SEASON'S GREETINGS

CQ

December 1968

75¢

In this issue

- Varactor Frequency Multipliers
- Dual-Gate MOSFETs
- Keeping the Volt Legal
- Continuous Motion Narrow-Band TV
- Updating the 51J Receivers

The Radio Amateur's Journal

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DECEMBER, 1968 VOL. 24, No. 12

CQ

The Radio Amateur's Journal

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DEPARTMENTS

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See page 122 for New Reader Service

NEW FROM INTERNATIONAL

FM-2400 FREQUENCY METER

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- Portable . . . Use It Anywhere

The FM-2400 is designed for testing and adjustment of mobile and base station transmitters and receivers at predetermined frequencies between 25 and 470 MHz. The FM-2400 provides an accurate standard frequency signal to which the transmitter can be compared. This same signal is applied to the associated receiver(s), thereby assuring an accurate frequency adjustment on all parts of the communications system.

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See page 122 for New Reader Service

ZERO BIAS

ONE of the fundamental pleasures of hamming, indeed a way of life to most active amateurs, is the local ham convention. What amateur hasn't attended one or more of these during the last year, renewing acquaintances with old friends, browsing through the dozens of equipment exhibits, occasionally listening to one of the technical talks, and in general getting just a little bit closer to his fellow hams? Now, it seems, there's a move afoot to put an end to such activity. Who's behind this move? Surprise, surprise—it's that champion of the amateur, the scourge of the commercial vested interests, Wayne Green, publisher of *73*.

During the past few months we've received copies of letters on the *73* letterhead, signed by Wayne himself, which have been duplicated and mailed to dozens of major manufacturers and distributors. The first of these, entitled, "Exhibiting at Conventions," goes into great detail as to how expensive such conventions are for the exhibitors, how little real benefit is derived financially, and in general how much time and labor they consume. The classic paragraph in the letter reads: "Now . . . the commercial. Let's suppose that you took a bundle of this same money and spent it on my favorite charity: *73*. You could run full page ads for seven months for the $2000 you spent on the show."

The second letter, entitled, "Subject: Prizes," was received by advertisers during the same month. The content attempts to convince the advertiser not to donate prizes to conventions, and winds up with this paragraph opener: "Are prizes really necessary for a hamfest? I notice that the attendance of the successful hamfests is growing each year though no advertising of prizes has been allowed by post office law. If a hamfest is fun the fellows will come. If it isn't fun not even prizes will drag the crowds in."

Obviously Mr. Green has missed a vital point. It costs money to put ham conventions together, lots of money. And the exhibitors' costs for attending as well as the prizes donated cover a small portion of the costs. What's more, most manufacturers and distributors welcome the opportunity to meet their customers face to face. They also feel that the good will generated by attendance and prize donations is worth the effort.

It's interesting to note that *73* magazine has been buying booth space in far fewer conventions the past few years, but they haven't missed out on the chance to sell subscriptions at the shows by letting the local convention committees set up sales agents for them on a percentage basis. Nor has Wayne turned down opportunities to speak at conventions despite his lack of interest in supporting them financially as an exhibitor.

We wonder what Mr. Green's next idea for the industry will be if he is successful in sabotaging the convention system. Perhaps he'll recommend that all ham gear be FCC type approved. That would kill off all building and force hams to buy their gear from his advertisers. At any rate, we think he's way off base.

CQ supports ham conventions, and always has. We attend those that are economically feasible as exhibitors, we send speakers to others, and we donate prizes to others still. We admit that we don't make a profit on hamfests, but we do try to generate a little extra good will and togetherness with our readers. Mr. Green knew that conventions were a part of amateur radio when he launched *73*, and he didn't hesitate to attend as many conventions as possible to build circulation. Now, it seems that the shoe is on the other foot. It's not financially to *73*'s best interests to support conventions, so let's get rid of them, he suggests. How typical.

Our Cover

Milton Mann, W9PRH, again supplies us with a front cover photo, this time from Formosa. Milt felt that the stark contrast between the massive 20 meter yagi on his stainless steel perch, and the farmer tilling a rice paddy behind a water buffalo was classic to the present-day Far East. Unfortunately, the identity of the beam's owner remains a mystery to Milt, and so, also to us.

Despite the un-Christmasy cover and mood of this page, may we wish you all a Very Merry Christmas from the entire *CQ* staff.

See Page 122 for New Reader Service

VALUE ANALYSIS

From 80 meters . . .

SWAN 508 FULL COVERAGE EXTERNAL VFO

The Model 508 Frequency Control Unit is designed for full coverage of 80, 40, 20, 15, and 10 meters. It provides for transmitting and receiving on separate frequencies, and plugs directly into the back of the 500C. A separate Dual-VFO adaptor is no longer required, since the relay control circuitry is built into the 508. A panel control permits selection of VFO's so that operation may be transceive mode with the 500C VFO, transceive with the 508 VFO, or transmit on the 500C and receive on the 508. The Model 508 features eight ranges of 500 kc each, with 5 kc calibration. It may also be used with the 350C transceiver.

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MODEL 510X (less crystals) . . $45

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80 through 10 meters • 520 watts • Home station, mobile, portable operation • SSB-CW-AM.

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mous model 250 is a consistent winner in VHF competition 250C is designed to set new records! We are confident that 0C will satisfy the most critical requirements of the serious perator.

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SPECIFICATIONS:

- uency Range: 50-54 MC
- er Rating: 240 watts PEP t in SSB mode, 180 watts nput, 75 watts AM input
- 6146 B Power output tubes
- rtion Products: down ap- . 30 db
- nted Sideband: down more 40 db
- er Suppression: better than b
- eiver Noise Figure: Better 3 db, with two 6CW4 nu- ors in Cascode
- ctivity: 2.8KC at 6 db down, crystal lattice filter at MC.
- nna Matching: Wide range twork.
- ring circuits: S-meter on ive mode, P.A. Cathode ent and relative output in mit mode.
- KC Crystal calibrator
- ctable upper and lower band
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Model 117XC **$105**

12 VOLT DC SUPPLY
Model 14-117 .... **$130**

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Model 210 .... **$120**

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PHONE PATCH
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FOR 2 METERS \N TV2 TRANSVERTER

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OUR READERS SAY

SB-34 Improvements

Editor, *CQ:*

In reference to an excellent article in September *CQ*, "The SBE 34 transceiver, Expanded Coverage and Convenience" by John J. Schultz, W2EEY/1, the author says "Some articles have described c.w. conversions involving outboard accessories but did not describe how to change the frequency coverage to include all of the c.w. portions of each band."

I wish to point out that the latter portion of this statement is not true in that in my article in your magazine for 1966 you will find an identical conversion scheme. One can even eliminate the 150 ohm dropping resistor by using a 36 volt relay, Potter and Brumfield of course.

In extensive pre-article correspondence with SBE I was impressed with the warning that any tampering of design parameters immediately voids their guarantee. This is especially true with respect to unpredictable duty cycles encountered in c.w., but particularly so in the matter of spurious beats which may occur outside of the ham bands. A spectrum analyzer was recommended.

In defense of ham equipment manufacturers it behooves conversion article authors, especially so where a model still is in current production, that a disclaimer must be implied or explicitly stated with respect to guarantees.

Katashi Nose, KH6IJ/1
Belmont, Mass.

P.S.: My SBE 34 has been on mobile c.w. now for 5 years, far exceeding SBE's warnings. However, I am changing over to the Schultz' keying method.

The Challenge to Newcomers

Editor,*CQ*

Your September editorial was excellent and I sent it to my Division director with some suggestions for ARRL.

Your October editorial bothers me. Ham radio may lack heroes, compared to auto racing or golf, but this is because it is not, and cannot be, a spectator sport whose journalists concoct heroes. Ham radio is as much of a participant sport as fishing, pursued by individuals and boring to spectators.

However, important individual contributors are identifiable. *My* hero is W4HHK, the first to bounce a ham signal off the moon.

You correctly noted in your September editorial that today's youth are better educated to meet the challenges they relish. They are also, however, much more discriminating about the challenges they take up, much more conscious of their own personal development and contribution to public good. And they are more sensitive to the appropriate use of public resources, such as the radio spectrum.

If you journalists glorify the wrong activities, you will repel the most desireable of the potential hams, not attract them. They will feel that they cannot accept ham radio's value system.

I propose the following as the best selling point for the kind of people you described in September.

1. Technical innovation–moonbounce, s.h.f., satellites, lasers, etc.

2. International person-to-person communication, not QSL collecting, but learning about other people and enhancing international understanding.

3. Emergency community service and improving personal operating skills.

In fact, I daresay that most of the public thinks that these are he activiies which most hams pursue. They certainly are the most saleable as dramatic and challenging activities for modern young people. After all, what other avocation combines the technical challenges of electronics with international conversation?

How will you justify certificate hunting as the best use of public resources, if you are asked by an intelligent prospective ham? It has no connection with two of the items above, and appears to interfere with leisurely person-to-person international communication.

Thomas E. Coates, WA8FQJ
Englewood, Ohio

Editor, *CQ*

You are Scratchi-ing the wrong itch, and the wrong mosquito bite. If you think that you have found the reason for a lack of interest in Ham Radio for the newcomber youngster.

In my estimation the reasons are the following:

Citizen band youngsters are running around, mobile, with 100 watt linear amplifiers, working 11 meter skip with no police force of any kind to stop them. 11 meters is wide open; why study for a test when you can have a good part of the benefits without bothering? Give 11 meters back to the Hams and interest in Ham radio will increase.

Unfortunately, our youth is more interested in long hair, smoking pot and in *S*ugar *E*asy *X*-Ray than in technical electronics or c.w. They have grown up with radio and television as a thing to be taken for granted. There is no marvel or wonder in picking up a mike and talking to a brother ham 2000 miles away. These kids were brought up with a TV set in their rooms since they were two years old. There is no wonder or amazement (as the older generations had) in the magic of communications.

Unfortunately, the younger generation has been brought up with a silver spoon in their collective mouths. Big Daddy in Washington is going to take care of them from the cradle to the grave. Big daddy at home is going to give them their sports car, etc. Why bother to work for a ticket when you can have a good time without working for anything. Incentive is gone.

This is part of the moral deterioration of our

See page 122 for New Reader Service

NEW DRAKE MODEL TR-6 6-M SIDEBAND TRANSCEIVER

Model TR-6 **$599.95** Amateur Net

COMPARE THESE FEATURES

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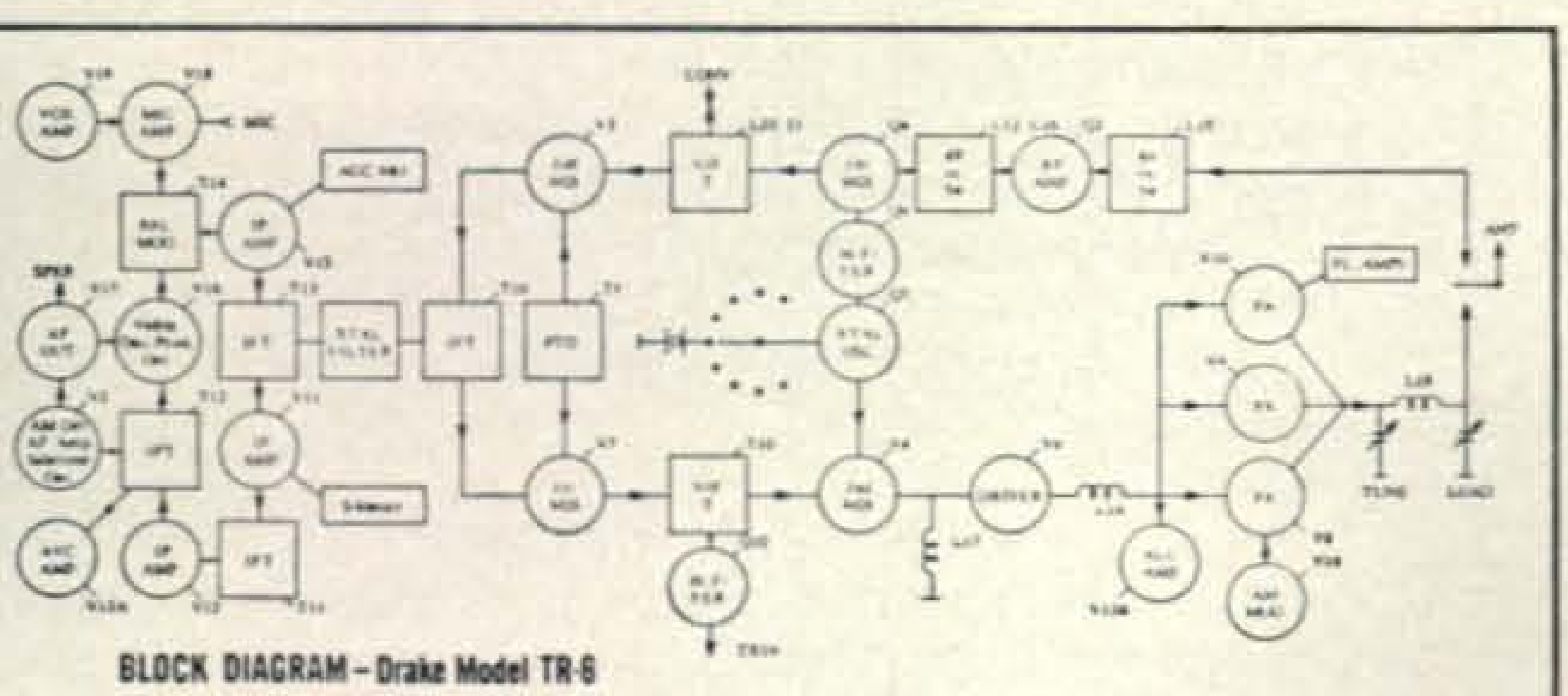

BLOCK DIAGRAM—Drake Model TR-6

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FREQUENCY COVERAGE: 49.4 to 54.0 MHz (crystals supplied for 49.9 to 51.1 only).
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CALIBRATOR: 100 kHz calibrator built in.
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RECEIVER SPECIFICATIONS

SENSITIVITY: Less than 1/10 microvolt for 10 db S+N/N ratio at 2.4 kHz band width.
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INPUT: 50 ohms unbalanced.
OUTPUT: 4 ohms to speaker or headphones.
AUDIO OUTPUT POWER: 2 watts at 10% HD.
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MANUAL GAIN CONTROLS: RF gain control sets threshold for AVC, AF gain control.
DETECTORS: Switch on front panel. Product detector for SSB and CW Envelope detector for AM.
NOISE BLANKER: On-off switch for accessory noise blanker on front panel.
INPUT: 13.9 to 14.5 MHz receiving input/output jack for converters and/or outboard IF receivers.

TRANSMITTER SPECIFICATIONS

POWER INPUT: 300 W PEP on SSB, 300 W PEP on AM. 300 W CW (50% maximum duty cycle).
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MODES: SSB (USB provided, LSB with accessory filter), AM (controlled carrier system), CW (semi-break in, Sidetone).
AMPLIFIED AGC: Prevents flat-topping.
CARRIER INSERTION AND SHIFT: Automatic on AM and CW, shifted carrier CW system.
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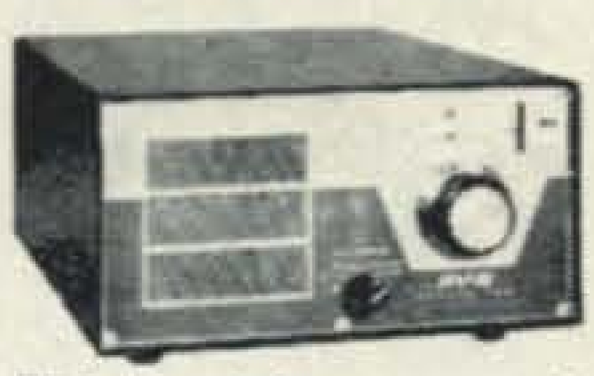
14 MHz OUTPUT: 13.9 to 14.5 MHz output for Drake TC-2 and other transverters.



TR-6 ACCESSORIES

RV6 Remote VFO. Separates receive and transmit frequencies within the same range . . . **$99.95**
FF1 Fixed frequency adaptor **$24.50**
MMK-3 Mobile mounting kit **$6.95**
Power supplies
- **AC-4** 120 V 50/60 Hz **$99.95**
- **DC-4** 12 VDC **$125.00**
- **DC-24** 24 VDC **$210.00**

MS-4 Matching speaker **$19.95**

See page 122 for New Reader Service

times and no half-cocked scheme about heroes or accomplishments as you suggest in Zero-Bias, is going to give kids a backbone.

Paul Ninken, W2WDH
Hewlett, N.Y.

A Novice Speaks

Editor, *CQ*

In the September issue of *CQ* you announced the FCC's rejection of the EIA's Novice proposals. I am 14, and have been licensed for four months. The EIA proposals were an affront to the intelligence of the modern teen-ager. An average 10 year old, with a little study, could pass the present Novice exam. If it weren't for the help of KG6AQT and WØAHH/KCG, I would not have been licensed. Let's get involved and recruit. Many of my friends, after viewing the rig, ask me how to get a ticket. I know that two of them are studying for licenses since then. Is it too much trouble to give a youngster a tour of the shack and say Hi on a ragchew net?

Another peeve of mine is the guy who thinks he's a great RXer because he has a six element beam up to 150' and a double kilowatt, which he uses to block out every low power signal on the band. I had to put up with a gang of these lads til I got another crystal. Most hams are very nice about giving the low power man a chance but the few skunks should taste some of their own guff. It's a handful like that who make 15 meters a battleground.

Kenneth Smyth, WN2WXR/WG6
F.P.O., San Francisco, Calif.

Announcements

Las Vegas, Nevada

"SAROC" Fourth National Fun Convention Jan. 8-12, 1969 in Hotel Sahara's new Space Convention Center, Las Vegas, Nevada. Advance registration $12.00 per person. Special $10.00 plus room tax per night for accomodations single or double. Ask any "SAROC" veteran or QSP QSL to Box 73, Boulder City, Nev. 89005.

New York Club Formed

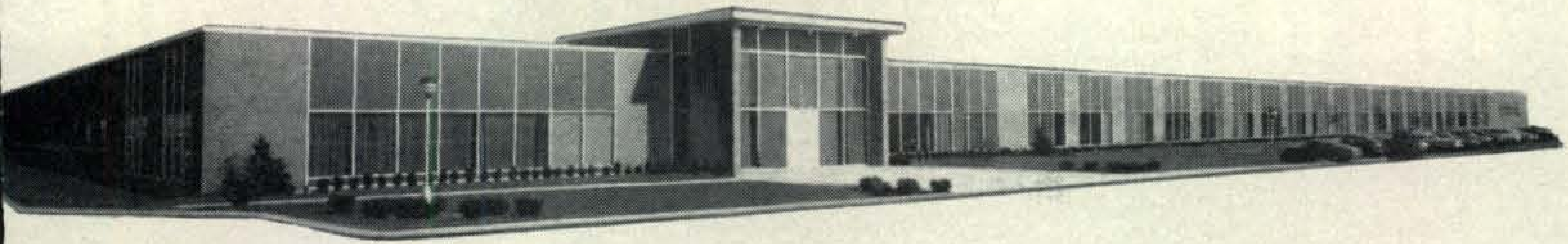
In Manhattan, Novices and other young hams announce the formation of the "Lower East Side Radio Amateurs Club." However, due to lack of funds at this time, they cannot start a club station. Any outdated or unwanted equipment would be greatly appreciated. They will pay all shipping costs. Mr. Z. Sawicki, 34½ St. Mark's Place, New York 10003 is president and the man to contact.

Gary, Indiana

The Lake County Amateur Radio Club announces its 16th Annual Banquet to be held at Teibel's Restaurant, U.S. 30 and 41 (near Schererville, Indiana), at 6:30 P.M., CST, February 8. Chicken dinner, entertainment and speeches. Plan to attend with your wife or girl friend. Tickets $4.00 each from Herbert S. Brier, W9EGQ, 385 Johnson St., Gary, Indiana 46402. Positiviely no tickets sold at door.

See page 122 for New Reader Service

's our first anniversary at 42° 06′ 07″ N and 88° 01′ 58″ W.



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Save $80 on the SR-46A Six Meter Transceiver complete with S-meter and mobile/base power supply. Regularly $199.95. Now only $119.95. Accessory HA-26 VFO and MR-40 Mounting Kit available at similar savings.

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Save $145 on the 175 watt HT-46 Five Band Transmitter with crystal filter SSB/CW operation and built-in power supply. Regularly $395. Celebration priced at $250.

See your favorite distributor NOW!

SALE ENDS JANUARY 1, 1969.

P.S. While you're there, check out the unequaled SR-400 and "simultaneous dual receive" HA-20.

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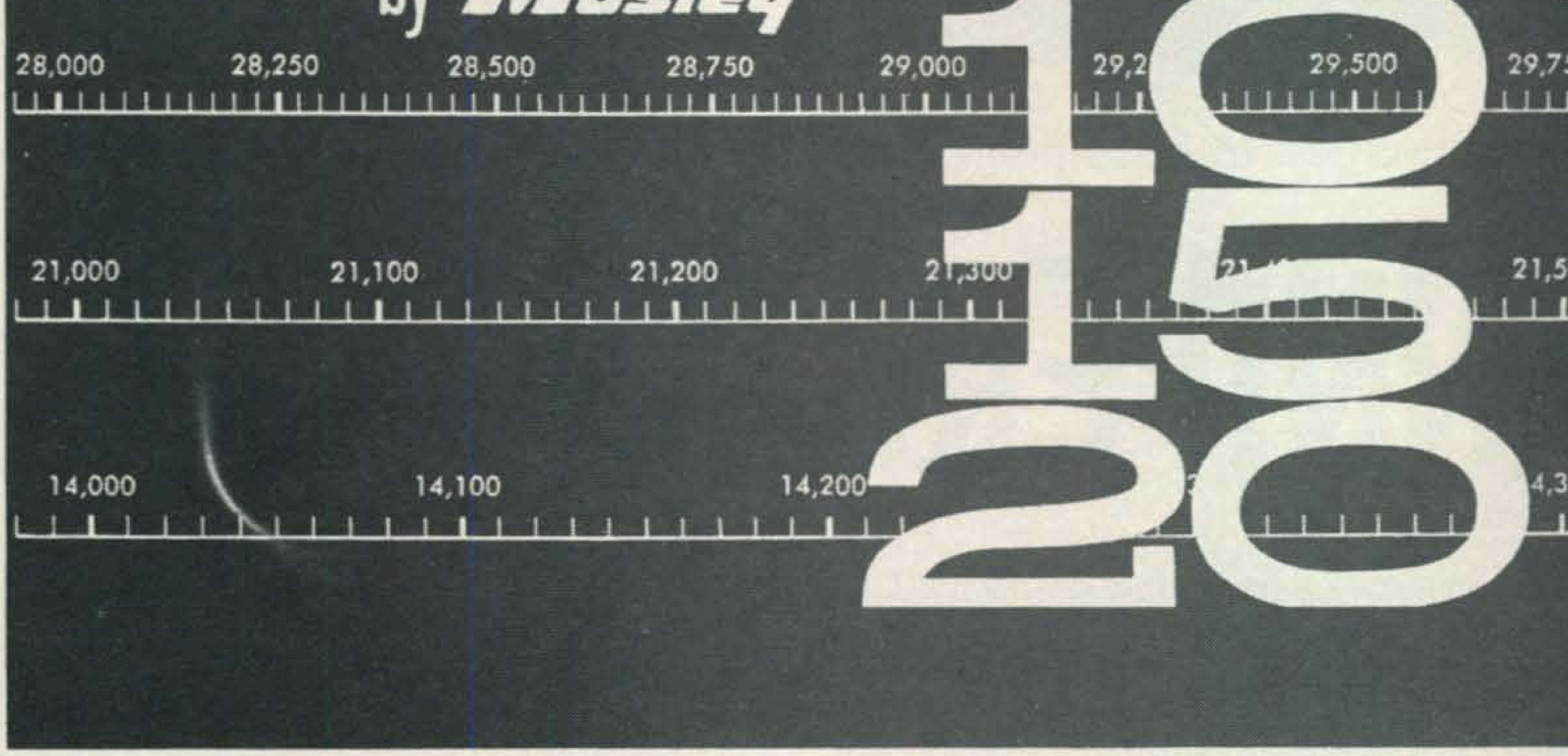
NEW | Cubical Quads by Mosley



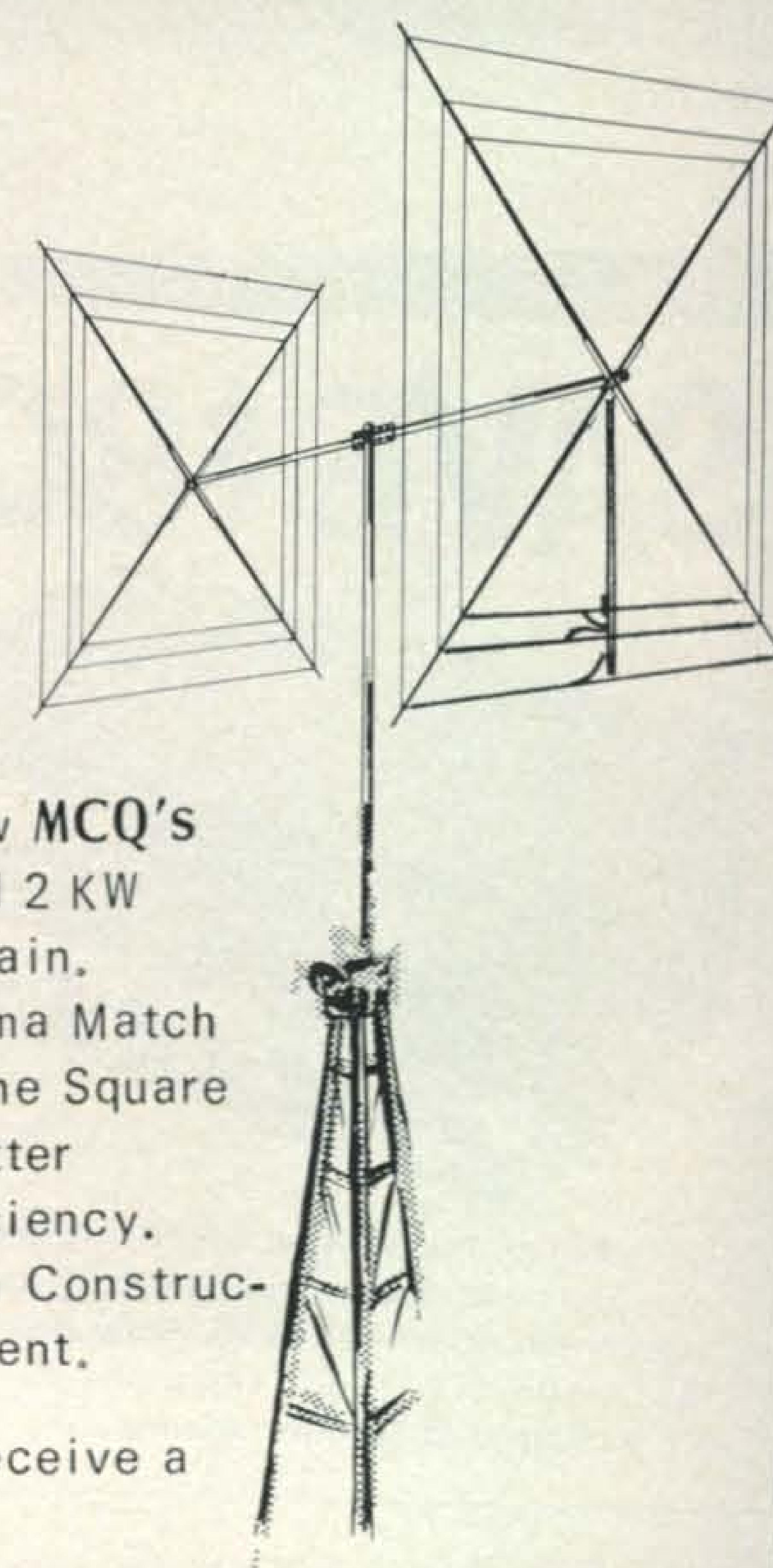
Four NEW Two-Element QUADS

SINGLE BAND QUADS

Model MCQ-10 for 10 meters
Model MCQ-15 for 15 meters
Model MCQ-20 for 20 meters

TRI-BAND QUAD

Model MCQ-3B for 10, 15 & 20 meters



Designed and Engineered for Superior DX, the new **MCQ's (Mosley Cubical Quads)** are rated to 1 KW AM and 2 KW P.E.P. SSB. Maximum Front-to-Back and Forward Gain. A Single 52 ohm Line feeds the Quads via a Gamma Match resulting in a low SWR over the full bandwidth. The Square Configuration of the **MCQ** Series guarantees better performance by providing optimum electrical efficiency. The Durable, Lightweight, Weatherproof Aluminum Construction yields a lifetime of maintenance-free enjoyment.

For detailed brochure, Write Dept. 169 . . . and receive a **FREE** 1968/69 Mosley Antenna Catalog.

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See page 122 for New Reader Service

An Inexpensive Varactor Frequency Multiplier

BY E. G. VON WALD,* W4YOT

THERE must be a lot of single and tri-band rigs around that leave out ten and fifteen meters, the best DX bands these days. If the station has a receiver that will take care of that end of it, the transmitters can be converted for a.m. and c.w. inexpensively and with good efficiency by using a varactor frequency multiplier.

Now, varactors come rather high, in cost. They are designed for v.h.f. and u.h.f., and they start at around twenty-seven dollars for a unit that will dissipate only ten watts.

Happily, diffused silicon power rectifiers will do just about as well, in the frequency range indicated, at least, and they cost far less. For instance, an equivalent unit to the low power varactor mentioned above is the Motorola HEP 153, which sells for $1.24 at the distributor.

Principles

For the benefit of those who aren't familiar with them, let's take a quick look at how varactor frequency multipliers work.

To begin with, the varactor itself is nothing but a back-biased semiconductor diode that behaves like a variable capacitor. The capacitance is a non-linear function of the voltage across it. It is this non-linearity which generates the desired harmonics, just as non-linearity in any system will do. Of course, the diode is not a pure reactance. There is a certain amount of loss resistance inherent in the material of the semiconductor, but this is small (in the order of one ohm) and therefore the harmonic generating efficiency can be made high, typically better than 70% for doubling, scaling down to between 50% and 60% for quadrupling.

In principle, the circuit for a frequency doubler has a series input tank tuned to the fundamental, in parallel with a series output tank tuned to the second harmonic, with the varactor shunting them both as illustrated in fig. 1(A). That resistor across the varactor provides self-bias, which automatically adjusts itself to varying levels of input signal amplitude, and permits using the multiplier on a.m. as well as c.w.

You can use this circuit for higher order harmonics, but the efficiency will be considerably improved if a third tank is added as in fig. 1(B). This extra tank is called an idler tank, a misnomer if there ever was one. The idler is far from being a loafer. It is a selective reservoir for second harmonic energy. When the circuit is being used as a tripler, the second harmonic energy circulates back through the varactor where it mixes with the fundamental (that non-linearity is just as good for efficient mixing as it is for harmonic generation). In quadrupling, the second harmonic energy is simply doubled again by the varactor. The output tank selects the desired harmonic and delivers it to the load.

Practice, however, is usually more complicated than principle, and this is no exception. See fig. 2 for the actual tripler-quadrupler

* 7 South Dixie, Lake Worth, Florida 33460.

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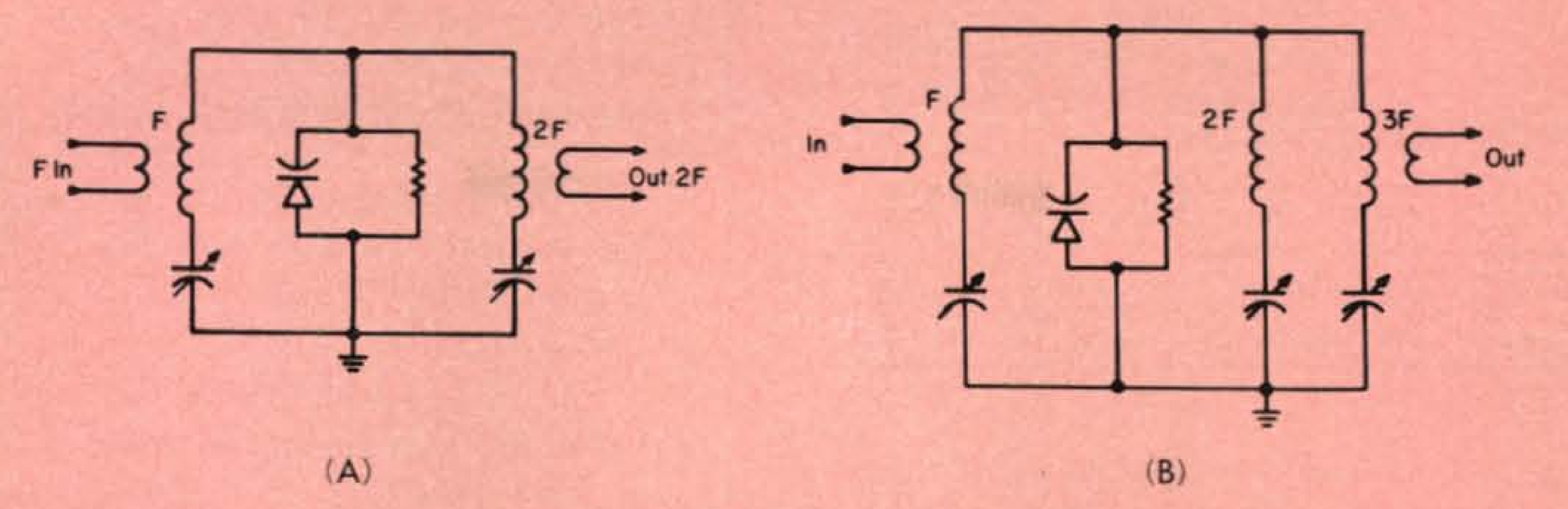

Fig. 1(A)—Basic circuit of a varactor doubler. (B) Basic circuit of a tripler requires the use of the doubler tuned circuit defined as an idler.

used here. Varactor frequency multipliers generate harmonics of all orders, just like any other kind of frequency multiplier, and suppression of the unwanted ones follows standard procedure. The double-tuned output is there for this reason.

