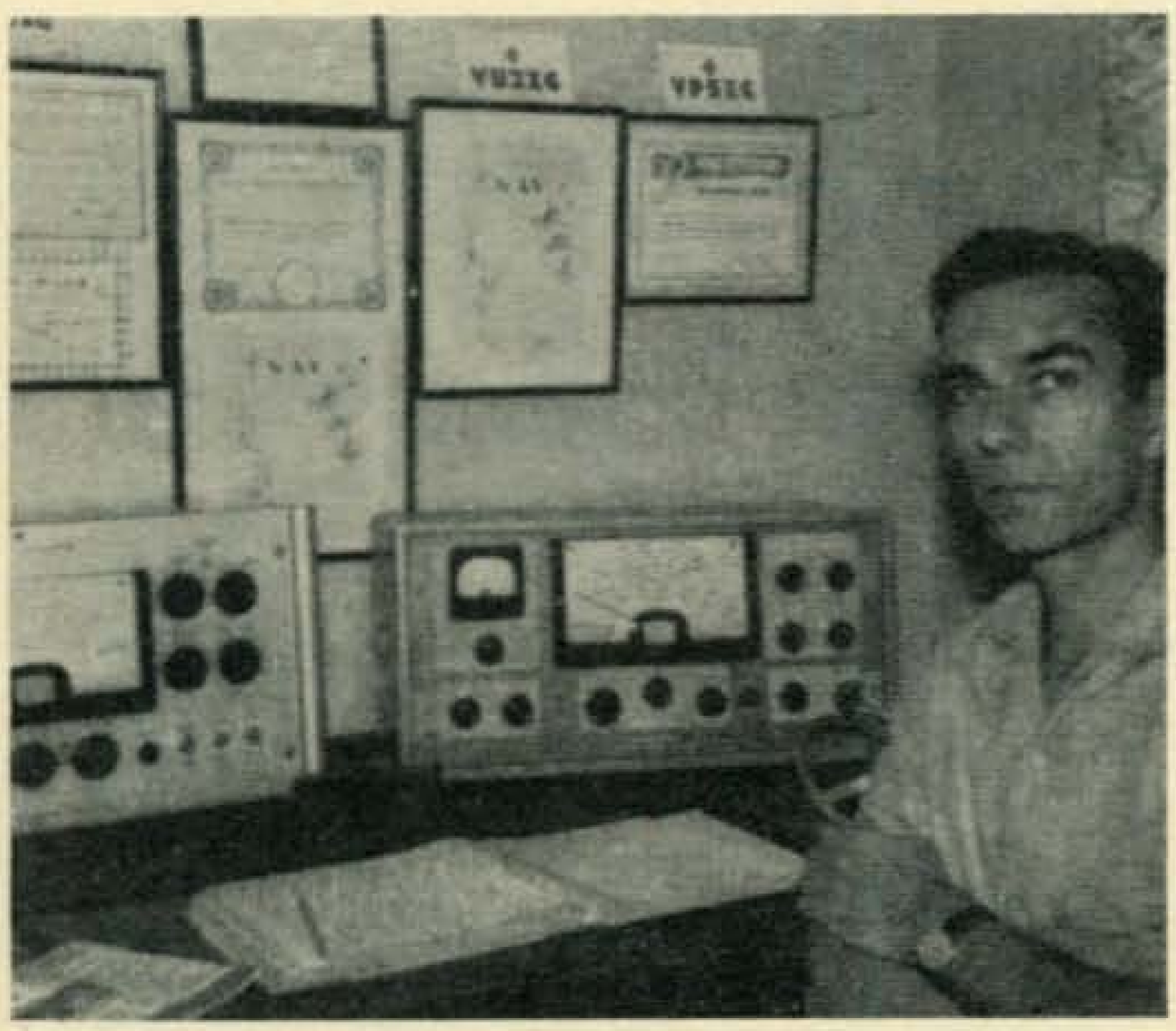
And, the fact that the over-all number of QSOs per station was off from last years' record shattering total lends further credence to the poor conditions we were subjected to.

Regardless of how you considered conditions there were still 1,194 stations that participated from a record breaking 49 States, 8 Canadian Provinces and 30 DX countries. Last year there was no activity from South Carolina and Hawaii. This year we had a number of participants from the former and two from the latter. The only State from which no activity occurred this year was Idaho. Of the 49 States participating, logs were received from all but Oklahoma.

Rules, regulations and logs were sent to stations in 57 different countries that are known to permit amateur operation on Top Band. Of this total, 32 countries are known to have participated. Since we received logs from 24, what happened to those other 8 who didn't submit theirs?

There is many a doubting Thomas amongst us who still can't visualize the DX potential that 160 holds. So, let us see what was on: DJ/DL, EI, G, GC, GD, GI, GM, GW, HB, HI, HK, HP, KH6, KL7, KV4, LZ, OE, OH, OHØ, OK, PAØ, VK, VP7, XE, ZB2, ZL, 4U1, 6Y5, 9L1, 9M4. What's the breakdown of participating

*48 Prospect Avenue, Westwood, N. J. 07675.



Pete Wingle, 6Y5XG. We'll sure miss his potent signal from Jamaica. Next contest he'll be operating from home in G-land.

stations by country? This may be of interest to you:

W/K	579	HI	1	OK	101
VE/VO	30	HK	1	PAØ	3
DJ/DL	25	HP	1	VK	2
EI	2	KH6	2	VP7	1
G	367	KL7	1	XE	2
GC	1	KV4	1	ZB2	2
GD	3	LZ	1	ZL	1
GI	9	OE	7	4U1	1
GM	14	OH	4	6Y5	2
GW	16	OHØ	1	9L1	1
HB	10			9M4	2

How was activity spread out across the United States and Canada? Let us make another listing of stations participating by district:

1st	37	7th	67	VE1	3
2d	92	8th	116	VE2	7
3d	42	9th	54	VE3	8
4th	49	10th	36	VE5	2
5th	23	VO	2	VE6	3
6th	63			VE7	5

May we once again make this request? Please be sure to sign your call letters to your logs. A few were very neatly recorded, but no indication of the call. Through a time consuming process of checking we were finally able to determine whose they were.

An important point for the DX boys to note: A QSO to each separate State and Canadian Province gives you an extra multiplier plus the 10 points for such a contact. But, on top of this you cannot count the United States and Canada/Newfoundland as separate multipliers, too, as some did.

For all of you to make note of . . . this is a c.w.-to-c.w. Contest only. C.w.-to-phone QSOs are not permitted nor are any cross-band contacts allowed. For the sake of awards, and in lieu of QSL, *CQ* will honor all listings within the logs received as sufficient proof of contact. And, we do not believe we are out of line in stating that ARRL will, likewise, agree on this point for any of their awards.

This Contest is a yearly event that is scheduled to run the last week-end of January. There is one change to be made in that the contest will commence two hours earlier than heretofore and run for 38 hours rather than 36 as in the past. Next year activity will commence 0001 GMT Saturday, January 28 and conclude at 0900 GMT Sunday, January 29.

A most attractive certificate shall be sent the winners in each State, Province and DX country and in cases where scores are close, a certificate shall be sent to second and third place contestants.

Comments? What Contest summary would be complete without them! This makes for interesting reading matter so let's get to it. . . .

1st District

W1BB/1: Didn't do as well as last year. Either getting older or spent too much time "digging in the mud" for the weak ones. Sunday morning came out of stone house at base of "tower" and found heavy snow storm in progress. Car almost buried in drift—dug it out—came home—shoveled walks—hit hay for pleasant Sunday snooze. All in all it was, condx notwithstanding, a GRAND affair! Wonderful to meet so many friends in yearly test; learned some lessons; enjoyed all of it. W1HLY: I didn't realize that 160 operation was so slim in this State (Rhode Island). I will give the Contest more consideration next year. K1OYB/1: We again used the 175′ vertical at WJAB. The antenna, along with its fabulous ground system, really dragged in the signals. K1NBN: Again a fine Contest but conditions not too great. Where was Rhode Island? [Many of us asked the same question—*Ed*.]. W1WY: A very disappointing week-end. Very few DX stations coming thru and those that did weren't consistent. Week before, the band was wide open. Activity down to almost nil during closing hours. Only a few of the diehards stayed on. Still very little activity in the two middle portions of the band.

Top Ten World-Wide

W8HGW	35,880	WA9AMZ	22,680
WØVXO	33,858	K2DGT	22,272
K8RRH	28,652	W9YYG	20,604
DL1FF	27,540	W8TJQ	20,564
W3EIS	25,398	W7VGQ	20,022

2nd District

W2UWD: This fine Contest seems to get better every year. K2DGT: As always, I got a big kick out of this event and enjoyed the fine operating tactics of all the boys. Signal levels appeared to be down from all areas, though. Was amazed to find the band open up to 600 miles right thru the morning and into the early afternoon hours. What happened to the "D-Layer" absorption? WA2KIZ: This is the first time I have entered this Contest and was very surprised at the activity. Toward end of Contest I found I was being called by stations which I had worked before. To me this indicates these stations weren't using check lists which I have found to be a necessity for contests. [How true—*Ed*.]; WB2LFL: Great contest. Who made me get on 160 anyway? K2GAL: I like this darn contest. WA2HLH: One of the greatest contests that I have entered. Was really surprised at the sound of the band during the first hour. There was more QRM than during the SS on 80. The strength of some of the stations was just fantastic. W4/8/9/Ø were coming in between S 5/9 at mid-day!

3rd District

K3NYG (Del.): During contest I ran 50 watts input. After contest I checked output. Only 7.5 watts to the antenna. Now I don't feel so bad with such a low score. W3EIS: How about changing the rules to help those of us who can't switch from East to West bands for more QSOs? [OM: You are in competition *only* with stations in your own State—*Ed*.]. Was doing fine until 0130Z Sunday when snow static from the 12″ blizzard wiped out all but S9 signals for 90% of the time for an 11 hour period.

Brice Anderson, W9PNE, of Lancaster, Illinois. With the QRP he has you should see his DX total.

The first column indicates the number of contacts, second is the multiplier, third is the number of different countries worked and the last column is the final score.

Connecticut

W1WY	179	42	5	16,380
K1PBW	155	41	3	13,038

Maine

K1OYB/1	133	46	9	15,916
W1UOT	98	25	2	4,900

Massachusetts

W1BB/1	121	36	5	13,968
W1PH	44	14	2	1,232
WA1CAG	18	9	2	324

New Hampshire

K1NBN	122	28	2	6,832

Rhode Island

W1HLY	3	2	1	12

Vermont

W1TH	41	18	2	1,476

New Jersey

W2EQS	184	46	7	19,176
W2IU	153	45	5	14,850
K2GAL	158	44	4	14,608
W2HUG	105	29	3	6,322
W2AQT	77	19	2	2,926
WB2OZW	35	10	2	700
WA2IZS	23	10	1	460
W2FPM	9	4	1	72

New York

K2DGT	188	48	8	22,272
W2UWD	171	49	6	18,718
WB2MFX	149	41	4	12,874
K2GNC	141	36	4	10,628
WA2HLH	121	32	2	7,744
WA2KIZ	121	30	3	7,500
W2GP	88	26	2	4,576
W2HAE	81	28	2	4,536
WB2LFL	66	19	2	2,508
WB2LUW/2	60	18	2	2,160
W2ZSD	15	7	1	210
WA2KSD	6	3	1	36

Delaware

W3EJU	43	17	2	1,402
K3NYG	39	15	1	1,170

Maryland

W3EIS	209	51	10	25,398
W3MSR	107	29	2	6,206

Pennsylvania

W3BUR	180	45	3	16,605
W3AJS	91	29	2	5,278

Alabama

W4OGT	54	24	2	2,592

Florida

W4WHK	90	32	6	8,268
K4IXG	57	29	5	4,002

Georgia

K4BAI/4	86	29	2	4,988
K4DKJ	13	11	1	286

Kentucky

W4ZCM	115	41	3	9,758

North Carolina

WA4FJM	147	35	2	10,290
W4PVT	134	26	2	3,484

South Carolina

WA4LDM	42	22	3	2,024
W4IWB	39	24	2	1,872

Tennessee

W4SQE	100	38	2	7,600

Virginia

W4KFC	160	44	7	16,884
WØVEH/4	97	33	4	6,930
K4AXF	104	26	2	5,408
K4PCL	76	26	2	3,952
WA4PAE	26	9	1	234

Arkansas

WØGDH/5	106	45	2	9,540
WA5KUD	58	23	3	3,596

Louisiana

W5TTB	3	3	1	18

Mississippi

K5MZU	111	31	3	7,130

New Mexico

W5SOT	45	21	2	1,890
W5OXE	9	6	1	108

Texas

K5LIW/5	134	46	2	12,328
W5FIX	51	32	4	3,776

California

W6JTB	140	45	7	14,400
W6RW	135	47	6	14,194
WA6JPR	96	37	5	7,918
W6OST	92	33	3	6,336
W6GWQ	74	31	4	5,084
W6WX	72	27	4	4,320
WB6NNJ	22	9	2	396

Arizona

W7AYY	51	23	3	2,530
W7ENA	45	23	2	2,070

Montana

W7GBL	60	24	2	3,280

Nevada

K7ZRG	83	33	2	5,478
K7ICW	70	30	2	4,140

Oregon

W7LNG	70	30	4	4,680
K7MLO	50	20	2	2,000
W7JRI	37	13	2	962
W7EN	25	13	3	754

Utah

W7ZC	65	30	3	4,140
K7OEP/7	66	31	2	4,092

Washington

W7VGQ	181	47	8	20,022
W7RGL	78	33	3	5,412

Wyoming

W7UFB	72	36	2	5,040

Michigan

W8TJQ	182	53	5	20,564
W8DGP	183	48	3	17,952
W8FBX	122	40	3	10,080
K8CGM/8	124	37	4	9,768
WA8EMJ	109	35	3	7,910
W8CLH	75	28	2	4,200
K8UTT	72	27	2	3,888
W8ROV	63	27	1	3,402

Ohio

W8HGW	207	60	11	35,880
K8RRH	212	58	9	28,652
K8HKB	188	49	5	19,992
W8MJG	121	37	2	8,954
W8YAT	65	29	2	3,770
W8PCS	58	28	1	2,248
W8VDF/8	18	14	2	404

West Virginia

W8PQQ	99	37	2	7,326
W8HZA	75	26	2	3,900
K8NNG	53	19	1	2,014
WA8DOY	37	14	2	1,036

Illinois

W9YYG	190	51	5	20,604
WA9GUO	125	44	2	11,000
W9PNE	74	33	3	5,148
K9WXA	76	33	2	5,016
W9LNQ	22	17	2	748

Indiana

WA9AMZ	194	54	6	22,680

Wisconsin

WA9GAR	134	45	3	12,420

Colorado

WAØCVS	86	36	2	6,192

Iowa

WØNFL	124	46	3	11,776
WØDRE	66	36	2	4,752

Kansas

WØPSF/Ø	108	39	2	8,424

Minnesota

WØVXO	225	62	12	33,858
WØRHI	90	37	2	6,660

Missouri

WØOGC	60	33	2	3,960
KØYGR	59	31	2	3,458

Nebraska

WØDTT	65	36	2	4,680

North Dakota

WØSDN	129	43	3	11,352

South Dakota

K1CAU/Ø	90	41	2	7,380

Newfoundland

VO1FB	58	27	8	7,020
VO1HN	30	17	4	1,700

New Brunswick

VE1TW	2	2	1	4

Nova Scotia

VE1ZZ	63	16	7	4,832

Quebec

VE2UQ	157	50	9	18,600
VE2ATU	61	22	2	2,684

Ontario

VE3DU	90	39	3	7,332

Saskatchewan

VE5JI	47	30	2	2,820

Alberta

VE6IZ	22	13	2	572

British Columbia

VE7AKI	84	36	3	6,624

Alands Islands

OHØNI	21	5	5	475

Alaska

KL7JDO	16	6	2	930

Australia

VK5KO	2	2	2	14

Austria

OE5CD	31	4	4	620

Colombia

HK4EB	13	9	3	990

Czechoslovakia

OK1IQ	119	16	16	7,392
OK1AHZ	122	12	12	5,568
OK1AEZ	102	13	13	4,862
OK1WT	101	13	13	4,537
OK3AKS	122	10	10	4,150
OK1AOX	93	10	10	2,970
OK1KDT	89	9	9	2,709
OK1KPX	81	9	9	2,547
OK1ALG	70	10	10	2,540
OK1KOK	79	9	9	2,528
OK1ZW	69	8	8	1,952
OK1AOV	66	7	7	1,358
OK1ADM	23	11	11	1,199
OL7ABI	51	7	7	1,141
OL1ACJ	48	6	6	1,044
OL6ACY	54	6	6	948
OK2HI	60	6	6	912
OL1AEE	54	5	5	810
OL6AAB	47	6	6	714
OK3BA	36	5	5	635
OK2BJU	40	5	5	565
OK3CDN	44	6	6	552
OK1AT	26	6	6	510
OK2LN	40	4	4	320
OK1AKS	32	4	4	296
OK2BCN	24	5	5	280
OK2BKW	30	4	4	232
OK3IF	25	3	3	204
OK1NK	22	4	4	184
OK1AKS	10	2	2	70
OK2BGN	4	2	2	22
OK1AII	1	1	1	2

Dominican Republic

HI8XAL	46	20	4	8,900

Eire

EI9J	87	18	12	8,820

England

G8NF	196	23	17	14,835
G3IGW	213	20	19	13,240
G3GBU	251	15	15	10,755
G4MH	174	17	15	9,401
G3KLH	212	13	13	8,073
G8FC	138	13	13	6,097
G3FVA/A	172	12	12	5,904
G5RP	165	12	12	5,760
G2DC	150	12	12	5,328
G3JVJ	116	13	13	4,368
G3GHN	125	10	10	3,570
G3HZL	86	10	10	2,390
G3SVD	68	7	7	1,225
G3MWZ	17	7	7	385

Finland

OH2SB	66	11	11	3,597
OH2KH	15	7	7	511
OH2HK	2	1	1	4

Germany

DL1FF	190	27	19	27,540
DL9KRA	155	22	16	17,138
DL8CM	120	13	13	7,202
DL8AM	120	12	12	6,732
DL1KB	108	11	10	5,687
DL1VW	60	11	11	3,862
DL1CF	60	9	9	2,502

Hawaii

KH6IJ	5	4	2	200

Isle of Man

GD3HQR	36	7	7	1,239

Jamaica

6Y5XG	54	29	8	14,703

Netherlands

PAØPN	44	10	8	2,400
PAØLOU	26	7	7	910

North Ireland

GI3OTV	69	8	8	2,544

Scotland

GM3KMR	129	12	12	7,488
GM3OXX	117	10	10	5,670

Sierra Leone

9L1HX	8	7	3	469

Singapore

9M4LP	10	4	4	308

Switzerland

HB9QA	91	14	14	6,118
HB9JG	84	11	11	4,455

United Nations

4U1ITU	61	8	8	2,440

Wales

GW3PMR	168	14	14	11,550
GW3GWX	93	11	11	4,972

Check logs are gratefully acknowledged from: GM3SVK; OK1AJY; OK1IJ; OK2QX; OL4ACF.

4th District

W4WHK: Fine Contest again this year. Worked my first W7s and doubt if I would have if it weren't for this test. Can hardly wait until next year and hope condx are as good. WA4FJM: Either the band was terrible this year or I got technical problems! Am checking the latter possibility. Never worked so long for so few QSOs. W4KFC: Enjoyed the contest as usual. Heard lots more I could usually raise but snow static wiped many of them out Saturday evening and suspect many others were similarly affected as the blizzard moved through the east. WA4PAE: The blizzard was much more fascinating; contest work is fun though. WA4LDM: Sure were lots of fun. K4DKJ: Sorry I could not operate any more reckon! W4IWB: The snow was falling and the shack was getting colder and colder so had to give up. Had lots of fun. K4DKJ: Sorry I could not operate any more but was just out of hospital. Condx were real good. The second night we set a record for it was the coldest day ever recorded here in middle Georgia—zero degrees.

5th District

WA5KUD: Tried my best to get in contest last year but my general ticket arrived a week *after* the affair took place. But you can plan on an Arkansas station as long as I'm here. W5SOT: East coasters were never strong. It was as if an electronic wall existed about in line with the Mississippi River. W5OXE: I was sorry not to have been able to participate more. Limited time on the 29th was unavoidable and power supply trouble in my transistorized v.f.o. did me in on the second day. Wait 'til next year!

6th District

W6RW: Los Angeles condx to the Pacific seemed much poorer than those experienced by stations north of us. For the most part, however, conditions were good. Activity might have been a bit down, unfortunately. Rain static plagued us the second night costing us at least one country although the six countries worked represents our best performance in the contest so far. W6JTB: Condx seemed to be even better than last year. As usual, all stations exhibited the high quality of sportsmanship characteristic of the Top Band operators. A very worthwhile contest. W6OST: More States on but fewer total ops. Some old timers missing. Always loads of fun. More fine operators on this one week-end than at any other time. As usual I was "an hour late and a dollar short" in QSOs. Maybe next year I can break 100 contacts. W6WX: You have my promise to be more "hep" for the next one. This appears to be a fun contest and I do hope it will be continued.

7th District

K7OEP/7: With a borrowed 280′ broadcast station vertical and the Great Salt Lake for a ground, I had a good transmitted signal, but had trouble on the receiver end with Loran, f.m. and a.m. QRM. Couldn't get s.w.r. reading because f.m. was diplexed on same antenna. The second night was much better than the first, contrary to usual, although I never heard any DX. K7MLO: Lots of fun once again. Poor response on second night but conditions good at this end. W7AYY: Lots of fun but, as per usual, with short whip antenna, I couldn't break into 1, 2, 3 or 4 land. Just as last year my best report came from XE2OK. W7VGQ: Enjoyed this fine contest to the fullest again this year. The highlight of the contest was I worked 9M4LP in Singapore and received RST 579. It was Bob's first W7 QSO. We again jumped for joy when HK4EB came back to us. Have worked 42 States and 10 countries on this band with due thanks to the last three 160 meter *CQ* Contests. This contest has done more to promote 160 activity than all other attempts combined. Let's see more of it. W7ZC: Always enjoy the 160 meter party. I don't know why I do it, though. I started out in 1919 and went the 150 meter route about 1923/24. Made WAS 'way back then. W7UFB: Oddly enough, I worked 98 less stations this year but 4 more sections. Had very little time to operate. Condx were good much of the time. Almost everyone was on to enjoy the contest.

8th District

W8HGW: A very good contest but the usual lack of stations Saturday night. Condx were just fair to Europe with only the best signals getting through. Where were the GM, GW, GI, EI boys? None heard here. Missed Vermont (W1TH) by seconds. He just disappeared. Had trouble with local QRM Saturday night due to a.m. phone protesting all the c.w. on band but I outlasted him. W8FBX: The 160 contest has become an annual event at W8FBX with 5 hams in on the fun. The operators were WA8BRS, WA8BHX while W8FBX, W8LXE and K8UOF gave aid and comfort on antennas and rig problems. The most unique part of our operation was the antenna. We used a ¾ wave semi-vertical supported by a six foot long box kite. Much to our surprise the monster stayed aloft the entire time of operation due to a steady wind off Lake Huron. W8DGP: Had K8EHD and Rolf Rasp (2d op at PY1NFC/PY1NEW) to ably assist. Although we had higher power and a better receiver and antenna than last year, score is only about the same indicating that condx weren't as good. W8ROV: A grand contest! Time was limited due to having to work. Watch my smoke next year! Biggest thrill was hearing my first European; next will be working one!

9th District

W9YYG: Used a 71′ base loaded vertical switchable to high or low segments with relay at base. Also used a 260′ inverted vee up 60′ at the center fed with open wire line. Both antennas were fed into a coax switch for fast changing from vertical to horizontal. Sure was a thrill to work 9L1HX. Europe came through very weakly. WA9GAR: This is really a contest! Sure wish more of the boys would have participated in the early morning hours. Also wish more use was made of the middle segments. WA9AMZ: Our big problem this year was local QRM. There were 5 stations operating the contest within a mile of us. I think next year you can look for our group from a more remote location. DL1FF and 9L1HX had terrific signals.

10th District

WØNFL: The temperature the first night was —26 and QRN was quite bad. Condx next night were much better. Thanks to all for a most enjoyable contest. WØVXO: The poor conditions held down my QSO totals but gave me a chance to look for multipliers and DX. I don't know how I got so many multipliers but they kept falling in line all the way to the end of the contest. One of the highlights was working 9L1HX. Since I entered the first 160 meter contest when it began 7 years ago, I have become fanatically interestd in the band. Each year it gets better. WØPSF/Ø: Worked the contest from my car on a hill 2 miles from my house. Had three 1000′ wires hung on a 240′ mast. Nighttime temperature —7 degrees. Was somewhat disappointed as worked no DX. Did hear XE1OK, 6Y5XG, 9L1HX and HK4EB.

Canada

VO1FB: Trans-Atlantic stations, which previously provided the majority of my contacts, were much weaker than usual. Even DHJ was only heard at sporadic intervals. European contacts numbered 17 as compared to

None other than Vic Clark, W4KFC, and one of the 160 stalwarts.

Stu Perry, W1BB/1 and "Mr. 160." As you read this, Stu and his wife Alice are on a round the world boat trip.

68 last year. Conversely, condx to the west appeared rather better than 1965. VO1HN: My very first contest!! You'll have to smile at the difficulties encountered at my station. Rain storm and winds up to 80 mph which blew the top off my chimney. Had to climb up on roof in all that wind and had no heat for rest of night and morning. Brass pounding with cold fingers and cramped ears from poor fitting headset. But, enjoyed every moment of the contest . . . believe it or not. VE2UQ: I was disappointed to be almost 2 hours late starting and then have the rig buckle up with a good 7 hours to go on Saturday night. Sure was cussin'. Funny how no West Virginia before while in this one must have been 3 or 4. Then, WØGDH going to Arkansas and having WA5KUC on anyway. VE2ATU: Here is my very disappointing log for the fracas. I heard all sorts of stuff but for some reason couldn't get out. We had a snow storm over the week-end and this could have been the major cause of my troubles. I have the feeling, though, that my ground system isn't what it was but cannot do much about it what with 2 feet of ice and snow covering it. VE3DU: On the whole, condx were good except that very few European signals were heard. Propagation to the west coast was very good with excellent signals both nights but QRM from W8/9/Ø on top segment made it rough for we VEs restricted to bottom segment. On Sunday evening the band sounded like a morgue. VE5JI: I found condx definitely poorer this year than the last two. The second night was definitely much poorer than the first. I didn't have much luck working the 1.8 mc. boys the second night as they were too busy chasing DX . . . an unheard of commodity at this QTH. VE6IZ: Sure missed the boat for a good score. Guess everything was against me that day. Got home from work and turned the receiver on and, gosh, the W4s were just pounding in along with W5s and others. However, when I went to tune up the rig I found out I couldn't get any load into the antenna. It wasn't 'til hours later that I discovered it was broken. By the time I got it fixed in 35 below zero weather about all that was coming in was the midwest and west coast and most of them calling CQ east. So, this wasn't my year. Sure don't hear much activity here on 160. However, during the contest there sure was a lot of action. VE7AKI: Many thanks for the certificate for last year's contest. It is the only one I have received in 30 years of hamming. I want to thank *CQ* for keeping the 160 meter contest going. It is the only time there is any c.w. activity on the west coast here. Where do all the c.w. stations go the other 363 days of the year? [Good question . . . *ed.*]

DX DX DX DX DX DX DX DX DX DX

Two very rare DX boys deserve the highest amount of praise and credit for their perseverance . . . as well as patience. They are none other than well known 9M4LP and VK5KO. Of the two the 9M4LP had a bit more luck. Just wish we could print their letters and remarks. We're sure you'd get the greatest chuckle in a long time. VK5KO: If I said I enjoyed this "grind" I'd be a 1st class liar. So, I'll tell the truth: "I hated every minute of it." 9M4LP: My most frustrating period was shortly after local sunset here when VK5KO started coming through. He called CQ every 10 minutes and I called him each time for the better part of 3 hours without any result. He didn't seem to be making any contacts at all. Perhaps he had an unusually high QRN level or maybe dirty contacts on the receive side of his antenna relay.

6Y5XG: I greatly enjoyed the Contest and look forward to next year's when I will be G3HVG. [Gosh, Pete, we sure will miss your 6Y5XG signal—*ed.*] PAØPN: Unfortunately the condx during the contest were very poor for the USA and the fish-phones in Germany and Poland between 1807 and 1820 kc didn't help matters any. The OW says I was very mad or crazy what with the hours I kept and the lost sleep. The best DX I heard was W9EWC. PAØLOU: Since I only returned home Friday night from a 2 week's stay in DL on business, I couldn't possibly take part both nights. But I did hear a number of signals as far west as WØ but nobody heard me. At 0530 I gave up and went to bed. Maybe next year more luck. OK1ZW: I am sorry I not heard W, VE, VO. OH2HK: Sorry but have no antenna for Top Band this time. It is hard to work with some kind of random length of wire hanging somewhere between trees. Heard W1BB and HK4EB with S7 signals. Hope better luck next year. OH2SB: W sigs peaking S9 at 0500Z but no luck on this end. W1BB said to G6BQ that conditions are bad but believe you me I have never heard Ws coming in as loud as they did even on 80 meters. I'll have a ⅝ wave antenna next year. KL7JDO: 160 meter operation is a real bear (Kodiak type, no less) up this way. Believe I am still the only active Top Band station in Alaska. I have been trying to stir up a little activity this way to back-up 75 meter net operation but, so far, very little results. The big thing, I think, is that the average ham receiver bought today doesn't have 160 on it, much less the transmitters. [So true—*ed.*]. KH6IJ: I hope to be on with better antenna and transmitter next year. I heard only WØVXO on the low segment and about 12 on the high. Loran interference not so much of a problem now that I am 100 miles away from a megawatt transmitter and not only 10 miles as I had been previously. So, things will look up for next year. HK4EB: [for those of you who want to know what was behind that terrific signal . . . RX HQ-170AC; TX 300 watts; Antenna a 40′ vertical plus loading coils . . . no radials—wow, what a signal—*ed.*]. Gus goes on to say: "Condx were good to the States and heard some 40 or 50 different stations in all call areas. Condx to other parts of the world were very poor and signals were down in the noise level [May be so, Gus, but OH2HK heard you S7—*ed.*]. HI8XAL: Bias resistor burned up both nights putting me off the air very early the second evening. Heard many Eu and 9L1HX. Only a temporary antenna in use but very shortly a 130′ tower will be going up. New QTH outside of town helped a lot. HB9QA: W/VE/VO were heard but no QSO. I don't believe that W, etc. DX is possible under contest condx with an output of ten watts. HB9JG: DX very good especially W8 and WØ but no QSO was possible due to low power and poor antenna. GM3SVK: Condx were very erratic over the period that I was on. Saturday afternoon, the 29th, only short skip operation was possible. GM3OXX: Enjoyed the contest very much. This was my first ever contest and condx were pretty grim.

[*Continued on page 98*]

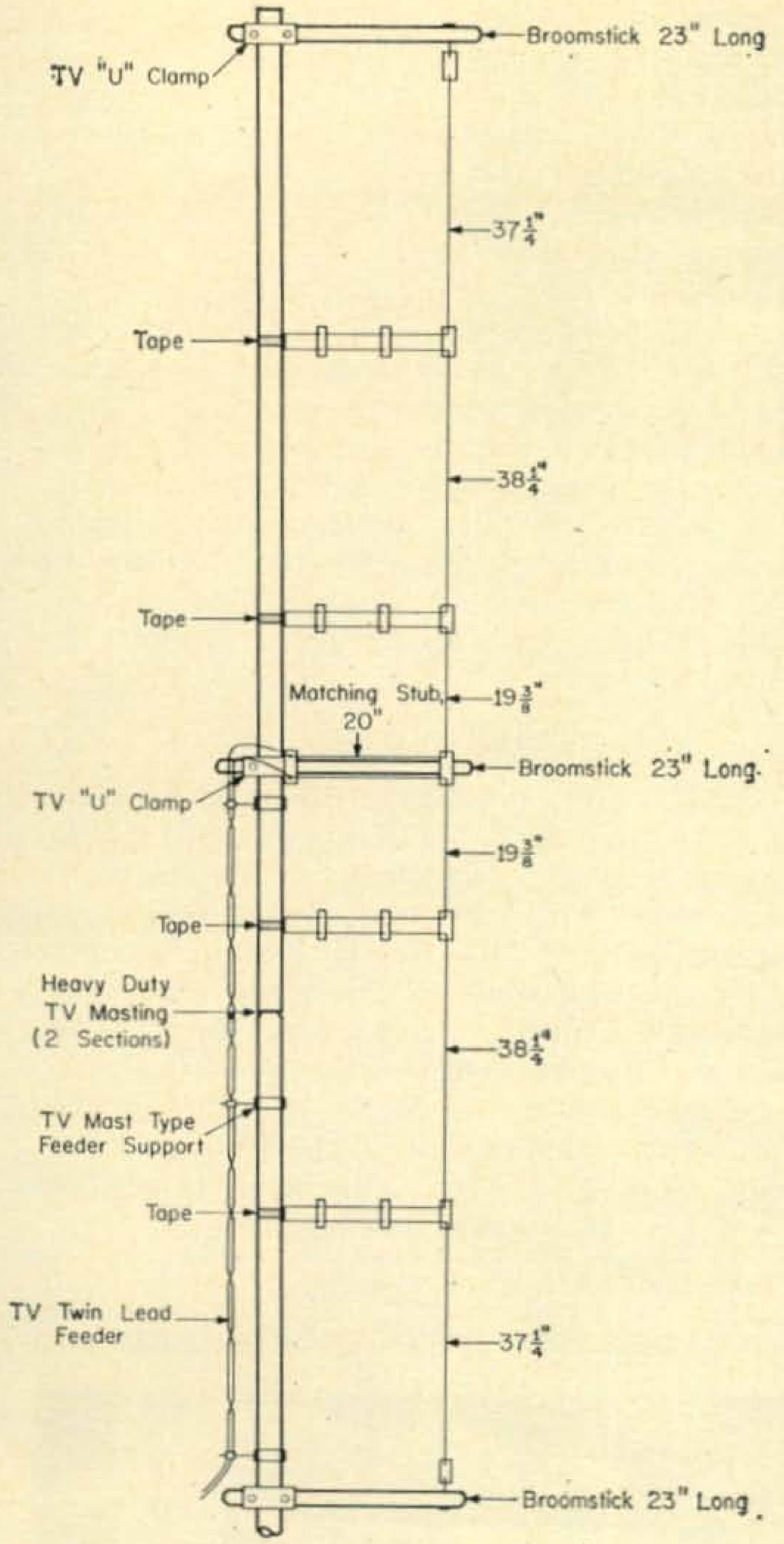


Fig. 1—Side view of the 2 meter off-set gain antenna used to get tailored coverage.

TAILORED ANTENNA COVERAGE FOR 2 METER F. M.

BY BYRON H. KRETZMAN,* W2JTP

A hot vertical antenna on 2 meters in the Long Island area improved performance greatly but also increased reception of undesired signals. The solution was to develop an antenna with a cardiod pattern and gain. The result is five half wave sections, in phase, with the mast acting as a reflector.

ANTENNAS for v.h.f. usually fall into two categories: the horizontally-polarized rotatable beam antenna, and the vertically polarized omnidirectional antenna. On f.m.,[1] on both 6 and 2 meters, vertical polarization is standard, mainly because this permits a simple whip antenna to be utilized for the mobile. Rotating beam antennas are seldom used because an omnidirectional pattern is normally most desirable for this kind of highly localized intercommunication.

Quite naturally, the first thought is to get the antenna as high as possible, and the second thought is to get as much omnidirectional gain as might be practicable. With the second thought in mind, a 5 element co-linear 2 meter gain antenna was developed and described in *CQ*[2] not too long ago. With the first thought in mind, and with the help of WA2GPC and WA2PZM, the gain antenna was mounted in the top of a tall oak tree. The tip of the antenna was 97 feet above the ground, and all 5 elements were well in the clear.

The result? Oh, brother! On 146.94, mobiles could be heard all the way up to Meriden, Connecticut; out to Peconic Bay on Long Island, and down the New Jersey coast to Atlantic City. Plus all of the base (home) stations in between; and, last but not least, the Poughkeepsie repeater, 50 miles to the north. The Motorola Sensicon receiver never shut up; it might just as well have had no squelch.

The Problem

Something had to be done. As we have mentioned before,[3] we were interested only in intercommunication within our own area—Long Island. Connecticut stations were not too much of a problem because they operate more on their own separate channel. New Jersey stations could be attenuated by simply lowering the elevation of the antenna, but this also attenuated too many of the Long Island stations. Lowering the antenna didn't attenuate sufficiently the Poughkeepsie repeater. Even with a very low-elevation

*431 Woodbury Road, Huntington, New York.

[1]Kretzman, B. H., "A New VHF Operation: FM," *CQ*, August 1963, p. 74.

[2]Kretzman, B. H., "Five Half-Waves in Phase on 144 Mc, *CQ*, March 1964, p. 80.

[3]Kretzman, B. H., "F.M. Mobile Techniques," *CQ*, May 1966, p. 50.

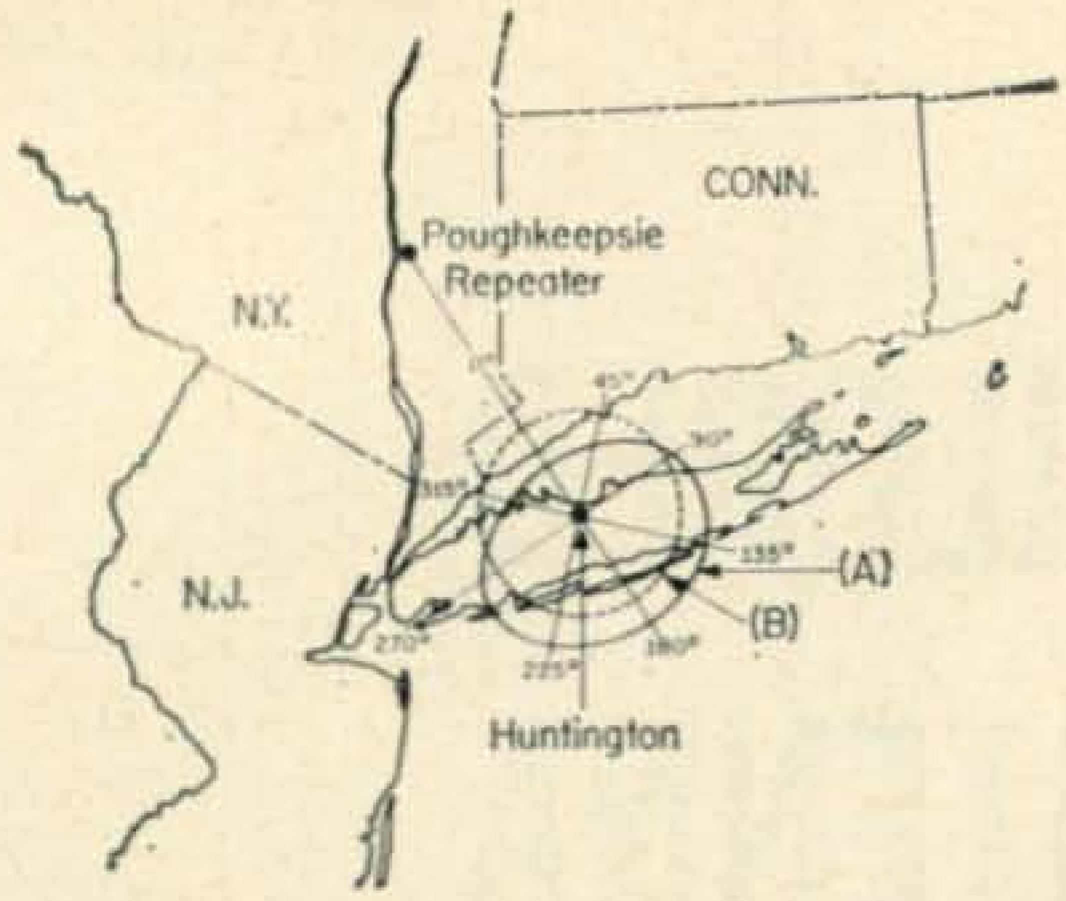


Fig. 2—Estimated coverage pattern of the off-set gain antenna (A) compared to that of a "gainless" omni-directional dipole (B). Note the careful orientation to get minimum response from Poughkeepsie.

ground plane antenna the squelch ran open, noisy from the constant flushing.

The Solution

Thinking about the problem, several conclusions were reached. First of all, the antenna must be at a lower elevation to reduce pickup from New Jersey. Second, an antenna with some sort of null, oriented so that the null was in the direction of Poughkeepsie, had to be used. Any sort of ordinary beam, yagi or even corner reflector, would give us the null, but the maximum lobe would then be south, into the Atlantic Ocean. What we needed, in addition to the null, was added gain to the sides. The cardiod ground plane has the required pattern, but it didn't have the required gain. What we *really* needed was an antenna like one we had on 2½ meters just before WWII: 8 half waves in phase, four on a side, spaced a half-wave apart. But, the mechanical problems of constructing such an antenna made us think twice about this. There ought to be an easier way!

At this point we hit upon an idea: Why not use the 5 half-waves in phase with a reflector; like, say, the metal supporting mast itself? Study of the expected patterns, from the engineering data in the Communications Products Corporation catalog, led us to the ¼ wave spacing to get not a null but *reduced* coverage towards the rear (towards the mast), *and,* a gain not only forwards but sidewards. Ah, ha! *This* looks like the "easier" way.

The Antenna

Mechanically, putting 5 half-waves in phase ¼ wave from a couple of aluminum TV mast sections is a "lead pipe cinch," to use the words of a certain W4. All that is needed, besides the masting, is three TV-style "U" clamps, a couple of broomsticks, some ¼" poly rod for spacers and end insulators; and, of course, the wire. We used #18 Copperweld for the antenna sections, and #18 soft-drawn copper for the phasing stubs. The matching stub at the feed point was made from #14 TW[4] house wire. If you use

[*Continued on page 104*]

[4]TW-Thermoplastic, Waterproof.

WN6OLL..... A TALENTED ACTRESS

BY LOUISA B. SANDO,* W5RZJ

Do you like movies? Well, whether or not you are a movie fan, here is one to watch for — "Picture Mommy Dead" — for among its stars is a talented young actress who is one of our amateur fraternity, Susan Gordon, WN6OLL.

According to Ray Meyers, W6MLZ, in his column "Calling CQ—Ham on Air" (published weekly in the *Los Angeles Herald-Examiner*), many other well known amateur operators have had a hand in this production. Susan's father, Bert I. Gordon, K6APL, was the producer and director; Harry Lindgren, W6CJ, handled the audio, and a number of other licensed amateurs worked on photography, lighting and audio techniques.

Co-starring with Susan are Don Ameche, Zsa Zsa Gabor and Martha Hyer, along with Maxwell Reed, Signe Hasso, Wendell Corey and Anna Lee.

W6MLZ comments Susan Gordon is no new-

[*Continued on page 102*]

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

Susan Gordon, WN6OLL, and her father, Bert I. Gordon, K6APL, producer and director, study script of film "Picture Mommy Dead" in front of portrait of Zsa Zsa Gabor, who plays the part of Susan's mother. This movie, released in August, is one of many screen and TV appearances for 16-year old Susan.

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:** $11\frac{5}{16}$"W x $6\frac{9}{32}$"H x $9\frac{3}{32}$"D. **Wt.:** $13\frac{1}{2}$ 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:** $9\frac{7}{8}$"W x $6\frac{9}{32}$"H x $9\frac{9}{32}$"D. **Wt.:** $12\frac{1}{2}$ 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 25, on page 110

The WRL Duo-Bander 84 S.S.B. Transceiver.

BY
WILFRED M. SCHERER,*
W2AEF

CQ Reviews:

The WRL Duo-Bander 84 Transceiver

THE WRL Duo-Bander 84 is a filter-type s.s.b. transceiver designed for l.s.b.-only operation on the 40 and 80 meter amateur phone bands. It is a very low-cost job (completely wired) and is relatively small in size. Yet it is capable of packing a good wallop with 325 watts p.e.p. input which should make it an ideal unit for either fixed-station or mobile operation on these two bands that probably are the most popular ones for reliable daytime and night time QSO's over distances up to 1500 miles or so.

Simplicity also is one of the keynotes for the Duo-Bander. There are no unnecessary frills nor multiplicity of controls—operation is easy. Both cost and space requirements are held down by the inclusion of special circuitry and the use of transistors in some of the stages of the unit.

The Duo-Bander 84 incorporates single conversion on both receive and transmit. A block diagram of the setup is shown at fig. 1. The set embodies several interesting innovations, one of which is the use of bandpass coupling circuits for the r.f. front-end of the receiver, eliminating the need for manually peaking up the incoming signal. The arrangement is shown at fig. 2.

Another function of the bandpass setup is to adequately attenuate spurious responses due to mixture products as a result of the particular frequencies used in the conversion scheme; in fact, because of such possibilities, the manual warns against attempting to open up the frequency coverage for operation outside the designed ranges of 3.8-4 and 7.1-7.3 mc.

The r.f. stage is also neutralized using the capacitance-bridge method, an expedient home-constructors of amateur gear might do well to consider where instability is experienced with a high-gain r.f. stage.

From the block diagram and fig. 2 it will be noted that the receiver r.f. stage also serves as the driver for the transmitter p.a. using the same fix-tuned bandpass coupling circuits. You don't have to tune the r.f. drive when shifting frequency. It is interesting to note that the tube used is a 12BY7, not that it is new as a transmitter driver, but it is the first time we've seen a husky tube like this used in the r.f. stage of a

*Technical Director, *CQ*.

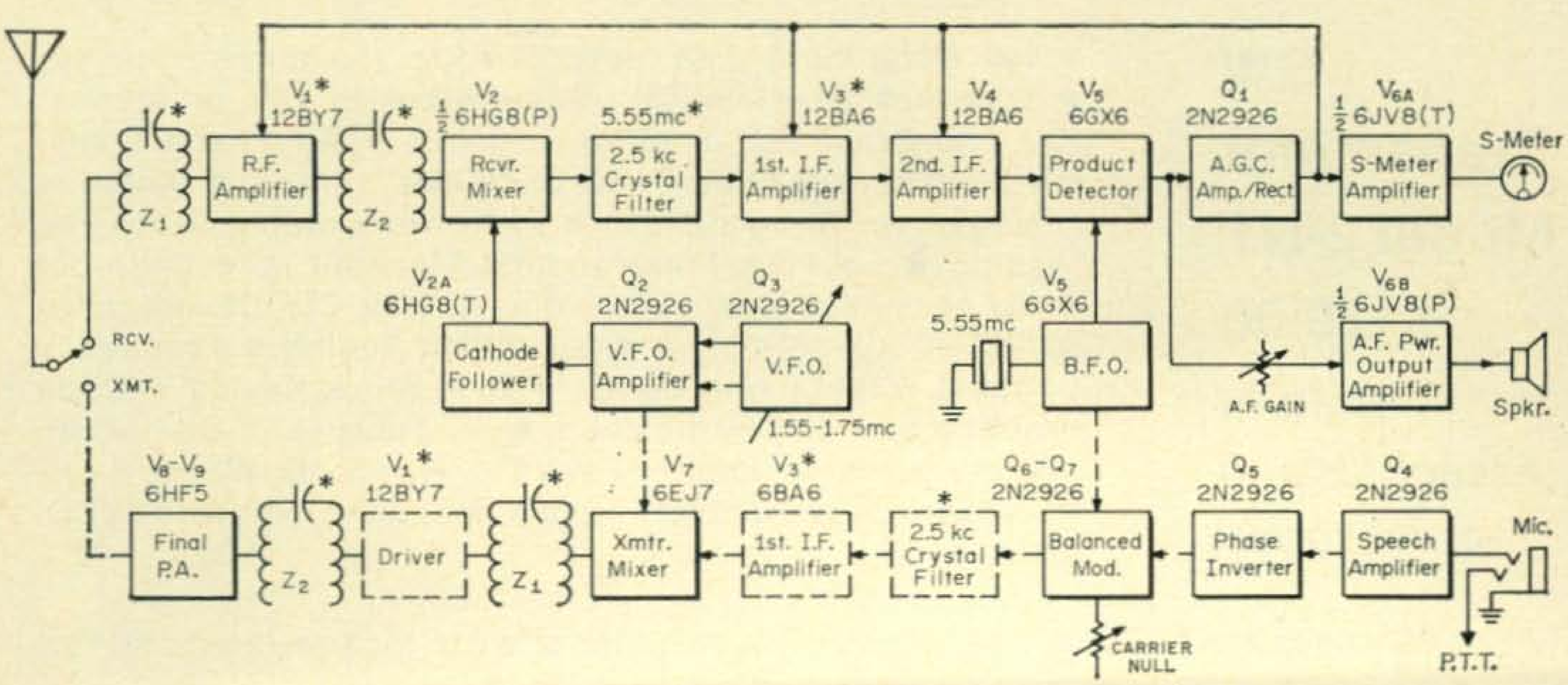


Fig. 1—Self-explanatory block diagram for the WRL Duo-Bander 84. Special details are discussed in the text. (*) Indicates circuits common to both receiver and transmitter.

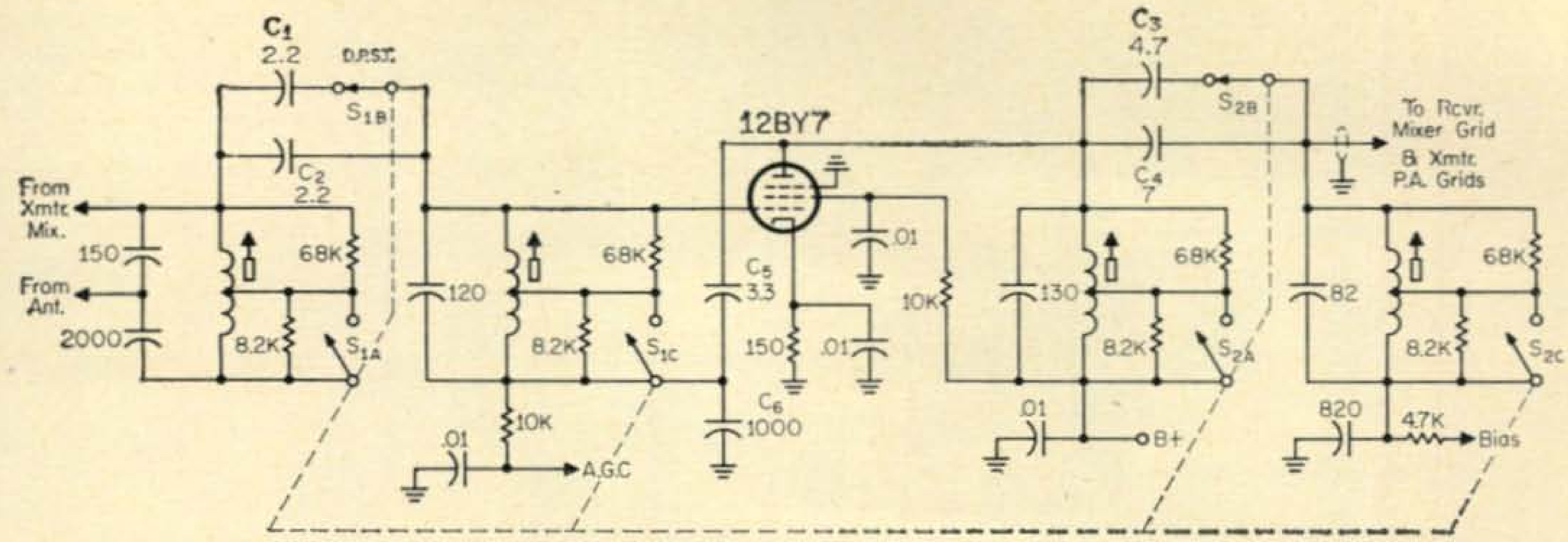


Fig. 2—R.f. bandpass-coupled circuits and bandswitching arrangement. The switches are shown as positioned for 80-meter use in which case all the inductance of each coil is engaged. Also, all the coupling capacitors are in the circuit. For 40-meter use, S_{1A}, S_{1C}, S_{2A} and S_{2C} short out part of the inductance in each resonant circuit, as are some of the loading resistors. At the same time S_{1B} and S_{2B} reduce the coupling capacitance by disconnecting C_1 and C_2. C_5 and C_6 are part of the bridge-neutralization circuit.

receiver. (Such use in conjunction with a large mixer tube might be a good bet for minimizing cross modulation and front-end overloading).

The V.F.O.

The 5.55 mc i.f. is obtained by heterodyning the incoming signals with the v.f.o. which operates between 1.55 and 1.75 mc. The sum frequencies are used for 40-meter operation, the difference frequencies for the 80-meter band. The low frequency of the v.f.o. contributes considerably to frequency stability, as does the use of transistors both for the oscillator and the buffer amplifier which follows it. The output circuit of the latter incorporates circuitry that minimizes harmonics from the oscillator. Zener-diode voltage regulation is applied to both stages.

Oscillator-voltage injection for the receiver mixer is made at the tube cathode, so a cathode-coupled triode is used between the mixer and the v.f.o. amplifier for proper impedance matching.

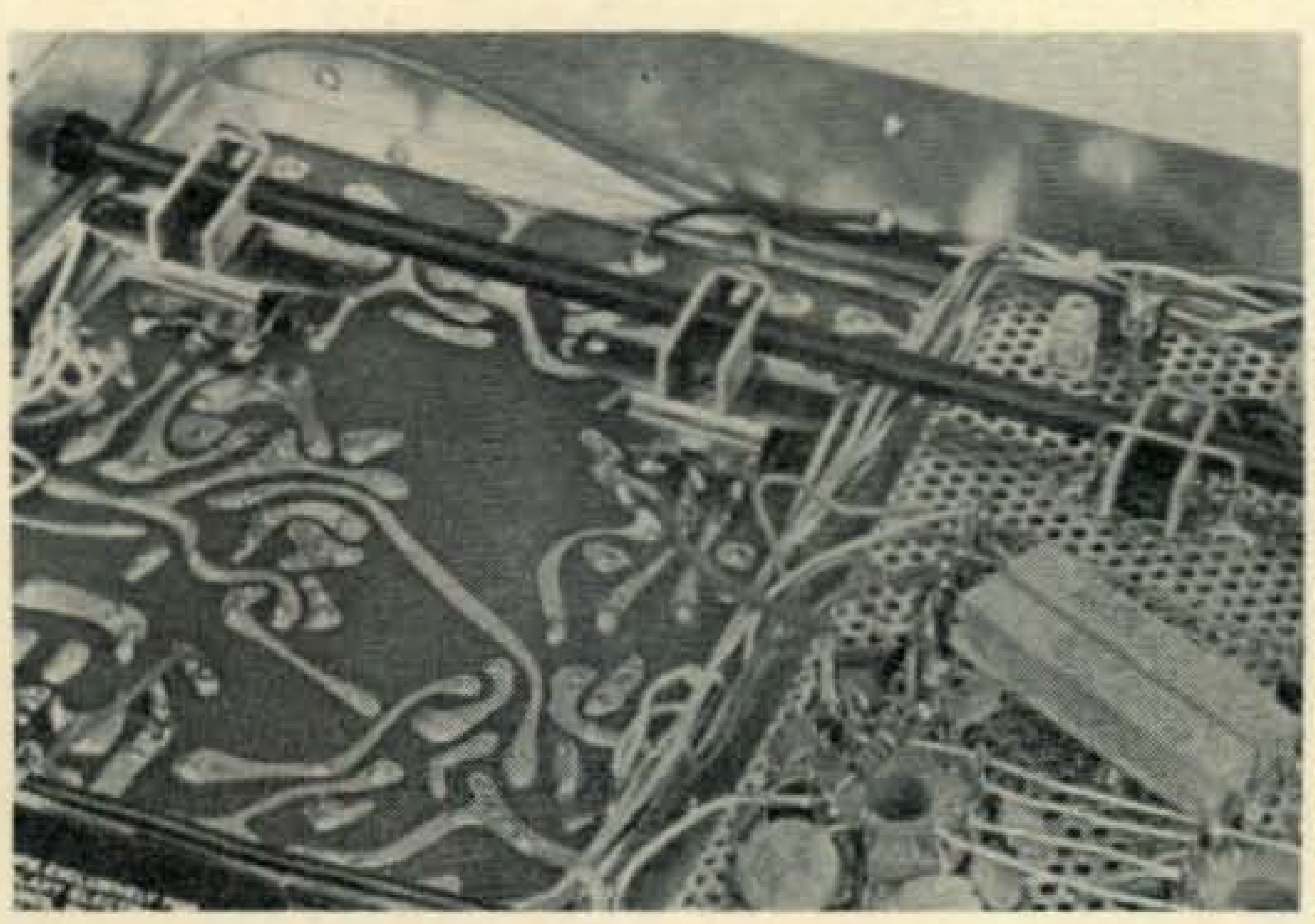
The product detector is a high-output type, using a 6GX6 pentode, and therefore is coupled through the a.f. gain control directly to the a.f. power-output stage without necessitating an additional amplifier. The set has a built-in loudspeaker.

A.G.C.

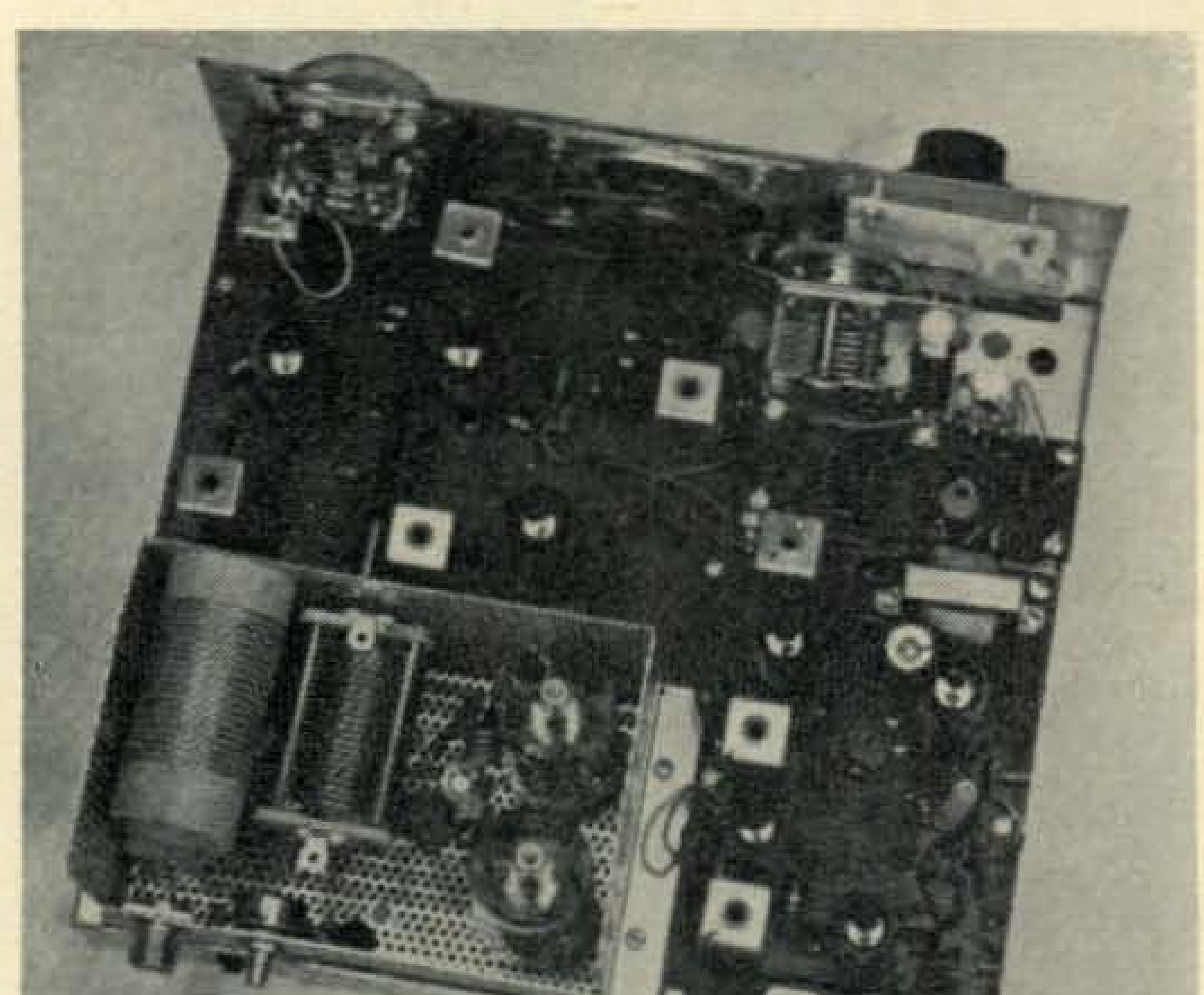
Several other transistors are included in the Duo-Bander 84, of which one is employed for an audio-derived a.g.c. It samples the a.f. from the product detector, amplifies and converts it to a d.c. voltage that varies at the average a.f. rate for controlling the gain of the r.f. and the two i.f. stages. The a.g.c. characteristic is exceptionally flat. The a.g.c. voltage also goes to a vacuum-tube triode that operates the S-meter as a v.t.v.m.

Transmitter

The transmitter contains four additional transistors. One is the speech amplifier, another is



Duo-Bander bandswitch setup. Three slide switches are mounted in line, with a single insulate rod passing alongside each one. The rod is supported front and rear in sleeve bushings. A U-shaped bracket, fastened to the rod at each switch, clamps around the associated switch lever. The switches are operated simultaneously using a panel knob to pull the rod forward for 80-meter operation or pushing it backward for 40 meters. A wire clip around the rear clamp keeps the rod from rotating and disengaging the clamps.



Top view of the Duo-Bander 84. The major portion of the set is built on printed-circuit boards, except the final amplifier which is assembled on the perforated base of its enclosure.

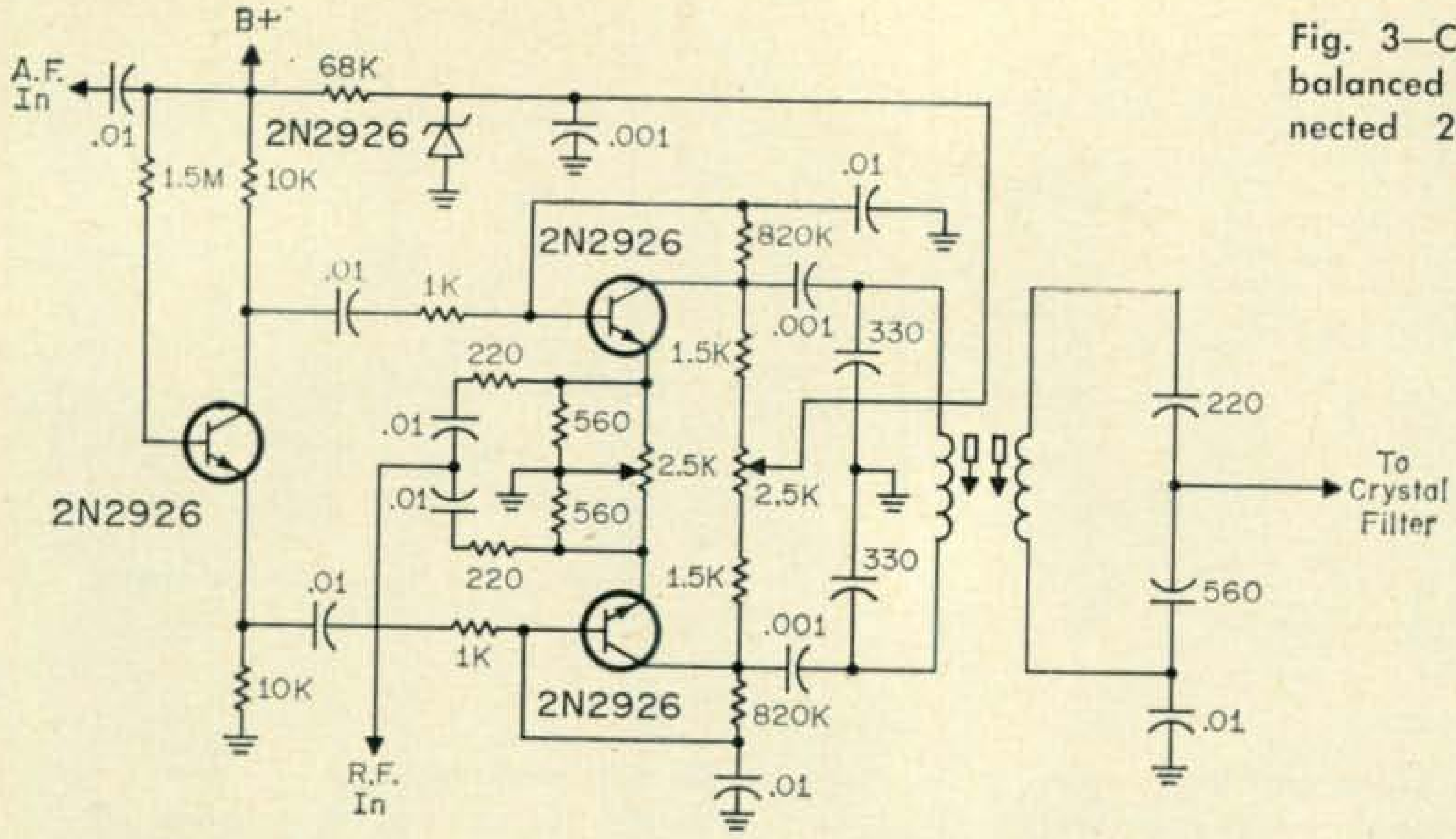


Fig. 3—Circuitry for the transistorized balanced modulator. D_1 is a diode-connected 2N2926 transistor (base and collector connected).

a phase inverter that provides a balanced a.f. signal to the remaining two transistors that make up the balanced modulator with circuitry similar to that used with vacuum-tube triodes. A stable null is ensured by a regulated supply voltage obtained with a zener diode. The modulator arrangement is shown at fig. 3.

The final p.a. operates in Class AB_1 and has a pi-output circuit which is fixed for matching to 50-ohm loads. The only tuning required is that for resonance. The p.e.p. input is 325 watts.

Metering

The meter indicates receiver S-units, transmitter relative-power output or correct bias adjustment for the p.a. A unique wrinkle is used for obtaining the three different functions without incurring the expense (and inconvenience) of using a manually-operated two-pole three-position switch.

The first two functions are automatically obtained when the transceiver is transferred between receive and transmit with the p.t.t. switch. When it is desired to check the p.a. bias setting with the meter, a slideswitch on the rear of the unit is pushed to BIAS. Once the bias has been set, you push the switch back to NORMAL. Subsequent operation of this switch is not needed, unless tubes are changed; however, an occasional bias check might be desirable after periods of time. If you should forget to return the switch to normal, the meter will not function on receive, and on transmit it will dip at resonance.

A sensitivity control is provided on the panel for adjusting the output-power reading. The S-meter zero-adjust is an internal control. The meter circuitry is shown at fig. 4.

Construction

Except for the final p.a., the Duo-Bander 84 is assembled on three separate printed-circuit boards. The transmitter and receiver r.f. sections are on one large board that is mounted above a cutout in the chassis. The two other boards, one for the v.f.o., the other for the i.f. strip, a.f. section, etc., are mounted on ⅜″ pillars above the chassis. There are no chassis cutouts below these two boards, so they most likely would have to be lifted off the chassis, should servicing be required. The transceiver is mounted in a case that is ventilated with large open slots. Its size is 5″ × 11⅜″ × 10¼″ (H.W.D.)

The unique mechanical arrangement for the bandswitching setup is shown at the underside photograph of the unit where it will also be seen that the metal mounting surface for the p.a. components is completely perforated using the same material as for the p.a. enclosure. Excellent ventilation is thereby realized.

The v.f.o. is operated by a two-speed dial that engages both planetary and gear type reduction mechanisms. Fast tuning with about ⅝ turn per 100 kc is obtained using an inner knob on the tuning shaft, slow tuning with 2¼ turns per 100 kc is had with an outer knob. An illuminated dial is calibrated in 2 kc steps about 1/16″ apart.