Construction

This unit isn't designed for miniaturization. The coils and capacitors are too large, and for ease in construction a certain amount of "air" is a convenience. The arrangement of parts it not at all critical, provided that the input and output are reasonably well separated; a few inches is adequate. Here, everything was mounted on a 7" × 9" chassis plate. Capacitor C_2 is "floating" for r.f., and can be mounted on standoff insulators or on a piece of Vectorboard mounted half an inch or so from the base.

Good heat sinking is a must, and don't forget the silicon grease. If you do, you are very likely to have to remember to pick up a new diode the next time you are in the store. Motorola sells an excellent heat sink (MS-10) for a few dollars, and that is the one used here. It is mounted beneath the chassis. Access to the diode is through a 1¼" inch hole punched in the chassis.

These circuits operate at high peak circulating current, and thus demand high-Q components. Fortunately, inexpensive, broadcast-band variables turned out to be perfectly adequate, as did Miniductor-type coils. Routine precautions should be taken against mounting the coils too close to large metal parts, such as the chassis, or the Q is likely to suffer.

Tune-Up

About the only essential items for tuning up are a receiver, an absorption wavemeter and some kind of dummy load. A reflectometer can be used to get a flat line between the exciter and the multiplier, which is a convenience but by no means required. At these frequencies, a good dummy load is a 115 volt light bulb. It may be necessary to convert the output circuit to parallel temporarily, though, in order to match the low impedance of the bulb.

In the beginning, to gain experience with the gadget, it might be wise to disconnect the idler circuit and use the thing as a doubler. Adjustment is easier and more quickly accomplished since the variables are fewer.

The first thing to do is to connect the exciter to the multiplier and get it loaded at some fairly low power, say ten to fifteen watts. Couple the wavemeter to the output while doing this, and adjust the output tanks for maximum output. The wavemeter is there to make sure you are on the right frequency, the second harmonic in this case.

After a little "feel" for the operation has been gained, reconnect the idler and peak it at the second harmonic, while resonating the output at the third. Again, adjust everything for maximum output, at the desired frequency. Once you have it working as a tripler, it becomes a simple matter to use it as a quadrupler, the only change being resonating the output at the fourth harmonic instead of the third.

It is a matter of some importance to realize that all the circuits interact to some extent, and adjusting any one of them has an effect

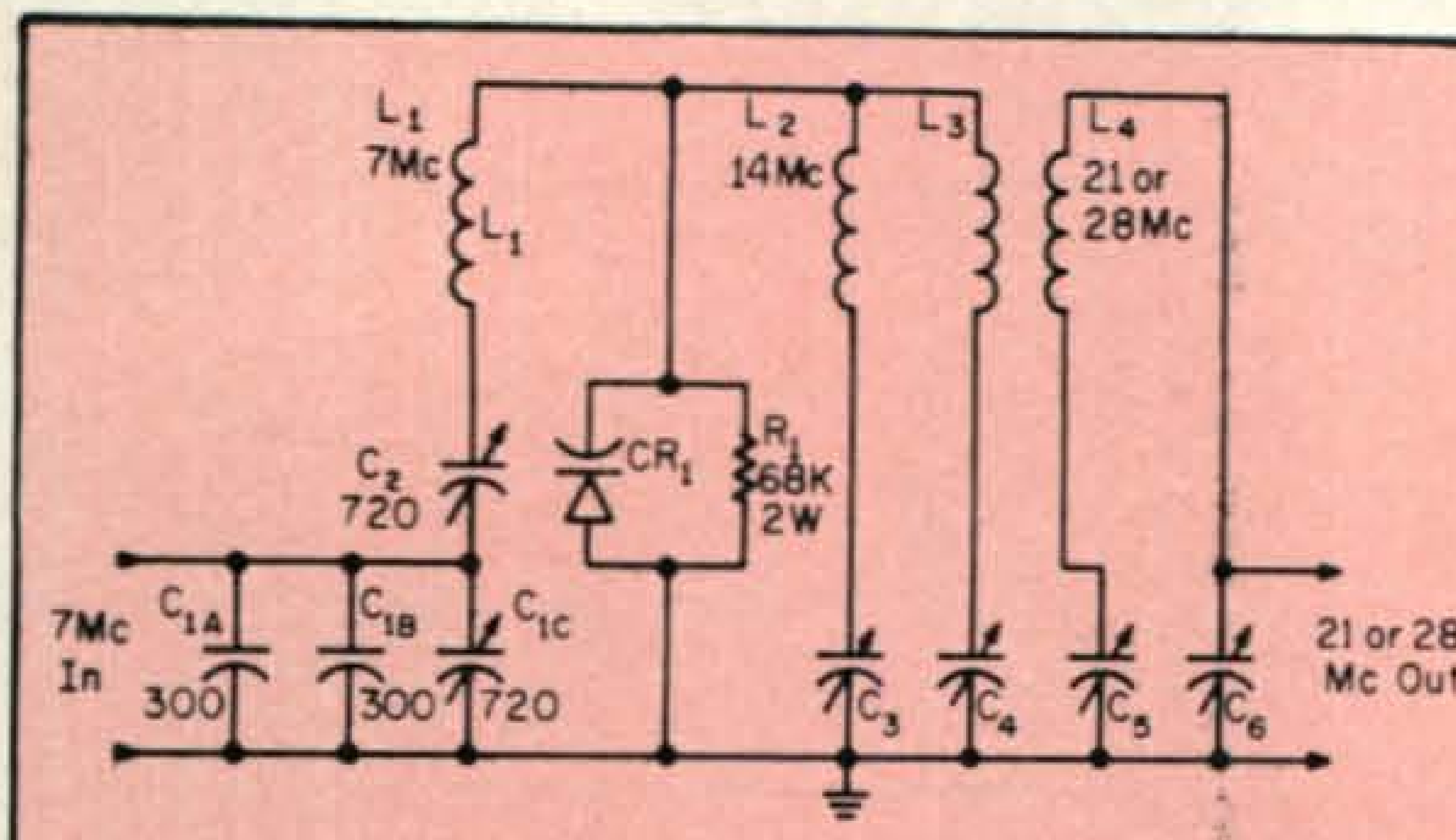

Fig. 2—Final configuration of the varactor multipler circuit that can perform as a tripler or quadrupler as determined by the tuning of C_4 and C_5. Capacitor C_{1C} is a dual 360 mmf per section paralleled for 720 mmf. Capacitors C_3, C_4 and C_5 are two gang superhet type variables with a 170 mmf and a 360 mmf section placed in parallel for 530 mmf.

CR_1—1N1186 diffused silicon rectifier.
L_1—24t, 1" dia., 8 t.p.i. Air Dux 808T or equiv.
L_2—5t, 1" dia., 8 t.p.i. Air Dux 808T or equiv.
L_3—4t, ⅝" dia., 10t.p.i. Air Dux 510T or equiv.
L_4—4t, 1" dia. 8 t.p.i. Air Dux 808T or equiv.

on all the others. Hence, the peaking operation should be repeated a few times, starting from the input and working to the output. This may make it sound a little like working a Chinese puzzle, but actually it is quite simple and you should get the hang of it quickly.

Once the multiplier has been adjusted for the low power, raise the input to the desired level. It will be found that the tuning settings for different power levels are somewhat different, so the tune-up will have to be repeaked slightly. As always, adjust everything for maximum output at the desired frequency.

When the output has been maximized at the peak power to be used, you are in business. For c.w., no change is made. To use it on a.m., just cut the drive in the exciter as for normal a.m. operation and fire away. The multiplier tuning is broad enough so that no readjustment should be necessary over a bandwidth of at least half a mc.

Diode Temperature

Up to now, nothing has been said about varactor temperature effects. It has been presumed that sufficient elementary caution has been exercised so that the diode hasn't been overloaded too much. Overloading causes excessive temperature rise, and the hot diode has a somewhat different capacitance range than a cool one, enough to upset the tuning adjustments when things return to normal. Also keep in mind that if the diode is allowed to run overheated for long periods of time, permanent degradation in performance can be expected. In this, varactors are no different from the final amplifier tubes in the exciter. So use the old finger-tip test on your diode. If it is too hot to touch, man it's too hot! Let it cool off before proceeding further.

Special Problems

There are two special problems. The first stems from the use of the broadcast band variables. These inexpensive capacitors won't take r.f. voltages much over 400 without arcing, and with some diodes this may develop. If so, either capacitive or resistive loading of the diode should make it behave, and the easier method is the second. Simply reduce the bias resistor to twenty or even fifteen kilohms. The value shouldn't be critical. It causes some detuning, so complete re-peaking must be done. Also, if carried too far, it will reduce the efficiency.

The other problem is that of parasitics. Yes, one might think that with nothing in the circuit more active than a diode, one could forget about those pesky nuisances. Unfortunately, there is such a thing as a parametric amplifier. Without getting involved in the very involved theory of those gadgets, suffice it to say that the circuit is substantially identical to that of the multiplier. Hence, particularly under heavy drive, oscillations may occur, and on any number of frequencies simultaneously.

The answer to this is the same as for spurious harmonic suppression, good filtering, only it must be applied to the input as well as the output.

There is only one way to make sure that these parasitics are under control, and that is to listen in on the output band. If the bugs are bad, you will hear the result smeared out over the entire band. It will sound like tuneable hash. Unless it is at least 40 db below the desired harmonic, something will have to be done about it. Some circuit variations used here had to be discarded on account of this. Parasitics were encountered in the circuit as shown only when the tanks were tuned quite far off the desired settings. A double tuned input might have eliminated even this tendency, but it wasn't needed and the additional complexity of tune-up it would involve wasn't relished as a prospect. *Incidentally, some* diodes are more prone to this unpleasantness than others.

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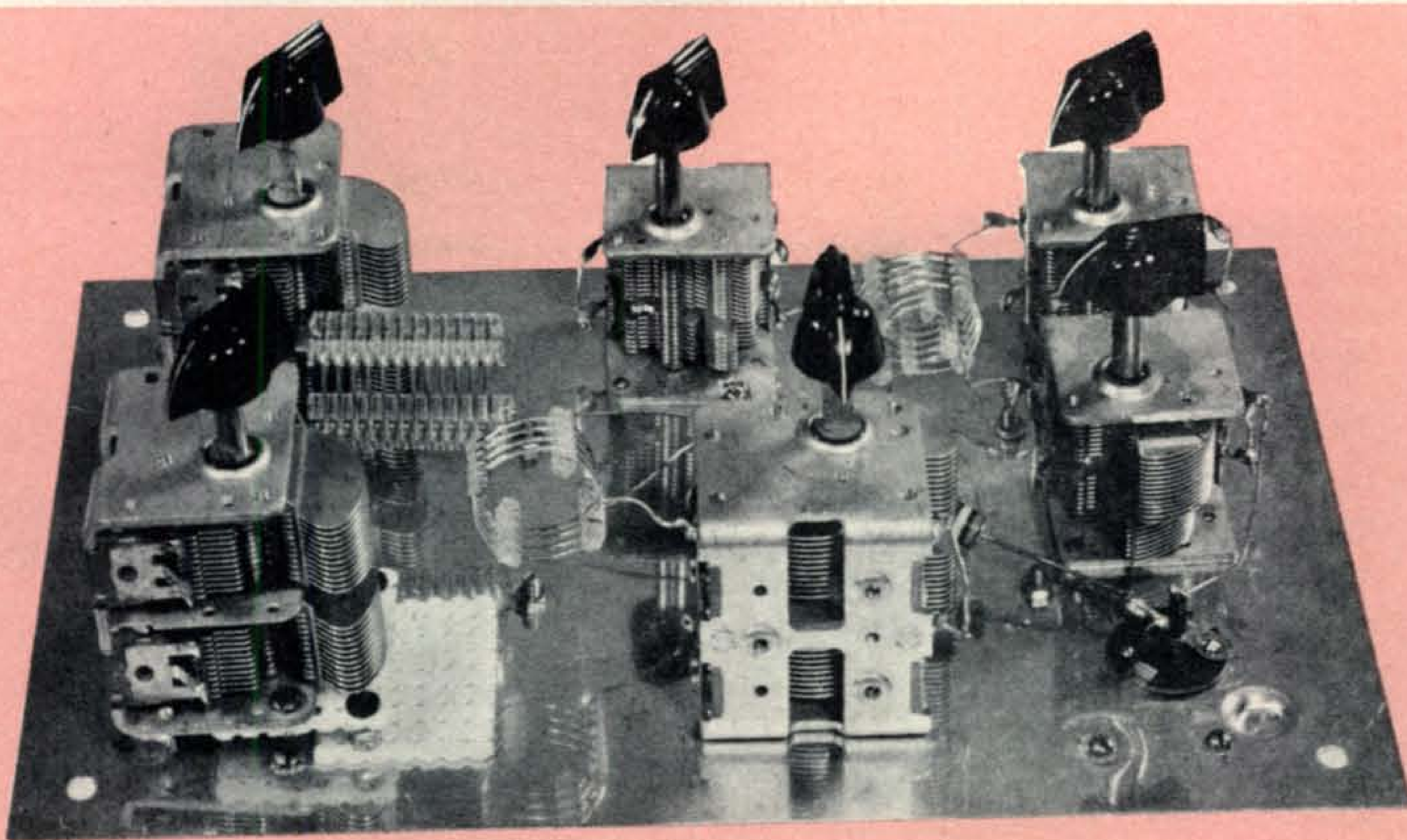


The varactor multiplier as described in the text. It is constructed on a 7" x 9" chassis bottom plate.

Miscellaneous

A number of different devices were tried out here to see how they behaved as varactors. In every case, the diffused silicon rectifiers came out ahead, one way or another. Zener diodes, for instance, worked just as well, but are considerably higher in price. The junctions of two different high power audio transistors were tried. Since they are designed to operate at frequencies over a hundred times higher than the rectifiers, it was expected that they ought to work pretty well here. They didn't. Not only was their efficiency low to begin with, they quickly overheated to the point where they weren't much good for anything.

Varactor multipliers, as indicated above, are surprisingly efficient, but they still show a net loss of twenty five percent or more of the input power. Most of this is dissipated by the varactor itself, and this brings up the question of how much power they will handle. There is a simple rule of thumb which can be followed. Figure one watt of device dissipation allowable for each ampere of rated current. This is only approximate, but it is roughly analogous to I.C.A.S. ratings on tubes. Thus pate about 35 watts as a varactor when properly heat-sinked. Here, it takes the full output the 1N1186 diode can be expected to dissi- of my NCX-3 on c.w. without any problems, since the duty cycle is 50% or less.

A peak inverse rating of 200 volts seemed to be about optimum as far as breakdown protection is concerned. Lower ratings will tend to degrade both power-handling capability and efficiency. On the other hand, above 200 volts, the prices seem to go up exponentially. Some bargain 55 amp, 400 volt units from Poly-Pac were tried. They worked pretty well, although they were more lossy than the Motorola units. Don't let any of this interfere with your trying out any odd-ball diode you might have on hand, though. You might be pleasantly surprised. The only really critical thing is that current rating, since this is basic in determining the internal losses.

Varous units of the same type-number were checked, and their capacitances ran pretty uniform. All the stud mounted diodes, regardless of current rating, ran between 250 and 350 mmf.

Parallel operation was also checked and proved entirely feasible without any special gimmicks. It should be remembered, however, that if a single heat sink is used, you might not be able to double the dissipation this way. The lower effective thermal resistance, owing to the distributed heat source, does improve things somewhat.

What about sideband? On the scope, the s.s.b. speech waveform resembles a.m., although with a different frequency distribution. It seemed worth a try, but it didn't work very well. Some words could be understood, but most of it resembled a particularly bad mixture of a.m. and f.m., with some incidental distortion added. Here again, sideband turned out to be fundamentally different from a.m.

[*Continued on page 119*]

State of the Art for '69 ?

YES !

The hottest thing to come along in years for high performance receiver design is the MOSFET (Metal Oxide Silicon Field Effect Transistor). New types—only recently available for general use—are capable of equalling or surpassing the performance of the best popular vacuum tubes in critical front end applications. Properly used, they finally lick the old transistor hang-up of achieving low noise plus extremely wide dynamic range. (Without the ability to handle very large as well as very small signals, your receiver is susceptible to cross-modulation interference from strong off-channel stations, and to distortion of strong on-channel stations due to inadequate AGC range.)

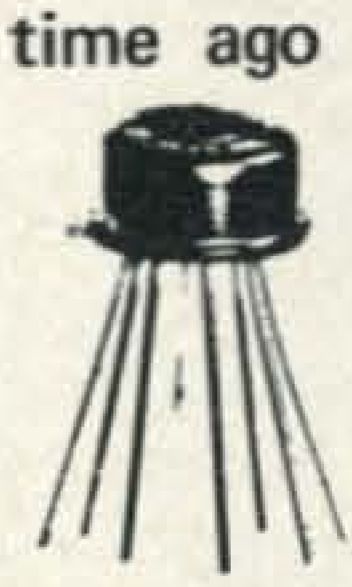
Certain of the newer MOSFET's combine the large-signal linearity necessary to avoid cross-modulation and the ability to be gain-controlled over a wide range without compromising that linearity—no more auxiliary RF attenuators to supplement marginal AGC!

Transistors are still pretty hard to beat for low voltage, relatively high dissipation applications, too . . . like power amplifiers and voltage regulators.

...AND NO

Digital integrated circuits have already taken the computer field away from transistors, and they're now revolutionizing instrumentation as well. Digital frequency counters using IC's, for example, do the job of much larger transistor units at a fraction of the cost.

Intensive development of Linear IC technology has paid off more recently. A short time ago linear IC's were very limited in performance, expensive, hard to get. Now they're readily available in a multitude of varieties . . . and inexpensive. . . doing for applications like I.F., audio and control amplification what the digitals did for computers.



Linear or digital, an IC does the job of several transistors plus the diodes, resistors and interconnections that make them into a complete ready-to-use functional block. Be it a complex JK flip-flop or a high-gain I.F. amplifier, the IC often costs less than just the resistors of the conventional circuitry it replaces! (Equipment reliability benefits, too . . . because of all the separate components and soldered joints that are eliminated.)

The POINT is, modern component technology has made available a remarkable variety of sophisticated devices.

The TRICK is in knowing WHICH ones to use WHERE for the best results . . . and HOW.

THAT'S OUR BUSINESS!

signal/one

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2200 Anvil Street N. • St. Petersburg, Florida 33710

CQ ATTENDS H.A.R.C. CONVENTION

BY ALAN M. DORHOFFER*, K2EEK

ON October 12-13, the Hudson Amateur Radio Council (H.A.R.C.), held their biennial Convention at the Hilton Inn in Tarrytown, N. Y. Well over a thousand amateurs and their families filtered thru the display areas; to and from lectures, looking for bargains, friends, information, literature, food, anything new, the rest rooms, the bar, and an occasional lost child. Beverly Wilcox, WB2UHZ, reigned over the Convention as "Miss Amateur Radio." Bill Leonard, W2SKE, gave an excellent after dinner talk at the banquet, which was attended by over 500 amateurs. It seems as though more prizes were awarded this year than at the last Convention. A large vote of thanks to Larry Strasser, K2UMM, and his wife Vicki, WB2WHP, Convention Chairmen, for the long hours of preparation and hard work to make the Convention a success. Everyone from Eliot Berelson, WA2HDP (upper left corner), to Charlie Taintor, K2LJL (lower right corner), enjoyed the two days and looks forward to the next Convention in 1970 ■

*Managing Editor, CQ.

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Putting the Gonset III on Two Meter F.M.

BY JAMES B. HARTLINE,* WA4OXA

With the advent of two meter f.m. so predominant throughout the country, much of the available supply of f.m. "two-way" radio equipment has been exhausted.

On the other hand, there are quite a few two meter a.m. transmitters and receivers as well as many transceivers sitting around collecting dust.

Several articles have appeared describing conversion from a.m. to f.m. with awkward outboard or crowded inboard f.m. modulators.

At our amateur club, we had several of the old Gonset Communicator III units, which were a.m. transceivers that were formerly used by Civil Defense, and were not compatible with our f.m. equipment. Therefore a project was undertaken to convert them to f.m.

We tried quite a lot of methods, among them, reactance modulators, outboard balanced modulators, and a number of trial and error innovations. Results of all of these were unsatisfactory for one reason or another.

Our aim was to utilize as much of the present set as possible, and it seemed practical to retain the speech section for the modulator. With this in mind, we decided to try phase modulation of the present oscillator stage and this turned out to be simple and very practical.

The circuit that finally filled the bill (fig. 1) was one that could be switched from a.m. to f.m. without sacrificing drive or quality in either mode.

Circuit Description

The 12BY7 pentode tube (V_1) is used as a crystal-controlled oscillator with the screen grid acting as its anode. Its plate couples a harmonic of the oscillator fundamental frequency to the V_2 stage. Phase modulation is accomplished by impressing the modulating voltage on the screen of the oscillator tube.

* Onslow Broadcasting Corp., Jacksonville, North Carolina 28540.

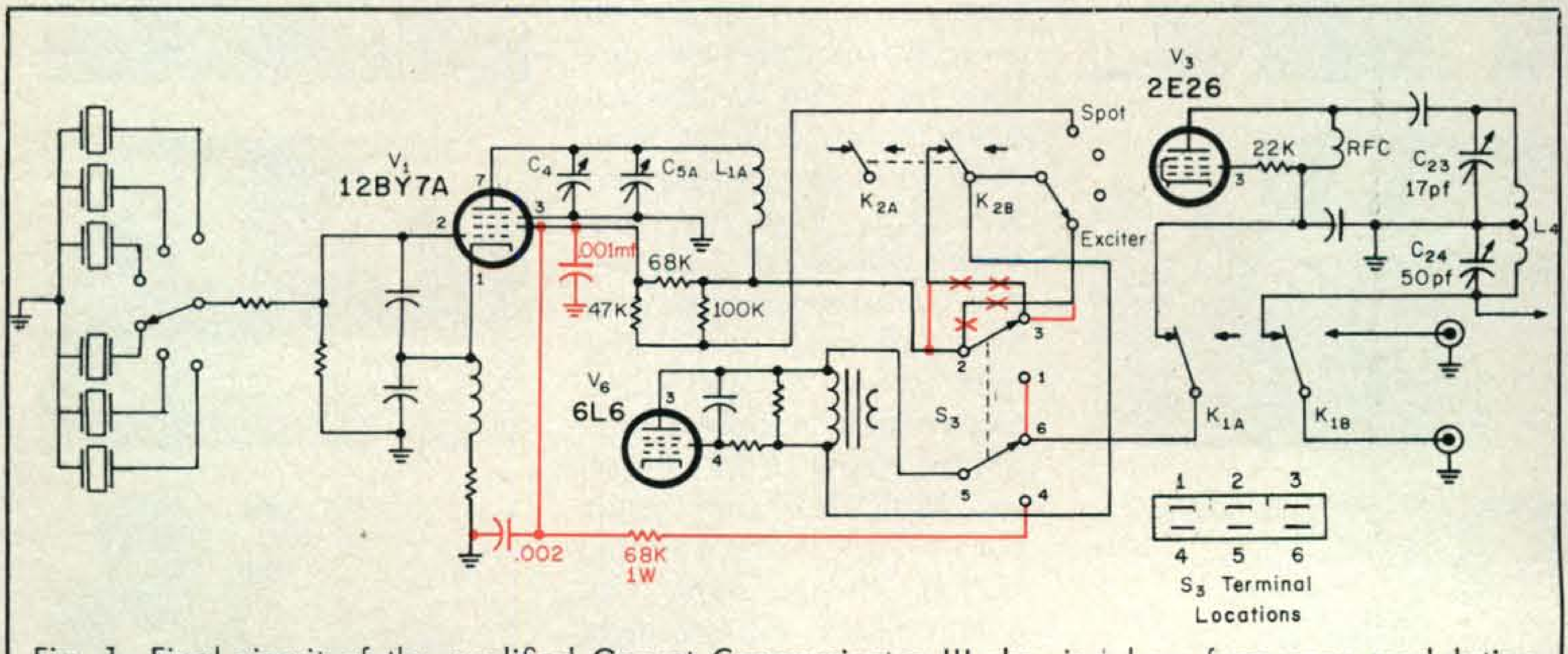

Fig. 1—Final circuit of the modified Gonset Communicator III showing how frequency modulation can be accomplished. All components and wires in color have been added. Switch S_3 formerly PA-TR is now the FM-AM selector.

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Modulation actually occurs at the fundamental frequency, and its swing is multiplied 18 times before reaching the antenna.

Modification

The following changes were made to the Communicator III:

Refer to fig. 1 and rewire switch S_3 as follows: (S^3 is the PA-TR Switch on the back of the transmitter chassis.)

1. Remove the two gray wires from lug 2 and the one gray wire from lug 3 of S_3. Note which wires come from which lugs.
2. Connect the gray wire removed from lug 2 of S_3 to lug 3. (The other end of this wire is connected to the exciter switch.)
3. Connect the gray wire removed from lug 3 of S_3 to lug 2.
4. Connect the gray wire remaining to lug 2 of S_3. (This wire supplies B+ voltage to V_1 and V_2.)
5. Now reverse the blue leads on lugs 5 and 6 of S_3. In some sets this may not be necessary. Check to see that after reversing the wires on lugs 5 and 6, the blue wire going to the plate (pin 3) of V_6 is connected to lug 5 and the wire to relay $K_{1(A)}$ (a) is connected to lug 6.
6. Add a jumper wire from lug 1 to lug 6 on S_3.
7. Add a 68K 1 watt resistor from S_3 lug 4 to pin 8 on V_1 12BY7 oscillator.
8. Add a .002 mfd capacitor from pin 8 on V_1 to ground on the tube socket ground lug of V_1.
9. Set VOLUME control (R_{27}) to obtain desired amount of modulation swing.
10. S_3 now becomes an AM-FM switch rather than a TR-PA switch. The PA position is FM and the TR position is AM.

Other Applications

While these values are chosen for the Gonset Communicator III, the same ideas can be applied to many a.m. transmitters that utilize a pentode for its oscillator.

If the oscillator is to be modulated by a lower level audio stage, such as a 12AU7, the 68K resistor may be paralleled by a capacitor of a value from .001 to .1 mf to transfer more audio from the modulator to the screen grid of the oscillator tube. The value should be chosen by trial and error to obtain smooth modulation and frequency response desired.

The rewiring of the Gonset S_3 switch in our conversion allows for switching the modulation transformer out of the 2E26 circuit to disable a.m. modulation. If you convert some other type set to f.m., don't forget to make this change as well, and do not jumper the modulation transformer winding in order to apply direct B+ to the final screen and plate. Instead, disconnect the modulation transformer from the plate and screen and connect a jumper from the B plus supply through appropriate relay contacts to supply the plate and screen.

About The Receiver

The receiver of the Communicator III will copy f.m. satisfactorily without modification. We did, however, put a discriminator in one receiver, and it worked nicely. The squelch works better as is with a.m. detection. A stronger signal is required to trip the squelch with the discriminator. This could be overcome with some re-design of the squelch circuit.

Modifications For Other Bands

This same circuit could be applied to a.m. transmitters in other bands, such as six meters. However, the multiplication factor from the crystal oscillator frequency to antenna must be considered. It will take more audio to modulate a transmitter with fewer multiplier stages, since the modulation swing is multiplied along with the frequency. ■

BY THE WAY...

At the HARC Tarreytown show, Oct. 12-13 (l. to r.) Howard Wolfe, W2AGW, Bill Schiffrin, WA2IZU, and Herman A. Bohning, W2MZV look over a specially cutaway display model CDE Ham-M rotor. Watch those fingers fellows!

CQ Reviews: The Heathkit HW-18 Series of Transceivers

The Heathkit HW-18-3 S.S.B. Transceiver.

BY WILFRED M. SCHERER* W2AEF

THE Heathkit HW-18 Series is a group of inexpensive single-band s.s.b. transceivers designed for operation on fixed-frequency channels. The HW-18-1 and HW-18-2 are for use on the CAP and MARS frequencies, respectively, in the 4450-4650 kc range. The HW-18-3 provides operation on the 160 meter amateur band.

Although there are radio amateurs interested in such MARS operations, there may be more who might like to take a crack at the fun and challenges offered by the fascinating "top band," as 160 meters is called by its adherents, without the necessity of special lashups involving transmitting and receiving converters, modifying existing equipment or having to settle for outmoded gear.

Now that the season, favoring 160 meter operation, is here, the HW-18-3 should be of special interest; nevertheless, we'll present a run-down on all three models.

Basic Features

Except for the operating frequencies, the HW-18 Transceivers all are basically the same, incorporating two instantly-switched crystal-controlled fixed channels using the same frequency both on receive and transmit for s.s.b. operation with a transmitter p.e.p. input of 200 watts. Insertion of a low-level carrier also is provided for comptability with a.m. receivers not equipped for conventional s.s.b. reception.

U.s.b. operation is provided with the CAP model, u.s.b. or l.s.b. is optionally fixed for one sideband only on both channels in the MARS unit, and l.s.b. is used with the 160 meter model.

Operation is simplified by the inclusion of only one tuning control that allows the fixed-channel frequency to be slightly varied for precise adjustment to the channel frequency or to that of the station being worked on the channel. The frequency variation is ±100 c.p.s. on the CAP and MARS units, ±250 c.p.s. with the 160 meter job. The overall accuracy for the crystals supplied with each unit is within .005%.[1] The transmitter plate resonance and loading are fix-tuned for operation into non-reactive (resonant) 50 ohm loads.

A.l.c. is furnished on transmit and a fast-attack, slow-release a.g.c. on receive. There also is a local-distance switch, the possible need for which is explained later. The panel meter indicates signal strength, a.l.c. level or p.a. cathode current. Push-to-talk operation is provided using a microphone supplied with the set to which it is permanently attached. Transmit-receive transfer is accomplished using all-electronic switching–there are no relays. A built-in loudspeaker is included.

The transceivers are packaged in a small case the same size as for the popular HW series of single-band 80-40-20 meter transceivers and may be used for fixed or mobile operation with external power supplies, the HP-23A for 120/240 v.a.c. or the HP-14 for 12 v.d.c. power sources.

The maximum power requirements are as follows: 12.6 v. a.c. or d.c. at 3.75 a.; 800 v.d.c. at 250 m.a. (peak); 250 v.d.c. at 100

*Technical Director, *CQ*

[1]Meeting the CAP and MARS requirements.

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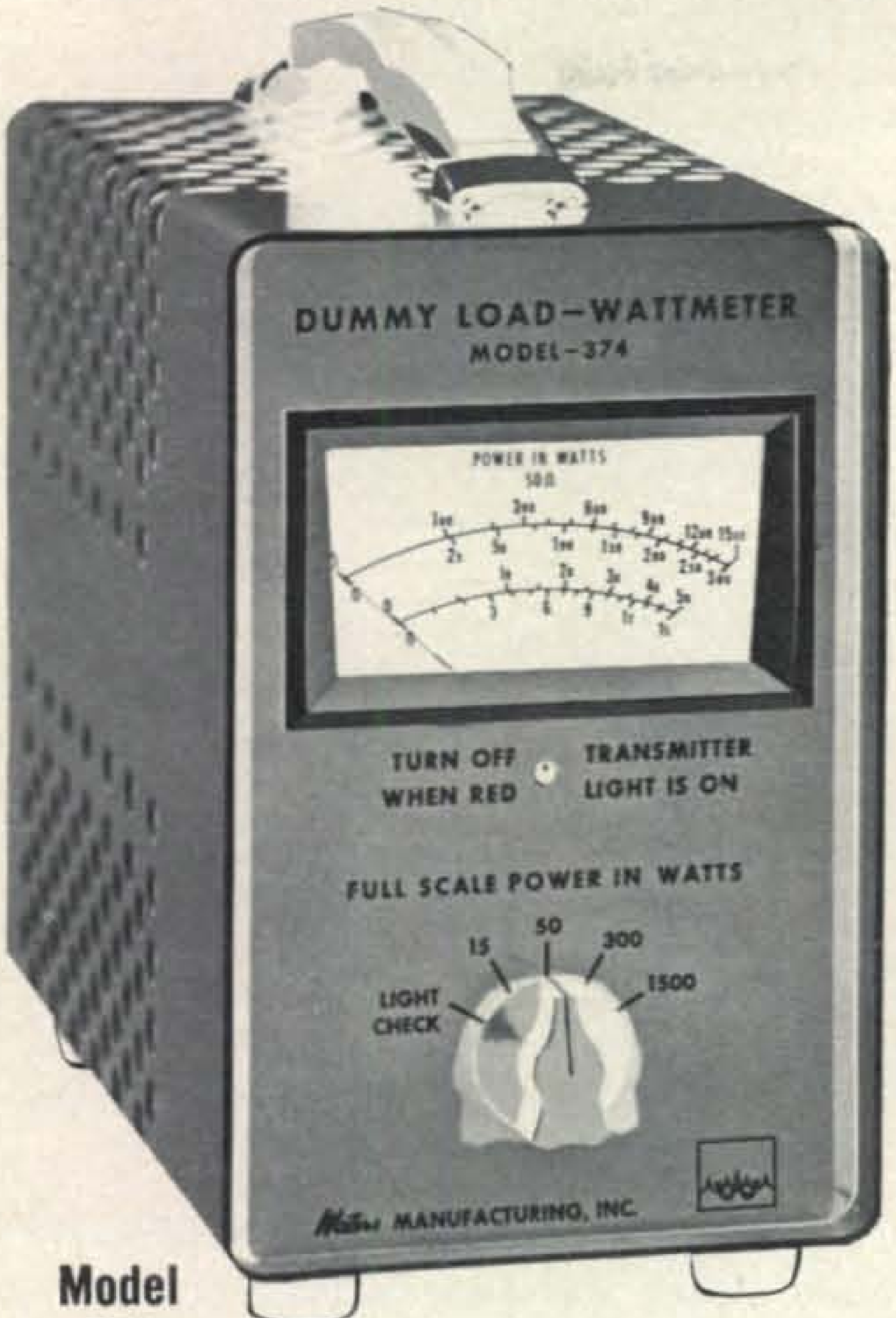
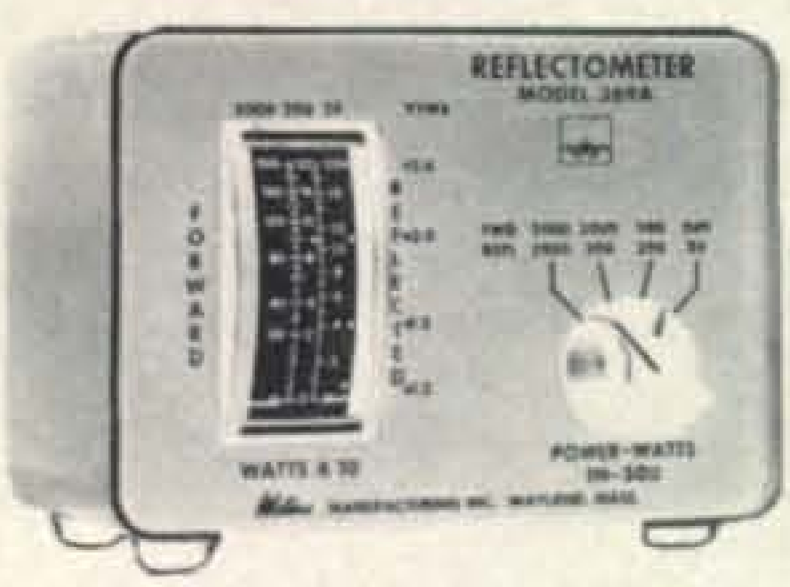
For a ham's happier Christmas...!