Other controls are: mic gain, carrier null, a.f. gain, plate tune, meter sensitivity and the "push-pull" bandswitch. A three-way mic jack (for

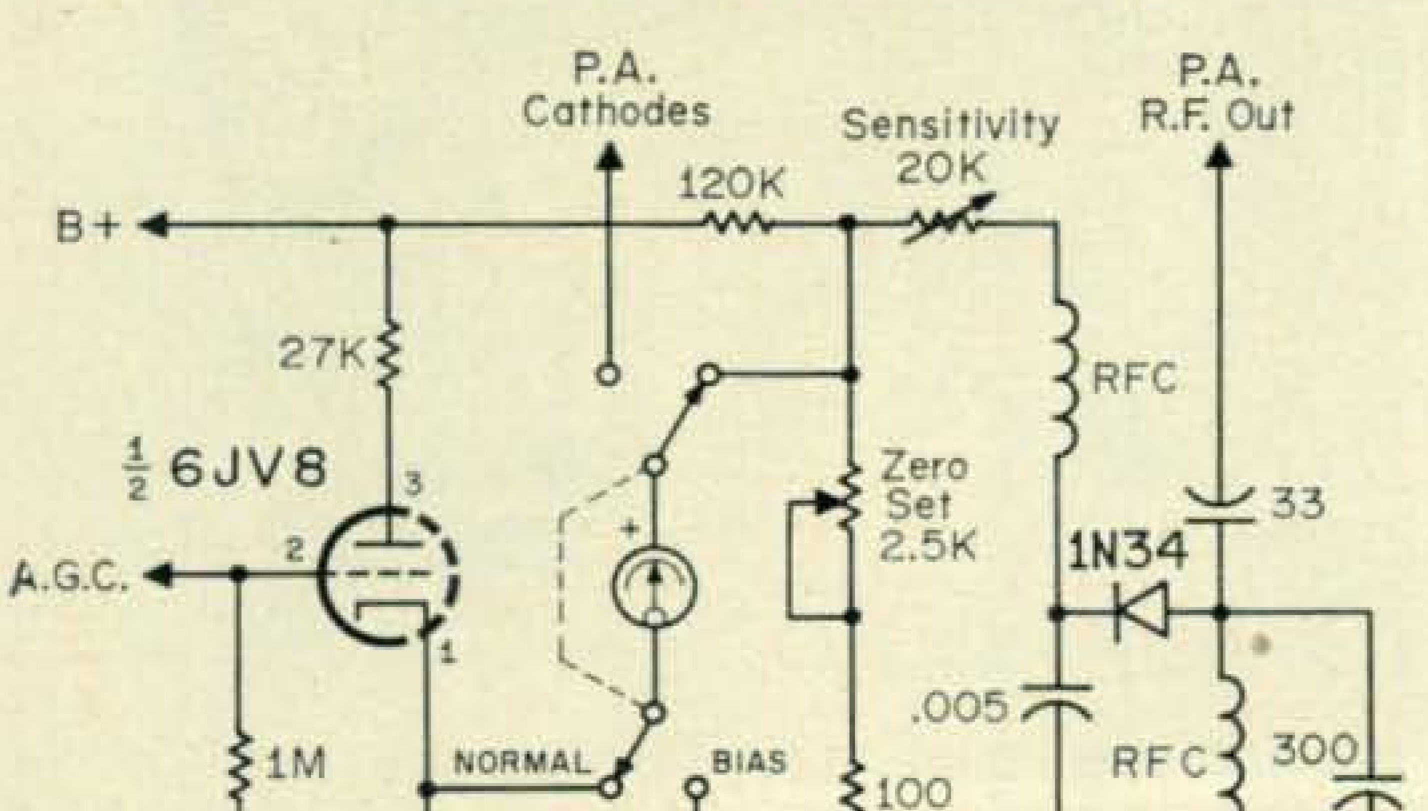


Fig. 4—Metering setup used in the Duo-Bander 84. During receive, the a.g.c. voltage is applied to V_1 which operates the meter as a v.t.v.m. for indicating S-units. On transmit, the receiver is disabled, so there is no signal to activate the S-meter. A sample of the r.f. output from the transmitter is rectified by CR_1 to produce a d.c. voltage, in proportion to the output, that is applied to the positive side of the meter. The negative end of the meter returns to ground through R_1. Changeover between the two functions is automatic. To read the bias setting, a slide switch, S_{1A}-S_{1B}, is manually operated to connect the meter across a resistance in the cathode circuit of the p.a. tubes. The meter then reads in proportion to the cathode current.

p.t.t.) is on the panel. A phono jack at the rear provides control for switching external gear such as a linear-amplifier. The center pin of the jack is grounded during transmit.

Operation

Aside from setting the v.f.o. to frequency, no other tuning is required for receive. Bandchanging is instantaneously set with the push-pull bandswitch.

For transmitter tuneup you advance the carrier-null control fully on, press the mic p.t.t. button and adjust the tune control for maximum output read on the meter. You then null out the carrier as indicated by the meter. To determine the proper modulation level, adjust the meter sensitivity for a full-scale reading when tuning up and during voice modulation the mic gain has to be set to where the meter kicks up about 30% of full scale.

As might be expected in view of the low cost for the set, some facilities are not provided. For instance: there is no a.l.c., so one must depend on the output-meter indications for limiting the modulation below flattopping. At any rate, the maximum allowable meter swing without flattopping with a particular voice and mic characteristics, should be determined with an oscilloscope. Another measure would be the use of an accessory a.f. clipper/compressor[1] with which the speech level can be limited.

Other features you don't have are: v.o.x.[2] crystal calibrator,[3] adjustable hairline fiducial [*continued on page 99*]

[1]Such as the WRL CA-27 Compressor.
[2]Many operators dislike v.o.x., saying it makes them nervous. Also v.o.x. is often used only as a lazy man's p.t.t. system, as may be evidenced by the lack of consistency in being able to break most operators using v.o.x. As for mobile, we've found a lavalier type mic hung from one's neck and a foot-pedal p.t.t. switch more satisfactory for hands-free operation.
[3]A handy accessory for transceiver use is "A Harmonic Rich 100 Kc Crystal Calibrator," *CQ*, Dec. '66, page 28.

ARIES—Another Communication Satellite Planned for The OSCAR Series

BY GEORGE JACOBS,* W3ASK

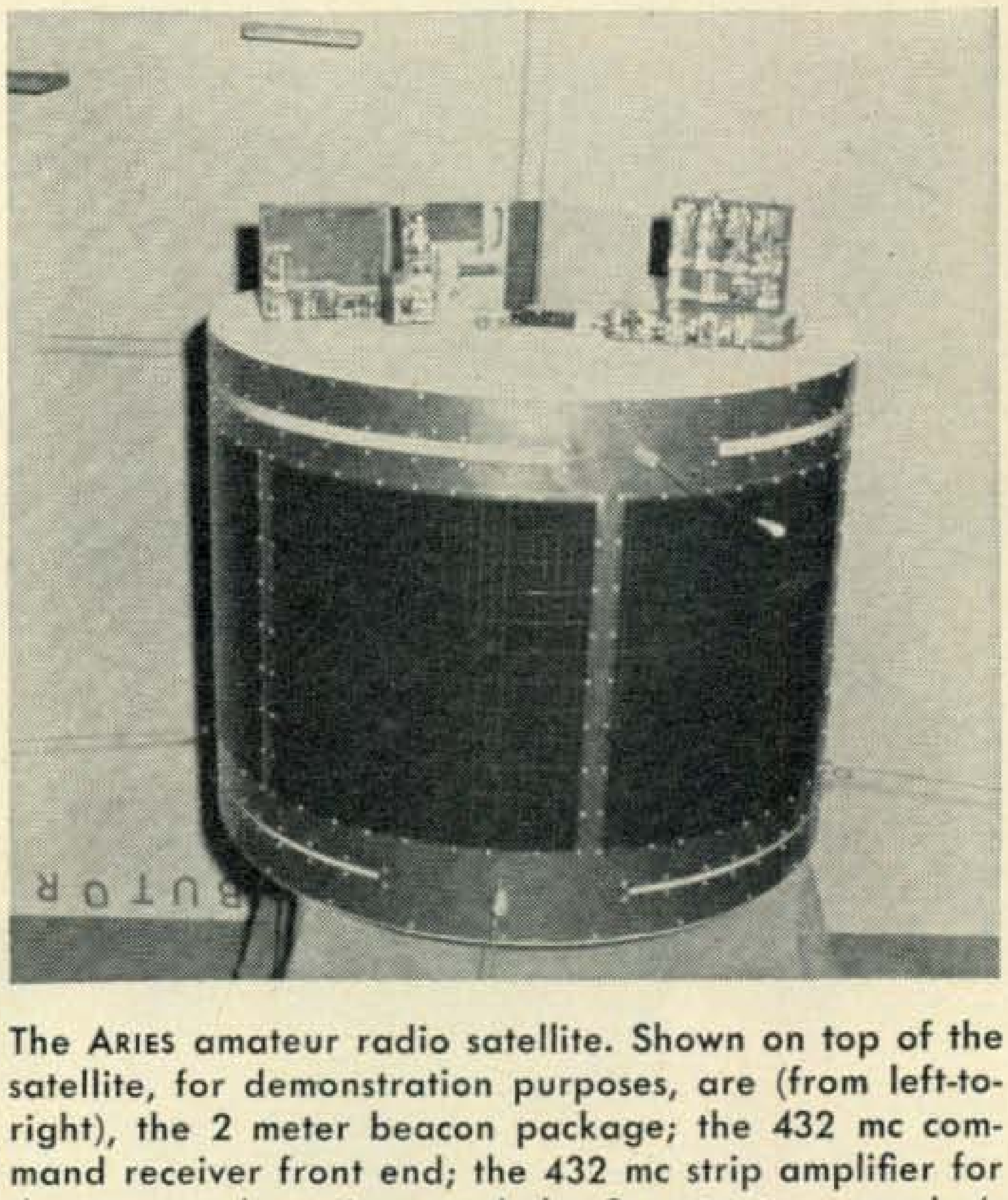
ARIES, another satellite planned for the Project OSCAR series, is nearing completion in Southern California. Conceived, designed and constructed by several groups of radio amateurs in the Los Angeles area, the ARIES satellite is the largest planned for Project OSCAR to date. The drum shaped satellite will stand two feet high, 3 feet in diameter, and will weigh nearly seventy pounds when completed.

ARIES, derived from *A*mateur *R*ad*i*o *I*n *E*xperimental *S*atellite, is also the name of a famous constellation, in which the stars outline the shape of a ram. The ARIES project is sponsored and spearheaded by members of the San Fernando Valley Radio Club, with members of the Autonetics, East Whittier, Fullerton and Lockheed Amateur Radio Clubs also participating. The nearly completed satellite was placed on display recently at the Southwestern Division A.R.R.L. Convention at Disneyland, where it was reported to be a big success.

Beacon Transmitters

The ARIES satellite will contain *four* beacon transmitters, one translator, a command receiver and telemetry circuits. The satellite is to be powered by both solar and battery supplies. The four beacon transmitters will operate on frequencies within the 144-148 mc band, the 220-225 mc band, the 430-440 mc band, and the 1215-1300 mc band. The two meter beacon will mark the upper edge of the output channel of the translator, and each beacon transmitter will also transmit telemetry data.

The telemetry data will include information about the tumble rate of the satellite, signal strength of the strongest signal in the translator's



The ARIES amateur radio satellite. Shown on top of the satellite, for demonstration purposes, are (from left-to-right), the 2 meter beacon package; the 432 mc command receiver front end; the 432 mc strip amplifier for the command receiver, and the 2 meter transponder's receiver section. There's a good change that ARIES may become either the fifth or sixth satellite to fly in the OSCAR series.

*11307 Clara Street, Silver Spring, Maryland 20902.

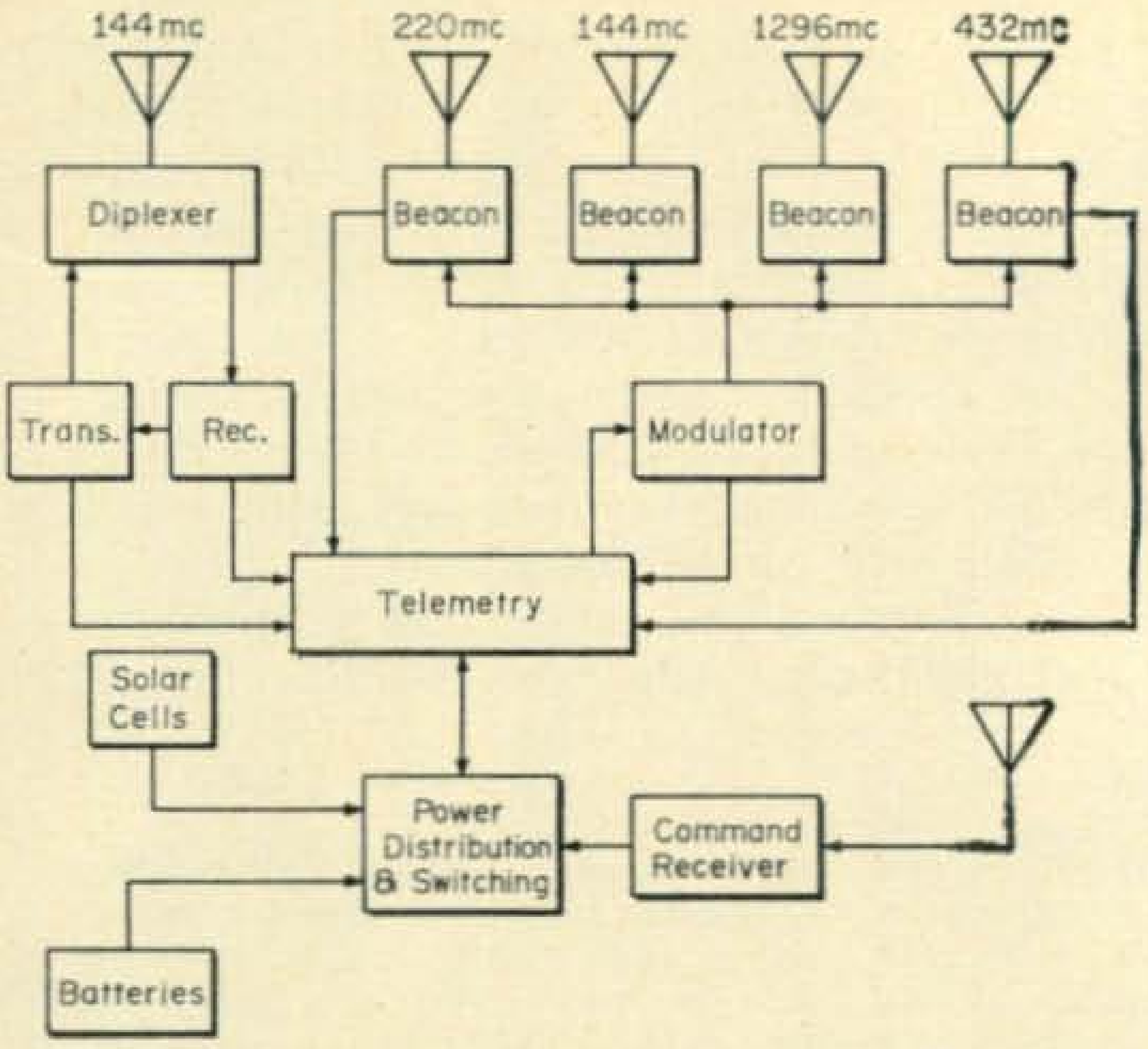


Fig. 1—Block diagram of the ARIES satellite.

channel, and temperature and voltage readings from several key points within the satellite. The telemetry information will be in the form of pulse width modulation which can be decoded fairly simply with a receiver and oscilloscope. It will be possible to turn each beacon transmitter on or off individually, and each transmitter will also be able to act as an f.m. repeater, using the command receiver aboard the satellite as its input.

At the present time, the following are the frequencies and powers planned for the four beacon transmitters:

Freq. (Mc)	D.C. Power Input (Watts)	R.F. Power Output (Watts)
144.13	2.5	1-1¼
223.0	2.5	¾
432.39	2.5	¾
1297.17	5.0	¾

Two Meter Translator

The ARIES satellite will be a live communications satellite, and will relay signals from the ground in the same manner as the OSCAR III and IV satellites. A two meter translator aboard ARIES will operate with an input signal between 144.975 and 145.025 mc, and will have an output frequency of 144.075 to 144.125 mc. A beacon signal will be located at the upper edge of the translator output, on 144.130 mc. The power output of the translator will be approximately 2.5 watts, radiated by an omni-directional antenna system.

The gain between the input and output terminals of the translator will be approximately 166 db. This is accomplished by using a pre-amplifier with a gain of about 18 db, a converter with a gain of approximately 48 db, an i.f. amplifier with a gain of 50 db, and a mixer-final amplifier with a gain of nearly 50 db. The receiver input filter will provide additional rejection of the translator output to prevent overloading of the following pre-amplifier stage.

Solid state construction is used throughout the translator. The converter uses a crystal controlled local oscillator operating on 134.3 mc, to convert down from 145.000 mc to 10.7 mc. The 10.7 mc i.f. amplifier consists of five stages, and a mixer combines the incoming signals from the i.f. amplifier with the output of the 134.3 mc local oscillator to derive the composite translator output. The final amplifier is a linear amplifier operating in class B push-pull, with a total of 2.5 watts distributed within the 50 kc bandpass. The pre-amplifier used on the receiving side of the translator is a high gain solid state device with a bandpass of 50 kc.

Antennas

The ARIES two meter translator system is unique in the OSCAR series of satellites in that the same antenna is to be utilized for both transmitting and receiving. This will be accomplished by the use of a diplexer, which will couple the transmitter output directly to the antenna system while simultaneously decoupling the transmitter from the receiver input. A quarter-wave stub, with omni-directional radiation characteristics will be used with the diplexer.

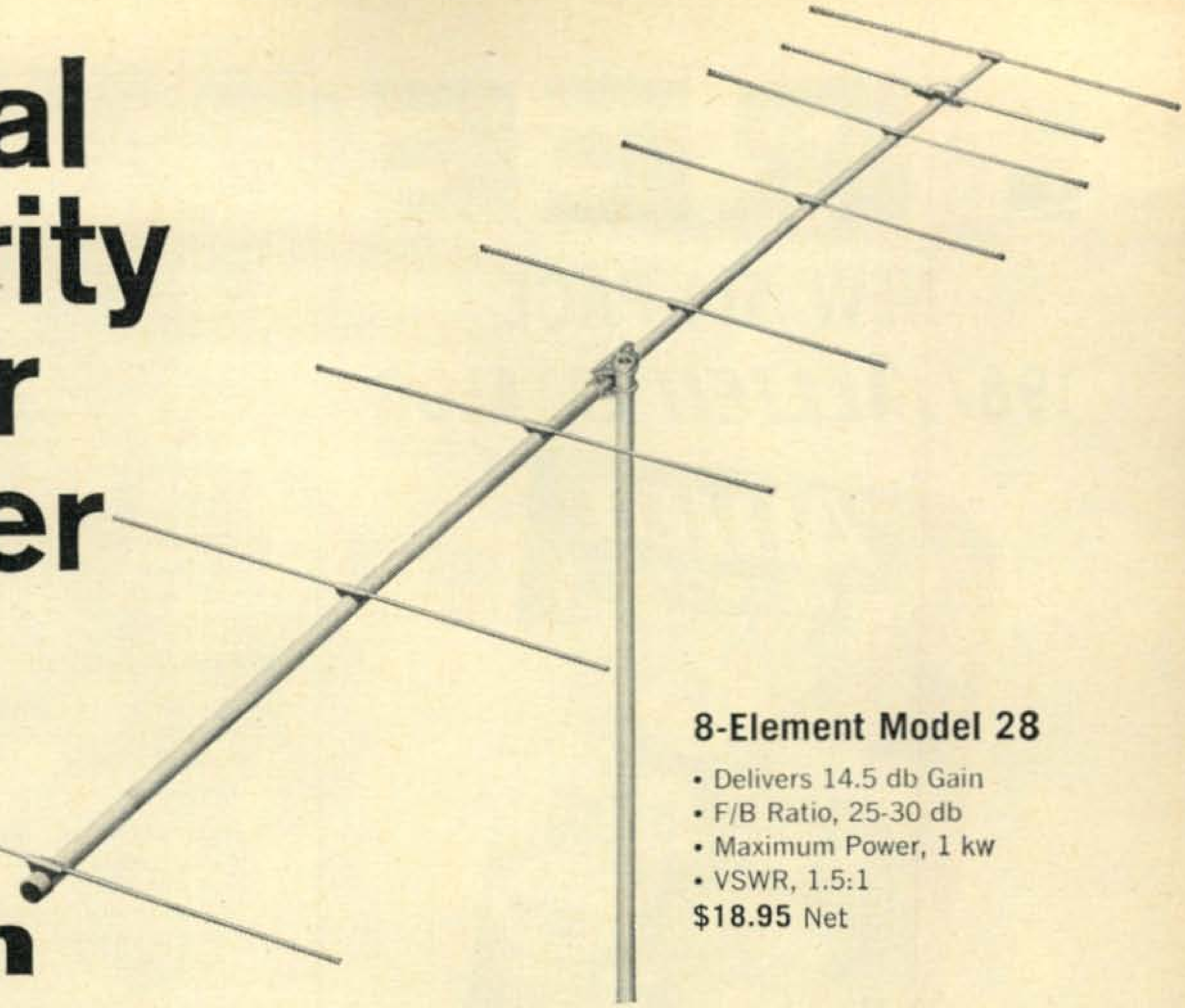
The 223 mc beacon transmitter will use three half-wave slot antennas, placed 120 degrees

[*continued on page 99*]

Here's some of the gang responsible for the ARIES satellite. Shown from left-to-right are Don Bain, WA6MRE; Bob Kolb, WA6SXC; Bruce McLincha, WB6NST; Don Etheredge, K6UMV; and Ewell Carter, WA6ZIJ. K6UMV is President of the San Fernando Valley Radio Club, and WA6ZIJ is director of the ARIES project.

Put real authority in your 2 meter signal

with a **hy-gain**



8-Element Model 28

- Delivers 14.5 db Gain
- F/B Ratio, 25-30 db
- Maximum Power, 1 kw
- VSWR, 1.5:1

$18.95 Net

optimum spaced beam!

Working Moonbounce, an Oscar, or over the horizon, there's only one way to be certain your 2 meter signal will have real authority...that's with a powerful Hy-Gain optimum spaced beam. Only Hy-Gain beams have solid rod optimum spaced elements that are scientifically staggered along the boom with sole reference to increased field strength intensity and pattern control to provide actual delivered performance equalling maximum theoretical gain. Only Hy-Gain beams have factory pre-tuned Beta Match to insure an optimum transfer of energy without sacrificing gain or pattern control. Additionally, to assure a perfect balance of currents to the driven element, Hy-Gain beams are supplied with a coaxial balun. In every detail, from unique design concepts to rugged structural characteristics, Hy-Gain 2 meter beams are built to put real authority in your signal.

All models now available from your Hy-Gain distributor or write...

HY-GAIN ELECTRONICS CORPORATION
8421 N.E. Highway 6—Lincoln, Nebraska 68501

Rugged machine formed heavy gauge steel boom to mast bracket accepts 1¼ to 1⅝" mast.

Driven element to boom bracket with exclusive Hy-Gain Beta Match.

Injection molded high impact styron parasitic element to boom bracket.

hy-gain's

15-element 2 meter Beam Model 215

- Delivers 17.8 db Gain
- F/B Ratio, 25-30 db
- Maximum Power, 1 kw
- VSWR, 1.5:1

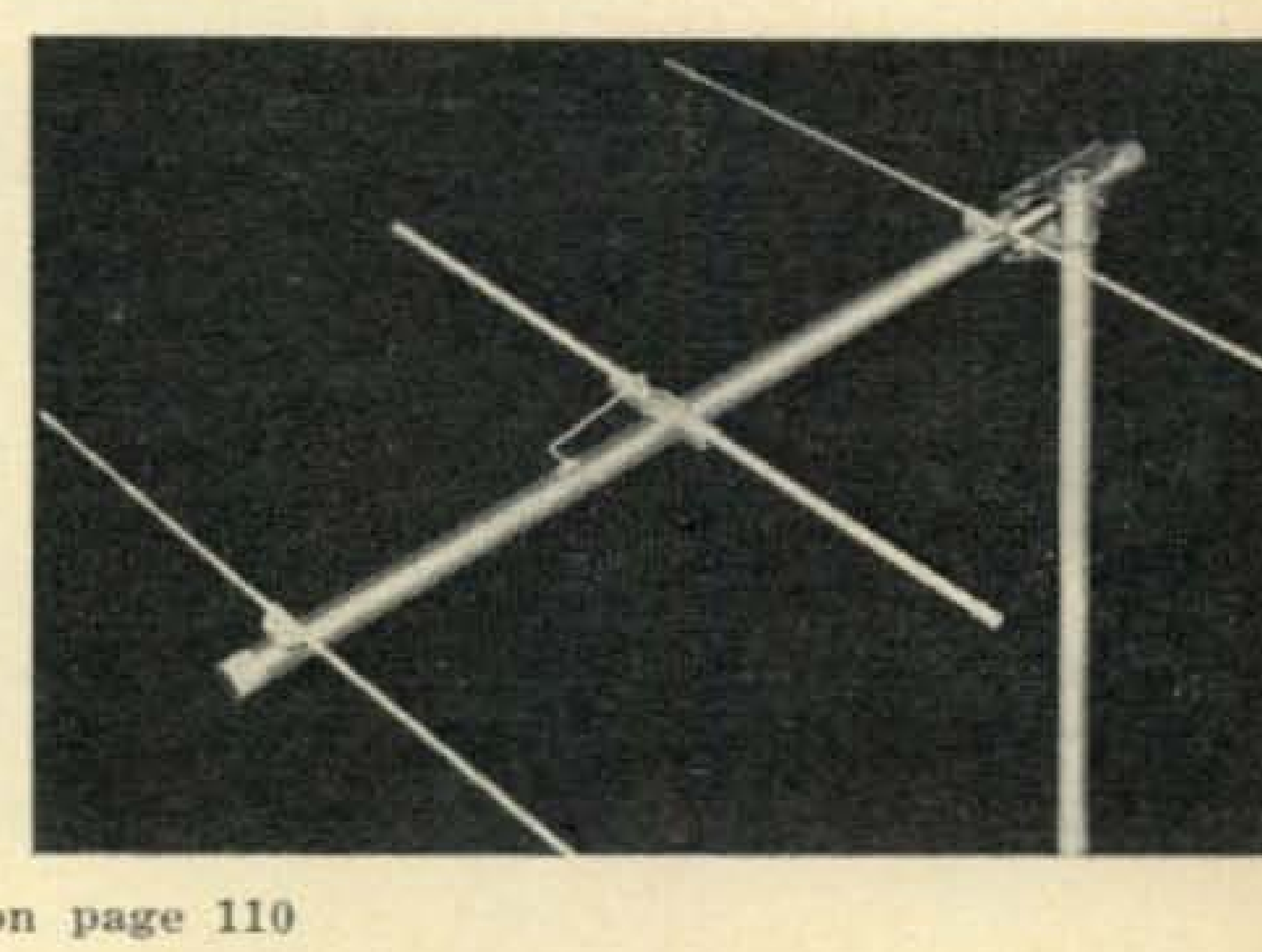
$39.50 Net

hy-gain's

3-element 2 meter Beam Model 23

- Delivers 9 db Gain
- F/B Ratio, 20 db
- Maximum Power, 1 kw
- VSWR, 1.5:1

$8.95 Net



For further information, check number 31, on page 110

For further information, check number 32, on page 110

1966 YLRL Anniversary Party

Time: CW—Start—October 19, 1966, 1200 EST (1700 GMT)
End—October 20, 1966, 1800 EST (2300 GMT)
Phone—Start—Nov. 2, 1966, 1200 EST (1700 GMT)
End—November 3, 1966, 1800 EST (2300 GMT)

Eligibility: All licensed YL and XYL operators throughout the world are invited to participate. YLRL members *only* are eligible for the Cup Awards. *Non*-members will receive certificates. *ONLY YLRL MEMBERS* are eligible for the Corcoran Award. Contacts with OMs will not count.

Operation: All bands may be used. Cross band operation is not permitted. Only one contact with each station will be counted in each contest.

Procedure: Call, "CQ YL".

Exchange: Station worked, OSO number, RS/RST, ARRL Section or Country. Entries in log should show the time, band, date, transmitter and power.

Scoring: a) CW and Phone sections will be scored as separate contests. Submit *separate* logs for each contest.

b) **Important! Note Change in Scoring From Previous Years!** All YLs located within an ARRL Section, score 1 (one) point for each QSO with another station located within an ARRL Section. Score 2 (two) points for each contact with a station not located in an ARRL Section. (ie; DX). DX YLs (by definition all stations not located within an ARRL Section) shall score 2 points for each contact with a station located in an ARRL Section. Score 1 point for each contact with another DX station.

Note: It is imperative that each YL know her Section. Do not use the name of the "country" if it is an ARRL Section. Hawaii, Puerto Rico, Cuba, Virgin Islands, Alaska, etc. are not DX as they are in ARRL Sections. (Section lists are available from the Vice President. Send s.a.s.e. to receive one).

Multiply number of contact points by total number of ARRL Sections or countries worked.

c) Contestants running no more than 150 watts DC input at any time, may multiply this score by 1.25 (low power multiplier).

d) SSB contestants running 300 watts P.E.P., or less, at all times may use the low power multiplier).

Awards: Highest CW score–Gold Cup (YLRL Member only). Highest Phone score—Gold Cup (YLRL Member only). Highest phone and highest CW score in each district and country shall receive a certificate. Highest *COMBINED* Phone and CW scores (YLRL Member) will receive the Corcoran award.

DX Awards: Given by Arlie Hager, W4HLF. Highest *Combined phone and CW scores*. From North and Central America, including Greater and Lesser Antilles—Cup. DX YL from any other part of the world—Cup. Please send logs airmail to be sure of qualifying.

Logs: Copies of all logs must show claimed score, be signed by the operator, postmarked no later than November 25, 1966, and received no later than December 9, 1966, or they will be disqualified. Send copies of logs to: Edie McCracken, K1EKO, Vice President, YLRL, P.O. Box 285, Westwood, Mass. 02090.

No logs will be returned. Be sure it is a copy of your log that you send. Carbon copies which are smudged in mailing and handling and become unreadable will be disqualified.

NEW FROM ALLIED knight-kit® 6 and 2-Meter Transceiver Kits

Knight-Kit 6-Meter Transceiver Kit

New top-performing Ham rig with many extras. Covers 50-52 mc and 49.980 MARS. Solid state universal power supply for 12 VDC mobile and 110-130 VAC. Noise-canceling push-to-talk mike. 3-stage transmitter has doubler, tripler and straight-through final. Selective dual-conversion receiver. Illuminated "S" Meter/Output Meter. Complete with all parts, wire, solder, and easy step-by-step instructions. **$139.95**

Knight-Kit 2-Meter Transceiver Kit

Compact and versatile Ham transceiver for General, Technician, or Novice class. Covers 144-148 mc. Built-in solid-state universal power supply. Dual-conversion receiver. Crystal-controlled RF and mixer stages. Noise-canceling push-to-talk mike. Complete with all parts, wire, solder and step-by-step instructions. **$144.95**

Knight-Kit 6 or 2-Meter VFO Kit

Features Clapp Oscillator, temperature-compensated and voltage regulated. Takes power from transceiver. B+ switch and indicator light. Back-lighted dial calibrated for 6 and 2 meters. Complete parts, instructions. **$19.95**

KNIGHT-KIT GUARANTEE

Build a Knight-Kit in accordance with our easy-to-follow instructions. When you have completely assembled the kit, you must be satisfied or we will return your money, less transportation charges, under the Allied guarantee of satisfaction. **ALLIED RADIO**

Read the unique money-back guarantee . . . exclusive in the industry . . . then rush coupon below for full details and Special Introductory Offer on 6 and 2-Meter Transceivers.

ALLIED RADIO, Knight-Kit., Dept. 12-JJ
P. O. Box 4398, Chicago, Ill. 60680

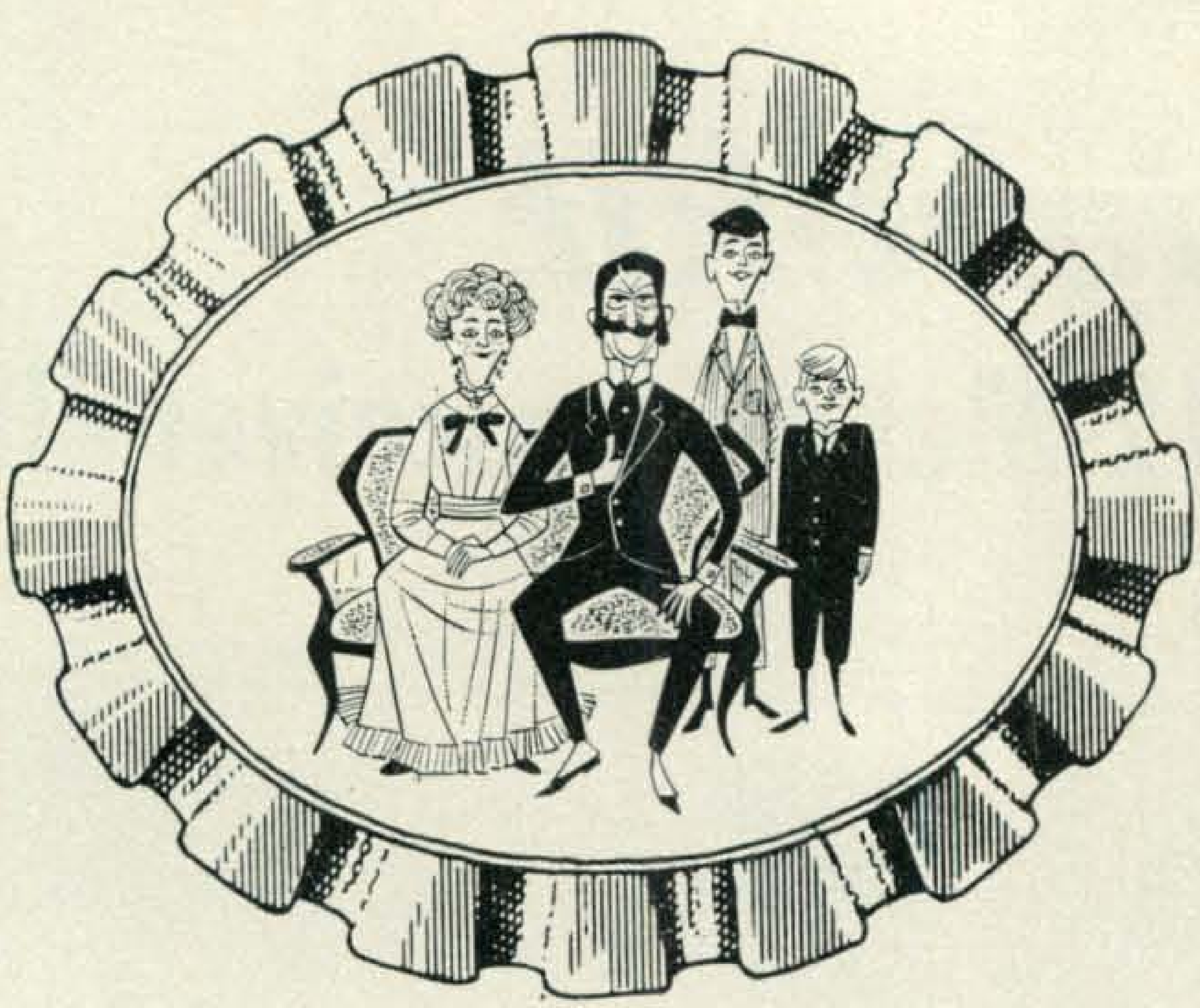
Send me full details and Special Introductory Offer on **Knight-Kit 6 and 2-Meter Transceiver Kits.**

Name______________________
PLEASE PRINT

Address______________________

City__________ State__________ Zip__________

For further information, check number 33, on page 110



Quiet Family Circle

BY SYLVIA MARGOLIS*

"And the King was so delighted that the beggar had DF'd the wicked bootleggers' QTH that he let him marry his only, beloved daughter, who was not only the most beautiful girl in the world, but who also had 294 countries confirmed. And, for a wedding gift, the King gave them a kingdom of their very own, with a complete rhombic farm, six-element, optimum-spaced beam on all bands and separate, solid-gold transceivers for every band and, instead of control knobs, the transceivers had huge diamonds and they all lived happily ever after. . . ."

NOT the Best of Spock, but it was the only bedtime story Jonathan understood and the only one he was likely to hear.

He had been three when the dreaded amateur radio virus attacked our home and, like the Plague which had decimated London three centuries ago, struck down the family, one after another. Jonny's elder brother, Laurie, aged eight, could still faintly remember the happy times when a radio was a thing you switched on to hear the news, an antenna waved on the head of a moth and New York was three thousand miles away. But Jonny knew nothing else. This was his world.

Daddy studied code and theory with the blinkered concentration of a Pilgrim Father stalking his first Thanksgiving Dinner. Laurie, who must copy everything Daddy did, entered the new element supremely confident that it would hold him up like the Dead Sea. Mother, inured by then to a dozen equally unlikely obsessions into accepting amateur radio as yet another phase in the Hard Day's Night that was her marriage, was uncommitted. This could be no worse than photography, movie-making, wood-turning, model boats, electric trains, rug-making, and the apple-cider-honey cult. Or could it?

Maurice passed the examinations and became G3NMR. Laurie became a fanatical short-wave listener. With a child's astounding memory for statistics, he was soon an authority on DX and a friend high up in the listing once called us to check a knotty point of coral-reef protocol, not with G3NMR, but with Laurie, all of 10 years old, who handled the problem as calmly and capably as U Thant!

So Jonny emerged from infancy into a childhood that seemed normal enough to him, poor mite, if faintly odd to other people. He accepted things, as children will accept the strangest situations, so long as they can call them Home. Some kids get parents who gamble away the grocery money and have to live on Relief, who drink and beat each other up when there's nothing worth watching on TV, who get religion. Our kids got G3NMR and his Ever Loving Wife.

Other children played cowboys and indians. Laurie and Jonny played hams and bootleggers or, better still, hams and FCC Inspectors. Other kids played police-cars chasing gangsters. Jonny drove his kiddy-car around saying:—

"The name is Jonny. I spell—T.O.M."

Other children annotated car numbers or train or plane numbers. My children competed to see who could hear DXCC quickest from the start

The G3NMR QSL bears this photo of the author and her husband. Note Maurice's hand over the mike—nobody other than a licensed British amateur may use the transmitter!

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

G3UML, Laurie Margolis, the author's eldest son, who obtained his license at the minimum British age, 14 years.

of the school vacations. Laurie did it once on 20 meters in 19 hours. Instead of toys for birthdays and Christmas, my children asked for their very own subscriptions to the Radio Society of Great Britain. At nine, Laurie was the youngest member ever, which information, thoughtfully included in his QSL, could reliably melt the heart of the thorniest DX-peditionist and squeeze a card out of him.

Realizing that this thing was bigger than any of us and that it was here to stay, I joined in, too. I listen regularly to a daily B.B.C. nation-wide program called "Woman's Hour," with an audience rating of two million and a consistently high standard of magazine material. A woman talked one day about her sufferings as the wife of a fishing addict.

"I suffer more than that!" I said and wrote them an article about our affliction. British licensing laws forbid anybody except a licensed amateur to use the transmitter under any circumstances whatsoever. So, forbidden to use our British amateur 150-watt power limit, I went out on 100 kilowatts.

After I had said my bit, a man came into the studio. "Where is the woman who talked about radio?" he demanded. I confessed.

"You're wanted!" he said.

This was IT. I had committed an obscenity, or fused the B.B.C. transmitters or offended de Gaulle. There would be a quick trial and I would be shot at dawn, or perhaps it might be made to look like an accident, to satisfy the C.I.A. At worst I would have to pay back the 20 dollars they were contracted to pay me.

"Where are we going?" I asked my gaoler.

"Chief Engineer wants to see you."

So it was the transmitters I had blown, not N.A.T.O. I tried to figure out how long it would take me to pay back two million dollars, on my dress allowance of twenty dollars a month.

We arrived. The Chief Engineer was a ham. He wanted me to have tea with him.

After this I began to write for British and American amateur radio magazines and *Mobile News* happened. Maurice joined the tiny, new-born Amateur Radio Mobile Society. Following the pattern of all clubs that survive the first three months, A.R.M.S. sought immortality in the printed word. Maurice owned an ancient, hand-operated mimeograph, his wife had a typewriter and her eye on the Editorial chair of the *New Yorker*, no less.

So *Mobile News* was born, single-sheet, parochial, clumsy. Seven years later it is a bulky, authoritative, printed magazine, with world circulation and enormous prestige and influence, although most of the work is still done voluntarily.

Mobile News week in our home each month is like Spring-cleaning week in others. All extraneous activity stops. Everybody is pressed into helping—proof-reading, checking, composing, plagiarising. Visitors, even ham visitors, are firmly discouraged, unless they are the bearers of good "copy." Sometimes, even, the rig is switched off *before* the filaments in the tubes glow red, so devoted are we to the production of this zany baby who grew so big and sassy.

The restrictions on their social life disturbed our children not at all. In the Summer they had Hamfests. Rarely a weekend goes by without a couple of these on the program and Britain is so small that there is always an event a few hours' drive from home.

The British Hamfest usually takes the form of a "Mobile Rally," with radio amateurs driving in with their families and friends to picnic, ragchew and occasionally participate, in leisured and dilettante fashion, in the entertainments provided. Favourite meeting spots are those magnificent estates and palaces owned by deprived aristocrats, who open their gates to the public at 50 cents a head, so that they can afford the vast upkeep of these inherited anachronisms. Here the peasants can gape at hundreds of acres of parkland, millions of dollars' worth of antiques and paintings, all in their original settings, with the chance of being shown round by a real Duke who, to many of them, would look far better hanging from a lamp-post. This is Democracy at work. Woburn, ancestral home of the Duke of Bedford, is the most popular, although Bedford has been hopelessly outclassed by rival Lord Bath who introduced to his estate 50 full-grown lions. All Britain eagerly awaits the news of the first tourist to be eaten. Mobile hams are hoping to be attacked by a lion, so that they can put out a MAYDAY . . .

A.4862, the author's younger son, Jonathan, an avid short-wave-listener.

"You're not going to believe this, Old Man, but. . . . . .!"

The Rally organizers need do no more than set up their talk-in stations, arrange a few esoteric contests and side-shows and exploit the status quo.

One of the biggest of these Rallies is the one which the Amateur Radio Mobile Society organizes on a U.S. Air Force Base—coming shortly in *CQ*—"Quiet Weekend with Uncle Sam."

Their unconventional environment had a spectacular effect on the children's education, which tended sometimes to the startling. The stream of overseas guests who visit us is, on the whole, a splendid influence, apart from the occasional lapse, like the very distinguished VE2 surgeon, who should have known better, who taught the Infant Jonny the words of one of the Tom Lehrer songs (of course it had to be the one about virility) and Jonny taught them to the little girl next door.

But the widening of their suburban, British horizon was indubitable. Thus Laurie would instruct his 7-year-old brother:—"Jonny, what's the capital of Brazil?"

"Brasilia."

"Correct. What's the capital of Venezuela?"

"Caracas."

"Correct. What's the capital of Costa Rica?"

"Don't know."

Bash.

"Now, Jonny, what's the capital of Costa Rica?"

Amid anguished howls Jonny would rapidly be acquiring the trauma that would drive him in later years to hit old ladies over the head and attribute it all to sibling-rivalry.

"Capital of Costa Rica, Jonny?"

"San Jose."

That way you learn fast. When TI2WR has dined in your home and your mother has made a fool of herself demonstrating her perfect coffee, then to find that Walter is a coffee grower—that way you learn very fast all about exotic countries.

You learn the facts of life, too, not all that jazz about birds and bees and hormones, but useful information, vital to a growing boy, like how to fine-tune a receiver, all about digital readout, the gain a quad has over a yagi, how to get a QSL out of a rare station and where Don Miller is likely to go next.

Some people look at their home as a shelter from the cold and rain, a fortress of privacy protecting them from the outside world, a refuge of peace and family harmony, symbolised by roses round the door, the old rocking chair, the smell of new bread, with a rosy-cheeked, grey-haired mother smiling her welcome.

The roses round our door need pruning because Daddy is busy building his new Heathkit, the smell of new bread is likely to be overwhelmed by the stink of melting transformers, or a Spanish omelette being cooked the way he used to do it on top of a mountain in Afghanistan by K6IWG. The grey-haired mother doesn't exist, period. Rather a black-tressed (Polycolour "Raven Black") termagant who yells at the kids to get their own supper because she has to meet a *CQ* deadline.

Overseas guests are given the V.I.P. treatment. W9AHR, Bill Carter, was taken to the famous R.S.G.B. Rally at Woburn Abbey, ancestral home of the Duke of Bedford. The silver dollar the author is wearing was given her by K7BGS, Mary Sturkey.

Our home has a dual function, as a radio QTH and an annexe of the London Hilton. In both characters it fails pitifully. As a QTH it is a mere 150 feet above sea level and there is room only for one telescopic tower. The area is densely inhabited by devoted TV fans and there is à factory nearby which uses an r.f. welding process to make furniture. Why can't people make do with sawn logs and buffalo hides for furniture?

As a Hilton-annexe we make a poor show, for we have only one spare bed and can't accommodate more than 50 people for a party. So, when an overseas visitor obeys my husband's burblings on 20 meters to "drop in when he is in London," and the local Boys come to meet him, we have to limit the guest-list to an extent that is frustrating and in direct contravention of the Ham Spirit.

Nevertheless the Guest Book has nearly achieved DXCC and the kids are never surprised at anything or anyone that arrives, whether it be for coffee, a drink, dinner, the night, the weekend, the week or the Summer.

My children are by no means condemned to a life that is entirely bucolic and home-spun. There is sophisticated entertainment for them, like the London SSB Dinners, the R.S.G.B. Golden Jubilee and the time we married off K6IWG, all tales told in *CQ*. We regretted taking them to the SSB Dinner, because they both had to have new suits, shirts and shoes, which they only wore once afterwards, when we married off K6IWG. Now they properly understand that they prefer outdoor events, where sweaters and jeans are the thing and much cheaper.

With one licensed amateur and two shortwave listeners in the house, life seemed complicated, but it was simple compared with what was to come.

My second ham was born in Geneva. We were there on vacation when we heard over 4U1ITU that Laurie had passed his radio amateurs' examination.

This change of status meant a certain amount of re-think in the family. Appointments had to be made to use the rig. Maurice swiftly, and with humility, learnt that he had been doing it all wrong for years, that he lacked application in his quest for DX, that his progress up the Ladder was lamentably slow. He was still permitted, though, to attend to such trivia as paying license fees and supplying equipment and QSL's. In that sphere he remained Dear Old Dad.

The Cordon Bleu of British awards, one which is eagerly sought and prized above all others, is the Commonwealth DX Club Certificate, with its distinctive badge, for which you have to work 50 Commonwealth countries on 20 and 50 more on any other band or bands. It's very difficult. Maurice had waited three years for the last, elusive QSL and counted himself lucky that it arrived in time for him to claim the coveted badge before his son!

I listened, fascinated, as Laurie elegantly handled a sheaf of jostling W's, shuffling them into disciplined order, or stalking an ephemeral, immensely rare station with fierce concentration and patience, pouncing at the precise moment for the kill. I heard him slip naturally into the role of M.C., so that a group of Europeans, who all wanted to work Don Miller, responded gratefully to the ice-cold control of this infant prodigy. Horrified, I heard him tell a UA1 that he was splattering, an Italian that he was calling right on top of Gus Browning. This was my kid, 15 years old, taking his place calmly among his peers, a man among men. I asked a distinguished British DX-er how Laurie was shaping. Was he not arrogant, brash, riding for a fall? No, it seemed he was doing very nicely indeed and had the makings of a creditable DX-peditioner.

But the Old Lion was still to have his uses. Came the TVI complaints. For months we countered them with tried and trusted routines like:

"Do you have a license to *receive* my transmissions?" with that frosty look that only we British can achieve properly, or:

"What about that gift *your* dog leaves on *my* front path every morning?" All techniques guaranteed to help you make friends and influence people.

The neighbors were influenced alright, to the extent of sending a Petition to the G.P.O.

Laurie asked tremulously: "What shall I do, Dad?"

The G.P.O. Inspectors were wonderfully understanding and accepted Maurice's explanation that that 48 hours' solid operation with the linear flat out was only to boost Britain's prestige in a Contest and that never, *never* would it happen again. G3NMR and G3UML are still on the air.

Now the system is simple and infallible. Jonny, aged 10, and proud of the authority vested in him, accepts that he needs little sleep after 6 A.M. As a very special privilege, he is allowed to start monitoring at dawn, when the Pacific and other goodies come in. If anything special is around, he must rush upstairs to wake his father and brother.

Occasionally, trying too hard, maybe, Jonny mistakes an F8 for an FO8, an EA1 for a JA1, and sounds a false alarm. Then he is soundly beaten and the error of his ways explained to him. If he behaves so irresponsibly, he will never grow to be big and strong and a licensed radio amateur like Daddy and Laurie. If he does well and finds them at least one new country a week, and never lets Gus Browning out of his hearing, he is rewarded by being able to log the morsels himself.

Of such is the Kingdom of Heaven. ■

Additional Improvements For The 75A-4

BY K. C. AGRELIUS,* K6SHA

AN article in the June 1965 issue of *CQ*[1] described several modifications to improve the performance of the 75A-4 receiver. I have since received many calls from those who made these modifications, asking why the recovery time was so slow in the SLOW AVC position. This can be corrected as shown in fig. 1. Figure 1(A) shows how C_{20} is ungrounded and connected to the junction of R_{98} and R_{104}. The 0.01 is added for improved r.f. bypassing. Figure 1(B) shows how components R_{90} and C_{112} are removed to improve the recovery time.

The changes shown in fig. 1(C) provides an increased negative bias on the control grid of V_{22} to insure complete muting. ■

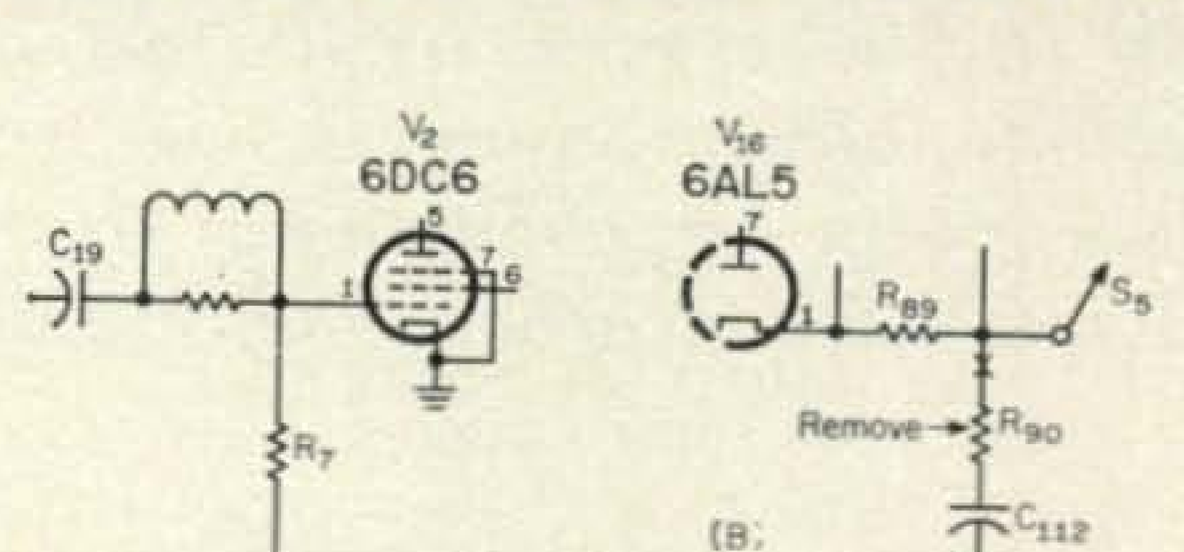


Fig. 1 (A) and (B)—Modifications to the 75A-4 improve recovery time in the SLOW AVC setting. The shielded wire that is added should have the braid grounded at both ends. (C) This modification improves the muting action.

*2109 Saxe Court, Thousand Oaks, California.

[1]Agrelius, K. C., "Improving the 75A-4 On SSB," *CQ*, June 1965, p. 53.

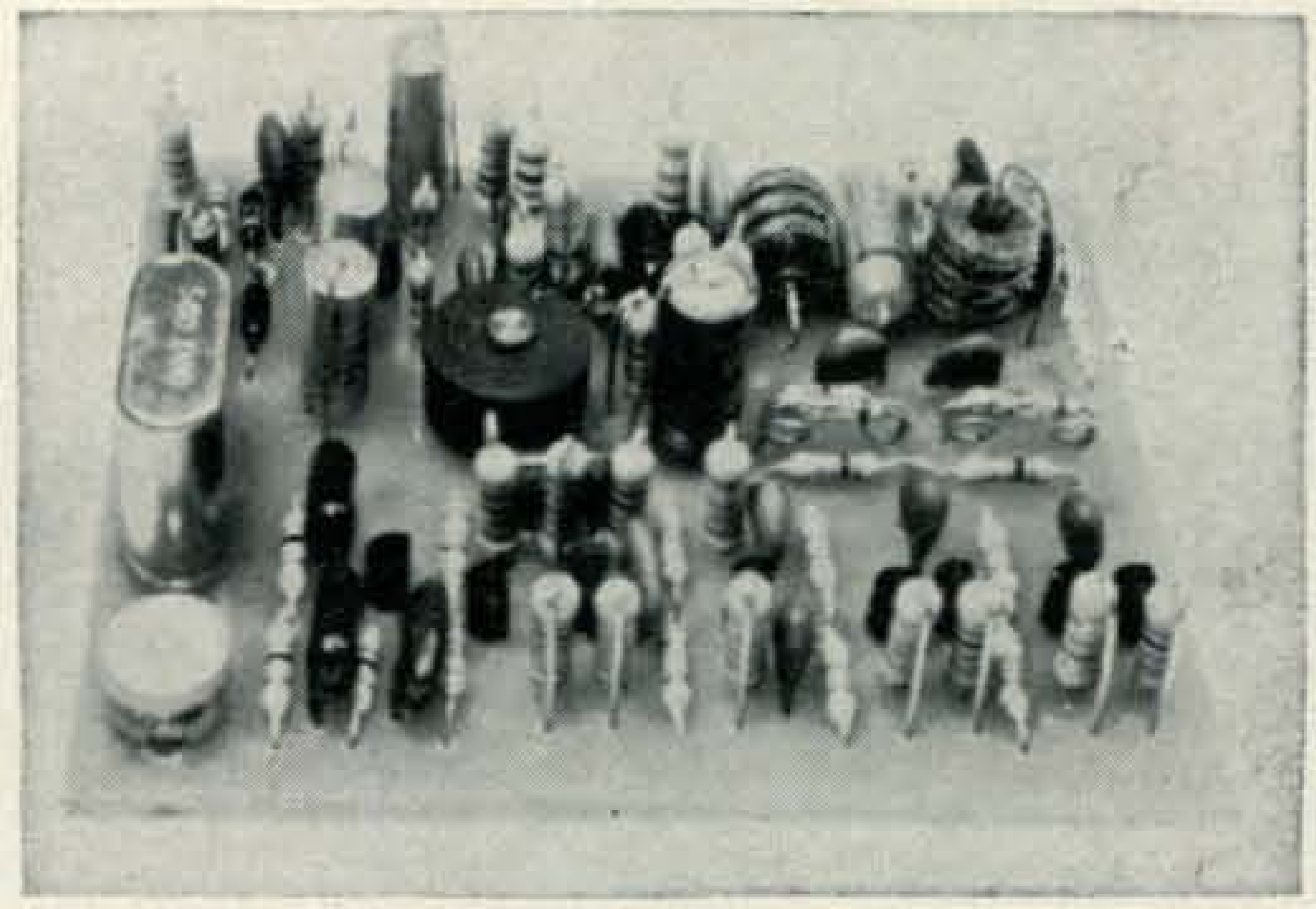
A PHASE-LOCKED LOCAL OSCILLATOR FOR ADVANCED RECEIVER DESIGN

BY E. J. KIRCHNER,* VE3CTP

The author describes a phase-locked local oscillator that can produce outputs beyond 30 mc, locked to plus or minus one cycle, in 500 kc segments. Used as the crystal oscillator in a double superheterodyne receiver it can reduce costs by eliminating crystals and increase accuracy and stability.

In recent years some manufacturers of commercial double conversion receivers and transmitters are employing so-called frequency synthesizers to circumvent the necessity for the many crystals to cover the h.f. spectrum from, say, 2 to 30 mc in small variable segments. The National HRO-500 is an example of such a receiver. It incorporates a frequency synthesizer which does the job of some sixty crystals needed using conventional circuits. However, anyone who took a glance at the circuit diagram of the HRO-500 will rule out, at the beginning, the duplication of such a circuit. In the home work shop it would be quite a hopeless undertaking.

*McPhar Geophysics, 139 Bond Avenue, Don Mills, Ontario, Canada.



The circuit described here is simpler than any known system, and because it employs only one simple tuned circuit and standard components, lends itself easily to home construction projects. The cost for the material, including the transistors, comes to around $30 if all parts are bought new, but could be considerably reduced if advantage is taken of the many items offered by the surplus houses. The transistors used are below the one dollar mark, yet are of the high gain, low noise, silicon variety, which, by the way, oscillates well up to 400 mc.

Double Superhet Operation

To give the reader an understanding of the operation and application of this local oscillator system let us look at the block diagram of a typical double conversion ham receiver shown in fig. 1. (It is assumed that the reader understands the reasons for the double conversion system.)

The signal picked up by the antenna is amplified in the r.f. stage and applied to the first converter where it is mixed with a signal from the high frequency oscillator (h.f.o.) which is in almost all cases controlled and stabilized by a crystal. The output of the first converter is called the first intermediate frequency (first i.f.) and is fed to the second converter where it is again mixed with a signal from the v.f.o. The resultant signal is called the second i.f. and is fed to the detector where the intelligence contained in the signal is recovered and which is then amplified to an audible level. The first i.f. and the v.f.o. are usually tunable over a 500 kc segment, the frequency range of which remains the same on all bands. This means that all desired bands have to be converted to this frequency range by the first converter in conjunction with the h.f.o.

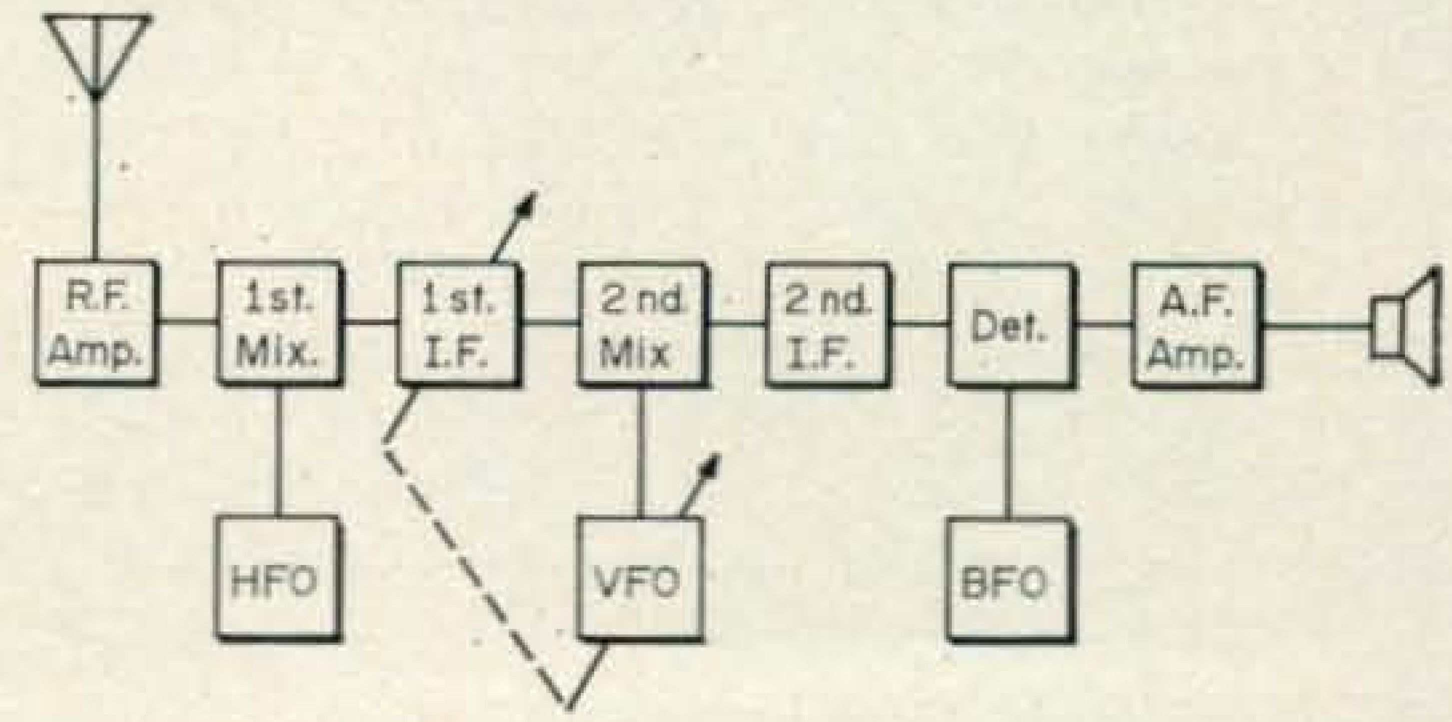


Fig. 1—Block diagram of a typical double superheterodyne.

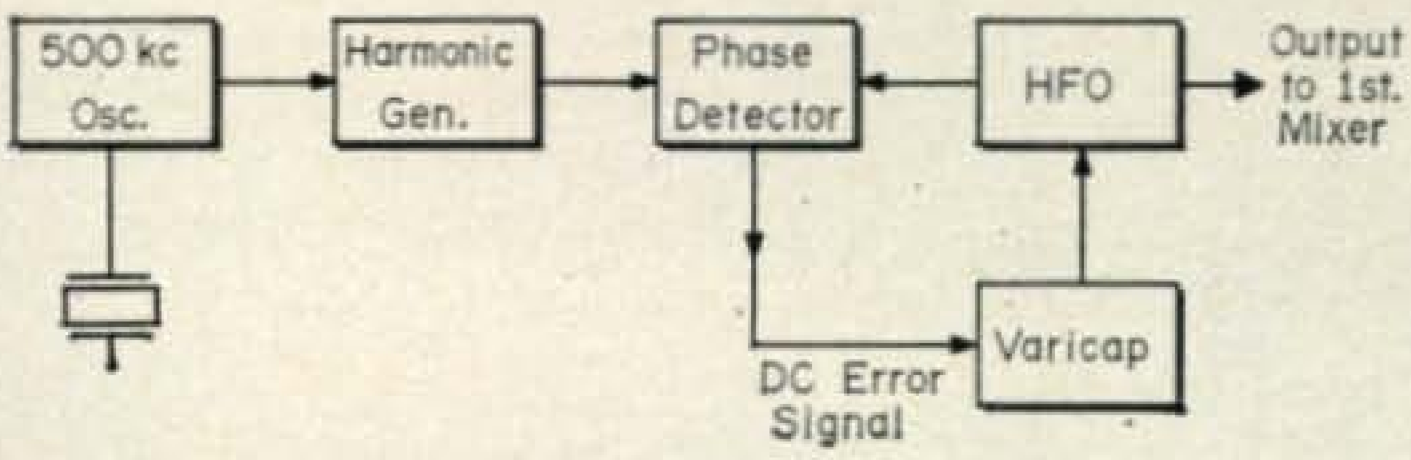


Fig. 2—Block diagram of the phase locked local oscillator used to produce output frequencies in steps of 500 kc. The output range is determined by the range of the h.f.o. whose accuracy can be held to ± one cycle.

A segment of 500 kc covers each ham band except for ten meters, (28 to 30 mc) which has to be divided into four segments.

It follows that in order to cover only the amateur bands from 80 through 10 meters eight fixed frequencies are required from the h.f.o. (eight crystals). For each additionally desired 500 kc segment in the h.f. spectrum one crystal has to be added. In fact one manufacturer of commercial receivers does exactly that and employs sixty crystals in connection with a sixty position switch. The high price for such a number of crystals plus the cost for a multi-position high quality switch precludes the use of such a system in home constructed receivers.

Operation

The locked h.f. oscillator described here can be substituted for such a multi crystal system in the h.f.o. It cuts the cost to a reasonable amount and as a bonus shows an advantage as will be pointed out later. The system is shown in block diagram form in fig. 2.

A precision 500 kc crystal oscillator drives a harmonic generator which produces square waves. These square waves are rich in harmonic content and produce multiples of 500 kc *e.g.* 1.0 mc, 1.5 mc, 2.0 mc, 2.5 mc . . . *etc.* up to beyond 30 mc. These harmonics are fed to a phase detector. The output of a free running oscillator (h.f.o.) is also fed to the phase detector and compared with the closest harmonic of the 500 kc crystal. Unless the h.f.o. is tuned exactly to a multiple of 500 kc a d.c. error signal is developed by the phase detector. This d.c. voltage is applied to a Varicap diode with the proper polarity. The Varicap essentially behaves like a variable capacitor across the tuned circuit of the h.f.o. This variable capacitor will adjust the frequency of the h.f.o. to the nearest multiple of the 500 kc crystal, and locks it to within one cycle. The output of the h.f.o. is then applied to the first converter of the double conversion receiver.

The additional advantage of this system over a conventional multi-crystal oscillator, as mentioned before, is that the output frequency of the h.f.o. is phase locked to within one cycle at *all* multiples of 500 kc while the many crystals of a multi-crystal system have to be individually aligned and even then will never be as close as one cycle. Further more, frequency drift occurs, sometimes in different directions, due to aging and other causes and the circuit requires frequent realignment.