Model
374
$145.00

DUMMY LOAD/WATTMETER

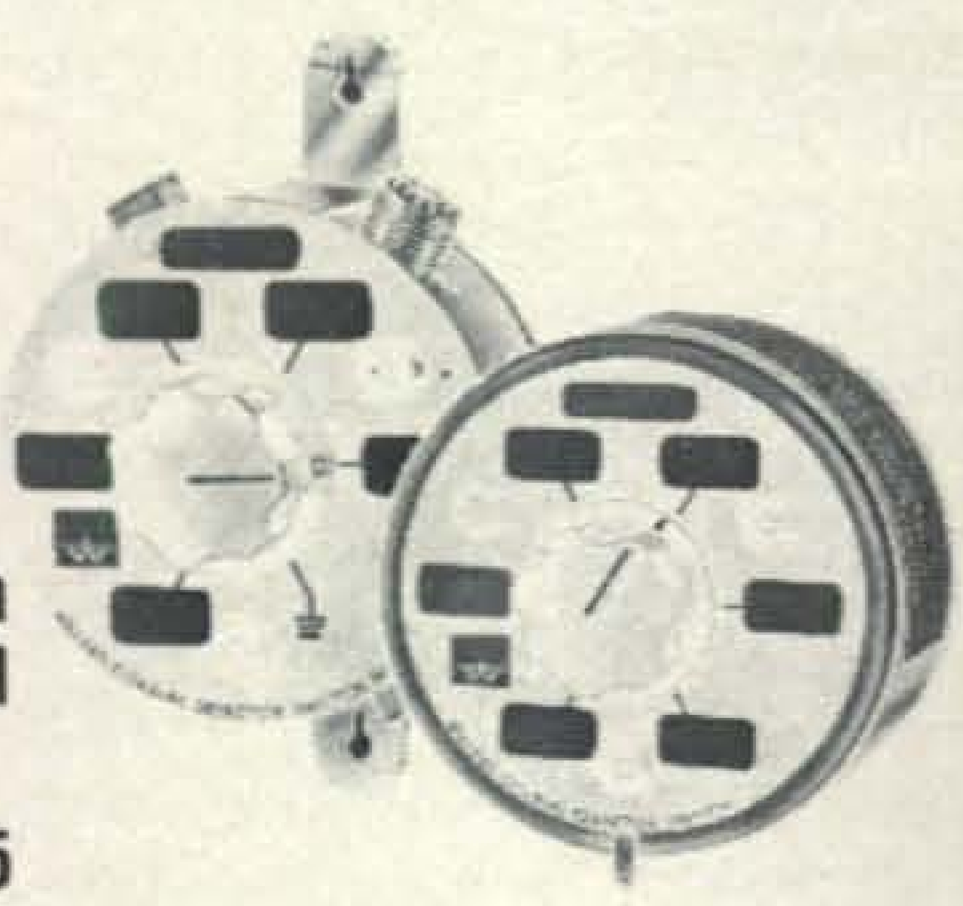
Waters '374' Dummy Load/Wattmeter will help him maintain his modern 2 KW (PEP) rig at peak efficiency. Registers power output to 1500 watts over a frequency range of 2 to 30 MHz. Its four calibrated scales (0-15; 0-50; 0-300; 0-1500) permit accurate readings to ± 5%. Load impedance: 52 ohms. VSWR: 1.3:1. Weight: 12 lbs.



Model
369A
$127.50

REFLECTOMETER

Measures both forward and reflected power (VSWR) simultaneously on unique double meter. Covers 3.5 to 30 MHz at 52 ohms on two separately set forward scales of 200 and 2000 watts (20 and 200 reflected) to insure accurate reading. Comes complete with directional coupler.



Model 375
6 - position
with rear axial
connecttors
$13.95

Model 376
5 - position
with side radial
connectors
$12.50

PROTAX Switches operate through 150 MHz

PROTAX ™ ANTENNA SWITCHES
with Automatic Grounding

Waters PROTAX ™ Coaxial Antenna Switches automatically ground the entire antenna system when the shack is shut down. Readily handles 1000 watts and comes complete with knob and escutcheon plate with eraseable marking panels. (Model 376 has mounting bracket.)

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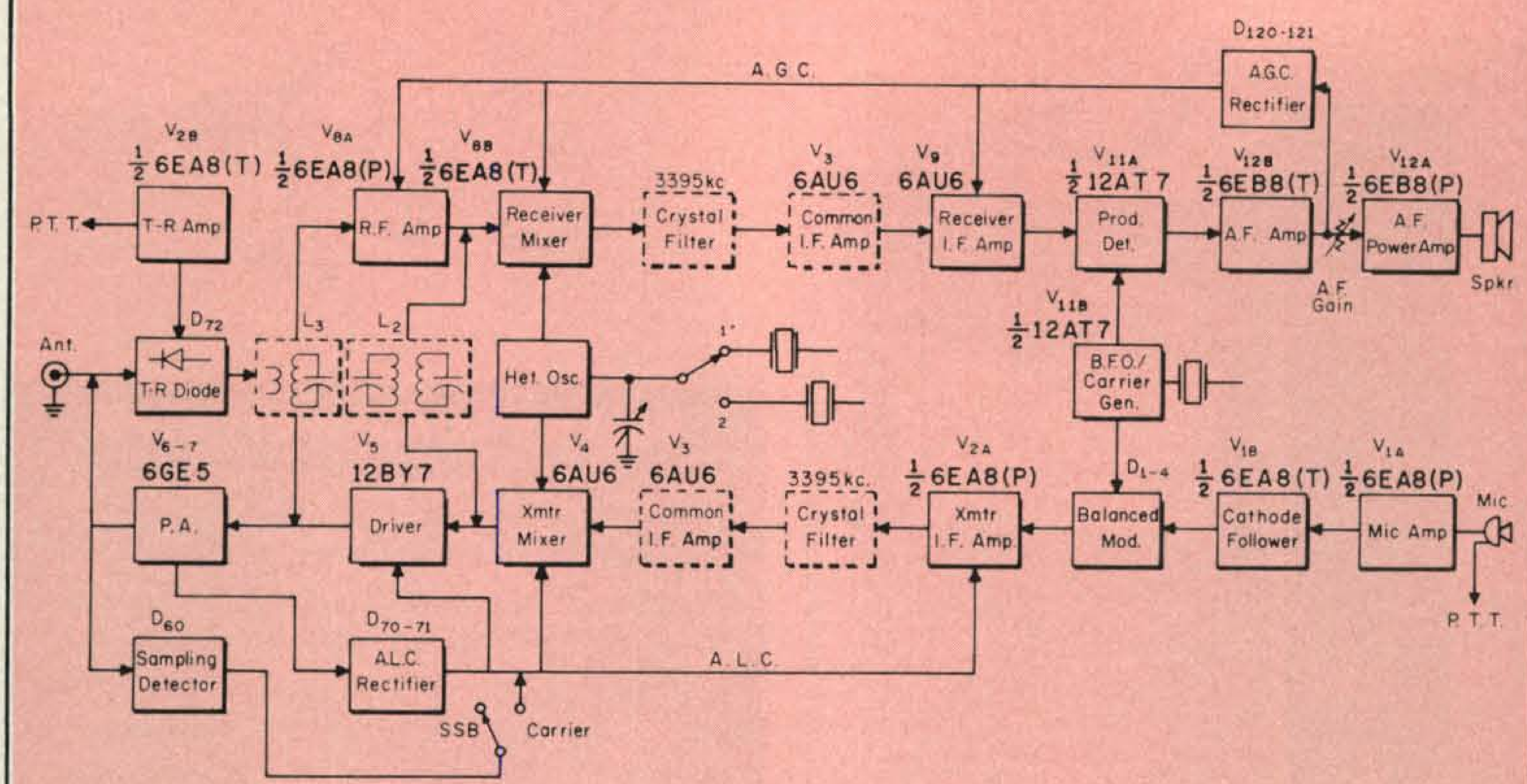


Fig. 1—Block diagram for the HW-18 Transceivers. Details are given in the text. Sections outlined with dashed lines are common to both receiver and transmitter.

m.a.; and −130 v.d.c. bias at 5 m.a.

Circuit Details

Single conversion to an i.f. of 3395 kc is used in the HW-18's for both receive and transmit as shown in the block diagram at fig. 1.

The heterodyning oscillator, which is employed for both modes of operation, is crystal-controlled with a Colpitts-type circuit. The crystal frequency can be varied over a small range (as specified earlier for each model) by a *clarifier* control which is a variable capacitor across the crystal that "rubbers" its frequency.

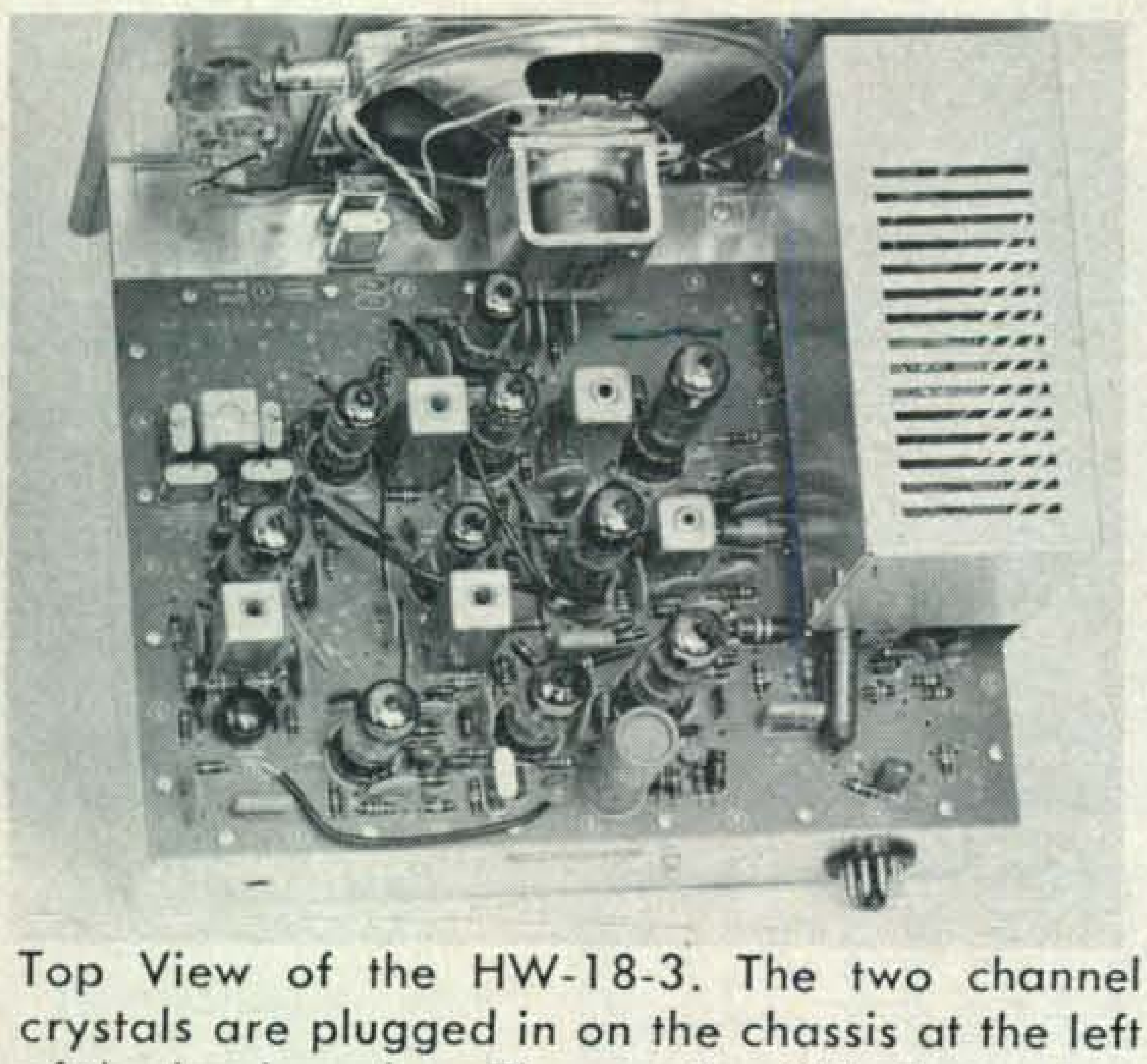
The frequency for the heterodyning crystals is equivalent to the channel frequency *plus* that of the carrier oscillator/b.f.o. For the HW-18-3 (160 meter model) the latter frequency is 3393.5 kc for l.s.b. operation only. In the HW-18-1 (CAP model) this frequency is 3396.5 kc for u.s.b. operation only. With the HW-18-2 (MARS model) a crystal is installed for one of the two sidebands only, thus confining operation on *both* channels to the sideband for which the related crystal is installed.

The r.f. circuits, L_2-L_3, are fix-tuned and common to both the receiver r.f. amplifier and the transmitter-driver inputs and outputs.

The crystal filter utilizes four crystals with typical h.f.-filter circuitry. It is not an encased unit as customarily found in commercial gear, but it is assembled by the user when the transceiver is put together. No alignment is required, however, as the only required adjustment (that of the filter inductor) has been made at the factory.

The product detector is a standard triode type with the b.f.o. injection at the cathode and the signal applied to the grid.

A.g.c. is the audio-derived type using two solid-state diodes in a voltage-doubler circuit.



Top View of the HW-18-3. The two channel crystals are plugged in on the chassis at the left of the loudspeaker. The p.a. is within the enclosure cage at the right.

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The a.f. voltage is taken from the output of the 1st a.f. amplifier, thus requiring that the a.f. gain be installed at the input to the a.f. power-output amplifier. A small positive voltage, obtained from the cathode of the a.f. amplifier, furnishes a delay for the a.g.c.

When operation is conducted in the vicinity of other transmitters, such as may be the case with mobile-to-mobile or -to-base operation, a *local-distance* switch is provided to prevent receiver overload or blocking. When set at the local position, the switch opens the cathode of the r.f. amplifier, disabling the tube, but allowing some signal to pass through the inter-electrode capacitance of the tube. About 30 db of attenuation is provided there with on strong signals.

Transmitter

A cathode follower matches the speech amplifier to the balanced modulator that is a conventional ring type employing four germanium diodes. The modulator output is quite low, so a transmitter i.f. amplifier precedes the crystal filter. The amplifier also provides the proper match between the modulator and the filter.

Two parallel-connected TV sweep-amplifier tubes (6GE5) make up the p.a., the output circuit of which is a fix-tuned pi-network for operation into the load specified earlier. The heaters of the p.a. tubes are isolated from the heater voltage line by means of a bifilar-wound r.f. choke.

A.l.c. voltage is obtained in the usual manner with rectification of the audio component appearing in the p.a. grid circuit when grid current commences during modulation. The a.l.c. voltage is applied to the transmitter i.f. amplifier, mixer and driver.

The low-level carrier for compatible reception with a.m. receivers is obtained with a d.c. voltage that unbalances the otherwise-balanced modulator. At the same time, the carrier output from the p.a. is sampled and rectified by a solid-state diode, the resulting d.c. voltage from which is applied to the a.l.c. line. This voltage is proportioned so as to limit the gain of the a.l.c.-controlled stages by an amount that holds the carrier output to about 20 watts.

The electronic switching for transmit-receive transfer is quite unique. It utilizes a vacuum-tube triode and a solid-state diode as described at fig. 2.

Construction

The HW-18 transceivers are assembled on

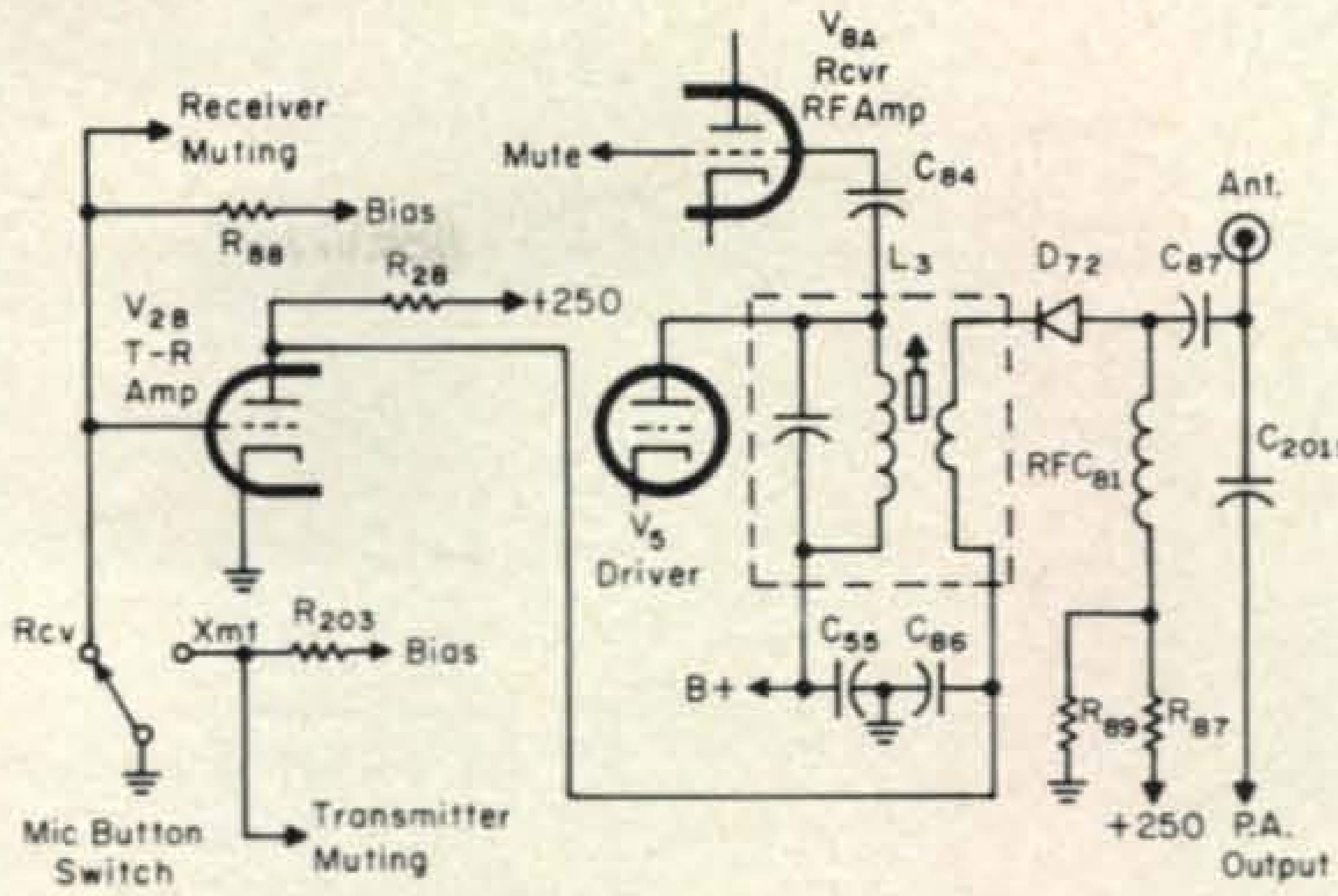


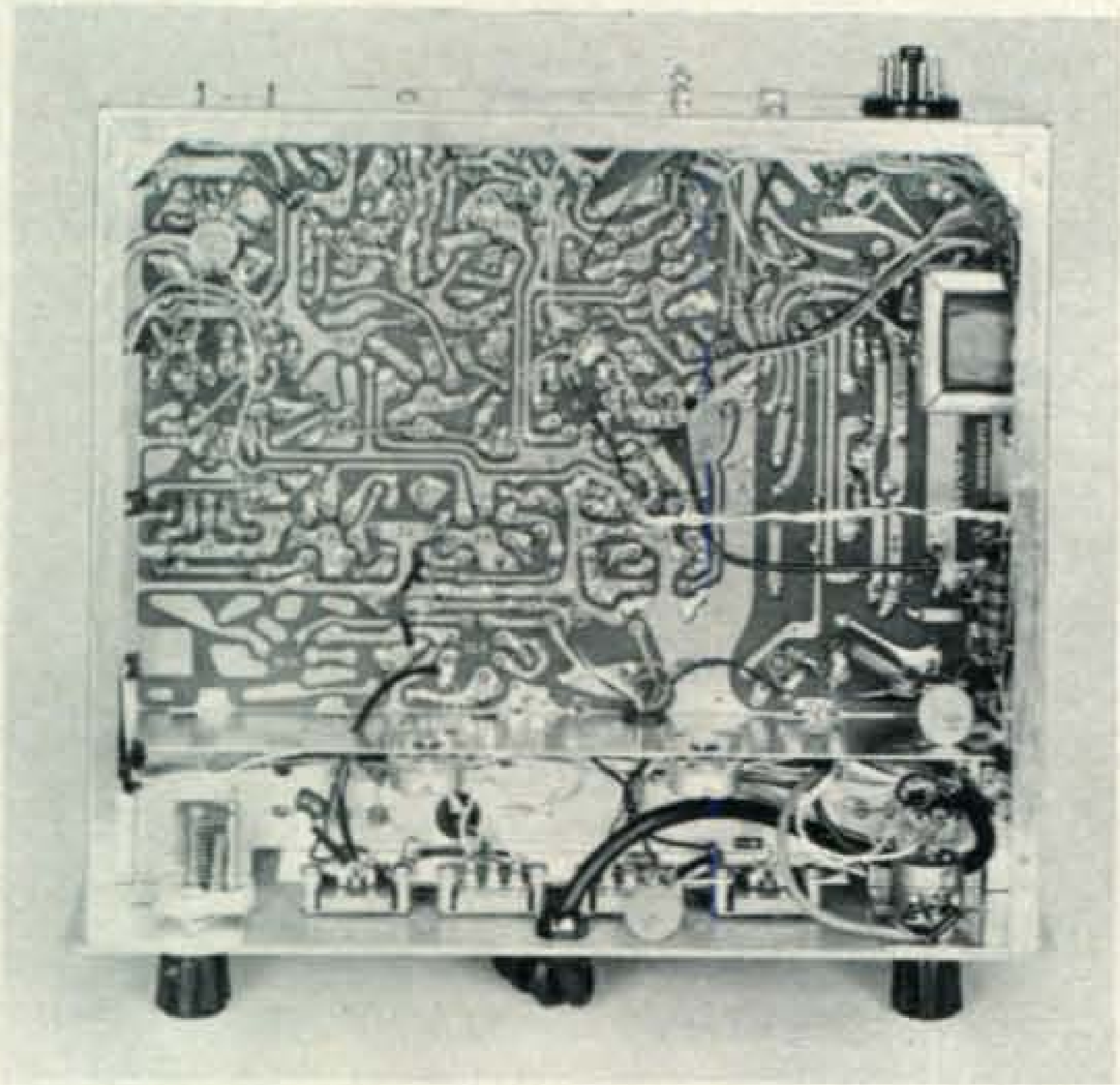
Fig. 2—Transmit-receive transfer setup used in the HW-18 transceivers. During receive the mic button switch grounds the grid of T-R amplifier V_2B which is then unbiased and thus draws a high plate current which produces a large voltage drop across R_{28}. This places a less-positive voltage on D_1 cathode than that on its anode as obtained from R_{87}-R_{89} junction. D_1 then conducts and allows antenna signal to be applied to the primary of L_3, the tuned secondary of which is coupled to the grid of V_8A through d.c. blocking capacitor C_{84}. The mic switch also grounds the receiver-muting line, removes cutoff bias and allows the receiver to function. At the same time, the switch activates the bias for the transmitter muting and disables the transmitter.

On transmit, the mic switch ungrounds the receiver muting line, permitting cutoff bias to disable the receiver. The switch also grounds the transmitter-muting line and activates the transmitter. The bias voltage from R_{88} also cuts off V_2B and there then is little voltage drop across R_{28}. This places a higher positive voltage (near 250 v.) on D_1 cathode than at its anode. This reverse-biases D_1 into non-conduction and opens the antenna circuit to L_3 primary. The secondary of L_3 then functions for only the driver, V_5.

a printed-circuit board that afterwards mounts on a heavy guage chassis. A color-coded wiring harness is supplied with the kit for power-control, interconnections and those required to the various plugs, switches, controls, etc. Adherence to the step-by-step instructions set forth in the manual results in about 7 hours of time required to do the work.

Checking various test points, final adjustment and alignment requires another hour or so. In this regard, the job is facilitated by identification numerals for the different test points, marked on both sides of the circuit board.

Another handy feature for servicing and tracking down wiring, is that on the main schematic diagram, the color-coded inter-



Bottom view of the HW-18-3.

connections are identified by numerals that correspond to the colors used for coding resistors. Letters marked at the leads shown on the diagram also indicate the circuit-board terminals for their connections.

Operation

Since the p.a. output is fix-tuned, the antenna system must present a near-resonant load of the proper impedance. Where such is not the case, a suitable antenna coupler with a 50 ohm input will be required.

All that is needed for receiving is to turn up the volume control, switch the crystal to the particular channel and, if necessary, zero in on the signal frequency, using the *clarifier* control. No other tuning is needed, as the r.f. tuning is fixed.

To transmit on the channel, you simply depress the p.t.t. button the microphone. Since the transmit-receive transfer is accomplished electronically, its operation is as quiet as a church mouse. Instructions for initially setting the mic gain (a rear-apron screwdriver-adjust control), are given in the manual. Monitoring can be conducted by observing the p.a. cathode current readings on the meter or by switching the meter to indicate the a.l.c. voltage.

If the station at the other end a QSO is not equipped to receive conventional s.s.b., you place the mode switch at the *carrier* position and the HW-18 transmissions will then be similar to a.m. with a carrier, except only the one sideband will be transmitted.

There is no provision for receiving a.m. in the usual manner, but where an a.m. signal must be received, such as most likely would be the case from a station not equipped for receiving normal s.s.b., you can read the a.m. signal by adjusting the *clarifier* control to zero-beat with the signal.

Since you're "rock-bound" to the same frequency on both receive and transmit, operation is limited to the particular two channel frequencies for which crystals are installed in the unit. These are selected by a panel switch. Should other channels be desired, appropriate crystals may be substituted by plugging them in at the crystal sockets on top of the chassis. The set must be removed from the cabinet for this change.

On the other hand, with the 160 meter model, v.f.o. transceive operation is possible by plugging the output from a 5.2-5.4 mc v.f.o. into one of the crystal sockets. Instructions as to the specific requirements and procedure for adjustment are given in the manual. In this respect we quote the manual as follows: "This modification is at the discretion of the builder, and the v.f.o. design information is *not* available from the Heath Company. It is possible that spurious signals or outputs may be produced by harmonics of the v.f.o."

It also should be noted that split-frequency transceive operation is not possible; that is, you're held to the same frequency on both transmit and receive. Therefore, communication on the 160 meter band cannot be carried on between stations in different areas of the country that are not permitted to operate within the same band segments.

Also, the transmitter must not be used in areas or at times when the d.c. input to the p.a. is by law limited to 25-50 watts, because the "idling" power input to the amplifier is too high in relation thereto.

The HW-18's are strictly designed for voice communications (primarily s.s.b.), so there are no provisions for c.w. operation. This rules out the possibility of working much of the DX available on the 160 meter band, as most of this type work is conducted with c.w. A do-it-yourself modification probably could be worked out in this respect, in which case some form of incremental frequency adjustment on receive would also be needed.

Performance

The unit checked in the *CQ* Lab was the HW-18-3 160 meter model using crystals for the 1809 and 1813 kc channels.

[*Continued on page 114*]

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THE DUAL-GATE MOSFET

BY JOHN J SCHULTZ,* W2EEY/1

Semiconductor developments produce many items of only passing interest. The dual-gate MOSFET, however, appears to be an item that is bound to have important and long term applications, particularly in receiver circuits.

DEVELOPMENTS in transistor technology seem almost to outspace the ability of builders to incorporate them into their designs. For many amateurs, this is certainly true as regards amplifiers using field effect transistors. Just as many amateurs are starting to commonly use FET circuits, the single gate FET's being used must often be regarded as already being somewhat obsolete in view of dual gate FET technology.

Fortunately, dual gate FET's are only slightly more complicated to use than single gate FET's but they offer some rather significant advantages over the latter type in applications as r.f. amplifiers, mixers and detectors. The advantages, moreover, are obtained at an extremely small increase in cost since dual gate devices have come out of the laboratories and are now being produced in quantity by various manufacturers.

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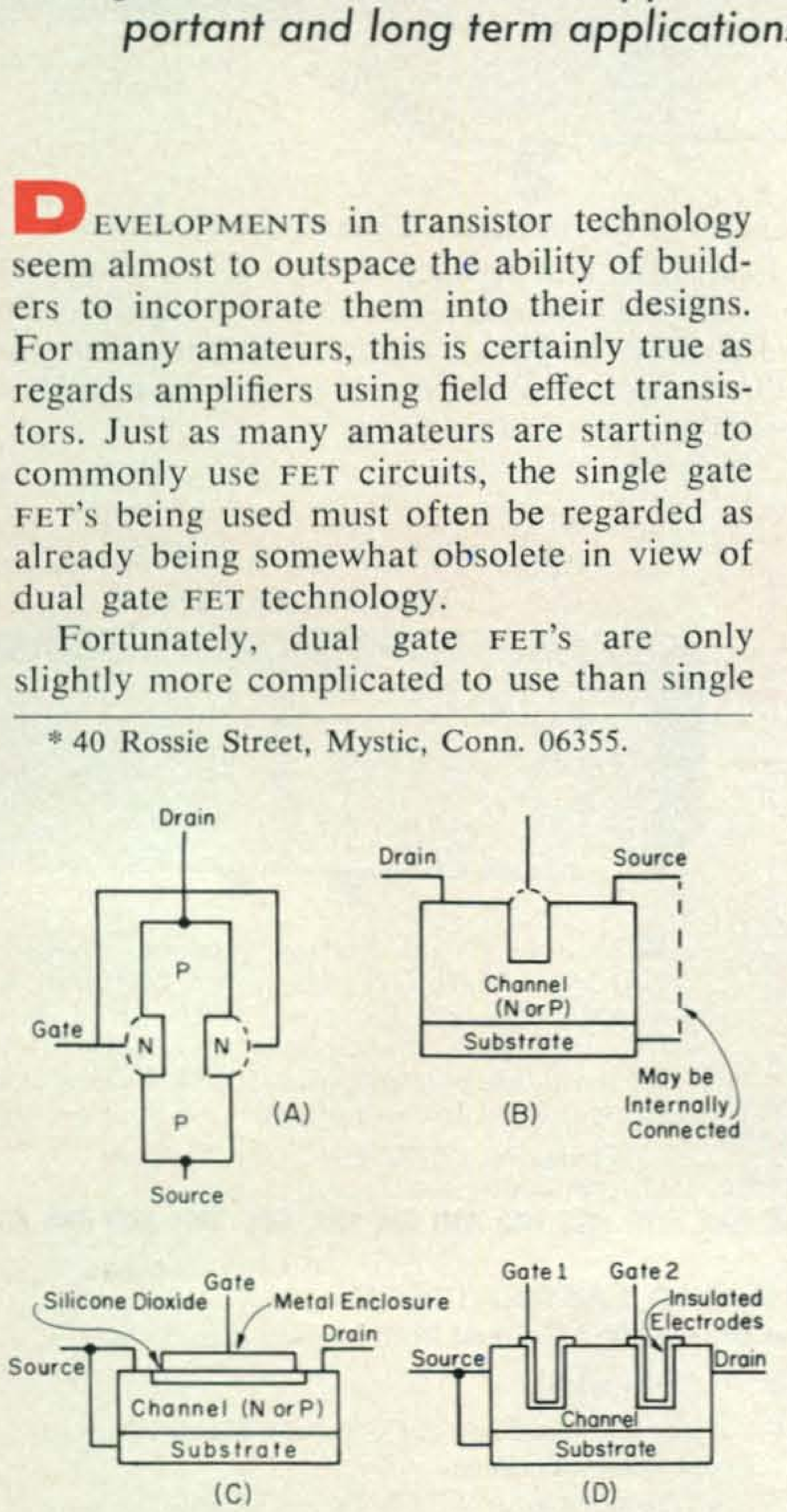

Fig. 1—Construction cross section of various junction FET's, (A) and (B), and MOS type FET's, (C) and (D).