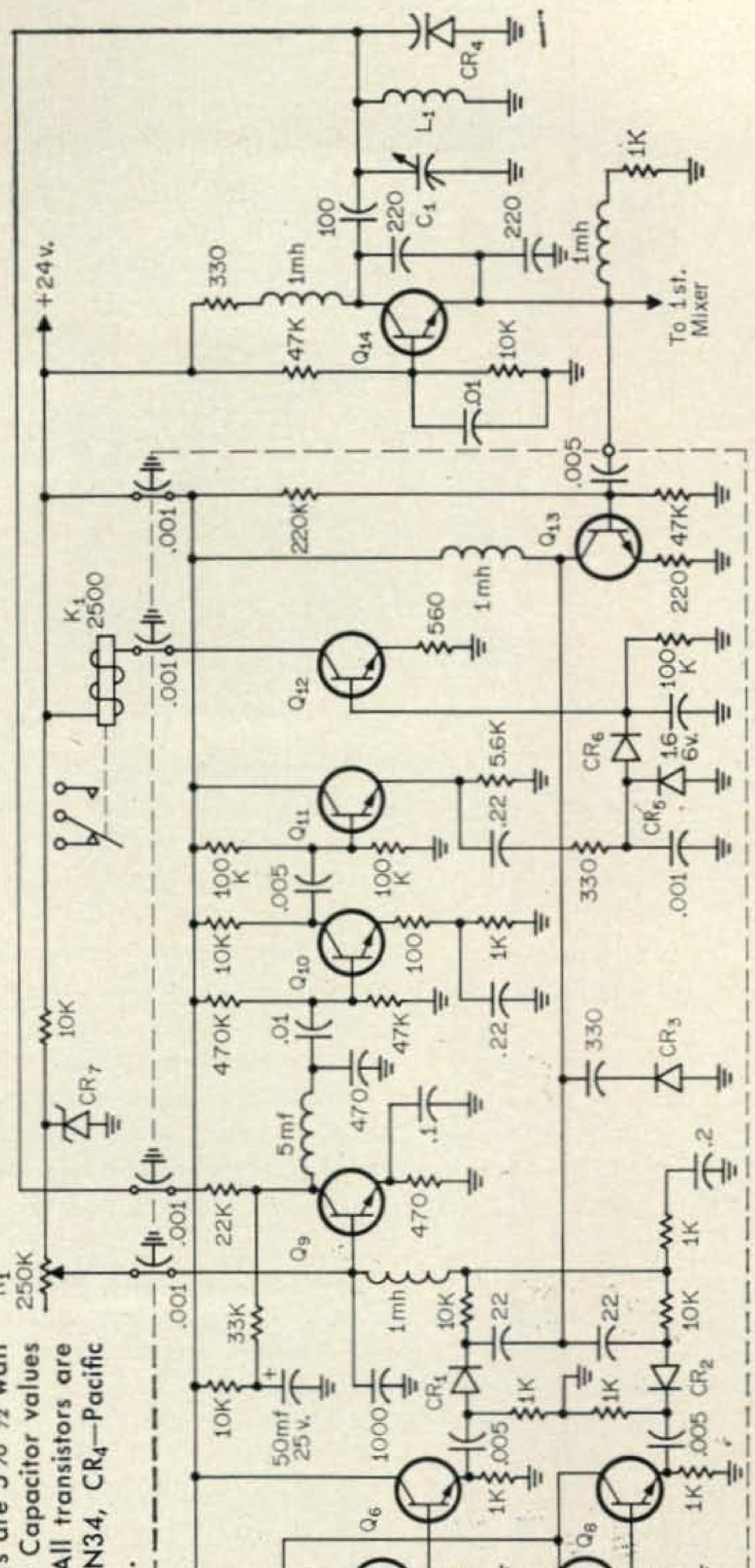
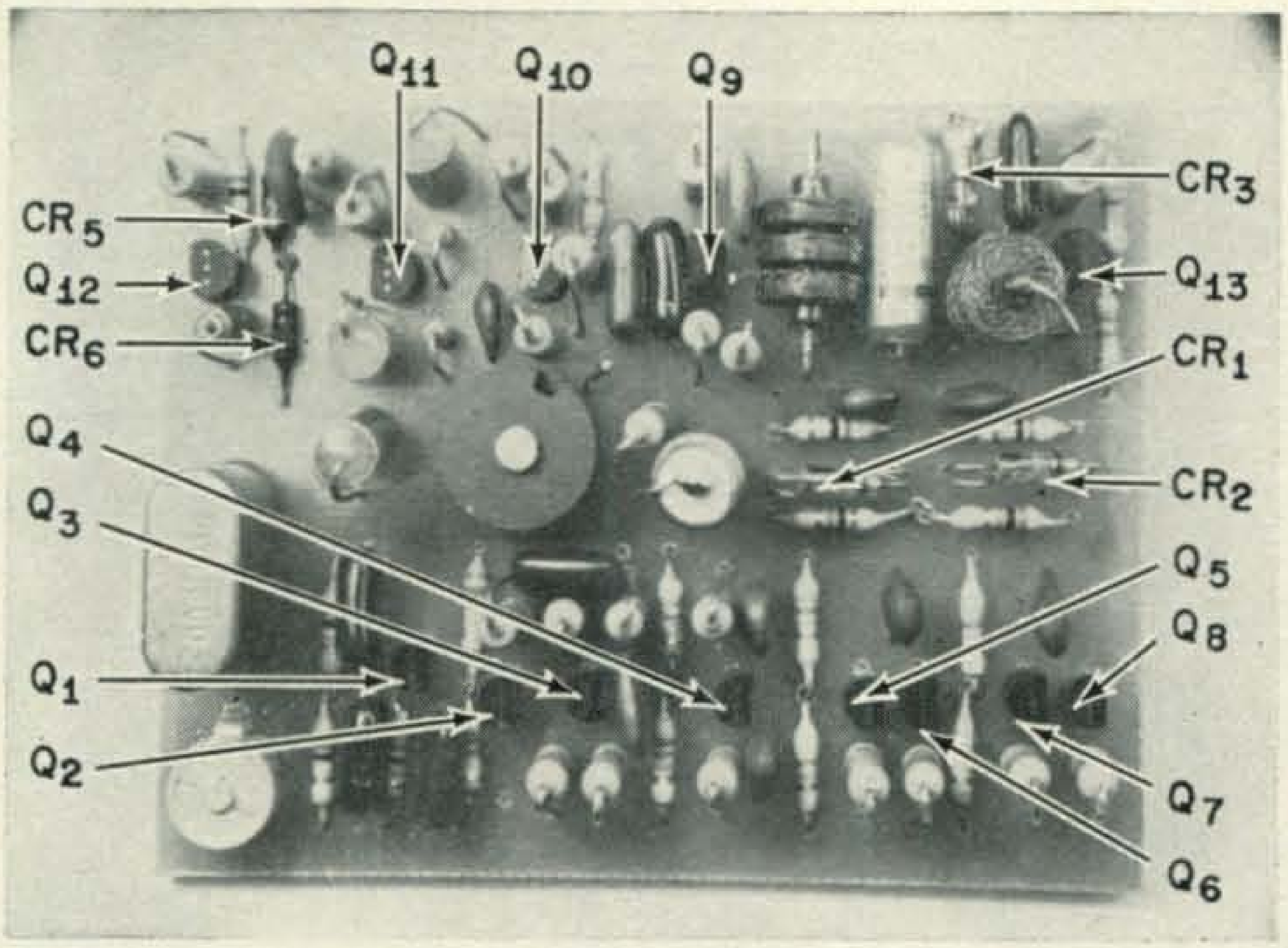


Fig. 3—Circuit diagram of the frequency synthesizer. All resistors are 5% ½ watt and all capacitors are disc ceramics except for the electrolytics. Capacitor values less than one are in mf; those greater than one are in mmf. All transistors are Motorola type MPS 6520. CR_1, CR_2—1N35, CR_3, CR_5, CR_6—1N34, CR_4—Pacific Semiconductors V-100, CR_7—6 volt Zener diode.



Top view of the board containing the circuit shows the layout. The v.f.o. is constructed on another board and is not shown.

usually stringent mechanical requirements for a high frequency oscillator can be neglected as the stability of the h.f.o. in the locked condition is wholly determined by the 500 kc crystal.

Lock Indicator

Transistors Q_{10}, Q_{11} and Q_{12} are not essential for the operation of the system. However, it was felt that it was desirable to indicate the locked conditions of the h.f.o. Also it is more comfortable for the ears if the receiver is muted when the h.f.o. is in a nonlocked condition (when setting the h.f.o. tuning capacitor to the next locking point).

In the unlocked condition a beat frequency is developed at the collector of Q_9 which constitutes the difference between the multiples of 500 kc and the h.f.o. frequency. This beat frequency is amplified in Q_{10} and fed to the impedance step down stage Q_{11}. The output from Q_{11} is rectified in the voltage doubler circuit, D_5 and D_6, and the resulting d.c. switches Q_{12} either on or off. The relay K_1 can then be used to mute the receiver. This is best done in the second i.f. stages. The other relay contact can be used to power a pilot light on the front panel to indicate unlocked condition.

Circuit Description

The circuit, shown in fig. 3, operates as follows: Transistor Q_1 is the 500 kc oscillator. As its output will be intentionally distorted in the following stages no tuned circuit is required for good sinewave form. The trimmer in series with the crystal is used to adjust the crystal frequency by zero beating it against a WWV station in the usual manner. When ordering the crystal, parallel resonance at 32 mmf should be specified.

Transistors Q_2 and Q_3 comprise a Schmitt trigger whose output are square waves at the rate of 500 kc and which are rich in harmonic content.

Transistor Q_4 is a phase inverter, with the outputs from the emitter and the collector split by 180 degrees. These two signals are both fed to impedance step down stages Q_5, Q_6 and Q_7, Q_8 to increase the efficiency of the phase detector D_1 and D_2.

Transistor Q_{14} is the h.f.o. whose LC components determine the desired frequency at which it should lock in. The h.f.o. is followed by a buffer stage, Q_{13}, which feeds the electrical center of the phase detector. The diode, D_3, distorts the waveform of the output from Q_{13} to enhance the locking properties of the h.f.o. The d.c. output from the phase detector is applied to the d.c. amplifier Q_9 and its output is applied to the Varicap, D_4.

The potentiometer, R_1, sets the proper operating conditions for Q_9, and should be adjusted for 8 volts d.c. at the collector of Q_9. The d.c. voltage at this point is critical and changes as the frequency range of the h.f.o. is switched to cover another band.

In a communications receiver designed by the writer, this problem was solved by a series of trimming potentiometers which are also connected to the bandswitch. Each pot was adjusted for 8 volts at the collector of Q_9 at the center of the tuning range of the h.f.o., thus eliminating an additional front panel control. The variable capacitor, C_1, tunes the h.f.o. through its range and can be an ordinary broadcast type. The

Practical Considerations

In general the layout is not critical. The circuit was constructed with different configurations and each time functioned well without hesitation. However it is recommended to shield the portion within the dashed lines on the circuit diagram. Feed through capacitors are used for all leads to the synthesizer except for the output lead from the h.f.o. feeding the buffer stage Q_{13}. Component values are not critical and don't have to be individually adjusted.

The area enclosed in the dotted line should be carefully shielded and bypassed to minimize the possibility of harmonic leakage from the 500 kc oscillator that might introduce spurious responses or unwanted r.f. input signal responses in the receiver.

If size is of no importance money can be saved by using parts normally associated with tube circuits as the small sized components are presently more expensive. The photos show the layout of the system used in the receiver mentioned earlier. The wiring is done by using the component leads themselves for interconnections.

The h.f.o. circuitry and the Varicap diode D_4 are not included on the synthesizer board. ■

For further information, check number 41, on page 110

Now A Flip-Of-A-Switch Selects Transceive Or

New HEATHKIT® SB-301 amateur band receiver

With These New Extra-Performance Features

• RTTY position on mode switch — SB-301 is a fully capable RTTY receiver • 15 to 15.5 MHz coverage for WWV reception • Built-in switch-selected ANL • Front-panel switching for control of 6 and 2 meter plug-in converters — enables complete 80 through 2 meter amateur band coverage • Improved product detector and audio circuitry • Simplified assembly procedure through "sub-pack" packaging and assembly techniques

Plus These Pace-Setting Features That Have Already Made The SB-300 Famous In Amateur Radio

• 80 through 10 meter AM, CW, & SSB reception with all crystals furnished • Crystal controlled front-end for same rate tuning on all bands • Famous Heath factory-assembled & tuned LMO for the ultimate in high stability and linear tuning • 1 kHz dial calibration — 100 kHz per dial revolution • Bandspread equal to 10 feet per megahertz • Tuning dial to knob ratio approximately 4-to-1 • The unequaled satisfaction of using a truly high-performance receiver you have assembled yourself

THE NEW SB-301 SETS "THE STATE OF THE ART" FOR AMATEUR BAND RECEIVERS. The new 15 to 15.5 MHz tuning range enables the most accurate attainable frequency check with the built-in 100 kHz crystal calibrator and WWV ... and as you read the specifications, notice the Heath pre-built LMO surpasses the tuning characteristics of every other receiver on the market. What's more, if your QTH is a high noise location, you'll appreciate the new ANL, providing excellent impulse noise rejection.

NEW "SUB-PACK" PACKAGING & ASSEMBLY SPEEDS CONSTRUCTION TIME. Components are packaged separately for each phase of construction ... saves you time in selecting components ... lets you see your progress more clearly as each phase is completed. Order the new SB-301 for unmatched value in a deluxe AM, CW, SSB, and now RTTY amateur band communications receiver.

Kit SB-301, Amateur Band Receiver, less speaker, 23 lbs. **$260.00**

SBA-301-1, Optional AM crystal filter (3.75 kHz), 1 lb. .. **$20.95**

SBA-301-2, Optional CW crystal filter (400 Hz), 1 lb. **$20.95**

Kit SBA-300-3, 6-Meter Plug-in Converter, 2 lbs. **$19.95**

Kit SBA-300-4, 2-Meter Plug-in Converter, 2 lbs. **$19.95**

Kit SB-600, Communications Speaker, 5 lbs. **$17.95**

SB-301 SPECIFICATIONS — Frequency range (megahertz): 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 15.0 to 15.5, 21.0 to 21.5, 28.0 to 28.5, 28.5 to 29.0, 29.0 to 29.5, 29.5 to 30. **Intermediate frequency:** 3.395 megahertz. **Frequency stability:** Less than 100 Hz per hour after 20 min. warmup under normal ambient conditions. Less than 100 Hz for ±10% line voltage variation. **Visual dial accuracy:** Within 200 Hz on all bands. **Electric dial accuracy:** Within 400 Hz on all bands after calibration at nearest 100 kHz point. **Backlash:** No more than 50 Hz. **Sensitivity:** Less than 0.3 microvolt for 10 db signal-plus-noise to noise ratio for SSB operation. **Modes of operation:** Switch selected; LSB, USB, CW, AM, RTTY. **Selectivity:** RTTY; 2.1 kHz at 6 db down, 5.0 kHz at 60 db down (crystal filter supplied). SSB; 2.1 kHz at 6 db down, 5.0 kHz at 60 db down (crystal filter supplied). AM; 3.75 kHz at 6 db down, 10 kHz at 60 db down (crystal filter available as accessory). CW; 400 Hz at 6 db down, 2.0 kHz at 60 db down (crystal filter available as accessory). **Spurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **Audio response:** SSB; 350 to 2450 Hz nominal at 6 db. AM; 200 to 3500 Hz nominal at 6 db. CW; 800 to 1200 Hz nominal at 6 db. **Audio output impedance:** Unbalanced nominal 8 ohm speaker and high impedance headphone. **Audio output power:** 1 watt with less than 8% distortion. **Antenna input impedance:** 50 ohms nominal. **Muting:** Open external ground at Mute socket. **Crystal calibrator:** 100 kHz crystal. **Front panel controls:** Main tuning dial; function switch; mode switch; AGC switch; band switch; AF gain control; RF gain control; preselector; connector & ANL switch; phone jack. **Rear apron connections:** Accessory power plug; HF antenna; VHF #1 antenna; VHF #2 antenna; mute; spare; anti-trip; 500 ohm; 8 ohm speaker; line cord socket; heterodyne oscillator output; LMO output; BFO output; VHF converter switch. **Tube complement:** (1) 6BZ6 RF amplifier; (1) 6AU6 Heterodyne mixer; (1) 6AB4 Heterodyne oscillator; (1) 6AU6 LMO osc.; (1) 6AU6 LMO mixer; (2) 6BA6 IF amplifier; (1) 6AU6 Crystal calibrator; (1) 6HF8 1st audio, audio output; (1) 6AS11 Product Detector, BFO, BFO Amplifier. **Power supply:** Transformer operated with silicon diode rectifiers. **Power requirements:** 120 volts AC, 50/60 Hz, 50 watts. **Dimensions:** 14⅞" W x 6⅝" H x 13⅜" D. **Net weight:** 17 lbs.

With Expanded Versatility — Whether You're DXing, In A Round Table, Net, Or Rag-Chew

• A single panel switch selects transceive or independent operation of SB-401 and SB-301 (or SB-300) combination — no cable changing required • Can be operated as an independent transmitter with any receiver when SBA-401-1 crystal group is installed • New simplified assembly procedure through "sub-pack" packaging and assembly techniques

Plus The Innovations And Rugged Performance Capabilities That Have Put The SB-400 Among The "Standard-Bearers" of Amateur Radio

• A completely self-contained desk-top transmitter with built-in power supply • Built-in antenna change-over relay • Famous Heath pre-built & tuned LMO frequency control • ALC for higher talk power • Optimum power level for operation "bare foot" or as a driver — 180 watts PEP SSB, 170 watts CW • Crystal filter SSB generation • Operates upper or lower sideband • VOX and PTT control • The same uncompromized tuning calibration, linearity, and stability that have made the Heath SB-Series unequalled not only in specifications but on-the-air performance.

VALUE COMPANION TO THE SB-301 OR SB-300. The Heathkit SB-401 provides full transceive operation with the SB-301 or SB-300 . . . gives you outstanding performance 80-10 meters with single-knob LMO control. In addition the SB-Series "combo" goes from transceive to independent transmitter-receiver operation with a flip of a single switch on the SB-401 front panel . . . perfect for DXing! The SB-401 derives all the necessary crystal oscillator voltages from the SB-301 or SB-300 . . . eliminates redundant circuitry! Include the SBA-401-1 crystal pack for complete, independent transmitter operation with receivers other than the SB-301 or SB-300.

Kit SB-401, 34 lbs. $285.00
SBA-401-1, Crystal Pack, 1 lb. $29.95

SB-401 SPECIFICATIONS — **Emission:** SSB (upper or lower sideband) and CW. **Power input:** 170 watts CW, 180 watts P.E.P. SSB. **Power output:** 100 watts (80-15 meters), 80 watts (10 meters). **Output Impedance:** 50 to 75 ohm — less than 2:1 SWR. **Frequency range:** (MHz) 3.5 — 4.0; 7.0 — 7.5; 14.0 — 14.5; 21.0 — 21.5; 28.0 — 28.5; 28.5 — 29.0; 29.0 — 29.5; 29.5 — 30.0. **Frequency stability:** Less than 100 Hz per hr. after 20 min. warmup. **Carrier suppression:** 55 db below peak output. **Unwanted sideband suppression:** 55 db @ 1 kHz. **Intermodulation distortion:** 30 db below peak output (two-tone test). **Keying characteristics:** Break-in CW provided by operating VOX from a keyed tone (Grid block keying). **CW sidetone:** 1000 Hz. **ALC characteristics:** 10 db or greater @ 0.2 ma final grid current. **Noise level:** 40 db below rated carrier. **Visual dial accuracy:** Within 200 Hz (all bands). **Electrical dial accuracy:** Within 400 Hz after calibration at nearest 100 kHz point (all bands). **Backlash:** Less than 50 Hz. **Oscillator feedthrough or mixer products:** 55 db below rated output (except 3910 kHz crossover which is 45 db). **Harmonic radiation:** 35 db below rated output. **Audio input:** High impedance microphone or phone patch. **Audio frequency response:** 350-2450 ±3 db. **Power requirements:** 80 watts STBY, 260 watts key down @ 120 V AC line. **Dimensions:** 14 7/8" W x 6 5/8" H x 13 3/8" D.

FREE CATALOG

Describes these and over 250 other Heathkits. Save up to 50% by building them yourself. Use coupon and send for your FREE copy!

HEATHKIT®

HEATH COMPANY, Dept. 12-9
Benton Harbor, Michigan 49022

☐ Enclosed is $_____________, plus shipping.

Please send model (s)____________________

☐ Please send FREE Heathkit Catalog.

Name____________________________
(Please Print)

Address__________________________

City_____________ State____________ Zip______

Prices & specifications subject to change without notice. AM-169

For further information, check number 43, on page 110

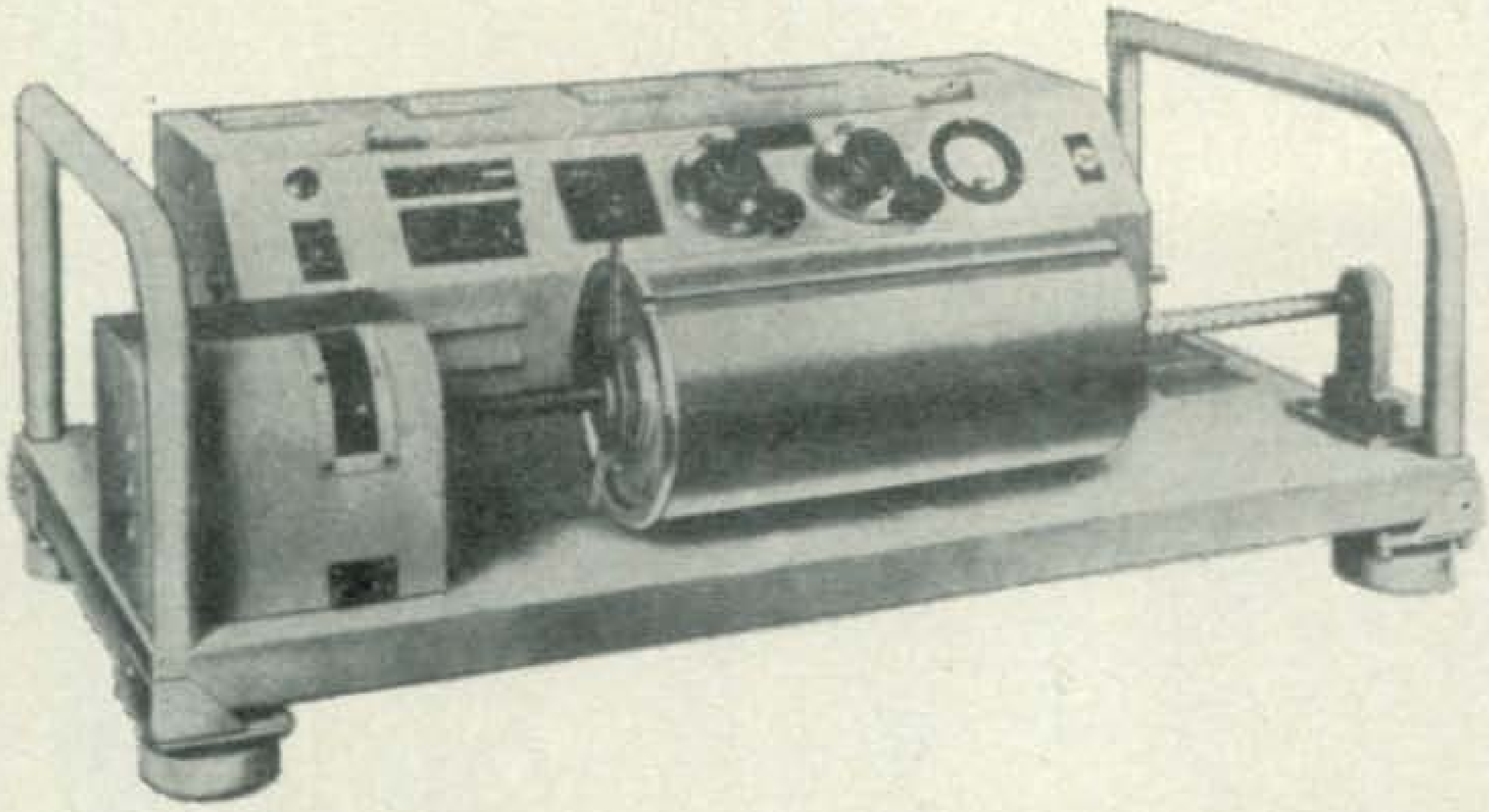


Fig. 1—This Navy AN/TXC-1 facsimile machine is typical of both military and commercial fax gear. The receiving paper is wound around the drum and held in place by the clamp bar. In transmitting, the original copy is placed on the drum and scanned by the recording photocell located behind the rotating drum.

FACSIMILE COMMUNICATIONS FOR AMATEURS

BY GORDON ELIOT WHITE,* AND WILLIAM T. TYRREL,† W2YKG

RADIO amateurs have a reputation for advancing the art of radio transmission and reception, a mark made early in the development of wireless communications. But with the advent of vast military and commercial spending in electronics the individual has been passed by on a flood of dollars. Huge organizations now have millions to spend on radio developments. As a result the amateur often finds himself lagging after modern technology.

Teletype, radar, television, satellite communications and facsimile have become ordinary modes of communication, but relatively few amateurs have worked them. RTTY is the exception among modern, high-speed radiocommunication modes, particularly since *CQ* began its RTTY column and later Durward Tucker's "A to Z" treatment of that subject.

Radar is not a practical amateur mode; television is being developed haltingly by a few dedicated amateurs, as is satellite comunication and space work, both rather expensive systems. Facsimile remains an almost totally untouched field of amateur radio communication. It is an area in which amateur pioneering remains to be done, where commercial practice is not, like multiplex RTTY, out of reach of the amateur.

In the belief that fax is a mode in which amateurs can still contribute to the state of the art, this article will attempt to outline facsimile communications as it exists today in commercial practice, and discuss the requirements for amateur facsimile transmission and reception.

*5716 N. King's Highway, Alexandria, Virginia 22303.

Fundamentals

Fundamentally, facsimile, fax as it is generally known, is the transmission of fixed images such as photographs, maps, diagrams, printed copy, QSL cards, *etc.*, from point to point via a radio or wire circuit.

The original copy is divided into a large number of tiny portions, which are then scanned by optical means. The optical information is converted to electrical impulses by a photoelectric cell. Those pulses are then transmitted to the distant point where they are recorded in the proper order, each bit faithfully reproduced in the proper shade of light or dark at the proper point on the receiving paper or film.

Similar procedures are used to reduce photographs to engravings for most newspapers and magazines. Look at a magazine photograph with a magnifying glass and you will see that the image is made up of many small dots. The darkness of the picture in a magazine depends upon the *size* of the dots in each area. Now fax reproduction produces pictures made up of a series of dots, generally much smaller than an average magazine cut. (Finer dots give better resolution, *i.e.*, sharper pictures.) Fax transmission may in some cases be as fine as 360 lines per inch for the highest definition.

Transmission

The chief method of dividing the original copy into bits for transmission is to wrap the photo or map around a drum whch is rotated. A phototube is moved laterally along the rotating copy very slowly in a manner permitting it to "look" at every part of the original. (Fig. 1.)

A small, sharply-focussed light is beamed at the copy on the transmitting drum, and the phototube reads the intensity of the reflected light. (See fig. 2.) The tube output is a d.c. signal which varies in amplitude as it "sees" light-to-dark changes passing before it.

In its simplest form this varying d.c. signal may be sent over a wire to a receiving machine where it varies the intensity of a spot of light aimed at a sheet of light-sensitive film or paper which is later developed photographically as a complete reproduction of the original copy.

Practically, more sophisticated methods of transmitting the signal are required than the simple varying d.c. voltage. Inductance and capacitance in wire lines and atmospheric and other adverse conditions on radio circuits demand a more sophisticated type of transmitted signal. Normally the varying d.c. signal is used to modulate an audio tone which can be sent over equalized wire circuits with good fidelity.

The characteristic varying audio signal can be heard as a BRRRRR . . BEEP, BRRRRR . . BEEP sound when fax pictures are being received, the tone depending upon the darkness of the original copy being scanned.

Synchronism

Obviously if we start scanning at the upper left corner of our picture at the transmitter we must start at the same point on our receiving paper and turn both drums at the same speed while the light moves laterally at the same rate at both ends of the circuit. (The resulting raster is similar in some respects to television scanning, although of course much slower).

Drum speed synchronism can be achieved most simply by driving the transmitting machine and the receiving device with identical synchronous motors connected to a common a.c. power system. As was demonstrated so sharply in the northeastern United States last November, most of the urban areas of the U.S. operate on just such an interconnected power supply.

The lateral movement of the scanning head is obtained by mounting it on a "lead" screw which turns either by a gearing system off the drum motor, or on its own synchronous motor. (The system is much like a screw-cutting metal lathe and is illustrated in figs. 1, 2 and 3.) Alternatively, the scanning head could be pulled along on a cable and pulley arrangement.

It is absolutely essential that the *drum* motors be synchronous. Satisfactory results for amateur work however may be obtained with any reasonably constant speed device for advancing the *scanning head*. The relationship between the drum speed and the lateral scanning determines the number of lines-per-inch, controlling thus both the definition and the aspect ratio (length to breadth).

The third requirement is "phasing." This means that the edge, or clamp bar on the transmitting drum must pass the scanning beam at the same time as the clamp bar on the receiving drum, (see fig. 1), or else you will get a black line across the received copy. The means of phasing a fax receiver in commercial practice is to send out a steady audio tone before the picture is transmitted. A contact on the transmitting drum interrupts the circuit for an instant once in each revolution. At the receiving end a similar contact is used to produce a pulse. The two pulses are fed into a circuit which activates a relay when both pulses occur simultaneously. In order to phase, the receiving drum is operated at a slightly slower speed until the phasing relay is actuated. Both drums operate thereafter at identical speeds, in phase. (See Phase Amplifier in fig. 3.)

Practical Transmission

Now that we have the basics out of the way, let's look at the way the fax signal is transmitted on practical radio signals. Amateurs are allowed to transmit A4 mode, or audio frequency shift amplitude modulation facsimile, on the six and two meter bands, and both A4 and F4 or carrier

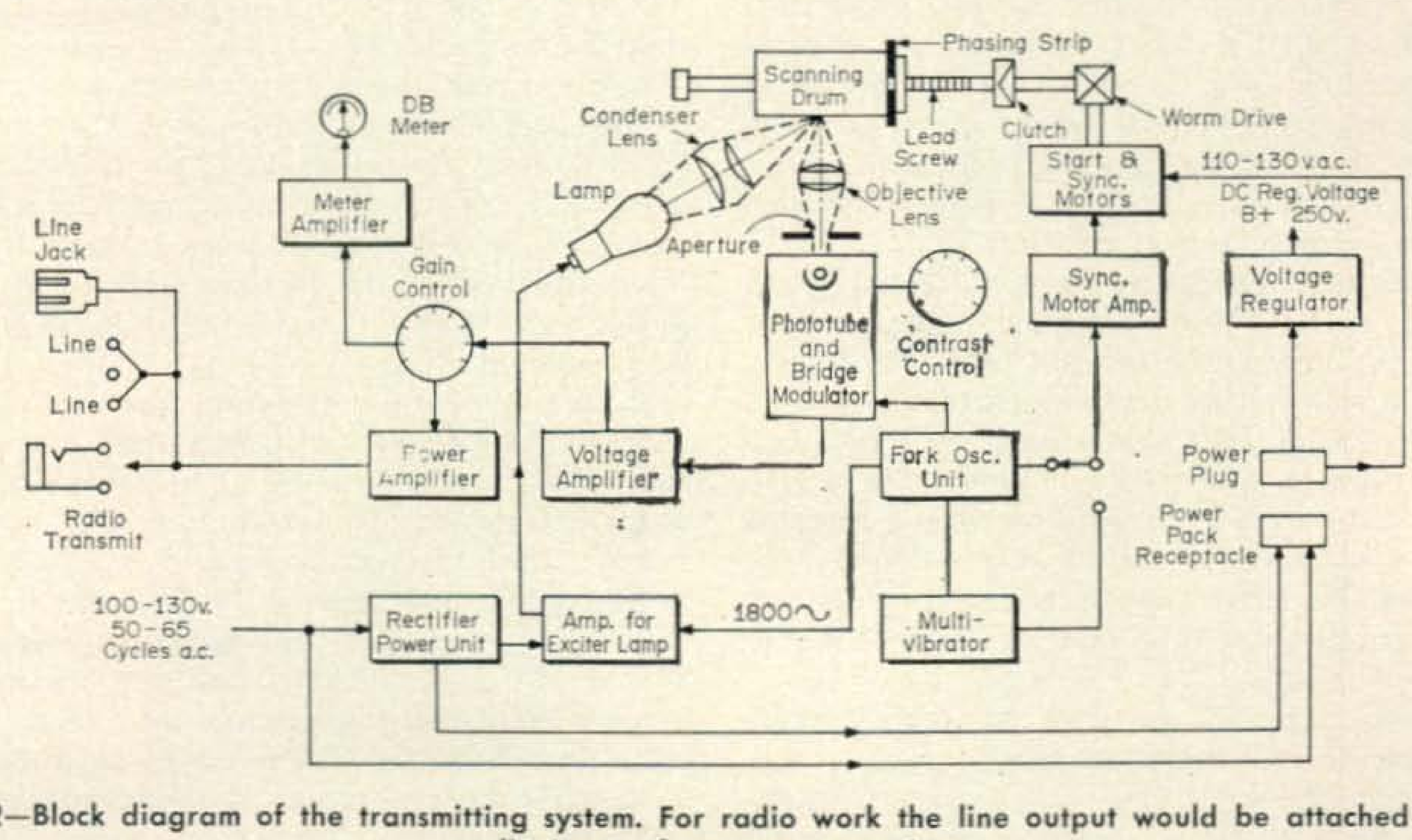


Fig. 2—Block diagram of the transmitting system. For radio work the line output would be attached to the audio input of an a.m. transmitter.

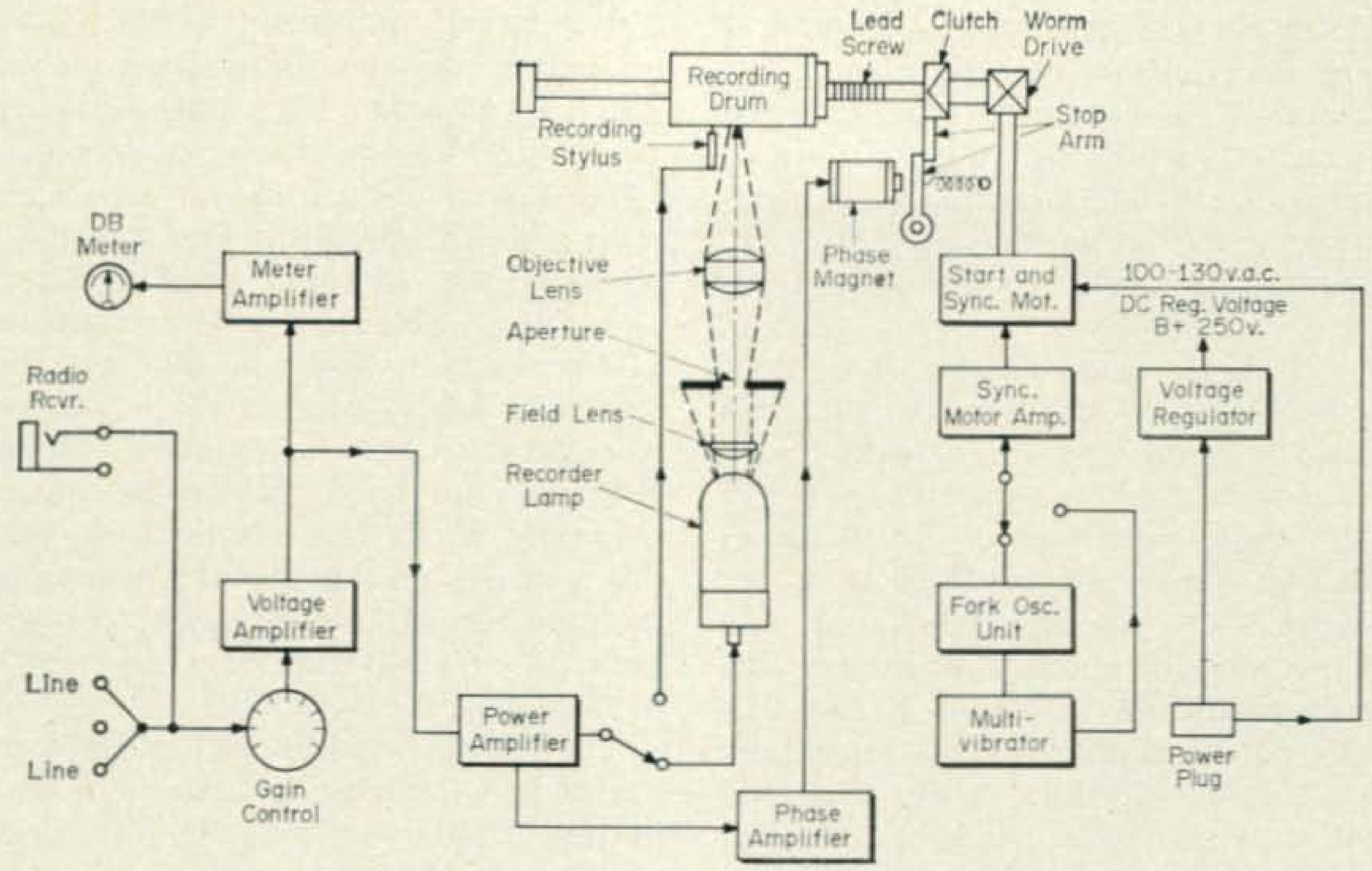


Fig. 3—Receiving block diagram of the facsimile machine. The audio signal is fed to the unit from the radio receiver through a converter that changes the audio f.m. to a.m.

frequency shift facsimile on the 220 mc bands and above. At this time the common commercial facsimile mode of F4 is not permitted to amateurs in the lower frequency bands. Since it is commonly heard in the h.f. bands, and can be easily received for test purposes, we will describe that mode. (Actually, to restrict fax to the v.h.f. bands is much like RTTY before f.s.k. was allowed in the lower frequencies—a little cramped. Possibly the FCC can be persuaded to liberalize things in the future.)

Commercial fax is widely used in the 2-30 mc bands for transmission of weather maps, press photos, and the like. The signal is transmitted by varying the frequency of the carrier in a manner proportional to the density variations in the picture. The press services and most military systems use a shift of 800 cycles, from white to black. (This is a little like the 850 cycle shift of standard RTTY f.s.k., however the shift is not a sharp flip-flop as in RTTY. In fax most of the tones are lighter or darker grays, thus the carrier is shifted more gradually as the copy is scanned. Practically, the signal shifts much less than 800 cycles much of the time.)

In receiving, the carrier shift is treated much like f.s.k. in RTTY systems, using the receiver b.f.o. to produce audio tones. Commercial press usage is normally operated with extremes of 1500 and 2300 cycles. The audio must be fed into a converter which amplifies and limits the signal, passing it through a discriminator and detector circuit to produce a varying d.c. voltage. This may either be fed to the receiving machine, or used to amplitude modulate an audio tone in some applications.

The converter, by the way, is much simpler than the RTTY "black box," since it merely acts as a discriminator. It does not need to contain complex pulse-shaping circuits, mark-hold, *etc.*, nor a powerful keying output. Fax is relatively more forgiving of QRM, noise, *etc.*, since only a small part of the picture is normally affected by such interference.

Much of the available military or commercial surplus fax gear operates on an 1800 cycle amplitude modulated audio tone. The scanning head converts the density variations of the picture into varying levels of audio for transmission purposes. On the receiving end the varying 1800 cycle tone is rectified to provide a d.c. signal to the receiving light. (Different audio tones may be used, with higher frequencies giving better definition when the circuit in use permits).

For amateur purposes, on six and two meters, A4 being the only legal mode, fax must be transmitted by audio frequency shift. Again, this is much like a.f.s.k. RTTY. White would be represented by, say, 2300 cycles and black by 1500 cycles. The d.c. output of the transmitting machine can be adapted to shift an audio oscillator, with the output of the oscillator fed to the speech input of a normal a.m. transmitter. (In this mode the *amplitude* of the audio remains essentially constant, the information being contained in the shifting *frequency*.) Again, the shift from one end of the picture scale to the other in fax is gradual, not an abrupt pulse like RTTY transmission.

At the receiving end, audio frequency shift is treated like carrier frequency shift except that the b.f.o. is not required. The audio signal is amplified, passed through limiters and a discriminator to produce a d.c. signal.

In commercial and military facsimile work audio frequency shift transmission is known as SCFM, or sub-carrier frequency modulation. Since a great many amateurs are already familiar with a.f.s.k. in RTTY work, we have tried to describe fax techniques in the same language.

There are several commercial converters such as the Acme MFM which can be used to change an amplitude modulated carrier to a frequency modulated carrier and vice versa. In surplus there is the Navy CV-172-U which can be used to convert an audio signal shifting 800 cycles in the 1500-2300 cycle range into d.c. for facsimile reproduction.

A practical amateur fax audio converter could consist of a sharply tuned filter designed to resonate at the upper frequency so that the d.c. output following the detector rectifier was highest at one end of the shift and lowest at the other. Common practice is to provide a black to white amplitude ratio of from 18 to 30 db.

Where the recorder requires an amplitude-modulated tone—say 1800 cycles—the converter simply modulates an audio oscillator with the varying d.c. signal we obtained above.

Synchronizing Forks

Earlier we discussed synchronism, a relatively simple requirement where the transmitting and receiving stations are on power mains that are interconnected as they are in much of the U.S. Where there is no such connection, as would be the case in DX work, or communications with military field units or ships, a more complex method of synchronism is used.

To achieve this an electrically-driven tuning fork is commonly used. This might be run at 960 cycles per second, and its output put through a string of frequency dividers to obtain a frequency of 60 c.p.s. That signal would then be amplified to a power level sufficient to drive the a.c. drum motor.

The fork must be stable within a few parts in a million. Forks used for such purposes must be made of temperature-compensated materials and are often sealed hermetically in a can to prevent variations from atmospheric causes. Forks which are suitable for fax use are expensive, in the $125 range, new. Fortunately they can often be found in surplus at from $5 to $15.

Standards

We will not presume to suggest standards for amateur facsimile, but it may be helpful to describe commercial practice. The U.S. press services. Associated Press and United Press International, use a drum speed of 60 r.p.m. The scanning head moves laterally at a rate of ½ inch per minute, *i.e.* 120 lines per minute.

Transmission is via h.f. radio in the 5 to 22 mc region, using carrier frequency shift of 800 cycles. Audio tones handled by the press converters are commonly 1500 and 2300 cycles.

According to the FCC, amateurs can use any reasonable drum speed for fax, in addition to the press speeds. Some weather map transmissions by the Navy and the U.S. Weather Bureau are sent at drum speeds of 120 r.p.m., with different scanning speeds. Where band conditions may change rapidly it might be advantageous to operate at quite high speeds in order to get an entire picture transmitted while the band is open, even at some sacrifice in picture definition.

The FCC says that the commercial 800 cycle shift is not a necessary requirement for amateur facsimile sent via audio frequency shift, so long as modulation does not exceed normal a.m. phone practice (100%).

Facsimile machines have never been very plentiful in the surplus market, one reason, perhaps, why fax has not caught on with amateurs. Fortunately facsimile gear need not be anywhere near as complex as a teleprinter machine. Anyone with fair mechanical skills could build a rotating drum and a scanner that was driven by a lead screw.[1]

Surplus

In surplus there are certain fax machines that are becoming more common such as the Navy AN/TCX-1B. Others are the FOC, built for the Navy by Acme Teletronix; the CNP and FOA, also Acme-built for the Navy, and the Times Facsimile Corp. FX and RC-120. The military RD-92/UX and UX-A are Navy receiving-only recorders. Discarded Press service machines are often excellent, including the Acme series and other, more modern gear. Muirhead, Ltd. makes machines which could be adapted for amateur use.

The most common receiving converter in surplus is the Navy CV-172-U, a simple, rack-mounted unit; somewhat similar is the CV-2C/TX. Both accept audio frequency shift signals and may be connected directly to the recorder.

Transmitting converters include the Navy KY-44 series which accept the a.m. audio tone from the fax scanner and apply a varying d.c. voltage to frequency shift circuits in the r.f. transmitter.

We will close with mention of two other methods of facsimile recording, the electrolytic and the hot-stylus systems. Both operate identically with the photographic methods described above up to the point of the receiving recorder. There, instead of varying a light's intensity, in the stylus method a conductive recording paper is used and the recording signal is amplified to a level of 450 to 500 volts. Depending upon the desired tone at each point in the picture the output voltage sparks from a stylus needle to the paper, burning away a portion of the surface.

In the electrolytic method a current is passed through a metal bar which is pressed against the paper, depositing different amounts of the metal on the paper. This is the type of reception used in modern AP and UPI machines in many newspaper offices which are replacing the older photographic equipment. Its definition is almost as good as the photographic process.

This then is facsimile. We hope that this outline will help to generate amateur interest in, to us, a fascinating communications mode. ■

[1]Tuke, J. B. "Copying Weather Pictures Via Amateur Facsimile" *CQ*, Aug. 1966, p. 25.

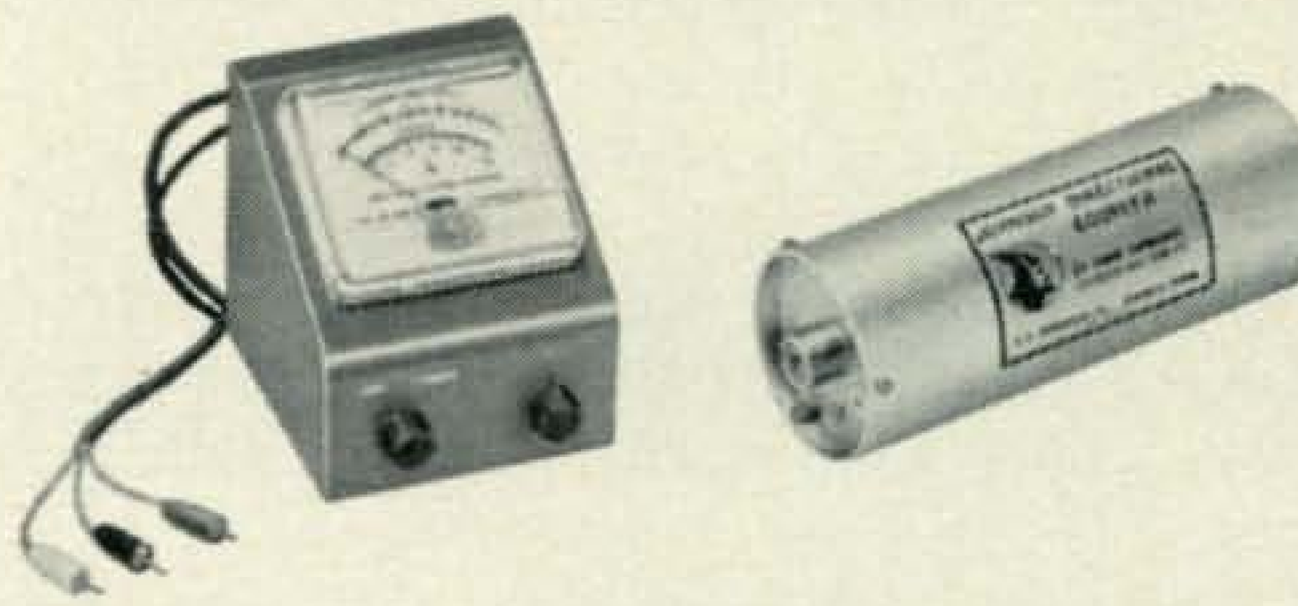
Anderson, W. G., "Amateur Reception of Weather Satellite Picture Transmissions," *QST*, Nov. 1965, p. 11.

For the most dependable line of amateur station accessories,
specify JOHNSON

MATCHBOX—Matches transmitter 52 ohm output impedance to balanced or unbalanced line. Provides unbalanced impedance to receiver. Complete bandswitching, 80 thru 10 meters—no plug-in coils.

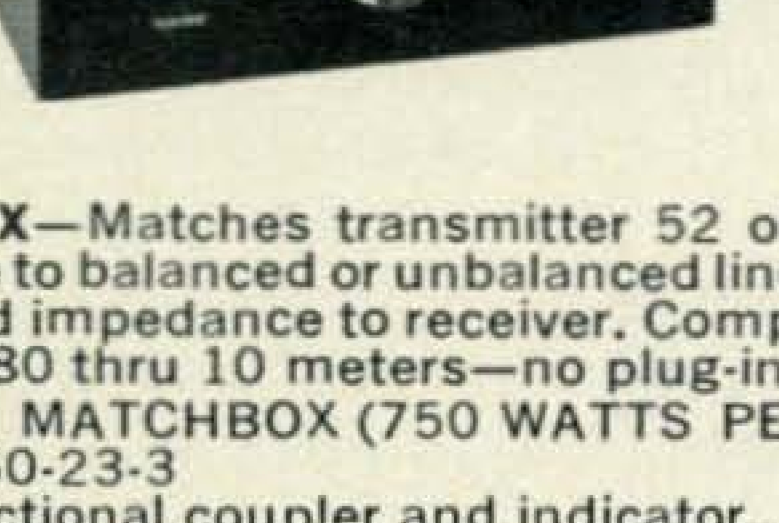
275 WATT MATCHBOX (750 WATTS PEP)
Cat. No. 250-23-3
With directional coupler and indicator.....$94.95
Cat. No. 250-23-1
Less directional coupler and indicator.....$64.95

KILOWATT MATCHBOX (3KW PEP)
Cat. No. 250-30-3
With directional coupler and indicator... $154.50



DIRECTIONAL COUPLER AND INDICATOR—Provides continuous reading of SWR and relative power in transmission line. May be permanently installed in 52 ohm transmission line. Handles full legal power.

Cat. No. 250-37
Directional Coupler, wired and tested.....$11.75
Cat. No. 250-38
Indicator, wired and tested...............$25.00

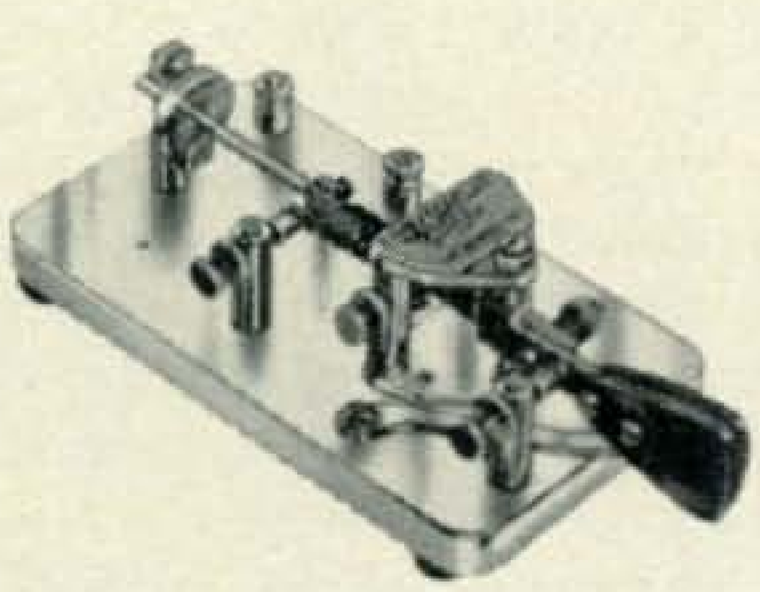


LOW PASS FILTER—Wired, pre-tuned. Handles more than 1KW RF—75 db or more attenuation of harmonics and spurious frequencies above 54 MHz.

Cat. No. 250-20
52 ohms, wired and pre-tuned............$14.95
Cat. No. 250-35
72 ohms, wired and pre-tuned............$14.95

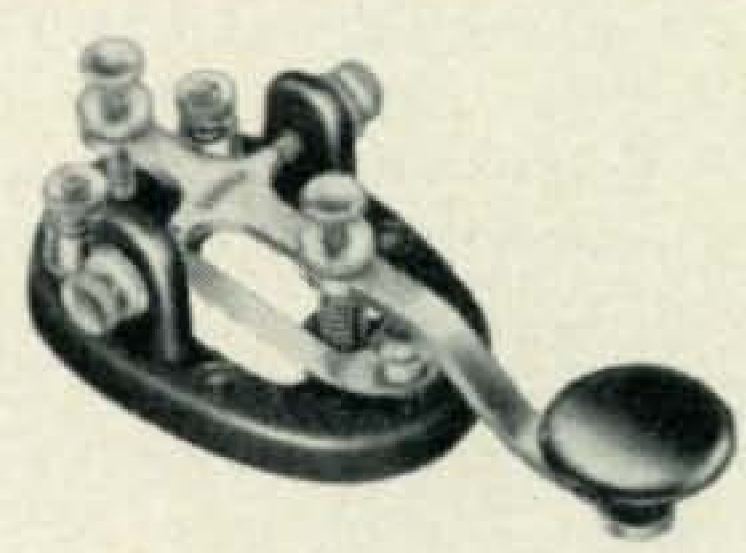
T-R SWITCH—High-efficiency electronic antenna switch. Double-gated circuitry with 6BL7 dual triode for receiver isolation. Rated at 4KW peak power. 3 to 30 MHz.

Cat. No. 250-39
T-R Switch wired and tested with tube....$29.95



DELUXE SEMI-AUTOMATIC KEY—Adjustable from lowest to highest speed ... smooth easy action ... 5 adjustments ... separate height adjustment for paddles. All parts heavily chrome plated.

Cat. No. 114-500
⅛" contacts,
black wrinkle base......$20.30
Cat. No. 114-501
¼" contacts,
polished chrome base..$25.50



STANDARD KEY—Heavy die cast base ... adjustable bearings ... "Cushion-contact" offers smooth keying action. ⅛" coin silver contacts.

Cat. No. 114-310
Black Wrinkle
no switch................$3.50
Cat. No. 114-310-3
Black wrinkle
with switch..............$4.25
Cat. No. 114-311
Chrome plated,
no switch................$5.50
Cat. No. 114-311-3
Chrome plated
with switch..............$6.50

E. F. JOHNSON COMPANY ®
1739 Tenth Ave. S.W. • Waseca, Minn. 56093

For further information, check number 48, on page 110

Rules: 1966 *CQ* World Wide DX Contest

Oct. 22-23, Nov. 26-27, 1966

I. CONTEST PERIOD

PHONE: Starts 0000 GMT Saturday, October 22. Ends 2400 GMT Sunday, October 23.
C.W.: Starts 0000 GMT Saturday, November 26. Ends 2400 GMT Sunday, November 27.

II. BANDS

Contest activity will be in the 1.8, 3.5, 7.0, 14, 21 and 28 mc amateur bands.

III. TYPE OF COMPETITION

1. Single operator
   (a) All Band.
   (b) Single Band.
2. Multi-Operator, Single transmitter.
3. Multi-Operator, Multi transmitter.
   (a) Multi-operator will be judged on all band operation only.
4. Inter-Club (local DX clubs).

IV. EQUIPMENT

There is no limit to the number of transmitters or receivers used, and competitors may use the maximum power permitted under the terms of their license.

V. NUMBER EXCHANGE

1. Phone stations will exchange 4 numerals, the RS report plus their Zone.

2. C.w. stations will exchange 5 numerals, RST report plus their Zone.

3. Stations in Zones 1 through 9 will prefix their Zone number with Zero (01, etc.).

VI. POINTS

1. Contacts between stations on different continents will count three (3) points.

2. Contacts between stations on the same continent, but not in the same country, will count one (1) point.

3. EXCEPTION: Contacts between stations in the North American continent only will count two (2) points (applies to N.A. only).

4. Contacts between stations in the same country will be permitted for the purpose of obtaining a Zone and/or Country multiplier, but no QSO points will be credited.

5. Only one contact per band with the same station will be permitted.

VII. MULTIPLIER

Two types of multipliers will be used.

1. Multiplier of one (1) for each Zone contacted on each band.

2. Multiplier of one (1) for each Country worked on each band.

VIII. SCORING

1. The score of each single band will be the sum of the Zone and Country multiplier for that band, multiplied by the total contact points on that band.

2. The total all band score will be the sum of Zone and Country multipliers of all bands, multiplied by the sum of the contact points on all bands.

3. Those sending in logs for a single band will be eligible for a single band award only. If a log is sent in for more than one band, indicate which band is to be judged, otherwise it will be judged as an all band entry.

4. A station will not be eligible for more than one award.

5. Single operator contestants must show a minimum of 12 hours of operating time to be eligible for an award. If a contestant operates on more than one band and wishes to be judged for a specific single band, he must show a minimum of 12 hours on that band.

6. Multi-operator stations must show a minimum of 24 hours of operating time to be eligible for an award.

IX. ZONES and COUNTRIES

The *CQ* Zone map and the ARRL and WAE country lists will be used as standards. The continental boundaries used for WAC will also be recognized. Should any question arise as to the positive location of a station the official definition will be final.

X. AWARDS

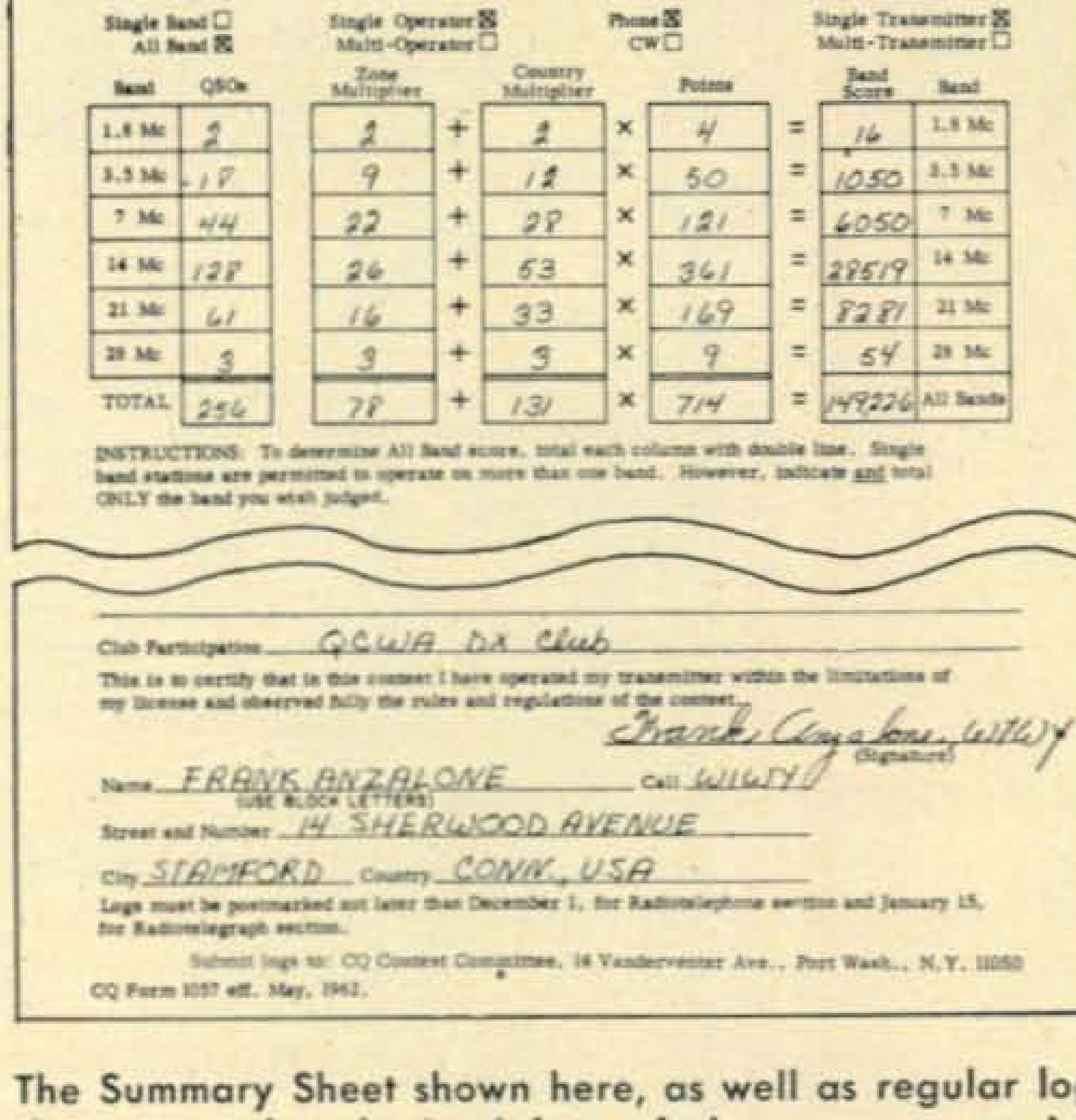
Certificates will be awarded for each section of the contest as follows:

1. To the highest scoring operator station no each single band.

2. To the highest scoring single operator station on all bands.

3. To the highest scoring multi-operator station in both divisions, single and multi-transmitter.
   (a) In each country.
   (b) Each call area of the United States and Australia.
   (c) Each Zone in Canada and the USSR.

4. Awards to multi-operator stations will be for all band.



CQ WORLD-WIDE DX CONTEST CQ — Page 1 of 2 Pages

Call W1WY

Single Band ☐ All Band ☒ — Single Operator ☒ Multi-Operator ☐ — Phone ☒ CW ☐ — Single Transmitter ☒ Multi-Transmitter ☐

Band	QSOs	Zone Multiplier		Country Multiplier		Points		Band Score	Band
1.8 Mc	2	2	+	2	×	4	=	16	1.8 Mc
3.5 Mc	17	9	+	12	×	50	=	1050	3.5 Mc
7 Mc	44	22	+	28	×	121	=	6050	7 Mc
14 Mc	128	26	+	53	×	361	=	28519	14 Mc
21 Mc	61	16	+	33	×	169	=	8281	21 Mc
28 Mc	3	3	+	3	×	9	=	54	28 Mc
TOTAL	256	78	+	131	×	714	=	149226	All Bands

INSTRUCTIONS: To determine All Band score, total each column with double line. Single band stations are permitted to operate on more than one band. However, indicate and total ONLY the band you wish judged.

Club Participation QCWA DX Club

This is to certify that in this contest I have operated my transmitter within the limitations of my license and observed fully the rules and regulations of the contest.

Frank Anzalone, W1WY (Signature)

Name FRANK ANZALONE (use block letters) Call W1WY

Street and Number 14 SHERWOOD AVENUE

City STAMFORD Country CONN., USA

Logs must be postmarked not later than December 1, for Radiotelephone section and January 15, for Radiotelegraph section.

Submit logs to: CQ Contest Committee, 14 Vanderventer Ave., Port Wash., N.Y. 11050

CQ Form 1057 eff. May, 1962.

The Summary Sheet shown here, as well as regular log sheets, may be obtained free of charge upon receipt of an s.a.s.e., or in the case of a DX station, 1 IRC.

CQ WORLD-WIDE DX CONTEST CQ Page__of __Pages

CALL WIDXE Log For 14 Mc Band COUNTRY U.S.A.
(Use separate log for each band.) PHONE ☐ CW ☒

DATE / Time GMT	STATION	SERIAL NUMBER Sent	Received	Fill in only when QSO is mult. Zone No.	COUNTRY	Points
NOV 27 1965						
0030	CX2CO	57905	59913	13	URUGUAY	3
07	CX1RY	58905	59913			3
13	LU5AQ	57905	58913		ARGENTINA	3
17	HK1QQ	57905	57909	9	COLOMBIA	3
21	YV5AGD	56905	57909		VENEZUELA	3
25	KP4CC	56905	56908	8	PUERTO RICO	2
29	KP4CK	56905	56908			2
31	VP7NY	55905	56008		BAHAMAS	2
33	W6RW	55905	55903	3	U.S.A.	0
36	W8TIN	55905	55904	4		0
1320	TF3AB	56905	56940	40	ICELAND	3
26	OX3KC	55905	56940		GREENLAND	3
30	VO2NA	56905	57902	2	CANADA	2
40	VE2NV	55905	55905	5		2
NOV 28						
1200	JA1YX	57905	57925	25	JAPAN	3
10	HL9KH	58905	57925		KOREA	3
16	KL7TDO	56905	56901	1	ALASKA	2
25	KH6IN	56905	57931	31	HAWAII	3
35	VK2GW	55905	56930	30	AUSTRALIA	3
45	VK6RU	55905	55929	29		3
TOTAL ZONES, COUNTRIES, POINTS THIS SHEET				13	15	47

CQ Form 1056 eff. May, 1962.

CQ WORLD-WIDE DX CONTEST CQ Page 4 of 8 Pages

CALL OH5SM Log For 14 Mc Band COUNTRY FINLAND
(Use separate log for each band.) PHONE ☒ CW ☐

DATE / Time GMT	STATION	SERIAL NUMBER Sent	Received	Fill in only when QSO is mult. Zone No.	COUNTRY	Points
OCT 23, 1965						
0445	5B4WS	5915	5920	20	CYPRESS	3
47	UD6BR	5815	5721	21	AZERBAIJAN	3
51	UG6KAA	5715	5621		ARMENIA	3
55	UF6FB	5615	5521		GEORGIA	3
0500	MP4BBW	5915	5921		BAHRAIN	3
06	OH2TT	5915	5915	15	FINLAND	0
07	I1AHU	5915	5915		ITALY	1
09	DJ1BZ	5915	5914	14	GERMANY	1
11	G82SH	5915	5814		ENGLAND	1
1700	VE3PY	5615	5504	4	CANADA	3
06	W9NGO	5515	5504		USA	3
10	VO2NA	5615	5502	2		3
15	WB2CCD	5515	5505	5		3
OCT 24						
0806	KA2JL	5615	5525	25	JAPAN	3
16	KG1BO	5515	5540	40	GREENLAND	3
25	TF2WGW	5615	5640		ICELAND	1
30	CT2AK	5615	5614		AZORES	1
35	CT3AV	5615	5633	33	MADEIRA IS.	3
TOTAL ZONES, COUNTRIES, POINTS THIS SHEET				10	16	41

CQ Form 1056 eff. May, 1962.

Here is a sample of a U.S. c.w. log (left) and a DX phone log (right). Zone and country multipliers are indicated to clarify trouble spots found in past contests. Note that point credit is not given for working your own country.

XI. SPECIAL AWARDS

A cup will be awarded to the highest scoring station in the world, in each of the following categories:

1. Single operator on a single band, Phone. *(Donated by Stuart Meyer, W2GHK).*
2. Single operator on a single band, C.W. *(Donated by Dr. Harold J. Megibow, K2HLB).*
3. Single operator on all bands, Phone. *(Donated by Bill Leonard, W2SKE)*
4. Single operator on all bands, C.W. *(Donated by Larry LeKashman, W9IOP)*
5. Multi-operator, single transmitter, Phone. *(Donated by John Knight, W6YY)*
6. Multi-operator, single transmitter, C.W. *(Donated by Dr. Anthony Susen, W3AOH)*
7. Multi-operator, multi-transmitter, Phone. *(Donated by the Radio Club Venezolano)*
8. Multi-operator, multi-transmitter, C.W. *(Donated by Hazard Reeves, K2GL)*
9. Single operator, all band phone in the USA. *(Donated by the Potomac Valley Radio Club)*
10. Single operator, all band c.w. in the USA. *(Donated by the North Jersey DX Association)*
11. Single operator, all band phone in Europe. *(Donated by operators of station W4BVV)*
12. Single operator, all band c.w. in Europe. *(Donated by operators of station W3MSK)*
13. A Plaque will be awarded to the DX Club (not a national body) submitting the highest aggregate score of the scores submitted by its members. *(Donated by* CQ*)*

(a) For a club to enter, an officer of the club must submit a list of its participating members and their scores.

(b) This list may include scores of single and multi-operator stations; both phone and c.w.

(c) Stations that are members of a competing club must indicate this fact on their report forms.

At the request of the donors, previous winners of a Trophy will again be eligible for the same Trophy after a three year period. There are no restrictions to the winning of the *CQ* Plaque.

In countries or sections where the returns justify, second and third place certificates will be awarded. Also such special and/or additional awards will be made as the Contest Committee shall choose.

XII. DISQUALIFICATION

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 per cent of the total number of contacts made will be deemed sufficient cause for disqualification.

XIII. LOG INSTRUCTIONS

1. In keeping a log, fill in Zone number and country, only the FIRST TIME it is contacted.

2. Use a separate sheet for each band and a tally sheet or report form.

3. Keep all times in GMT.

4. All contestants are expected to compute their scores. Logs should be checked for contact duplications and proper point credit before they are submitted.

5. Make sure name and address is clearly noted on each entry, PRINT or TYPE.

6. Each contestant must sign a pledge that all rules and regulations have been observed and that the report is a true one. Note sample contest report form. If official forms are not available, use a duplicate form as indicated. The size is 8½ × 11" with 40 contacts to the page.

8. Copies of the Zone Map, log sheets and report forms are available from *CQ*, address listed below. Send a large self-addressed envelope, with sufficient postage. In the case of overseas stations, IRC coupons are acceptable. Indicate quantity of sheets required.

XIV. DEADLINE

All entries must be postmarked NO LATER than December 1, 1966 for the phone section, and January 15, 1967 for the c.w. section. In rare isolated places the deadline will be made more flexible. Send logs directly to:

CQ WW Contest Committee
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050
(Indicate Phone or C.W. Section)

(Please circulate this information to your DX friends and radio club.)

UNDERSTANDING

Field Effect Transistors

BY HARRY R. HYDER,* K7HQN

PART II

Part II of the three part series covering the field effect transistor discusses the electrical characteristics, temperature effects, high frequency operation, noise and basic circuitry.

THE most remarkable thing about the electrical characteristics of f.e.t.'s is that they are almost perfectly predictable. This does not mean that all f.e.t.'s are the same; far from it. But remarkably few variables are present.

At frequencies where the effects of interelectrode capacitances are unimportant, the transfer characteristics of any f.e.t. are expressed by the following equation:

$$I_D = I_{DSS}\left(\frac{V_{GS}}{V_P} - 1\right)^2$$

Where: I_D = Channel current.
I_{DSS} = Channel current at $V_{GS} = 0$.
V_{GS} = Gate-to-source voltage.
V_P = Cutoff (pinch-off) voltage.

This is true for all f.e.t.'s within very narrow limits. Thus, by making two measurements, I_{DSS} and V_P, the characteristic curves of any f.e.t. may be plotted.

It is also apparent that the curve is a parabola, and that the f.e.t. is a perfect square-law device. A typical curve is shown in fig. 4A.

The transconductance of the f.e.t. at any channel current may be found by drawing a line tangent to the curve at the desired point. The slope of the line is the transconductance, as in fig. 4B.

Another interesting characteristic of this parabolic curve is that a tangent drawn at I_{DSS} always intersects the abscissa at one-half the pinch-off voltage. This is very convenient when measuring an f.e.t., since measuring the actual pinch-off voltage is quite difficult: the channel current is very small and changing very slowly at this point. Therefore, merely measuring I_{DSS} and the transconductance at I_{DSS} gives all the information necessary to plot the curve.

For any gate-to-source voltage, the channel current changes very little with changes in drain-to-source voltage. Figure 5 is a typical set of curves. They look surprisingly like those of a pentode vacuum tube. In fact, the f.e.t. has been called a solid state pentode. I think it is more analogous to a triode with a large unbypassed cathode resistor. In the f.e.t., the built-in cathode resistor is that part of the channel distributed between the gate area and the source, and it is the degeneration caused by this resistance that gives the f.e.t. its high dynamic output resistance. Under some conditions, the f.e.t. may be operated with no external self-bias resistor; more of that later.

The square-law characteristic of f.e.t.'s may not sound like just what is wanted for a low distortion amplifier, but it should be remembered that the characteristic curves of vacuum tubes and bipolar transistors are not exactly straight lines either. When properly operated, the harmonic distortion in an f.e.t. will be as low or lower than with either a transistor or a tube, and the intermodulation will be far lower, because of the absence of higher-order curvature in the f.e.t.'s characteristics. The harmonic distortion in an f.e.t. is exclusively second harmonic.

The square-law characteristic can be very desirable in mixer or product detector applications, which will be described later.

Some useful f.e.t. parameter interrelationships are given in fig. 6.

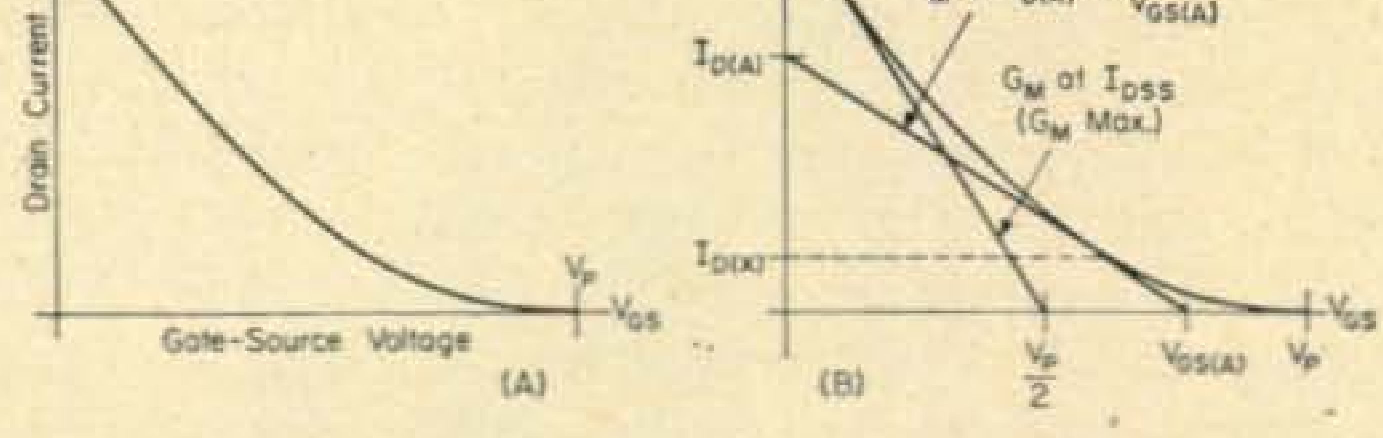


Fig. 4 (A)—A typical f.e.t. curve showing I_D versus V_{GS} is a parabola. (B) Transconductance of the f.e.t. is determined by drawing a line tangent to the curve at the desired point as shown above.

*Senior Engineer, Motorola Inc. Military Electronics Division, 8201 E. McDowell Road, Scottsdale, Arizona 85252.

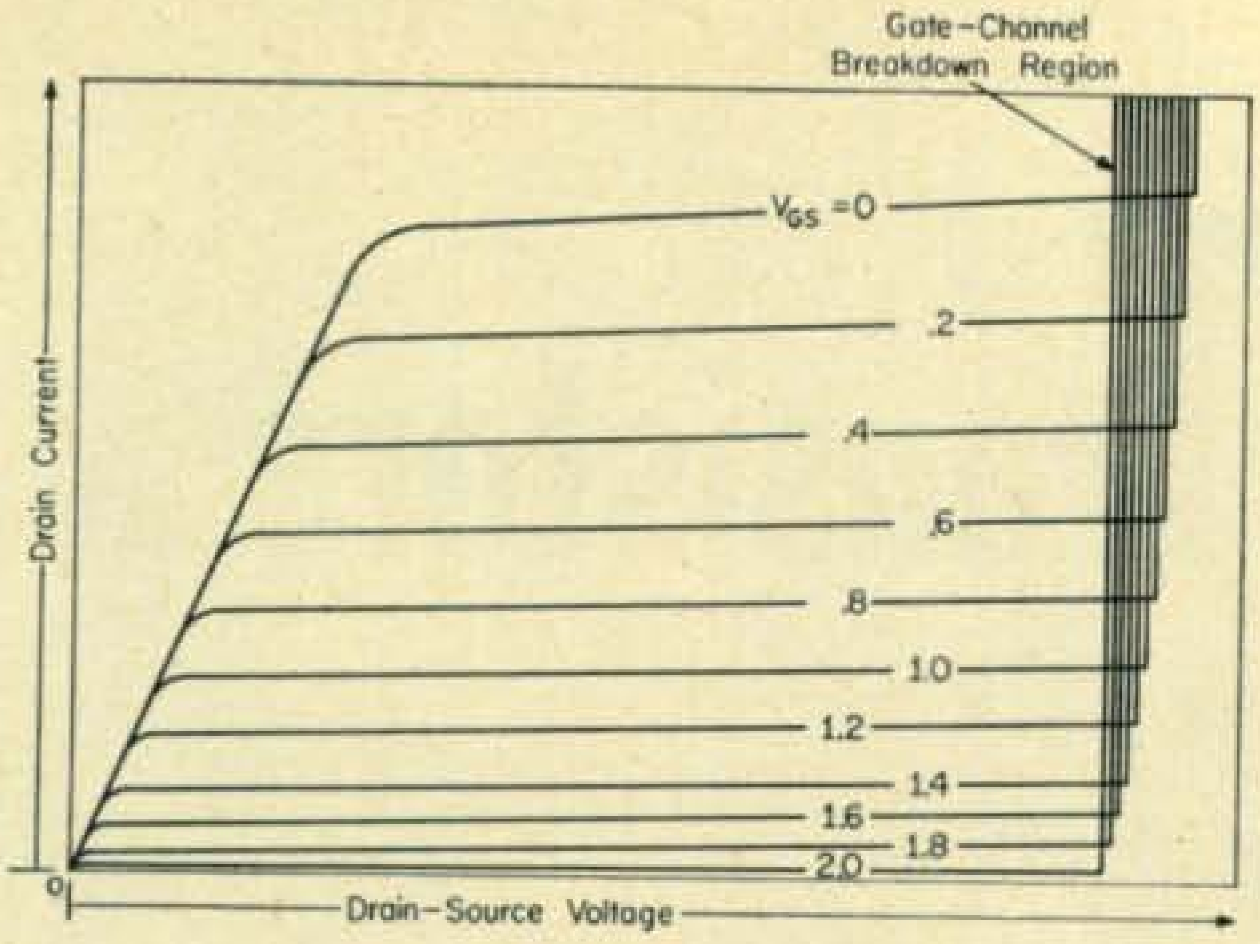


Fig. 5—Set of curves for an f.e.t. shows typical output characteristics.

Temperature Effects

Like all semiconductor devices, f.e.t.'s are affected by temperature. The effects are less troublesome with f.e.t.'s than with bipolar transistors.

The principal effect is a decrease of carrier mobility with increasing temperature, which shows up as a decrease in channel current.

The second, and lesser effect, is an increase in gate-channel leakage current as the temperature goes up. This is important only when there is a very high resistance in the gate-to-source circuit.

Figure 7 shows channel current versus gate voltage at three temperatures for a typical f.e.t. This particular graph has an interesting feature: at one point, the three curves cross. This would be the ideal point to bias a d.c. amplifier: the drift would be zero.

In amateur service, temperatures more than 30° C above or below room temperature are rarely encountered. This eases the situation considerably, but it is a good idea to be quite conservative in your design.

F.E.T. Amplifiers

Like other three-terminal amplifying devices, there are three possible amplifier configurations. These are shown in chart form in fig. 8, with pertinent formulas. These circuits are so close to their vacuum-tube counterparts that little need be said.

Miller effect is present in the common-source circuit to the same degree as in a triode, and is calculated in the same way. This may be significant in audio amplifiers where high-frequency response is important, and in tuned amplifiers. F.e.t. tuned amplifiers, however, will usually need neutralization to prevent oscillation; this will also minimize Miller effect.

The common-gate circuit will probably be most used as the second section of an f.e.t. "cascode" amplifier, which is just as efficient an arrangement as its vacuum tube equivalent. This is one way of obviating the necessity for neutralization of a tunable h.f. amplifier.

The common drain circuit, or "source follower," is our old friend the cathode follower in solid-state guise. One excellent application would be as a miniature high-impedance probe for a v.t.v.m. or oscilloscope.

F.e.t.'s respond fairly well to a.g.c. voltages. The degree of control is a little better than with a sharp-cutoff pentode or triode. A.g.c. voltage may be applied to one or both gates.

High Frequency Operation

The transconductance and input impedance of f.e.t.'s decrease with frequency. The effects are directly related. The reason is fairly obvious. The input of an f.e.t. looks like a small capacitor in series with a rather low resistance. The capacitor is the capacitance of the gate-channel junction, and as was explained earlier, it is the signal voltage across this capacitor that makes the f.e.t. work. At low frequencies, practically all of the signal voltage appears across the high reactance of the junction. At high frequencies, the reactance decreases; less of the input signal appears across the junction and more across the channel resistance where it does no good. And, of course, the channel resistance starts to appear across the input.

The high frequency figure of merit for an f.e.t. is G_m/C_{iss}, where C_{iss} is the common source short circuit input capacitance. This is a good criterion for comparing f.e.t.'s, and gives a clue to the difficulty of designing high frequency f.e.t.'s. The conflicting requirements are that the gate must be large for high transconductance and small for low capacitance.

$$\textit{Channel Current } (I_D) = I_{DSS}\left(\frac{V_{GS}}{V_P} - 1\right)^2$$

$$\textit{Pinchoff Voltage } (V_P) = \frac{2\, I_{DSS}}{G_M\ (Max)}$$

$$G_M \textit{ at any } V_{GS} = \frac{2}{V_P}\sqrt{I_{DSS}\, I_D}$$

$$\textit{Second Harmonic Distortion} = \frac{V_A}{4\, V_P}\sqrt{\frac{I_{DSS}}{I_Q}}$$

$$\textit{IM Distortion} = \frac{V_A\, V_B}{V_P\sqrt{2(V_A^2 + V_B^2)}} \cdot \sqrt{\frac{I_{DSS}}{I_Q}}$$

Where: I_D = Drain (channel) current.
I_{DSS} = Drain current at $V_{GS} = 0$, with gate connected to source.
V_{GS} = Gate-to-source voltage.
V_P = Pinchoff (cutoff) voltage.
I_Q = Drain current at operating point.
V_A, V_B = Signal voltages, instantaneous values.

Fig. 6—Some useful f.e.t. parameter interrelationships.

But great progress has been made. Units are now available that give good gain at 500 mc. It is all a matter of designing smaller, more efficient structures.

Noise

There are three types of noise present in field-effect transistors. The first is shot noise due to gate channel leakage, and is usually completely insignificant.

The second type is due to thermal generation and recombination of carriers in the depletion region. This noise is inversely proportional to frequency, but becomes predominant only below about 100 cycles. The same type of noise is present in bipolar transistors, but usually starts at about one kc.

The third and principal type of noise in f.e.t.'s is the thermal noise of the channel conductance. Although this noise originates in the channel, it is usually specified as though it originated at the input, making for convenience in noise figure calculations. It may be specified in terms of noise figure or equivalent noise input voltages under some specific conditions, or as an equivalent noise resistance. The equivalent noise resistance is an imaginary resistor, connected in series with the gate, that would produce the same thermal noise voltage at the output of the amplifier as is actually there. Obviously, the lower the equivalent noise resistance, the quieter the device.

Equivalent noise resistance is a factor commonly used with vacuum tubes, so it provides a good comparison. For a good triode tube, it has been found to be approximately equal to $2.5/G_m$. The theoretical equivalent noise resistance of f.e.t.'s, however, is about $1/G_m$, substantially lower.

This does not mean that using an f.e.t. as the input stage of your new v.h.f. receiver automatically guarantees a low noise figure; life isn't that simple. Low noise figures are obtained only by very careful circuit adjustment, particularly the input coupling network. But f.e.t.'s have the potentiality of giving better noise figures than either bipolar transistors or vacuum tubes.

There are two areas where low amplifier noise is an important consideration: v.h.f. and audio. In the communication bands below 30 mc, the high level of atmospheric noise does not make it worthwhile to struggle for low noise figures.

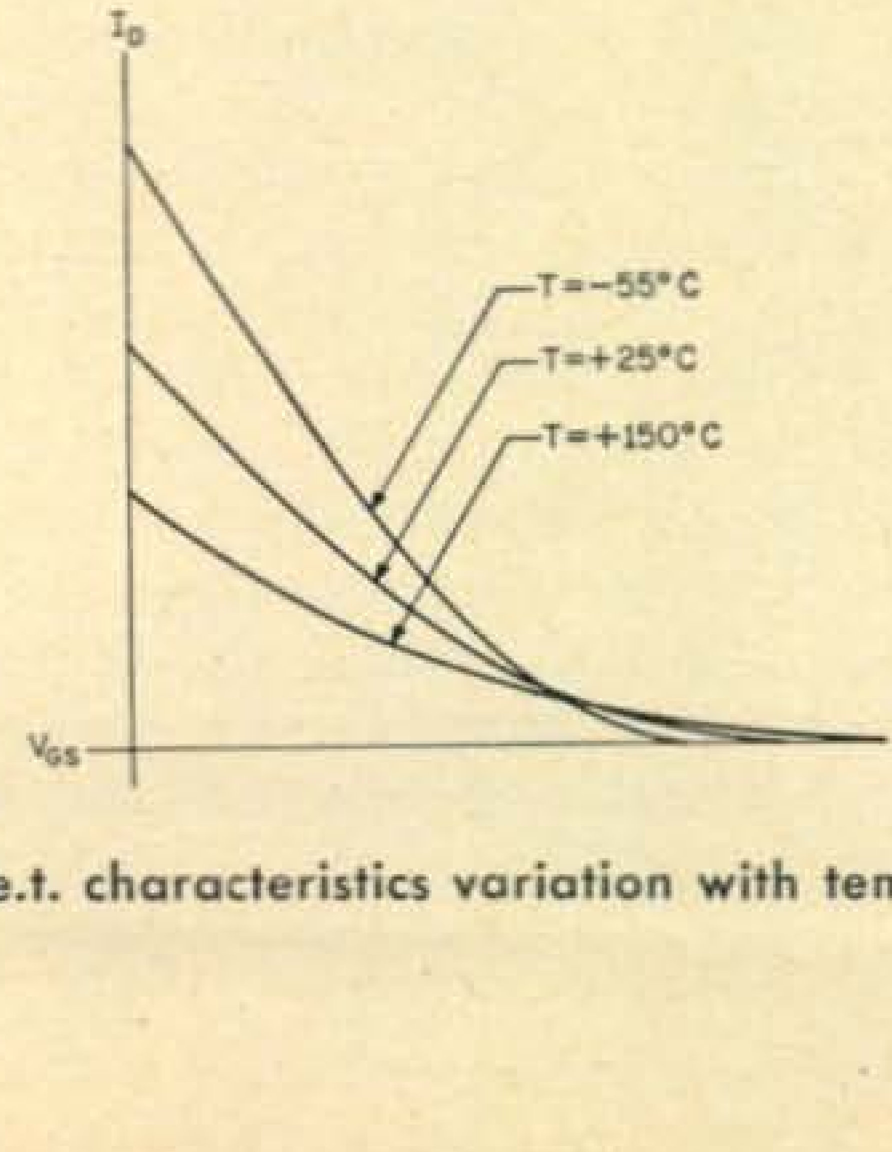
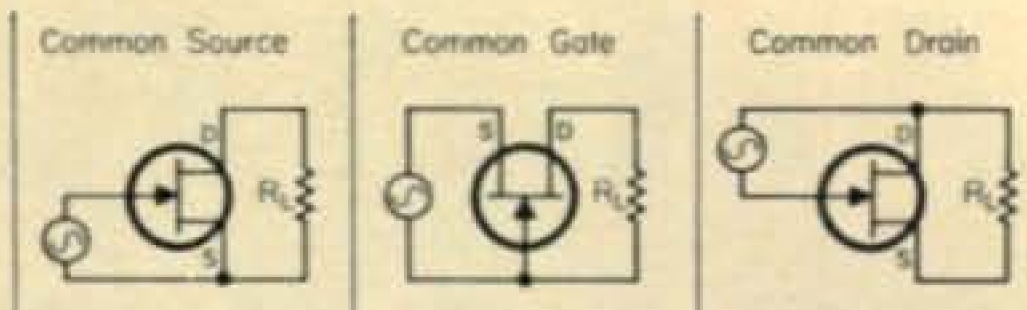


Fig. 7—F.e.t. characteristics variation with temperature.



	Common Source	Common Gate	Common Drain
Gain Formulas R_D=Dynamic Drain Resistance ($\mu = G_M R_D$)	$\approx G_M R_L$ $= G_M \frac{R_L R_D}{R_L + R_D}$	$\approx G_M R_L$ $= (1+\mu)\frac{R_L}{R_D + R_L}$	≈ 0.9 $= \frac{\mu R_L}{R_D + (1+\mu) R_L}$
Output Resistance Seen by R_L	R_D	R_D	$\approx \frac{1}{G_M}$, $= \frac{R_D}{1+\mu}$
Phase Inversion	Yes	No	No
Equiv. V.T. Circuit	Grounded Cathode	Grounded Grid	Cathode Follower
Equiv. Transistor Circuit	Common Emitter	Common Base	Emitter Follower

Fig. 8—Three basic f.e.t. circuits and the pertinent formulas are shown above.

A low noise audio amplifier could be used to advantage in a communications receiver. The product detectors now commonly used work best at low signal levels. An f.e.t. audio stage following an f.e.t. product detector would make a potent combination; less i.f. gain would be needed than is conventionally used.

No v.h.f. man needs to be told of the desirability of low noise figures. The f.e.t. gives him another and potentially more powerful tool in the battle of the db.

F.E.T. Oscillators

In general, any triode oscillator circuit may be used with an f.e.t. with little change. This is in contrast to bipolar transistors, where pains must be taken to prevent the low impedance of the device from adversely affecting the frequency determining elements.

F.e.t. oscillators do not operate with gate current in the same way that vacuum tube oscillators operate with grid current. When the grid of a tube goes positive, the plate current continues to follow the grid voltage, up to a point. But when the gate of an N-channel f.e.t. goes positive, it merely limits. A fairly large gate-to-source resistor should be used, to limit any gate current to a safe value. Oscillation amplitude can be controlled by varying the supply voltage or source self-bias resistor.

FET Mixers and Detectors

Because of its almost perfect square-law characteristics, the f.e.t. makes an excellent heterodyne detector. As the first mixer in a h.f. or v.h.f. superheterodyne, where low noise and freedom from cross-modulation are important, the f.e.t. has no peers.

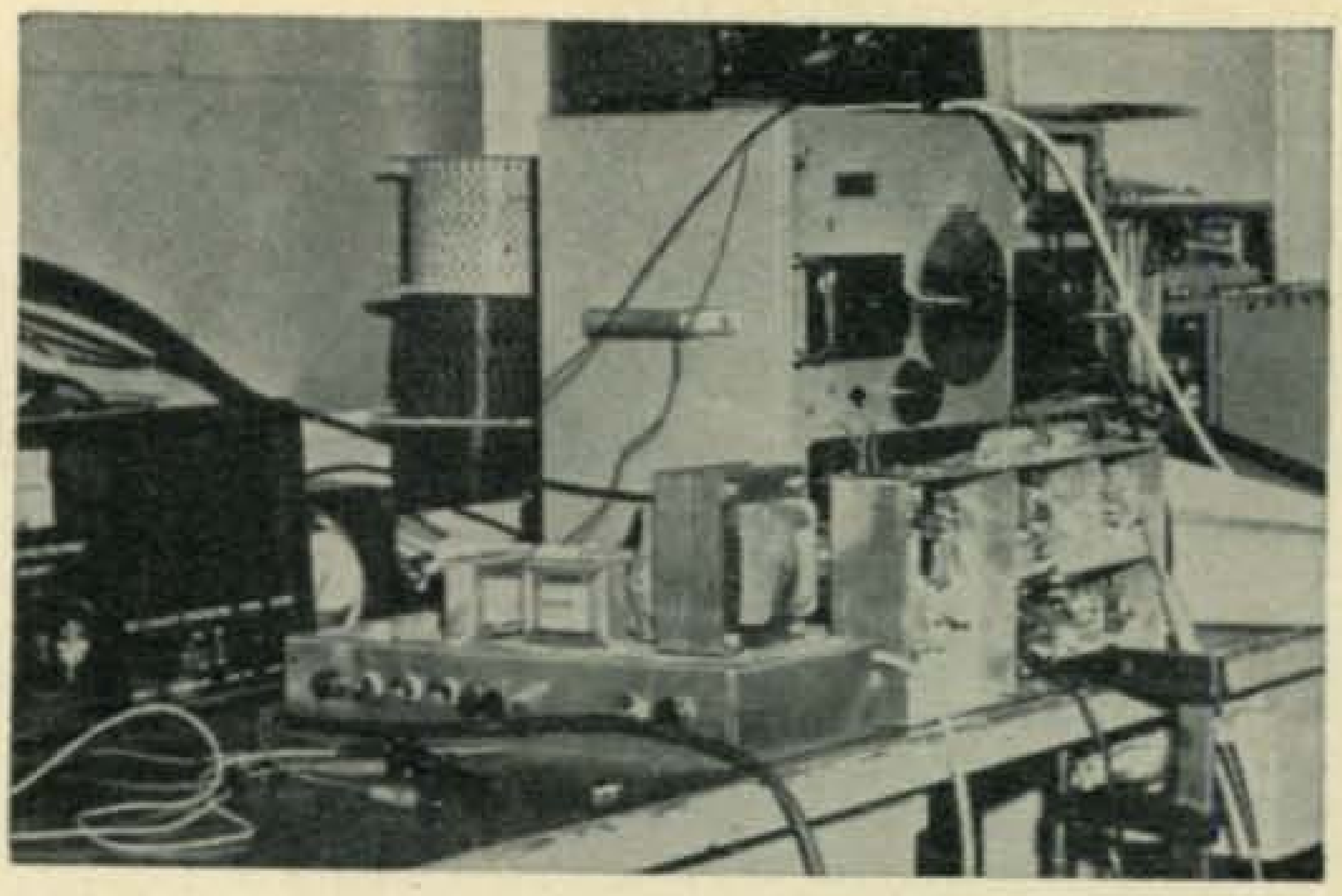
For optimum operation as a mixer or product detector, the gate bias should be equal to half the pinchoff voltage. The drain current at this point will be 25% of I_{DSS}, with no local oscillator injection applied. Injection will cause the average drain current to rise.

The oscillator may be applied to the gate, the source, or in the case of a f.e.t. tetrode, to the second gate.

[*Continued on page 106*]

AMATEUR COLOR TV IN FINLAND

BY JAAKKO J. RAHOLA,* OH2AZT



The station of OH2AJ as it was during the first amateur color TV transmission. From left, the Drake 2-B RX, TV transmitter power supply, the transmitter chassis clamped to the table, and behind it a signal generator. On top of the generator a part of the 2 m converter power supply can be seen.

On the 23rd of May, 1965, one chapter was added to the history of amateur radio in Finland, in Europe, and possibly in the world. On this day the first amateur color TV signals were transmitted and received by a small group of amateurs in Helsinki, Finland. The system used was NTSC, adapted to the European 625 line, 25 frame TV system, and the short program consisted of 35 mm test slides and the RETMA Color TV Test Film. The demonstration took place as part of the annual VHF/UHF Meeting program arranged by three amateur clubs in Helsinki.

As long as the Electronics Group of AGA Company in Finland had experimented with color TV, it was the dream of some members of the staff to build receivers for themselves and have their own color transmissions. But it is not likely for a private company to obtain such a license in Europe, where all broadcasting usually is government operated. So amateur TV seemed to be the only possible solution to this problem.

At that time, we had three eager radio amateurs among the staff, and many others, who were interested in the fine radio hobby. So early in 1963 the AGA Radio Amateur Club was founded. As two of the three hams were holders of the Technician Class license, it was clear that we would concentrate on v.h.f./u.h.f. The club obtained OH2AJ as call sign, and construction of the rigs could begin.

Transmitter

The first project was a small 70 cm transmitter, which could be used as driver for a later p.a. stage, or modulated with a TV signal as it was. A simple and straightforward design with about 10 watt maximum c.w. output was considered suitable, and so the QQE04/5 double tetrode (equal to the American type 7377) was chosen for output tube. The circuit in fig. 1 shows the result.

The first E180F pentode works as normal crystal oscillator, with third overtone series resonant crystals on 48.2222 and 48.3333 mc chosen by a switch. For the sake of stability, these are built in a crystal oven fed from the heater supply. This was not really necessary, but as there was an oven available, it was used. The lower crystal gives, after two triplings, the normal carrier frequency 434 mc, and the second crystal goes on 435 mc for adjustment and reference. The only difficulty with this type of oscillator was to adjust C_1, L_1, and the mutual coupling between L_1 and L_2 so that both crystals gave equal amplitudes of oscillation without starting problems.

The second E180F tube acts as Class C tripler, its plate coil being loosely coupled to the balanced grid coil of the second tripler, QQE02/5 (6939). The following 430 mc tank circuits are made as parallel-line resonators in the conventional style, both plate lines being tuned by shorting bars without capacitors, and the p.a. grid line, as well as the output link, are tuned with variable capacitors. The tank circuits are built in separate chassis compartments by placing an aluminum shield across the tube sockets, and no neutralization is necessary.

Modulation

In theory, cathode modulation was found most attractive, but as the heater of the QQE04/5 is connected to the cathode, this system was impractical. As plate or screen modulation with TV signals is quite difficult from an amateur's point of view, there were only two possibilities left. First, a kind of absorption modulation was tried, by connecting a ¼ wavelength stub at the output, and terminating it with some variable impedance, as a tube, transistor or varactor. This simple system was measured to give up to 50% good modulation, but more was not obtained because of the difficulty of cutting the stub to the correct length. When a considerable roll of coax cable was cut into a few millimeter long pieces, we gave up. Besides, we were a little afraid of the possibility of not obtaining the necessary bandwidth of nearly 7 mc with this system. Then there was only grid modulation

*Pihlajamaentie, Stensvik, Finland.

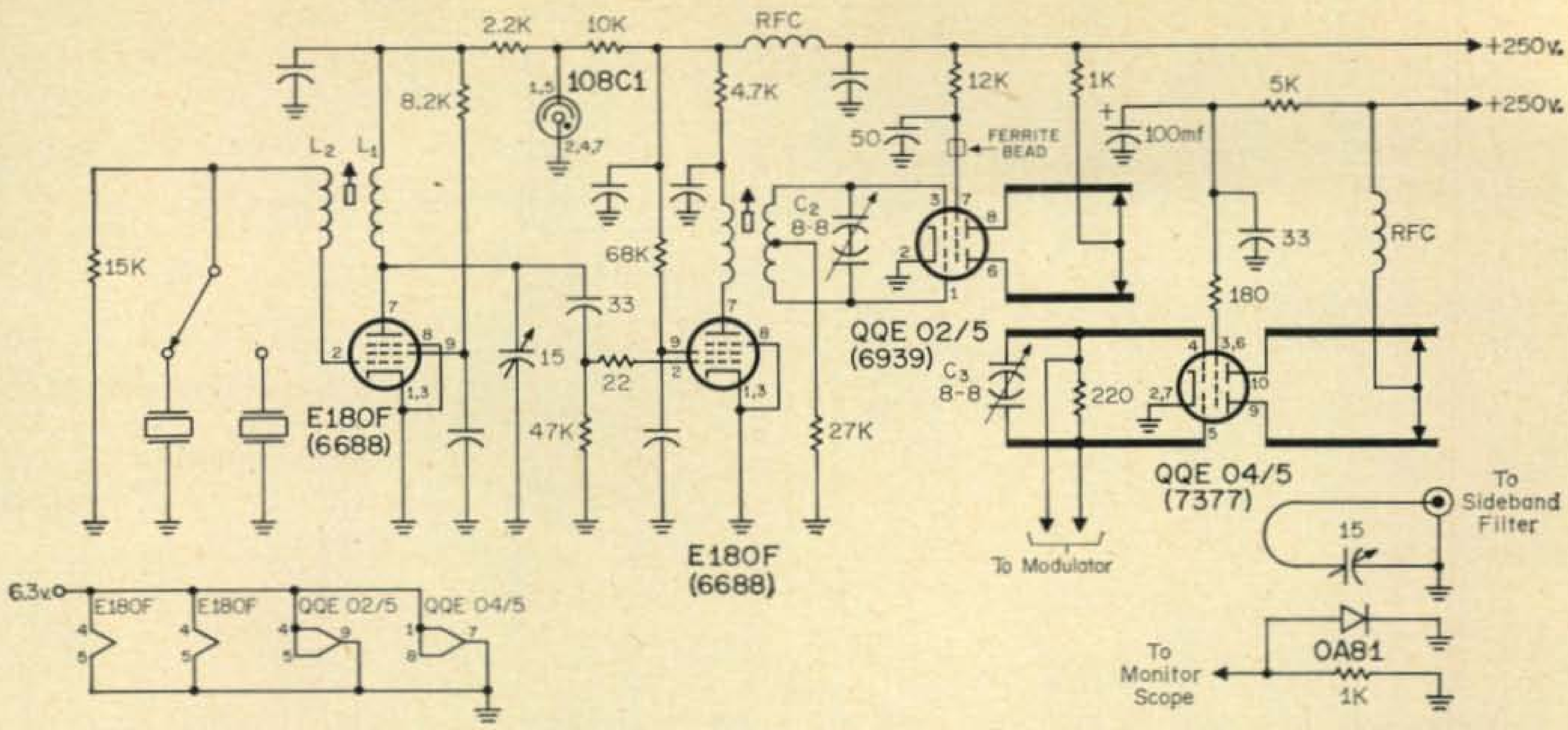


Fig. 1—Circuit of the OH2AJ color TV transmitter. All unmarked capacitors are 0.007 mf. All capacitors marked are in mmf except where otherwise noted.

left, and a long series of experiments began.

The characteristics of the output stage were measured by plotting the r.f. output as function of other parameters, mainly the grid bias. This revealed, that a video signal with sync peaks at —1 volt and white peaks at —9 volts would give a modulation of 90%, with only very little sync stretching necessary for linearity. The first practical approach was a d.c. coupled modulator stage with the upper end of plate load resistor grounded, and cathode fed from —150 volts. The modulator plate would be directly coupled to the grids of the p.a. stage, through small r.f. chokes, of course. Then, the modulator current would determine the p.a. grid bias.

As the video signal available from the company's equipment was at ground level, a.c. coupling to the modulator tube, with d.c. restoration at the grid, was necessary. Sync stretching and other such linearizing adjustments were possible in the video generator apparatus, so this was no problem.

This modulator seemed to work well after the suitable tube type was found. Tests with black-and-white signals gave very good pictures, even if the efficiency was very low, and only a few watts of r.f. output was obtained. But the first test with color modulation was a big disappointment. All color information seemed to get lost somewhere in the r.f. circuits (this may be the reason why the brass resonant lines now have attained a beautiful greenish tint!).

After a few thoughts, the reasons for color loss were clear for us. The r.f. circuit bandwidth was not broad enough, because of high *Q* resonators. This was simply corrected by damping the p.a. grid circuit with a 220 ohms resistor, and using the output link to double-tune the plate circuit. Still the picture did not improve very much, and a second thought revealed, that C_3, the p.a. grid tuning capacitor, appeared as shunt for video frequencies, thereby increasing the modulator load capacitance too much to be compensated with normal peaking methods. A sufficient degree of peaking could be obtained by suitably tuning the output circuit, but this increased the phase shift, thereby introducing too much delay time error for good color pictures.

Up to this stage, the project had proceeded very slowly. Everything was built after normal working hours at the company's laboratory, and the Club members usually were too tired to sit more than spuriously at this work. Now, however, the most active experimenters, OH2AZP, Tage, and OH2AZT, Jaakko, had both started constructing their own rigs, and who would care for a club project under such circumstances? So the transmitter collected still more dust on its shelf. There it was lying until April 1965, when the club decided to take part in the arrangements of the following VHF/UHF Meeting in May. Meanwhile, the AGA laboratory staff had increased by a young and enthusiastic amateur, OH2FF, Per, who now took the soldering iron and started experimenting.

As the transmitter already was in such condition, that it was not impossible to get it work-

"The gang" of OH2AJ, AGA Radio Amateur Club. From left to right: OH2WG, Toivo Järvinen, chief engineer of the TV factory; OH2FF, Per Aure, laboratory engineer; OH2AZP, Tage Lönnfors, technical manager of AGA Electronics Group; OH2AZT, Jaakko Rahola, sales engineer for communications & special electronics; Stig Björklund, laboratory chief engineer.

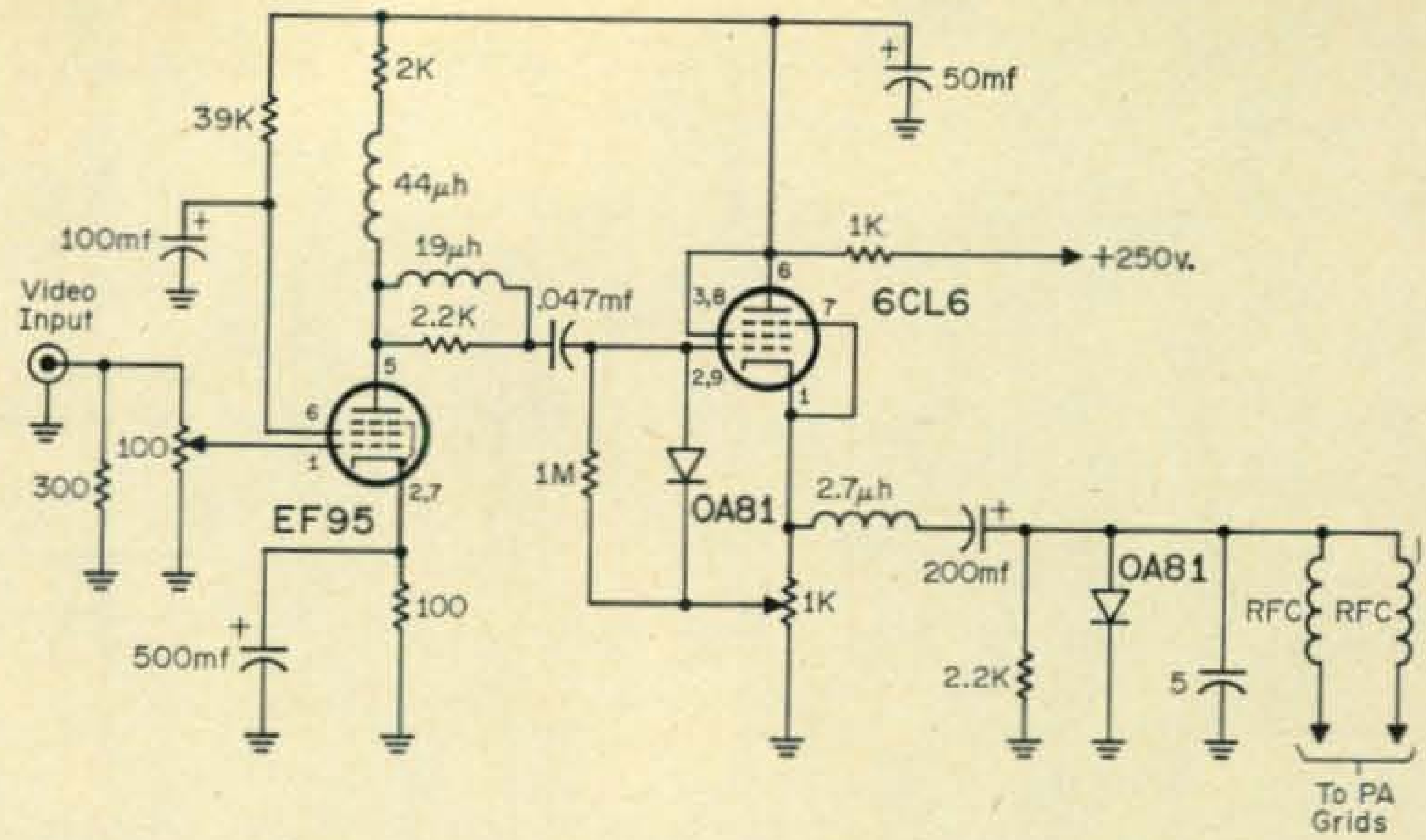


Fig. 2—Circuit of the OH2AI color TV modulator.

ing properly, the first step to be taken was to see, whether any of the existing color receivers could be used for the project. Many hours were spent in looking for u.h.f. tuners that could be tuned down to 430 without appreciable loss in sensitivity and bandwidth. When this was found and built into the best possible receiver, the RX problem seemed to be solved. But there still was one problem left. European TV standards prescribe 7 mc channel width, and therefore the carrier frequency was chosen at 434 mc. The lower band edge happens to be at 430 mc, so it was necessary to cut the lower sideband. Also, the receiver is much more sensitive for incorrect sideband ratio than a b-w receiver, and this demanded the use of a proper vestigial sideband filter.

Per was put to work at the lathe, and the result was a simple, but good double-tuned filter with coaxial resonators. All this work took so much time, that when the transmitter again was taken under consideration, we only had a few days left to the meeting.

A fast check showed, that there was no use trying to put color through the existing modulator. Therefore, a new approach was made, now using a low output impedance cathode follower. After a few nights' work Per ended up with the circuit diagram as shown in fig. 2.

Video output at about 1 volt peak into 75 ohms, sync negative, was available from the company's equipment. This was fed into the EF95 amplifier stage, which also corrects the frequency response by combined shunt and series peaking for best picture quality. The chokes in the plate circuit had to be chosen very carefully, and the adjustment was made by cut-and-try methods until the best picture was obtained. Grid bias of the a.c. coupled cathode follower is adjusted by the pot in the cathode lead, and the diode was found necessary for best linearity. Coupling to the r.f. amplifier grids is through a large electrolytic capacitor, with a peaking coil in series with it. The critical European TV watchers absolutely demand d.c. restoration, which can be found in every TV set on this side of the ocean, so a diode had to be placed across the output. The modulating signal is fed to the p.a. grids through small r.f. chokes, and a 5 mmf capacitor bypasses too high frequencies from the modulator output.

The receiver end. From left, Stig Björklund, laboratory chief engineer at AGA, and OH2AZP, Tage Lönnfors, chairman of the AGA Radio Amateur Club. Tuning the receiver is OH2HK, OH v.h.f. manager.

This arrangement worked very well, and good color pictures were obtained in the lab. As only one receiver was to be used, it was very easy to compensate for small nonlinearities in the modulator and transmitter by slight adjustments of burst and sync level and gamma correction. The output waveform was monitored by placing a diode in the plate tank compartment, so that its leads acted as pick-up link, and connecting this to an oscilloscope. (See fig. 1.)

Antennas

One day before the meeting the RX was brought to the QTH of OH2AA, where the meeting was to be held. The difficulties were not solved by getting the equipment in good working condition. Even if the distance to be crossed was not more than a few miles, very good antennas were to be found to ensure good pictures. The transmitter antenna location was good, so it was no problem. A normal four-over-four skeleton slot array was already mounted on top of the factory building, high over the roofs of the surrounding industrial quarter.

At the RX, a dipole with a big corner reflector was first tested, but it did not give enough gain. A few minutes before the shops were closed for the weekend, a new 8 over 8 beam, similar to

[Continued on page 101]

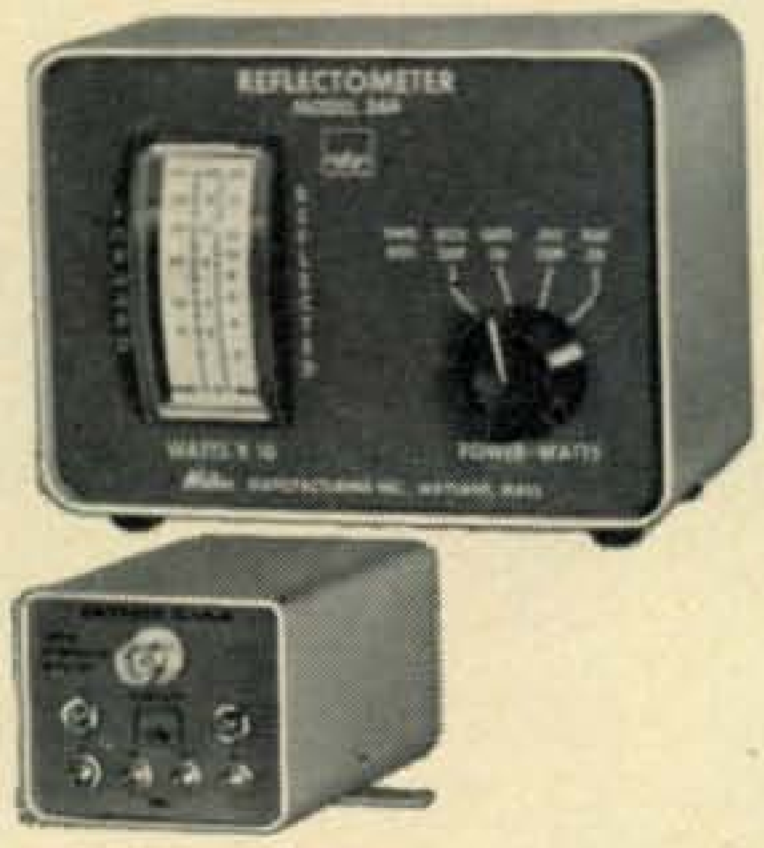
Peak-up your operating performance with Waters "Convenience-Engineered" gear. . .!

Perfection . . . in a PHONE PATCH

UNIVERSAL HYBRID COUPLER & PHONE PATCH

Mod. 3002 (less battery)
$69.95
Mod. 3001 (Without Compreamp)
$49.50

Enjoy the ultimate in phone patches with this compact coupler, precision-engineered at Waters. Designed for effortless VOX operation, it is the only patch with its own speech processor (Model 3002). Its built-in Compreamp maintains correct out-going levels eliminating all manual switching and whenever needed, the Compreamp may be used independently of the patch. Provision is included for switching a tape recorder in and out for both recording and playback.



Waters REFLECTOMETER

Amazing new Reflectometer with its unique dual meter tells at a glance both forward and reflected power of your rig in RF watts. Two separately set forward scales of 200 and 1000 watts (20 and 200 watts reflected) insure accurate readings. VSWR can be immediately determined from the calibrated reference chart. Comes complete with remotely located Directional Coupler and connecting cable.

Model 369 . . . . $115.

Waters COMPREAMP™

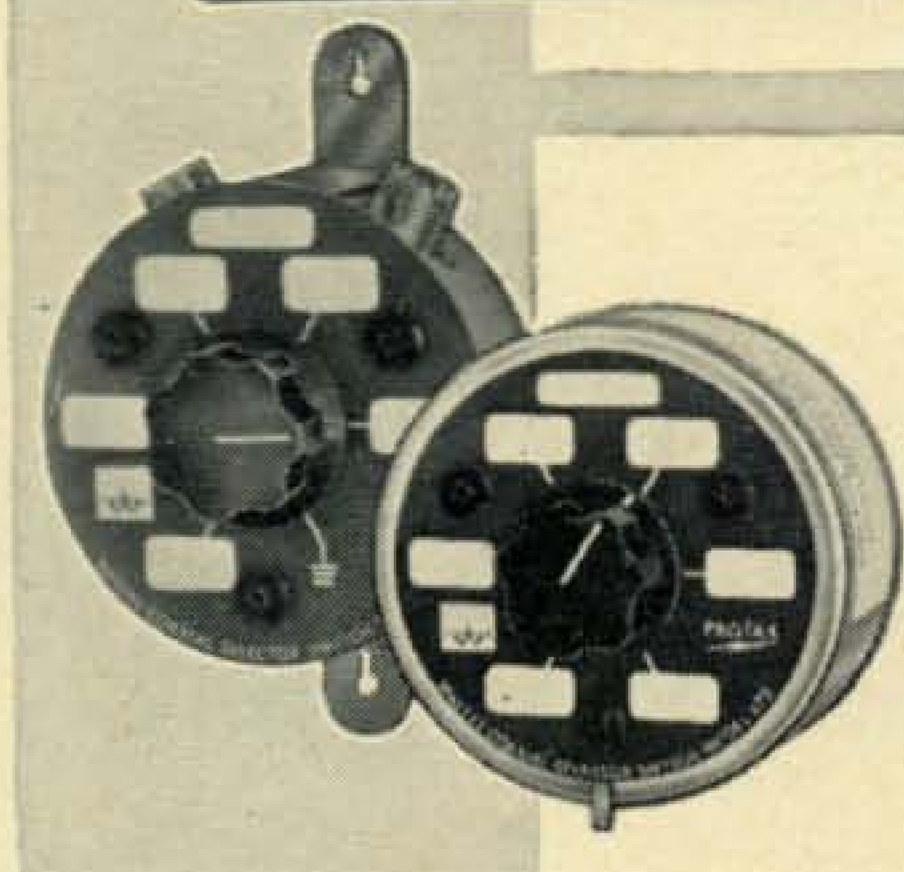
Get more "talk power" into your signal with a Compreamp! Solid state, self-powered and compact it installs in a jiffy in the mike line of either fixed or mobile rig. Great for that added punch when QRM and band conditions are tough.

Model 359 $27.95 (less battery)

Waters CODAX™

CODAX — the automatic keyer that puts rhythm-smooth CW at your fingertips. Never anything like it! Feather-touch double paddle is automatically timed for 5 to 50 WPM. Operates block grid or into mike jack for VOX CW on either sideband. Monitors the signal, too!

Model 361. $92.50 (less batteries)



Waters PROTAX™

A must! Brand new Coaxial Antenna Switch that automatically grounds the antenna system when the shack is shut down. Handles a full 1000 watts . . . comes complete with knob, escutcheon plate with erasable marking panels and mounting bracket on Model 376.

Model 375.
6-position rear axial connectors $13.95
Model 376.
5-position side radial connectors $12.50

WATERS
MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

WATERS PRODUCTS ARE SOLD ONLY THROUGH WATERS QUALIFIED DISTRIBUTORS

For further information, check number 26, on page 110

The Oscilloscope

Part III

BY WILFRED M. SCHERER,* W2AEF

Installment three covers the use of the scope for amplitude modulation measurements and monitoring. Waveform, trapezoid and circular displays are covered.

Having discussed the principle functions of the oscilloscope during previous installments in this series, we shall now take up some of the practical applications related to amateur gear. These mainly concern checking the performance of and monitoring the a.m., s.s.b., c.w. or RTTY operation of transmitters. This is accomplished by observing the r.f. output signal from the equipment.

The oscilloscope may be coupled to the transmitter using any of the methods shown in fig. 1.

*Technical Director, *CQ*.

The r.f. signal is fed *directly* to the vertical plates of the c.r.t., since the oscilloscope amplifier usually is not designed for r.f. amplification, except in the "wideband" type of instruments wherein their amplifier is useful up to 5 mc or so. Where terminals are not provided for direct connection to the vertical plates, they may be added to the instrument with circuit modifications made as shown in fig. 2.

A.M.

Let us first take a look at a.m. displays. With an unmodulated (c.w.) carrier applied to the vertical plates of the oscilloscope and with the horizontal sweep turned on, the display will appear as shown at fig. 3(A). Modulating the transmitter with a single sine wave a.f. tone (in

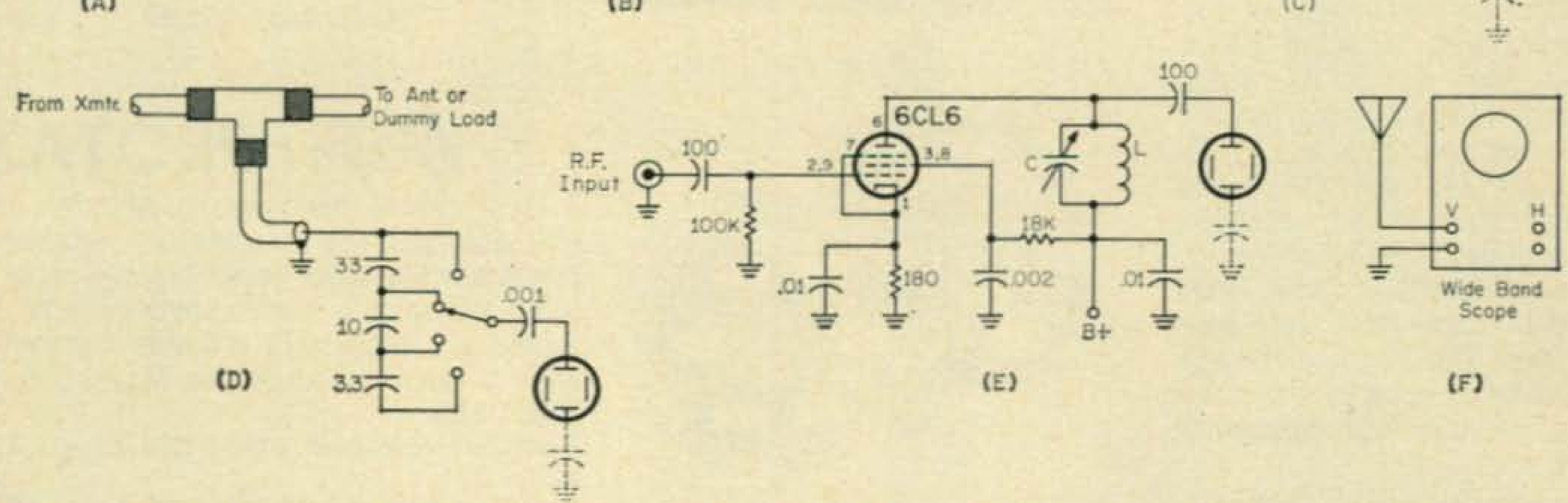


Fig. 1—Methods of coupling the oscilloscope to transmitter, the L-C circuits should resonate at the operating frequency. Where one of the vertical deflecting plates is not already grounded, a ground return through a 0.001 mfd capacitor should be made as indicated by the dashed lines. In circuits (A), (B) and (C) the r.f. amplitude on the c.r.t. is controlled by the degree of inductively coupling to the transmitter tank. At (D), various size coupling capacitors may be switched in as needed for desired amplitude. Circuit (E) is an effective arrangement for use where very low power r.f. is involved. If the transmitter frequency is below 5 mc, a wideband scope connected at the transmission line or used with a small pickup antenna, at (F), will provide high sensitivity and the display amplitude may be conveniently adjusted with the vertical gain control. A good quality wideband scope is required to obtain symmetrical negative and positive modulation peaks.

the 300-3000 c.p.s. range) will produce a pattern like that at fig. 3(B), after the horizontal sweep has been adjusted for the desired number of a.f. cycles. In cases where the image cannot be made to stand still (such as may be due to unstable horizontal sweep frequency), sync may be applied as shown at fig. 4.

If the display appears to be exceptionally fuzzy, tilts to one side, exhibits elliptical loops or has superimposed horizontal traces, chances are that r.f. leakage between the vertical and horizontal circuitry of the scope, r.f. phase shift, parasitics, instability or r.f. harmonics may be present. Also, where resonant coupling circuits are used, they might be improperly tuned.

The percentage of modulation may be determined as indicated at fig. 5(A). Overmodulation is indicated when the negative peaks square off and break up the carrier at the base line (Fig. 3D) while modulation above 100 percent on the positive peaks is indicated when the peak level exceeds twice that of the carrier. Unequal negative and positive peak amplitudes, based on the initial carrier-level reference, usually indicate the presence of carrier shift.

The waveform of the modulated r.f. envelope can indicate the presence of distortion just like the a.f. waveforms do as described last month. Such distortion may occur in the a.f. amplifiers, the modulator or within the modulated r.f. stage itself. Examples are shown at fig. 3(E)(F).

When it is desired to monitor the modulation during voice operation, sync should be removed and the horizontal-sweep frequency should be set (usually between 60 and 200 c.p.s.) to where the speech waveforms may be readily discerned.

Overmodulation is most easily recognized by bright spots that show up at the center of the pattern along the horizontal axis when the negative-peaks modulation exceeds 100%. In this connection, it should be noted that overmodulation on the negative peaks breaks up the carrier and thus can cause splatter. During operation, it will therefore be best to set the a.f. level to the point just below that where bright spots occur at the negative peaks.

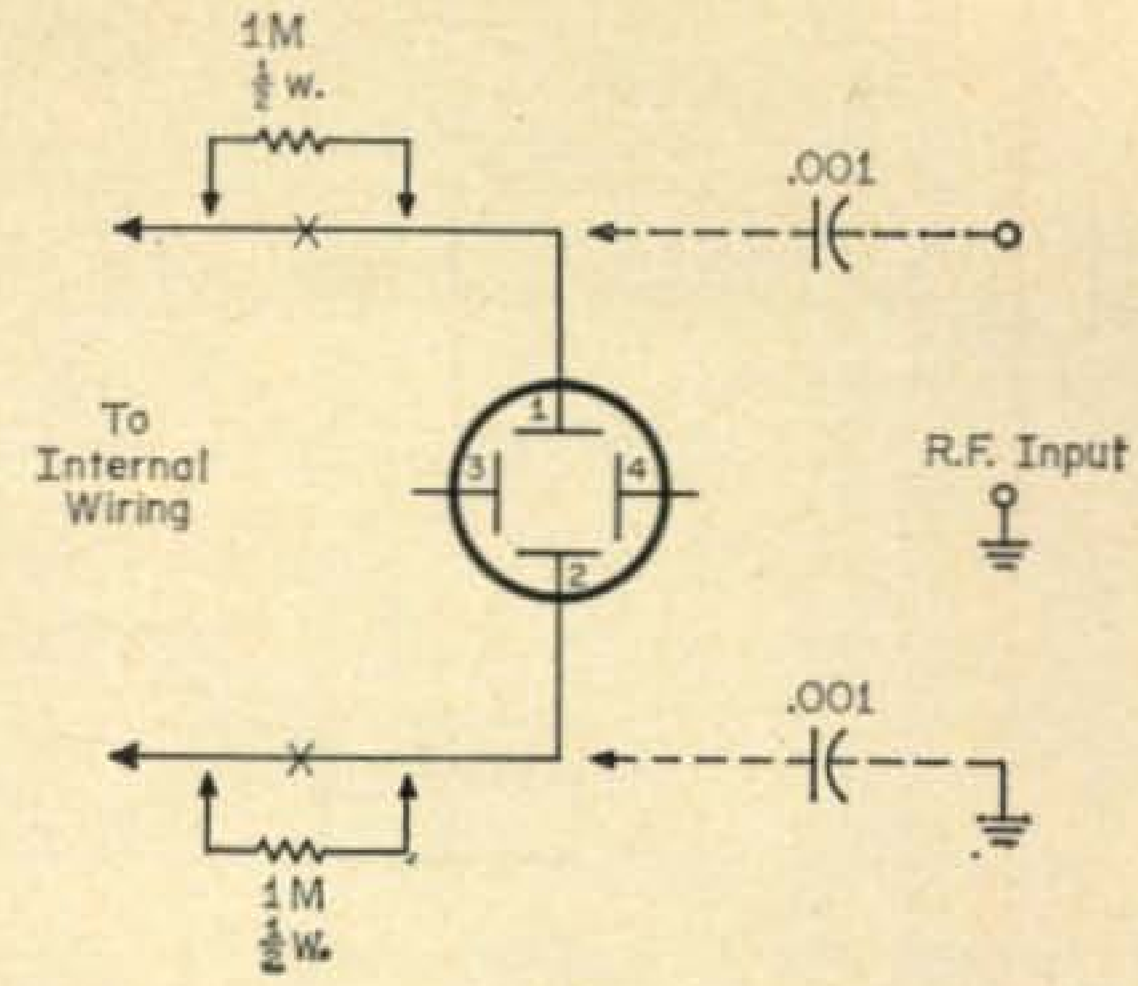


Fig. 2—Circuit modification for direct r.f. connections to vertical deflecting plates of an oscilloscope not so equipped. This is made by opening the normal c.r.t. socket connections at points marked X and inserting 1 megohm isolating resistor (or 2.5 m.h. r.f. chokes). Where plate #2 is already grounded directly, the resistor at that point is not needed. Isolating resistors similarly installed at plates 3 and 4 will minimize the possibility of r.f. leakage and phase shift through the internal wiring of the instrument, that could cause pattern distortion. These changes may affect the normal frequency response of wideband oscilloscopes, in which case the resistors should be removed or shorted out during regular functions.

Not as instantaneously recognizable is positive-peak overmodulation or overload indicated by "flattopping" on the crests. This is mainly due to the maximum peak-power capabilities of the modulator or the modulated r.f. stage.

Trapezoid Displays

The displays just described are r.f. envelope

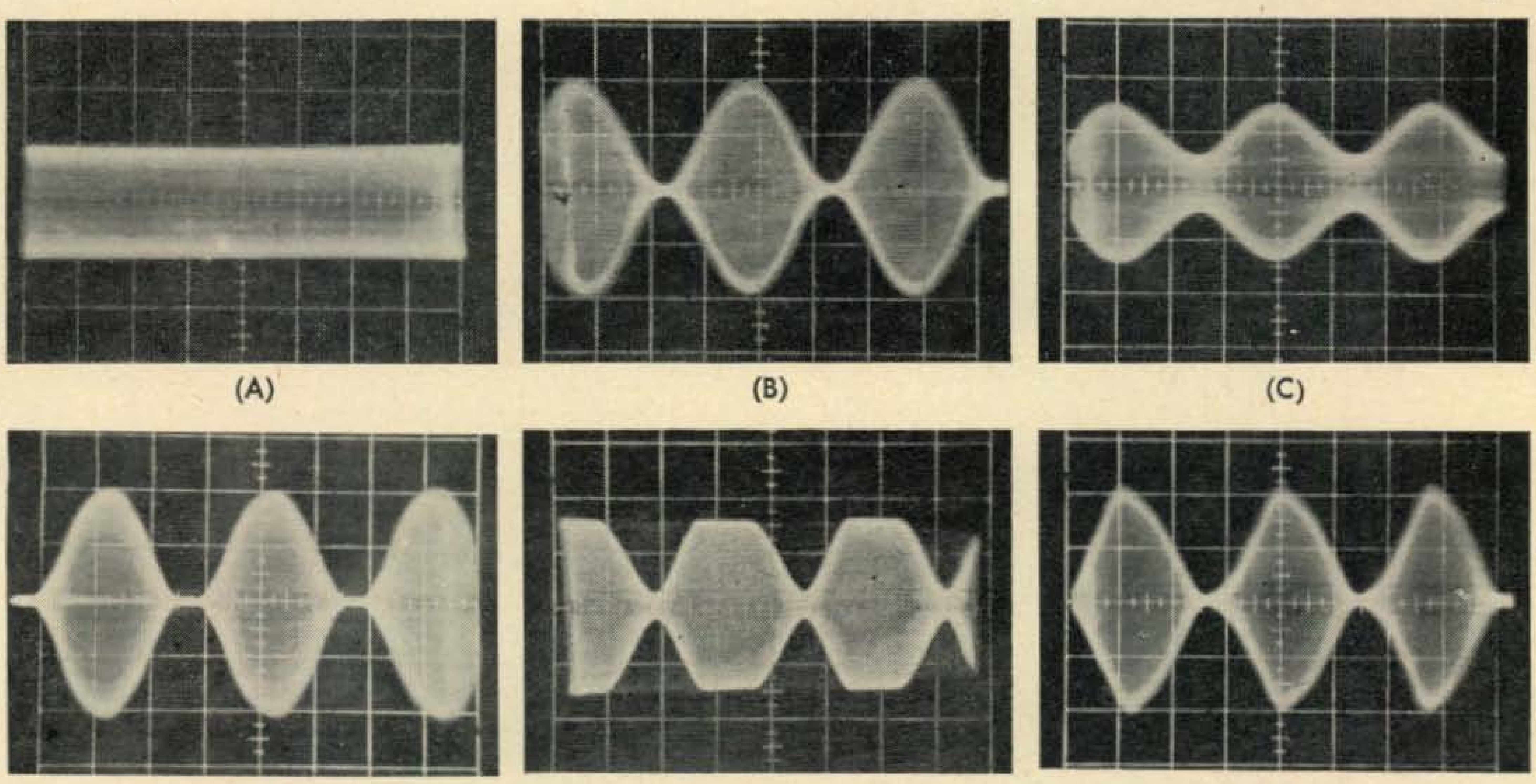


Fig. 3—R.f. envelope displays obtained with oscilloscope. (A) c.w. carrier (unmodulated); (B) 100% modulation; (C) 50% modulation; (D) overmodulation on the negative peaks breaks up the carrier along the center of the horizontal axis; (E) flattopping; (F) distortion evidenced by irregular waveform.

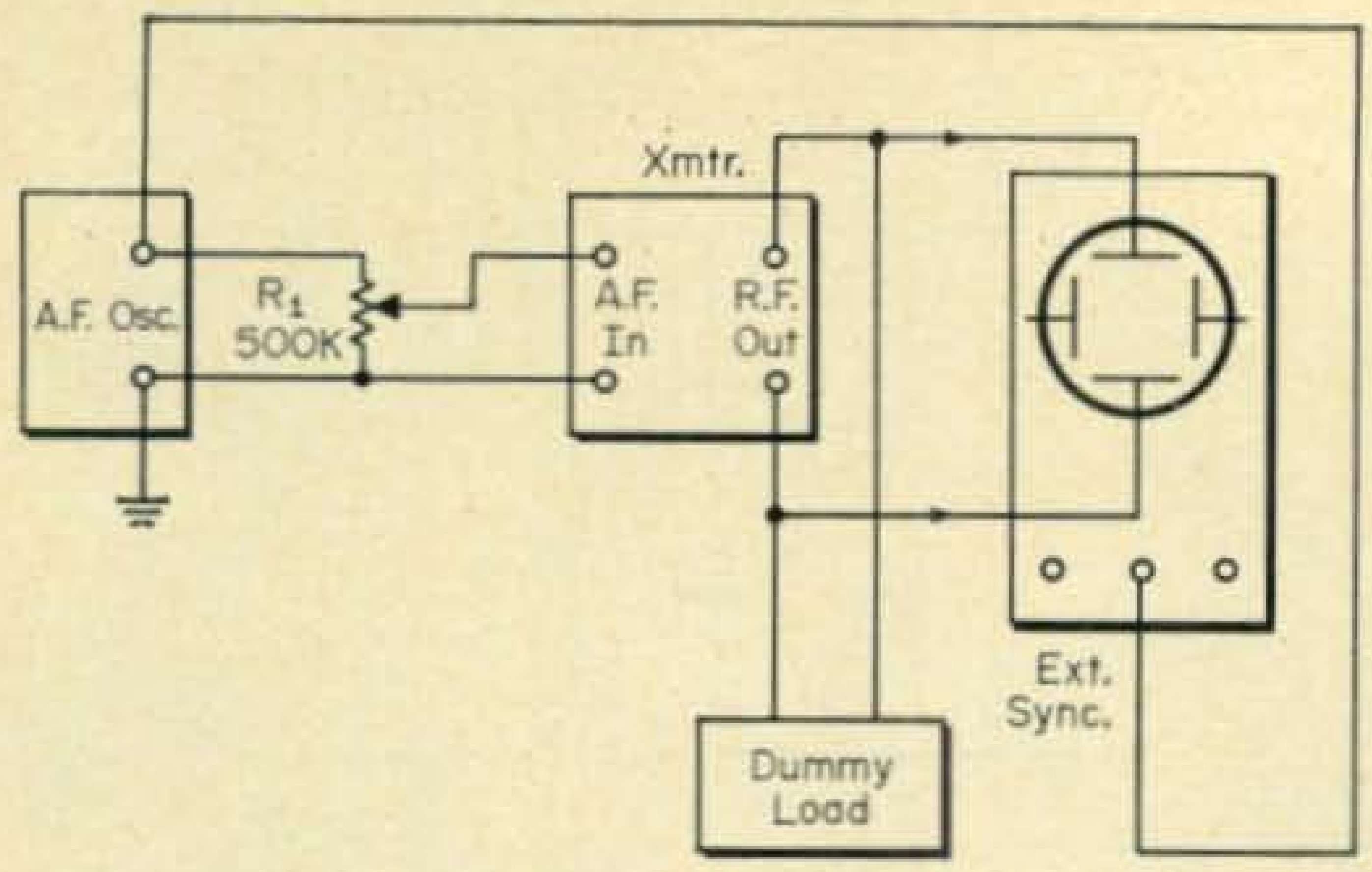


Fig. 4—Connections for application of sync control. A high-level a.f. signal usually is required to synchronize the oscilloscope sweep frequency, so the a.f. oscillator must be operated near its maximum output. This level must then be reduced with R_1 to prevent overloading the a.f. input stages of the transmitter.

patterns. Another type is the trapezoid. This is obtained by applying the r.f. signal to the vertical plates as for the envelope pattern, but instead of using the horizontal sweep of the scope, a sample of the a.f. modulating signal is applied to the horizontal amplifier as shown at fig. 6. Sync is not required.

Typical trapezoid displays may be seen at fig. 7 and the determination of the percentage of modulation is indicated at fig. 5(B). Negative-peak overmodulation is indicated by a bright horizontal line extending out of the center corner, while positive-peak modulation beyond the transmitter capabilities is shown by a rounding or flattening of the top and bottom corners. Such observations may be made either during a steady-tone test or with voice modulation.

Since the method compares the input and output signals against one another, the presence of distortion may be readily recognized as with the similarly obtained a.f. displays shown previously. Any departure from a straight edge indicates distortion. See fig. 7(F). Likewise, if the edges of the trapezoid tend to exhibit a loop instead of being solid, phase shift is present. See

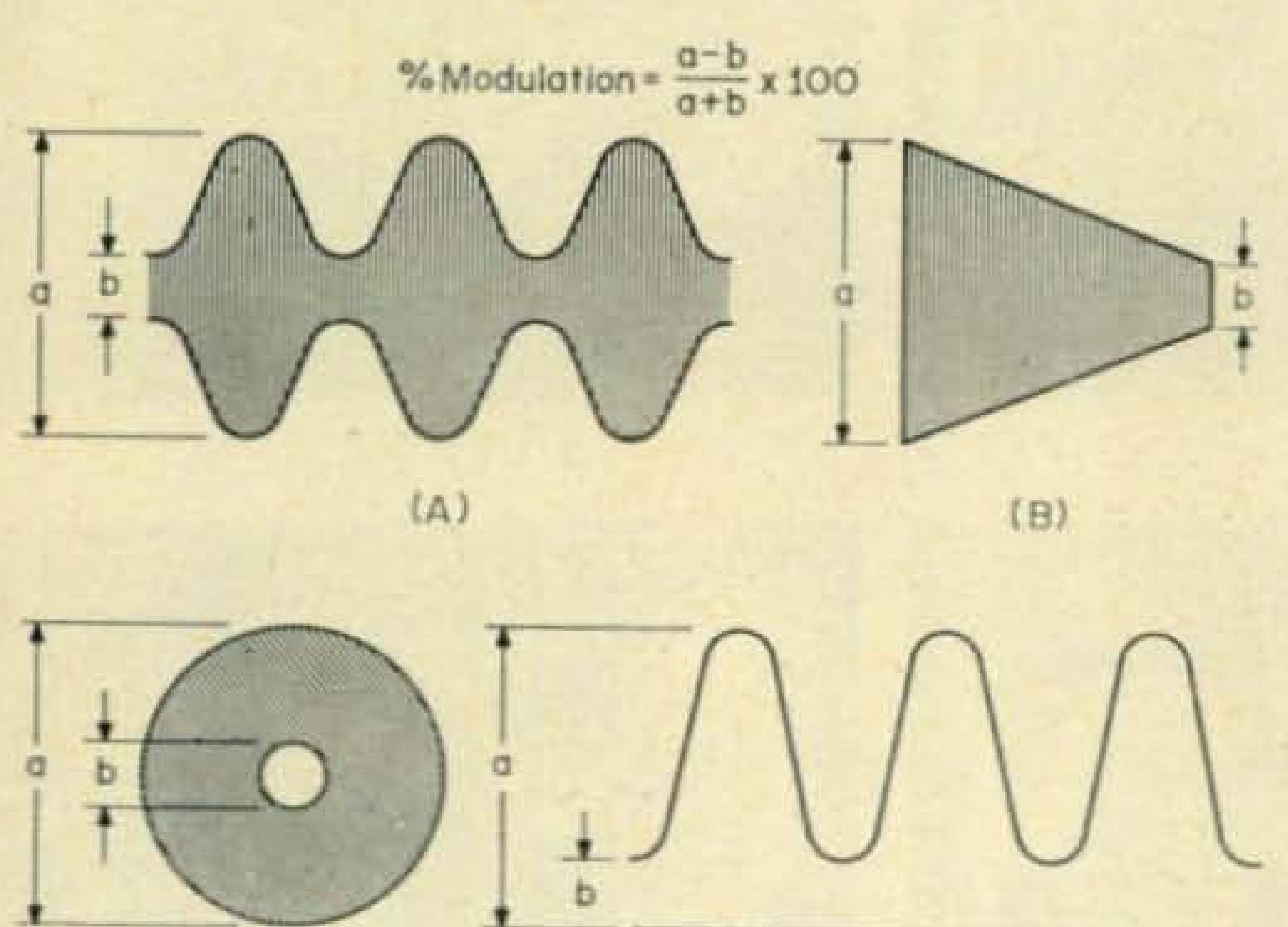


Fig. 5—The percentage of modulation with the various type oscilloscope displays is determined by the formula shown above. Dimensions *a* and *b* are obtained at (A) with r.f. envelope displays; at (B) with trapezoidal displays; at (C) with circular displays; at (D) with demodulated displays.

fig. 7(G). This can often be corrected by installing a phase-shift network in the a.f. line to the scope as described earlier in this series.