The purpose of this article is to explain the basic composition of the dual gate MOSFET's and to present various circuits in which the device can be used. Comparisons are made between the dual gate MOSFET and both regular junction transistors and single gate FET's.

Basic Dual Gate FET

One often hears the single gate FET referred to as the transistor equivalent of the triode vacuum tube. In this sense, the dual gate FET is then the solidstate analog of the multigrid vacuum tube. The comparison can't be carried too far but, in general, it is true that the dual gate FET can perform best in those applications where multigrid vacuum tubes are frequently used. Unlike the vacuum tube, however, where all sorts of problems develop because of transit time effects between elements and which cause noise and distortion, these effects are not present in the dual gate FET.

Figure 1 (A) is a representation of a single gate FET. This type is usually called a junction type because there exists an NP junction between the gate and the drain-source P-type semiconductor material. Although the gate is operated biased to the source so that no current flows through the junction, the presence of the interface creates problems which reduce the gate input impedance to less than its optimum value.

Figure 1 (B) is an extension of fig. 1 (A), a so-called four terminal junction gate FET. In effect it can be considered to have two parallel gates, or at least a construction which allows a form of two gate operation. Usually the small gate which has the lower capacitance to other elements was used as the signal input gate and the larger gate was used for bias and a.v.c. purpose.

Junction type FET's are giving way in most r.f. applications now to MOS (metal oxide semiconductor) type FET's. Figure 1 (C) shows the representative construction of a single gate MOSFET. The gate actually consists of a metal electrode which is separated from the N-type drain-source material by a very thin layer of silicon dioxide. The oxide layer perfectly insulates the gate and no interface effects take place. This allows the input impedance of the gate to be as high as 1000 megohms. The fact that the gate is insulated also allows "field effect" control of the current flowing between the drain and source terminals by either enhancing or depleting the current carriers in the gate controlled portion of the N-type material. Thus, one may find a voltage of either polarity specified for the gate control voltage, depending upon the FET's construction.

Figure 1 (D) is a representation of the dual gate MOSFET. In this case, the gates are in series and either one can exercise independent control of the FET's operation. There is some capacitance between the gates which results in mutual coupling but it is rarely of significance until frequencies of 400-500 mc are considered. Many, but not all, dual gate MOSFET's operate in a depletion mode and so the polarity of the bias on the gates is opposite to what one expects after having been used to simple junction type FET's. Generally, most dual gate MOSFET circuits are arranged so that the gate nearest the drain is fix-biased and the gate nearest the source is used for the signal input, similar to the usual vacuum tube tetrode circuit.

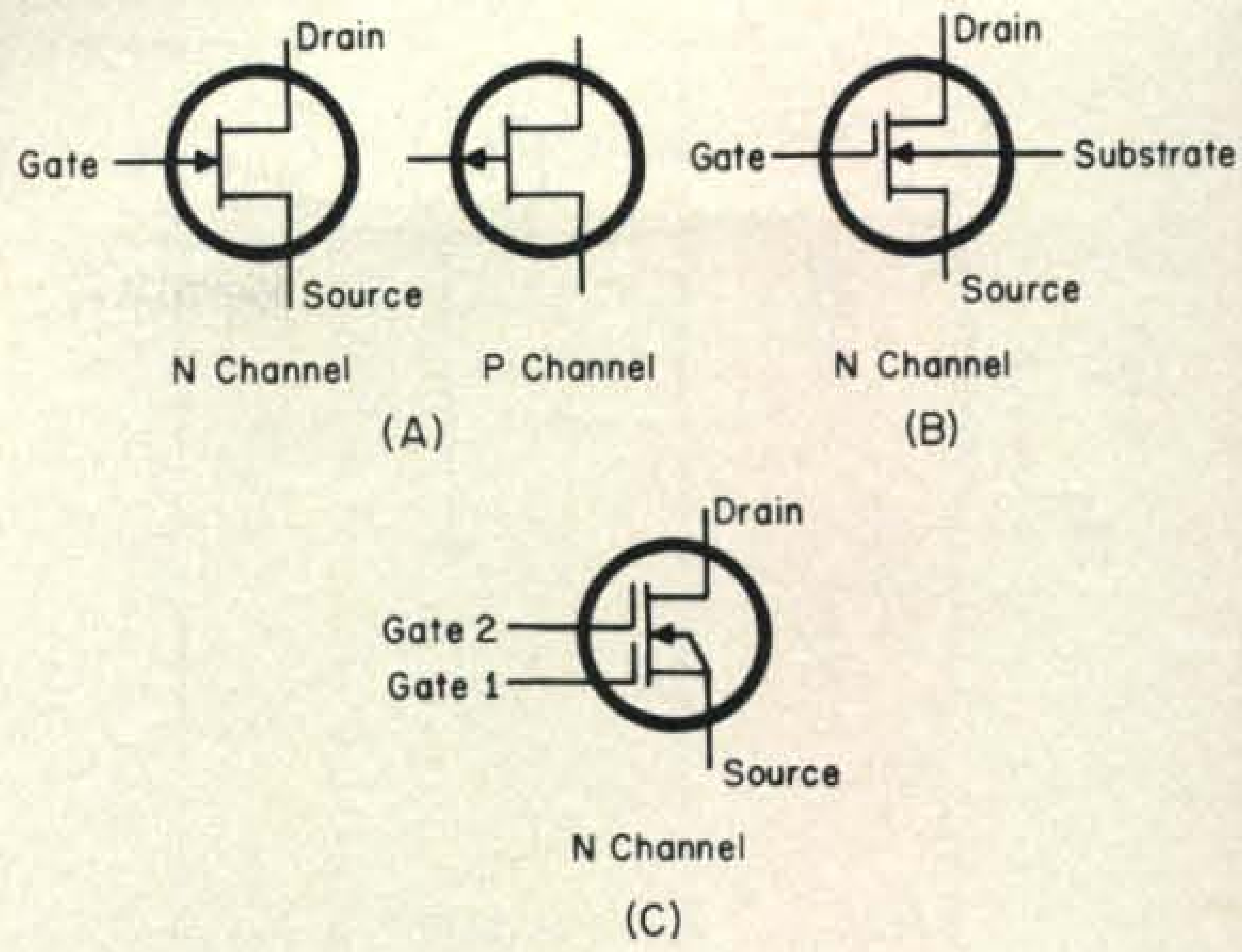

Fig. 2—Simple FET symbols (A are clear enough. Single gate MOSFET symbol (B) can have arrow on either substate or source lead. Dual gate MOSFET symbol (C) shows internal connection of substrate to source.

Advantages

The dual gate MOSFET is not a cure-all for all transistor problems but its list of advantages is impressive. For amplifier applications, the list includes low noise, good power gain, excellent dynamic range, good a.v.c. range and low feedback capacitance. Unlike a conventional transistor where the application of an a.v.c. voltage is reflected in a change in the transistors input impedance, this effect does not take place and input circuit detuning does not occur. Since the dual gate MOSFET can be turned off by an a.v.c. voltage applied at the non-signal input gate, the dynamic range is very great and essentially equals that obtained with a vacuum tube amplifier. Since the gate nearest the drain can be grounded for r.f., it acts as a shield between the input gate and the drain output circuit. As a result, feedback capacitances of less than 0.02 mmf occur and neutralization is not necessary up to at least 400-500 mc.

Power gains are not extraordinary but certainly sufficient, usually ranging from 15 to 20 db. Noise figures vary from 3.5 to 5 db.. even up to 500 mc.

As a mixer, the dual gate MOSFET really shines. The two gates allow distinct coupling to the FET for each signal input. The signal applied to one gate actually modulates that applied to the input gate by effecting a change in the input gate's transfer characteristics. The process is different from the usual diode mixing where the diode is operated in its nonlinear "square-law" region and a forest of spurious responses occur as a result of the mixing action. The frequency spectrum output of the dual gate MOSFET is particularly "clean" with only the main mixing products being essentially present. For this reason, most manufacturers who are starting to in-

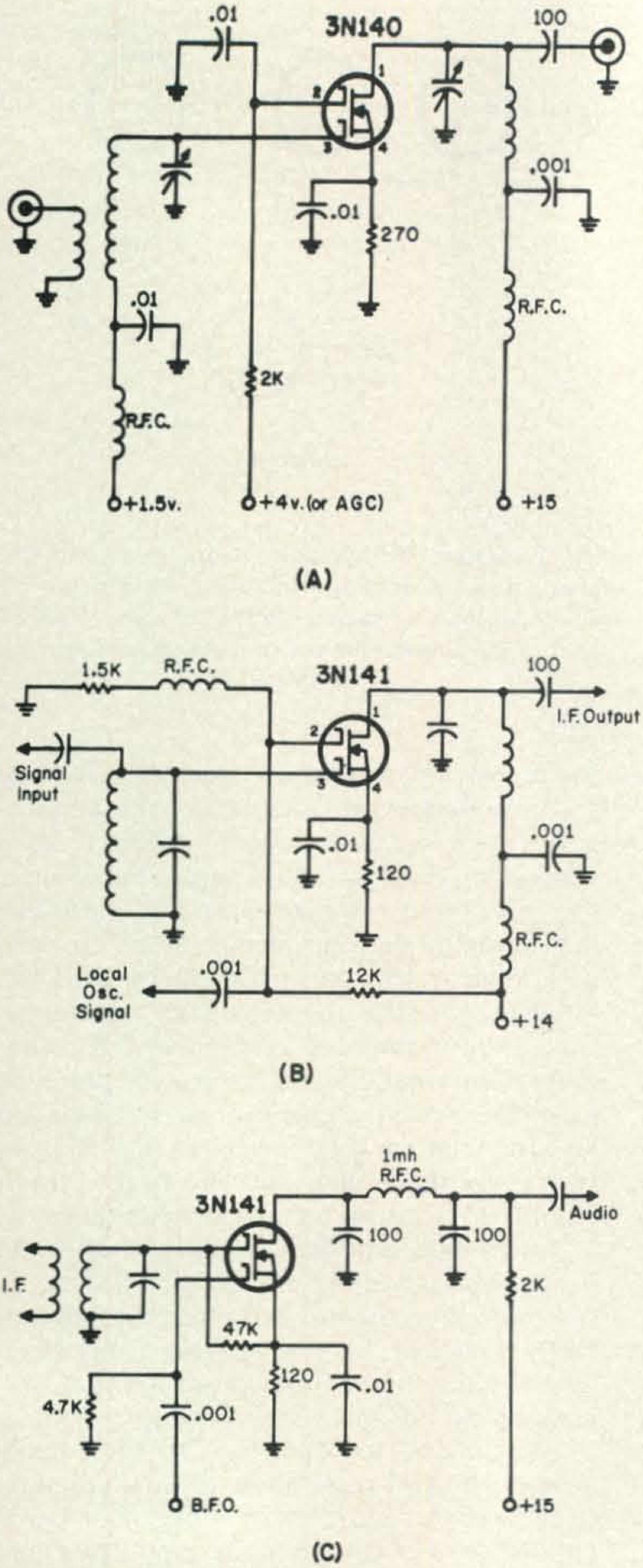

Fig. 3—Dual gate MOSFET applications as a r.f. amplifier (A), frequency mixer stage (B) and product detector (C).

corporate r.f. amplifiers in a receiver using a dual gate MOSFET almost invariably follow the r.f. stage with another dual gate MOSFET as the mixer stage.

The low distortion mixing features of the MOSFET are usable in many other applications as well, product detectors, for instance.

Disadvantages

The only real disadvantage of the MOSFET is really more a handling one than an electrical one. The MOSFET is quite stable when wired in a circuit, but when by itself it is very sensitive to electrostatic charges which could cause a current flow and rupture the than oxide coating between the gate and the semiconductor channel. Its leads must be kept connected together during storage and handling of the leads should be avoided. During equipment construction, the soldering iron used should be grounded.

Circuit Symbols

Since more and more dual gate MOSFET circuits are being developed, it would seem that the circuit symbols would be standardized but the actual situation is that most manufacturers create their own symbols. Figure 2 (A) presents the single gate junction type FET symbols. For a dual parallel gate unit usually two arrowed leads are shown, each entering from one side. Figure 2 (B) presents the most commonly used symbol for a single gate MOSFET. The gate is shown separated to indicate that it is insulated from the channel material. The direction of the arrow on the substrate lead indicates N or P-type channel material. If the substrate lead is internally connected to the source, it is usually shown as such within the circle. The circuit symbol for the dual gate MOSFET (fig. 2 (C)) is a simple extension of that for the single gate MOSFET.

Typical Circuits

Figure 3 shows three typical applications to which inexpensive RCA or similar dual gate MOSFET's can be put. The bias voltages shown for the r.f. amplifier stage of fig. 3 (A) may seem complicated but they can all be derived from the drain voltage with simple resistor voltage divider networks. The drain current should be from 7-10 ma. The amplifier will work at lower drain voltages but the voltage should not be reduced below 7.5 volts or else the noise figure will increase rapidly.

The basic mixer circuit shown in fig. 3 (B) may be used up through the 220 mc band with suitable tuned circuits and r.f. chokes. Figure 3 (C) is particularly simple but effective product detector circuit.

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KEEPING THE VOLT LEGAL

BY DAVID P. SMITH *

The legal value of the U.S. volt will be changed on January 1, 1969! Don't worry, however; the change is extremely small and will not detectably change the calibration on any readers test or measuring instruments. That such an event as a change in the value of the volt can take place, however, does serve as a reason to present the very interesting story of electrical unit reference standards. The story of these ultimate U.S. reference standards which stand behind many intermediate standards used to calibrate our simple meter, multimeter and other test equipment for voltage, current and resistance measurements is both informative as well as useful to appreciate the real meaning of the basic electrical terms that we commonly accept as being valid by definition.

IN our routine measurements of voltage, currents or resistance we often tend to disconnect the values that we read for these quantities on a meter from any physical reality. It is useful, however, to remember that the very earliest experiments having to do with electrical effects were concerned with the attraction between electrostatically charged bodies and the attractive force that existed between wires carrying electrical currents. Many experimental and fundamental physical laws have been developed dealing with the force of attraction between charged bodies and the force of attraction between current carrying wires of specific dimensions and specific separations. In other words, the effect of electrical quantities can be expressed in terms of the mechanical units of length, mass and time. Electrical quantities are, therefore, calibratable against mechanical units.

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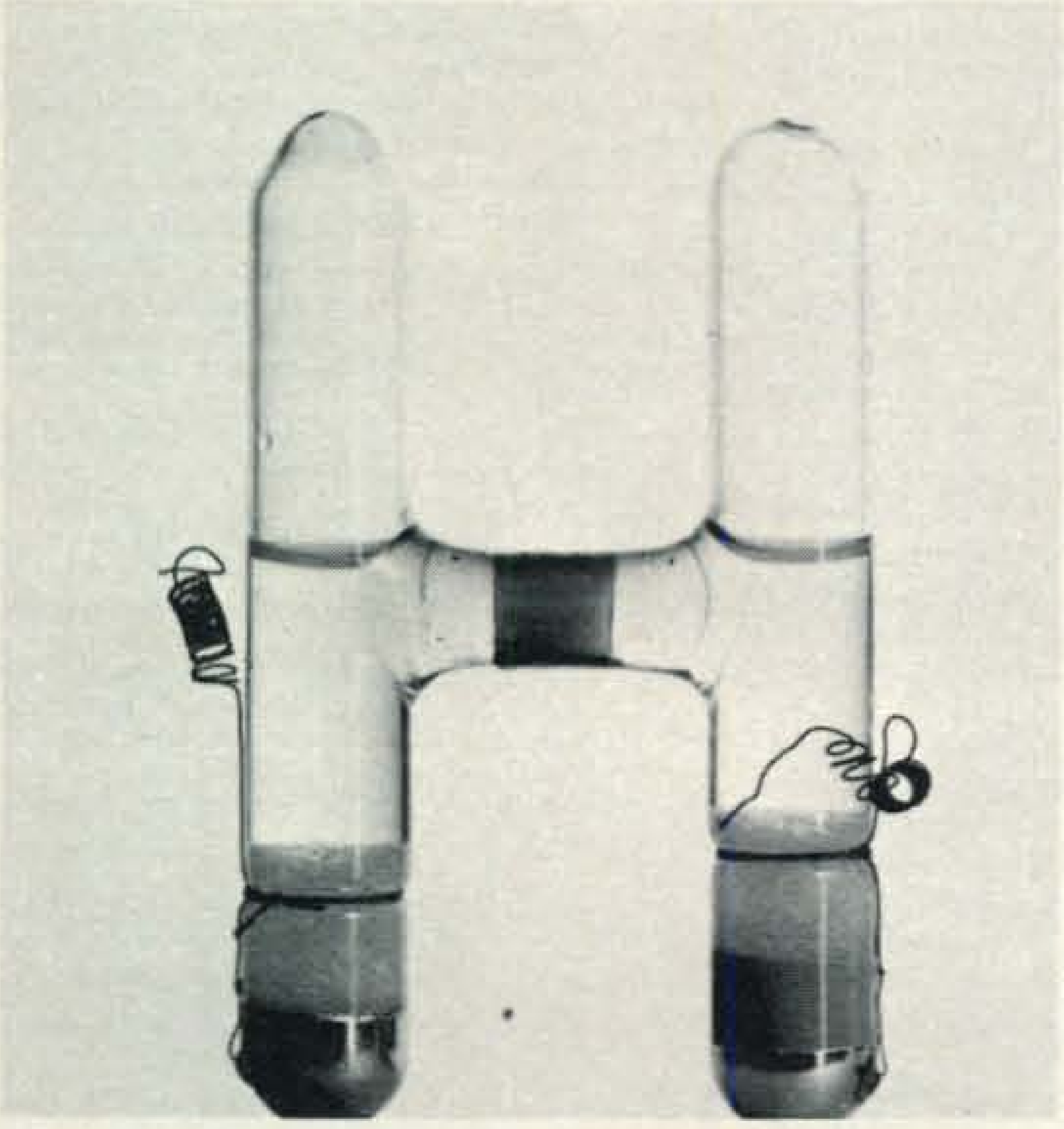

The basic Weston Cell. A group of 44 such cells in a special oil bath constitute the U.S. National Reference Group for the legal volt. *(N.B.S. Photo)*

Many systems have been devised and used over the last several hundred years to express the mechanical units of measure.[1] The two most promient systems, however, are the cgs (centimeter-gram-second) and mks (meter-kilogram-second). The cgs system is also referred to in terms of cgs electrostatic or cgs electromagnetic units when it references electrical effects, depending upon whether the values stated have been derived from laws based upon experiments with electrostatically charged bodies or the force attraction due to electrically generated magnetic fields. Some early scientists felt that electrical quantities

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should be only expressed in terms of some defined mechanical system of measure. Various European scientific societies strongly urged such a system of measurement in the mid-1800's. If their ideas had been adopted, we would now be saying that instead of a 1 volt output, a battery or amplifier stage would have an output expressable in some number of mechanical units, such as *X* number of cgs (centimeter-gram-second) electromagnetic units or *Y* number of mks (meter-kilogram-second) units. Current and resistance values would have been stated in similar terms and each time it would have been necessary to state that the cgs or mks values referred to so many units of voltage, current or resistance.

[1]For *scientific* purposes in all countries.

Fortunately, the International Congress of Electricians (a purely scientific body) in 1881 adopted the cgs as a fundamental system but the simple volt-ampere-ohm as a practical system. Try to imagine the confussion that was saved by this relatively simple decision. If it had not been done, our circuit descriptions would today be filled with references to 10,000 cgs em units of voltage across 100,000 cgs em units of resistance, *etc.*, instead of simple values of voltage and resistance in terms of volts and ohms. The congress established a defined relationship between these fundamental and practical units which is still the basis for the mechanical standards for electrical units. The electrical units, defined on the basis of units of length, mass and time, were termed absolute units. The values determined by the Congress were:

1 absolute volt =
10^8 cgs em units of potential
1 absolute ohm =
10^9 cgs em units of resistance

The ampere was determined to comply with the defined relationship of Ohm's law and so:

1 absolute ampere =
10^{-1} cgs em units of current

Although many of us remember their derivation, it is still interesting to note again the people for whom the volt, ampere and ohm were named. Surprisingly enough, they are a rather international group consisting of an Italian, a Frenchman and a German. The volt was named after Alessandro Volta who in the late 1700's devised numerous forms of electric potential sources including the common electrochemical battery. The ampere was named to distinguish Andre Marie Ampere who in the first decades of the 1800's determined many of the fundamental current-magnetic field relationships. The ohm was named after a somewhat forgotten scientist—Georg Simon Ohm whom in 1827 stated the principle of Ohm's law. Oddly enough, the latter principle has remained the most fundamental building block of electrical unit mathematical interrelationships.

Exactly dimensioned capacitors are used to calibrate the National Reference standard for the ohm. *(N.B.S. Photo)*

The cgs em values which the Congress chose for the volt, ampere and ohm were not totally arbitary. The Daniel cell, a convenient laboratory cell construction in use at that time, produced about 1 volt. The Siemens mercury column, used as a laboratory resistance standard, measured about 1 ohm. It should be understood, however, that the basic definition of a volt was 10^8 cgs em units and not the potential of the Daniel cell. The Daniel cell happened to have a potential value near the defined value for a volt and so it could be used as an electrical reference standard. As scientists later developed more accurate ways to make cgs em unit measurements, it actually developed that the typical Daniel cell had a potential value of 1.07 to 1.14 volt and the Siemens mercury column measured about 0.94 ohm.

Since the electrical units were tied to cgs em units, various laboratory methods were

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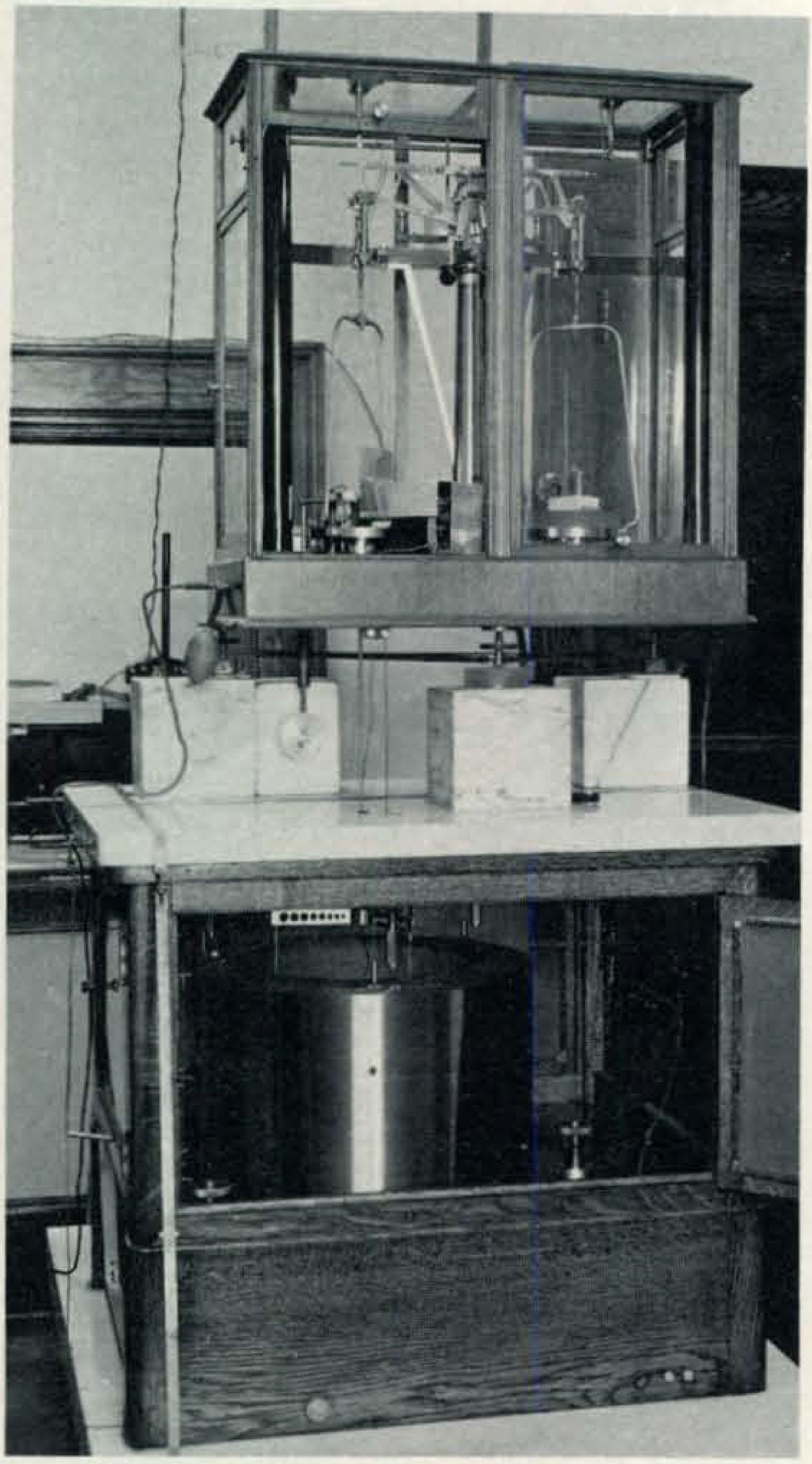

Current balance as used to determine the absolute value of the ampere in terms of mechanical units. *(N.B.S. Photo)*

devised to accurately measure the cgs em units corresponding to the practical units of voltage, current and resistance. Many of these methods are very elaborate and some are described briefly later. It is interesting to note, however, that no way has yet been found to measure voltage directly in terms of cgs em units. Practical attempts at absolute electrical measurements deal with ampere and ohm measurements and the principle of Ohm's Law is used to determine voltage values.

Absolute Measurements and Reference Standards

One should not confuse the meaning of absolute measurements with the nature of reference standards. Absolute measurements are laboratory procedures conducted to determine the present value of some reference standard, such as a reference voltage cell. The reference standard is a device which has been especially constructed to maintain its properties without change over an extremely long period of time and under as wide a range of environmental conditions as possible. Since no means have been devised as yet to maintain a standard ampere "on the shelf," reference standards only exist in reality for voltage and resistance. (The resistance standard is a specially constructed wire resistor and the voltage standard a Weston cell, as described more fully later.) Absolute measurements can only be made for absolute amprere and the absolute ohm, however, and the value of the voltage reference standard is determined by using Ohm's Law.

One may wonder why it is necessary to obtain reference standards when some absolute measurements can be made. The reason is that absolute measurements are not made simply. They are long, tedious procedures that can take many months and involve considerable computation since the quantities measured must all be ultimately related to the standards maintained for our mechanical and time references.

The National Bureau of Standards maintains the U.S. reference standard for the volt and the ohm. These standards are periodically checked with the standards maintained by other countries through the Bureau International des Poids et Mesures, Sèvres, France, which also coordinates the reference standards maintained by various countries for the units of length and mass.

Absolute, International and Legal Volts

Without making an interesting story too confusing, it is useful to trace the various terms associated with the practical naming of reference standards. Although an absolute volte (ampere, ohm) is defined in terms of cgs em units, other terms, such as the International volt and Legal volt, are used.

In 1893 a Clark cell was used as a reference standard for voltage since it appeared to be an extremely stable unit. The "International" volt was defined for practical use based on the cell's potential at 15°C. Of course, one can't create an extremely stable chemical battery with a specified voltage. The actual voltage of the Clark cell was about 1.434 volts. An international volt was equal to 1/1.434 times of the potential of a Clark cell. An international ohm was based on the resistance of a specified size mercury

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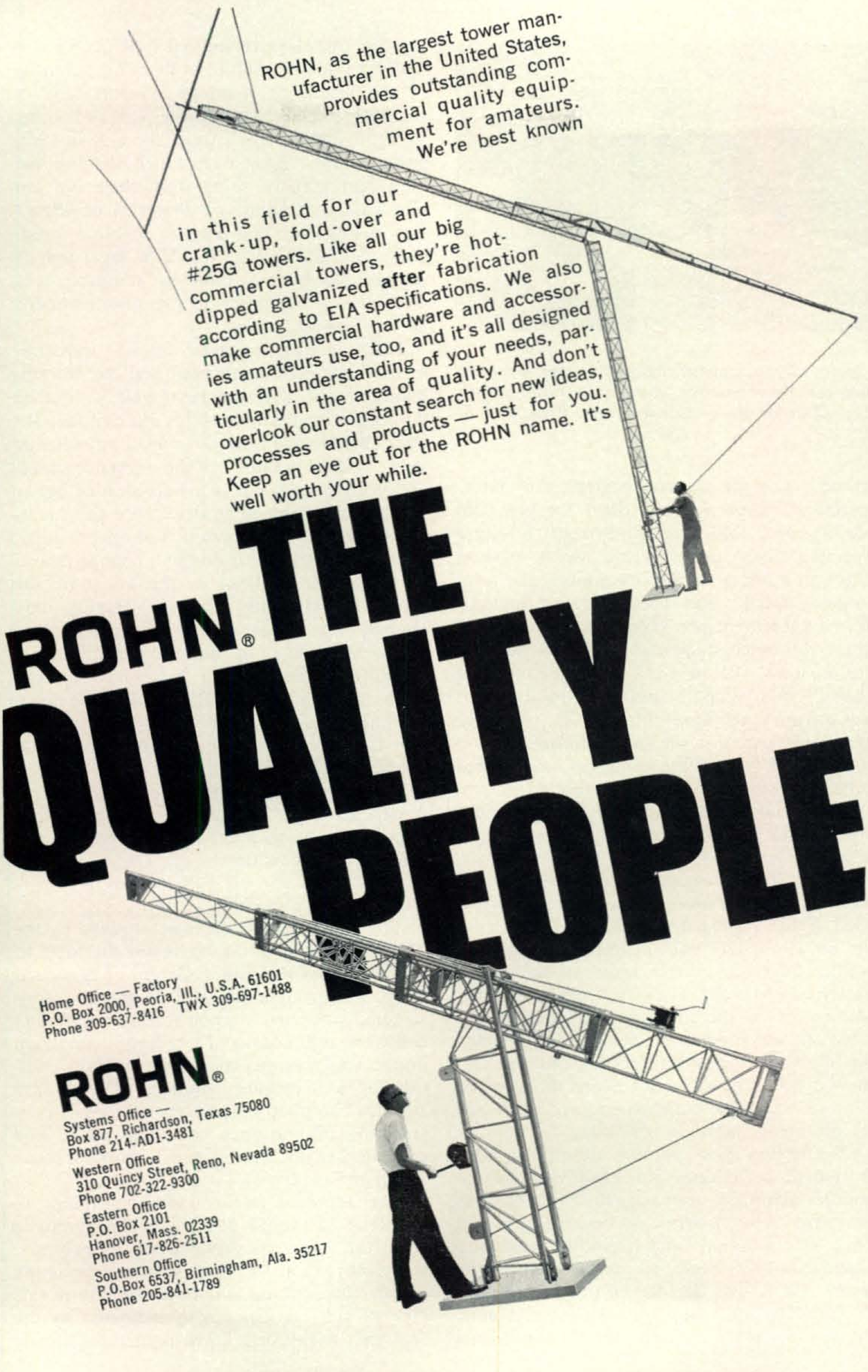

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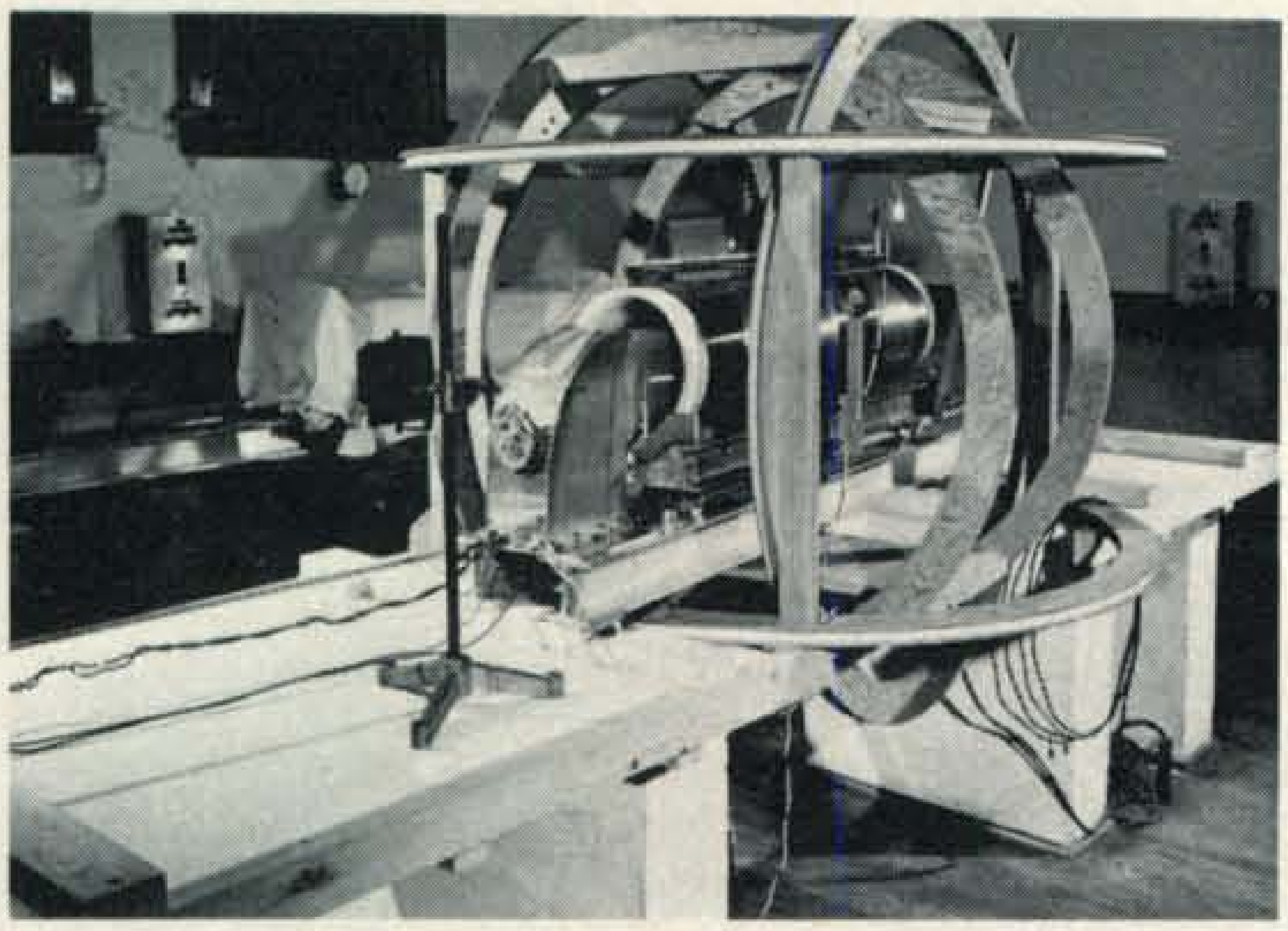

Electro Dynamometer apparatus for absolute ampere determination with compensating coils for effect of the earth's magnetic field. *(N.B.S. Photo)*

column at a specific temperature. An "international" ampere was defined for practical use as being that value of current causing a specific silver deposit rate when passing through a nitrate of silver solution. The term "international" was used because international agreement was obtained for the use of these reference standards. The U.S. adopted Public Law 105 in 1894 which defined the "legal" volt, ampere and ohm in terms of cgs em units as represented by the reference standards used for the international units.

A small "fly in the ointment" developed when as scientists in many countries improved their means of cgs em unit measurements, the Clark cell didn't prove to be so ultra-stable!

In 1910, international agreement was obtained to use the more stable Weston Normal Cell as the standard reference cell. In order to be consistent with former international values, its voltage was rated to be 1.0183 international volts after new absolute measurements of the international ampere and ohm. As was mentioned before, each country maintains its own reference standards and they are compared about every three years. The result of the comparisons are expressed as the mean international volt.

No matter how perfect laboratory measurement techniques for even very fundamental quantities appear at the time, they do improve. After a while, it became apparent that international and absolute reference standards units were no longer exactly the same and it was decided to make reference to standards only in terms of absolute units. In 1948, precise absolute measurements showed that 1 international volt (U.S.) was really 1.00033 absolute volts. The potential of the reference standard Weston cells in absolute terms then became 1.01864 volts. To again define "legal" units, the U.S. in 1950 passed Public Law 617 which defined the ohm and ampere using only their cgs em unit values and the volt in terms of Ohm's Law (using ohm and ampere absolute standards). So, since 1950 the U.S. legal volt is represented by the value of standard cells calibrated using absolute measurements for the ampere and ohms.

Now, once again, better absolute measurements have been conducted and the determination made that the legal volt should be 0.00001 volt greater in terms of absolute voltage. This change does *not* reflect any change in the voltage potential of the reference standard Weston cells but is a reflection of better measurements made to determine the standard ampere and ohm in terms of cgs em units. Most of the change is due to a change (about 11 parts per million) in the value of the measured absolute ampere. Hardly any change (1 part per million) has taken place in the absolute ohm measurement.

So, if a manufacturer has reference cells calibrated against the NBS standard, he must, starting on January 1, 1969, add 0.00001 volt to their value to be legally correct. Of course, such a small change hardly affects most owners of electrical measuring instruments but it is of concern to laboratories engaged in very precise measurement and calibration procedures.

The U.S. Voltage Standard

The U.S. "legal" volt is maintained by the National Bureau of Standards in the form of The National Reference Group of Standard Cells. The group consists of 44 specially constructed saturated Weston (cadmium sulfate) cells. The cells consist of a cadmium amalgam anode and mercury-mercurous sulfate cathode in a saturated solution of cadmium sulfate. The photograph shows the basic construction of one such cell. The anode and cathode are located at the bottom of each leg of the H shape.

The reference volt is based upon the mean potential of the 44 cells. A cell is removed from the reference group when its potential drifts more than 1 μv from its previous steady value. The extreme long-term stability of this type of cell construction is indicated by the fact that many cells have retained a steady

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value for 60 years. The actual group of reference cells are kept under elaborately controlled environmental conditions. They are maintained in a constantly stirred oil bath. The oil is regulated at 28°*C* and the room air temperature at 25°*C*. The oil bath also serves to protect the cells from light which can slightly affect their chemical states.

The cells are quite sensitive to current flow. Even small current demands from them act to decrease their voltage although they can recover their steady state values once left unloaded. In order to calibrate other secondary reference cells from the primary cells, the cells to be calibrated are basically connected in series with the reference cells. The difference in voltage between the cells is determined by a special bridge circuit that can measure voltage differences to 0.1μv. Elaborate precautions are taken to insure proper contacts throughout the measuring system such as connections to the reference cells using mercury filled cups.

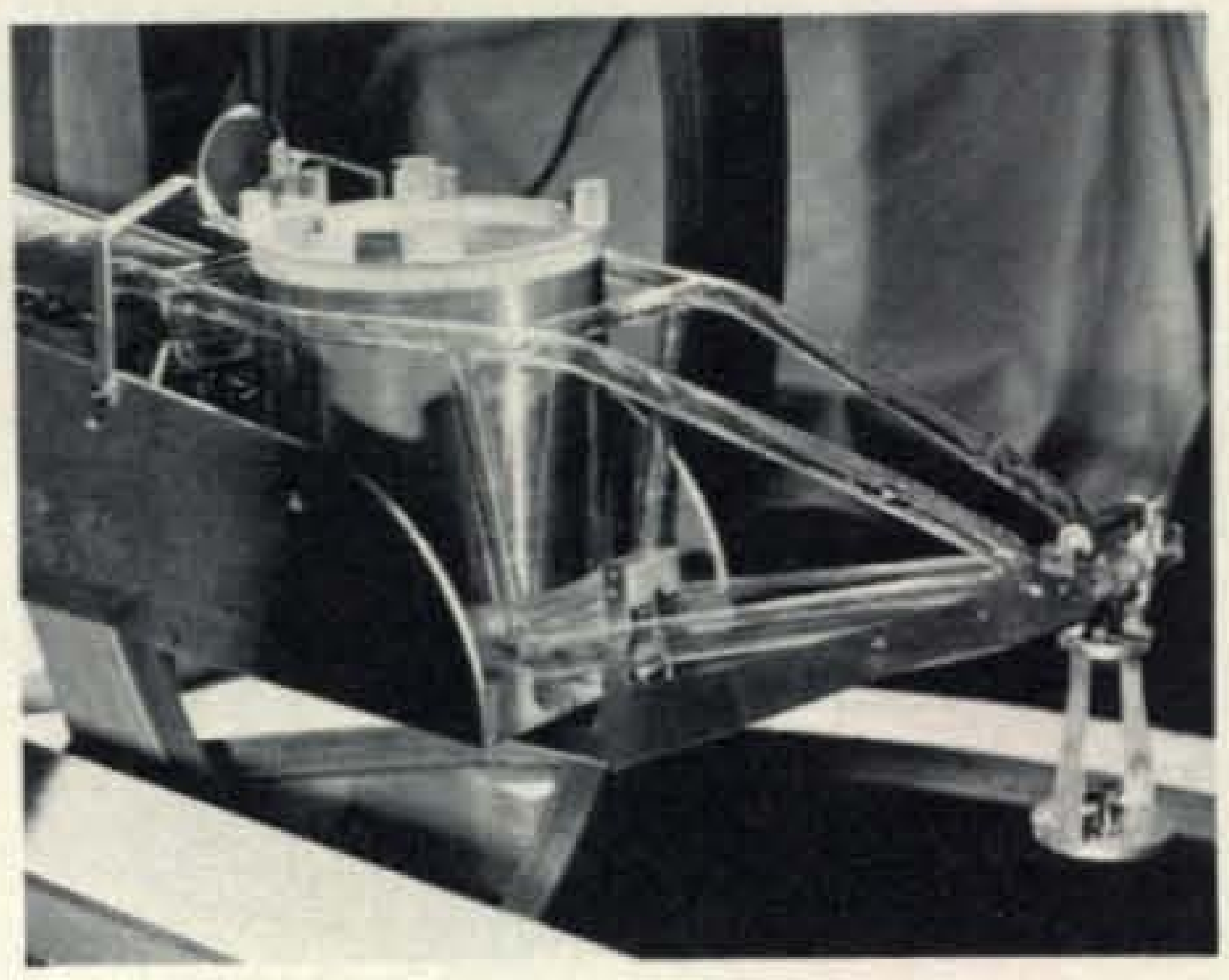
"Customer" reference cells are not really compared directly with the National Reference Group but really with "working reference cells" which are maintained in Washington, D.C. and Boulder, Colorado. These cells are calibrated against the national standard. The calibration of a primary reference for a customer is not a simple process. Ten days are required for calibration of customer cells with one measurement being done per day and then averaged.

The National Ohm Standard

The national reference standard of resistance is maintained by the National Bureau of Standards using a group of 1 ohm manganin resistors. The maintenance of a resistance standard is somewhat different than that of a voltage standard in that a standard can be constructed to be one ohm. The voltage standard value must be determined by a stable chemical formulation.

The resistance standard is constructed using a double walled cylinder with manganin resistance wire wound around the inner cylinder and the space between the cylinders filled with dry air. The construction is extremely stable over long periods of time and, in fact, is the most stable of electrical standards. Secondary resistance standards which can receive NBS calibration against primary standards are made in decade value to 10,000 ohms.

The calibration of the primary standards



Dynamometer apparatus for ampere measurement employing a fused quartz balancing apparatus. *(N.B.S. Photo)*

was formerly done by an elaborate mutual inductance method which involved highly accurately dimensioned inductors and an accurately switched step voltage. Now, the computable capacitor method is generally used to calibrate the resistance standard. The basis for its usage is that capacitance can be computed solely on the physical dimensions of a capacitor. As shown in the photograph, a highly accurately dimensioned capacitor is constructed. The impedance of the capacitor at some exactly know frequency is compared with the resistance value of the primary reference resistor. As mentioned, the value of the reference resistor has shown extremely little variation. Over a period of 20 years, the reference has varied from 0.999997 to 1.000004 ohm, a total variation of 0.0000043 ohm.

Absolute Ampere Measurement

As mentioned, no method has been devised to keep a reference standard ampere "on the shelf," so many methods involving great complexity have been devised to measure the absolute ampere in order to calibrate other reference standards, such as the voltage reference standard cells in conjunction with the value determined for the reference standard ohm. Three methods were used recently to finally arrive at the new voltage reference standard value by the measurement of the absolute ampere, one a current balance method and two dynamometer methods. All the methods involve a force calculation and so depend upon the calculation of the acceleration due to gravity, a standard value which also was recently recalculated using experimental methods.

The current balance method depends upon the force between two current carrying wires being balanced against the gravitational force on a know mass (see photo). In the center of a large coil a smaller movable coil is placed which is attached to an arm of a precision balance. When the current in the two parts of the outer coil is reversed, the change in the force on the small current-carrying coil is measured by the balance. From the change in force and the dimensions of the coil, the absolute value of the current flow in amperes is determined in terms of length, mass and time.

The two electrodynamometer methods used to measure the absolute ampere are somewhat similar. In one method a wooden framework is used to compensate for the earth's magnetic field (see photo). The metal housing that enters the large solenoid contains a small rotatable coil and a balance arm. When the direction of the current through the coils is reversed, torque is produced on the small coil. This coil is connected to the balance arm so that as it tends to rotate, equilibrium is upset. Balance is restored by adding known weights to the balance arm by means of the rod and pulley arrangement at the outer end of the housing. From the known weight, the length of the balance arm and the geometry of the windings, the value of the current in absolute amperes can be calculated in terms of length, mass and time.

The other dynamometer method makes use of a coil connected to a fused quartz balance arm (see photo). When the small coil is placed inside a solenoid (not shown), the current through the coils causes a tendency for the smaller coil to rotate and tip the balance arm. Known precision weights are added to the balance to restore equilibrium as observed by means of the lens, scale and pointer at the upper left of the coil. The weights at the lower right are placed on the pan for adjustment purposes, before the measurement sequence starts, to balance the initial system.

Summary

Some of the reference standards and apparatus used for the measurement of absolute electrical values may appear to be somewhat old-fashioned at first glance. Yet, they are the means by which the highest precision measurement can be made. Various atomic standards have been proposed to replace the reference standards but none as yet has been found to be fully suitable.

The value of reference standards is sometimes hard to appreciate, especially when one talks aout minute changes in these standards. Accurate and stable values for these standards, however, are the "hard rock" basis for continuing further progress in this age of high-speed and highly sophisticated electronics. The various mathematical relationships which govern electronic equipment performance are fine, but to build and use a piece of equipment a physical reference standard must exist. ■

NATIONAL RARE BLOOD CLUB

Lou Goldberg, WB2SSM, has been named chairman of the Amateur Radio Division of the National Rare Blood Club.

Mr. Goldberg will canvass amateur operators in the United States to seek out those with rare blood and invite them to join the National Rare Blood Club, 164 Fifth Avenue, New York 10010. Mr. Goldberg will aid the club in its search for the 25% of the population that has rare blood because of the increasing shortage of rare blood in hospitals across the U.S.

Rare blood donors are not paid, nor does the recipient of rare blood pay for the blood he receives. Being a member of the Club is a two-way street. Not only does a donor help himself in time of emergency, but he also helps another human being.

The National Rare Blood Club, funded by the Associated Health Foundation, Inc., an offshoot of the Knights of Pythias, has supplied free almost 3,000 units of rare blood yearly. ■

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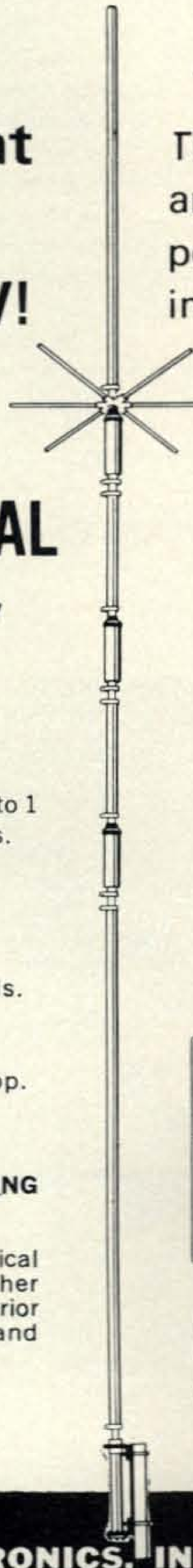

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EXPERIMENTS WITH THREE ARRAYS ON ONE BOOM

BY SAM E. PARKER, *W6ZWK

Part II

Part II of the two part series concludes with a discussion on isolation of the three arrays by line sections, isolation by networks, the effects on s.w.r. and the antenna patterns.

PART I of this two part series covered the general construction and tuning of the elements of three arrays on a 36 foot boom. Part II, below, discusses the various methods of coupling the three antennas to one feed line with minimum adverse effects on the patterns and s.w.r.

Isolation By Line Sections

Since any two of three arrays can be combined at a given set of relay contacts, three different combinations are possible using this approach. Experience with two of these combinations will be briefly described.

Initially, the 20 and 10 meter arrays were combined at the normally-closed contacts, as indicated in fig. 9. The basic problem is to determine the lengths l_1 and l_2 of interconnecting lines that transform the driving point impedances Z_{ab} and Z'_{ab} to very high values in the operating portions of the 10 and 20 meter bands respectively. These lengths depend not only upon the electrical characteristics of the cable sections employed but also upon their terminating impedances at non operating frequencies. Assuming that the values of X_C and X_i afford resonance at 14.2 mc, the value of Z_{ab} was estimated at 28.6 mc. The value of Z'_{ab} was estimated at 14.2 mc in a similar manner. Neglecting effects of distributed parameters as well as components of reflected impedance, it was further assumed that coil reactances vary directly with frequency and capacitive reactances vary inversely with frequency. Under these conditions, the average values of X_i permit the desired terminating impedances to be estimated and, as illustrated in fig. 10, the electrical lengths of the line sections are readily determined from a Smith chart.

As shown in fig. 10, line sections of 0.074 and 0.414 wavelengths are indicated at 28.6 and 14.2 mc respectively. Using cable having

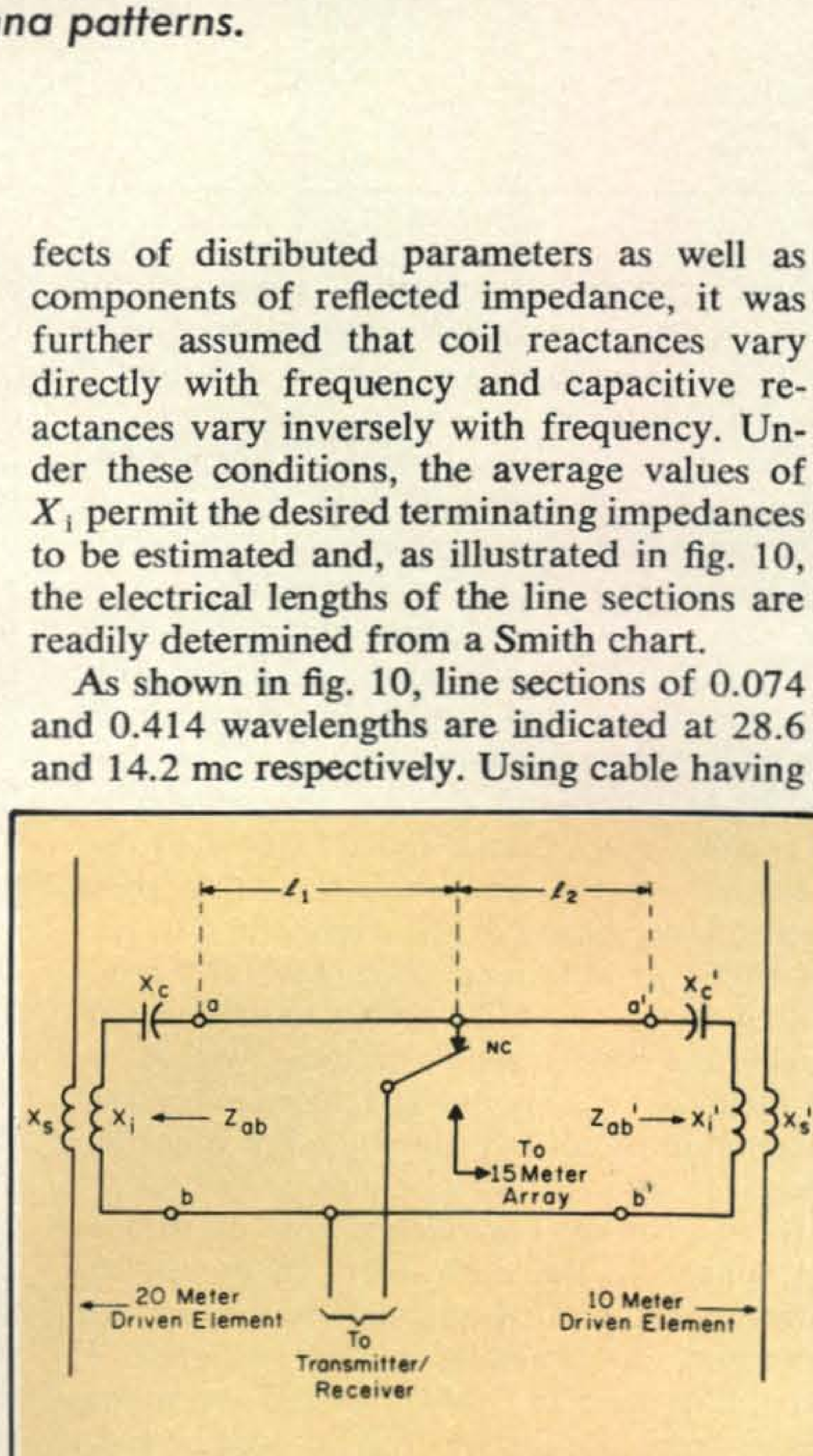

Fig. 9—Identification of impedances and line lengths involved in combining the 20 and 10 meter arrays at the normally-closed relay contacts.

* 3651 Liggett Drive, San Diego, California 92106.

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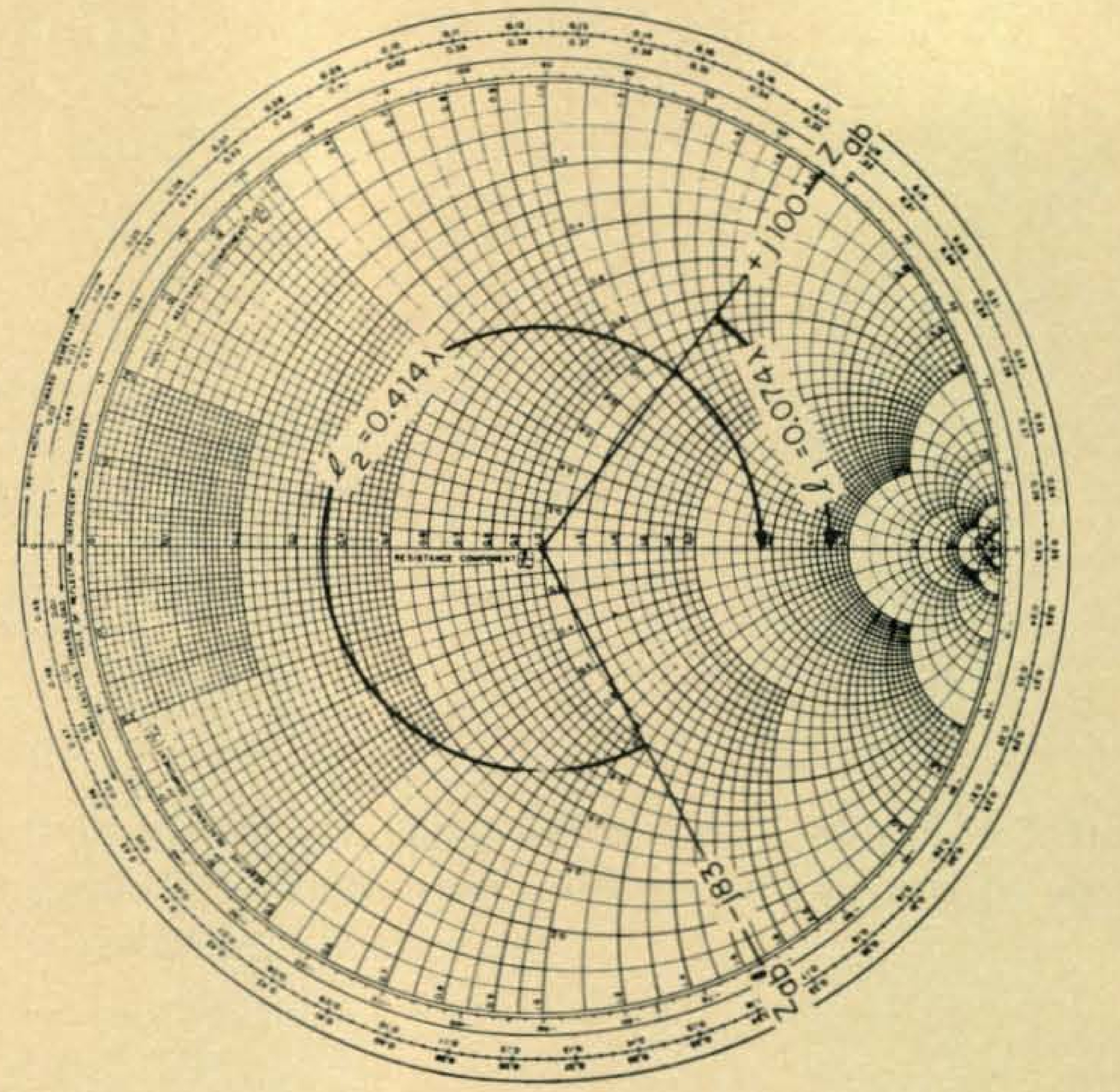

Fig. 10—Smith chart showing electrical lengths of 50 ohm cable required to transform load reactances of −j83 and +100 to very high values at 14.2 and 28.6 mc respectively.

polyethylene dielectric with a velocity factor of 0.67, the corresponding physical lengths of the cable sections are computed to be 1.7 and 19.2 feet.

The 20 meter driven element was already connected to the relay through three feet of cable so initial tests were made after merely connecting the 10 meter driven element to the same contacts through 20 feet of RG-9B/U cable. The s.w.r. of the 20 meter array was not noticeably effected; but the s.w.r. of the 10 meter array changed significantly when the 20 meter driven element was connected by a cable more than a foot longer than that indicated by the Smith chart. Using these connections, however, no difficulty was experienced in obtaining unity s.w.r. by readjusting the 10 and 20 meter matching networks; and it was found that the s.w.r. of the 15 meter array was not adversely influenced by combining and readjusting the other arrays.

In spite of the convenience of the foregoing approach, the desirability of combining harmonically related antennas in this manner is rather questionable. Unless isolation is essentially perfect, some second harmonic energy from the 20 meter array will be radiated by the 10 meter array and unnecessary interference will result. After operating about two weeks to gain some experience with this combination, the 10 and 15 meter arrays were combined as described below.

The 10 and 15 meter driven elements were connected to the normally-open relay contacts without disturbing the connections to the 20 meter driven element. Using data from Table I as explained in Part I, terminating impedances Z_{ab} and Z'_{ab} in fig. 11 were estimated at 28.6 and 21.2 mc and electrical lengths of appropriate line sections were estimated from the Smith chart in fig. 12.

In this case results were quite different from those experienced earlier. After the 10 and 15 meter matching networks had been separately adjusted to provide unity s.w.r. at 28.6 and 21.2 mc, they were combined by sections of cable having lengths l_1 of 3.5 feet and l_2 of 10.4 feet. Connecting the 15 meter driven element had a negligible effect upon the s.w.r. of the 10 meter beam, but the later noticeably influenced the s.w.r. of the 15 meter beam. Moreover, successive adjustments of the two matching networks merely made matters worse and it became apparent that these tuning and loading conditions were divergent.

This difficulty was corrected by two changes. The 10 meter driven element was connected by a section of cable 12.6 feet long, an increase of 2 feet, and the brass slug was replaced by the slug of Feramic

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Q2 material described in connection with Table II (in Part 1). After this unthreaded slug had been properly positioned, RTV silicone rubber adhesive/sealant was applied. (This General Electric product was also applied to all brass slugs following their final adjustments to avoid possible movement from incessant antenna vibration over a period of time.

This experience in combining the 10 and 15 meter arrays shows the importance of using line sections that afford a very high degree of isolation. If one array exerts a negligible effect upon the s.w.r. characteristic of the other, problems with devergent tuning and loading conditions cannot arise and, for reasons explained later, desirable pattern charactertistics are more likely to result.

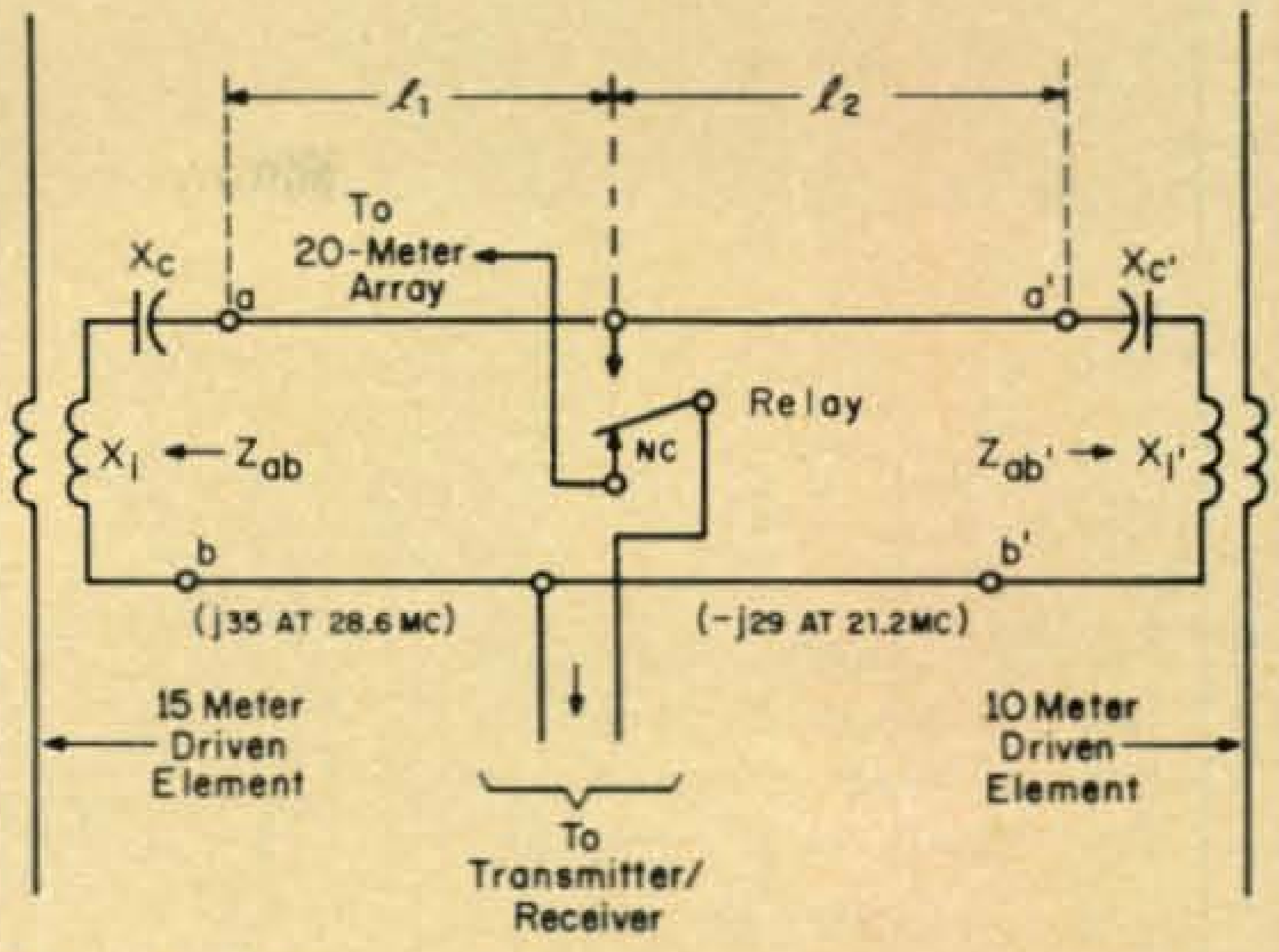

Fig. 11—Estimated load reactances used in obtaining lengths of cable sections for combining the 10 and 15 meter driven elements.

Isolation By Networks

Certain possibilities of combining two or more antennas on a single feed cable by means of linear passive networks will be briefly discussed. While this technique was not used in the present tests, it has been widely used by the military and communications industry for operating several equipments with a common load, and may prove helpful to the experimentally inclined amateur in planning his future antenna farm.

Techniques for designing certain networks for parallel or series interconnections have been known for many years.[2] For purposes of illustration, consideration will be limited to fractional-x complementary filters connected in parallel. These are readily adapted to antenna feed systems employing a coaxial line.

Figure 13 provides schematic diagrams and design equations for complementary filter networks that permit two antennas to be operated on different bands with a single feed line. This approach is readily extended to include antennas on five (or more) bands, as indicated by the block diagram in fig. 14. The cutoff frequency of each complementary filter pair is normally chosen at the geometric mean between adjacent edges of their operating bands. Since amateur bands are well separated, the choice of cutoff frequencies is not critical and can be made to simplify computations or to aid in selection of components. (The difficulty of procuring or fabricating suitable capacitors probably explains the rather limited use of these techniques by amateurs.)

Two properties of the fractional-x complementary filters are especially important in antenna combining. In their respective stop bands where the image attenuation constant is roughly 26 db or more, the input impedance is practically independent of the load impedance. For this reason the s.w.r. of one antenna will not be unduely influenced by matching adjustments of the other antennas. Each of the complementary filters provides impedance variations in its stop band that approximate the variations of a shunt arm of the associated filter. Since the stop band of the high-pass filter corresponds with the pass band of the low-pass filter, for example, the high-pass filter provides roughly the same reactance variations as L_2 and C_2 at frequencies below f_c. In similar manner the low-pass filter provides the reactance variations of L_2' and C_2' above f_c. For these reasons, these shunt elements are omitted at the terminals that are connected in parallel.

S.W.R. Characteristics

There are many unresolved questions regarding the mutual effects of intermixing arrays on the resulting impedance and pattern characteristics. Other important questions pertain to effects of height above ground and other environmental influences. These complex questions have not been resolved by analytical studies and reports of empirical tests often appear questionable or contradictory. While this study makes no pretense of

[2] U.S. Patents 1,557,229 and 1,557,230 issued to O. J. Zobel. Also, E. A. Guillemin, *Communication Networks*, Vol. II, pp. 356-360, John Wiley, New York, 1935; and F. E. Terman, *Radio Engineers' Handbook*, 1st Ed., pp. 237-238, McGraw-Hill, New York, 1943.