Circular Patterns

Another type of modulation display is the circular pattern which is obtained by simultaneously applying the r.f. signal to both the vertical and horizontal plates of the oscilloscope, with the r.f. for the horizontal plates fed through a 90 degree r.f. phase-shift network. With no modulation, an open circle appears on the c.r.t. screen. With modulation the circle expands inward with the negative peaks, outward with the positive ones. Overmodulation (on the negative peaks) is indicated whenever a bright spot appears at the center of the circle. Modulation percentage is found as indicated at fig. 5(C). Distortion is evidenced whenever an unsymmetrical circle is seen. The r.f. phase-shift network must be readjusted when the radio frequency is changed, so the circular pattern is seldom used.

Demodulated Patterns

Demodulated patterns provide a display of only the a.f. component and thus appear on the c.r.t. screen as an ordinary audio signal with a single-line trace. These are obtained by the use of an r.f. demodulator probe connected to the vertical-input amplifier of the scope. Typical circuitry is shown in fig. 8. This arrangement is a particularly handy expedient for use with oscilloscopes that are not provided with facilities for r.f. connections directly to the deflecting plates; however, a *d.c. coupled* vertical amplifier should preferably be incorporated. Some other advantages of this method will be mentioned shortly.

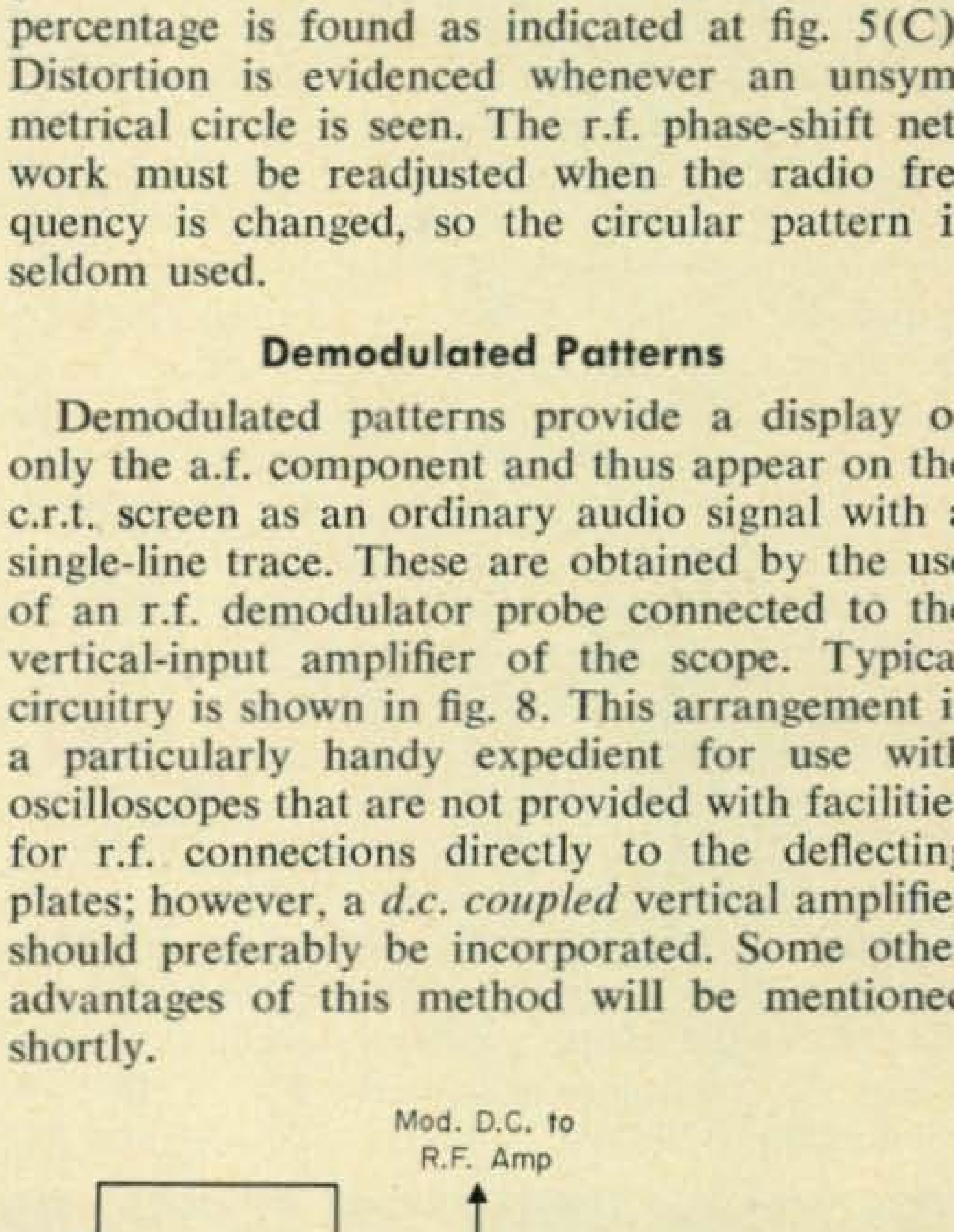
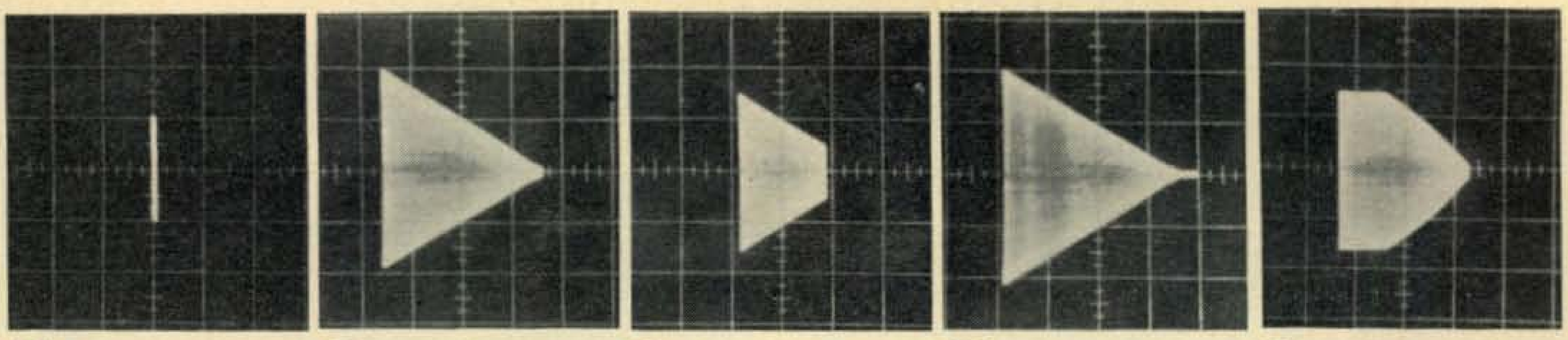
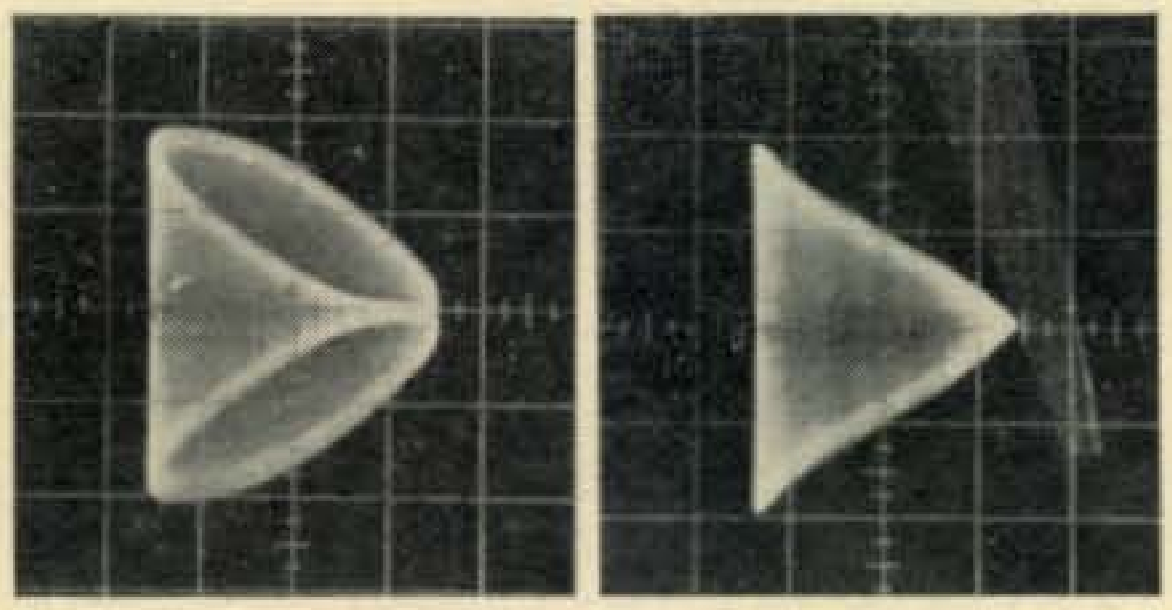


Fig. 6—A.f. connections for obtaining trapezoid displays with the oscilloscope. The voltage rating of C_1 should be at least twice the d.c. supply voltage. Resistors R_1 and R_2 should be proportioned to limit the a.f. potential at their junction to less than 1 volt. The series value of $R_1 + R_2$ should amount to at least 250,000 ohms for each 100 volts of d.c. plate potential. One watt resistors should be satisfactory. The audio signal also may be obtained from a lower level a.f. stage or from the a.f. signal source; however, phase shift in the amplifiers most likely will require the use of a phase shift network at the horizontal input to the scope.



(A) (B) (C) (D) (E)



(F) (G)

Fig. 7—Trapezoid displays obtained wtih oscilloscope. (A) c.w. carrier (unmodulated); (B) 100% modulation—a symmetrical triangle is obtained when the vertical and horizontal amplitudes are equal; (C) 50% modulation; (D) overmodulation on negative peaks indicated by a horizontal line extending to the right; (E) flattopping; (F) curvature of sloping sides indicates distortion or nonlinearity; (G) loops at sloping sides indicates presence of phase shift.

The procedures for obtaining and interpreting demodulated patterns are as follows:

1. Connect the demodulator probe to the transmission line as shown at fig. 8.

2. Set the vertical gain on the scope to zero. Transmitter off.

3. With the horizontal sweep set at a low audio frequency, adjust the horizontal gain for a trace across the c.r.t. screen.

4. Adjust the *vertical*-positioning control so that the horizontal trace is one or two inches (or some other convenient reference point) *below* the center of the screen.

5. Apply the *unmodulated* r.f. carrier and adjust the *vertical* gain to a point where the horizontal trace appears across the *center* of the screen.

6. Modulate the transmitter with a single test tone (about 1000 c.p.s.).

7. Adjust the horizontal sweep until two or three cycles of the demodulated r.f. appears as a single-line trace of the waveform from which the presence of distortion may be determined or the modulation percentage may be found as shown at fig. 5(D). Also refer to fig. 9.

Overmodulation is indicated whenever the negative or positive peaks flattop. This usually can be more readily seen here than with r.f. envelope patterns during voice modulation. Under this type of dynamic operation the peaks may tend to exceed their amplitudes noted during steady-state conditions which may be attributed to higher peak capabilities related to high-voltage regulation.

An oscilloscope with an a.c. vertical amplifier may be used in the manner described only for detecting distortion or for monitoring purposes, but the modulation percentage will be difficult to determine. Also, some bounce of the display may be experienced according to the time constants of the amplifier circuitry.

[*Continued on page 100*]

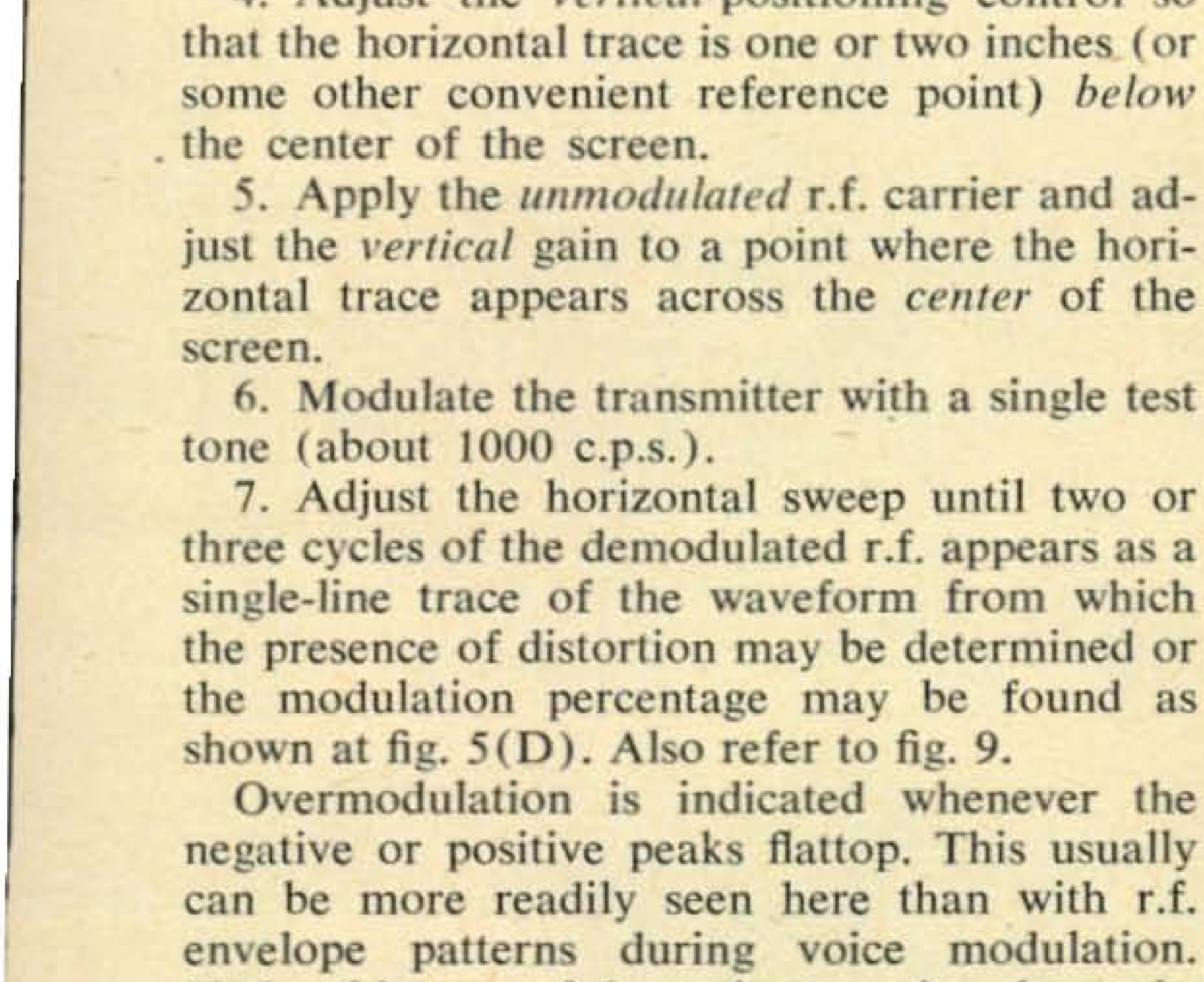
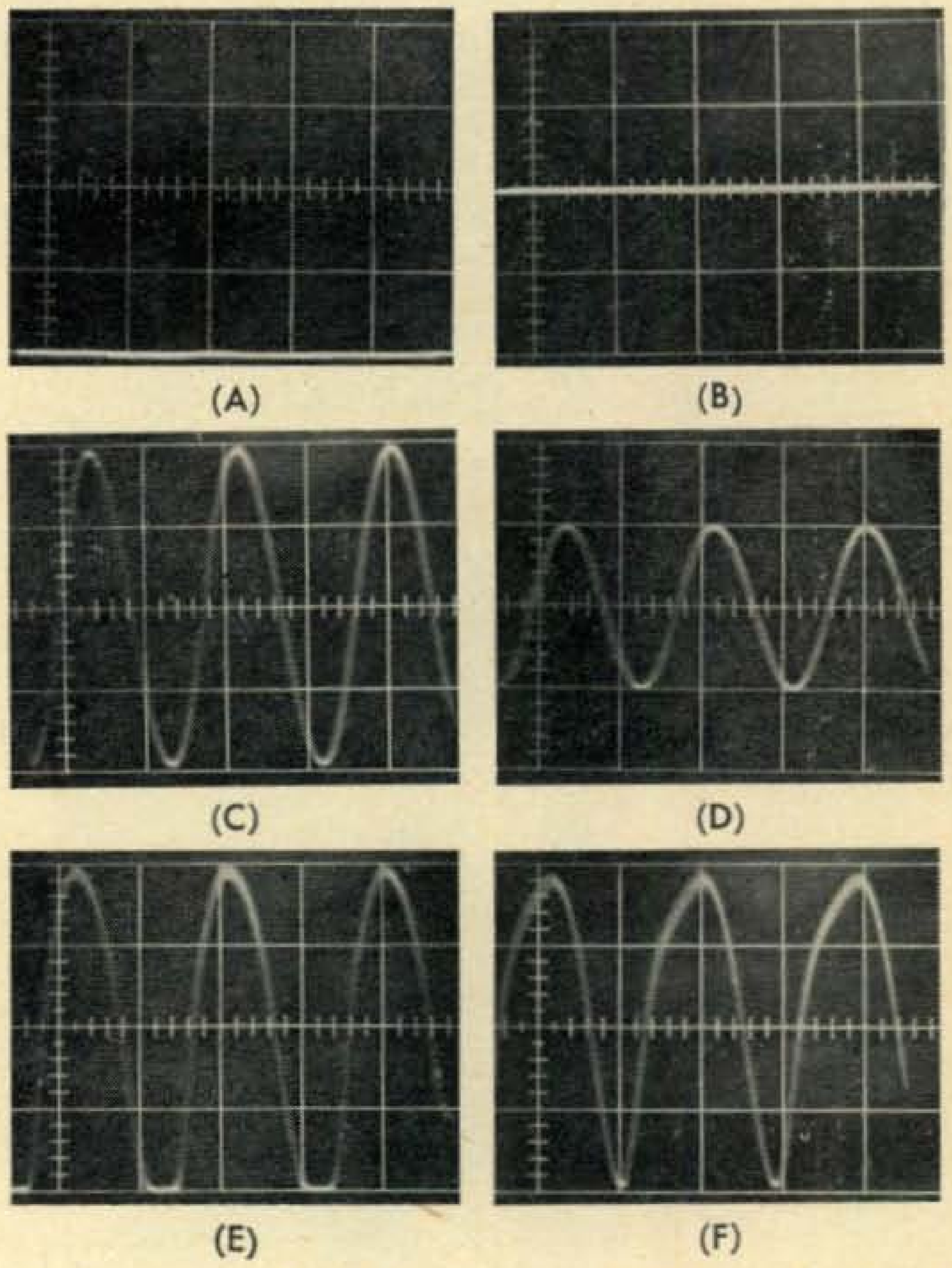


Fig. 8—R. f. demodulator circuit for use with oscilloscope. Resistors R_1 and R_2 should be proportioned to limit the peak r.f. potential applied at the diode to about 50 volts. The sum of $R_1 + R_2$ should be 5000 — 10,000 ohms.



(A) (B) (C) (D) (E) (F)

Fig. 9—Demodulated displays. (A) With no r.f. signal applied horizontal trace is first positioned below center for a reference base; (B) With unmodulated carrier applied, vertical gain on oscilloscope is adjusted for a carrier-level reference at the center; (C) Demodulated waveform with 100% modulation. Note amplitude relationship to base reference shown at (A). (D) 50% modulation; (E) overmodulation on negative peaks; (F) distorted signal.

Earl Thomas (left), W2MM, shown presenting the Quarter Century Wireless Association's "Golden Anniversary Award" to Tom Appleby, W3AX. Tom began his radio amateur activities shortly after the turn of the century, and he's as active as ever from his Washington, D.C. QTH.

Barry Vogel, OA6BO, (right) is a Peace Corps volunteer from California living and working in Tacna, Peru. While there he visited the station of Jose Gylling, OA6AI shown on the left. Barry just wound up a year and a half working in radio and TV as well as small arts and crafts projects in Peru and should be home at this time.

PEOPLE AND PLACES

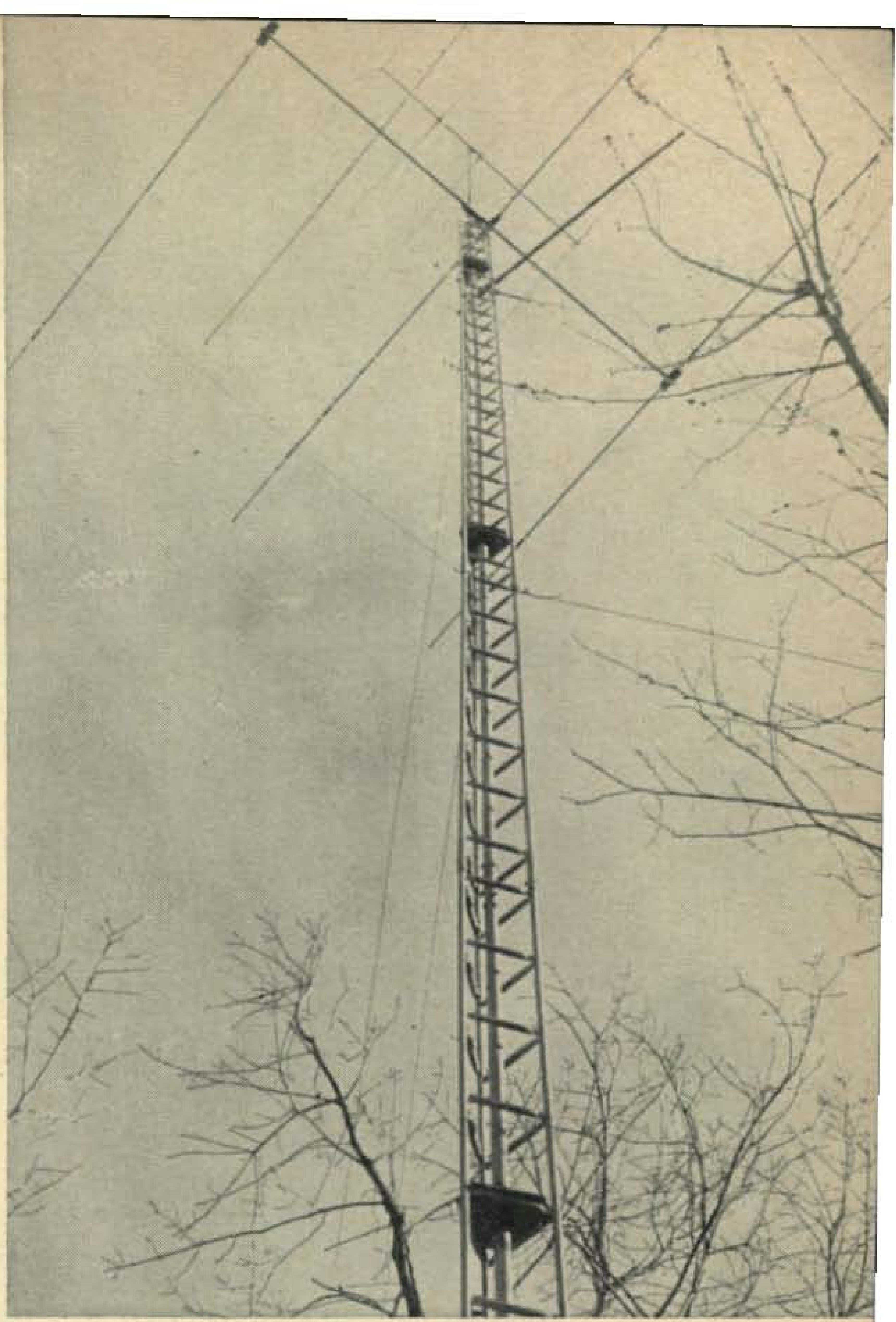
This is Clyde Stottlemyre, KR6MM, presently stationed with the military on Okinawa. He will be changing duty stations soon after spending over two years on the island. Clyde asks us to remind some of the fellows that he has worked to please QSL. His stateside calls is W3HEO.

Here's proof that Lee Kerbel, W4EDE, of Alexandria, Virginia can do more than put out a strong signal on 20 meters ssb. Lee's just finished roasting that turkey seen in the pot, as his XYL Vivian, who hails from YV5-land, looks on with amazement.

Gerard de Buren, world-wide ambassador for amateur radio, and holder of several calls, including WA6QAU, HB9AW and FP8AW, shown operating from W3ASK during a recent visit to the United States.

DON'T FORGET TO SEND IN FOR LOGS FOR THE CQ WW DX CONTEST

The main torque-tube, consisting of three 20 foot sections, extends down inside the tower to within 3 feet of the ground. At the 20, 40, and 60 foot levels, thrust bearings on supporting plates support the torque-tube.



THE TORQUE-TUBE ANTENNA DRIVE

BY DONALD W. BIRKS,* K9IUI

The system described below permits installation of the antenna rotator at ground level by installing a torque-tube in the tower to support and rotate the antenna array. The ease of maintenance, increased structural strength of the tower, and added safety are all good reasons for considering such an installation.

I HAVE probably been up and down as many towers, poles and various supporting devices as any amateur in the country. But an accident involving changing a light bulb in my front yard left me permanently crippled and no longer able to climb. A ladder fell while I was performing this heroic deed at the dizzy altitude of approximately 6 feet, and I wound up with a shattered leg and wrist. I shudder to think what could have happened if this fall had originated from the 65 foot level of my amateur antenna tower!

Fortunately for me, prior to the accident, I had installed a torque-tube system in my tower with the rotator at ground level, eliminating the necessity of climbing the tower every time the rotator chose to act up. The system is certainly nothing new, and I take no credit whatsoever for originating the idea. I thought, however, that those of you who do have a gray hair or two in your head and feel that your tower gets taller every time you try to climb it might be interested in the installation which I finally evolved.

*Grand View Drive, Peoria, Illinois.

To start with, my original antenna system consisted of a 65 foot Rohn No. 6 TV tower, with a three element TH-3 Thunderbird beam at the 65 foot level. On top of the TH-3 was a 10 foot mast supporting a 5 element 6 meter beam. I originally had a 15 foot section of 1¼" galvanized water pipe serving as a mast for both antennas. This mast extended down into the tower about 5 feet where it was connected to a commercial rotator and brake. The top 10 feet of this mast, which was used to support the 6 meter beam, was later replaced by a 10 foot section of TV masting which permitted easy removal of this assembly. This system worked quite well for a number of years until the rotator and its associated indicator system began to require more and more frequent repairs. This, of course, necessitated many trips up and down the tower. Then too, here in central Illinois the winters are not as balmy as they might be and even though the rotator was apparently in good working order, snow, ice, and low temperatures often made it extremely sluggish or even caused it to fail.

As time passed and I had neither the zip nor the fortitude to be climbing my tower on a dark, freezing night even if Gus was operating from a Lamasery in Tibet and the skip was right into 9-land, I thought I had better give some attention to a method using ground level rotation equipment.

As can be seen from fig. 1, the system which I finally developed consists primarily of a long torque-tube down through the center of the tower terminating at a prop-pitch motor at the base of the tower. Although I do not recommend it, I installed this torque-tube after the tower was erected and without bringing the beam down to the ground. Again, this was in my younger, more foolish days, and I doubt if I would attempt to do this again.

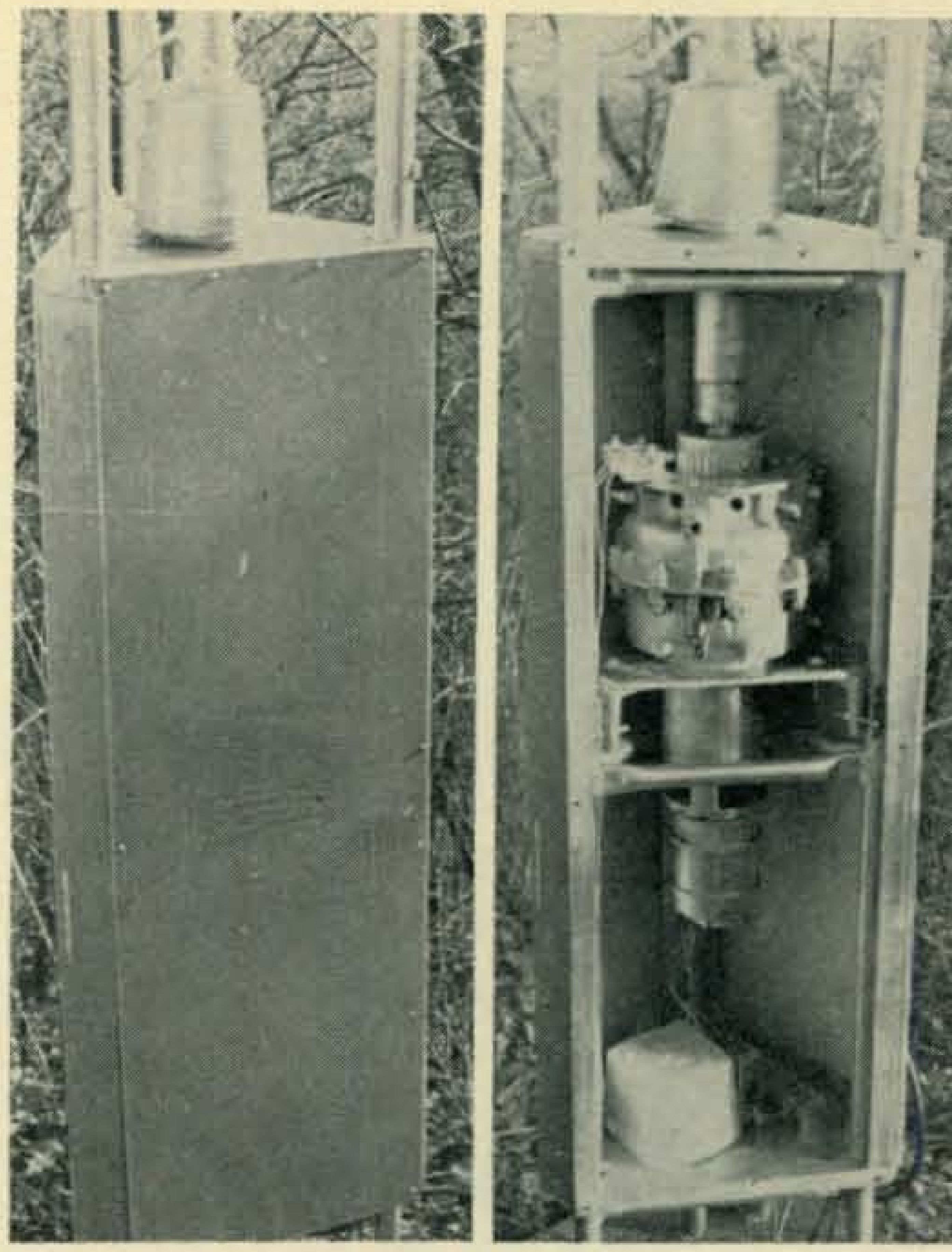
The basic idea is to stuff a 60 foot torque-tube made up of 1½ inch galvanized pipe down a 65 foot tower from the top! If you don't think this is a neat trick, try it and I think you will agree with me! Obviously, a saner method would be to install the tube as the tower is being erected or by taking off one or more top sections of the tower.

Constructing the Torque-Tube

I began this exciting saga by purchasing three lengths of 1½" galvanized water pipe. This pipe has an outside diameter of 1⅞" (1.90"), and an inside diameter of slightly under 1⅝" (1.61"). It comes in 22 foot lengths and weighs approximately 2.7 pounds per foot. That means that each section weighs approximately 60 pounds.

Unfortunately, 1¼" pipe will not telescope into 1½" pipe and this is why my first stop was at a local machine shop. The o.d. of 1¼" pipe is 1⅝" (1.66"), just 0.05" too big to fit into 1½" pipe. The i.d. of 1¼" pipe is 1⅜" or (1.38"). I cut some 1¼" pipe into 16" lengths to serve as plugs in joining the sections of the 1½" pipe together. I had the machine shop turn down the 1¼" pipe slightly so that it would fit inside the 1½" pipe. These plugs extended about 8" inside each adjoining section. After the plugs were turned down and fitted, they were drilled for two bolt holes on either side of the joint at right angles to each other to take 7/16" by 2½" machine bolts. These holes were placed at 3 inches and 6 inches from the center of the joint.

At the same time I had a plug machined for the uppermost section in order to join my 1¼" mast to the 1½" diameter torque-tube. This plug was also approximately 16 inches long and it was machined on one end to fit the 1¼" mast and the other end was machined to fit the inside of the 1½" torque-tube. Fortunately, regular TV masting will slip inside 1¼" pipe, so no adapter plugs were necessary for mounting the 10 foot section of mast supporting the 6 meter beam. The sketches in fig. 1 show the details of these plugs. They were relatively inexpensive to turn down, since it was not close tolerance work. Prior to installing them in the tower I gave them a good coat of aluminum paint to prohibit rusting as much as possible.



Views of the rotor housing with cover closed and removed shows the method of mounting the rotor, the selsyn directly beneath the rotor, the relays and terminal strip at the base, the plastic cover to prevent rain from entering the rotor housing, and the tubing from the weep hole above the plastic cover.

Slip Joint and Plugs

While I was at the machine shop I had them make me two more gadgets. One of these was a plug with a shoulder on it to fit the top of the prop-pitch motor and the other was a sleeve to serve as a slip joint between the main torque-tube and the prop-pitch motor. Details of these two plugs are also shown in fig. 1. By removing the bolts on each end of the sleeve, it can be pushed up into the torque-tube proper, permitting removal of the prop-pitch motor without lifting the entire torque-tube, which is a pretty heavy piece of apparatus when it has two beams on top of it.

Supports and Bearings

In addition to the torque-tube and its associated joining plugs, some supporting plates and bearings were fabricated to support the torque-tube at 3 points up and down the tower. Triangular plates (see fig. 2) were made from ¼ inch mild steel by a local steel fabricating shop. I furnished the shop with a cardboard template made to the exact dimensions of the supporting plate. Making these plates is a simple shearing operation and the 2 inch hole in the center for the torque-tube and the hole at one corner to permit passage of the coax cable was flame cut since the dimensions were not critical. A 1-15/16" steel set collar (Browning) held in place with set screws and an Aetna No. E-24 grooved ball thrust bearing with a 1-15/16" i.d. were mounted on the torque-tube above each supporting plate. These support the torque-tube evenly up and down the entire length of the tower and permit very easy rotation. As originally furnished, the collars came equipped with only one Allen-Head set screw. I drilled and tapped for two additional set screws at 120 degree angles around the collar. The supporting plates are fastened to the tower with "J" or "U" bolts hooked over the rungs, although it probably is not necessary to fasten them at all.

Lubrication

There is often a great deal of debate whether or not to lubricate tower shafts, bushings, bearings, *etc.*, due to the resultant thickening of the lubricant in cold weather which sometimes hinders or even completely stops rotation of masts and torque-tubes. However, I did lubricate the torque-tube supporting bearings with an automobile wheel grease which is highly resistant to both water and temperature change.

In addition, I fabricated cone shaped funnels which are fastened to the torque-tube above each thrust bearing in order to keep as much rain and snow as possible off the bearing.

Rotor

The prop-pitch motor itself rests on another ¼" steel plate which is fastened to the tower with angle brackets. These angle brackets can be cut from pieces of 1½" angle iron and used with a clamping plate made out of sheet metal. The plate on which the prop-pitch motor rests had a large diameter hole flame cut in it so that the prop-pitch motor itself could stick down below the plate. The bolts were removed from the circular flange which attaches the motor to the prop-pitch gear box. Corresponding holes were drilled through the mounting plate and longer bolts were used to secure the prop-pitch motor to the plate in this manner.

Rotor Protection

One of the most important aspects of this entire installation is the weather proofing of the prop-pitch motor and its associated transformer, relay, limit switches, *etc. Before* making the final connection between the torque-tube and the prop-pitch motor, I slipped a circular plastic refrigerator container on the torque-tube in an inverted position. The bottom of this plastic cup had been slit and the projecting ears pointed upwards for taping to the torque-tube after the installation was complete. Also at this time I built the top of the triangular box enclosing the assembly and placed it in position in the tower and then slipped the torque-tube down through it. (A ¾" wooden ring was screwed and glued around the hole through which the torque-tube passes. This serves as a dam so that any water

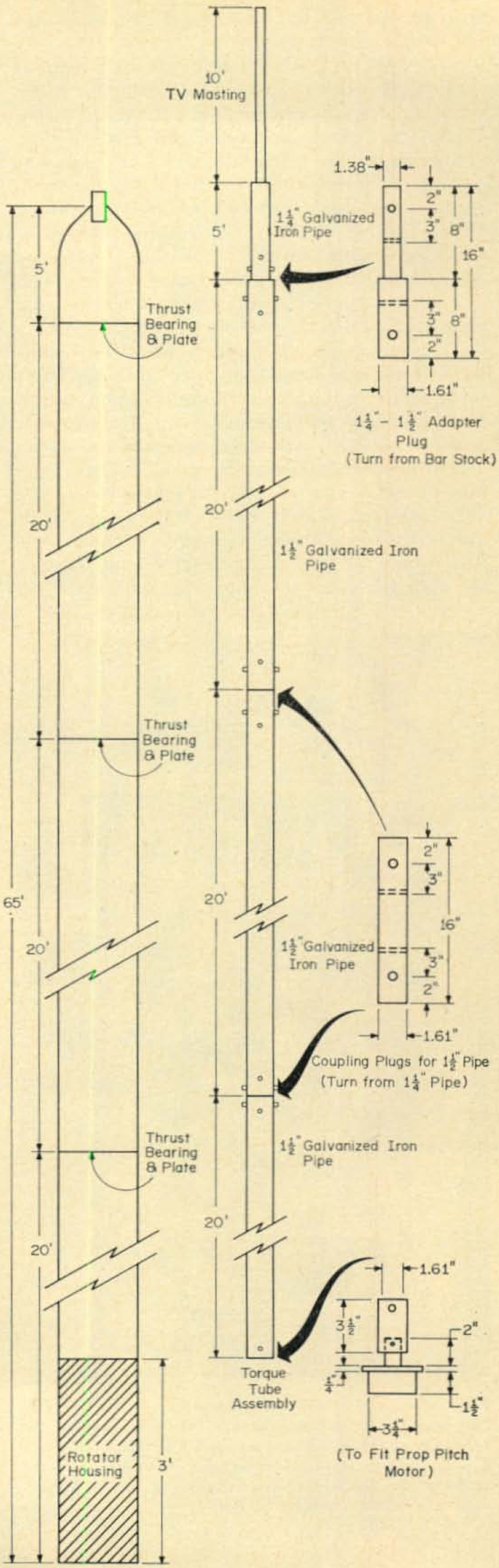


Fig. 1—(Left) Dimensions of the torque-tube used to rotate a three element beam atop a 65' Rohn No. 6 TV tower. (Right) Details of the torque-tube assembly and the plugs needed to couple the sections together. The holes in the plugs are drilled to pass 7/16" bolts.

shed by the plastic cup will not run back into the torque-tube hole.)

Plug the bottom of the torque-tube with a cork or a wooden plug before attaching the prop-pitch motor. This plug should extend above the top of the plastic container and a weep hole should be drilled so that any water or condensation in the torque-tube will run down the tube, hit the plug and then drain out through the weep hole. This is extremely important, otherwise water will seep down through the torque-tube and damage the prop-pitch motor and its electrical connections. I attached a small copper tube to lead the water beyond the plastic cup.

To complete the weatherproofing of the installation I made another triangular end piece to fit underneath the prop-pitch motor upon which were mounted the terminal strip, transformer, and reversing relay. I then connected the upper and lower triangular ends by wooden strips, suitably bevelled, and covered this frame work with 1/8" tempered Masonite which I painted with aluminum paint. In order to make a water-tight joint where the legs of the tower extend through the ends I caulked the joint with caulking compound and painted over it. In addition, I placed another plastic container over the transformer to further protect it in the event that the box did leak. One side of the box was fastened on with screws in order that it could be removed for inspection and servicing.

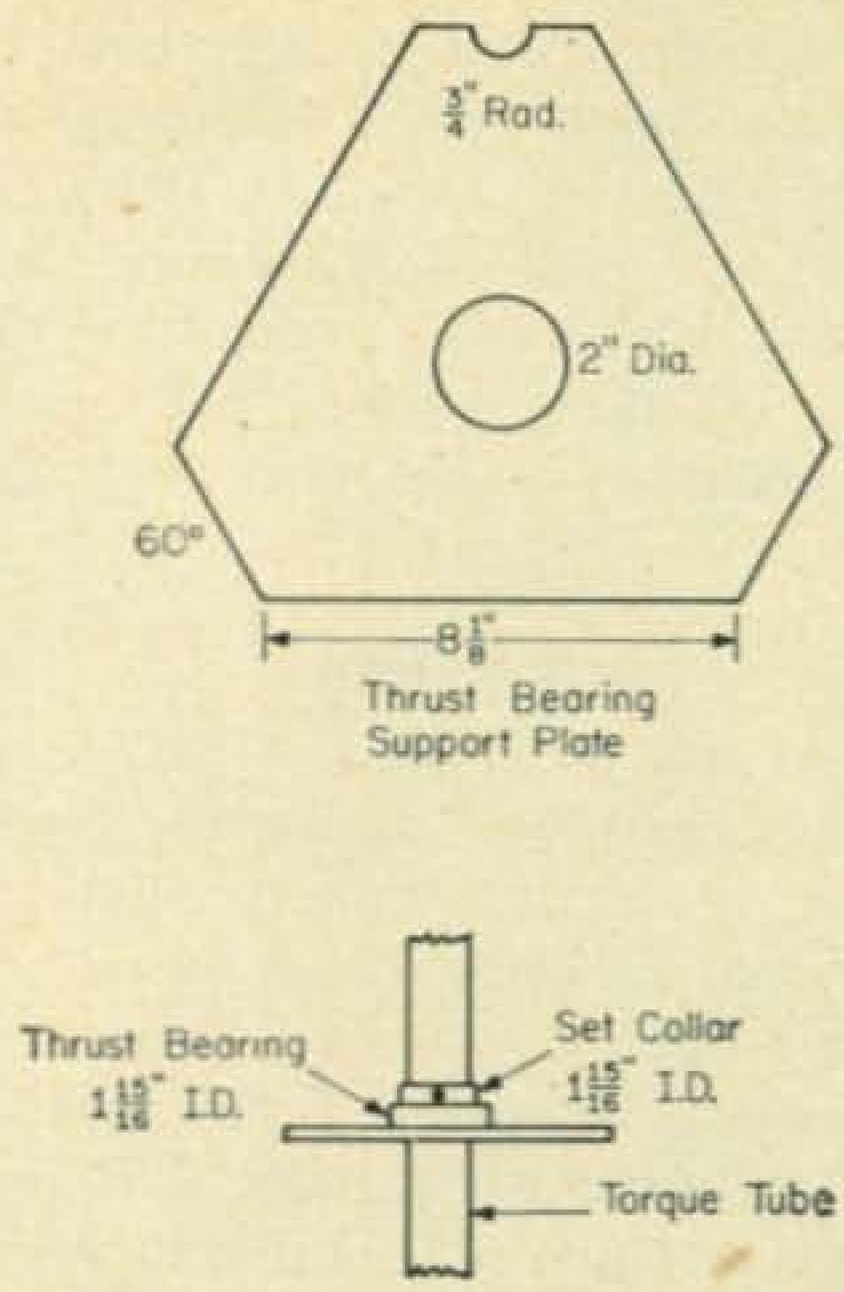
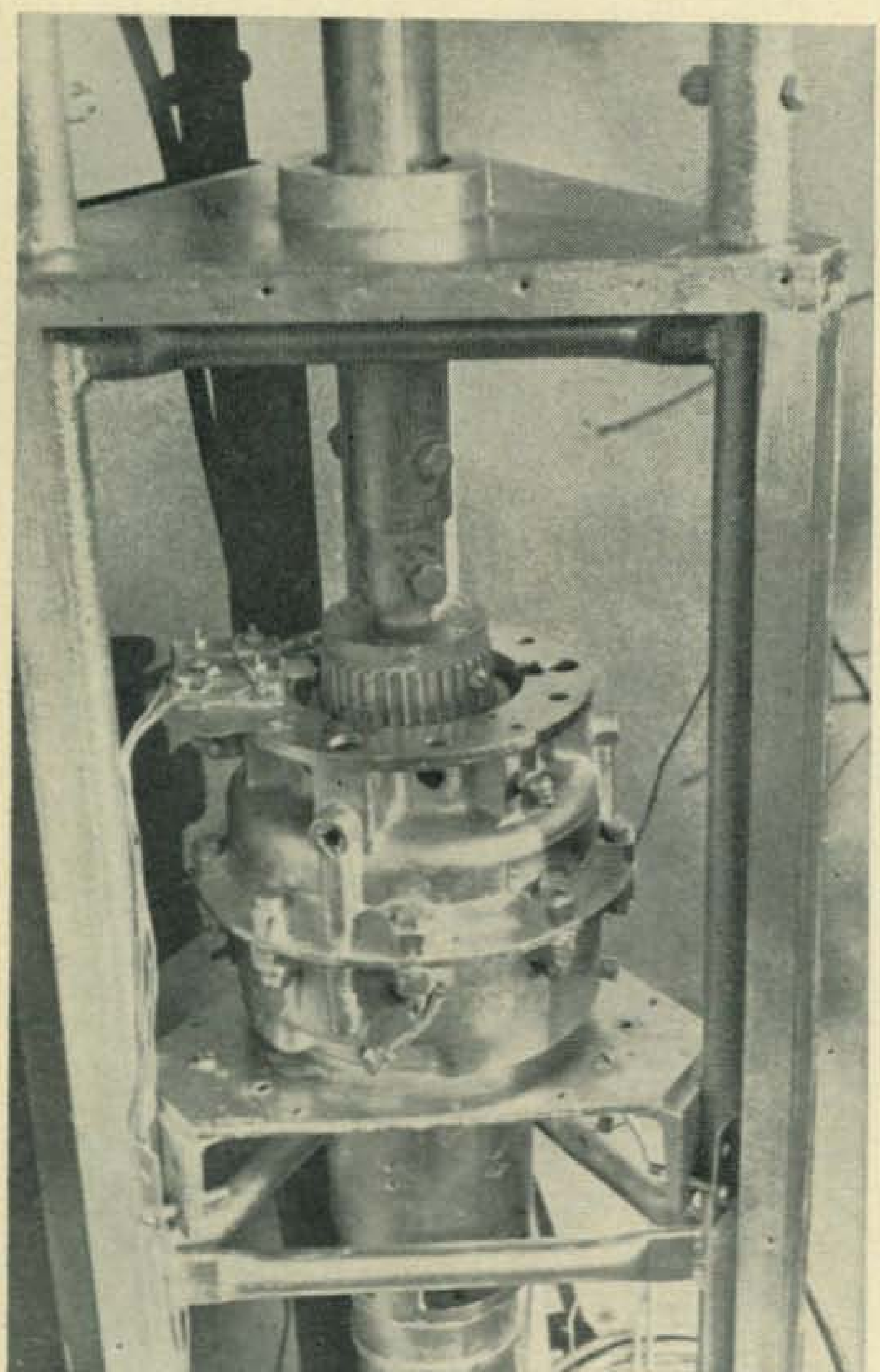


Fig. 2—Details of the thrust bearing support plate fabricated from 1/4" mild steel.


A close-up view showing the housing construction and the prop-pitch motor which is mounted below the torque-tube. They are connected by an adapter which can be slid up into the Torque-tube, permitting removal of the prop-pitch motor without lifting the whole torque-tube assembly.

If at all possible, it is very desirable to use an enclosed relay for reversing the prop-pitch motor. I had used an old open relay from my junk box but it soon became corroded and caused trouble. Once this was replaced with a plastic encased relay my troubles from this source were ended.

The indicator system consists of a pair of 110 volt selsyns, with the one in the shack driving a disc which permits a beam of light to shine through it onto a transparent map of the world centered on my QTH. There are many ways of driving the selsyns from the prop-pitch motor or from the torque-tube, but in my particular case the selsyn is mounted directly beneath the prop-pitch motor and connected directly to it by a mechanical coupling device.

Conclusion

This system makes for a much stronger tower in as much as it literally adds a fourth leg, and the entire weight of the tube, antenna array and rotator is borne by the bottom tower section almost at ground level. All the tower does now is support the tube in a vertical position. Any ham will appreciate the ease with which maintenance can be carried out using this system.

If the rotator gives up the ghost on a cold dark night during a DX contest, you can at least run out, disconnect one bolt, and rotate the whole outfit by hand. Above all, the safety of this system, both to operator and equipment, is something that cannot be lightly disregarded. If you no longer enjoy romping up that tall tower, try this system—you will be glad you did when it is finished. I was!! ■

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

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.

CAT.NO. 220-509

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!

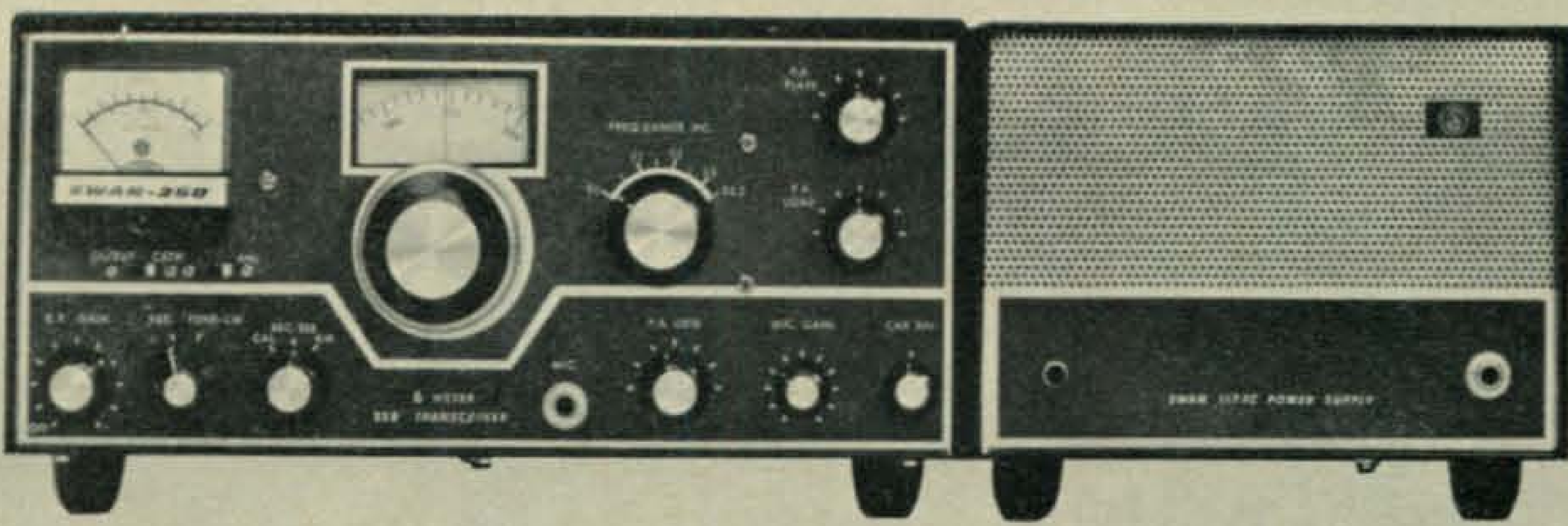
Address inquiries to:
MARLBORO
NEW JERSEY 07746
Tel. (201) 462-1880

West Coast:
LOS ANGELES
CALIFORNIA 90065
Tel. (213) 245-1640

Communication Products Company
DIVISION OF
PHELPS DODGE ELECTRONIC PRODUCTS
CORPORATION

For further information, check number 47, on page 110

NEW FROM SWAN



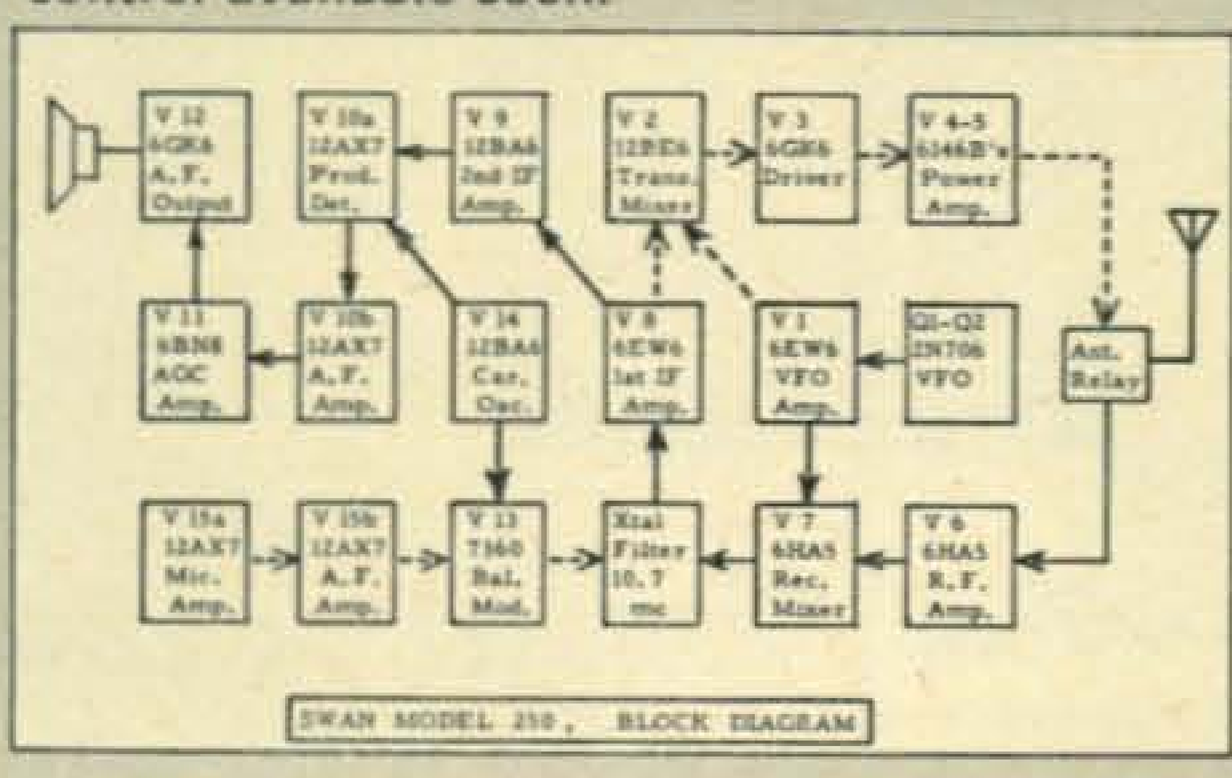
SWAN 250

6 METER
SSB TRANSCEIVER

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. Includes
- ★ **Separate AM detector.**
- ★ **Automatic noise limiter.**
- ★ 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.
- ★ Automatic noise limiter.
- ★ **Price, amateur net:**
  Swan-250 .... $325

External VFO for separate transmit-receive control available soon.



6 Meter Band Openings Increase!

With sun spot activity now on the increase, 6 meters is rapidly becoming one of the most interesting bands to operate, and the next few years will undoubtedly see tremendous activity on this band. Sporadic E openings are occurring several times each week over all parts of the country, making excellent contacts possible from Coast to Coast and over intermediate paths. With long F2 skip and trans-equatorial propagation to look forward to, plus the consistent ground wave and tropospheric scatter contacts made possible with the power of the Swan 250, there is practically no limit to the operating pleasure you can find in the VHF world above 50 mc.

The Swan 250 is at its best in the SSB mode. for which it was primarily 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

SWAN
ELECTRONICS CORP.
OCEANSIDE, CALIFORNIA

For further information, check number 56, on page 110

Dual Triode Mixers;
A Comparative Discussion

BY FRANK C. JONES,* W6AJF

Dual triodes, as mixers, have been in use for some years and are deservedly popular. When homebrewing equipment using these circuits it is frequently necessary to make adjustments in component value and applied voltages to attain maximum performance. Some of the more desirable circuits, their required component values and application are given below.

THIS article is about the advantages and problems in the use of dual triode tubes as mixers. These have become more popular and are in fairly widespread service during the past few years. Dual triodes are suitable for balanced mixers in s.s.b. generators, in linear mixers in radio receivers and converters and as product detectors for s.s.b. or c.w. reception. The latter becomes a fair a.m. detector in receivers by switching off the b.f.o.

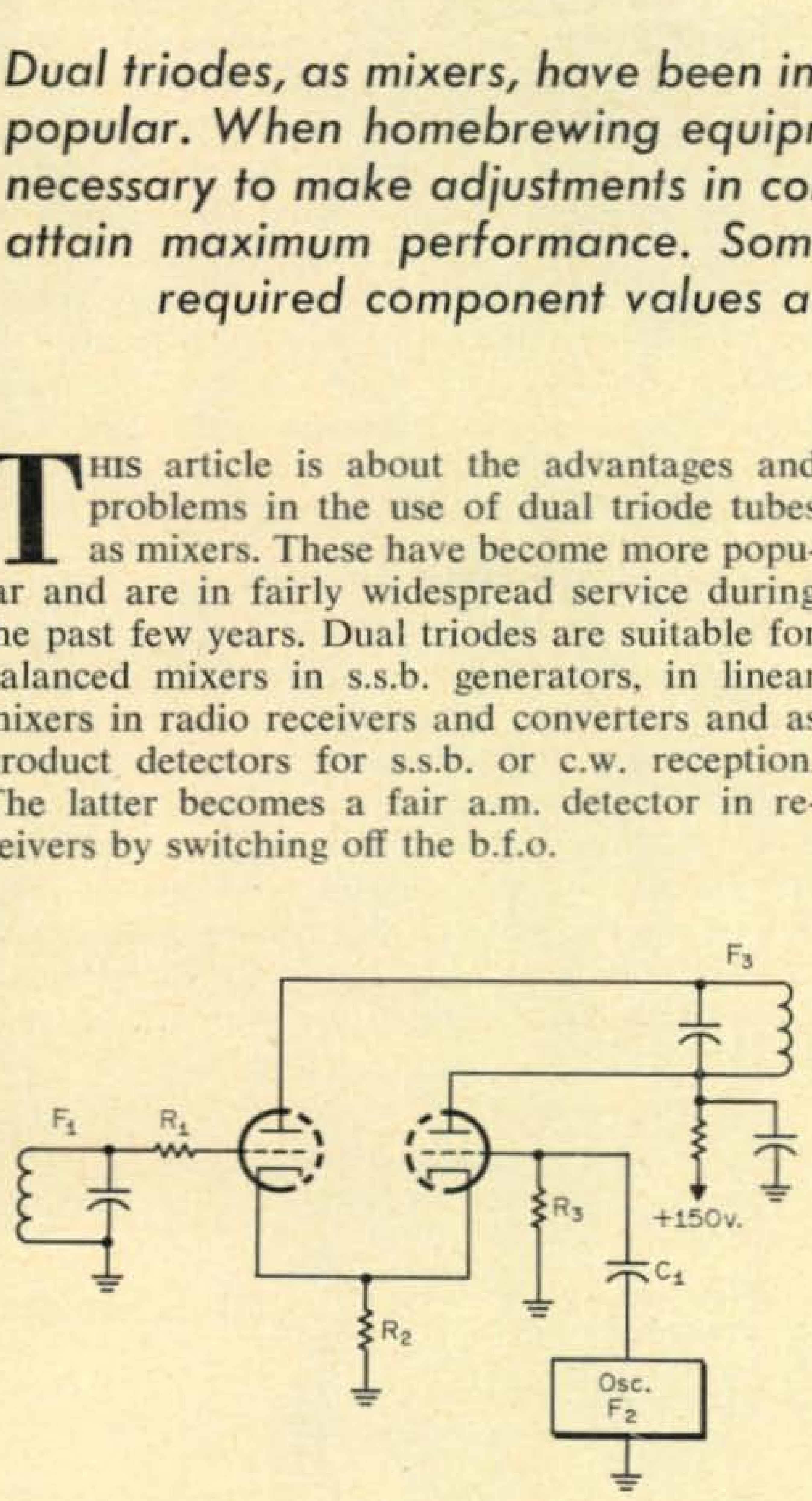


Fig. 1—Circuit of a linear dual triode mixer. Typical values are discussed in the text.

The circuit of fig. 1 has been used as an excellent mixer with low noise figure for some time. It is quite "linear" that is, free of cross-modulation effects for use in strong signal locations. It really shines as the front end tube in a low frequency receiver such as the 2 mc band where broadcast stations and Loran signals ruin weak amateur signal reception for many commercial receivers. Most multigrid tubes as mixers can be made fairly linear but are noisy and weak signal reception becomes impossible without a low noise r.f. amplifier ahead of it. This makes the desired and undesired signals stronger and the latter may then be great enough to overload the mixer tube, producing cross-modulation.

The 7360 balanced modulator or mixer tube is good for front end use in a receiver since its n.f. is fairly low and it is nearly impossible to overload it in most locations. However, it's cost is much higher than common type dual triodes. The dual triodes also have an even lower n.f. and can be made to handle inputs of up to 0.1 or 0.25 volt before cross-modulation becomes a problem. This is less than for 7360 type of tubes but is still high enough to do an excellent job in most receiving locations. The problems are to use a type of dual triode and values of plate voltage and resistors which will meet the local requirements. Some tubes such as 12AT7 and 2C51 tubes have very low noise figure but will not stand as much input as the lower mu 12AU7 or similar type tubes.

In fig. 1, R_1 is always necessary in order to prevent excessive regeneration or even oscillation in the input frequency f_1 region. Usually values of 20 to 100 ohms, ½ or ¼ watt size, will prevent oscillation. This problem is present because the cathode coupling resistor, R_2, is not bypassed and the r.f. impedance is enough to turn the input triode into a Colpitts type of oscillator. Resistor R_2 cannot be bypassed as the mixer action is in the cathode circuit of the two triodes. The second triode acts as an isolating cathode follower between the oscillator and the signal input triode. Resistor R_2 also tends to make the mixer more linear in its action.

The oscillator r.f. voltage should be kept well below one volt peak for 12AT7, 2C51 and 6J6 dual triodes. With lower mu tubes such as a 12AU7, the voltage may be as high as two or three volts with 150 volt plate supply and even higher for 250 volt supply. Resistor R_2 values are normally between 500 and 2000 ohms for any tubes with 105 to 150 volt supply. In nearly all cases 1000 ohms is satisfactory. Capacitor C_1 in fig. 1 can be a small compression variable which can be set to give optimum oscillator injection and left alone after that adjustment.

*850 Donner Avenue, Sonoma, California 95426.

Typical values of frequency in fig. 1 might be f_1=1.8 to 2.0 mc, f_2=2.255 to 2.455 mc and f_3=455 kc, the i.f. range. This mixer is suitable for much higher values of f_1, f_2 and higher i.f. frequencies, f_3. In the example shown, two tuned circuits in a pre-selector arrangement would be gang tuned with the v.f.o., thus requiring a three gang capacitor for proper image frequency suppression.

Converters

Many amateur band receivers do not include the 160 meter band of 1.8 to 2 mc. but only tune segments of the higher bands such as 3.5 to 4.0 mc, 7 to 7.5 mc, etc. One of these bands can be chosen as an i.f. system and a 12AU7 or other triode used as a mixer with crystal control such

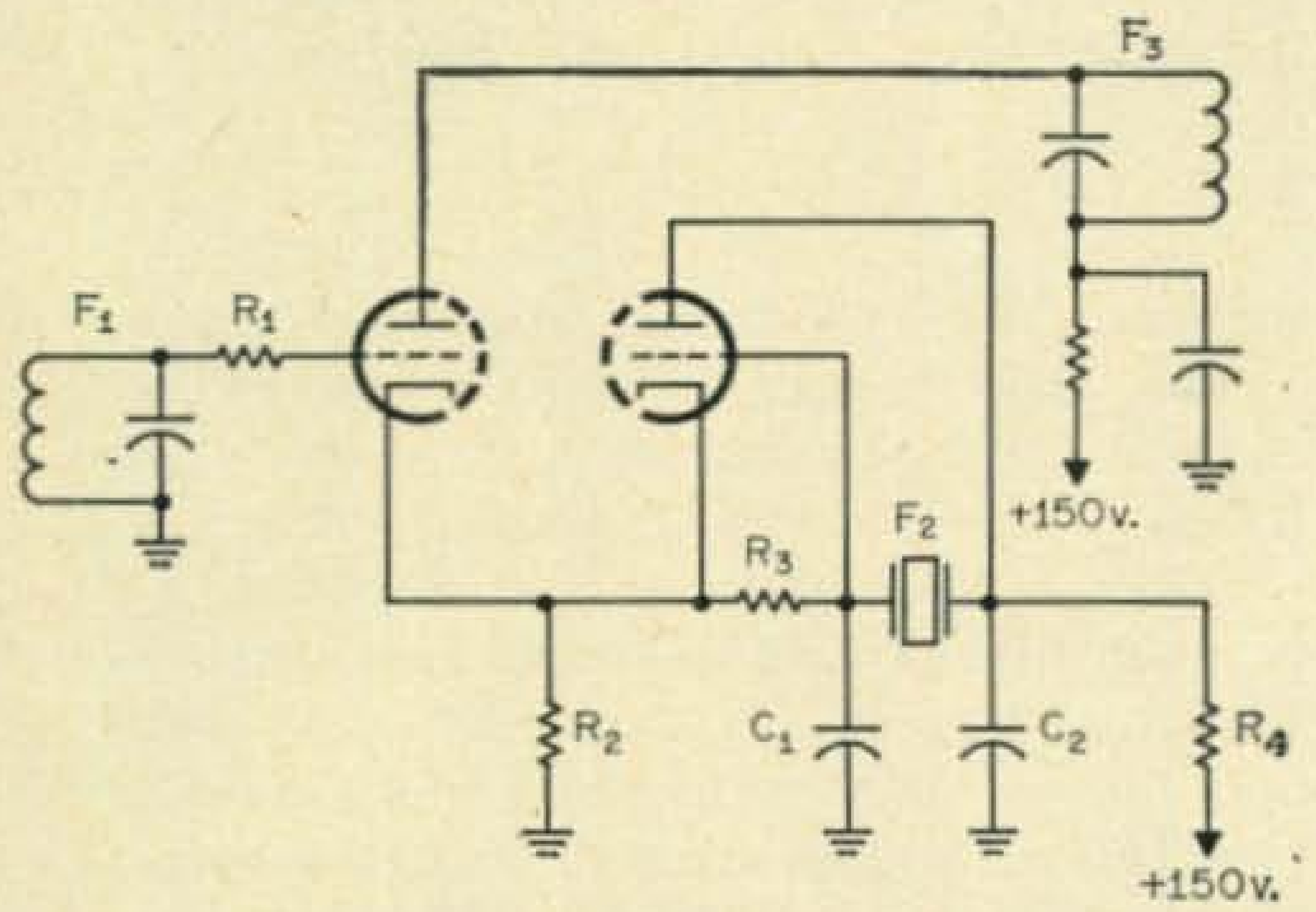


Fig. 2—Circuit of a mixer where one section of the dual triode is also the oscillator.

as shown in fig. 2. Here the oscillation amplitude should be kept as low as possible for consistent crystal oscillator operation by trying different values of C_1, C_2, R_3 and R_4 of fig. 2. Typical for this type service with the i.f. receiver tuning from 3.6 to 3.8 mc for 1.8 to 2.0 mc signals would be a 5.6 mc crystal. Values of C_1=50 mmf, C_2=22 mmf, R_4=50K or higher and R_3=50K to 200K with R_2 at 1500 ohms; R_1 at 75 ohms should be satisfactory with a plate supply of from 100 to 150 volts.

Any oscillator-mixer system where the dual triode serves both functions such as in the circuits of figs. 2 and 3, should always have the oscillator grid leak, R_3, connected from grid directly to cathode. This makes the tube start oscillating easily at low effective plate voltage. Much higher values of R_3 and R_4 are needed for low frequency oscillators. Too high a value of R_3 may produce a blocking form of oscillation with signals repeated over a wide band. Resistor R_4 should be as high a value as possible without too much loss of conversion gain since too strong an oscillation will produce mixer overload and bad cross-modulation effects. Changes in the value of R_4 may be needed for different types of tubes and higher or lower plate supply voltages.

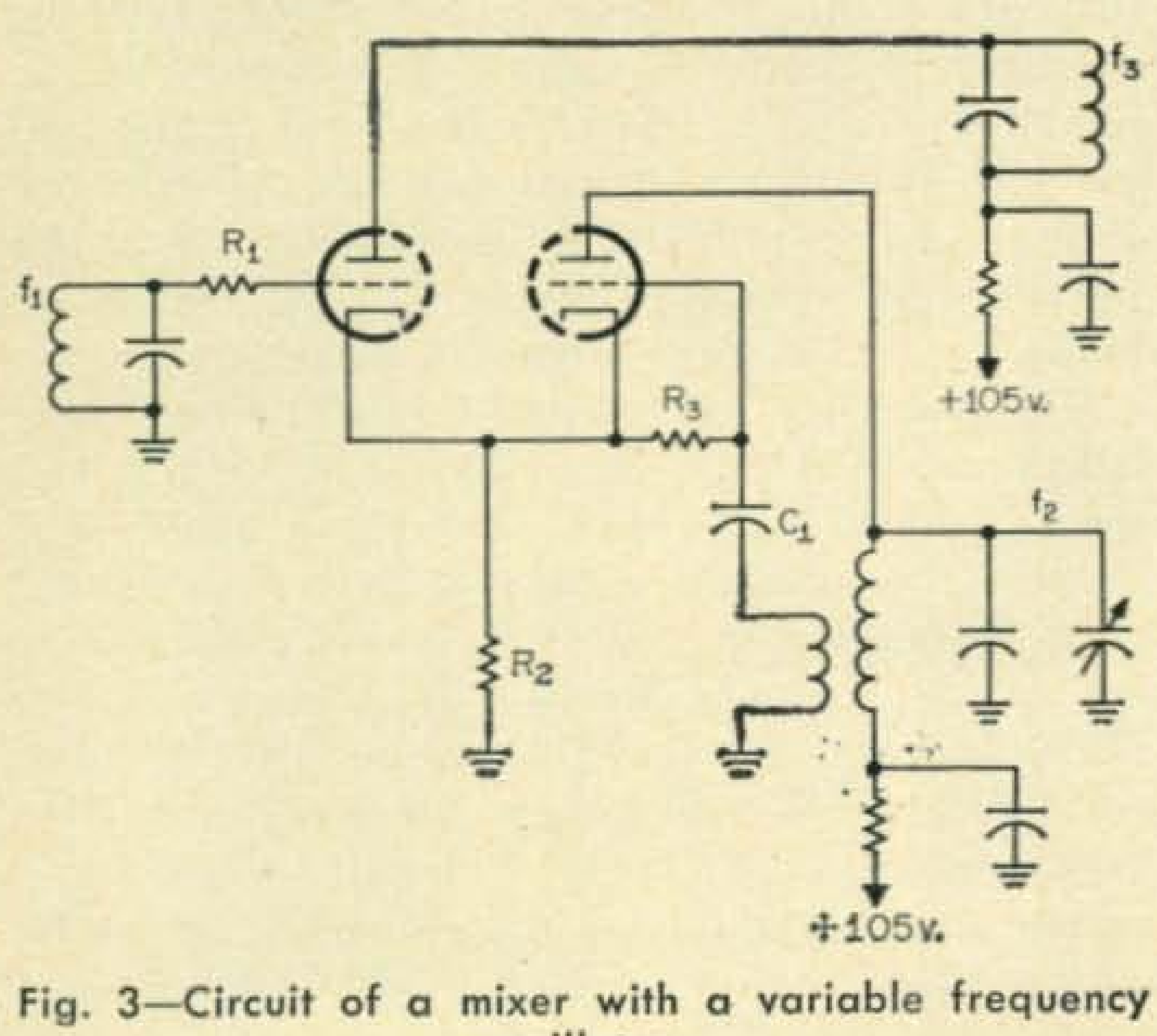


Fig. 3—Circuit of a mixer with a variable frequency oscillator.

Capacitor C_1 in fig. 3 is usually a 100 mmf silver mica with the plate circuit using a good quality variable shunted with silver mica or NPO condensers and a high Q, mechanically stable coil. The grid feedback coil may consist of from one to five turns of small wire over the tuned plate coil. This form of circuit seems to have better stability than tuned grid circuit oscillators. The i.f. frequency, f_3, can be of any desired value ranging up to 20 mc or so.

Product Detectors

Figure 4 shows one form of product detector which has been used quite often following the last i.f. amplifier. It works well with less than 0.1 volt signal input but requires a separate a.v.c. or a.g.c. system in the receiver. Too much signal voltage will overload the detector since the effective plate voltage is quite low as a result of the a.f. plate resistor. Resistor R_1 can be of any value from 75 to 220 ohms; R_2 is usually 2K to 3.9K; R_3=¼ to ½ megohm and R_4 is at least 50K.

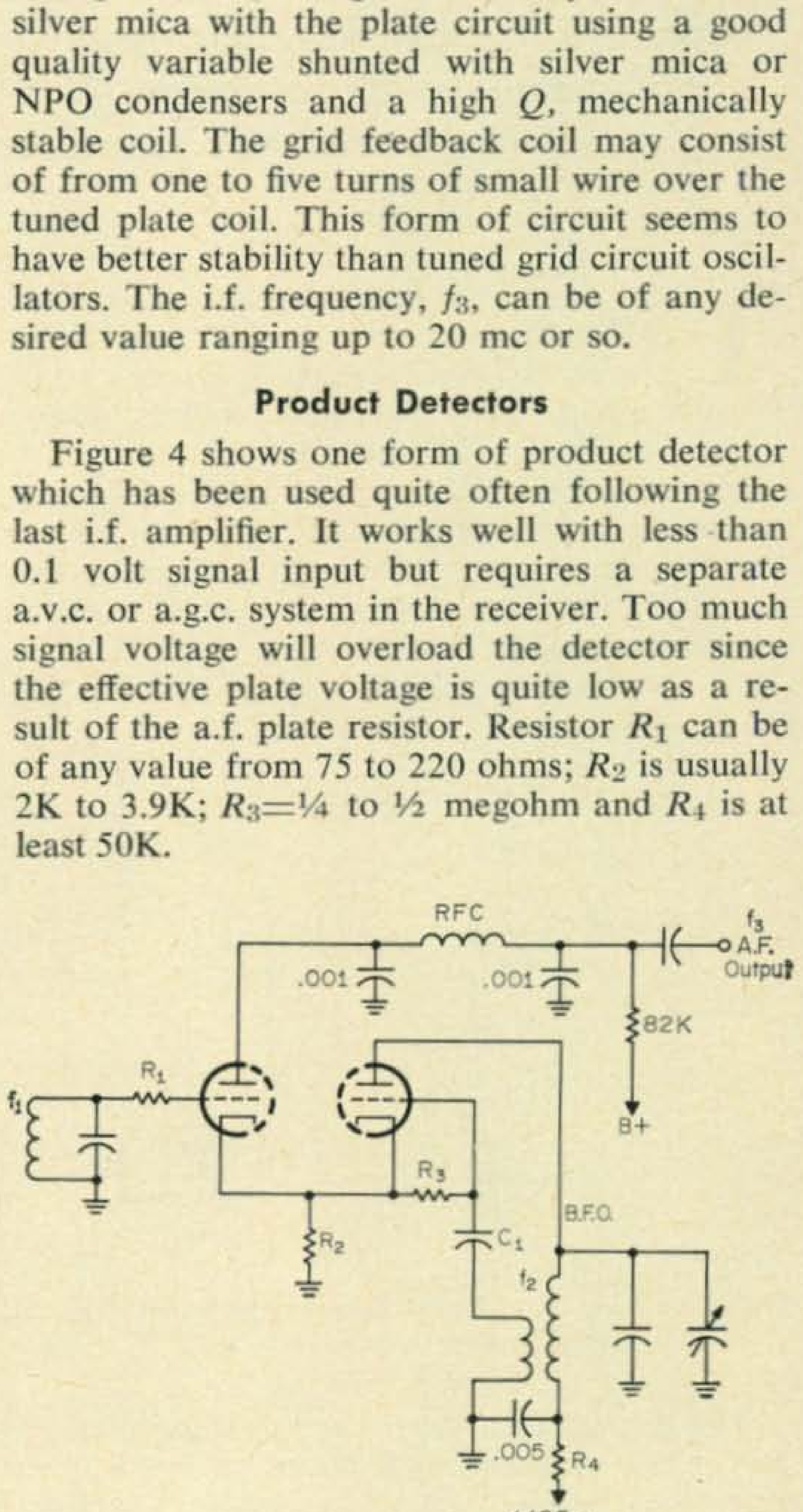


Fig. 4—A dual triode product detector for s.s.b. or c.w. performance.

The b.f.o. should be adjustable to either side of the i.f. frequency, f_3. When the b.f.o. is not operating, a.m. signal reception is possible with fair results as long as the a.v.c. or a.g.c. system holds the input signal to a small fraction of a volt. The b.f.o. is sometimes crystal controlled as indicated in fig. 2. The only problems are to keep the signal input to less than 0.1 volt and to have the b.f.o. injection power at as low a value as will give good s.s.b. and c.w. signal reception.

A low pass i.f. filter is needed to prevent a.f. amplifier overload from the b.f.o. voltage. An alternative, is to use a series tuned circuit at the b.f.o. frequency connected from mixer plate to ground so as to short out this voltage but not reduce the a.f. output voltage.

Balanced Mixer

The dual triode can be used as a balanced mixer or sideband generator as shown in figs. 5 (A) and (B). The advantage of this system is that no push-pull circuits are needed. The carrier frequency energy is balanced out of the output fairly well by means of a small capacitor, C_2 in either (A) or (B). The oscillator voltage into the grid is about 180° out of phase in the plate circuit and in phase through the cathode circuit around to the mixer plate circuit. By making C_2 a small variable, these two voltages can be balanced out so no carrier frequency is left across the mixer load circuit. In practice, good balance is difficult to achieve but by varying the value of R_4, C_1 and C_3, the balance can be as much as 20 to 30 db down from the sideband. If the sideband filter has the carrier frequency at a point of —20 or —30 db down from the sideband frequency, the total carrier attenuation can be very good. The sideband generator of fig. 5(B) was used in a homemade s.s.b. unit at W6AJF. Capacitors C_1 and C_2 were 5 to 50 mmf trimmer capacitors and R_4 was a small 10K potentiometer.

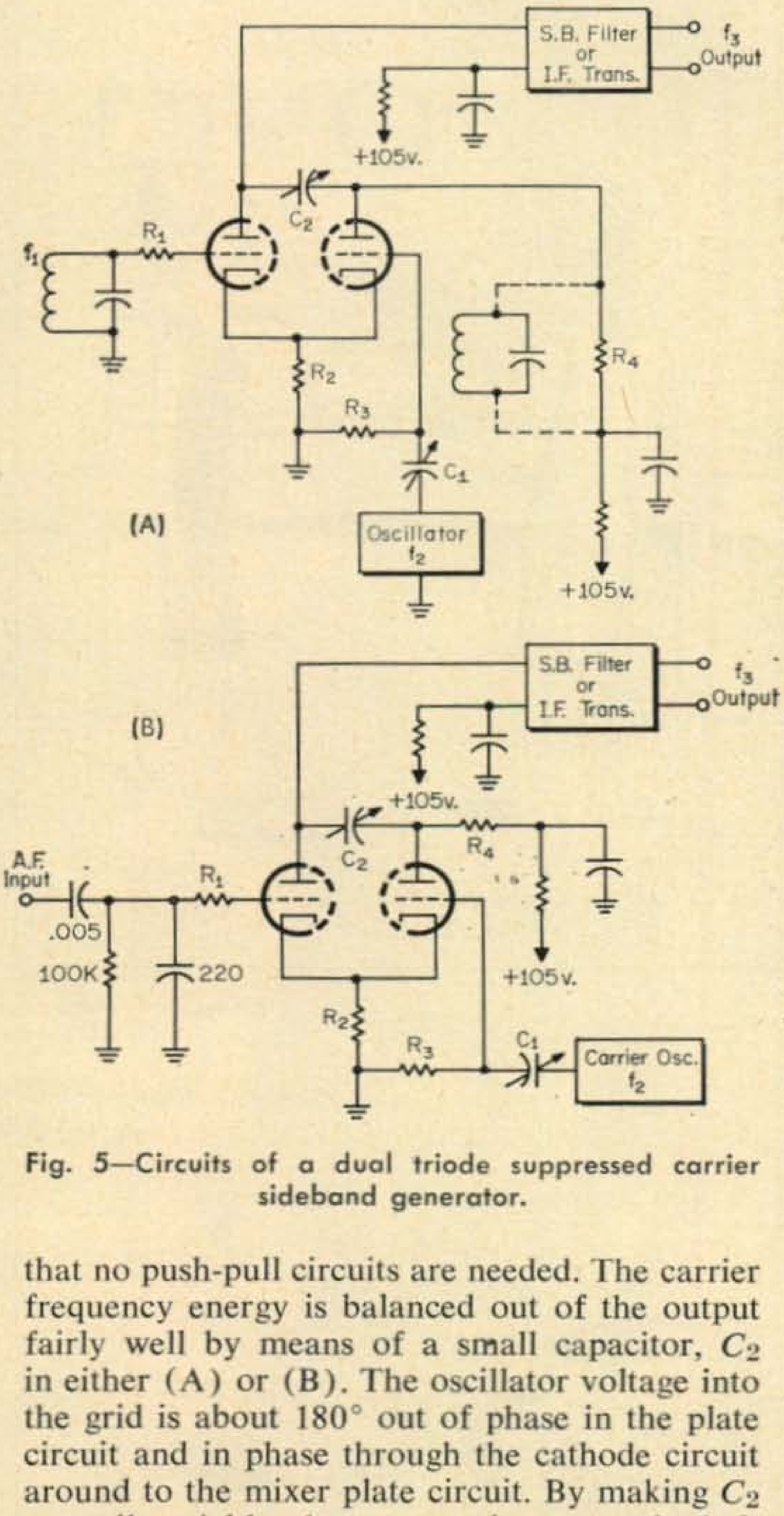


Fig. 5—Circuits of a dual triode suppressed carrier sideband generator.

The type of circuit shown in fig. 5(A) was used in succeeding mixers in this generator. As the frequency of operation reached above 14 mc, a small tuned circuit was added across R_4 in order to achieve better phase relations in the balancing circuit. The oscillator voltage only had to be attenuated about 10 or 15 db more than was provided by the following tuned circuits. This could be done in the dual triode mixer by using a balancing circuit as outlined in fig. 5(B).

The gain of these mixer circuits from input to output, with high impedance circuits, usually runs at about 5. It may be less or more depending upon the value of cathode resistor and upon the G_m of the tube. In all cases oscillator amplitude should be kept down to a volt or so as measured across the cathode resistor R_2 with an r.f. probe.

Receiver and transmitter mixers should have an r.f. signal which is only down to ¼ or ⅕ of the oscillator injection voltage at the cathode resistor but sideband generators should keep the ratio at about 1/20 or 1/15 in order to obtain a clean s.s.b. signal. A diode r.f. voltmeter of very simple form can be connected across the cathode resistor to first measure one r.f. voltage, with the other off and *vice versa* in order to check these ratios and the amount of r.f. oscillator voltage with respect to the d.c. cathode bias. The peak r.f. voltage from the oscillator, at the cathode, should be somewhat less than the d.c. bias across R_2. The two r.f. voltages added, should also be less than the d.c. bias value.

This discussion of circuits and problems may help builders of homemade gear in getting the desired results in their transmitters or receivers. ■

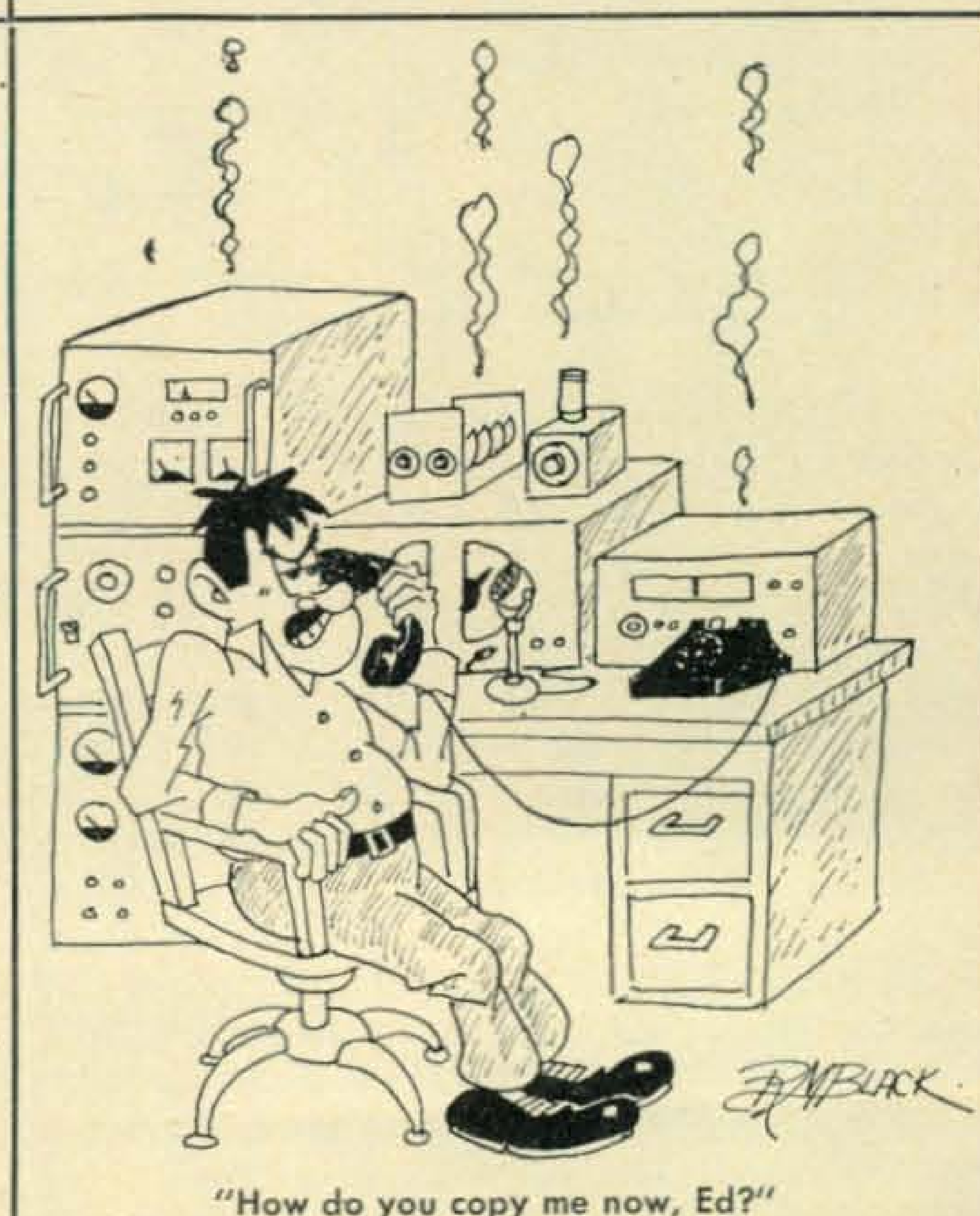
"OK, Old Man . . . looks like I'd better QRT at this end!"

Clever Quips!

"DINNER'S READY"

"Ralph calls it single something or other. . . . It means everybody talks funny."

"Honey! there's a Mr. W3QTZ to see you."



"How do you copy me now, Ed?"

LASERS

BY KAYLA BLOOM,* WØHJL

Their properties, sources, potential applications, and dangers.

THE announcement of the first operating laser was made in July 1960 by Theodore Naiman. This was a solid state ruby device. In January of 1961, the gaseous discharge device came along. And, in November of 1962, the third type of laser was developed. This is the Electron-Injection or Junction laser. First of all, what is a laser and what makes this type of emission so different?

1. Laser emission is monochromatic. It is a single wavelength, or very narrow band of wavelengths of visible light, ultraviolet light, or near infrared energy.

2. It has such a small divergence at the source, that the rays are so nearly parallel that the beam may spread only 100-200 feet over a distance of 20 miles.

3. Tremendous energy fluxes may be produced. Power densities many times that found at the surface of the Sun can be achieved.

4. It is coherent. The individual waves remain in phase along the axis of the beam.

5. Laser radiation follows the physical laws of optics, therefore the high energy fluxes can be concentrated by the use of a convex lens which can focus this high energy on a microscopic target.

The laser is highly stable, highly directive, conveniently handy, coherent, and has enormous intensity and energy. Sounds almost like we are describing a human being, doesn't it?

The solid state laser is the one with which we are most familiar and with which most of the research in the field has been done. The most common materials used for this type are rubies and neodymium doped glass. The solid state lasers for the most part, produce a pulsed wave emission at a variety of specific frequencies depending upon the crystal source. By Q switching, it is possible to increase the energy by shortening the pulse duration. This type of laser has an efficiency of about 1%.

The gas laser, which uses a helium-neon device, produces a continuous wave rather than a pulsed wave. Its efficiency is even less than that of the solid state device, but has the advantage of a greater range of wavelengths and produces a relatively spatially coherent wave. In other words, it is possible to produce coherence in two or more planes, giving a wave front with a single phase across the entire wave front.

The newest type, and perhaps the one we might be most interested in from the viewpoint of communications, is the Injection Laser. This also produces a continuous wave emission using gallium-arsenide as the source. It has a wavelength in the near infra-red frequencies. The efficiency is about 20% as opposed to the 1% for the solid state and slightly less than 1% for the gas laser. It has the advantage of being easily tuned for frequency and therefore its development in the communications field is more likely.

Laser Applications

Now, what do we know about the usefulness of lasers? We have merely begun to scratch the surface. Let's compare it to the X-Ray. Roentgen discovered the X-Ray in 1895. The practical application of the X-Ray for diagnostic purposes began very quickly. However, 30 years passed before electronic theory developed sufficiently to put X-Rays to other uses.

It wasn't until semiconductors were developed that the problems of amplification, generation, and detection of frequencies up to several thousand megacycles was achieved. Medical research with lasers is going on at a rapid rate. We can anticipate possible break through in cancer research. By using special optics, it will be possible to develop an instrument small enough to insert into the lungs, esophagus, intestines, *etc.*, and use the beam to destroy small tumors. It is already in use in eye surgery to repair damage to the retina. Some researchers are working on the possible use as a cutting tool. As the research continues, we will be hearing more about the laser.

In the field of communications we have had the recent observations of Gemini 7 who were able to make use of laser beams. When the time comes that we have several vehicles in space, the laser is expected to be used for communications between them. With the lack of atmosphere, this means of communications will be the most efficient we can utilize.

Meanwhile, back here on earth the possibilities in communications are being studied. It is anticipated that our present microwave systems will ultimately be replaced by laser emission. It

*175 South Jasmine Street, Denver, Colorado 80222.

is a well known fact that the higher the frequency, the more information can be sent over a pair of wires, a microwave, or in this case . . . a beam of light. Where our present microwave system has frequencies in the order of 50 billion c.p.s., the laser produces frequencies in the order of 400 TRILLION Cycles per second. It is estimated that a single laser beam can furnish enough circuits for telephone, telegraph, TV, Data-phone (and by 1970 it is expected that more machines will be talking to each other than people), to replace all the wires and cables which are in use in the entire United States today.

Out in Space again; we figure on sending men to the moon within the next few years. Since the Moon is in darkness for 14 days at a time, the men will need light in order to work. The cost to send generators, fuel, etc. to the Moon, to illuminate them at work would be far too high. By using laser light, with it's highly directional qualities, we could beam a laser from earth to the surface of the moon and illuminate an area about 1 mile in diameter.

Used as a radar instrument, the laser could first map the surface of the moon to show the best landing area for our moon men. It's use in radar is being explored from a military angle also. A ring of laser beams around our country will provide not only a warning of approaching aircraft or missiles, but will provide a silhouette of the approaching craft. Once it is determined that the approaching vehicle is a hostile one, the same beam can be intensified and can be used to destroy the object.

In industry the laser has great potential. The laser can drill through any substance known to man, including tungsten, steel, and even diamonds. Some scientists refer to the "Gillette Power" of the beam . . . meaning the number of stacked stainless steel razor blades the laser can penetrate in one millionth of a second. It can be used as a welding tool to fuse alien metals such as aluminum to brass or steel.

Laser research is going on in Science, Industry, Communications, Military and Medicine and the next few years should provide some interesting developments in all these fields.

Laser Dangers

At this point there is a growing concern on the part of laser developers and research people that the dangers involved in handling lasers are high. Going back to the X-Ray comparison, it was many years before the dangers of exposure were known. It was not at all unusual many years ago to find a dentist who had some of his fingers missing. He used to hold the plates in the patient's mouth because he got a better picture that way. No one told him, because no one knew, that constant exposure to X-Rays would finally destroy the tissues of his hands. It was only a few years ago that someone finally got around to the discovery that there was a significantly higher rate of abnormalities among the children of people who worked with X-Rays than among those of the general population. And, a more significant rate of sterility existed among these people than the general public. As a result of this experience, there has been much research on the dangers of laser irradiation. Lasers can destroy cancerous tissue. They can also destroy healthy tissue. They can repair the damaged retina of the eye, but by the same token, they can damage the retina. Naturally, there is a high correlation between the amount of damage and various other factors. The duration of the pulse wave, the repetition rate, the frequency magnitude of the energy flux, *etc.*

My very brief article on Laser Dangers in *CQ*[1] brought me 42 letters from people who were working with lasers and were unaware that they were in any danger. All but one were from high school kids who were building lasers to use in science fair projects. Kits are now available at well under $100 including power supplies. How do we protect ourselves from the hazards of exposure to laser beams? Since in many cases the beam is not visible, it is difficult to say, "Don't get in it's way." The following is a list of guidelines.

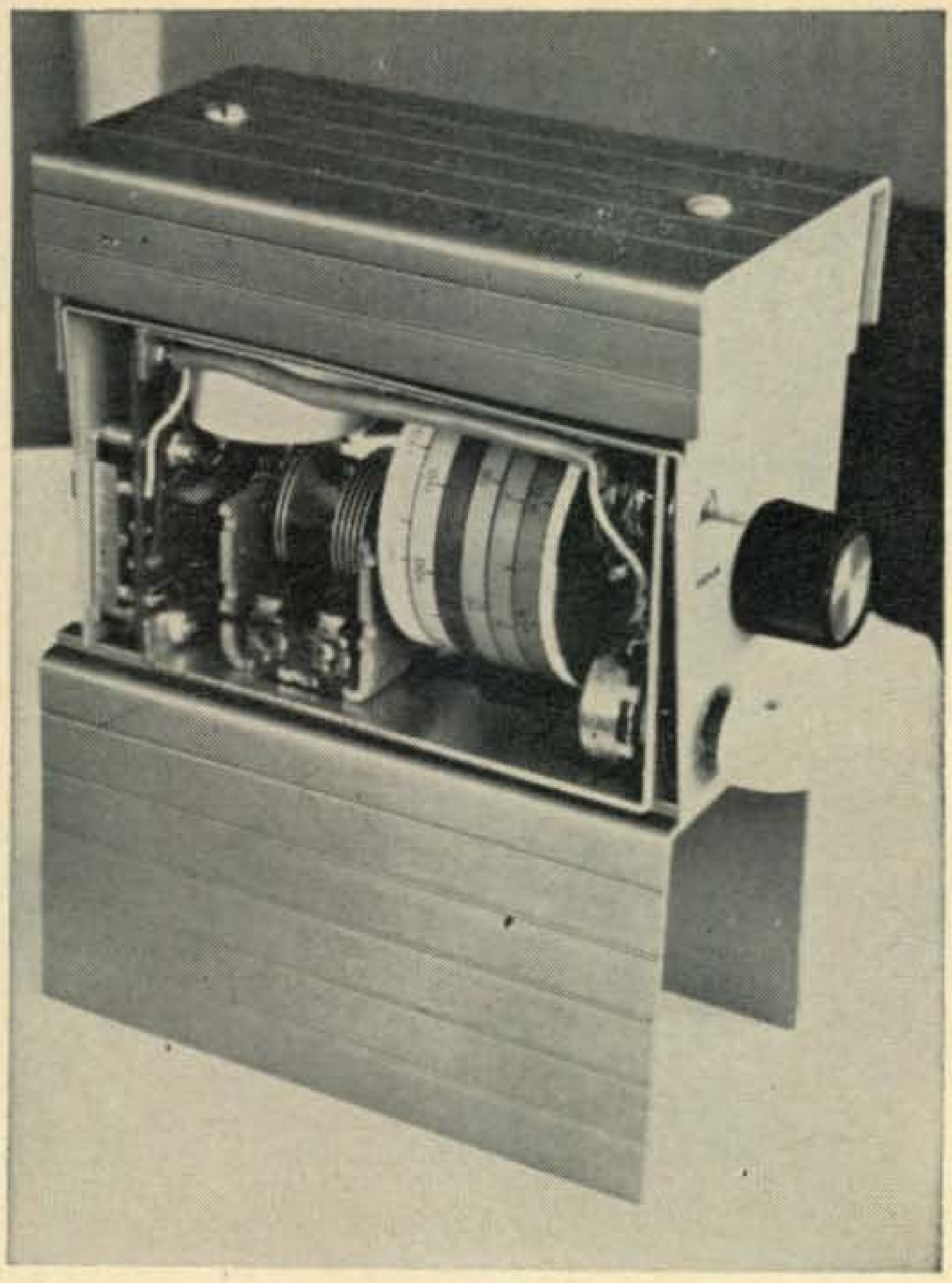
1. The laser beam should be discharged into a background which is non-reflective and fire resistant.
2. An area should be cleared of personnel for a reasonable distance on all sides of the anticipated laser beam path.
3. Looking into the primary beam must be avoided at all times, and equal care should be exerted to avoid looking at specular reflections of the beam, including those from lens surfaces.
4. Avoid aiming the laser with the eye, to prevent looking along the axis of the beam, which increases the hazard from reflection.
5. Work with lasers should be done in areas of high general illumination to keep the pupils of the eye constricted and thus limit the energy which might enter the eye.
6. If you are working with lasers have frequent general ophthalmologic examinations. Be certain the examination includes fundoscopic and slit-lamp studies and mapping of the visual field.

Remember that the tolerance levels have not yet been established. Damage may not show up immediately after exposure and surface damage may not show at all. Brain damage to mice has been severe with no visible external signs. Mirror reflections may be as dangerous as exposure to the primary beam. A glass surface may reflect 4% of the beam energy, enough to cause retinal damage. Since the solid state devices usually have an invisible beam, recognition of reflection is difficult.

The development of any new form of communication technique has, in the past, caused the ham population to begin experimentation. I'm sure lasers will be no exception. If you do decide to work with lasers, please heed the warnings. The QRM is bad, I admit, but there must be a better way to get rid of it than by losing our ham population through carelessness. ■

---

[1]Bloom, K., "Laser Dangers," *CQ*, September 1965, p. 38.



View of the Tunnel Dipper showing the location of the new SENSITIVITY pot. Note the shaft of the original pot without the knob now used for gross control of sensitivity.

MODIFYING THE HEATH TUNNEL DIPPER

BY R. L. GUNTHER,* W6THN

THE Heath Tunnel Dipper is a marvelous little gadget, and has only two drawbacks: it can't go below 3 mc (awful things happen if you try it), and the sensitivity control is simply too critical. Nothing can be done about the former condition, and you are well advised not to dump the older a.c. model which could go down to any frequency, and which had a nice logging scale for accurate calibration. Something can, however, be done about the sensitivity control, and that is what this article is about.

The problem is simple; the sensitivity control is so critical that it is virtually impossible to adjust it. The first thing that occurred to me was to set up a resistance network to expand the action of the control already in place. This was not difficult to do, but it turned out to be useless because the transistors that amplify the tunnel-oscillator signal are temperature sensitive.

The expanded sensitivity scale turned out to be impractical, because a moderate amount of heating or cooling of the Tunnel Dipper drove the meter off scale (lower and higher, respectively), and it could not be readjusted. The only alternative was to install another variable resistor to act as a fine adjustment on top of the original control. This was done, and the extra pot was added to the lower left of the front panel. There is quite a bit of room there, although the rest of the chassis is pretty compact.

An ordinary pot and ordinary knob were used, but a miniature type might make a neater job. The additional control was 10K, and was added in series with the top end of the original 100K control. The small knob was removed from the original shaft. Gross adjustment of sensitivity can now be made easily by finger action on the old control, and the new one had sufficient range to take care of ordinary room temperature variation, but provided a much smoother control of meter action. An unexpected advantage was the fact that the space taken up formerly by the knob of the (now) gross control is better used for finger action on the tuning control, and that the position of the new control is more out-of-the-way. This assumes that you are right handed, of course, but applies to some extent to the converse.

By the way, if you happen to lose the fancy little allen wrench used for the small knob of the original sensitivity control, a good substitute is an appropriate size of jeweler's screwdriver; at the low prices they cost nowadays, every workshop should have a set of them.

If you have not yet constructed your Tunnel Dipper, you would be well advised to install the extra pot before, rather than after assembly,[1] but leave the original pot in place; it must be adjusted for those unhappy moments when you have to make resonance measurements on antenna arrays in the bitter cold or heat. And I might mention that the Tunnel Dipper has the same vulnerability to heat as any other piece of transistorized equipment: if you leave it lying about in the hot sun while you adjust the antenna stub, you will find said stub resonance becoming progressively less distinct, until it disappears completely—and permanently, as far as the Tunnel Dipper is concerned. Of course no such thing could happen in California, but I mention it for the sake of the inhabitants of the Vast Wilderness east of the Mountains. ■

*1440 Curson Ave., Los Angeles 19, California.

[1]And allow extra length for the white lead of the 3 wire cable at the pot end.

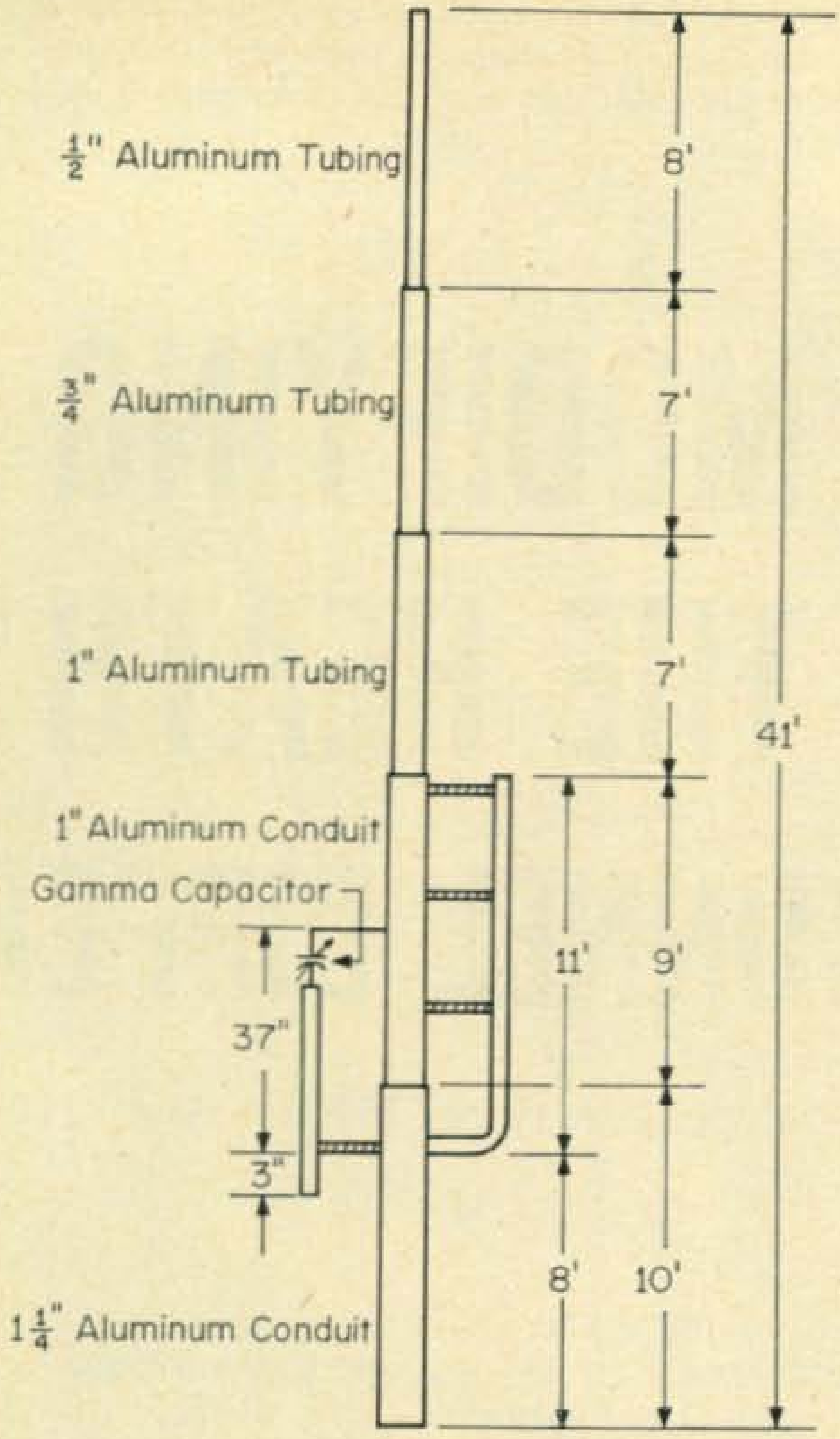
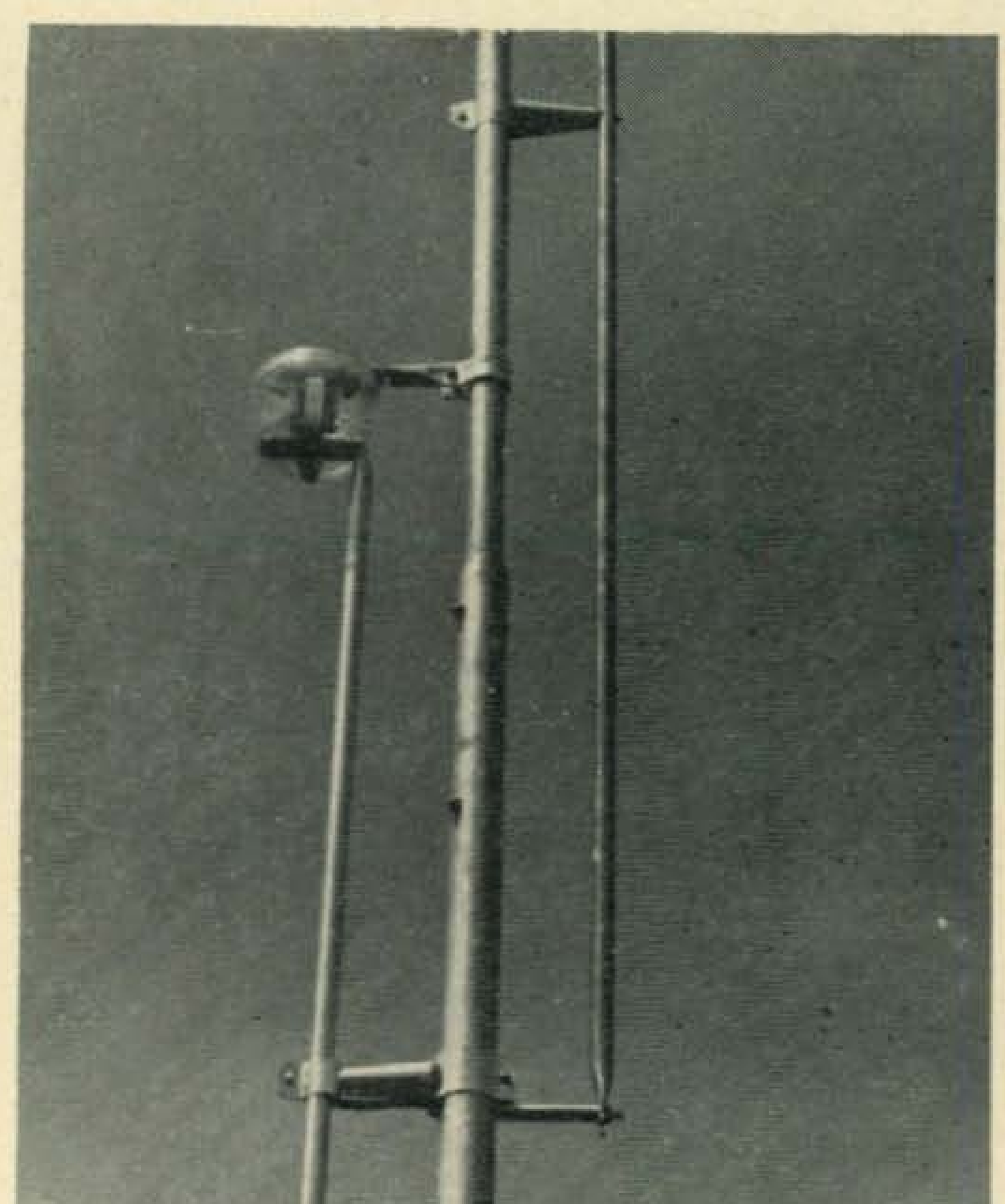


Fig. 1—Modified version of the W3JHR Mark II vertical antenna. The insulators used to support the gamma match and the 21 mc stub are #135-504, made by E. F. Johnson.

AN ECONOMICAL FOUR-BAND DX ANTENNA

BY GEORGE P. JINDELA,* W2MTO

This antenna is the third version of the original presented in CQ in 1953. The newest version makes no electrical design changes but due to the lack of availability of many of the components, changes the structural assembly.



Fifteen meter weather proof capacitor in position on the Gamma match.

THE vertical antenna described here made its debut in *CQ*, November, 1953,[1] and because of popular acceptance, was superseded by an improved version, *CQ*, July, 1960.[2]

Both antennas were developed by W3JHR and named Mark I and II, respectively. The latter is self supporting, and, like its predecessor, covers the 80, 40, 20 and 15 meter bands. Mark II was ideal for my location and I vowed that some day I would build it. The opportunity arrived five years later when a storm blew down the station antenna.

I soon discovered, however, that some of the major antenna components available five years ago, are now virtually extinct. Sears Roebuck no longer supplies the 2" dia. × 20' aluminum irrigation pipe used as the lower section in the original antenna. The Jennings vacuum capacitor, used to tune the 15 meter Gamma match, has disappeared from the shelves in surplus houses. A new one costs $100! Even the 12" × 22" × 12" aluminum box used to house the antenna tuning unit has become a rarity. It is available on special order at a premium price. All other parts for the antenna are easily obtainable.

*99 Arthur Drive, Parsippany, New Jersey 07054.
[1]Lee, P., "A Four-Band DX Antenna," *CQ*, November, 1953, p. 20.
[2]Lee, P., "The Four Band Vertical DX Antenna, Mark II, *CQ*, July 1960, p. 28.

By improvising, one can overcome the aforementioned obstacles and save money at the same time. The irrigation pipe can be replaced by slip fitting a 1" dia. × 10' aluminum conduit 12" into one end of 1¼" diameter pipe. These sizes do not telescope together with a tight fit. Make a 12" aluminum sleeve from 0.020" sheet, and slip it over the end of the 1" pipe. This will assure a snug fit. Bolt the two sections together with two ¼-20 × 2" brass bolts.

The overall length of the joined sections will be 19', one foot shorter than the original, one piece, irrigation pipe. This is of no concern since the missing foot is regained in the remaining length of the antenna. Telescoped lengths of 1", ¾", and ½" diameter aluminum tubing make up the remainder of the antenna. (See fig. 1.) Joints are made snug with 0.020" aluminum sleeves and bolted together.

Gamma Capacitor

The expensive variable vacuum capacitor was replaced with a receiving type, (National STH-250). The plate spacing will be practical for power levels up to a few hundred watts. Above this, a transmitting type variable is recommended. The capacitor is mounted in a weather proof plastic food container which has a twist-lock cover. The rotor connection passes through the bottom of the container via the shaft. The stator connection is made at the cover through two plastic feedthrough insulators. Use an acrylic cement between cover and container before sealing.

The problem of the antenna housing unit was solved by making a wooden box of appropriate dimensions and lining it with 0.020" sheet aluminum. The unit was then painted and topped with a few asphalt shingles.

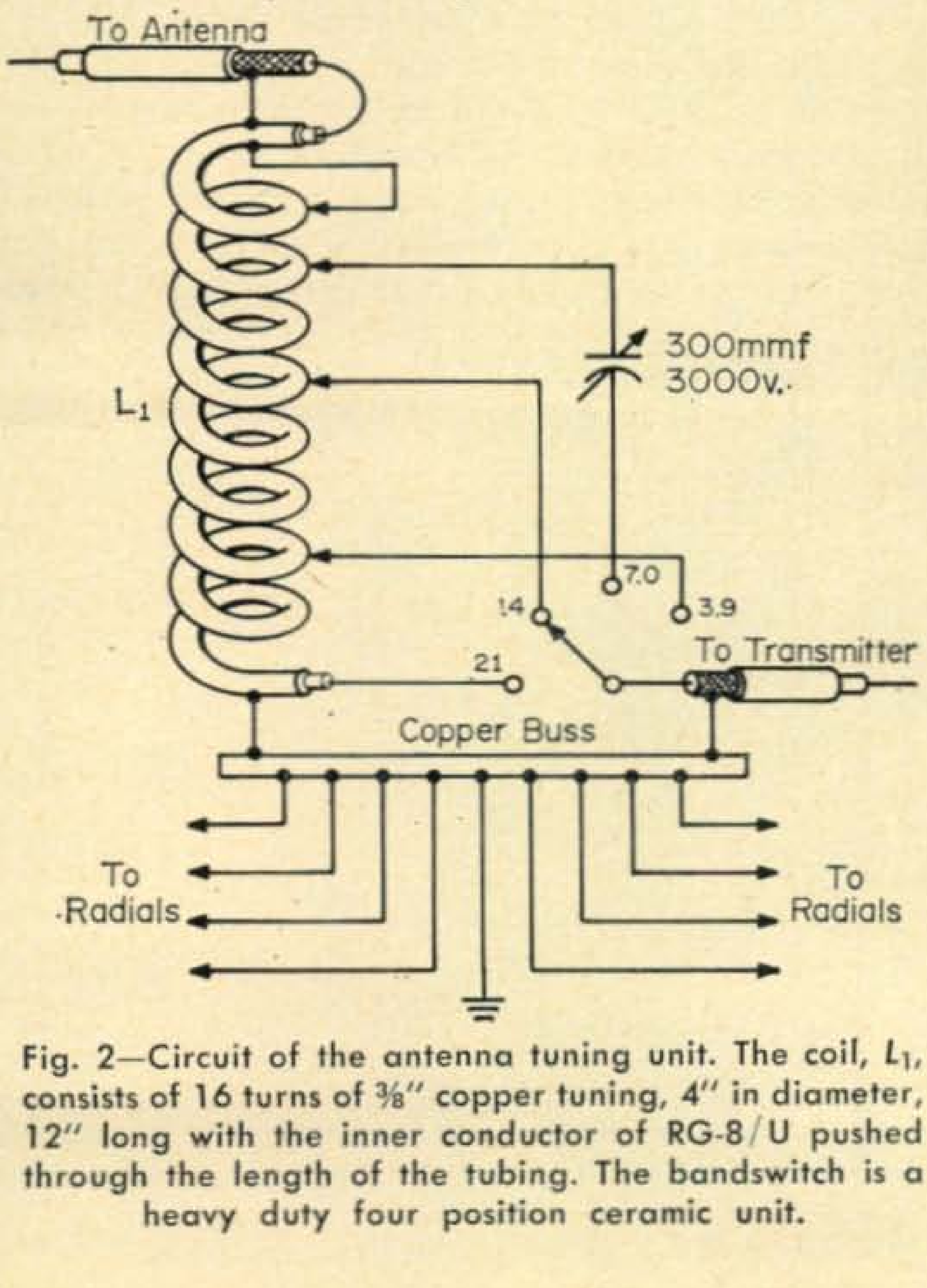
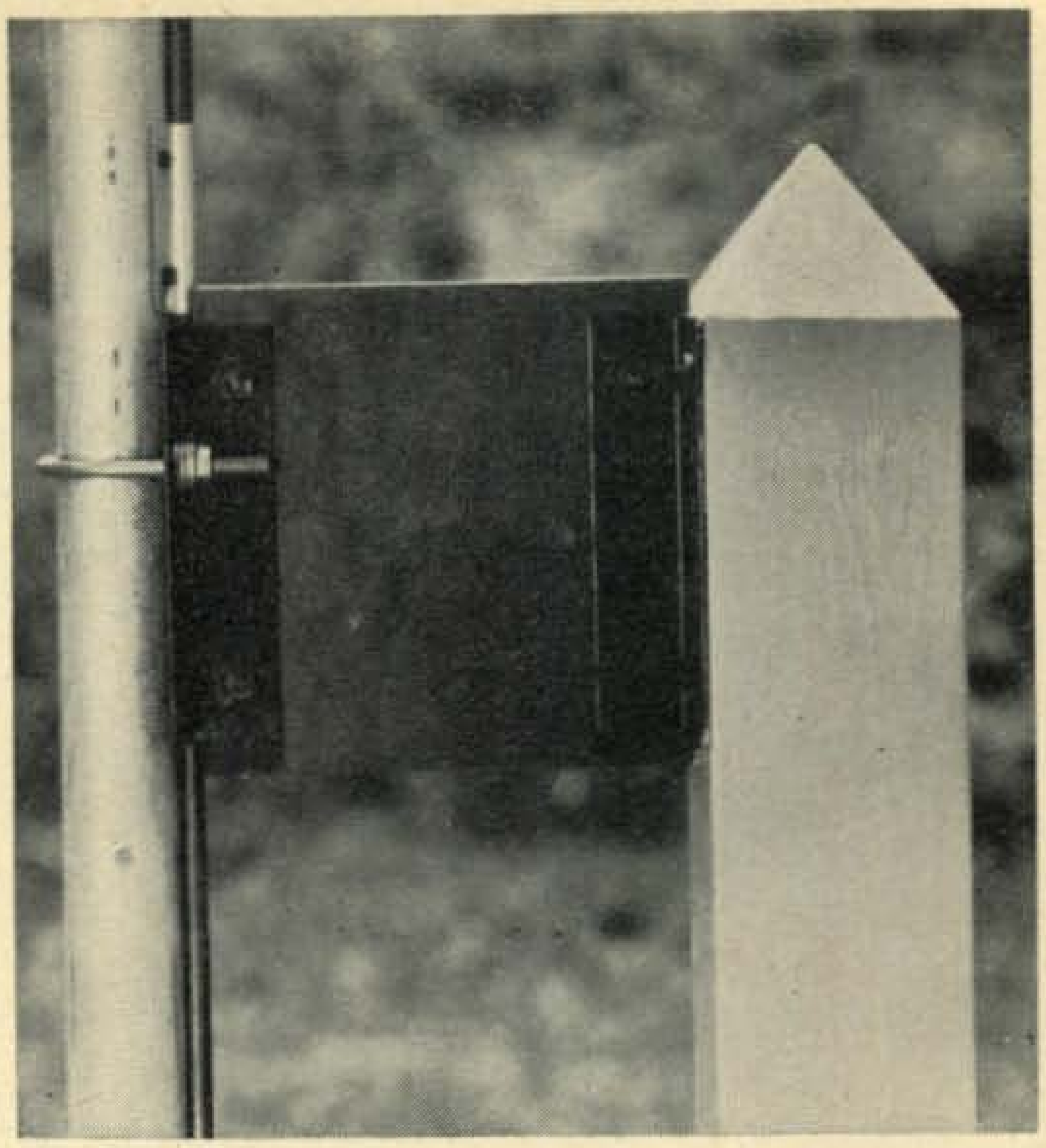


Fig. 2—Circuit of the antenna tuning unit. The coil, L_1, consists of 16 turns of ⅜" copper tuning, 4" in diameter, 12" long with the inner conductor of RG-8/U pushed through the length of the tubing. The bandswitch is a heavy duty four position ceramic unit.

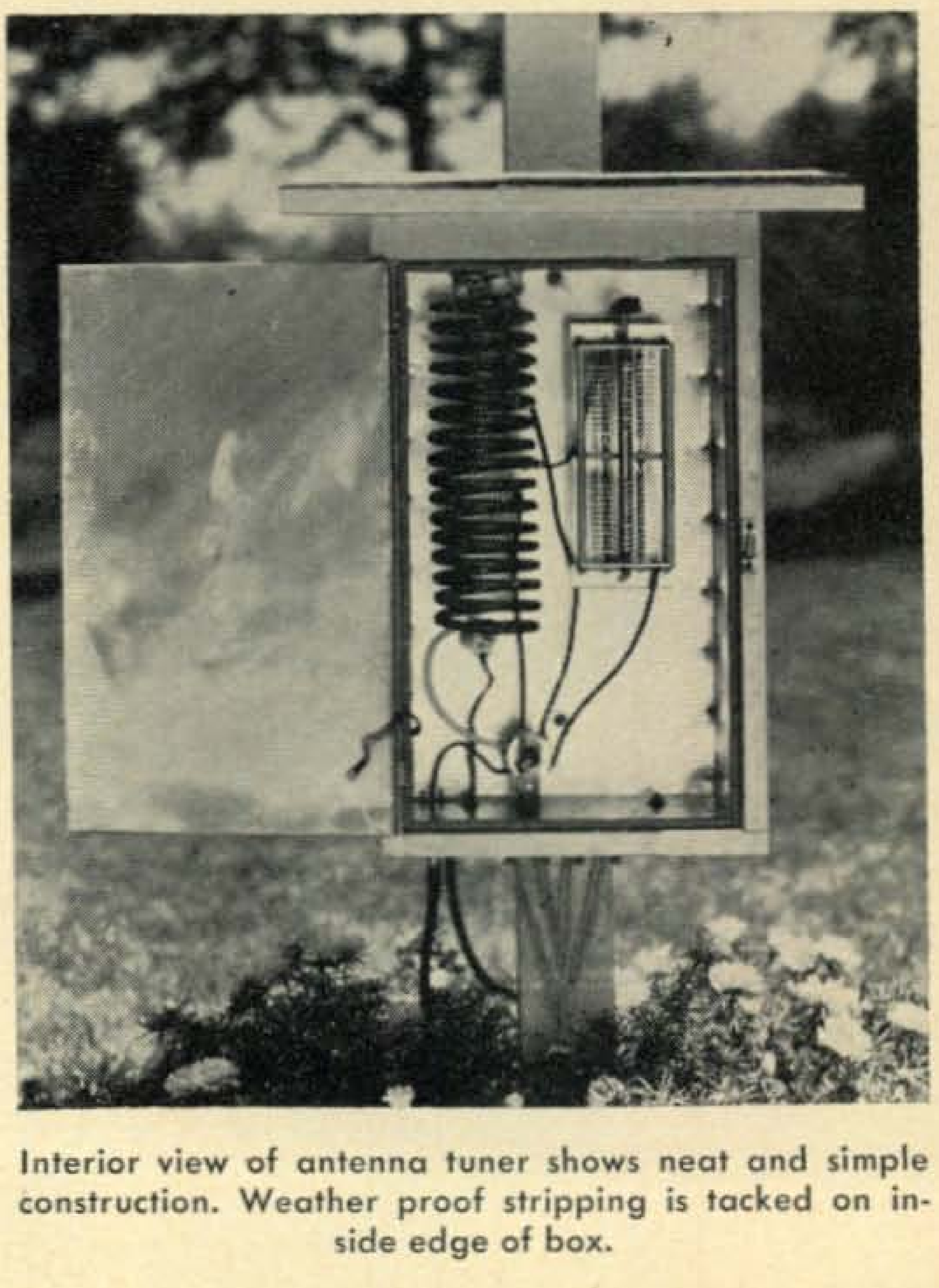


Close up of ¾" × 7" square, phenolic insulator (paper base, NEMA XX). Note use of 1½" × 1½" × 6" angle brackets and "U" bolt. One pair of brackets extends 7/16" past the edge of the insulator to permit space for passage of the coax.

Stand Off Insulators

To further reduce costs the three commercial standoff insulators supporting the main mast were replaced with "home brew" types. Each is made from phenolic laminate, paper base, NEMA XX, ¾" thick by 7" square. This indestructible insulation is sold in plastic houses at $2.00 per pound.

Two opposite edges of each square are sandwiched and bolted between a pair of angle



Interior view of antenna tuner shows neat and simple construction. Weather proof stripping is tacked on inside edge of box.

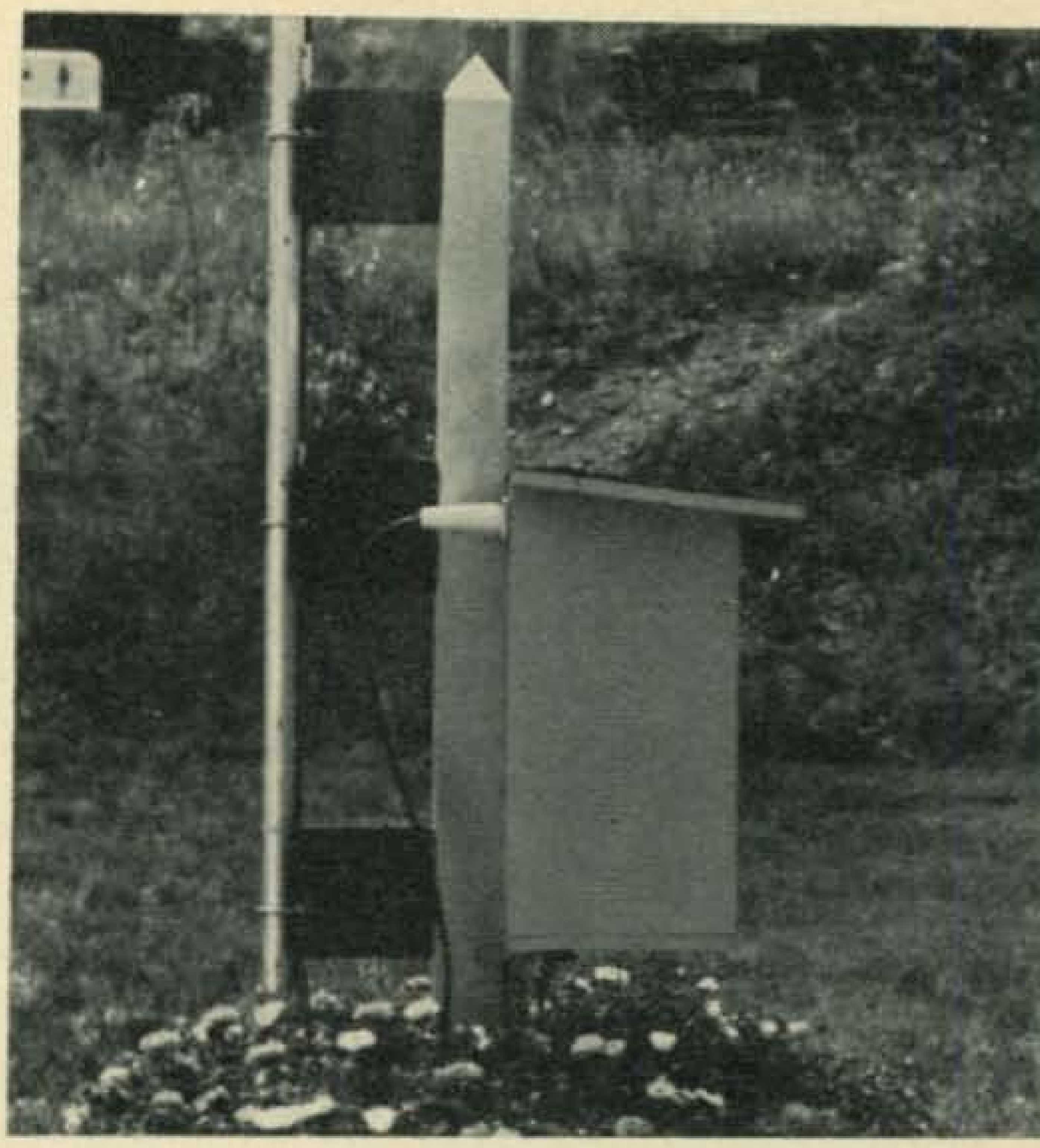
brackets, 1½" × 1½" × 6". One pair is mounted flush to the edge, the opposite pair extend 7/16" from the edge to permit passage of the ⅜" copper coax line between pipe radiator and insulator. It was obvious after mounting the three insulators to the post that two could have easily done the job. The savings on two "homebrew" insulators versus the three original commercial type will be approximately $17.

Radial System

The underground radial system, described in the earlier articles, was terminated at the bottom of the box to a piece of copper bus, 8" × 1" × ¼" thick. Connection of the #9 aluminum wires to bus is made via "Burndy" #KPA-4C solderless connectors. The ends of two wires fit nicely into a single connector. Each connector is bolted in place with a ¼-20 × 1" brass bolt.

After constructing the antenna it was found that the 3" porcelain insulators supporting the 15 meter stub would pull out during severe winds. This was corrected by applying an epoxy cement to the threads and screws on both ends of the insulators.

Aside from the mechanical deviations mentioned, the rest of the antenna was constructed as recommended by W3JHR, even to the extent of planting flowers at the base of the antenna. Needless to say, this delighted the XYL. ■



Three home made phenolic laminate, insulators support the antenna.

PIGGY BACK OPERATING DESK

BY ROBERT SNOW,* K4MFR

If your operating desk is too small and you have difficulty finding room for a mike, a key, a log, an ash tray, lamp, note pad, and in addition to all these necessities, some place to put the transmitter and receiver, here's a simple addition that can provide an extra amount of space for a minimum outlay of cash.

My operating desk is the standard 30 inches high but only 18 inches deep. This doesn't allow much room after the transmitter and receiver take their space. So I added a "piggy back" as shown in fig. 1. The whole thing can be assembled in less than an hour. Mine cost me $2.31 for an 8-foot length of 1 × 12 cut into three pieces. It was cut into two 30 inch lengths leaving one 36 inch length for a shelf. If you don't have some scrap lumber in your junk box, an 8 foot length of 1× 2 would be very useful.

The basic design is similar to a book shelf except for the backward slant of the top shelf. I put only one shelf in mine, but after putting it in use, I would suggest adding another shelf for storing cables, filters, and other accessories. If you do this, you will need an additional 3 feet of 1 × 12.

Use the 1 × 2's for shelf supports. I would suggest you use screws to fasten all joints. Give each joint a coat of glue before assembling. By dropping the rear of top shelf about 4 inches, an angle of approximately 20° will result. This gives a nice tilt to the front panel of your equipment. My receiver and transmitter are each 17 inches wide. This leaves plenty of room on a 36 inch shelf without crowding.

With the "piggy back" pushed against the wall and the regular operating desk placed in front of it, I now have plenty of operating room. A little stain, varnish, or paint completes the project. Of course, you may modify the dimensions to suit your particular desk. ■

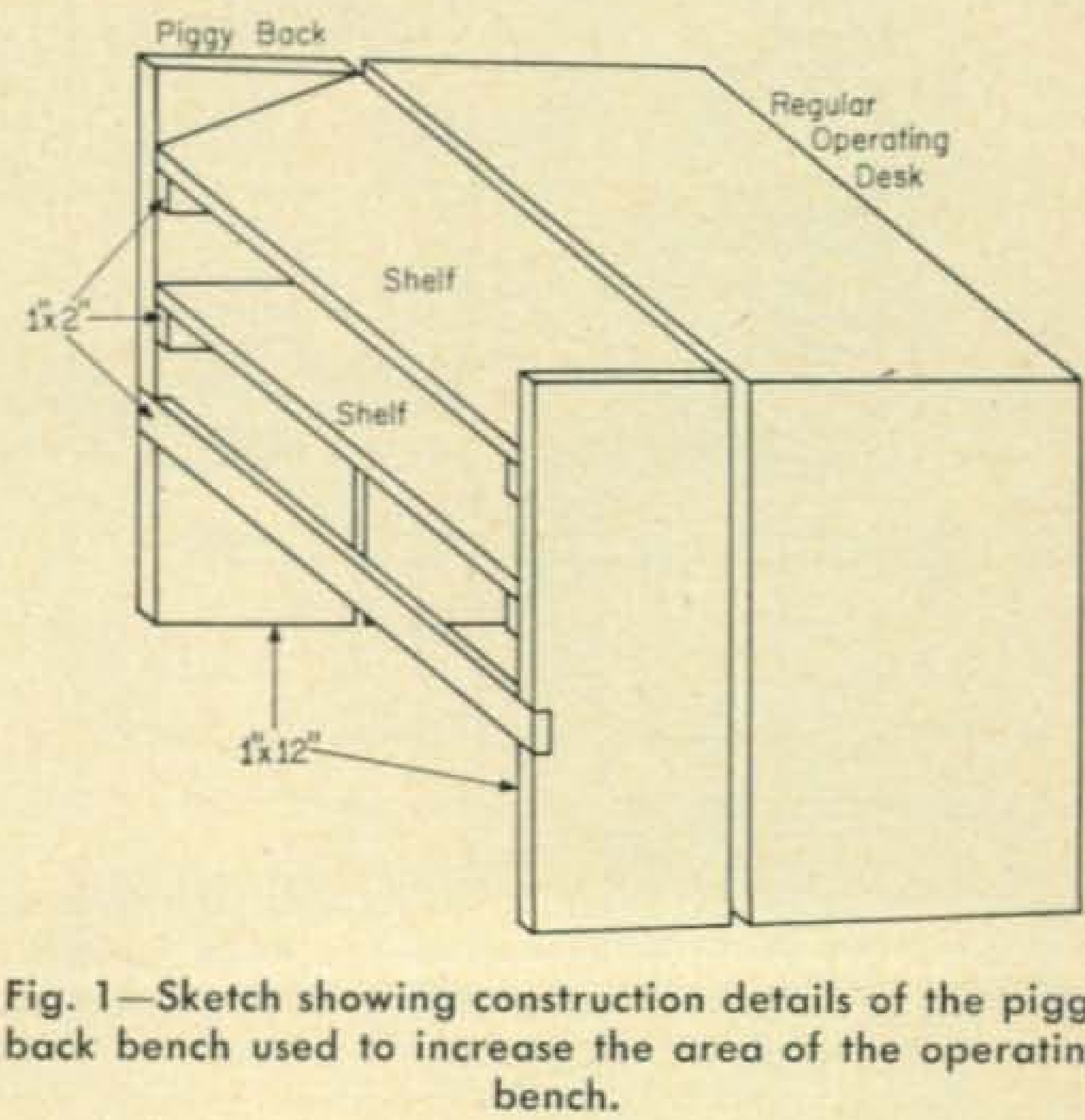


Fig. 1—Sketch showing construction details of the piggy back bench used to increase the area of the operating bench.

*713 Quarterstaff Road, Winston-Salem, North Carolina.

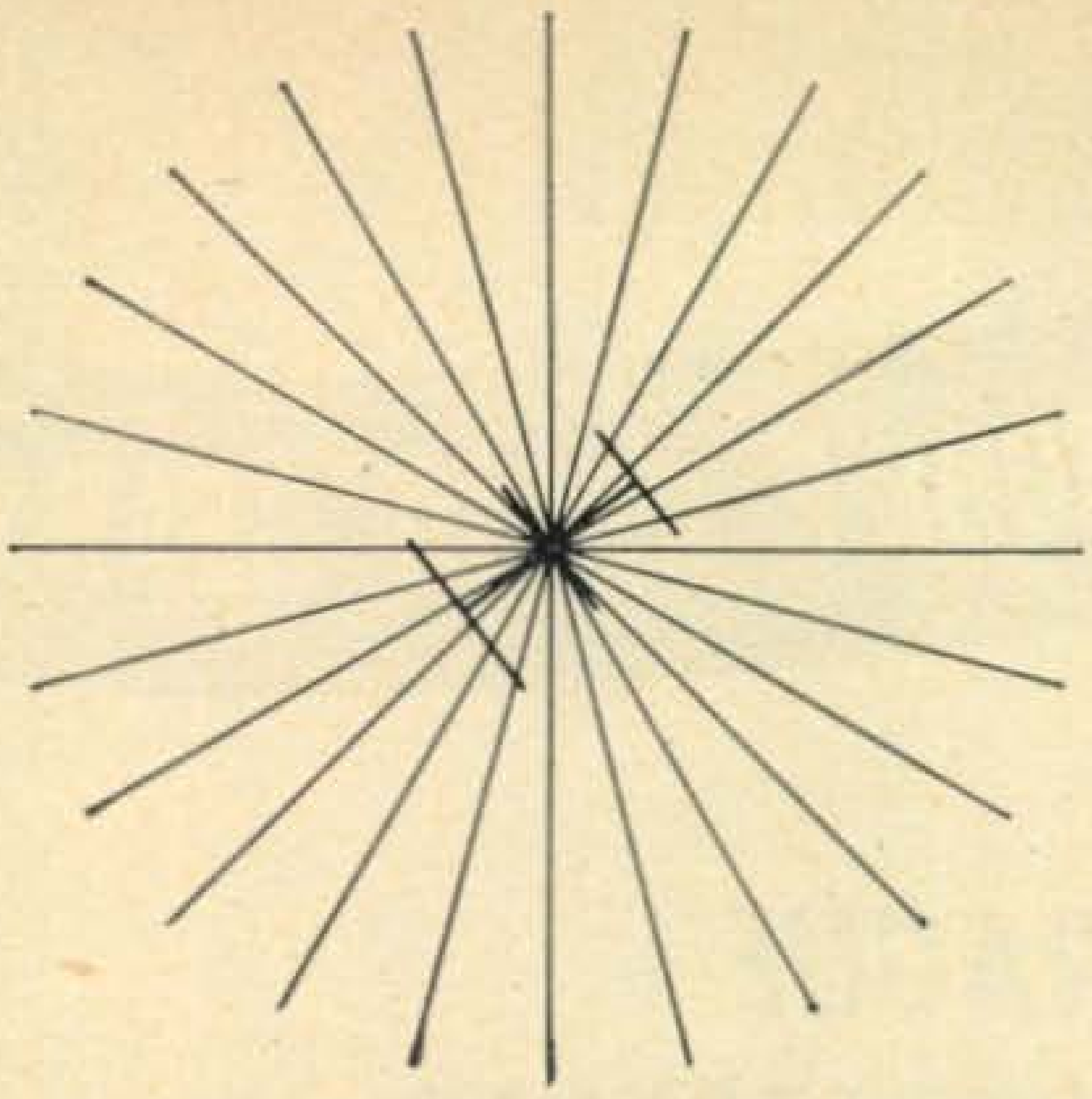


Fig. 1—Radials extending outward from a horizontally polarized beam have little effect on the pattern. The radials will have some effect on the beam impedance as there are always wires of the same polarity under the beam.