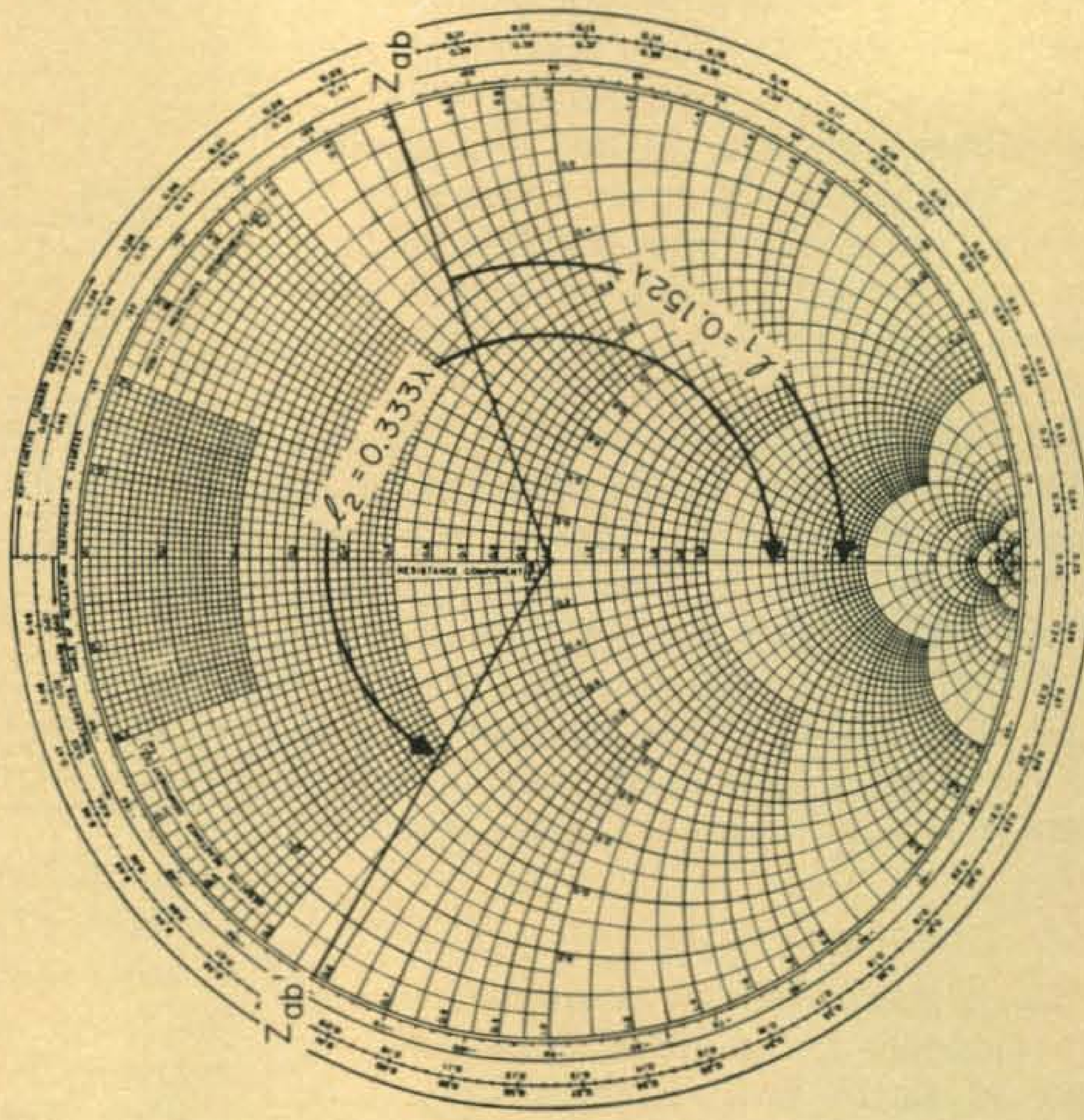

Fig. 12—Lengths of 50 ohm cable that transform the estimated load reactances in fig. 11 to very high impedances.

having answers to all these challenging problems, observations based on available data may be of interest and perhaps encourage further experimentation along these lines.

Contrary to results of McCoy's recent tests using 15 and 20 meter beams separated only a foot,[3] our tests show that the s.w.r. characteristics of intermixed 15 and 20 meter beams change significantly with their elements separated several feet, as shown (at right) in fig. 3. After the three 15 meter elements were added in 1965, a bifiler wound inductor and capacitor assembly that had been used for years with the 20 meter beam alone was found to provide insufficient coupling. The *RC* resistance meter showed that the input resistance had increased considerably, being roughly comparable for both arrays. To verify this, the 20 and 15 meter driven elements were directly connected to the relay through short sections of RG-9B/U cable and the minimum s.w.r. measured below 1.5 on both bands. After repeated changes in the lengths of the driven elements it was possible, in fact, to achieve a s.w.r. that approached unity within the two bands. It is emphasized, however, that this approach to multi-band beam design is not recommended. The directivity suffered noticeably from successive changes in the lengths of the driven elements and the s.w.r. was unduely influenced by rain and fog. This sensitivity to moisture is typical of many instability problems that are likely to result from the use of coupled impedances of moderately high Q factor for impedance control.

This apparent contradiction with McCoy's observations may be due in part to the different terminating conditions employed with the coupled antennas. McCoy is understood to have used "gamma" matching with separate feed lines. Since the lengths and terminating conditions of these lines are unspecified, the impedances present at the "terminals" of the parasitic driven elements may have been considerably different from those experienced with coaxial transformers and electrically short connections to the relay. Jourdan discusses the situation as follows: "Except when antenna 2 is very near a resonant length or when it is very close to antenna 1, the input impedance of antenna 1 will be nearly the same with antenna 2 open-circuited as it would be with antenna 2 entirely removed from the field of antenna 1."[4]

Information is available for estimating effects on input impedance that result from

[3] McCoy, L. G., "Note on Beam Stacking," *QST*, Nov. 1967 p. 38.

[4] Jordan, E. C., *Electromagnetic Waves and Radiating Systems*, p. 348, Prentice Hall, New York, 1950.

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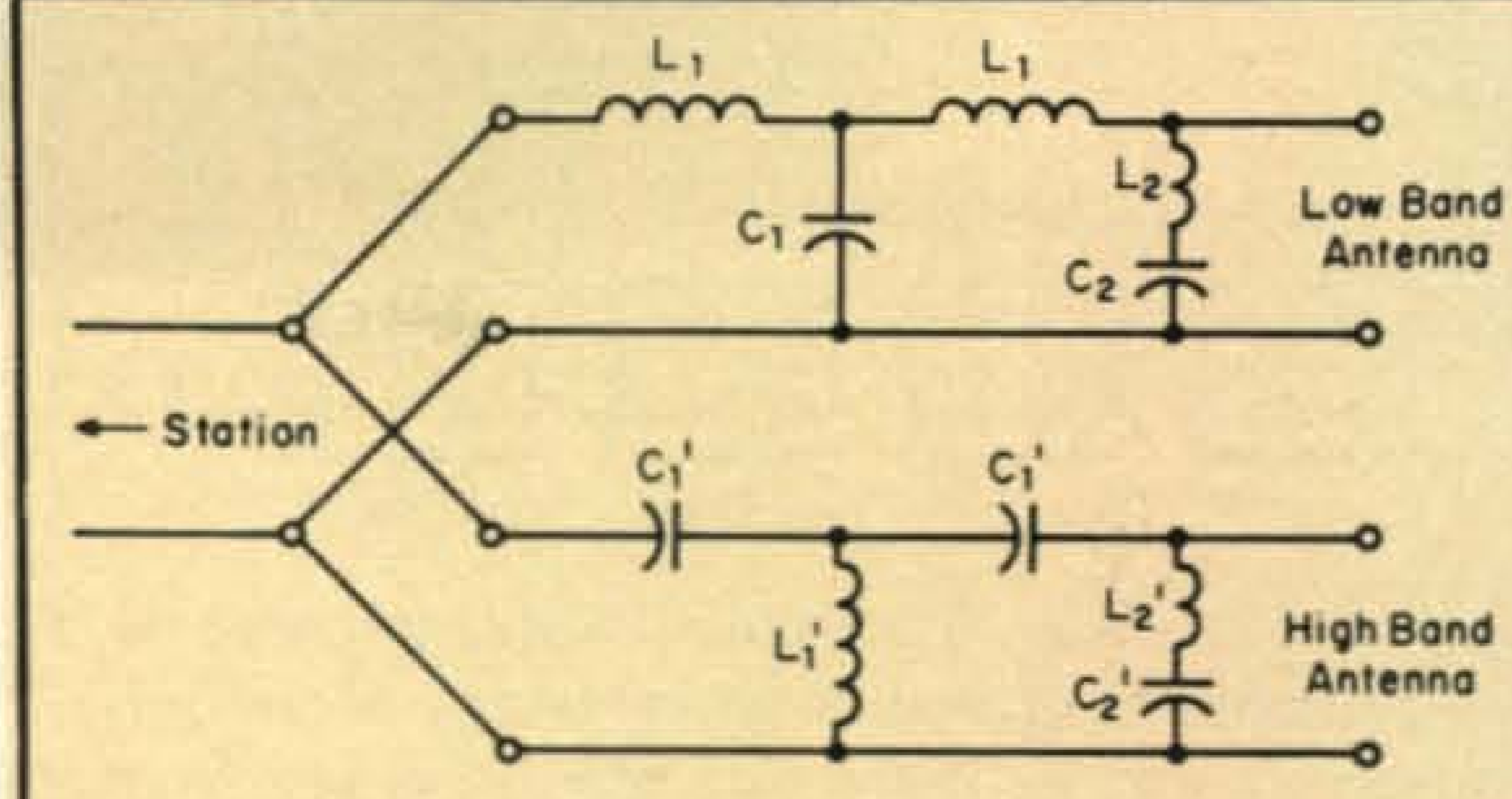
intercoupling certain antennas of unequal length separated about one-tenth wavelength or more.[5] Since one foot corresponds to 0.0144 wavelength at 14.2 mc, extrapolation from this study to separations of a foot or less is rather questionable, and the present problem is further complicated by the cumulative effects of several similar elements in the different arrays.

Problems regarding effects of height on antenna impedance are usually approached by assuming an antenna and its image equally separated by an infinite, perfectly conducting ground plane. Under these idealized conditions, both the resistive and reactive components of mutual impedance oscillate about zero as height above effective ground increases from zero to about one-half wavelength, or more.[6] The separation between an antenna and its image obviously depends upon the location of the effective ground plane below the earth's surface and, in extreme cases, this clearly reduces effects of moderate changes in antenna height. Ground losses further reduce the variations of mutual impedance components. Taking into account the three bands of frequencies involved, it is easy to see that a wide variety of impedance effects can be experienced as a multi-band antenna structure is elevated. The manner in which the s.w.r. changes will depend in large measure on the matching technique employed and, therefore, the impedance characteristics described below may not directly apply to installations utilizing different feed systems.

After preliminary adjustments on a wooden ladder, the three arrays were again tuned and loaded at a height of 24 feet, with the tower vertical. In fact, the arrays were readjusted on several occasions using different frequency combinations and slugs of brass or ferrite (or none at all). Without attempting a complete account of these tests, typical data will be given to illustrate major results and observations.

In an early test series the arrays were adjusted for unity s.w.r. at 14.2, 21.3 and 28.6 mc at a height of 24 feet. No change in s.w.r. was observed upon combining the 10



$L_1 = (M+1)R_0/\omega_c$

$C_1 = 2/(R_0\omega_c)$

$L_2 = \left(\frac{1-M^2}{M}\right)R_0/\omega_c$

$C_2 = M/(R_0\omega_c)$

$\omega_c = 2\pi f_c$

$L_1' = R_0/(2\omega_c)$

$C_1' = \left(\frac{1}{1+M}\right)\left(\frac{1}{R_0\omega_c}\right)$

$L_2' = R_0/(M\omega_c)$

$C_2' = \left(\frac{1}{1-M^2}\right)\left(\frac{1}{R_0\omega_c}\right)$

Fig. 13—Schematic diagrams and equations for designing fractional —x complementary filter networks. The parameter M is usually given the value 0.6 and R_0 is 50 ohms in most coaxial feed systems now commonly used.

and 15 meter feed lines at the relay. The s.w.r. characteristics were again measured after the antenna had been raised to 60 feet. While no significant change in the impedance properties of the 15 meter array was observed at this height, significant changes occurred in the 10 and 20 meter bands.

The s.w.r. of the 20 meter array increased from unit at 24 feet to 1.6 at 60 feet. However, unlike the shift to higher frequency observed by McCoy (*op. cit.*) in somewhat similar 20 meter tests, the point of minimum s.w.r. remained at 14.2 mc. Actually, some shift in minimum s.w.r. to higher frequency had been expected from earlier experience with 20 meter beams at this height.

Having anticipated possible need for tuning adjustments at 60 feet, the variable vacuum capacitors had been fitted with small aluminum wheels (or flat pulleys) which facilitated rotation from the ground by means of waxed lacing cord. (Variable air capacitors, of course, can be controlled in similar manner.) When capacitor adjustment failed to reduce the s.w.r. to unity at 14.2 mc, a pulley of similar design was made of dielectric material and attached to the threaded brass slug by a short fiberglass rod. The graph at top of fig. 15 shows the s.w.r. characteristics obtained from adjustments of the capacitor and slug at this height. The lower graphs give measured characteristics of the 15 and 10 meter arrays at the same height and bearing. These arrays were not readjusted after the tower was raised.

[5] Cox, C. R., *Mutual Impedance Between Vertical Antennas of Unequal Heights*, Proc. I.R.E. (Waves and Electrons Section), Vol. 35, No. 11, pp. 1367-1370, November, 1947.

[6] King, R. W. P., Mimno, H. R., and Wing, A. H., *Transmission Lines, Antennas and Wave Guides*, p. 126 (Fig. 19.1), McGraw-Hill, New York, 1945.

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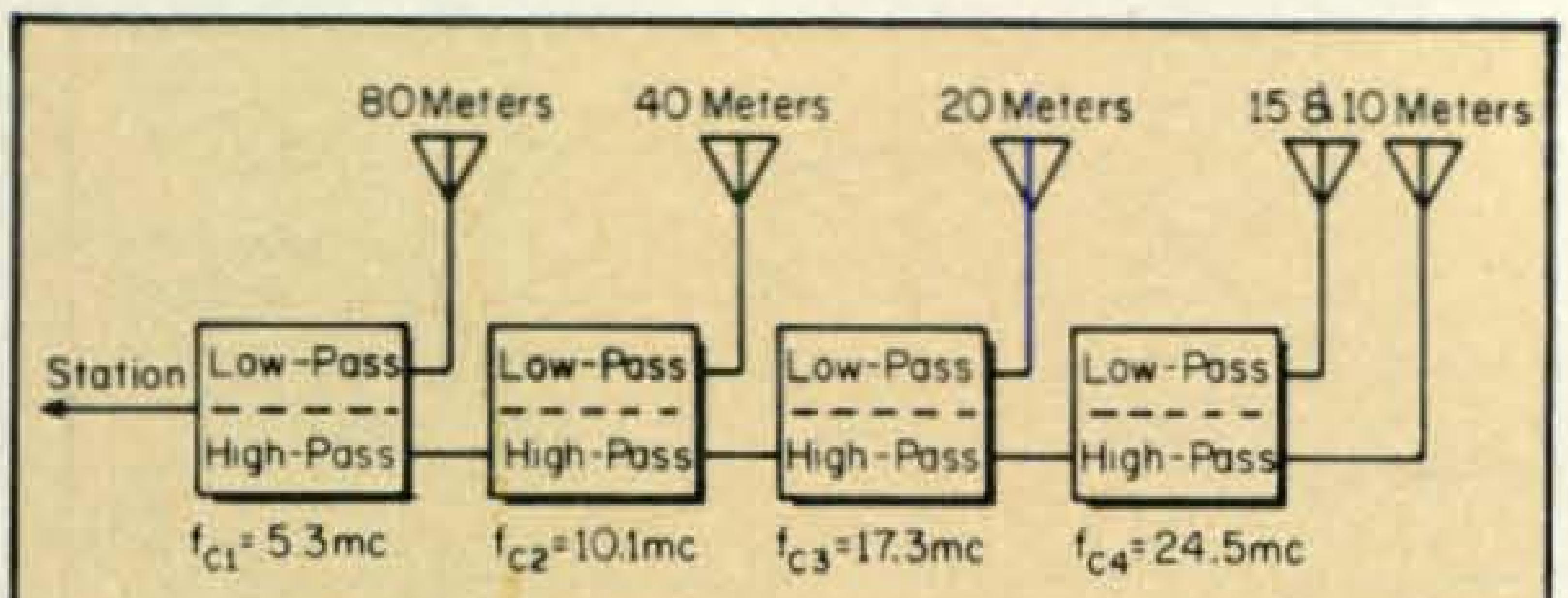

Fig. 14—System of fractional —x complementary filters providing operation of antennas on all h.f. amateur bands by means of one feed line from the station. Typical cut-off frequencies are included.

In fig. 15, the s.w.r. characteristics of the 10 meter array are inferior to the others in two major respects. A somewhat narrow operating band is afforded between practical limits of s.w.r. and, as shown by the dotted curve, the s.w.r. is a function of incident power. Most of the s.w.r. measurements in this study were made with the incident power constant at 200 watts and all of the arrays exhibit stable impedance characteristics at this power level. For incident power of 400 watts, however, the s.w.r. curve of the 10 meter array shifts about 100 kc higher in the band. The exact reasons for this shift are uncertain but intercoupling with the 20 meter elements is believed to be the underlying cause of this instability and of the reduced operating band. Note that the 20 meter elements are approximately a wavelength long at 28.4 mc and coupling effects from these "resonant" elements may cause the driving point impedance of the 10 meter array to change quite rapidly with frequency. Under this condition, a small change in tuning capacitance from moderately high input current could account for this shift in s.w.r. (It should be noted that this capacitor is rather old and its plates are pitted and discolored.) Among other potential sources of power instability, the possibility of nonlinear effects of the ferrite slug seems unlikely since the same shift in s.w.r. occurred after the 10 meter array had been adjusted for minimum s.w.r. (around 1.7) without the use of a slug in the coaxial transformer. The possibility of equipment instability was ruled out by operating at high power in the 10 meter band with a 500 watt dummy load. And because of stability of 15 meter operations and the high degree of isolation afforded by the combining technique, this does not appear to be a likely source of instability.

The foregoing considerations illustrate a variety of problems that may result from excessive intercoupling as well as from numerous other sources. In general, the limitation of the available operating band and the critical nature of 10 meter adjustments are considered much more significant than the minor impedance changes at high power. In fact, it seems unlikely that these changes would be noticed during normal operations.

It is emphasized that the impedance characteristics of the 10 meter array can probably be improved through the use of better instrumentation and adjusting techniques. Determination of element lengths from resonant frequencies was especially uncertain at these higher frequencies because the grid dip meter was extremely sensitive to effects of the operator's hands and body. Tuning and loading adjustments were so critical that it was practically impossible to obtain comparable s.w.r. characteristics after successive adjustments. And height caused the s.w.r. to vary in a random manner, as illustrated in Table III. These data were measured with the antenna pointing southeast at a bearing of 135 degrees. The incident power was constant at 200 watts.

Frequency (mc)	*Measured Values of S.W.R.*		
	at 24 feet	*at 45 feet*	*at 60 feet*
28.5	1.925	1.500	1.375
28.7	1.329	1.754	1.375
28.9	2.438	2.692	1.925

Table III—Measured values of the s.w.r. of the 10 meter array at three frequencies and three heights above ground.

Along with height, topography and ground conductivity, utility lines and other structures significantly influence the impedance of the antenna. This is illustrated in Table IV which includes values of reflected power (in watts) at different bearings relative to geographic north. Since the incident power was approximately constant at 200 watts, values of s.w.r. are readily computed using the magnitude of the reflection coefficient,

$$|\gamma| = \sqrt{\frac{\text{Reflected Power}}{\text{Incident Power}}} \qquad (6)$$

in the expression

$$s.\,w.\,r. = \frac{1 + |\gamma|}{1 - |\gamma|} \qquad (7)$$

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Bearing (degrees)	Reflected Power in Watts with 200 Watts Incident			
	at 14.2 mc	at 21.3 mc	at 28.5 mc	at 28.7 mc
0	2	1	2	10
45	3	0	2	12
90	4	0	2	15
135	0	0	2	15
180	10	0	1	18
225	4	0	2	16
270	3	0	2	12
315	2	0	2	10

Table IV—Values of the reflected power at selected frequencies with the antenna pointing in different directions.

Of course, various charts and graphs are available for this purpose.

An abrupt change in reflected energy is observed at 14.2 mc. With the antenna pointing southeast across San Diego Bay, the s.w.r. is unity; but with the antenna pointing south at a bearing of 180 degrees, toward major utility lines that extend across the south boundary of the lot at a height of about 30 feet, the s.w.r. increases to 1.6. Very little change occurs at 21.3 or at 28.5 mc, but the s.w.r. of the 10 meter array changes significantly at 28.7 mc. This appears to support the hypothesis that this array is unduly influenced by coupling with the 20 meter elements at certain frequencies.

A Few Comments Regarding Patterns

Lacking adequate facilities for measuring patterns, these comments will be quite general and brief. Available information is limited to a few comparative tests and performance reports which are often unreliable and unrealistic. Experience with the 10 meter array is especially limited and inconclusive.

The 20 meter array affords the best comparisons since it was used for some time before the others were added. Following the installation of the 15 meter elements about two years ago, general performance and reports have been comparable in every respect to earlier experience with the 20 meter array alone, making due allowance for the improved propagation conditions that have occurred during this period.

The pattern and overall performance of the 15 meter array has been equally satisfactory, comparing favorably with the four element 20 meter array. Tests using a calibrated step-attenuator ahead of the Model 75S-1 receiver indicate that both arrays provide front-to-back ratios in the order of 20 db, or more, with a single minor lobe behind the main lobe. This fact is mentioned because the advantages of a high front-to-back ratio are not always apparent when achieved with two minor lobes displaced somewhat from the back of the beam unless, of course, the geographic location of the station is taken into account.

The pattern of the 10 meter beam, although perhaps adequate for many purposes on this particular band, is clearly inferior to the patterns of the larger beams. Limited tests indicate that the front-to-back ratio is around 15 db.

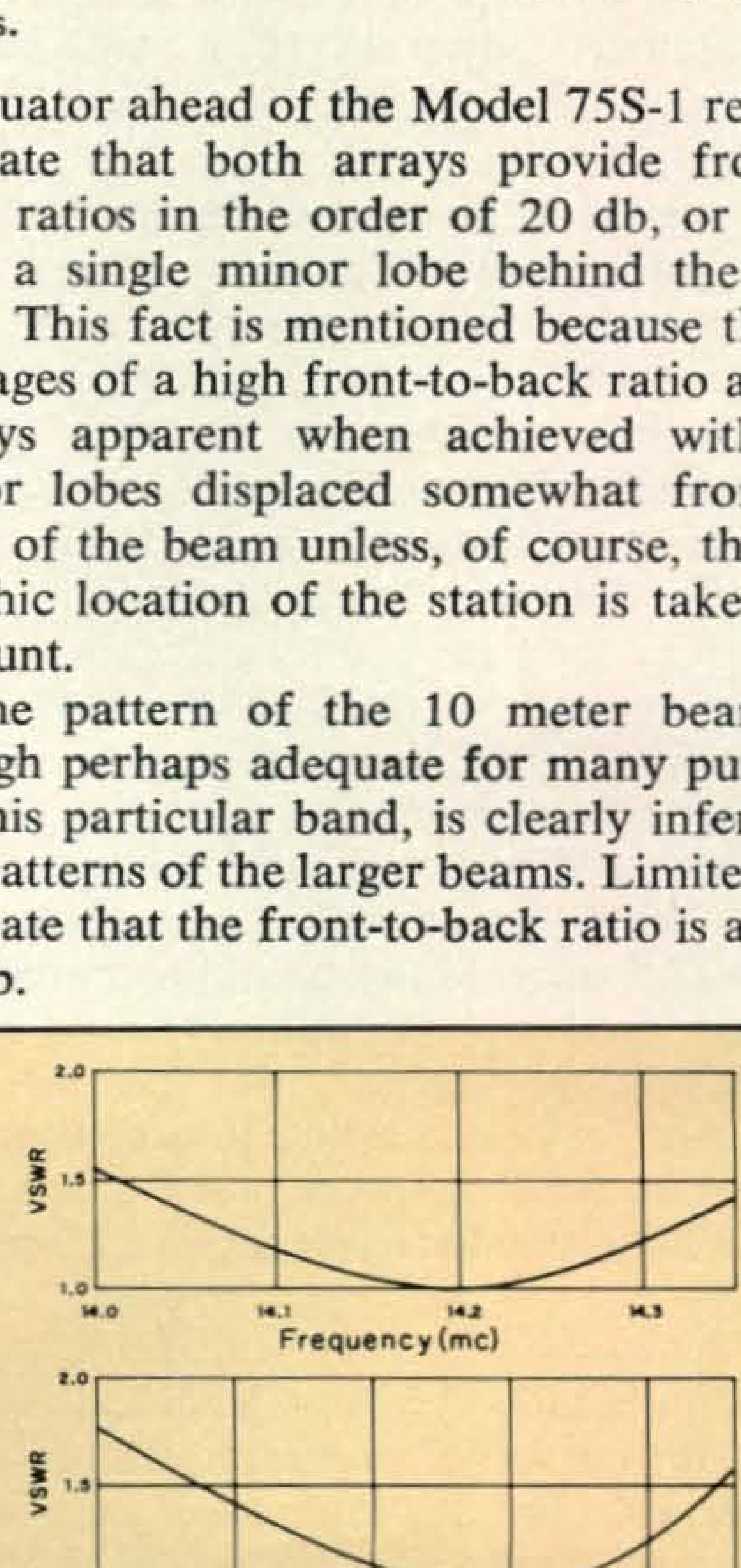

Fig. 15—S.w.r. characteristics of the three intermixed arrays at a height of 60 feet, measured with the antenna pointing south-east across San Diego Bay.

The importance of a high degree of isolation between arrays with combined feed cables should be stressed from the standpoint of pattern as well as impedance. At frequencies outside a relatively narrow operating band, the pattern of a Yagi-Uda array may usually be characterized as bidirectional or, in certain cases, as omnidirectional. It is practically impossible to predict the effect of combining this pattern with that of a directional array, depending upon the relative signal strengths and phase relationships involved. It seems safe to assume, however, that the resulting forward gain and front-to-back ratio will usually suffer from inadequate isolation. Since an improperly designed and poorly adjusted beam gives these same undesirable characteristics, one should not assume that unsatisfactory patterns from multi-band beams are necessarily due to inadequate isolation.

The use of instantaneous relay switching permits interesting comparisons between the several arrays at frequencies within and well removed from their normal operating bands. Out tests show that both the 20 and 15 meter arrays invariably provide much better performance in their normal bands than in other bands. On the other hand, the forward gain of the 10 meter array is only a few db (corresponding to one or two S-units) better than the 20 meter array in the 10 meter band. In part, this results from the fact that the 20 meter array is a fairly good bi-directional antenna on 10 meters with a measured s.w.r. of 3 at 28.5 mc. (Many omnidirectional h.f. antennas used by the military have s.w.r. approaching this value.) For purposes of comparison, it is interesting to note that this 20 meter array gives an s.w.r. of 8 at the non-harmonically related frequency of 21.3 mc.

Summary And Concluding Remarks

The combination of three Yagi-Uda arrays on one 36 foot boom provides a rather compact, versatile antenna structure.

Intermixed arrays may be fed satisfactorily by a single coaxial cable using a transfer relay that is energized and controlled by the same cable. Arrays and other antennas also may be isolated by suitable line sections, or by linear passive networks such as fractional-x complementary filters.

Coaxial transformers and bifilar wound inductors provide an effective means for coupling a balanced antenna to an unbalanced line. These transformers may be controlled by magnetic or non-magnetic metallic slugs. In common with other well known matching techniques, a variable capacitor in the primary circuit is desirable for reactance control.

Slug controlled inductors are convenient for obtaining small variations in the electrical lengths of parasitic elements for experimental or special purposes. Since this requires subdividing and insulating the parasitic elements, these inductors are not recommended for general amateur applications.

Divergent tuning and loading adjustments can be experienced when two arrays are connected by line sections unless their lengths are correctly determined, taking into account the terminating impedances of the arrays at the proper non-operating frequency bands. This problem is avoided if the s.w.r. of one array is not effected when the other array is connected.

The input impedances of two or more arrays may change appreciably when their elements are intermixed on the same boom. These changes depend upon the terminations of the various arrays and upon the size, quantity and separation of the elements involved.

It is impossible to predict effects of height on the input impedance of a parasitic array without careful consideration of frequency, topography, ground conductivity, proximity and orientation of utility lines, and numerous other environmental factors. The manner in which these factors influence s.w.r. depends in large measure upon the particular matching technique employed. However, as long as the s.w.r. remains around 1.5 or less, the percentage of power reflected is relatively small and losses in 50 ohm cable of moderate size (RG-8/U or larger) do not increase appreciably at frequencies below 30 mc.

Directive properties of the four element 20 meter array and of the three element 15 meter array do not appear to be significantly affected by combining them as shown in figs. 1 and 3. When adjusted in similar manner, the pattern of the 10 meter array in figs. 2 and 3 is definitely inferior to that of an isolated beam of comparable design. Considering certain simplifications inherent in this approach and the vagaries inherent in 10 meter operations, performance of the 10 meter portion of the composite array may prove to be quite adequate for most purposes.

Although further work along these lines is encouraged, it is suggested that certain advantages of a motor-driven winch be considered before undertaking extensive tests of this nature on a heavy crank-up tower. ■

See page 122 for New Reader Service

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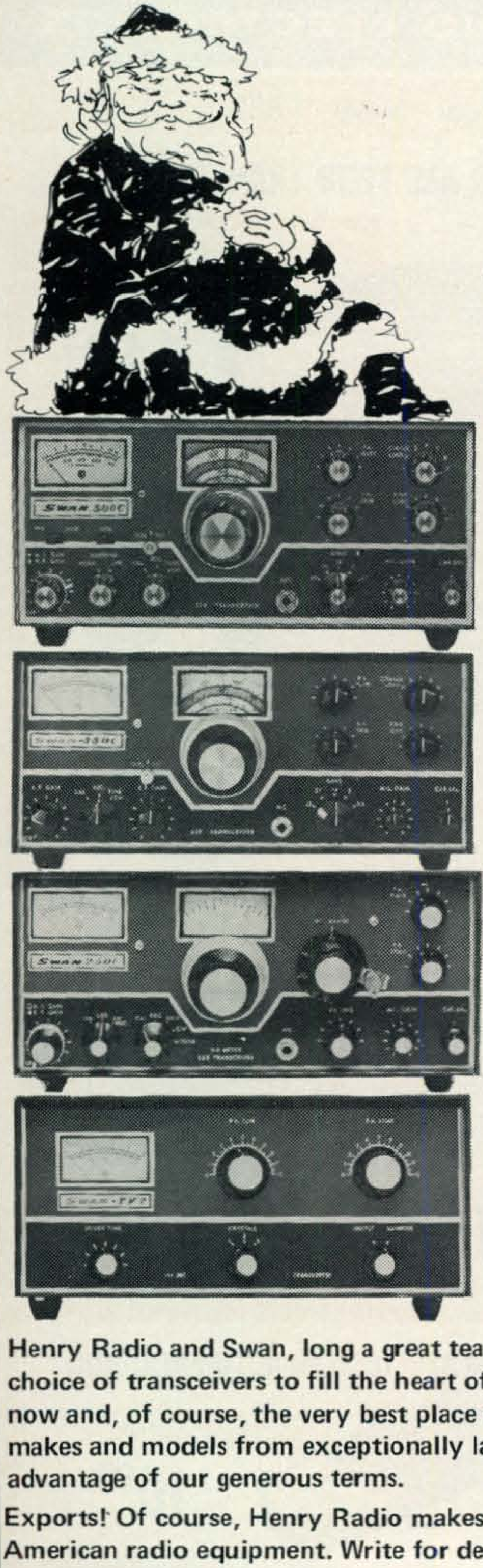

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A Continuous Motion Narrow Band Television System

BY SID DEUTSCH* AND RAYMOND SIMPSON,† WA2PYX

Part III, Conclusion

Parts I[1] and II[2] of this three part series described the principles and requirements of the slow scan TV transmitter and receiver. Part III now provides the circuits necessary to construct the transmitter and receiver units.

SINCE pseudo-random dot scan was invented in 1961, many units have been constructed. Vacuum tubes, transistors, and even integrated circuits have been used; bandwidths have ranged from 240 c.p.s. to 1 mc. The transmitter and receiver schematics and waveshapes of figs. 7 to 10 represent the best ideas distilled out of this previous work. Some of the circuits were originally designed for much higher frequencies, so that the *C* and *L* values have been scaled down to a bandwidth of 3.1 kc. Some of the circuits were originally designed with vacuum tubes, and the transistorized version has not been fully tested. Because of these changes, the experimenter will undoubtedly find that some touch-up is necessary.

Transmitter Video Section

The important waveshapes, voltage levels, and frequencies for fig. 7 are given in fig. 8. All waveshapes are shown starting from the same instant of time. This is at the start of vertical and horizontal retrace, at the start of dot blanking "off" in fig. 2(C), and at the start of the "O" position in fig. 3.

The boxes labeled "BMV" in fig. 7 represent the bistable multivibrator shown near the upper-left corner of the diagram.

The action starts with the 6144 c.p.s. clock oscillator of fig. 5 (see waveshape ①). An astable multi is shown although, as previously mentioned, it may be better to use a tuning-fork oscillator because the clock should be accurate to ± 0.01%.

The clock directly drives the sampling-pulse generator a monostable multi (② and ③). This in turn drives a monostable multi square-wave generator (④ and ⑤). The square-wave output is integrated to get the triangles of ⑥.

The bistable multis change state when a negative-going edge enters. During stable periods, the two outputs (such as ⑦ and ⑧) are equal but of opposite phase.

To generate the 0.163 msec vertical sync pulse ⑮, a bistable multi is switched by ⑭ and is then reset by ⑧. In a somewhat similar fashion, to generate the 0.997 msec horizontal sync pulses, ⑩ and ⑫ are combined to give pulses ⑬ whose positive duration is 0.977 msec; the latter work in conjunction with the 48 c.p.s. square wave ⑱ to give ⑳.

The s.p.s.t. switches at the output of the 24, 12, 6, and 3 c.p.s. square-wave generators (waveshapes ㉑ through ㉔) allow proper setting of the pseudo-random scan amplitudes.

Starting with the sync signal ⑮, the vertical scanning waveshape is developed by means of an emitter follower, sawtooth generator, emitter follower, and power output stage. Here the triangles of ⑥ are combined

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† Carlisle Place, Merrick, New York 11566.

1 Deutsch, S., Simpson, R., "Continuous Motion Narrow Band Television System," Part I, *CQ*, April 1968, page 16.

2 Part II, *CQ*, May 1968, page 65.

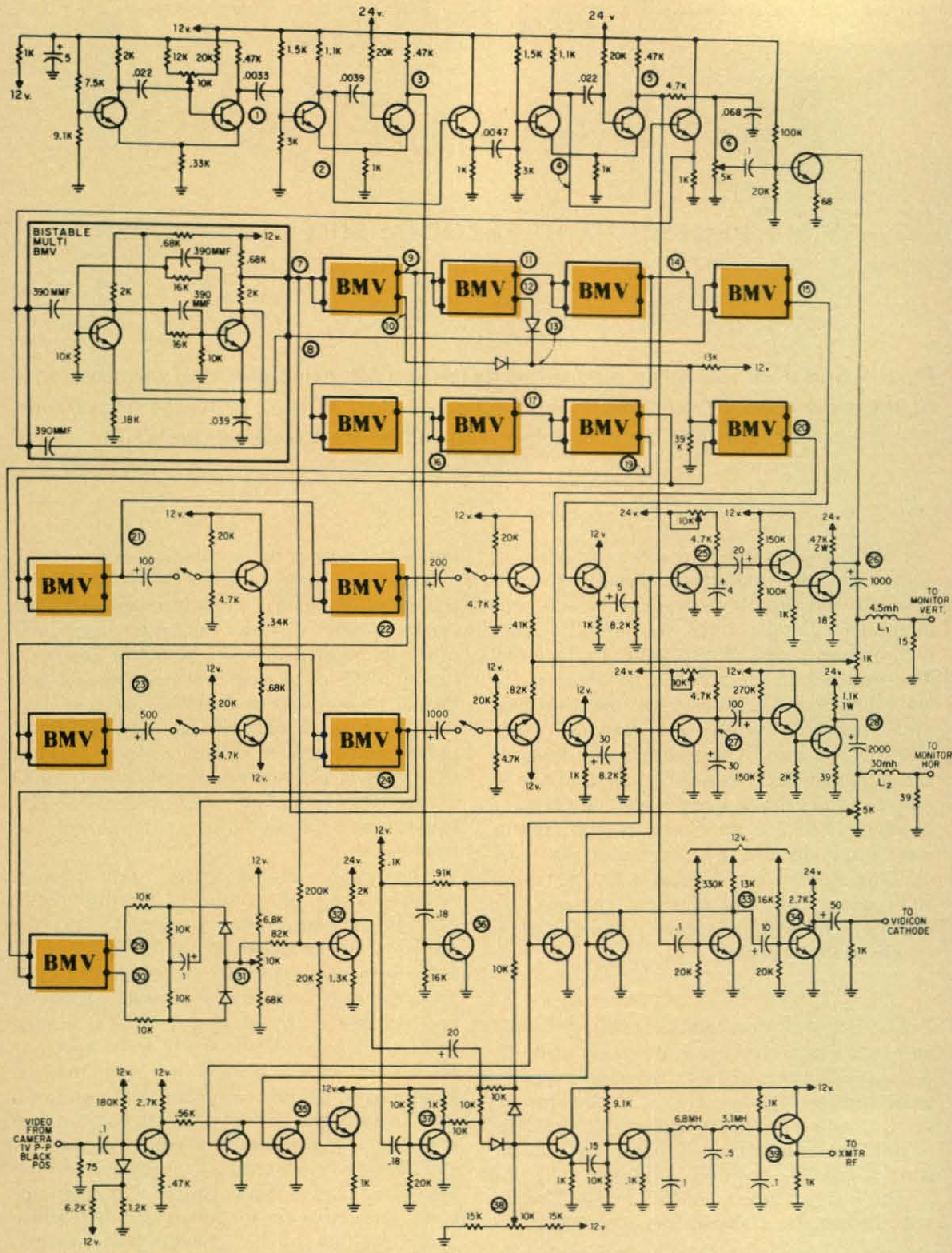

Fig. 7—Video section of the transmitter using a 3.1 kc pseudo-random dot scan system. All transistors are n.p.n. silicon types with a beta of approximately 50 and all diodes are germanium. The blocks marked *BMV* are bistable multivibrators with circuits and parts values identical to those shown in the upper left block (waveform 7-8). The waveforms, frequencies and voltage levels for this circuit are shown in fig. 8.

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with the sawteeth of ㉕ to give the stepped wave of ㉖. The pseudo-random square waves are also added in at this point. A similar sequence is used to generate the horizontal sweep signals ㉗ and ㉘ starting with ⑳.

If ㉖ and ㉘ have poor linearity, the square waves will not register properly and there will be a loss of resolution at the edges of the picture. It may be necessary to modify experimentally some of the given transistor base bias resistor values in order to optimize the operating locus of each stage.

The vertical and horizontal sync signals are combined with a dot square wave ⑤ to generate the blanking waveshapes ㉝ and ㉞. The vertical and horizontal sync signals are also combined with incoming video to give ㉟. On the drawing of this waveshape, (fig. 8), W, B, and S respectively indicate white, black, and sync tip levels.

By gating ⑨ "on" in a bidirectional gate that is driven by ㉙ and ㉚, reset sync ㉛ is generated. It is combined with the 3072 c.p.s. dot sync ⑦ and with ㉟ to yield the composite video signal, ㉜. Composite video is then applied to a bidirectional gate that is driven by sampling pulses ㊱ and ㊲. The sampled video consists of narrow 10% pulses ㊳, but passage through a low-pass filter finally yields the band-limited output,

A 6144 c.p.s. trap at the output has been omitted because it may or may not be required depending on local conditions.

Video Section of Receiver

The important waveshapes, voltage levels, and frequencies for fig. 9 are given in fig. 10. Again, all waveshapes are shown starting from the same instant of time.

In the top row in fig. 9, sampling pulses are derived from the incoming dot sync. First, the 3072 c.p.s. component of the video signal is extracted (waveshape ① in fig. 10). The unloaded Q of this tuned circuit (as well as that of the others in the receiver) should be at least 50. Additional rejection of the non-3072 c.p.s. components is next accomplished (②), followed by a full-wave rectifier, ③. The latter signal synchronizes an astable multi to give a 6144 c.p.s. square wave, ④.

The objective of the above filtering is to give a clean sync waveshape at ③, uncorrupted by changes in lower-frequency components. If the picture information has a strong component at 3072 c.p.s., it can reverse the phase of the net signal at ②, but this should have no effect on ③. The net signal at ② can momentarily disappear, however, so that it may be better to use a high-Q tuning-fork oscillator rather than an astable multi to produce ④.

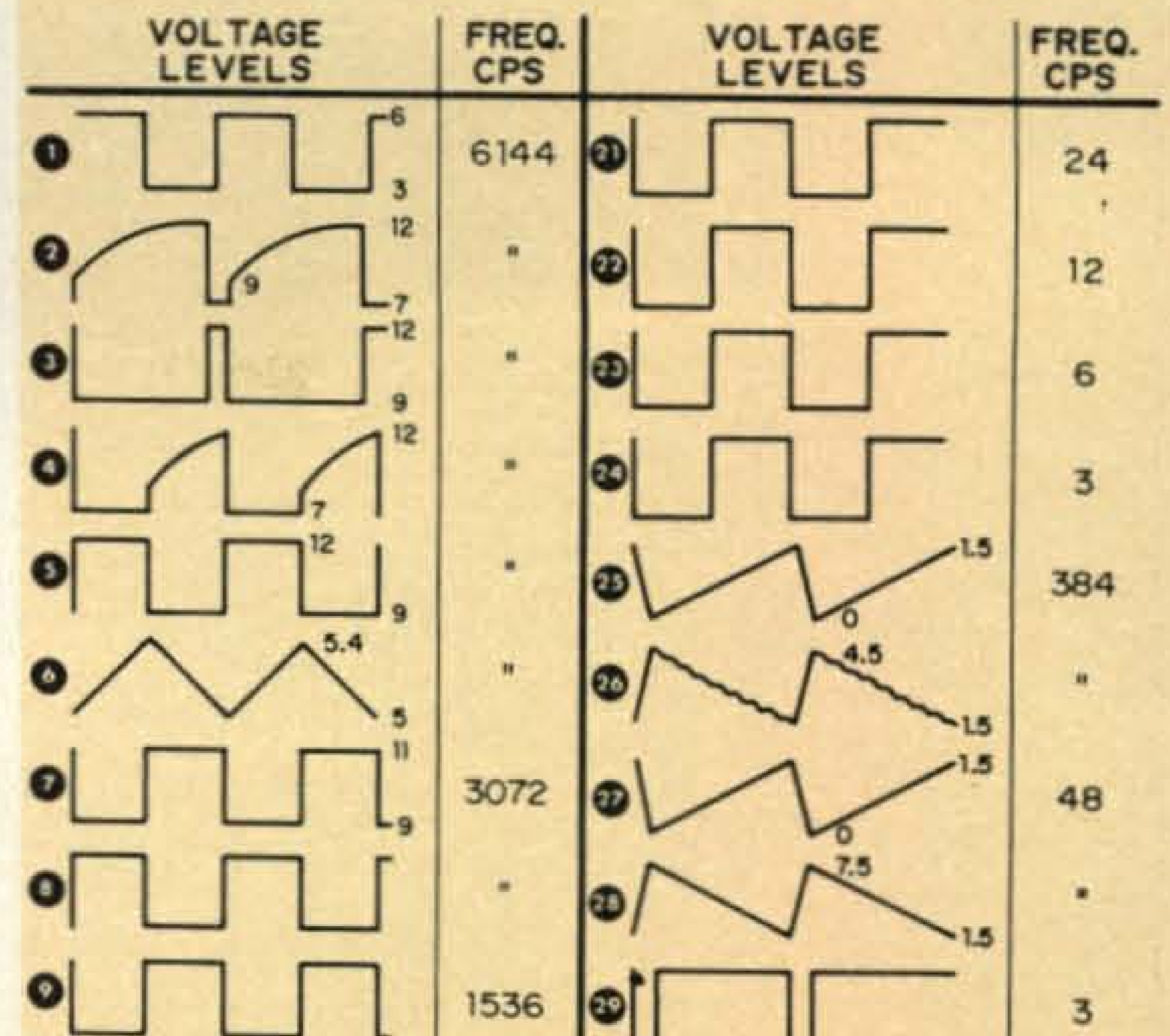
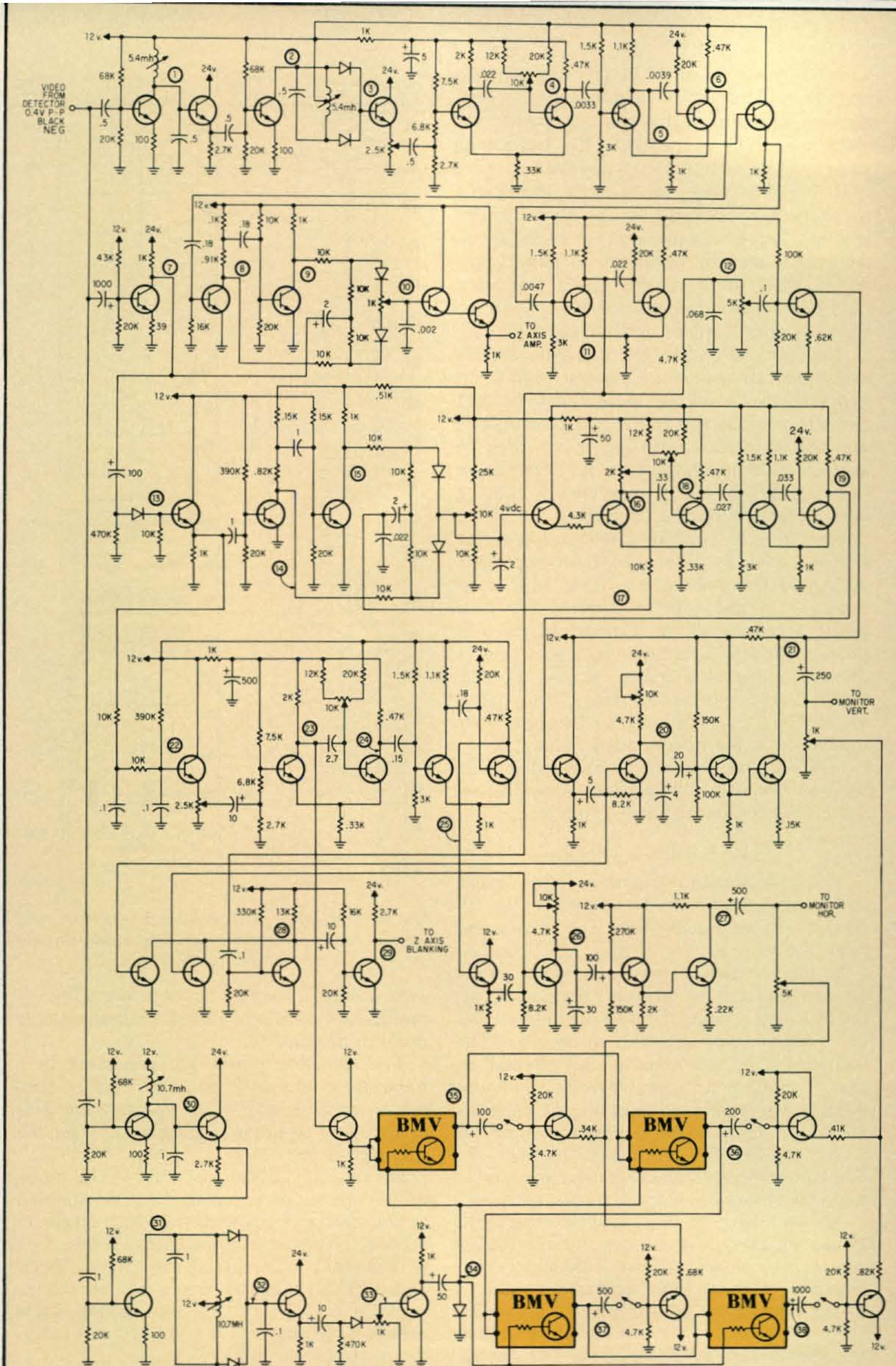


Fig. 8—Transmitter waveshapes, frequencies and voltage levels. All waveshapes are shown starting at t = 0.

The sampling pulses are generated in a monostable multi, ⑤ and ⑥. This in turn drives a monostable multi square-wave generator, ⑪. The latter is integrated to get the triangles of ⑫.

Because of the low pass filter at the transmitter, the video signal ⑦ must be sampled at the correct instant during each cycle in order to restore the original video levels. This is done in a bidirectional gate driven by ⑧ and ⑨. Each sampled output is stretched, as depicted in ⑩, until the next gating pulse occurs. Waveshape ⑩ is amplified and fed to the picture tube grid.

As is the case with conventional television,



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automatic phase control is employed in fig. 9 for the high-frequency sweep. First, the picture information is clipped off, leaving vertical and horizontal sync pulses, ⑬. Next, the sync pulses are amplified sufficiently (⑭ and ⑮) to become gating pulses in a bidirectional gate. Here they operate on a 384 c.p.s. square wave, ⑰, that is fed back from an astable multi, ⑯. If the multi starts to speed up, ⑰ moves to the left relative to ⑭ and ⑮, the d.c. output voltage of the bidirectional gate drops, and this tends to slow down the multi. The output of the astable multi, ⑱, drives a monostable multi that generates the vertical retrace pulse, ⑲.

Waveshape ⑬ is passed through a two-section RC integrator that removes narrow pulses but retains the relatively wide horizontal sync pulses, ㉒. The latter then synchronize an astable multi, ㉓ and ㉔. The output of the astable multi drives a monostable multi that generates the horizontal retrace pulses, ㉕.

Starting with retrace pulse ⑲, the vertical scanning waveshape is developed by an emitter follower, sawtooth generator, emitter follower, and power output stage sequence similar to that of the transmitter. The triangles of ⑫ are combined with the sawteeth of ⑳ to give the stepped wave of ㉑. The pseudo-random square waves are also added in at this point. Similarly, horizontal sweep signals ㉖ and ㉗ are generated starting with ㉕.

The vertical and horizontal retrace pulses are combined with a dot square wave ⑪ to generate the blanking waveshapes ㉘ and ㉙. The latter is fed to the picture tube cathode (through a d.c. blocking capacitor).

The reset pulse is derived by first extracting the 1536 c.p.s. component of the video signal, ㉚ and ㉛. A full-wave rectifier and peak detector then yields the reset burst envelope, ㉜. Noise is clipped off, ㉝, and the reset pulse is amplified and clamped to ground, ㉞. It is applied to the base of the left-hand transistor in the 24, 12, 6, and 3 c.p.s. square-wave generators (㉟ through ㊳).

Fig. 9—Video section of the receiver using a 3.1 kc pseudo-random dot scan system. All transistors are n.p.n. silicon types with a beta of approximately 50. All diodes are germanium types. Blocks marked *BMV* are bistable multibrators as in fig. 7. Waveshapes for the receiver section are shown, along with frequencies and voltage levels, in fig. 10.

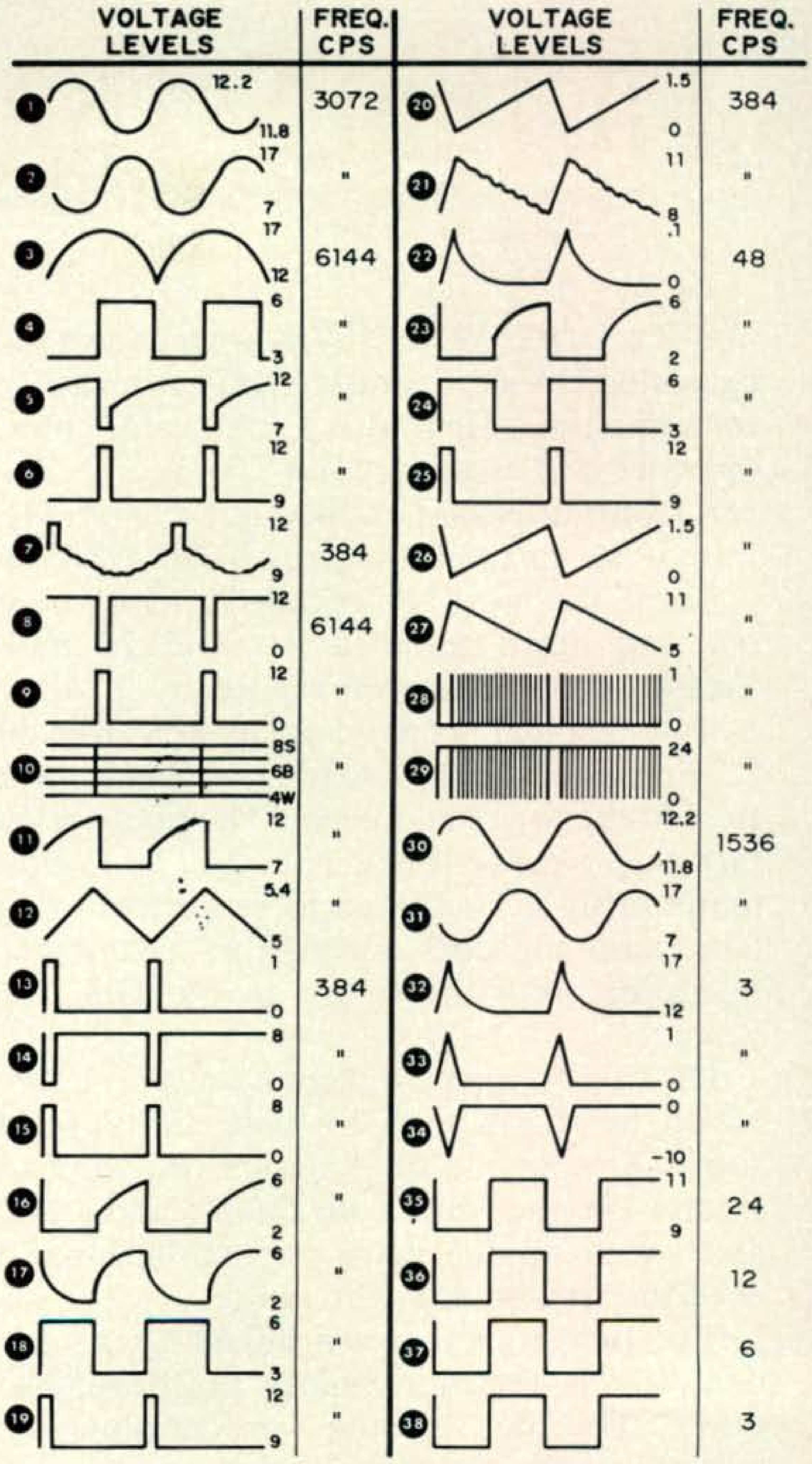


Fig. 10—Receiver waveshapes, frequencies and voltage levels. All waveshapes are shown starting at $t = 0$.

Conclusion

We have described a simple method for displaying 3 frame/sec television pictures without large-area flicker. This is the lowest frame rate at which long-persistence phosphors such as the P38 can be used. Although rapid motion appears to be blurred, the time constant is sufficiently small as to justify the title "continuous-motion" television. With a video bandwidth of 3.1 kc, the 3 frame/sec picture contains 1800 visible elements.

With wider bandwidths we can get better resolution or, by using a shorter persistence phosphor such as the P28, we can decrease the motion deterioration. The relation between bandwidth, resolution, and frame rate

[*Continued on page 118*]

PICTURES THAT TELL A STORY

BOB LANE, WA6ZIQ, is well-known as a respected DX-er, operating KG6 from Saipan for some time. He is also a competent contest operator and won a recent CQ World Wide DX Contest. Now stationed at Feltwell, Norfolk, U.K., he holds the British call, G5AAM.

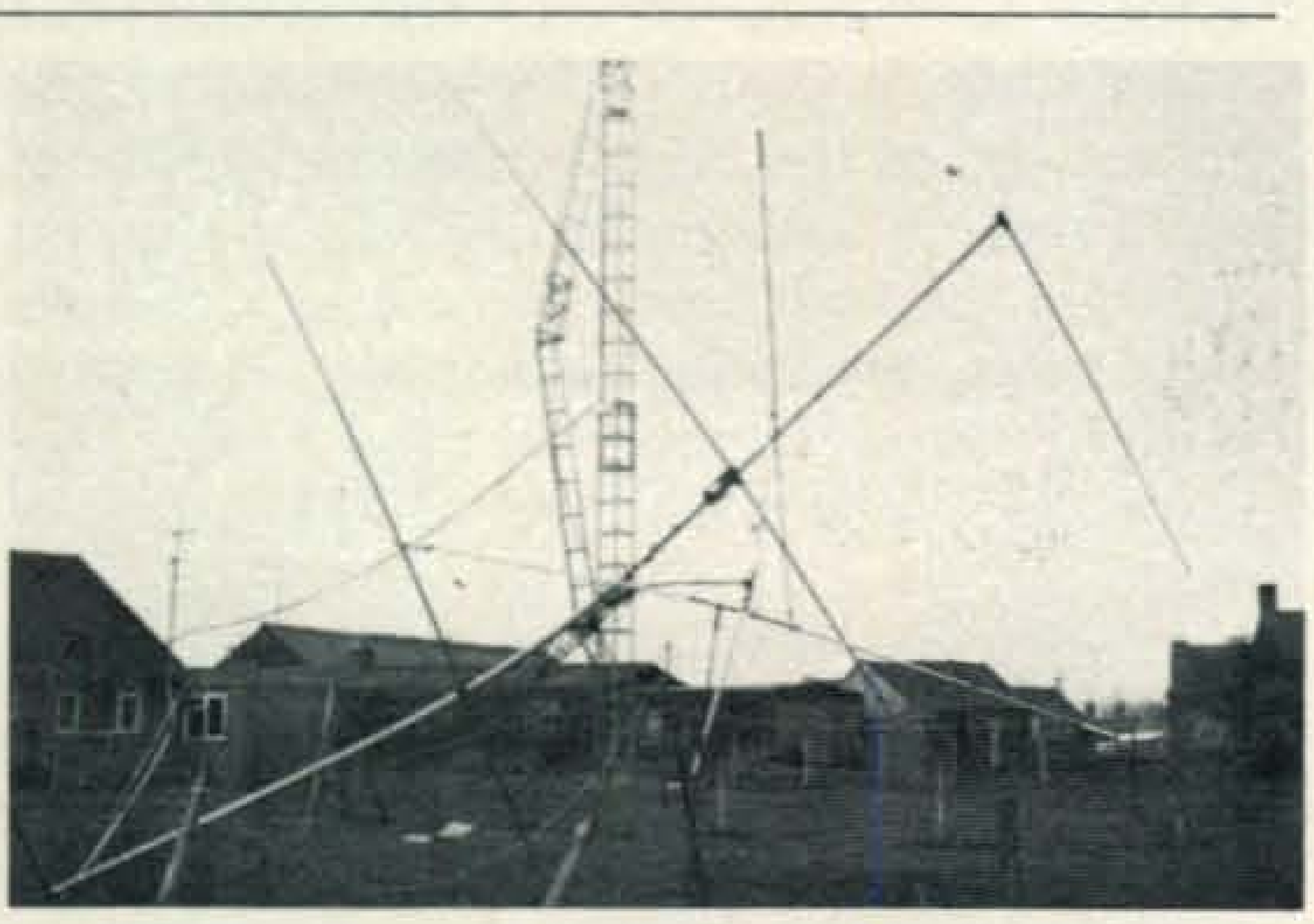
Came the most severe gale in living memory and down tumbled the 4-el 20 meter Telrex, which had been topped by a Mosley 3-el Duobander—the whole at well over 100 ft. Fortunately no damage was done, other than to the tower and beam. The photo shows how the tower bent like a hairpin. So Bob has temporarily been forced to retire from amateur radio and does not plan to recommence operation until his return to the U.S. next year.

He has, however, taken up a new hobby, which he shares with his wife and 3 young sons—Boy Scouts of America. Bob is Cubmaster for the local Cub Scouts and "operates" with all the drive and enthusiasm he used to put into amateur radio.

The two hobbies were linked by an incident which occurred before the beam blew down. The local Scouts were needing new equipment and uniforms which were in short supply. Bob contacted W3WFP, Ray Duerling, in Fallston, Md. and, during the QSO, mentioned what he wanted. Ray combed the local stores until he had accumulated everything on the shopping list, then had the goods shipped to U.K., so that Bob's Cub Scouts were equipped without delay—thanks to amateur radio. ■

G5AAM/WA6ZIQ in the operating position at Feltwell, Norfolk, England.

W3WFP, Ray Duerling, who provided Scout uniforms for Bob's Cub Scouts.



The beam after the gale.

Bob Lane as Cub Master at the Feltwell Blue & Gold Banquet.

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VERTICAL ANTENNAS

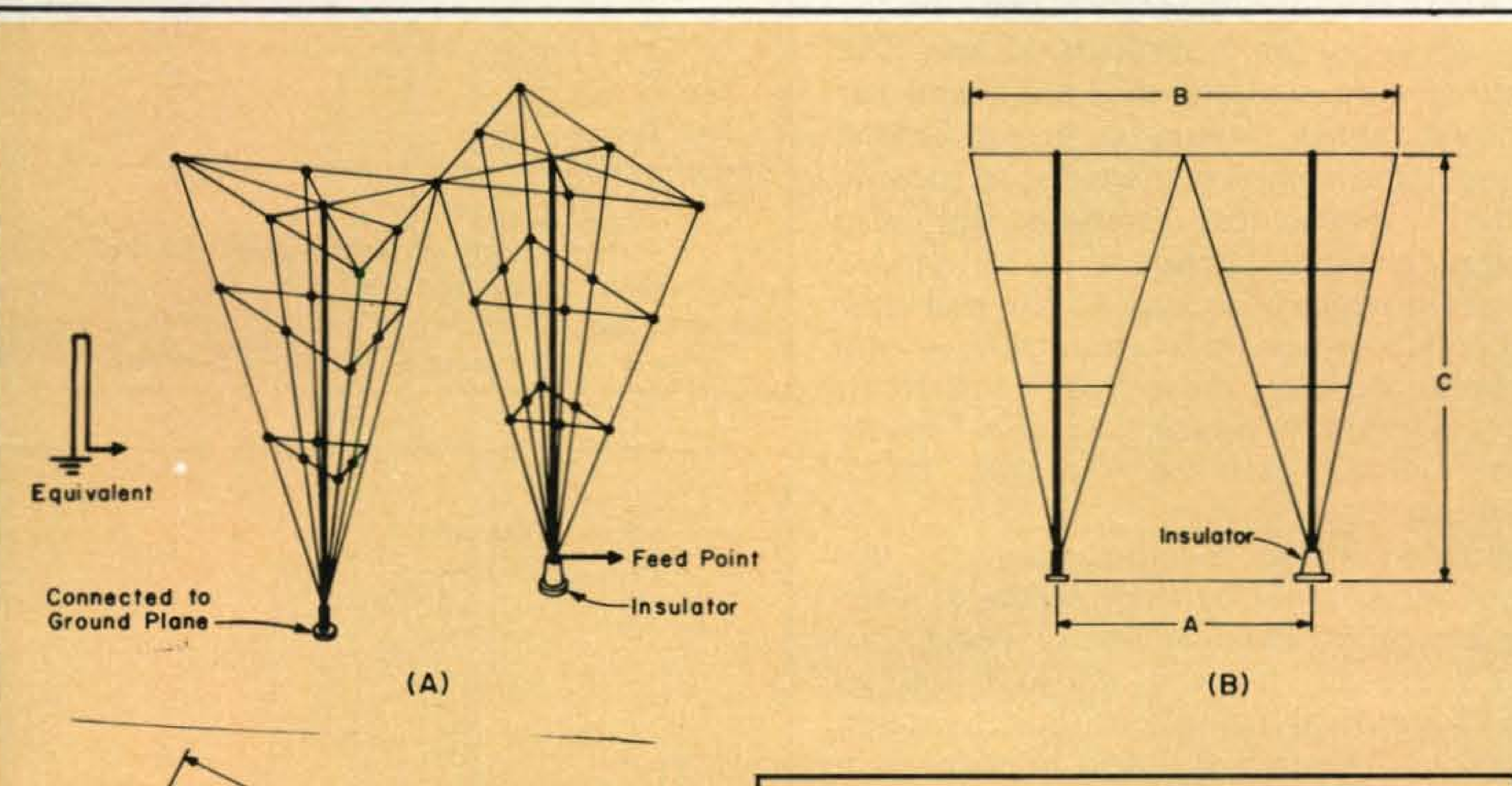
Part VII

BY CAPT. PAUL H. LEE*, W3JM

Several additional broadband vertical antennas are described in this article of the series, Part VII. These antenna types can very easily be adapted to amateur use as shown by the author.

IN Part VI it was stated that conical structures make ideal broadband radiators, and their use, both as inverted cones and discones, being fed against a flat planar surface, were shown. This matter can be carried further by stating that the structure does not have to be conical but can be pyramidal in shape. This configuration lends itself to the joining of two structures together to form a folded unipole. Such a configuration is shown in fig. 65 in perspective view. The two pyramids rest on their apexes, with a junction at

*5209 Bangor Drive, Kensington, Md. 20795.



Dimension	3.0-10.5 mc	7.0-24.5 mc
A	27′	11.6′
B	45′	19.3′
C	45′	19.3′
D	20′	9.6′
E	25′	10.7′

Fig. 65(A)—Perspective view of a triangular folded unipole and its equivalent circuit. (B) and (C)—Side and top views of the triangular folded unipole and the critical dimensions for two frequency ranges of interest to amateurs.

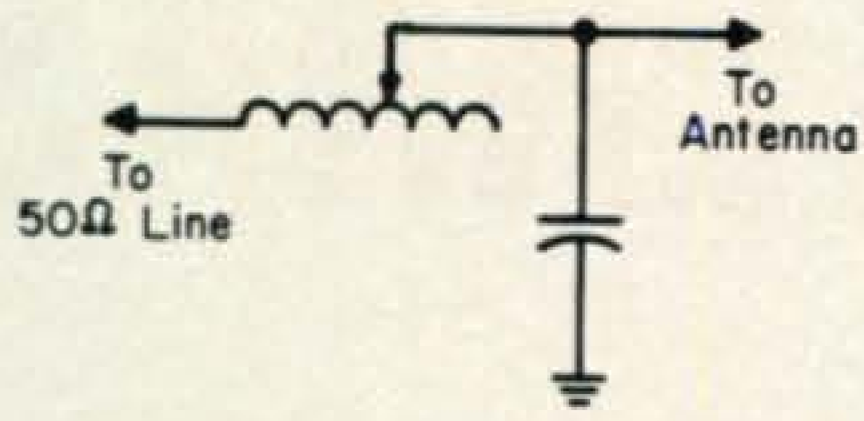


Fig. 66—Circuit of the *L* network used to match the triangular folded unipole's 175 ohm feed impedance to a 50 ohm line.