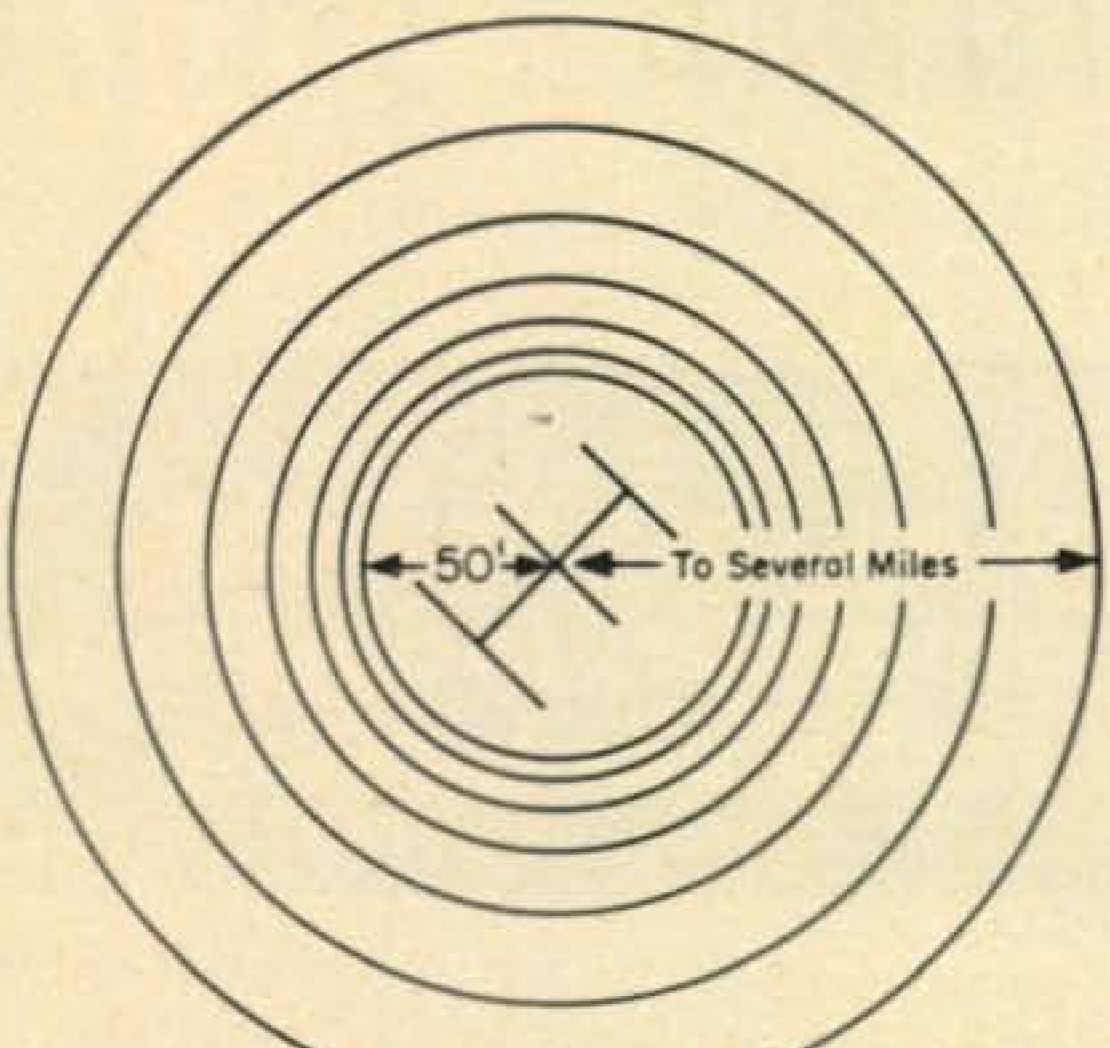


Fig. 2—The only way to get beneficial effects from radials for a horizontal beam is to place them in a circular pattern. They will always have the same polarization as the beam regardless of the direction. To be effective the radials must be from 50 feet to a couple of miles in radius. Tapered spacing of radials gives the best distribution of wire and balance of pattern. Although the wires farthest out are the widest spaced from each other they still maintain a constant spacing in reference to the angle of the energy directed at them. A reverse taper of the radial spacing shown will tend to reduce high angle radiation lobes and increase energy in the lower angles, possibly lower it a bit.

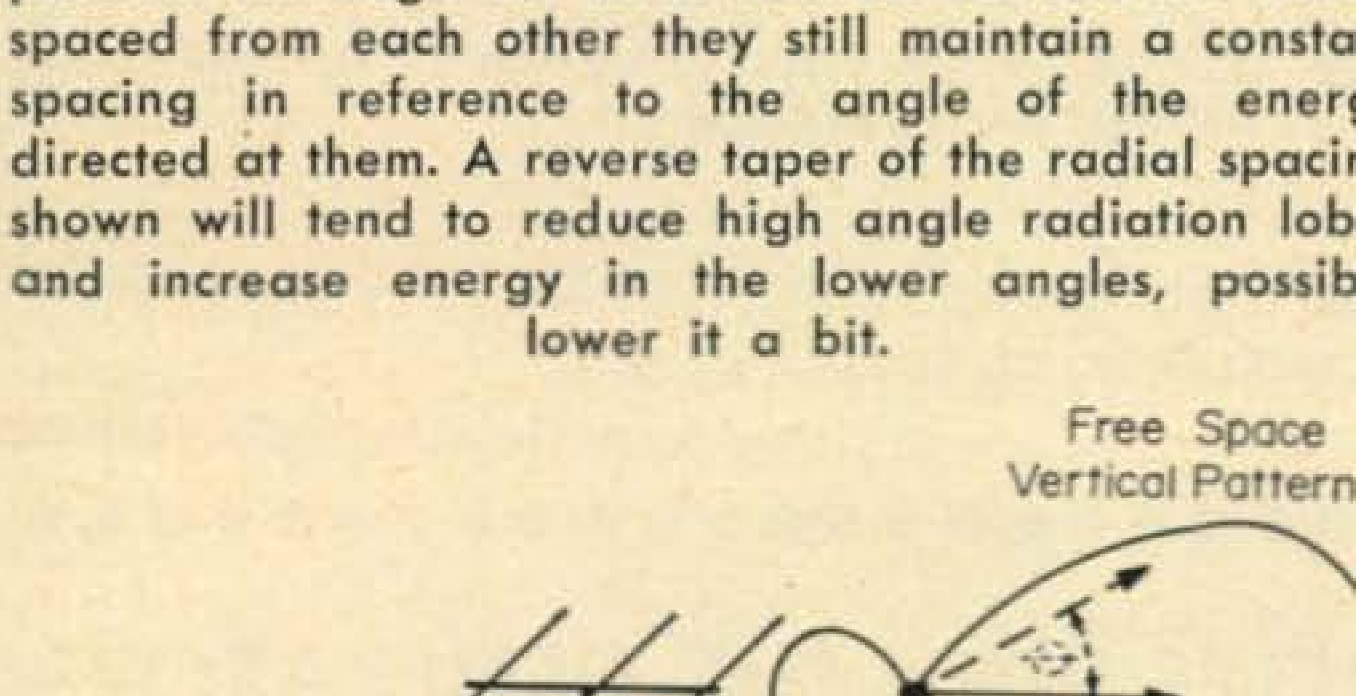


Fig. 3—Angle θ is where the r.f. of the highest amplitude is concentrated and which forms the major lobe. A perfect ground (no reflection losses) will add 6 db gain to the free space pattern.

Ground Radials for Beam Antennas

BY KEN "JUDGE" GLANZER,* K7GCO

SOME amateurs have made the mistake of running radials out from a tower (as illustrated in fig. 1) that supports horizontally polarized beam antenna. The hope is to improve the ground reflections. Unfortunately, the radials will be of little value at the far reflection points as the radials will be vertically polarized while the beam's pattern is horizontally polarized. Since the beam has a free space vertical pattern directed at the horizon there is only a small percentage of the energy directed straight down. The energy that is radiated straight down will have some effect on the final impedance although the parasitic elements have the greatest control. The component directed straight down will find some radials of the same polarization and therefore, be reflected with little loss and have some effect on the final impedance but little effect on the pattern.

The correct way to utilize radials for a horizontally polarized beam is shown in fig. 2. These circular radials will have the same polarization as the beam regardless of the direction in which the beam is pointed. However, to be in the main field of the beam's free vertical space pattern the circular radials must be located no closer than about 50 feet to the base of the tower and extend outward for up to a couple of miles. This is obviously impossible for most installations and too costly where possible.

It should be obvious at this point that the ground conductivity of your neighbor's lot, his house wiring, hot air ducts and anything else metallic will control the reflection of the beam's energy and determine its angle of radiation and what you receive.

The best location is where the surface is flat and has a very high conductivity; this is salt water. Many live near or right on a salt water beach and so have the ultimate antenna location. An added advantage of a beach front location is that there are no factories or other houses on the waterfront which contributes greatly to noise free operation. In the salt water direction these locations are often better than a high hill. ■

*202 South 124, Seattle, Washington.

For further information, check number 51, on page 110

You say your taxes were raised?

You missed three payments on your Jaguar XK-E?

You had to turn in your Playboy Club Key?

Your salary was cut?

You say the F.C.C. has expressed interest in your four different calls?

You say food is so expensive it's cheaper to eat money?

You say you invited your boss to dinner and during the soup course the finance company repossessed your furniture?

You say your XYL backed the family car out of the garage after you backed it in the night before, and now you can't get to the Newsstand to get your monthly copy of CQ?

HOLD IT!!

While we are in no position to alter the tax structure, give you a raise, or sway the F.C.C., we *can* save you a pile of cash on CQ! So drop that anchor, pick up a pen and dash off a CQ subscription right away!

1 yr.	**I PAY ONLY $ 5.00**	a savings of $ 4.00
2 yrs.	**I PAY ONLY $ 9.00**	a savings of $ 9.00
3 yrs.	**I PAY ONLY $13.00**	a savings of $14.00

And now with all this newfound money at your disposal, you can begin to really live again!

DX

BY URB LE JEUNE,* W2DEC

Here and There

CO4 Pinos Island: CO2BO will DXpedition to Pinos Island as CO2BO/CO4 for three days from Sept. 30th to Oct. 2nd. His frequencies will be 1825, 3505, 7013, 14026, 21039, and 28052. *(Tnx CO2BO).*

CE9 South Shetlands: CE9AO active on 7009 kc at 0830 GMT. *(Tnx VERON).*

CR3 Portuguese Guinea: CR3KD is CT1KD he is active on 21060 kc c.w. and several frequencies on 15 a.m. phone. *(Tnx VERON).*

FW8 Wallis Island: Robert, FW8RC, is on almost every Sunday at 0700 GMT on 14241 kc.

KG6I Marcus Island: KG6IF has been reactivated by the arrival of a new ham. He is active between 14200 and 14240 after 1000 GMT. *(Tnx Puerto Rican DXer).*

KR6 Okinawa: The following letter is from Pat, KR6UD: "I thought I might include some notes about the happenings on the Island of Okinawa lately. I have been the QSL and Awards Manager for KR6 for the past two years and am still continuing the job. Since I am a civilian with the Gov't here, I am here for a longer stint than the majority of the military personnel.

"We currently have approximately 80 stations on the air with a good portion of the stations being military unit stations providing phone patches to the U.S. for the personnel stationed here on the Island. About 80% of the stations belong to the Okinawa Amateur Radio Club. There is, of course, a varying degree of activity from the stations here even though they are numerous.

"The more active are: KR6's US, MM, UL, JZ, LL, JM, & CO. A lot of the other stations being heard in the U.S. are the boys on this end that run phone patches for the people here. Surprisingly, there are not many of the boys on c.w. Pat, KR6UD, Clyde, KR6MM, and Pete, KR6JZ, are on the air almost daily on c.w. and a few of the others join occasionally. 15 meters is producing good openings to both Europe and the U.S. here during the periods 0700 to 1500 GMT. We are looking for some good openings on 10 meters this fall. We are now having occasional openings into the Pacific and I have recently spoken with MP4TBO but we have not had an opening to the states since October of 1965.

"Lou, KR6DB/KR6OJ recently departed for the states and Clyde, KR6MM, will be off the air and ready to leave in just a few short weeks. Pete, KR6JZ, works c.w. only and is the big man on the Island for DX. He is now 215/201 and going strong. His QSL manager is W2CTN. Bill, KR6BA and Martin, KR6UL, are looking daily for their good friends back in the states on 14 mc s.s.b. Martin is currently our club President and Bill is the V.P. Martin operates 14240 daily beginning 9030 GMT."

*Box 35, Hazlet, New Jersey 07730.

VKØ Macquarie Island: Colin VKØMI, active most Saturdays on 14045 kcs at 0530 GMT. *(Tnx LIDXA).*

ZD9 Gough Island: The following is ZD9BC's operating schedule: Transmits on 14140 or 14125 kc. Listens between 14240 and 14260 kc. QRV 1730 to 1830 and 2000 to 2100 GMT. *(Tnx DXer).*

ZL4 Campbell Island: ZL4CH, 14053 starting at 0430 GMT weekends. *(Tnx LIDXA).*

4U2 British Guinea: 4U2BZ on 14075 is the first station using this new prefix. *(Tnx VERON).*

9G1 Ghana: The ban on amateur radis transmission has been lifted and 9G1's are active again.

New Prefixes: The first of the new DK prefixes are starting to show from Germany. SMØ is now being assigned for the city of Stockholm.

QTH's and QSL Managers

W1JYH was recently listed in error as the QSL manager for PJ2ME. Roger is the manager for PJ5ME while W2CTN is the manager for PJ2ME.

CO2BO/CO4	Lt. W. T. Broder, Box 40, NAVCOMMSTA, FPO, New York 09544.
GB2GC	via G3POI.
GR3RAF	via G3NAC.
FW8RC	R. Cleret P. T. Mata-Uta Wallis Island via Noumea, New C[illegible].
FY7YL	via FG7XL.
HBØXB	via DJ5CQ.
HP9FC	via VE1DH.
K4ERV/KB6	via K4MQG.
KR6CO	via K2VPU.
LX2UW	via DOTM.
MP4QBB	via K4TJL.
PA9CU	via PAØHEN.
PX1BRM	via PAØBRM.
VQ9RH	via K5QVH.
ZB2AM	via W1HGT.
4X4SK	via W2IWP.
4X4SO	via W2IWP.
4X4UL	via W2IWP.
7XØGL	3 Rue Flamand Bechar, Algeria.

73, Urb, W2DEC

This happy looking gent is Roy, ET3AC. Roy was recently FL8AC and has operated as M1AC, KA2AC, 9A1AC, HL9KT, DL5AC, DJØFL, KH6FNT, and KR6ER. *(Tnx W4NJFO).*

Propagation

BY GEORGE JACOBS,* W3ASK

A MARKED seasonal change in high frequency propagation conditions is expected during September. During the daylight hours conditions should improve on 10, 15 and 20 meters, although these bands will close somewhat earlier than during the summer months. During the hours of darkness, improved propagation conditions are expected on 40, 80 and 160 meters, with these bands remaining open somewhat longer than during the summer months.

Static levels should begin to decrease during September, and signals are expected to sound stronger during many DX openings.

During September, and continuing through the fall season, there is generally a noticeable improvement in propagation conditions on long circuits between the northern and southern hemispheres, for example, between the USA and Australia, or between the USA and South America. This improvement should be noticeable on all amateur bands between 10 and 160 meters.

With the rise in solar activity and the seasonal change in propagation conditions, the 10 meter band is expected to come back to life again this September. Good DX openings to many parts of the world should be possible during the daylight hours, especially during the latter half of the month.

Although 20 meters is expected to be the best band for DX propagation conditions for a few hours after sunrise and during the late afternoon and early evening periods, 15 meters may turn out to be the optimum DX band to many areas of the world during most of the daylight hours.

Forty meters is forecast to be the best band for DX propagation conditions during the hours of darkness, with some fairly good openings also forecast to many areas of the world for 80 meters during the same period. Some 160 meter DX openings may also be possible during the hours of darkness, or during the sunrise period, especially towards the end of the month.

This month's *CQ* Propagation Charts contain a detailed forecast of short-skip openings between distances of approximately 50 and 2300 miles, as well as forecasts for Alaska and Hawaii. These forecasts are valid for September and October, 1966. See last month's column for a band-by-band forecast of DX conditions for September.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for September

Days	*Forecast Rating & Quality* (4)	(3)	(2)	(1)
Above Normal: **6-7, 12, 17, 22, 26**	A	A-B	B-C	C
Normal: **3-5, 8-9, 11, 13, 15-16, 18, 20-21, 23, 25, 27, 30**	A-B	B-C	C-D	D-E
Below Normal: **1, 10, 14, 19, 24, 28**	C	C-D	D	E
Disturbed: **2, 29**	D	D-E	E	E

HOW TO USE THESE CHARTS

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

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

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

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

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

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

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

6—These Propagation Charts are valid through Oct. 31, 1966. These Charts 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

Meteor activity is generally at a low level during September, and few meteor-scatter openings are likely to occur on the v.h.f. bands during the month.

Sporadic-E propagation usually decreases considerably during September, but some 6 meter short-skip openings may occur over distances ranging between approximately 1000 and 1300 miles, especially during the early part of the month.

Some v.h.f. openings should result from the increased level of auroral activity expected during September. Generally, auroral activity coincides with periods of ionospheric storminess. Check the "Last Minute Forecast" appearing at the beginning of this column for periods that are forecast to be disturbed during the month, as chances are good that v.h.f. auroral openings may be possible during these periods.

Sunspot Cycle

The Swiss Solar Observatory reports a mean sunspot number of 46 for June, 1966. This results in a smoothed sunspot number of 24, centered on December, 1965. The sunspot cycle is based upon the values of smoothed sunspot numbers, and the new cycle continues to rise at a relatively slow rate.

The following are the provisional 12-month smoothed sunspot numbers reported for 1965:

Jan. 12	July 16
Feb. 12	Aug. 16
Mar. 13	Sept. 17
Apr. 14	Oct. 19
May 15	Nov. 22
June 15	Dec. 24

As was mentioned in last month's column, actual band conditions for the past year have been considerably better than the level of solar activity observed during 1965 would indicate.

A smoothed sunspot number of 50 is forecast for September, 1966.

CQ DX Contest Special

This year's *CQ* Worldwide DX Contest will be held on the following dates:

October 22-23 — Phone Period
November 26-27 — C.W. Period

As has been the practice for the past fifteen years, next month's Propagation column will be devoted to a special forecast for the Contest periods. 73, George, W3ASK

SEPTEMBER–OCTOBER, 1966

Band Openings Given In Local Standard Time

AT PATH MID-POINT

(24-HOUR SYSTEM)

Band (Meters)	*50-250 Miles*	*250-750 Miles*	*750-1300 Miles*	*2300 1300- Miles*
10	*Nil*	09-13 (0-1)	07-09 (1) 09-13 (1-2) 12-21 (0-1)	07-09 (1-0) 09-11 (2-0) 11-13 (2-1) 13-17 (1) 17-21 (1-0)
15	*Nil*	07-09 (0-1) 09-13 (0-2) 13-21 (0-1)	07-09 (1) 09-11 (2) 11-13 (2-3) 13-16 (1-3) 16-19 (1-2) 19-21 (1) 21-07 (0-1)	07-09 (1) 09-11 (2) 11-13 (3-2) 13-16 (3) 16-17 (2) 17-19 (2-1) 19-07 (1-0)
20	11-21 (0-1)	07-09 (0-1) 09-11 (0-2) 11-14 (1-4) 14-16 (1-3) 16-21 (1-2) 21-07 (0-1)	07-09 (1-2) 09-11 (2-4) 11-14 (4) 14-16 (3-4) 16-18 (2-4) 18-21 (2-3) 21-22 (1-2) 22-07 (1)	07-09 (2) 09-13 (4-2) 13-15 (4-3) 15-18 (4) 18-21 (3) 21-22 (2) 22-00 (1) 00-05 (1-0) 05-07 (1)
40	07-09 (0-2) 09-11 (2-4) 11-15 (3-4) 15-17 (2-3) 17-19 (1-2) 19-21 (0-1)	07-09 (2-3) 09-11 (4-3) 11-15 (4-2) 15-17 (3) 17-19 (2-4) 19-21 (1-4) 21-23 (0-3) 23-02 (0-2) 02-05 (0-1) 05-07 (0-2)	07-09 (3-2) 09-11 (3-1) 11-15 (2-1) 15-17 (3-2) 17-19 (4-3) 19-21 (4) 21-23 (3-4) 23-02 (2-3) 02-05 (1-2) 05-07 (2-4)	07-09 (2-1) 09-15 (1-0) 15-17 (2-1) 17-19 (3-2) 19-23 (4) 23-02 (3-4) 02-05 (2-3) 05-07 (4-2)
80	06-08 (3-4) 08-21 (4) 21-03 (3-4) 03-06 (2-3)	06-08 (4-2) 08-16 (4-1) 16-18 (4-2) 18-21 (4-3) 21-03 (4) 03-05 (3-4) 05-06 (3)	06-08 (2-1) 08-16 (1-0) 16-18 (2-1) 18-21 (3-2) 21-03 (4) 03-05 (4-2) 05-06 (3-2)	06-08 (1) 08-16 (0) 16-18 (1) 18-21 (2) 21-03 (4-3) 03-06 (2)
160	16-18 (1-0) 18-20 (2-1) 20-05 (4) 05-07 (3-2) 07-09 (2-1) 09-11 (1-0)	17-19 (1-0) 19-20 (1) 20-02 (4-3) 02-05 (3-2) 05-07 (2-1) 07-09 (1-0)	19-20 (1-0) 20-22 (3-1) 22-02 (3) 02-05 (2-1) 05-07 (1)	20-22 (1-0) 22-02 (3-2) 02-05 (1) 05-07 (1-0)

†Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST; and 10 hours *behind* GMT.
*GMT or Z Time is 5 hours *ahead* of EST; 6 hours *ahead* of CST; 7 hours *ahead* of MST; 8 hours *ahead* of PST; and 9 hours *ahead* of Alaskan Standard Time in the zone between Skagway and 141 degrees west longitude, etc.
‡Indicates possible 10 meter openings.
§Indicates possible 160 meter openings.

HAWAII

Openings Given in Hawaiian Standard Time†

To:	*10/15 Meters*	*20 Meters*	*40 Meters*	*80/160 Meters*
Eastern USA	09-12 (1)‡ 07-12 (1) 12-13 (2) 13-15 (3) 15-16 (1)	03-05 (1) 05-07 (2) 07-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-19 (1)	17-19 (1) 19-21 (2) 21-00 (3) 00-02 (2) 02-04 (1)	18-20 (1) 20-23 (2) 23-02 (1) 21-01 (1)§
Central USA	09-13 (1)‡ 07-10 (1) 10-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	05-06 (1) 06-08 (3) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (4) 17-18 (2) 18-19 (1)	17-19 (1) 19-21 (2) 21-02 (3) 02-04 (2) 04-05 (1)	18-20 (1) 20-01 (2) 01-03 (1) 21-02 (1)§
Western USA	10-15 (1)‡ 07-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	05-06 (1) 06-07 (2) 07-12 (3) 12-16 (4) 16-18 (3) 18-19 (2) 19-21 (1)	17-18 (1) 18-19 (2) 19-00 (4) 00-05 (3) 05-06 (2) 06-07 (1)	18-20 (11) 20-22 (2) 22-03 (3) 03-04 (2) 04-05 (1) 23-04 (1)§

ALASKA

*Openings Given In GMT**

To:	*15 Meters*	*20 Meters*	*40 Meters*	*80 Meters*
Eastern USA	21-23 (1)	18-21 (1) 21-00 (2) 00-02 (1)	08-12 (1)	*Nil*
Central USA	21-01 (1)	18-21 (1) 21-23 (2) 23-01 (3) 01-02 (2) 02-03 (1)	08-13 (1)	*Nil*
Western USA	20-21 (1) 21-23 (2) 23-02 (1)	17-18 (1) 18-22 (2) 22-01 (3) 01-02 (2) 02-04 (1)	08-11 (1) 11-14 (2) 14-16 (1)	11-14 (1)

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

September 10-11	WAEDC Phone
September 10-12	Pan American Contest
*September 17-18	SAC C.W.
September 17-19	Washington QSO Party
September 17-19	Pennsylvania Party
September 20-22	YLRL "Howdy Days"
*September 24-25	SAC Phone
*September 24-25	MARC VE/W
*October 1-2	WADM C.W.
October 1-3	Massachusetts Party
October 1-2	VK/ZL Oceania Phone
October 8-9	VK/ZL Oceania C.W.
October 15-16	RSGB 21/28 mc Phone
October 15-16	VU2/4S7 DX C.W.
October 15-16	California QSO Party
October 19-20	YLRL C.W. Party
October 22-23	**CQ WW DX Phone**
October 29-30	RSGB 7 mc Phone
October 29-30	VU2/4S7 DX Phone
October 29-31	Maryland/DC QSO Party
November 2-3	YLRL Phone Contest
November 12-13	OK DX C.W. Contest
November 12-14	ARRL SS Phone
November 12-13	RSGB 7 mc C.W.
November 19-21	ARRL SS C.W.
November 26-27	**CQ WW DX C.W.**

*Activities not officially announced.

Pan American Contest

Starts: 1700 GMT Saturday, September 10
Ends: 0500 GMT Monday, September 12

This is the annual Peruano contest open to all amateurs in the American Republics and the Panama Canal Zone.

Activity will be on phone only, a.m. and s.s.b., all bands 3.5 thru 28 mc.

The number exchange will be the usual 5 figures, RS report plus any 3 figure combination chosen for the first contact. However these 3 figures are not used again. Instead for each subsequent contact, the last 3 figures received in the previous contact will be used for the last part of your serial number. Therefore your number exchange will always be different.

To be eligible for an award your log must show at least 20 contacts, one of which must be a Peruvian contact (OA).

Awards as follows: A—The RCP Trophy, a gold medal and certificate to the highest scorer. B—A silver medal and certificate to the highest scorer in each country. C—A certificate to the second highest in each country. D—And banners to all contestants sending in a log. In addition, the foreign contestant with the highest score is expected to make a personal appearance at the presentation ceremonies in Lima during the first two weeks of December 1966. Jet transportation will be provided by the Radio Club Peruano.

Logs must be in the hands of the Radio Club Peruano, P.O. Box 538, Lima, Peru, not later than October 12, 1966.

Washington State QSO Party

Starts: 2300 GMT Saturday, September 17
Ends: 0500 GMT Monday, September 19

*14 Sherwood Road, Stamford, Conn. 06905.

This is the 1st Annual Washington QSO Party sponsored by the Boeing Employee's ARS.

All bands may be used, c.w. and phone, and the same station may be worked once on each band and mode.

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

SCORING: Wash. stations 1 point per contact including in-state contacts, multiplied by total states, provinces and countries worked. All others 2 points per contact multiplied by total number of Wash. counties worked (max. of 39).

FREQUENCIES: C.w. 3560, 7060, 14060, 21060, 28100. A.m. 3990, 7260, 14230, 21310, 28600. S.s.b. 3960, 7220, 14290, 21290, 28700. Novice 3735, 7175, 21110.

AWARDS: Certificates to highest scorer in each state, province, country and Wash. county. Also the Worked Five Bears Award for working five club members and a gold seal endorsement for either certificate for working club station K7NWS.

Mailing deadline is October 8th and they go to: Boeing Employee's ARS, Att: Willis Propst, K7RSB, 18415 38th Avenue S., Seattle, Wash. 98188.

Pennsylvania QSO Party

Starts: 2300 GMT Saturday, September 17
Ends: 0300 GMT Monday, September 19

This is the 9th Annual Penn. QSO Party sponsored by the Nittany Amateur Radio Club.

Use all bands and modes and the same station can be worked once per band and mode.

EXCHANGE: QSO number, RS/RST and QTH. County for Penn. stations, ARRL sections or country for out of state stations.

SCORING: Penn. stations, 3 points for out of state QSOs, 1 point for Penn. contacts, multiplied by ARRL sections and countries worked. All others 1 point per contact multiplied by number of Penn. counties worked (max. of 67).

FREQUENCIES: 3575, 3875, 7075, 7275, 14075, 14275, 21075, 21325. Check phone band on even numbered GMT hours.

AWARDS: Certificates to the first place station in each ARRL section and country. In addition the latest U.S. Call Book to the top Penn. and out of state station.

Mailing deadline October 17th. Send logs to: Nittany ARC, Box 60, State College, Penn. 16801.

YLRL "Howdy Days"

Starts: 1700 GMT Tuesday, September 20
Ends: 1700 GMT Thursday, September 22

This is a YL-only QSO "get together" in which contacts are made between members of the Young Ladies Radio League as well as non-members.

No particular rules but send a list of your contacts, indicating members and non-members to the YLRL Vice President: Edie McCracken, K1EKO, P.O. Box 285, Westwood, Mass. 02090.

Massachusetts QSO Party

Starts: 2300 GMT Saturday, October 1
Ends: 0500 GMT Monday, October 3

This is the 2nd Annual Mass. QSO Party sponsored by the M.I.T. Radio Society, W1MX.

Use all bands and modes and the same station can be worked once per band and mode.

EXCHANGE: QSO number, RS/RST and QTH. County for Mass. stations, state or province for others.

SCORING: Two points for each completed contact. Mass. stations use states and provinces for their multiplier. Out of state stations, Mass. counties (max. of 14).

FREQUENCIES: C.w. 3560, 7060, 14060, 21060, 28060; S.s.b. 3960, 7220, 14290, 21410; A.m. 3990, 7260, 14230, 21310. Novice 3735, 7175, 21110.

AWARDS: Certificates to top station in each state, province and Mass. county. (QSLs for the Worked All Mass. Counties Award go to: Thomas J. Kirby, W1EUJ, RFD #1, Frost Road, Tyngsboro, Mass. Include s.a.s.e. and fifty cent fee.)

Mailing deadline for contest logs is October 24th and they go to: M.I.T. Radio Society, W1MX, Box 558, 3 Ames Street, Cambridge, Mass. 02139.

VK/ZL/Oceania DX

Phone—October 1-2. **C.W.**—October 8-9.
Starts: 1000 GMT Saturday. **Ends:** 1000 GMT Sunday in each instance.

Following rules apply to stations other than VK/ZLs:

EXCHANGE: Usual 5 and 6 figures, RS/RST plus a progressive 3 digit contact number start with 001.

SCORING: Oceania stations, 2 points for each VK/ZL contact, 1 point for rest of world. Rest of world, 2 points for each VK/ZL contact, 1 point for Oceania contacts. Multiply total points by sum of VK/ZL call areas worked on all bands for final score.

LOGS: Must show in this order: Date/time in GMT, station worked, band, number sent and received and QSO points. Underline each new VK/ZL call area worked and use separate log for each band. A summary sheet with name and address in BLOCK LETTERS and scoring is also requested.

AWARDS: Attractive pictorial certificate will be awarded to the top scorer in each country and each call area in W/K, JA, SM, UA, for all band and single band operation. There is an s.w.l. section but only VK/ZL stations are to be listed, with log procedure same as shown above for transmitting stations.

Logs must be in hands of committee before January 21, 1967. To: N.Z.A.R.T. Contest Committee, Box 489, Wellington, New Zealand.

RSGB 21/28 Mc Phone

Starts: 0700 GMT Saturday, October 15
Ends: 1900 GMT Sunday, October 16

It's the world working the British Isles on 21 and 28 mc phone, and with improving conditions this could be interesting.

EXCHANGE: The usual 5 figures, RS plus a progressive 3 digit contact number starting with 001.

SCORING: Each contact is worth 5 points. In addition a bonus of 50 points may be claimed for the first contact with each British Isle country/number prefix on each band. (i.e.: G2, G3, GB2, GC3, GM6, etc.) A possible 37 on each band. Your final score will be the sum of QSO points and bonus points.

AWARDS: Certificates will be awarded to the leading single operator and multi-operator station in each country and VE, VK, W/K, ZL and ZS areas. There is also a s.w.l. section with rules same as listed above, except that the bonus points are 20.

Include a summary sheet with your name and address in BLOCK LETTERS and other pertinent information. And don't forget the usual signed declaration.

Mailing deadline is October 31st and logs go to: R.S.G.B. 21/28 mc Contest Committee, 28 Little Russell Street, London, WC1, England.

VU2/4S7 DX

C.W.—Oct. 15-16. **Phone:**—Oct. 29-30.
Starts: 0600 GMT Saturday. **Ends:** 0600 GMT Sunday in each instance.

This is the 3rd annual DX contest organized by the VU2/4S7 boys and we are advised that rules are the same as in previous years. However those were rather brief.

The conventional exchange of 5 and 6 figures, RS/RST plus a progressive 3 digit contact number starting with 001 was used.

Each contact with a VU2/4S7 station was worth 2 points, contacts with other DX stations 1 point. There was no indication of a multiplier. It is recommended that the same log procedure as indicated in the VK/ZL contest be used.

Certificates will be awarded in each country and W/K, JA, SM, UA, VK and ZL call areas for all band and single band operation. There is also a s.w.l. section with scoring same as the transmitter section.

This year your logs go to: ARSI Contest Committee, P.O. Box 534, New Delhi 1, India. Mailing deadline is November 15th.

CQ WW DX

Complete rules for our World Wide DX Contest will be found on page 49 of this issue. A brief rundown was given in last month's CALENDAR.

There are no changes from last year's rules, but 2 additional Trophies are being added for our European contestants. These are donated by the operators of stations W3MSK and W4BVV respectively.

Attention is called to Par. XII, disqualification for duplicate contacts in excess of 3 per cent of the total made. This will be strictly enforced and noted. You are expected to thoroughly check your log before submitting it.

There is still time to get logs, summary sheets, and Zone maps from *CQ*. A s.a.s.e. of course.

Editor's Notes

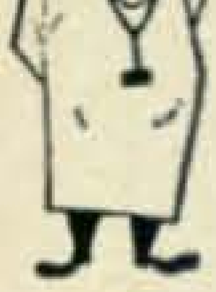
Once again I find it necessary to gripe about not receiving notification of coming events in time. It's their loss, of course. The sponsors of these activities are losing out on some good publicity. However, I do feel obligated to the readers of this column and apologize for not being able to keep them posted on coming events.

I have received many inquiries regarding as to what happened to the certificates for the 1965 SSB Contest. Through no fault of ours we found it necessary to get the addresses of the winners from the *Callbook*. However they have been sent out and you should have them by the time you read this. Let me know if your's is still missing. 73 for now, Frank W1WY

"This gets the v.f.o. stable in no time . . ."

HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV



THIS month HAM CLINIC devotes its space to answering typical questions received from Novices and Novices-to-be only.

We have always had a soft spot in our hearts for the Novice, for we believe that given enough encouragement and help, the Novice of today will surely be the extra-class licensee of tomorrow.

Ham radio is an exciting and rewarding hobby, but the youngster who is a ham or ham-to-be is deserving of all the help he can get (especially with technical problems) because it is so easy to become discouraged when starting out.

Questions

General Class Try—"I passed my Novice ham exam without difficulty and am now studying for my General exam. My code speed is now over 12 w.p.m. My father suggests I ought to go ahead and take the exam because I can try again if I fail on the first try. This way, I can be sure I pass on the second try. What are your ideas?"

Study to pass the first time! Why not have some patience? It is a nice feeling to pass the *first* time around. Some who have tried your approach stopped studying and still have no licenses. Be 100% prepared and not sorry.

Equipment Choice—"My parents tell me that if I pass the General class exam they will let me pick out any new equipment (under $600) that I want, providing I sell my present low cost receiver and transmitter. What do you suggest for equipment for a General class-to-be?"

If I were you I would pick out a good 5 band transceiver, a 3 element beam antenna and a good mike. To save money you might consider clean used equipment (from a reputable dealer). With a transceiver you can add a high power linear later. Keep your present receiver (if it is a good one) but sell the transmitter. If you buy new equipment you have then enough for sets like the Galaxy V, SB-34, Swan 350 etc. A used SR-150 or other fine set in this class can now be bought for less than $500.00.

Study Emphasis—"I am 14, a Novice going for my General, and ham radio has interested me in a career in radio-electronics. What I want to know is where I should concentrate my study efforts now before I enter college and decide what branch of radio-electronics to take up."

First, I suggest you study *all* of your subjects in high-school well, but try to excell in physics, mathematics and english (yes, english). With a good math background, some physics, and the ability to express yourself in writing and speech, you'll be in a good position to study radio-electronics. Above all, emphasize the math.

Static Dissipation—"On a rainy day my receiver pops all over the place. What causes this and is there any cure?"

No doubt dissipation static is the cause of the popping. Charges build up on the antenna and leak through your receiver to ground. Try a neon bulb (NE-2) first between antenna and ground connection on your receiver. If this does not work try a Cushcraft lightning arrestor which is inserted in the coaxial cable. It will help. It will tend to leak off the accumulated charges.

TVI on 21 mcs—"My folks still cling to an old TV set with 21 mc i.f. Is there any practical way to cure this set of 21 mc TVI? I tried traps and filters but without success."

Actually no. Of course a new i.f. strip can be installed but this is expensive and would cost more than the set is worth. Staggering i.f.'s (detuning) may work but it depends on the set design.

Meter burn-out (DX-60)—"I have burned out the meter on my DX-60 twice now. Before I install a new meter please tell me what might cause this. I tune according to instructions. Each time the meter blew I did not load up too high. While sending, the meter just stopped working."

This is a hard one to diagnose. First check the meter switch connections for a possible short. Next, check the bleeder on the power supply. An a.c. line transient could be suspected but I doubt this. A meter shunt shorted to ground could be a cause but on the DX-60 I doubt that this is your case. In some sets having no clamp tube, momentary loss of r.f. excitation can cause large current surges that can burn out a meter. If you can before installing the new meter, try an 0-500 d.c. milliammeter temporarily in place of the regular meter for reading total final plate current and watch it while operating for surges—and especially when you turn the set *off* or back on while the tubes are still hot.

Poor Ventilation—"Is it true that a transmitting set containing a fan should be operated with all covers closed?"

It depends on the design of the ventilation system. On large transmitters containing two or more air blowers, the ventilation design provides for "closed cover" operation. Removing the covers allows the air (in some cases) to flow "helter-skelter" without maximum effect. On ham transmitters (especially s.s.b. units of short duty cycle) there is no large problem.

Antennas and Best Design—"Tell me, why are even old-timer hams constantly changing antennas? There must be some 'best general design' antenna a guy can put up and forget about. Is there?"

I hate to say this but the day a ham settles on one antenna he will no doubt be a *real* old-timer just content with what he has. I wish there were

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

a "best general design" antenna, but I know of none. Changing antennas and experimenting with them can be fun. Remember that location has a lot to do with antenna performance. One type antenna may work fine in one location but in another may be marginal.

6146-B Changes—"A lot has been written on the RCA 6146-B tube versus its older brother, the 6146. Tell me: would you use the new tube instead of the old in a new transmitter design?"

Yes. The new tube is definitely better than the old and will give better performance. As a direct replacement it can also be used, but be careful how high you load it—your power supply may not have the reserve power.

Stray r.f.—"I have an old Babcock mobile transmitter which I use for fixed operation. Since installing it and when talking into the mike and touching the mike with my lips, I get a slight burn. A small neon bulb will light when touched to the mike. What do I do?"

First check your ground system—make sure the connecting lead is *short* and the ground good. Next check your antenna matching; the s.w.r. should be low (1:1 to 2:1). If these are OK, then install a 2½ mh r.f. choke in series with your mike by-passed to ground with a .001 mf ceramic capacitor.

SX-115 Microphonics—"When using my SX-115 receiver and tuning I can hear a noise in the speaker. This noise also can be caused by hitting the cabinet with my bare hand. What's wrong?"

A microphonic tube. Tap each tube *lightly* with the eraser-end of a pencil. Replace the offending tube (the one that sounds loudest when tapped). If this is not your trouble check the mechanical condition of the condenser gang (for loose capacitor segments).

110V–220V Transformer Use—"I have a 220 to 110 v.a.c. transformer. Can I use it backwards for 110 to 220 v.a.c.?"

Yes, but never exceed the wattage rating of the transformer either way.

Heath Mobile Supply—"I have a Health mobile power supply (second hand) of a very early vintage. I have had to replace the transistors in this 3 times. What are the probable causes for this?"

Generator voltage too high and maybe too much heat—if the unit is mounted in the engine compartment. Limiting resistors of a few ohms (10 ohms) can be tried in series with the collectors of the transistors. Better yet, keep the generator voltage down to about 13.2-13.3 volts by proper adjustment of the voltage regulator. Mount the unit away from the engine to reduce heat induction.

HX-50 Buy—"I have a chance to buy an HX-50 transmitter for $225.00. It is clean. What I want to know is what should I check for before taking it?"

Obtain the help of a disinterested General class ham who can give it an on-the-air check on *all* bands and who has some technical ability. Look for badly done modifications and proper calibration. Check output on all bands and stability. Good luck!

Instruction Book—"I wrote to the —— Company for an instruction book on a second hand receiver I bought. They replied they had none left and referred me to you. Can you help?"

I have only one copy on the set you own and will not part with it on a loan or any other basis because I have lost too many books this way. I suggest you advertise in *CQ* for a copy. I am sending you a Xerox of the schematic however.

Regenerative TVI—"I built a transistorized regenerative receiver. I note that when I use it next to our TV that it causes lines to appear. This happens only when the regenerative receiver is about 2 feet away from the TV set. Should I worry?"

No. All regen receivers radiate, some more than others, but yours seems to be putting out a real weak signal. However, I would advise you to check it out with another radio receiver (on the same frequency) at various distances. The FCC frowns on any device that causes r.f. interference.

Set Design—"Please design a transmitter having the following specifications etc. and send me all step-by-step details."

Sorry this we cannot do as explained in this column many times before. Time is simply not available to do personal design work—even for money.

Intercom "I"—"We have an intercommunications system in our home. When I work on 7 mc (c.w. of course) the clicks can be heard in three speakers, but not all. What gives and what's the cure?"

The cause is no doubt a poor ground, inherently bad keying circuit, r.f. induction and/or rectification of same. Try a 2½ mh r.f. choke in series with speaker leads. But do try to find out if your set is operating properly too. You may have to add a keying filter. Make sure the intercom amplifier is grounded properly, even though only 3 speakers are affected.

Book Reviews

The *Transistor Radio Handbook* by Don Stoner and L. A. Earnshaw was, in my estimation, written for hams. Containing 177 pages, it starts off with transistor theory and ends up with power supplies; in 6 chapters. A number of construction projects are included in the book, the best being the 40 meter s.s.b. transceiver as designed by Jo Emmet Jennings, W6EI.

For those who do not like to be bogged down with theory and prefer practice, this book will be appreciated. It can be obtained from Editors and Engineers Ltd. New Augusta, Indiana for $5.00 under the cat. No. EE-044.

It is *my* opinion that Bill Orr's (W6SAI) 16th Edition of the *Radio Handbook* (RH) also published by Editors and Engineers is better than ever. Completely revised, this 808 page book is certainly worth the $9.50 charged for it. New construction projects are scattered throughout for the ham who still does his own building or who is interested in new techniques.

The RH contains a lot of good theory and has special chapters on radio mathematics and calculations as well as electronic computers.

The information on the construction of the 4-400A linear amplifier is alone worth the price of the book.

What impresses me with the RH (in contrast to some others) is the wealth of usable information it contains. For example, a number of design charts are included covering everything from rhombic antennas to a coil calculator nomograph.

The pages on s.s.b. are detailed and there is little left to one's imagination. For the novice, advanced ham or even the practicing engineer, the RH contains more information than any other being marketed today. I recommend it highly to HAM CLINIC readers.

Parallel Output Tubes—"A friend of mine claims that one of the 6146 tubes (that operate in parallel) in his Apache burned out but that he still could use the set okeh. Is this possible?"

Yes, but it is a wonder the other tube did not go too because it was taking the power usually shared by the other tube. If he had pulled out the dead tube and operated he would have noticed some difference because the load would have changed. Even the dead tube presents some shunt capacitance through its elements.

DX-40 Output Change—"I note that the output of my DX-40 changes if I hold the key down for more than a minute. Why is this?"

Why hold the key down for a minute? If you are on the air this is not a good practice. If the transmitter works okeh otherwise I would forget about the change if I were you. Could be due to a heating final tube, crystal heating or an unsteady or bad key contact.

DX-60 Tuning Unit—"Will an antenna tuning unit help me get out better with my DX-60?"

It all depends upon your antenna. The tuning unit is only a matching-loading device. You already have a good pi-network in the DX-60 which will load most antennas used by novices.

Veroboards—"I'm a Novice who likes to put together transistorized gadgets, but I don't like making circuit boards. Any suggestions?"

Sure. Why not try Veroboards? They are easy to work with and fun to use. Write Vero Electronics Inc., 48 Allen Blvd., Farmingdale, New York for info. The Veroboard requires no etching. Kits are available from $1.95 to $29.95.

Thirty

We could fill a whole issue of *CQ* with questions from Novices and still have many questions left over. Some of the questions are good and some indicate that the writer has no radio handbook. Every ham or ham-to-be should have a handbook of some sort. But good or bad we welcome the opportunity to help *all* hams. For this month then.

73, & 75, Chuck, W6QLV

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

USA-CA HONOR ROLL

3000		1500		500	
W2QHH	5	W2QHH	49	W2QHH	572
2500		W4KA	50	WAØJKT	573
W2QHH	16	W6DIX/7	51	W6OED	574
2000		**1000**		GW3NWV	575
W2QHH	29	W6DIX/7	101	I1BAF	576
		W2QHH	102	WPE4IIO	577

SPECIAL USA-CA HONOR ROLL
Top Twenty-Five County Hunters

K9EAB	3079	K5SGK	2960	W8UPH	2368
WØMCX	3079	K4VOF	2944	K3LXN	2331
K8CIR	3069	K8IWI	2780	K8VSL	2180
W9ICF	3050	K8KOM	2700	K8EUX	2154
WA9AJF	3010	VE3-9301	2679	W5NXF	2080
W2QHH	3001	WØKZZ	2591	WA5AEB	2062
WØJWD	3000	WØVFE	2527	W2JWK	20[illegible]0
K5SGJ	2961	WØGYM	2500	K9UTI	2000
		W9CMC	2401		

THE "Story of The Month" is about Howy, W2QHH, but here is the data on awards issued. Howy, W2QHH earned a USA-CA-3000 Award and of course 2500, 2000, 1500, 1000 and 500, all Mixed. Leo, W4KA received a USA-CA-1500 award endorsed All Phone. A USA-CA-1500 award endorsed Mixed went to "K.D.," W6DIX/7 as well as All s.s.b. for his USA-CA-1000 and USA-CA-500 Awards. Mixed USA-CA-500 awards went to Donald, W6OED and Dave, WAØJKT. Robert, GW3NWV received a USA-CA-500 award endorsed All 2 X s.s.b. which is the first USA-CA award to any GW. Mino, I1BAF received a USA-CA-500 award endorsed All Phone and it was the first All Phone award to Italy. Sil, WPE4IIO received a USA-CA-500 Award which is the 11th to an s.w.l. and the 1st to the 4th district.

Howard S. Bradley, W2QHH
Winner of #5 USA-CA-3000 Award

"Howy" was first licensed in 1933 as W8JIW in his present location, this was prior to the call area alterations. Successive rigs of from 10 to 35 watts input on 160 through 10 meters into a simple end-fed Hertz antenna produced many awards, among which were DXCC on 5 bands and WAS on 7, and many "firsts" including the first WAC/YL and WAS/YL. An early "county" style search earned the first award outside Europe for contacting the 22 Cantons of Switzerland (H-22). Some 300 countries were worked before the acquisition of a "QRO" Ranger which is loaded only to an average input of 55 watts and used on all bands, feeding the same wire antennae (one 135 feet long and 25 feet high, the other 264 feet long and 45 feet high). Current DX total rests at 332 countries.

Howy was often dubbed "Mr. Certificate," especially when he wrote such fine articles for *CQ*. The first was "The Certificate Seeker's Directory" which appeared in *CQ* of February, 1953. This was followed by "Certificate Seeker's Directory, II" in *CQ* of November, 1955 and "Certificate Seeker's Directory, Part III" in *CQ* of August, 1956.

Awards in general are no longer "chased" (although he has some 400 or more awards), but when one appears that has special appeal, he tries to add it to the "fold." Such an award was the Puerto Rican award issued in honor of "Pappy," KP4KD, who had been a special friend down through the years and who Howy had contacted on 7 different bands.

Cards received in the course of completing 7-band WAS and many state awards, plus YLCC-1400, gave a good "foundation" for USA-CA but the awesome task of listing same, kept W2QHH from applying for some time, but once the 3000 total was within "range," W2GT's encouragement produced the necessary "spark."

Other hobbies include that of hunting, fishing, trapping, stamp collecting (W, VE and flowers on stamps) and botany. With no more technical background in botany than in radio (½ year of biology), Howy has developed a profound interest in native plants and has over 2000 growing in the limited confines of a small lot. Many are rarities seldom grown in cultivation (many that experts said could *NOT* be grown in his climate) and some have been successfully propagated and passed along to other native-plant fans, serving to perpetuate these unusual things for the future. For any readers in remote areas, especially locations which are subjected to severe winter cold, Howy would be very interested in exchanging seed or plants from such spots.

Howy's occupation is that of a mailman, walking a route of some 17 miles a day (but less than for a period of 15 earlier years) and is in his 26th year of deliverying the local mails. He has been married for 27 years and has two sons, one of whom is entering his final year in college.

A special word of thanks to everyone (fixed and mobile stations alike) without whose toler-

W2QHH & Equipment

*103 Whitman St., Rochelle Park, N.J. 07662.

ance and help, W2QHH, could never had hoped to attain the 3000 county total. Operation at his location has become very discouraging with ever-increasing local noise from some 5 or 6 sources so that receiving has become the major drawback in choice DX and county hunting. The above-mentioned helpfulness on the part of all has therefore become increasingly important and appreciated the more as local conditions have deteriorated.

Letters

John, W9OIJ/P, WB2LZF, writes, "The inevitable happened, I'm being transferred at once, so will be unable to follow the schedule printed in your June column. QSLs for all W9OIJ/P operations will always be available from Stu Meyer, W2GHK."

Doc, W4GJW, writes, "Given about a month's notice, I will offer to go to Winston, Walker, Marion, Lamar, Fayette and perhaps Blount counties (Alabama) some Sunday afternoon if enough need for these is made known. Recently I made a 50 mile round trip to a county only ot have one taker present, whereas many stations said they would be on to get that needed county." Write: Arthur W. Woods, M.D., W4GJW, The Babies and Children's Clinic, Cullman, Alabama 35055.

Ned, W1RAN, writes, "We had over 350 QSOs on Field Day from Dukes County and want to return, perhaps in September. Those *eager* for Dukes county drop a card to me and I'll notify them *direct* of definite plans." Write: Ned Raub, W1RAN, 207 Thames St., New London, Conn. 06320.

Irene, K5WZA, writes, "You and your readers should be interested in a New Mexico Ham Directory I am working on. I am sure it is the first of its kind.

All fifteen-hundred hams in the state are listed with their proper counties included after their addresses. It will also include a list of the Albuquerque-only-hams with their phone numbers and listed by their names in alphabetical order. It shows many things which most hams do not realize, such as there is NO resident ham in Mora county and Harding has only three.

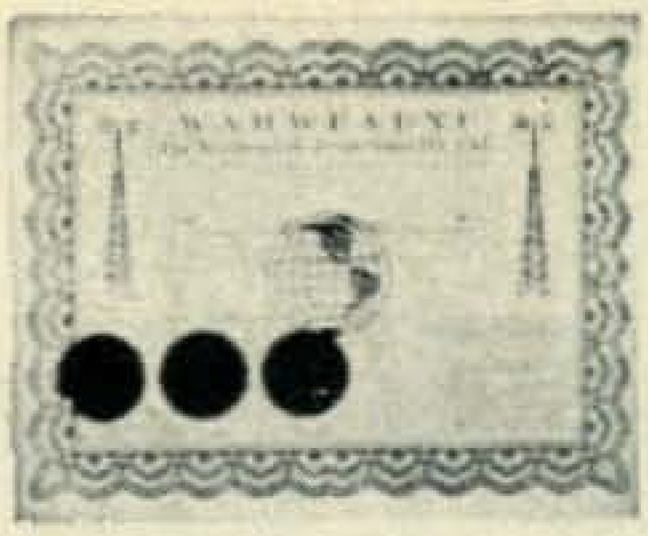
The book will be 11" × 8½" with semihard cover and plastic spiral binding for easy handling. Price will be $2.00 and it will be ready for December with the up-to-date list and information.

Anyone interested could drop me a card (no money at this stage) for reservation, as printing will be limited." Write: Irene Henderson, K5WZA, 120 10th St., N.W., Albuquerque, New Mexico 87102.

Awards

The Amateur Achievement Award: Sponsored by the Ohio Valley Amateur Radio Association will be issued to any Amateur submitting satisfactory evidence of complying with at least seven (7) of the fourteen (14) requirements. No date limit on requirements. Satisfactory evidence shall be in the form of a sworn statement signed by a Club Officer of Two Amateurs or a Notary Public or other Officer authorized to administer oaths. Cost of the Award is five (5) IRCs or the equivalent in Mint Stamps or Paper Currency from the country of the applicant. Endorsements s.a.s.e. or 1 IRC. Send application to Custodian, John F. Berryman, K4RZK, 53

The Amateur Achievement Award



WANWPADXC Award

The BENELUX Award

Hart Dr., Hebron, Kentucky 41048. Requirements: 1. **CW**—Hold a Code Proficiency Certificate issued by a National Radio Society endorsed for a code speed in excess of the code speed required for the applicants license. 2. **DX**—Hold a DXCC or equivalent certicate issued by a National Radio Society. 3. **VHF**—Hold at least (3) three **vhf** Awards. 4. **Competition**—Win 1st or 2nd place at least twice for your county, state, district or province in any National or International Contest or 3rd place at least three times. 5. **Technical**—Construct and use in your station any piece of equipment using at least three (3) stages. Kits do not count. 6. **County Hunting**—Hold basic USA-CA or equivalent award. 7. **Public Service**—Any Public Service Award or Letter on City, County, State or National level. 8. **Journalism**—Have an article dealing with amateur radio published or accepted for publication in a National magazine, local newspaper or be a regular contributor to club publication. 9. **Incentive**—Hold highest class amateur radio license available in your country. 10. **Mobile**—Have operated a minimum of ten (10) hours mobile and have operated outside home state, county or province. 11. **Emergency**—Within past three (3) years have participated in one of the following: Three hours actual emergency, or five hours emergency drill, or ten hours ARRL Field Day or equivalent. 12. **Club Service**—Serve as an officer of any formal amateur radio organization. 13. **Traffic**—Membership in Mars or equivalent organization or else handle 100 pieces of formal traffic in nets during one year period. 14. **Awards**—Hold membership in Certificate Hunters Club, Award Hunters Club International or have 25 awards from at least 3 continents and 10 countries.

WANWPADXC Award: Sponsored by the Northwestern Pennsylvania DX Club (Club Station WA3CKV) are happy to offer this award for contacts with club members after January 1, 1960. Class C—work 3 members; Class B—work 4; Class A—work 7. FOR DX: Class C—work 2; Class B—work 4 and Class A—work 6. KL7, KH6 and VE8 considered DX for award requirements only. Contacts with WA3CKV, the club station, count as 2 QSOs toward Class A or B but one point for Class C. Endorsements above 7 in steps of 2, and DX above 6 in steps of 2 also. AOMB/M applies. Application by log data only, QSLs not necessary but logs will be carefully checked. Award available to s.w.l.s on heard basis. Members include: K3FXM, NJH, QJE, QJL, UOC, USC, VPN, ZOP, WA3AWB, WA3DCN and WA3DLS. All are active on all bands s.s.b., a.m. and c.w. Cost: USA, Canada, KH6, KL7 $1.00 or 10 IRCs. DX cost is 3 IRCs. Endorsements s.a.s.e., no charge to DX. Apply to NWPADXC Awards Manager, Mickey Manafo, K3UOC, 2419 Willow Street, Wesleyville, Pa. 16510.

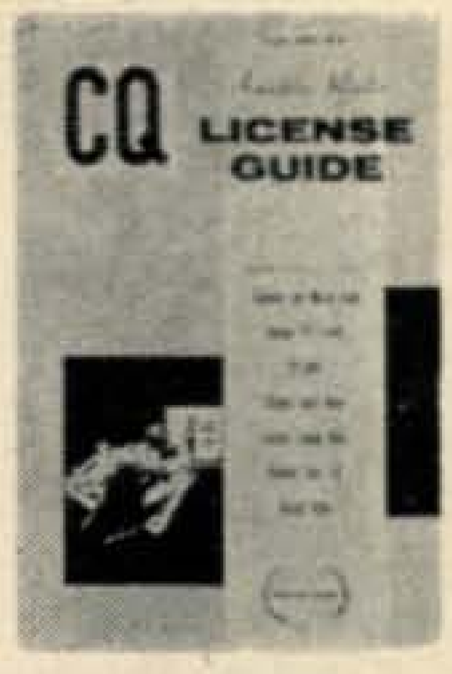
The Benelux Award: Sponsored by the well-known Antwerp (OSA) CW-DX Club and it's name is derived from the Belgian-Netherlands-Luxembourg economical union (founded in 1947). It is available to licensed amateurs and/or s.w.l.s. throughout the world. European amateurs must provide proof of contacts with 7 Belgian, 7 Netherlands and 2 Luxembourg stations. The rest of the world and /MM stations supply proof of confirmed contacts with 4 Belgian, 4 Netherlands and 2 Luxembourg stations. SWLs must supply proof that 7 Belgian, 7 Netherlands and 2 Luxembourg stations have been heard and confirmed. Any mode of transmission and any band may be used as long as operation is in accordance with standard amateur service practice. Contacts must be made after January 1, 1947, minimum signal report—c.w. 448 and Phone 44. Send **full** log data and GCR applies, do not send QSLs. Cost: 7 IRCs, 50 Belgian francs, 4 guilders (florins), 1 U.S. dollar or the equivalent. NO STAMPS. Send to Benelux Award Manager, Antwerp (OSA) CW-DX Club, P. O. Box 331, Antwerp-1, Belgium. This club also issues the famous WOSA and

[*Continued on page 106*]

CQ TECHNICAL BOOKS

CQ ANTHOLOGY I

We've looked back through the years 1945-1952 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out and are unavailable.



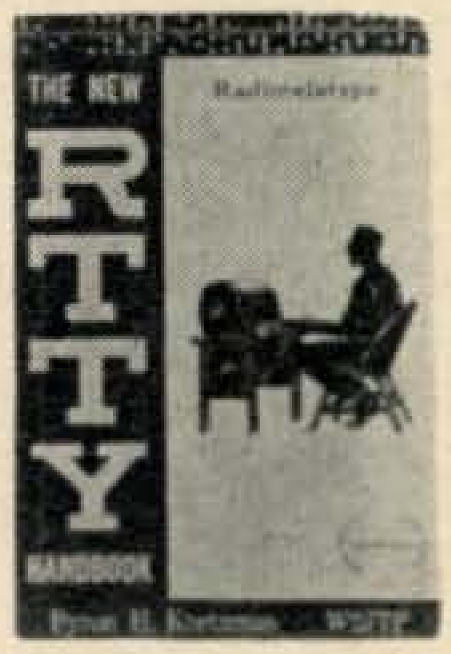
CQ LICENSE GUIDE

212 pages of everything the Amateur must have to get his license and progress toward the general class ticket. Plus many additional pages of vital information for the ham operator.

ANTENNA ROUNDUP

A common denominator for all ham stations is the antenna. Here at last is the cream of antenna information packed into a 160 page book. Forty-seven information-packed articles that will dispel much of the mystery surrounding antennas.

See Page 103 May issue for ANTENNA Roundup II.



THE NEW RTTY HANDBOOK

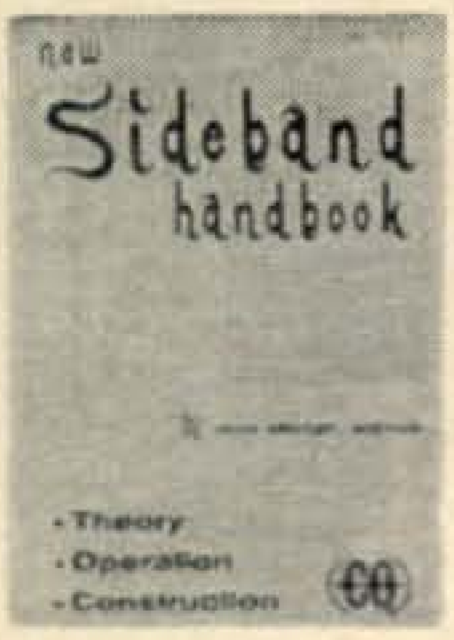
A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section in getting started, all written by Byron Kretzman, a well known authority in the field. First printing sold out. Second printing on hand.

CQ ANTHOLOGY II

Top favorite CQ articles from 1952 to 1959 . . . including some you may have missed . . . compiled into one new information-packed book! No more need to try to locate sold out back copies of CQ. This Anthology includes past articles of lasting interest to every amateur radio enthusiast. Over 250 pages of text. Over 75 different articles. A definite Must for your shack!

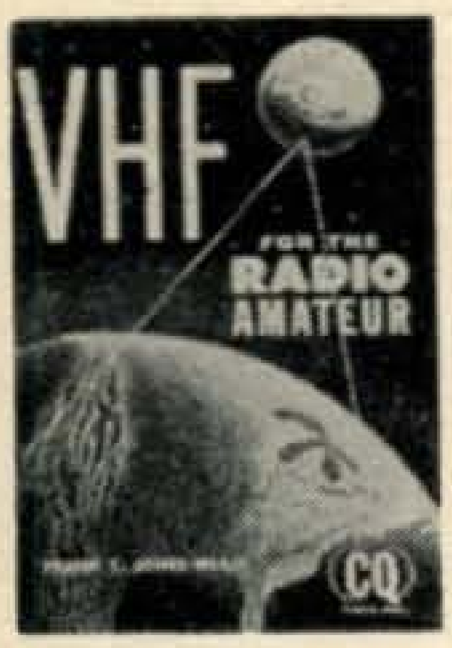
MOBILE HANDBOOK

This new Mobile Handbook by Bill Orr, W6SAI, has been getting raves from top experienced mobile operators. Written for advanced, as well as beginning mobile operators, much of this information cannot be found anywhere else. This is NOT a collection of reprints.



SIDEBAND HANDBOOK

Written by Don Stoner, W6TNS, who was almost one full year in the preparation of this terrific volume. This is **not a technical** book. It explains sideband, showing you how to get along with it . . . how to keep your rig working right . . . how to know when it isn't . . . and lots of how to build-it stuff gadgets, receiving adaptors, exciters, amplifiers.



VHF FOR THE RADIO AMATEUR

If you are, or are planning to be a VHF operator, you can't afford to be without this dynamic new handbook written especially for you. Filled from cover to cover with all new and original construction material presented so you can understand it. Written by Frank C. Jones, W6AJF, nationally acclaimed for his VHF pioneering.

SURPLUS SCHEMATICS

This is a book literally loaded with schematics for all the currently popular pieces of surplus gear. Most amateurs are well aware of the problems encountered in purchasing seemingly inexpensive surplus units, only to find that no schematic diagram is available. Trying to figure out the circuitry cold turkey can be many-times more difficult than the most involved puzzle, and purchasing a single instruction book can run as high as $3.50.

COWAN PUBLISHING CORP. Book Div.
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

CQ ANTHOLOGY I	$2.00	☐
CQ ANTHOLOGY II	3.00	☐
ANTENNA ROUNDUP #1	3.00	☐
ANTENNA ROUNDUP #2	4.00	☐
SIDEBAND HANDBOOK	3.00	☐
VHF FOR THE RADIO AMATEUR	3.50	☐
SURPLUS SCHEMATICS	2.50	☐
CQ LICENSE GUIDE	2.50	☐
"NEW RTTY HANDBOOK"	3.95	☐
MOBILE HANDBOOK	2.95	☐
ELECTRONIC CIRCUITS HANDBOOK #1	3.00	☐
ELECTRONIC CIRCUITS II	3.00	☐
SHOP & SHACK SHORTCUTS	3.95	☐
SURPLUS CONVERSION HANDBOOK	3.00	☐
CODE RECORD	3.50	☐
REGULAR LOG SHEETS (100)	1.00	☐
SSB LOG SHEETS (100)	1.00	☐
HAM'S INTERPRETER	1.50	☐
TVI HANDBOOK	1.75	☐
BINDER—YEAR WANTED	4.00	☐
DIODE SOURCE BOOK	2.50	☐
USA-CA RECORD BOOK	1.25	☐

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

SIRS: My check (money order) for $________ is enclosed. Please send the following items to:

Name____________________

Address____________________

City________ Zone______ State________

SURPLUS sidelights

BY GORDON ELIOT WHITE*

SURPLUS antennas have long been in the "dog" category—bulky, unwieldy, or cut for the wrong frequency or otherwise of little use to the amateur or anyone else not owning a tank or an aircraft carrier. I will not attempt to change that general opinion, but I think it should be pointed out that there *are* some interesting military skyhooks around that might be worth a look-see.

Some of the jeep-mounted whips are passing useful, particularly for Civil Air Patrol or other C.D. use, where a utility type vehicle is to be equipped with radio gear. Several aircraft v.h.f.-u.h.f. antenna designs adapt readily to mobile operations where looks are not paramount. The Aircraft Radio Corp. A-12 is a v.h.f. whip that can be easily trimmed down to 2 meter use. (It is cut originally for the 108-135 mc aircraft band) A.R.C. also made a bent half-wave A-15 on a slightly stronger mount for ice-resistance; this makes a little more streamlined an appearance on your car.

The transmitter-hunters of course are familiar with the several aircraft loop antennas—A.R.C. made the L-10-A and there are several manual and motor-driven Bendix loops in the MN-31, MN-26 and ARN-6, -7 sets. The ARN-6 is a miniature loop in a small glass housing. I find that the smaller and more complex the loop the less useful it is to a ham. The big outside loops by Bendix, and some of the smaller Army loops for tracing enemy signals are the best. The shipboard stuff is almost all too big.

There are some exceptions to the general run of shipboard antennas, but we will get to them later. There are antenna "kits" being disposed-of by the Army, but some of these, particularly for the standard military rhombics, are pretty large for the amateur, and most of the instructions tell you to provide a dozen 40-foot utility poles to hang the things on. If you hanker after this sort

*5716 N. King's Highway, Alexandria, Virginia 22303.

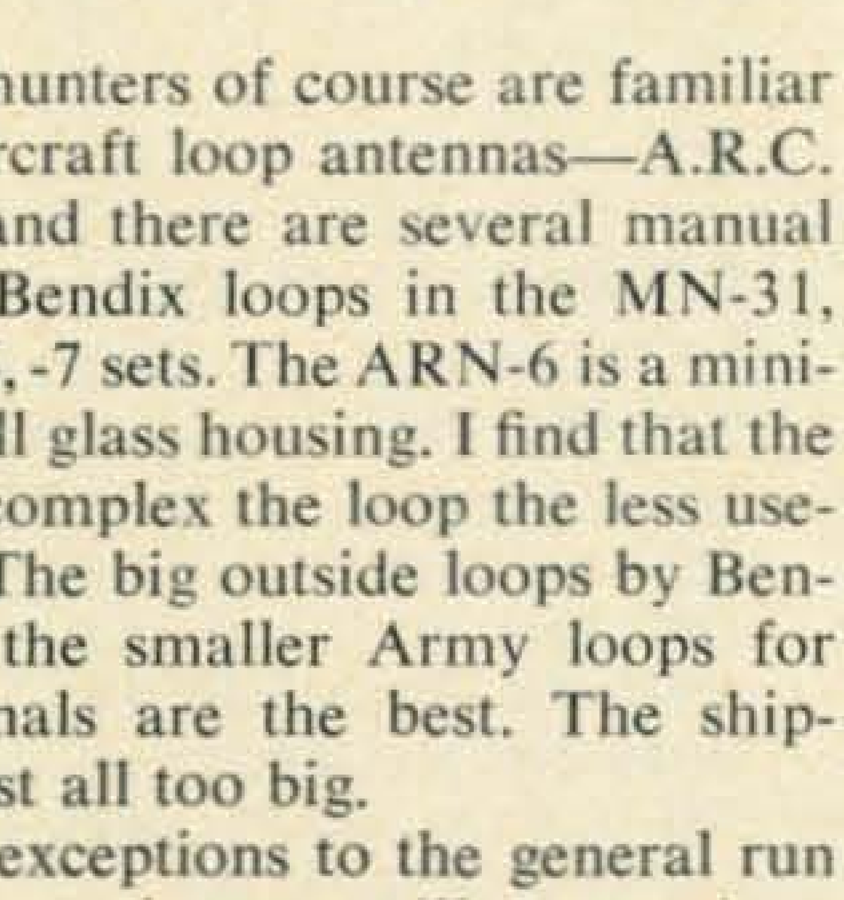


Fig. 1 — The AS-989/ML log periodic antenna, mounted on its 18 foot mast during trials at Ft. Monmouth, N.J. The antenna is rated at an average 6 db gain in the direction of the tip of the cone. It may be mounted for either vertical or horizontal polarization.

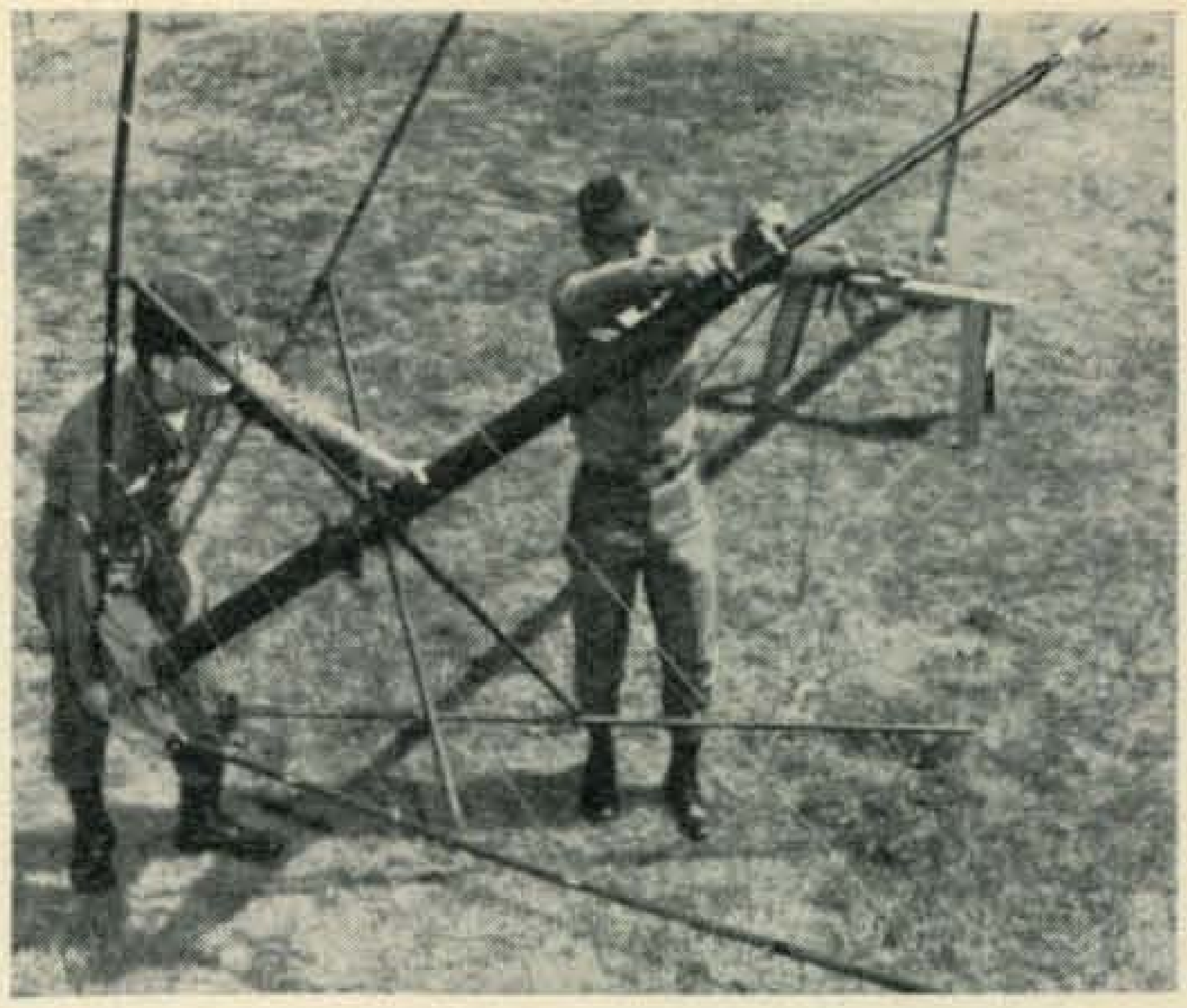


Fig. 2—Army technicians set up the AS-989/ML antenna, which is used in monitoring or jamming operations. Its 60 degree beamwidth makes it easy to align. A rotator could be added for amateur use.

of thing, order TM 11-666 from the Superintendent of Documents for $1.25. It has more than 200 pages of *antennas and radio propagation.*

But as you may have guessed, I have just found a batch of much more interesting surplus antennas, the AS-989/ML. This unit comes complete with a base plate, hinged 18 foot tall mast, boom, stays, wiring and balun, in fact everything but the 50 ohm coax lead-in. The real beauty of the thing though is its frequency coverage: it is built to cover *50 mc through 1200 mc*—yes, that is *a band 1150 mc wide*—with a maximum v.s.w.r. or 2.6:1. If you take only 50-1000 mc the maximum v.s.w.r. drops to 2.3:1 and the average is only about 1.8:1.

This of course is no ordinary military antenna. The AS-989 was designed in 1964 at the Signal Corps' Fort Monmouth, N.J. labs for countermeasures transmitting and receiving equipment. In layman's language that means for listening to the enemy's signals and then trying to jam them. This would be a perfect antenna for the RDO or the AN/APR-4 which covered 38-4000 mc with various plug-in tuning units, or for the CV-253/ALR, a more recent plug-in for the APR-4, covering 38-1000 mc. (The CV-253 has coax connectors for four antennas on its front panel; the designers never believed something like the AS-989 would be built)

As fig. 1 shows, the AS-989/ML is of course a log-periodic design, built in a pyramidal shape. The tip of the cone is a fibreglass structure and the elements are supported by collapsible fibreglass struts. Amateurs have long known that log-periodic designs held great promise, but few have been built, probably because of their inherently difficult construction. The Discone antenna, which has some of the broad-band characteristics of the log-periodic, but an omnidirectional radiation pattern and much less gain, could be said to be a cousin. (See *CQ* July 1949 and July 1950 for articles on the discone.)

The AS-989 is rated to produce a beam width of between 60 and 75 degrees, in either vertical

SURPLUS CORNER

For further information, check number 34, on page 110

For further information, check number 35, on page 110

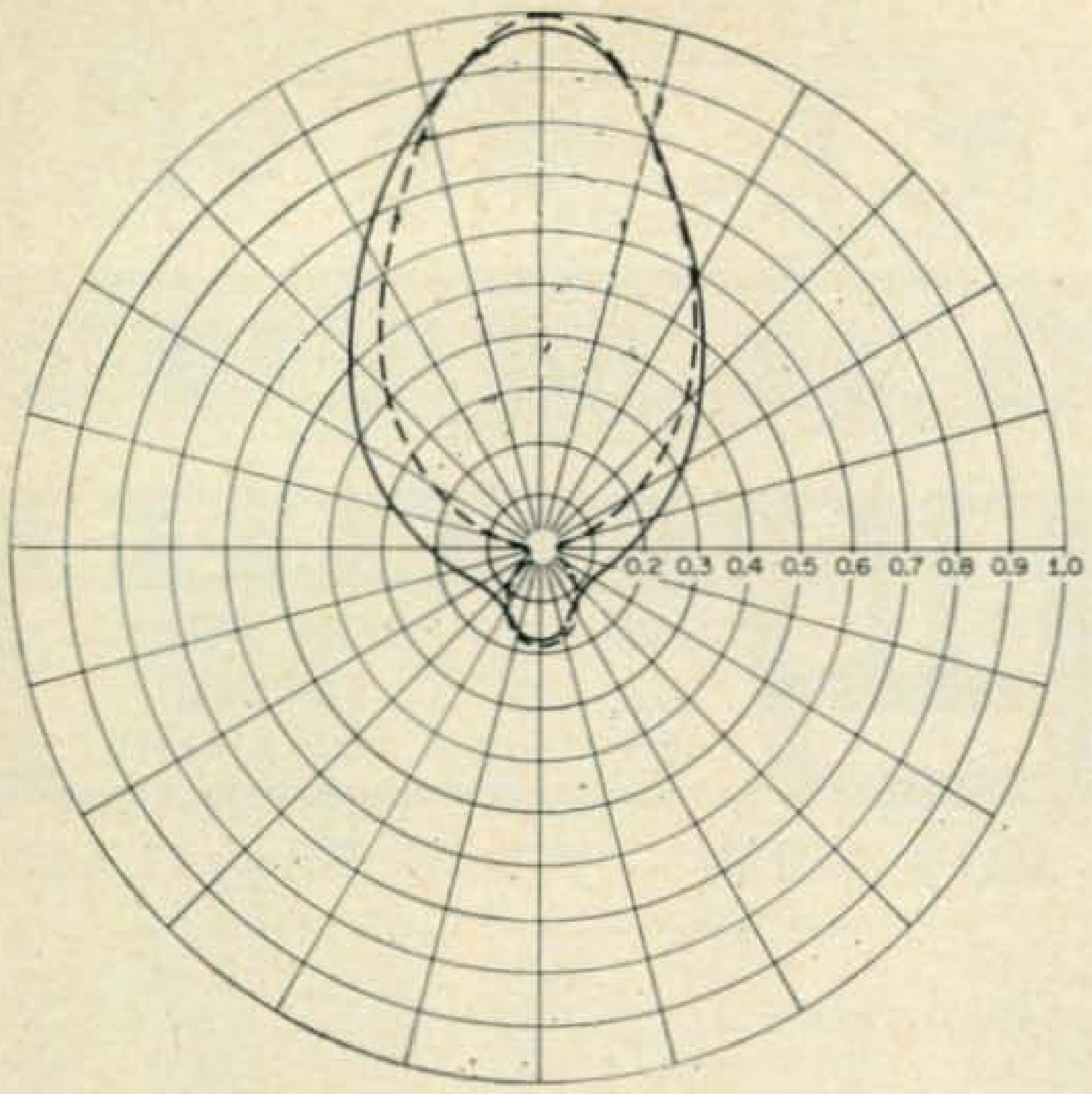


Fig. 3—Polar radiation pattern for the AS-989/ML antenna. Although this pattern was made at 150 mc, there are no significant variations over the entire band, 50 to 1200 mc. Note that vertical and horizontal polarization provide very nearly identical patterns.

or horizontal polarization, depending upon the orientation of the antenna structure when mounted. Its gain over a dipole is an average 6 db and the front-to-back ratio is 10 db.

The unit can handle a kilowatt easily in transmitting. It weighs 178 pounds, and the entire package in two fitted wooden packing crates weighs in at 424 pounds. The Army says it will stand up in a wind of 87 mph.

In case someone thinks I am pulling their leg, let me say that I am completely serious—I have the development file on this antenna from the U.S. Army Signal Research and Development Laboratories, Microwave D/F and Antenna Section, Countermeasures Division, Evans Area, Ft. Monmouth, N.J. to prove it.

Fig. 2 shows the antenna being set up by two Army men, a process that takes about 15 minutes.

Fig. 3 is a polar chart of the AS-989 taken at 150 mc. The 60 mc and 300 mc patterns are virtually identical, and there are no serious differences elsewhere in the band.

Fig. 4 shows the v.s.w.r. over the 50 mc—1200 mc band for the antenna, and as you can see the ratio does jump around with frequency, but for the lower part—below 950 mc—is quite acceptable, averaging well below 1.8:1. Interestingly, the amateur bands at 50, 144, 220 and 432 mc fall into relatively low points on the curve, with v.s.w.r.'s of 1.3; 1.7; 1.2 and 1.65 respectively. For the man who wants to keep an ear on wide chunks of the v.h.f. bands, from the six meter frequencies to the aircraft channels in the 108-135 mc area, the police and fire at 156 mc, and the higher amateur megacycles plus the military aircraft from 220 to 400 mc, this is just the ticket.

The relative broadness of the pattern, the adaptability of the antenna to either vertical or horizontal polarization, and the respectable 6 db gain are all great big plus factors for the log-periodic over dipoles, beams, and the other v.h.f. designs, with the exception of great gain and great directivity in multi-element Yagis and the more complex beams, corner arrays, etc. I have no quarrel with the super-gain antenna gang, particularly for space communications work, but they suffer from quite restricted bandwidths, with astronomical v.s.w.r.'s anywhere except on the precise frequency for which they are cut.

The prime limitations on the frequency covered by such a log periodic antenna are: (1) the size of the elements at the low end, and (2) the ability of the balun to match the transmission line at the high-frequency end. The AS-989 could conceivably be used up to 12,000 mc, or higher—there is no theoretical upper-end cutoff—but the balun sharply degrades performance above the 1200 mc point. The v.s.w.r. goes up, and at least the power-handling capability declines.

The antenna has a characteristic impedance of 180 ohms, balanced, at the mid-point, and the balun supplied is made by tapering about a ten-foot length of RG-17/U coax cable which terminates in a standard type C female connector to match either an RG-17/U or RG-9/U feed line. It might be worthwhile to experiment with an open-wire feedline of 150-180 ohms, or possibly coax such as RG-72/U, RG-114/U, RG-125/U, RG-146/U, which have impedance characteristics in that range, with, of course, appropriate baluns.

The feed point is at the tip of the fibreglass nose cone, and the direction of maximum radiation is outward from the tip of the nose, unlike most other horn-shaped antennas.

I have seen these units, brand new in their packing cases, at Sasco Electronics, 1009 King Street, Alexandria, Virginia, listed at $50. If anyone wants to duplicate the design I will be

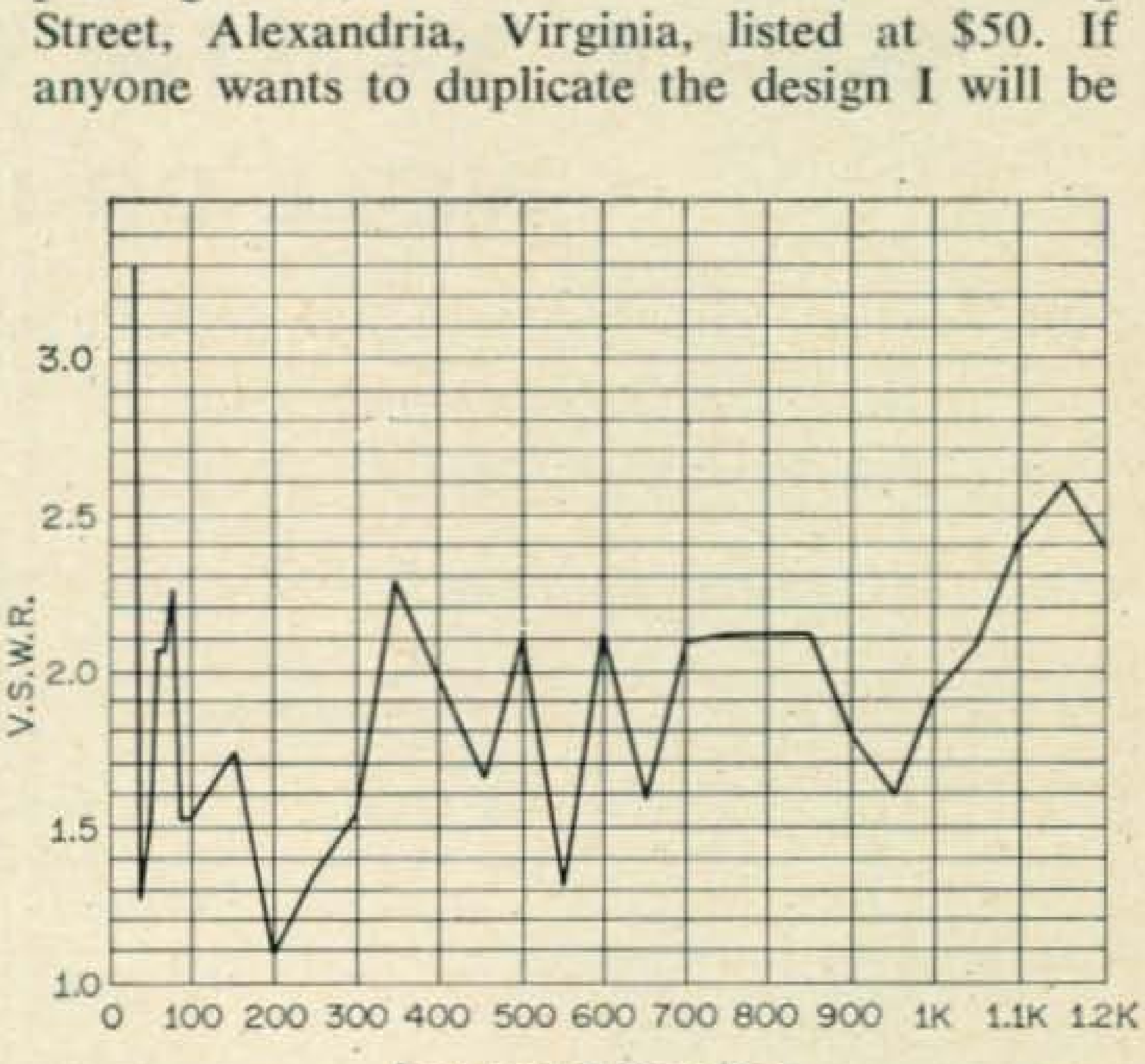


Fig. 4—Diagram of VSWR vs frequency, over the band of the AS-989/ML antenna. The ratio is very high for frequencies below 6 meters, but is no worse than 1.7:1 for any of the amateur bands from 6 meters through 432 mc. There is no theoretical cutoff point at the upper end, but the required balun degrades the v.s.w.r. above 1200 mc.

For further information, check number 49, on page 110

glad to furnish the measurements of the unit, less the balun. Write me, enclosing a SASE.

I have gotten quite a bit of mail recently, particularly on the Boehme 5-C RTTY Converter. The only people I *know* have this unit are at Boehme, 200 Shames Dr., Westbury, L.I., New York. If there are any other dealers who have them I would be happy to mention them in my correspondence.

I have had a good response from readers to my request for information on some of the surplus sets for which the manuals are particularly rare. Clyde Keenan, K7WTQ, and Jim Cooper, W2BVE, sent me several items I had been unable to find here. If anyone else can help with schematics, or the loan of a handbook on the AN/ARR-27, the AN/TRC-7, the T-271/ART-28, the AN/PRC-36, the TS-OAP-1, or the SFO-2 regenerative repeater, I would much appreciate it. Incidentally, I have a card from one Doug Sopher, but he did not include his return address.

I have just made my summer pilgrimage to the New York area, and can report that Radio Row is just about gone, to be replaced by that World Trade Center. The old downtown surplus stores are now scattered all over New York, and it takes a week to make the rounds I used to do in one Saturday morning. Communications Equipment Co., uptown at 343 Canal Street, is still in business, and some of the downtown outlets have relocated in that area.

I stopped in to see Dave Wassermann at Veterans Salvage Co., 323 Market St., Paterson, N.J., and saw some brand new Teletype perforated tape splicers, with base, parts, instructions, all boxed up for $2.95. Haven't seen too many of these around. Dave also has bought a stock of parts for the BC-348 receivers, and can supply i.f. cans, variable condensers, and other mechanical and electronic parts for that old standby set. He has Western Electric lineman's test sets, a real antique, with a big Weston 0-40 volts d.c. meter and other goodies, at $29.95. They weigh 80 pounds in shipping containers.

I note that in my dissertation on the AN/URR-13 and AN/URR-35 v.h.f. receivers in the April 1966 *CQ* I did not mention that the URR-13 is a single-conversion set, the URR-35 is double-conversion. Otherwise the sets are so nearly identical that they cannot be identified as one or the other without the nameplate.

I said I would mention some shipboard antennas that could be used ashore. There may be more, but the AT-150/SRC is a broadband u.h.f. dipole, with mounting mast, for the 200-400 mc band. The AS-390/SRC is a u.h.f. ground plane, also broadband for the 225-400 mc area. The AS-1018/URC is a sleeve-type u.h.f. antenna. The CNA-66147 is the dipole used with the RDZ, an early u.h.f. set, and the NT-66095 is a similar unit, cut for the 100-156 mc band, used first with the AN/ARC-1 on board ship. All of these are useful chiefly for omnidirectional work, and exhibit wide bandwidths and no gain. ■

160 M. Results [*from page 22*]

Hope to enter next year. GD3HQR: The antenna used was my regular one—a Joystick (7½') mounted vertically 12 feet high with 40' feeders and Type 3 Joymatch tuner. Input 10 watts. Not really the set-up for a WW Contest but at least I got a few points. By the way, my total of countries on 160 with the Joystick is 11. Best DX is ZB2.

G5RP: I'm a little disappointed that I didn't do better than a total of 5760 points but I had no success with trans-Atlantic QSOs at all. On the recent "first-timers'" morning I worked VO and W1-2-3 but I was unable to achieve this through the contest QRM. G4MH: Used a 132' vertical supported by a balloon but the wind became too strong the second night so switched over to a 400' longwire. Vertical was 3 S points better. G3GHN: Sorry we still couldn't make it across the pond. Heard plenty of W/VE and HK4EB but no luck. G3IGW: It seems likely that LZ1ARN is a pirate. [We certainly hope he is legit, Mike. It's the first time we have heard of LZ using Top Band—*ed.*]. G2DC: I am not a great fan of this band but I do enjoy firing up my little 9 watt job for this event. Found trans-Atlantic condx fairly poor for this year. My antenna is only a 45' vertical base loaded. Although I get around Europe ok with it, I don't have much luck with real DX. G3HZL: The contest was enjoyed as usual but I didn't try hard enough. Reckon my stamina is failing. Couldn't get up first night and felt too tired to stay up the second—hi!

K5LIW/K5RWK. The "Shack."

EI9J: Well, as they say in G-land the test as far as I was concerned was a "poor show." If only my signal could have been heard as well as I could hear you fellows on Saturday morning it would have been very fb. All USA, except W6/7 which I didn't try ot hear had good signals. The results of my Saturday morning efforts being so poor I didn't think it worth-while losing any sleep on Sunday. DL1FF: Condx have been okay but not up to usual par. Best DX was 9M4LP whom I tried to get for 3 years before finally succeeding. One thing that interested me greatly was to have daylight contacts around noon with OK, OH, HB, G, GM, etc., all over 500 miles. Hadn't tried this before. DL9KRA: Had two 4' balloons in readiness to support a half wave vertical. At 2300Z a friend came over to help with the tedious job of filling them with gas which took 45 minutes. Then off they went into the misty night sky. And then I got a jolt I shall never forget. The wire was charged with static electricity without the presence of dark clouds or a storm. Quite amazing. Reminded me of old Benjamin Franklin.

P.S.: If you boys think condx were on the poor side thank your lucky stars that we escaped this. In early March old Top Band underwent a black-out on Dx which only now is beginning to show some signs of letting up as this is being written (Spring '66). According to our friend Stew (need I say W1BB?) a 35,000-mile-across sunspot was responsible. What do you think of that, eh? 73, Charlie, W2EQS

Globe Duo Bander [*from page 29*]

for v.f.o. dial,[4] r.f. gain control,[5] and c.w. operation.[6] Another missing item that might have been included, however, is a phone jack.

Performance

On the performance side the Duo-Bander 84 shaped up quite nicely. The v.f.o. tuning mechanism was exceptionally smooth, good a.g.c. and a.f. quality were obtained on receive and strong-signal-handling capabilities were excellent. Intelligent sounding a.m. reception also was obtainable by zero-beating with the carrier. For working a.m. stations, not equipped for receiving s.s.b., you can insert carrier with the null control to have a.m. type operation. Fine s.s.b. signal quality also was experienced.[7]

Performance specifications are not given in the manual, so for those interested in statistics, here is what *CQ* Lab measurements turned up: Receiver sensitivity—0.2 μv for 10 db S/N; Unwanted-sideband suppression at 1 kc—38 db; A.g.c. characteristic—fast attack, slow release with only 5 db a.f. output variation with r.f. input signal change of 86 db (1-20,000 μv); Spurious input-signal responses—down at least 70 db; Stability—200 c.p.s. drift from cold start at 72° ambient after 10 minutes, 150 c.p.s. the next 30 minutes and 35 c.p.s. or less per hour thereafter. With ±20% line-voltage shift, the frequency held to less than 5 c.p.s. Banging the cabinet produced no evidence of instability from vibration. On transmit with 120 v.a.c. input line voltage, the r.f. power output (d.c. conditions) was just under 200 watts; approximately 220 watts for s.s.b. p.e.p. Sideband suppression was as on receive, carrier suppression was at least 50 db down.

Power requirements for the unit are as follows: 800 v.d.c. at 400 ma peak (10% regulation from 80 to 400 ma); 325/375 v.d.c. at 200 ma with 10% regulation; minus 100 volts d.c. at 30 ma; 12 v.d.c. at 200 ma and 12 v.d.c. at 5 amperes. These facilities are available with separately purchased 120 v.a.c. or 12 v.d.c. power supplies.

The WRL Duo-Bander 84 is priced at $159.95, less power supply and microphone, but with mobile gimbal mount bracket and hardware. The Model AC-384 power supply for 120 v.a.c. is $79.95. Model AC-48 for only 250 watts p.e.p. is $49.95. The Model DC-384 solid-state mobile supply for 12 v.d.c. is $99.95. The supplier is World Radio Laboratories, Inc., 3415 West Broadway, Council Bluffs, Iowa 51501.

—W2AEF

[4]Exact calibration indexing can be made by internal adjustment at the v.f.o. according to the alignment instructions in the manual.

[5]None is really required with the a.g.c. and signal handling performance of the receiver, but where it is desired to drop the signal-input level, an external r.f. attenuator may be used.

[6]As might be desired in the available range of 7.1-7.2 mc.

[7]With the 80-meter band, it was found possible to also tune the final for output on 40 meters. Proper tuning for 80 is obtained when output is indicated nearest the clockwise end of the control.

ARIES Satellite [*from page 30*]

around the perimeter of the satellite, to give omni-directional radiation. On 432.39 mc, four half-wave slot antennas will be spaced equally around the satellite's perimeter to give omni-directional radiation, while on 1297.17 mc, the beacon transmitter will use a three element collinear array projecting from the top of the package.

Power Supply

Total power to be dissipated by the ARIES satellite will be approximately 28 watts. This power is to be furnished by two batteries, and is to be supplemented by solar cells. To prolong battery life, battery boil off will be prevented by pressurizing the compartments containing the batteries. In addition, the satellite will carry a command receiver which will allow the systems to be turned on and off by commands from a ground control station, to conserve power.

Aries Team

The ARIES project is under the sponsorship of the San Fernando Valley Radio Club, in cooperation with the Project OSCAR Association. Radio amateurs from several other clubs in the Los Angeles area are also participating in the project. Ewell Carter, WA6ZIJ is project coordinator; Howard Mann, WB6AQI and Mike Baugh, WB6IWF (President of the East Whittier Radio Club), are in charge of procurement; WA6ZIJ and Bruce McLincha, WB6NST are building the two meter translator; Jim Rippey, WB6LDF (President of the Lockheed Amateur Radio Club), is in charge of the 1297 mc beacon; the 220 mc beacon is being built by members of the Autonetics Amateur Radio Club; WB6NST is responsible for the 144 mc beacon transmitter; antenna design and development is under the supervision of Don Etheredge, K6UMV/W6DMP (President of the San Fernando Valley Amateur Radio Club); Gus Toures, K7VAU is in charge of constructing the satellite's outer shell; Howard Slack (no call) is responsible for the command circuitry; the command receiver design and construction is in the hands of Bob Kolb, WA6SXC; Don Bain, WA6MRE has the job of fitting the entire package together; John Franz (no call) is developing the telemetry circuits; and Ed Gilbert, W6GAT, Ellis Calkins, WA6OPX, Dick Carroll, WB6GFD, Bill Skellenger, WB6BXJ and Al Ostronics, WB6KZQ are all giving a helping hand.

A good part of the ARIES satellite is now complete. Final testing is about to begin, and it is hoped that the satellite will be turned over to the Project OSCAR Association late this year, for a spring launching. It is planned that the satellite will be placed in a synchronous orbit, and it is expected to have a useful life of up to a year.

You'll hear lots more about the ARIES satellite, as launch time draws near. Meanwhile, more complete information concerning the satellite can be obtained directly from Don Etheredge, K6UMV/W6DMP, President, San Fernando Valley Radio Club, Post Office Box 3151, Van Nuys, California 91407. ■

OSCILLOSCOPES [*from page 61*]

Demodulated patterns produce a very sharp trace of the a.f. waveform which makes them most desirable for close observations. It also has the advantage of not requiring any tuned circuits or r.f. input connections to the scope, provides a high degree of sensitivity and allows a convenient level to be obtained with the amplifier gain control. The r.f. response is limited by the probe characteristics which usually are suitable up to 250 mc or so, making it ideal for use on the v.h.f. bands where conventional methods with most scopes result in r.f. leakage and phase shift that make observations difficult at the higher frequencies. See fig. 10.

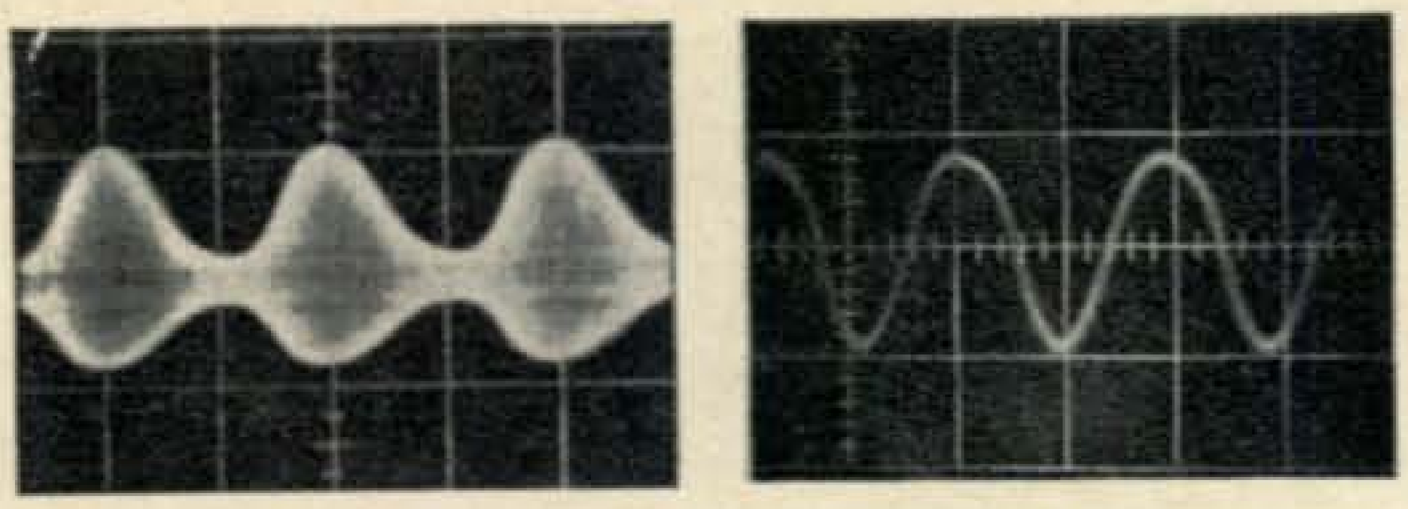


Fig. 10—Comparison between r.f. envelope and demodulated displays of a 144 mc signal. (A) R.f. leakage and phase shift in the oscilloscope circuitry distorts the r.f. envelope display. (B) Same signal is clean using demodulated display.

Input/Output Comparison

As with the trapezoid, input/output comparisons can also be made. With the demodulator probe connected as just described and with a sample of the a.f. modulating signal applied to the horizontal input of the scope, tilted solid-line traces may be obtained like those previously demonstrated with a.f. testing[1]. See fig. 11. If the patterns tend to be elliptical, an a.f. phase-shift affair will be needed at the horizontal input to close up the trace.

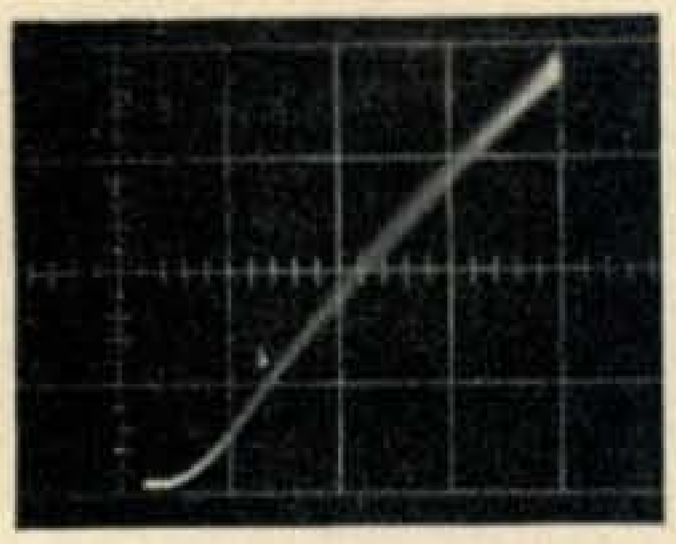


Fig. 11 — Single line input / output comparison display obtained between demodulated r.f. signal and a.f. input signal. Negative-peak overmodulation is indicated by the sharp curve at the lower end.

Flattening at the bottom of the trace indicates modulation in excess of 100% on the negative peaks while a similar effect at the top indicates flattopping or maximum modulation capabilities on the positive peaks. Other distortion is evidenced if additional portions of the trace curve.

S.s.b. and other applications of the oscilloscope will be covered next month.

[1]Scherer, W. M., "The Oscilloscope, Part II," *CQ*, August 1966, page 52, fig. 6.

Amateur Color TV [*from page 56*]

the transmitter antenna, was bought. For still more gain, a transistorized u.h.f. preamp, originally made for commercial CATV purposes, was hastily tuned down to 430. With this preamp at the antenna, the picture was practically noiseless, and did not suffer from ignition interference.

Everything was finally completed a few hours before the meeting began, and, needless to say, the show was a big success. In spite of the provisional setup, the transmitter worked perfectly, without any sign of "show effect." The picture quality was surprisingly good, so all the boys of OH2AJ had a reason to be satisfied. ■

Integrated Circuits [*from page 14*]

Adjustments

After assembly of the receiver is complete, check all wiring to be certain no errors have been made. Particularly, determine that the proper connections have been made to the I.C.'s. Insert the 9 volt battery, observing polarity, and connect a suitable antenna to the antenna terminals. While signals will be heard with a whip or wire antenna, best results will be obtained with a beam or coax antenna connected through a 50-72 ohm line.

To tune the receiver, adjust C_2 and C_3 until the characteristic superregenerative hiss is heard in the speaker. Capacitor C_1 is then tuned to the desired signal frequency, readjusting C_3 as necessary to maintain regeneration. A setting of C_2 will be found where good regeneration can be achieved across the entire tuning range with repeaking of C_3 being the only necessary operating adjustment.

The I.C. superregenerative receiver has all of the virtues, and weaknesses, of its long line of vacuum tube and transistor predecessors. Good DX can be heard at appropriate times on the 10 meter amateur and 11 meter CB bands. Like most superregenerative circuits, however, tuning is fairly broad. The ambitious experimenter can add another tuned WC1146T stage between the antenna and the oscillating detector. This will greatly increase gain and selectivity in the receiver.

Conclusion

There is little doubt that in years to come I.C.'s will find their way into all types of amateur equipment from the speech and vox stages of s.s.b. transmitters to the i.f. and audio sections of sophisticated receivers. For compact portable gear they offer further reduction in weight and size. In all equipment, they will bring greater performance at lower cost to the benefit of the amateur and the hobby.

The writer wishes to acknowledge the valuable assistance of Mr. Len Kudravy, K3ASU, who built the model receiver shown in fig. 5. ■

WN6OLL [*from page 24*]

comer to the screen or television, her singing and acting having been enjoyed by many in dozens of TV spectaculars such as "Ben Casey," "Alfred Hitchcock Presents," "Seventy-Seven Sunset Strip," "Danny Thomas Show," "Alcoa Premier" co-starring with Fred Astaire, "Miracle on 34th Street" with Ed Wynne, "Playhouse Ninety," "Louis Armstrong," "Five Pennies With Danny Kaye," and in "My Three Sons" with Fred Mac-

For further information, check number 20, on page 110

For further information, check number 21, on page 110

For further information, check number 22, on page 110

For further information, check number 39, on page 110

For further information, check number 40, on page 110

Murray.

Susan became interested in amateur radio a number of years ago as a result of her Dad's activities. At that time her mother, Flora, joined the amateur ranks as a Novice with the call WN6OVW. Flora worked her code speed up to 11 wpm, but gave up her studies to help Susan with her acting career, which she started at age 8. Susan is now 16, will be a senior this fall at Hamilton High School, and is a member of the honor society. She is the only girl to have enrolled and completed the electronics course at Hamilton High, where she is active in the school radio club. Susan gets a real thrill out of being able to communicate by c.w.

Bert says Susan has been so busy with school and career she has not yet been able to get her General, but will go after it "with a vengeance" this summer. Flora plans to study with her so they can get their Generals together, and may well have them by the time you read this. The Gordons have two other daughters, Carol, 19, and Patricia, 12. Bert says Patricia plans to go for her Novice this summer and with an aptitude in electronics and music he thinks she will do very well.

Bert, K6APL, has been licensed since 1943 and particularly enjoys ssb operation. His station includes the Collins "S" Line, with Gonset 101 linear amplifier, and Hi-gain Tri-Bander on a 65-foot tower.

In "Picture Mommy Dead" Don Ameche plays the part of Susan's Dad; Zsa Zsa Gabor, who meets a tragic end in the picture, is her mother, and Martha Hyer portrays her stepmother. Bert adds, "I am extremely proud of the wonderful job Susan did in 'Picture Mommy Dead.' The story revolves around the part she plays which calls for her gradual decline into insanity, and is terribly demanding."

"Picture Mommy Dead" is scheduled for release in August, and surely is worth watching for. After observing much of the movie being produced, W6MLZ predicts in his column it will appear on next year's list of Academy of Motion Pictures "Oscar" Awards. ■

Tailored Coverage *[from page 24]*

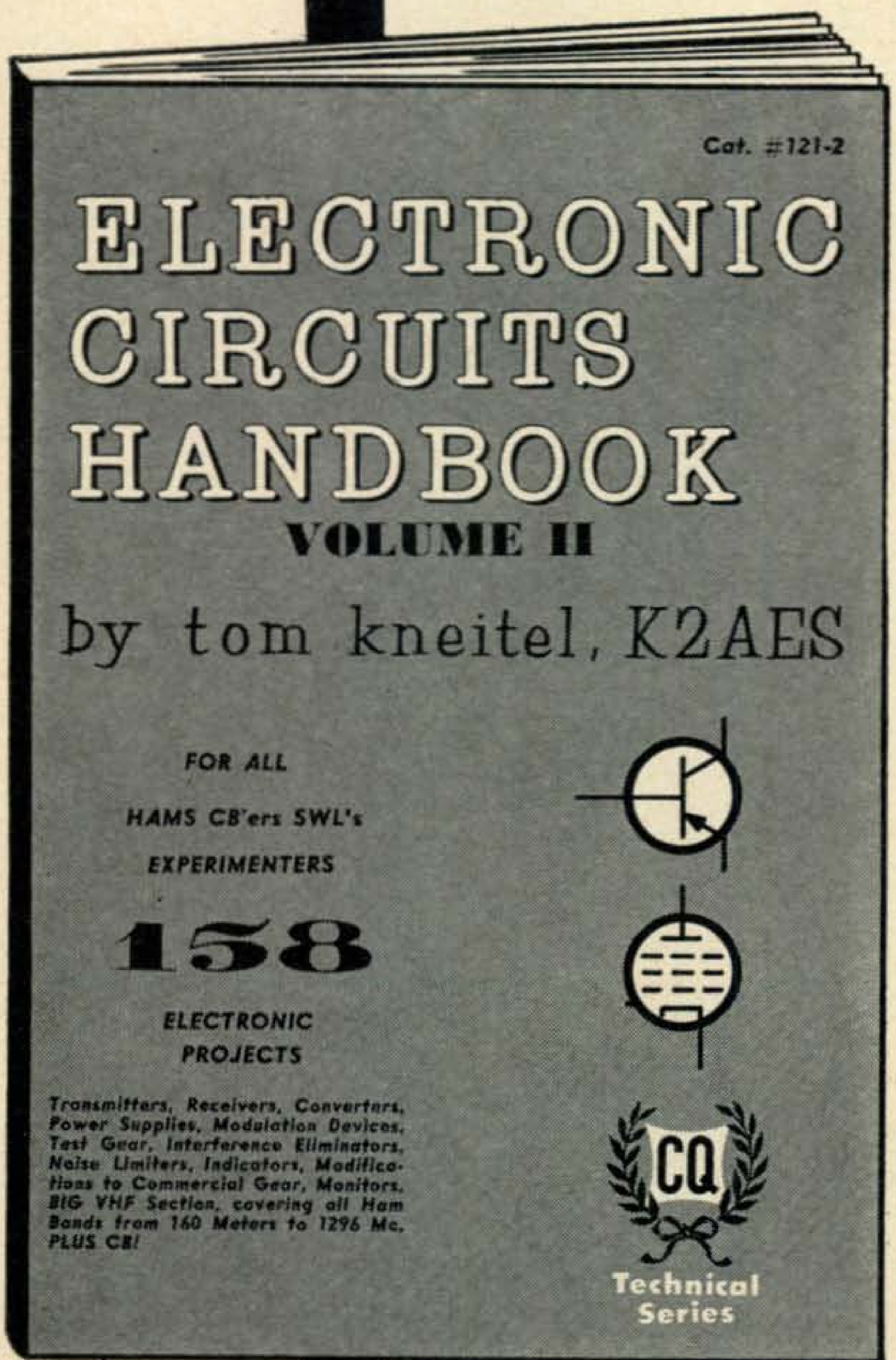
heavy duty masting you don't need any guy wires. Figure 1 shows the construction in detail.

Ordinary TV twin lead was attached at the end of the stub in the center. Mast-type TV feeder insulators were used to bring down the twin lead; behind the mast, we might add. The run was short because as soon as the feeder was brought into the house, a coax balun (26" of RG-59/U) was used to transform the impedance to the 50 ohms required by the f.m. equipment. Foam-type RG-8 coax was then used for the feeder run inside the house.

Performance

The antenna was installed with the top about 45 feet above ground. It was oriented so that the mast was directly between the elements and Poughkeepsie. Figure 2 shows the estimated cov-

ONE MORE TIME



Volume I was a sellout. Here's your chance to get in on the follow-up to the Electronic Circuits Handbook!

Tom Kneitel, K2AES, has dug up 158 more electronic projects aimed at making life in ham radio a snap. Included in Volume II of the Electronic Circuits Handbook are transmitters (1 watt to a kilowatt), receivers, power supplies, modulation devices, test gear, QRM killers, modifications to commercial gear, monitors—all this plus a special added BIG VHF section. There's something here for every band from 160 meters to 1296 mc/s! Keep it around the shack to get you out of that sudden panic when the radio store is closed and all you can rely upon is the overflowing junk box. How many books will give you a poor man's 40 or 80 meter transmitter while simultaneously solving the problem of what to do with that 117N7GT that you've had lying around for 9 years?

Quick, send $3 and we'll rush you an early copy of Electronic Circuits Handbook, Vol. II.

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

Gentlemen: Enclosed is $________ for ____ copy(ies) of the brand new ELECTRONIC CIRCUITS HANDBOOK, Volume II. Please rush me one of the first copies hot off the press!

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

Name ____________________, **Call** ________

Address __________________________

City ____________ **State** ________ **Zip** ____ erage pattern compared to that of a reference omnidirectional dipole. The lower elevation resulted in more than sufficient attenuation of the signals from New Jersey, and the reduced response off the back attenuated the Poughkeepsie repeater enough so that the squelch could be turned in to eliminate the flushing, and, still not prevent hearing most of the locals and mobiles on Long Island. In fact, it was somewhat amazing to find out just how much our local coverage had picked up, compared to the old antenna. By the way, the antenna was mounted in the exact location and with the top at the same height as the old "gainless" antenna we had used prior to the tree installation of the omnidirectional antenna. Beautiful. ■

FET's [*from page 53*]

For mimimum cross-modulation, the instantaneous sum of oscillator and signal voltages should not exceed the pinchoff voltage; the gate should not be driven to conduction or cutoff. When used as a low-level mixer, with signals in the range of microvolts, the peak-to-peak-oscillator voltage can be made just slightly less than the pinchoff voltage, for high conversion gain. When signal levels are higher, such as in a second mixer or product detector, the oscillator voltage must be reduced, which also reduces the conversion gain.

As with vacuum tubes, the conversion conductance of an f.e.t. will be about one-fourth the amplifier transconductance.

Because of the f.e.t.'s relatively high interelectrode capacitances, isolation between signal and oscillator circuits is likely to be poor, resulting in "pulling" and high oscillator radiation. Pulling can be made negligible by interposing an isolation stage, such as a source-follower or emitter-follower, between the oscillator and mixer. Local oscillator radiation should not be a problem if the set is equipped with a tuned r.f. amplifier, but if it is not, a double-tuned antenna transformer is recommended.

As a high-level product detector, the oscillator injection should be reduced, as explained earlier. In addition, it is desirable to use an audio choke or high-impedance audio transformer as a load, rather than a resistor. This will permit a higher drain voltage and current, increasing the signal-handling ability of the detector.

[*To be continued*]

USA-CA [*from page 92*]

HOSA (Worked or Heard Antwerp stations) and the new OSA Maritime Mobile Award. Send s.a.s.e. or s.a.e. and IRC for full details.

It has been a wonderful and busy month, now some more county hunters will be making the 3000 mark! Keep your eye on CONTEST CALENDAR for QSO Party DATA and if you have a POD26 you do not need, let me know. Receipt of wonderful letters from CT1IK, DL9PF, EL2D, G6FO, I1RCD, OZ4H, PY1BLG, VK9GN, 9V1LP, 9V1RS, ZL1AMQ, and Geoff Watts are gratefully acknowledged. How was your month?

73, Ed., W2GT.

Announcements [*from page 11*]

and Bonn, Wichita, Kansas. Write to Guy Wilson, 5531 E. 38th Street, N. Wichita, Kansas, 67220, for full information.

Chicago, Illinois

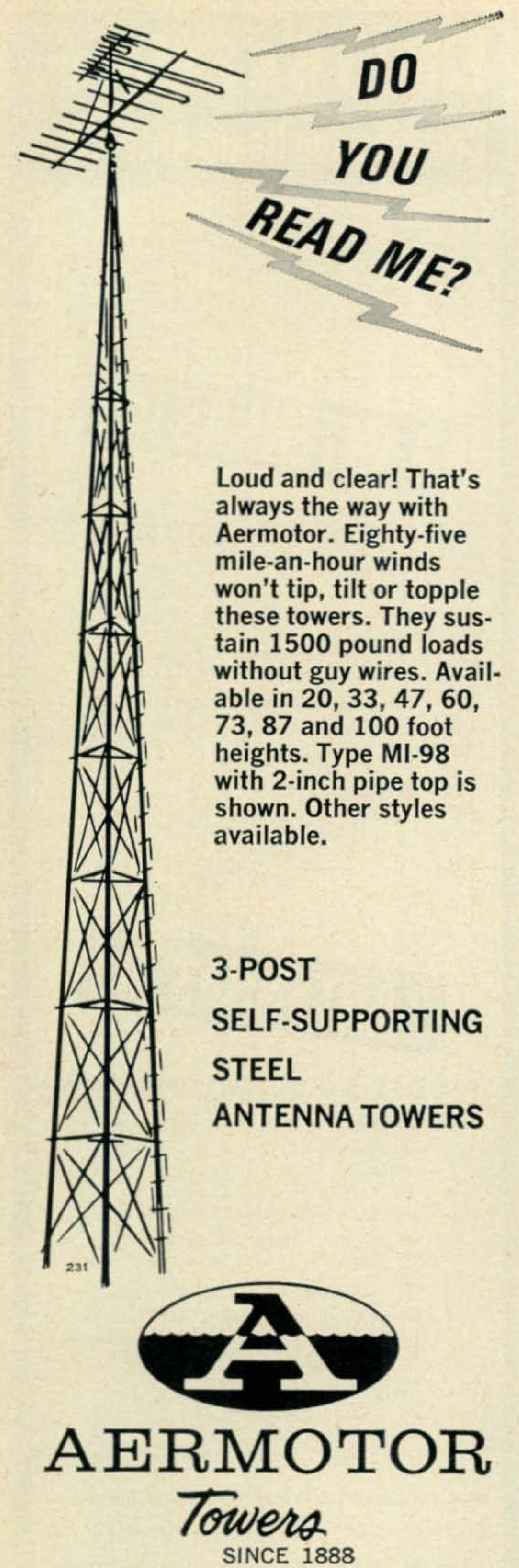
The Chicago Area Teleprinter Society will hold its 12th annual CHI-RTTY meeting and dinner on Sunday, Oct. 2, in Meeting Room Seven of McCormick Place, Chicago, preceding the National Electronics Conference. As usual, no admittance is charged for the meeting. Further information may be obtained from Robert E. Paculat, W9JBT, 1327 N. Hamlin Ave., Chicago, Ill. 60651.

County Hunters

W3AYS will operate in rare Wyoming County during the Pennsylvania QSO Party, Sept. 20 and 21. The following weekend he will operate W/VE in Ontario in Bruce or Grey County and then Mantolin.

25th Anniversary Planned

Al Shelleday, W2RJ, is trying to organize a gathering (25th Anniversary) of the personnel of the 9th Signal Service Company stationed at Fort Shafter, Honolulu, Hawaii radio station WTJ, on 7 December 1941. If anyone has knowledge of the present whereabouts of these fellows, please send a card to Al Shelleday, W2RJ (A2RJ), Box 92, West Milford, N.J., 07480.



For further information, check number 45, on page 110

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $1.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day of the second month preceding date of publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

Direct All Correspondence & Copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050.**

QSL's 3-color glossy. Rutgers Vari-typing Service. Free Samples, Thomas Street, Riegel Ridge, Milford, N.J. 08848.

QSLS, QUALITY PRINTING samples dime, refundable, Johnson, Box 245, St. Paul, Minn.

CB, SWL, QSL, WPE CARDS. $7.50 per 1,000 and up! FREE SAMPLES! ABCD Printing, P.O. Box 658, Edgewater Branch, Cleveland, Ohio 44107.

EMBOSSED QSL CARDS. Free Samples. Ace printing Service, 3298 Fulton Road, Cleveland, Ohio 44109.

HUNDRED QSL's. $1.00. Samples, dime Holland, R3, Box 649, Duluth, Minn. 55803.

QSL-SWL-WPE cards. Samples 10¢. Log sheets, QSL cards, Decals, Rubber Stamps, Certificates. MALGO PRESS, Box 375, Toledo, Ohio 43601.

QSL's BROWNIE-W3CJI . . . 3111 Lehigh, Allentown, Pa. Samples 10¢ with catalogue 25¢.

FREE COPY of totally new HAM PUBLICATION. Send QSL or postcard today. Nothing like it before! HAM'S MARKET NEWSPAPER, Box 13934, Atlanta, Georgia 30324.

WRL's bluebook saves you money! These prices without trades: KWM2—$675.00; NCX—$197.10; GALAXY 300—$161.10; NCL2000—$399.60; HT37—$233.10; HX20—$152.10; GLOBE KING—$179.10 up; 75S1—$278.10; SX117—$206.10; PMR8—$67.50; HQ170C—$197.10; 2A—$161.10. Hundreds more, free list. WRRL, Box 919, Council Bluffs, Iowa 51501.

WANTED: Military, Commercial, SURPLUS . . . Airborne, Ground. Transmitters, Receivers, Testsets, Accessories . . . Especially Collins . . . We Pay Cash and Freight . . . RITCO, Box 156, Annandale, Virginia (703)-560-5480 Coect.

RESEARCH SERVICE—Research bulletins on detailed studies of QRM, Frequency Usage. Incentive Licensing and other subjects. Engineering reports on new ham equipment detailing unbiased best buys. No advertising accepted. Annual subscription $3.00. Amateur Radio Research Service, Box 879, Mesilla Park, New Mexico, 88047.

BUILD A CODETYPER. Transistorized electronic computer-typewriter for Morse teaching or keying your rig with fb fist. For schematic, parts list and technical dope send $2 to Computronics Engineering, Box 6606 Metropolitan Station, Los Angeles 90057.

BARGAINS! Transmitters, receivers offered, wanted in "The Ham Trader." Next 12 interesting issues $1. Sample free. Brand, WA9MBJ, Sycamore, Illinois.

.01% Accurate Audio fork oscillators for RTTY, etc. Box 65, Geneva, Illinois.

SAVE ON ALL NEW OR USED HAM GEAR. Call or write BOB GRIMES, 89 Aspen Road, Swampscott, Mass. 617-598-9700.

WANTED: Laboratory Test Equipment. Electronicraft, Box 13, Binghamton, N.Y. 13902.

NOVICE CRYSTALS 80-40M $1.05 each. Also other freqs. Free list. Nat Stinnette W4AYV, Umatilla, Florida 32784.

"HOSS-Trader," Ed Moory—"need's CASH to buy hay for his ponies. Following Demonstrator equipment with full factory warranty: NCX-5, $509.00; TR-4, $489.00; Swan-350, $349.00; Galaxie 5, $345.00; R-4A, $329.95; NCL-2000, $519.00; KWM-2, $895.00; 75S-3-B, $489.00; 30L-1, $419.00; SB-34, $329.00; New Ham-M Rotor & Demo Mosley TA-33 Beam, $169.00; Demo Ham-M Rotor, $89.95; T4-X $339.00; Package Deal, New NCX-5 & Demo NCL-2000 Reg. Price $1,370.00 CASH price, $995.00. Package Deal, New Swan 350 & Swan Mark-1 2000 Watt Linear Display Model, Regular price, $963.00; CASH price $775.00; Reconditioned Gear: SB-33, $189.00; 32S-3, $499.00; TR-3, $379.00; TERMS: Cash." Ed Moory Wholesale Radio, Box 506, DeWitt, Arkansas, Phone WHitney 6-2820.

RTTY GEAR for sale. Write for list-issued monthly. 88 or 44 Mhy toroids. Five for $1.75, postpaid. Elliott Buchanan W-6-VPC-1067 Mandana Blvd., Oakland, California 94610.

HAVE: 4X500's, 4CX250's, 4X150's. Swap for old toy trains. W3SYT, Rockwell, 8672 Lincoln Blvd., Pittsburgh 15237.

WANTED: Northern Radio Co. Type 105 Models 4&6 Frequency shift Keyers complete with Type 105 Model 4B Power Supplies and NRC Type 108 Model 2 Master Crystal Oscillator-Multipliers. Top prices paid. Jack Bloch, 73-12 35th Avenue, Jackson Heights, N.Y.

FOR SALE: Heath Two-er, six element beam, mike added output meter, coax, manual. $40. W2EEJ, (516) 5V 6-0809.

HALLICRAFTER SX101A. Gud cond. 30.5 MC conv. IF $175.00 firm. Filter King 6M and National 2M conv. for above $12.00 ea. R. Brookes, 2805 Artic Ave., Atlantic City, N.J.

FOR SALE: Hallicrafter SR-46, new, Saturn halo, mobile bumper mount, mobile kit, mike. $110. W2EEJ, (516) IV 6-0809.

SELL: Complete mobile: KWM-2, noise blanker, AC and DC supplies, mounting bracket, microphone, Hustler 80M, 40M, 20M, 15M antennas and mount, package deal, $900.00. HT-32A, new power transformer, $275.00. Louden boomer linear, less power supply, $125.00. Heath HO-1 monitor scope, $50.00. Ham-M rotor, $75.00. Telrex 3-el 15-M beam, optimum, $100.00. Eldico Keyer, EE-3 $25.00. Cushcraft 2M 11-el beam, $5.00. Homebrew KW supply, silicon, variac controlled, $75.00. NC-303, calibrator, $200.00 F.O. Bartholomew, K2EFA, 15 Avonbrook Drive, Blackwood, N.J.

Did You Know

. . . That it cost only 10¢ a word to insert an ad in CQ's Ham Shop? CQ that's right; only 10¢ a word will buy you an ad that will be seen by more active amateurs than *anywhere* else! So why wait to sell that extra piece of gear or those spare parts? Simply send your typewritten copy along with your remittance (10¢ per word minimum $1.00) to: Ham Shop, c/o CQ The Radio Amateurs Journal, 14 Vanderventer Ave., Port Washington, New York 11050. You will find that your ad has more than paid for itself.

Non-commercial ads only

FOR SALE: BC221AE, new, with manual and calibration book. $45. call 516-IV 6-0809. W2EEJ.

FOR SALE: National NC-98, with manual, $55. Write W2EEJ, or phone 516-IV 6-0809.

EICO 753 SSB transceiver with matching power supply. Practically new. Make offer. Dick Stutman, Route 1, Box 602-H, Lakeland, Florida 33803.

6MTR FM: GE and Motorola mobile transmitters with tubes. 50 watts, good condition $15.00 each. Shure mobile microphones hi or lo impedance with spring cord $3.95. Bob Shaffer, W3TRW, 229 Homevale Road, Reisterstown, Maryland 21136.

FOR SALE by original owner HT-37, HT-41, HQ 160 plus all accessories such as T.O. Keyer, Waters compreamp. Etc. All in excellent condition. Prices reasonable. All replies answered immdiately. Write 44 Washington Avenue, River Edge, N.J.

SELL: Instructograph, tapes—$45.00. Complete Rider Code Course—used $5.00. RCA-W.R.-50A Signal Generator from kit—$30.00. Robert Fritz, Bx. 66, Clifford, North Dak. 58016.

VIKING VALIANT II 250 Watt Phone transmitter, never used—Cash & Carry $150. Jr. H.S. 74 Queens, 61-15 Oceania Street, Bayside, N.Y. BA 4-8423.

FOR SALE: Signal generator TS-497B/URR. 2—400 MC. Good condition $250.00, plus shipping. Consider HQ-180, SX-122 or TR-3 in trade. KL7BCO, Box 263, Eagle River, Alaska 99577.

PEORIA HAMFEST September 18, Exposition Gardens, Peoria, Illinois, Peoria Area Amateur Radio Club, Advanced Registration $1.50 Write: Ferrel Lytle, W9DHE, 419 Stonegate Road, Peoria, Illinois.

SELL HW-12 SSB XCVR with home brew AC supply $110.00. Excellent condition unmodified. W4GCR/2 Box 53, Fishers, N.Y. (716) WA 4-2003.

SIGNAL LACK PUNCH?! Carve the pile-ups.! 4-1000A's Guaranteed, $39.95, 2/$75, postpaid, insured. K6Caa, 3408 ViaDona, Lompoc, Calif. 93436.

WANTED—QST's—Last four issues needed to complete private collection. 1916—FEB., MAY, JUNE, JULY. Any reasonable price paid. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., New York 11050.

WANTED . . . Silver dollars. Any condition, will buy or trade. Drop a line if you have any other coins for sale or trade. Scott Cowan, Dept. J5, 73-62 Bell Blvd., Bayside 64, N.Y.

NEW **17TH EDITION** *of the world-famous*

RADIO HANDBOOK

- **Most comprehensive how-to-build-it source**
- **Problem-solver for designers & builders**

Completely revised and enlarged by William I. Orr, W6SAI. This is the comprehensive communications manual which is the industry standard for electronic engineers, technicians, and advanced radio amateurs. Explains in authoritative detail how to design and build all types of radio communications equipment.

LATEST HOW-TO-BUILD DATA

The new 17th Edition of the RADIO HANDBOOK presents design data on the latest amplifiers, transmitters, receivers, and transceivers. Includes greatly enlarged sections on single-sideband equipment and design, and semiconductors. Gives extended coverage to r-f amplifiers, special vacuum-tube circuits, and computers. All equipment described is of modern design, free of TVI-producing problems.

THOROUGHLY REVISED & UPDATED

Provides a complete understanding of the theory and construction of all modern circuitry, semiconductors, antennas, power supplies; full data on workshop practice, test equipment, radio math and calculations. Includes aspects of the industrial and military electronics fields of special interest to the engineer and advanced amateur. The 17th Edition of the RADIO HANDBOOK provides the broadest coverage in the field—complete information on building and operating a comprehensive variety of high-performance equipment. All data is clearly indexed. 832 pages; 6½ x 9¼"; hardbound. Invaluable for amateurs, electronic engineers, and designers.

SAVE SPECIAL PRE-PUBLICATION PRICE!

EE166, New 17th Ed. RADIO HANDBOOK. Special Pre-Publication price until Sept. 30, 1966, Only...... $10.95

(After Sept. 30, 1966, regular price will be $12.95)

Available also in Spanish and Italian editions.

Order from your electronic parts distributor or send coupon below.

EDITORS and ENGINEERS, Ltd.

P.O. Box 68003, New Augusta, Ind., Dept. CQE-9

☐ Ship me EE166, the new 17th Edition RADIO HANDBOOK at the special pre-publication price of $10.95.

$______ enclosed. ☐ Check ☐ Money Order

Name________________

Address________________

City________ State______ Zip______

READER SERVICE

NAME ____________ CALL ________
(Please Print)
ADDRESS ____________
CITY ____________
STATE ____________ ZIP CODE ________

Please send me more information on your ads in the Sept. 1966 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77			Total Inquiries				

Void after Sept. 1966

CQ MAGAZINE, Dept. RS
14 Vanderventer Ave.
Port Washington, L. I., N. Y. 11050

advertisers index

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

Order direct from International Crystal Mfg. Co.

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

INTERNATIONAL

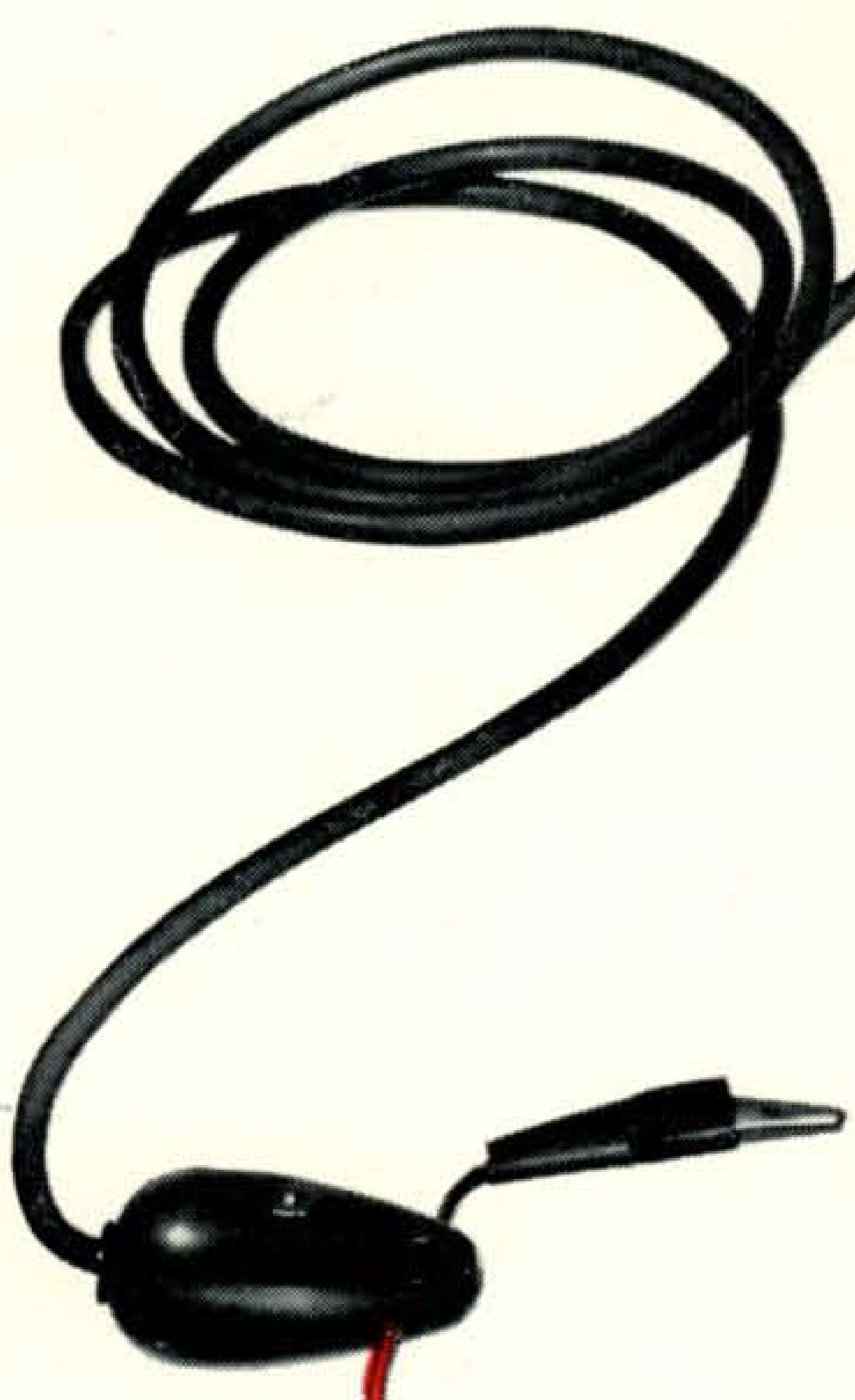
CRYSTAL MFG. CO., INC.

18 NO. LEE · OKLA. CITY, OKLA. 73102

For further information, check number 46, on page 110

For further information, check number 55, on page 110

3 more features —all new



Here is RCA's new WR-50B RF Signal Generator—wired or kit. It looks just like the old WR-50A, but the resemblance ends there. It has all the features you liked in the older model...plus 3 new ones you'll find in red below:

- Wide frequency range from 85kHz to 40MHz in 6 overlapping ranges plus harmonics for higher frequencies
- Built-in crystal calibrating oscillator circuit with front panel crystal socket
- Internal 400 Hz audio oscillator
- *NEW—Sweep output at 10.7 MHz with return trace blanking for sweep alignment of FM receivers*
- *NEW—Sweep output at 455 kHz with return trace blanking for sweep alignment of new transistorized AM radios*
- Individual inductance and capacitance adjustments for each range
- Modulation level control
- Two-step RF attenuator switch plus a continuously-variable attenuator control
- *NEW—additional switch for further attenuation of crystal oscillator output*
- The Optional Distributor Resale Price is only $65.00. Kit Form, $45.00, includes pre-assembled range switch with prealigned coils and trimmers. See the RCA WR-50B at your authorized RCA Test Equipment Distributor.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

RCA

The Most Trusted Name in Electronics

For further information, check number 15, on page 110

Or. . . do you need a new rig for fixed-station use? Or a second or even third rig for vacation or even portable operation? Or a replacement for a single or tri-band transceiver? For that matter, the brand-new National 200 five-band transceiver, at only $359, is a natural for *anything* that demands top-notch SSB, CW, and AM performance on the 80 through 10 meter bands with minimal investment. Traditional National Workmanship and our one-year guarantee are yours, in a five-bander priced even lower than a kit rig!

▪ Complete coverage of the 80 through 10 meter bands. ▪ 200 Watt PEP input on SSB, plus grid-block CW and AM. ▪ Separate product and AM detection plus fast-attack slow-release AGC in all modes. ▪ Crystal-controlled front end and single VFO gives high stability, plus identical calibration and tuning rate on all bands. ▪ Crystal lattice filter for high sideband suppression on transmit, and rejection of adjacent channel QRM on receive . . . plus solid-state balanced modulator for "set-and-forget" carrier suppression. ▪ Operates from new low-cost AC-200 supply ($75.00) or from NCX-A or mobile power supplies. ▪ Extra features like: ALC; 45:1 planetary/split gear tuning drive; automatic carrier insertion in AM and CW modes; universal mobile mount included.

Your dealer has the National 200 in stock right now. See him today for a demonstration.

New National 200, of course.

NATIONAL RADIO COMPANY, INC., *37 Washington St., Melrose, Mass. 02176*

For further information, check number 14, on page 110