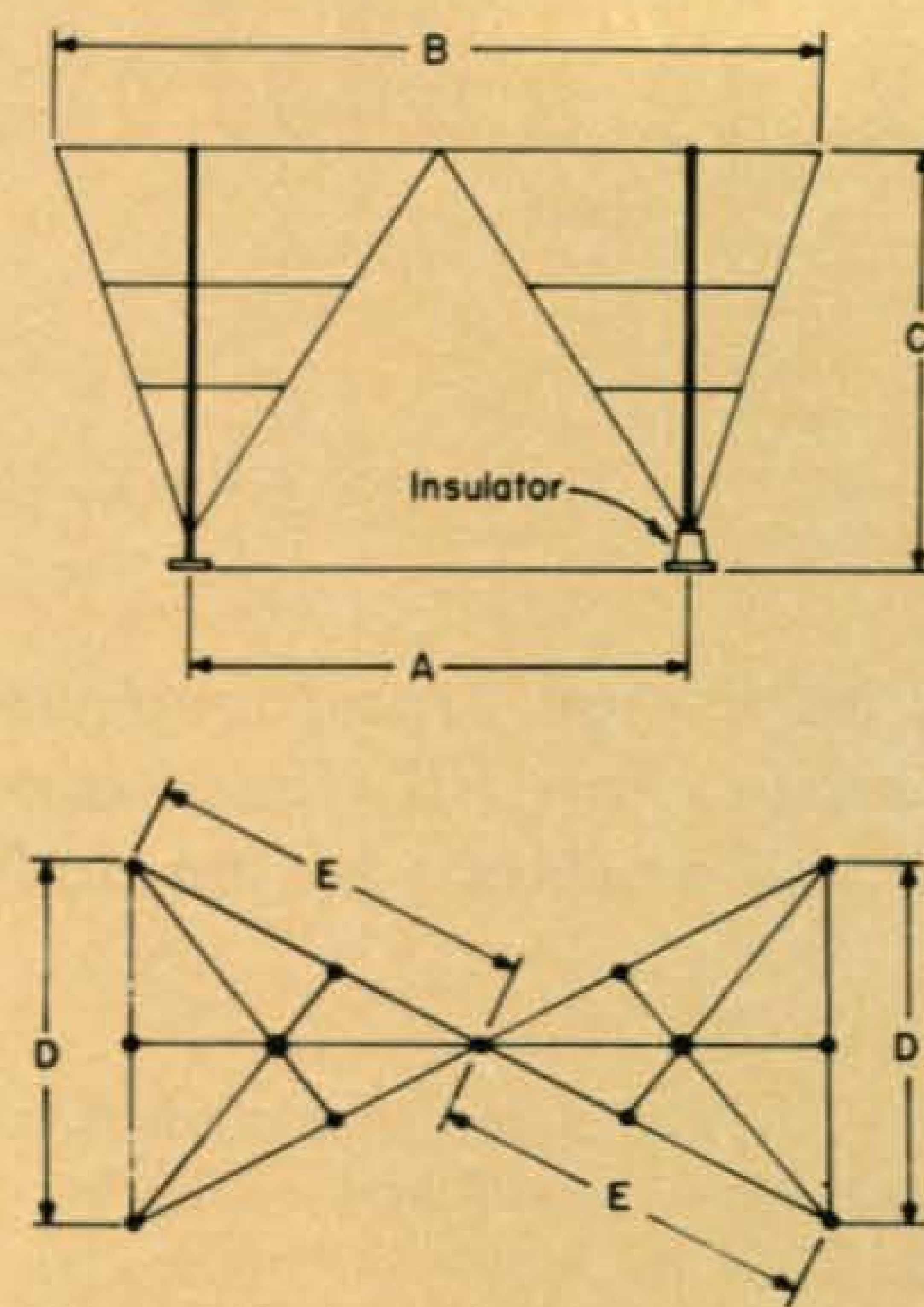
their bases. One apex is grounded, and the other is fed. A ground system is required.

The Folded Unipole

This antenna was used on the "Voice of America" ship USCGC Courier, which for a period of about ten years was moored in the eastern Mediterranean Sea as a short wave and medium wave relay broadcast station. This facility has since been decomissioned and replaced by shore based equipment and antennas, but these broadband structures were very interesting and unusual. There were two of them on the ship. One was for a frequency range of 6 through 11 mc, and the other was used for 9 through 17 mc. The structures were made of steel angle and bar stock, assembled around a strong central steel pipe, and completely welded to provide not only mechanical strength but also thorough electrical bonding of all pieces. This was necessary because of the maritime environment which in a short time would have produced many "rusty bolt" connections in an unwelded structure, and also because of the power involved (35 kw 100% modulated.

Figure 65 shows the dimensions of this antenna for several frequency ranges of interest to amateurs. It is capable of being used over a frequency range of 3.5 to 1 with an s.w.r. of less than 1.5 to 1 at the feed point, referred to the nominal design impedance of 175 ohms which was desired for these antennas. For 50 ohm feed it was necessary to use a simple L network as shown in fig. 66, with shunt capacity and series inductance. Even with the network in use the s.w.r. will still be good over quite a wide frequency range, such as the entire 3.5 to 4.0 mc band for example, without retuning.

The 175 ohm design impedance results from the use of a rather acute angle at the apex of each pyramid. The apex angle of the structures shown in fig. 65 is about 30°. If the apex angle is increased to about 60° (the same value as used in the discone antenna of



Dimension	3.0-10.5 mc	7.0-24.5 mc
A	56′	24′
B	90′	38.6′
C	45′	19.3′
D	51′	21.8′
E	51′	21.8′

Fig. 67—Dimensions of a triangular folded unipole with an apex angle of 60°. This angle, instead of the 30° shown in fig. 65, will provide a feed impedance of 50 to 75 ohms.

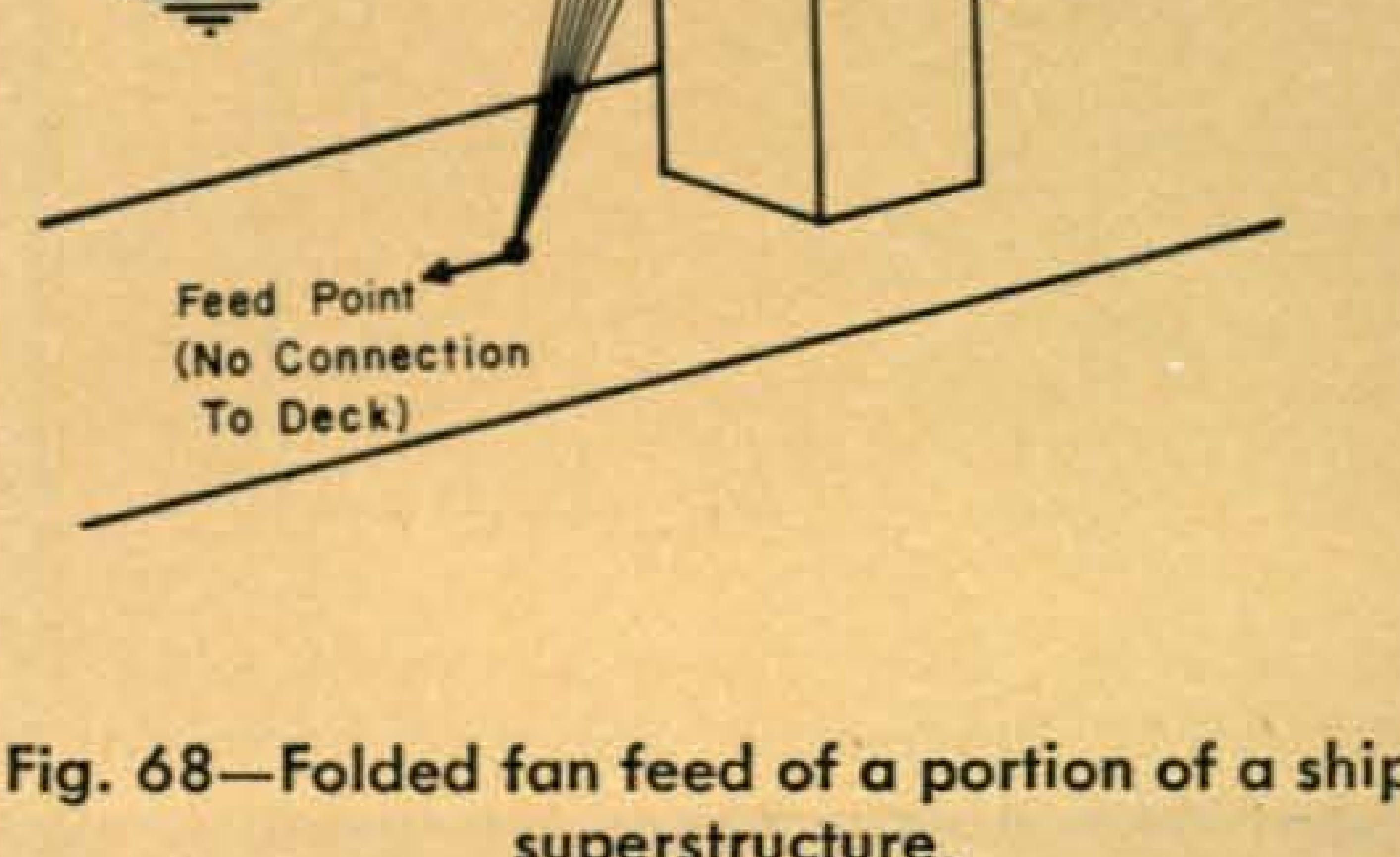


Fig. 68—Folded fan feed of a portion of a ship's superstructure.

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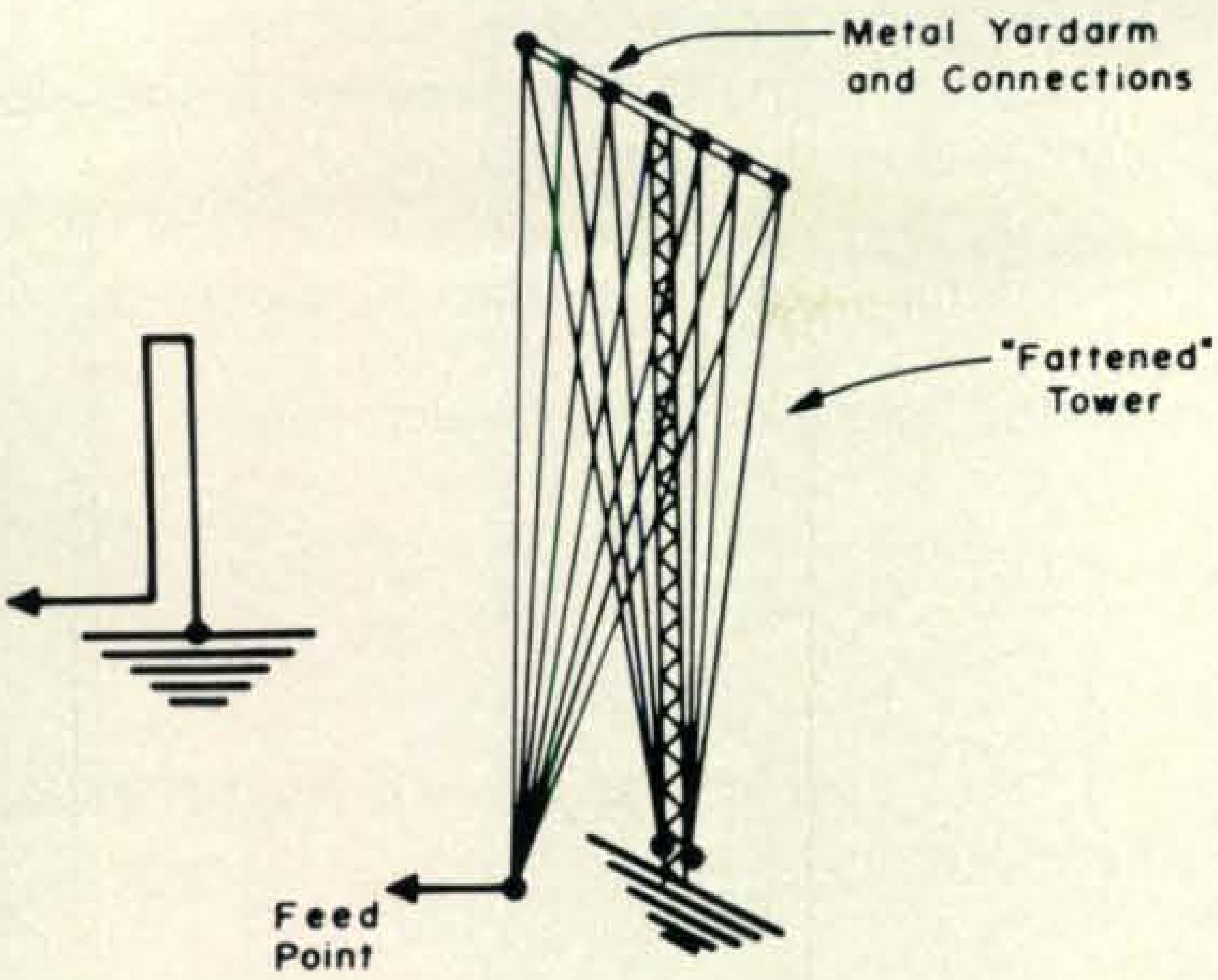

Fig. 69—Broadband folded fan on a tower.

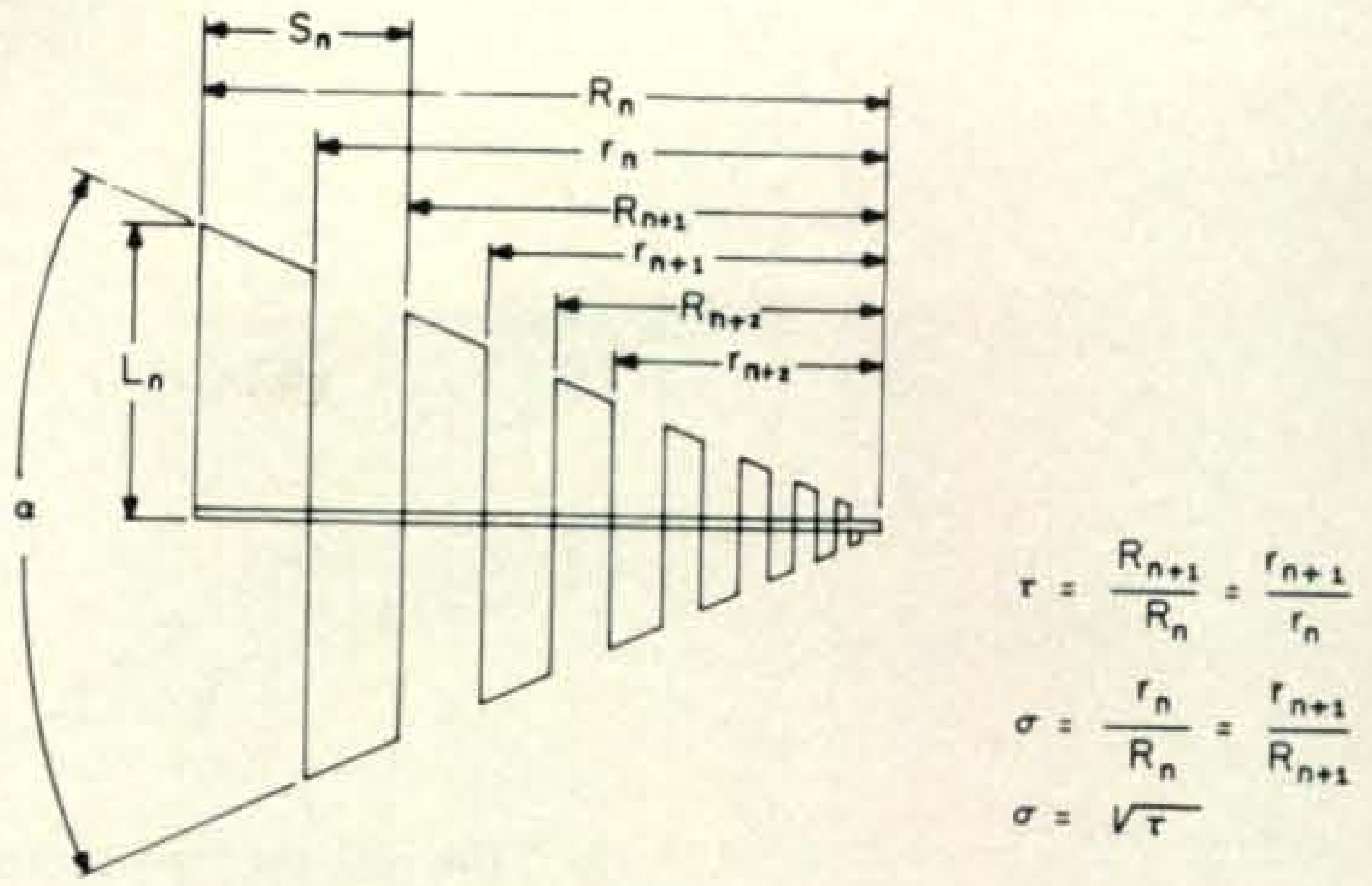

Fig. 70—Basic log-periodic antenna structure and some of the design formulas discussed in the text.

fig. 48), this impedance will come down to a more reasonable value of 50 to 75 ohms, and the excursions of the reactance versus frequency curve will be less pronounced[62, 63]. One might assume this to be the case, from what has been said previously about broadband structures, for as the apex angle is reduced in value to 0° we have a linear folded monopole whose input impedance will have extreme variations versus frequency. With the 60° apex angle, the dimensions of fig. 67 will apply. It will be noted that the horizontal area required for the antenna has increased over that needed for the 30° case. This was another factor affecting the shipboard installation, where space was limited.

The amateur could build an antenna of this type using pieces of aluminum tubing flattened on their ends and bolted together. The entire structure would be quite light weight, and would require only four lateral guys and two longitudinal guys.

The Folded Fan

Another arrangement which is somewhat similiar to this is a folded fan type of antenna which is being used on shipboard. An entire portion of a ship's superstructure such as a stack, fire control director or radar tower, *etc.*, is driven as a part of a folded fan type of unipole, as shown in fig. 68. The amateur who has available a tall metal structure such as a chimney or tower can apply this type of feed to it and obtain quite good broadband results. In fact, if the tower is a thin one, it can be "fattened" by the use of a second fan as shown in fig. 69. For matching 50 ohm line to this type of feed, "cut and try" will be required, for I cannot give any absolute values of reactances required. However, if the total height of the folded fan is less than 1/4 wave, the impedance should be quite reasonable (several hundred ohms or less) and easy to match with a simple T or L network.

The Log Periodic

The types of antennas described above are nominally non-directional, with perhaps 1 to 3 db variation in the horizontal pattern polar plot. Let us now consider a *directional broadband* radiator, the vertical log-periodic antenna. Where in the previous cases we were using simple linear structures and making them broadband by lowering the effective *L/D* ratio, the log-periodic is of a different breed. This type of structure is composed of thin linear elements, and its geometry is defined so that the radiation pattern and the impedance repeat periodically with the log-

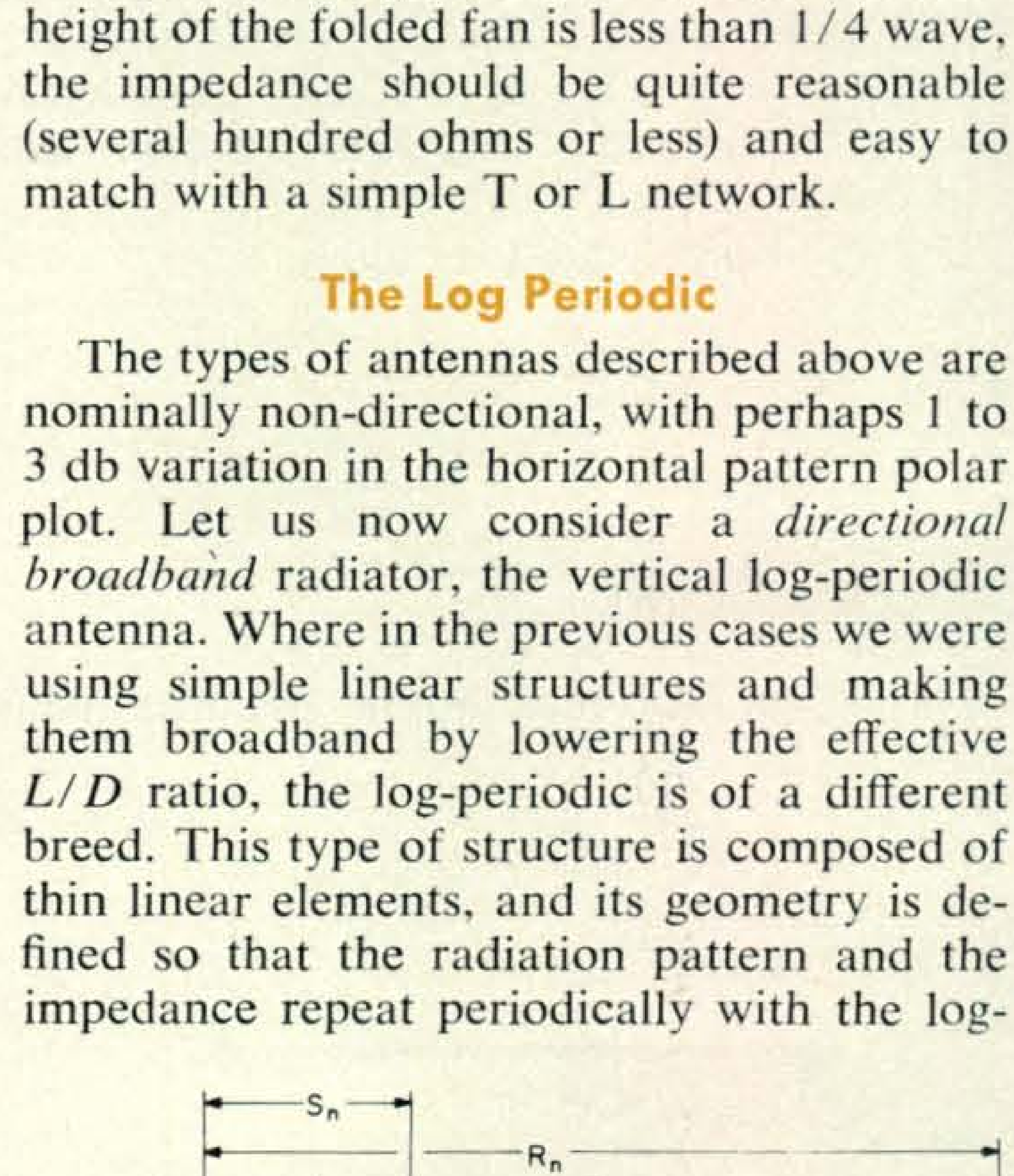

Fig. 71—A vertical log-periodic antenna.

62 Jasik, Henry, *"Antenna Engineering Handbook," McGraw-Hill, p. 3-11, 3-12.*

63 Brown, G. H. and Woodward, O. M., "Experimentally Determined Radiation Characteristics of Conical and Triangular Antennas," *RCA Review,* Dec. 1952.

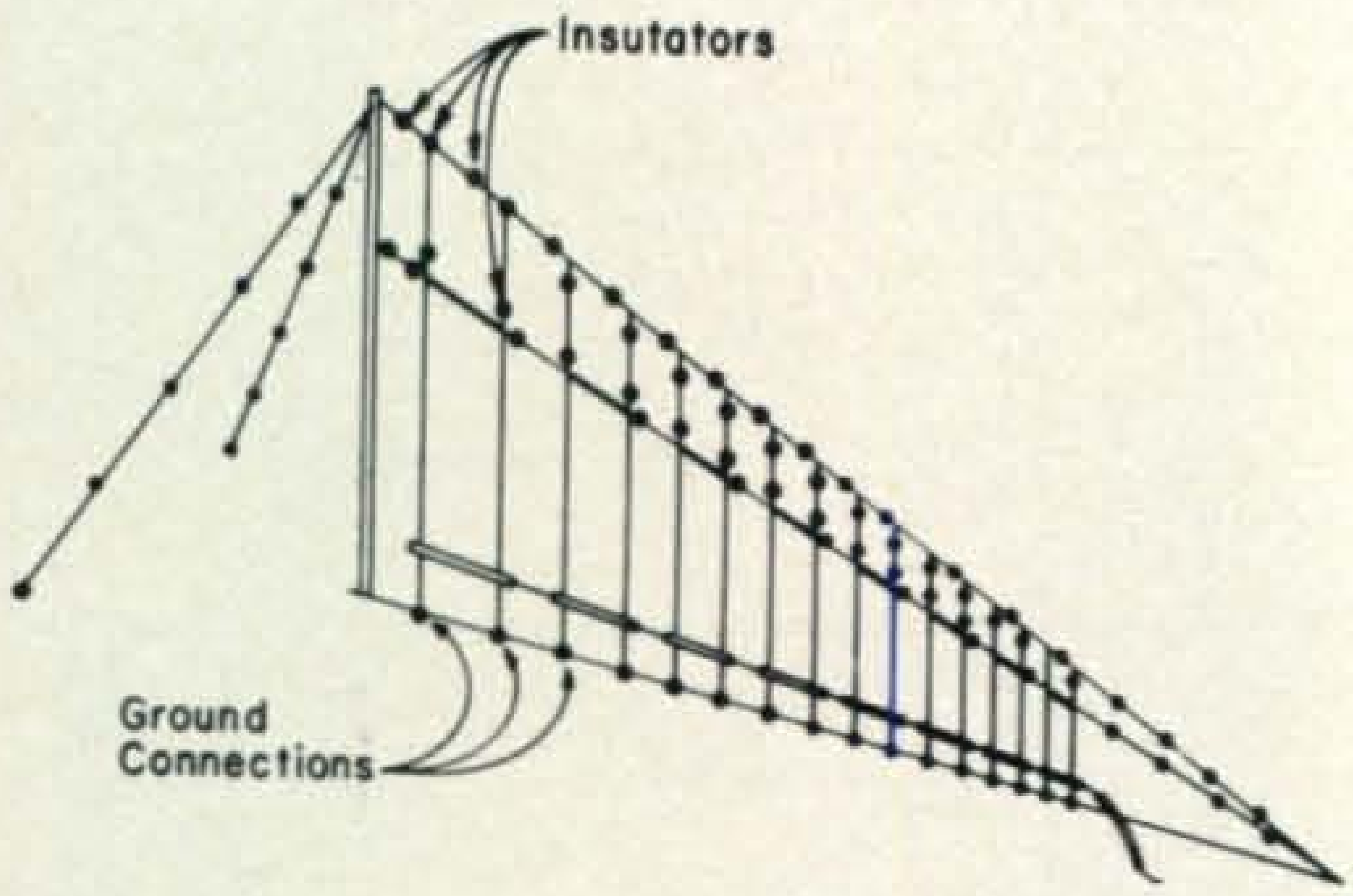

Fig. 72—Sketch of a wire type log periodic constructed by suspending the teeth from a catenary strung from a tower to an anchor block.

arithm of frequency. Some basic design theory of log-periodic antennas is in order here, applying to all types and not only to vertical ones, in order that their operation can be understood.

Figure 70 shows a basic type of log-periodic antenna, used here merely to show the relationships of the various dimensions. (Never mind how it is to be fed at this time.) This antenna is a trapezoidal tooth structure made of wire. One of the basic parameters is the "design ratio," which is called τ. Also related to it is σ, which is equal to: $\sqrt{\tau}$ The following equations apply:

$$\tau = \frac{R_{n+1}}{R_n} = \frac{r_{n+1}}{r_n}$$

$$\sigma = \frac{r_n}{R_n} = \frac{r_{n+1}}{R_{n+1}} = \sqrt{\tau}$$

The design ratio must not be less than about

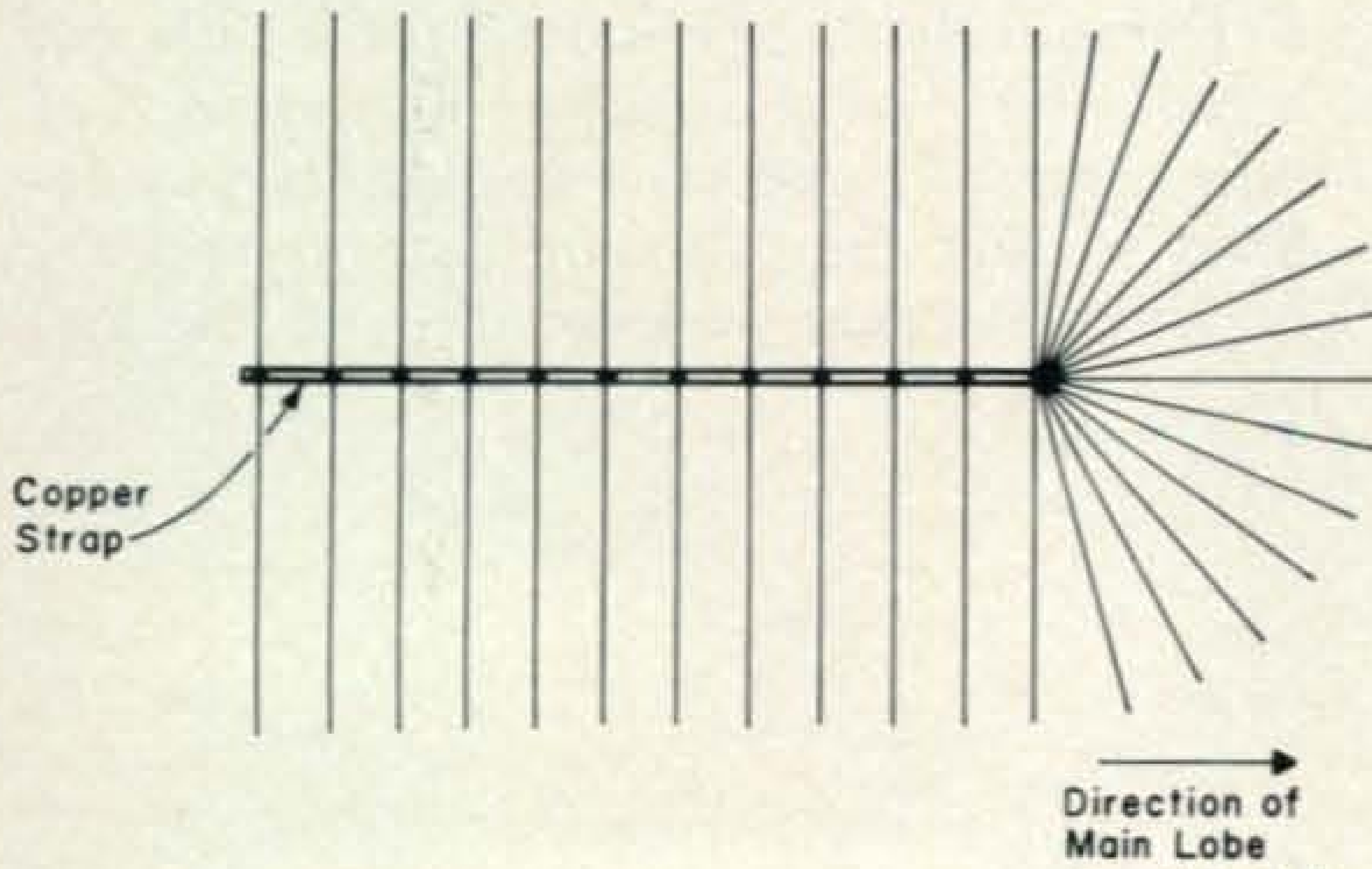

Fig. 73—Radial system for a vertical log periodic. The radials should be at least a quarter wavelength at the low frequency limit of the antenna and all joined by a 2" wide copper strap.

0.7 for good gain and low back lobes.

Another important parameter is the element spacing-to-length ratio.

$$\text{Spacing } S_n = R_n - R_{n+2} = R_n\,(1-\tau)$$

and the length of the n-th element is:

$$L_n = R_n \tan\frac{\alpha}{2}$$

and the element spacing-to-length ratio, therefore, is:

$$\frac{S_n}{L_n} = \frac{1-\tau}{\tan\frac{\alpha}{2}}$$

Experimental work has shown that this ratio should not exceed a value of 1.30 for proper operation of the antenna. Thus for a given angle , there is a minimum value of

$$\tau_{\min} = 1 - 1.3\tan\frac{\alpha}{2}$$

The frequency range of an antenna of this type is determined by the length of the longest and shortest elements, which are 1/2 wavelength at the lowest and highest frequencies, respectively. For all practical purposes, the detail with which the small end can be built determines the high frequency limit.

It can be seen from the above that there are a number of interrelated parameters in the design of a log-periodic antenna. As the antenna is made shorter for a given frequency range, the number of elements decreases, the design ratio decreases, and the front-to-back ratio and gain decrease. On the other hand, a longer antenna is more expensive to construct, and requires more real estate.

The configuration shown in fig. 70 is a balanced one. There are several ways of constructing and feeding this one, and antennas of this type are usually used in the horizontal mode, with a rotary mounting for directional operation, with the direction of the main lobe off the small end of the antenna. Since we are dealing with vertical antennas in this series, consider fig. 71, which is one half of the above antenna, with the lower half replaced by a ground system. A practical configuration which will give good results is

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shown. The front-to-back ratio at the lower frequencies will be about 14 db, while at the higher frequencies it will be about 20 db, with the value of $\alpha/2$ shown.

This antenna is fed by means of a capacitive coupling arrangement. The outer conductor of the coaxial feedline is broken between the trapezoidal teeth, as shown, and each piece is connected to one of the teeth forming one plate of a capacitor. The inner conductor is the other part of the capacitor, and is common to all teeth. The bottom end of each tooth is connected to the ground system. Angle $\in$ is about 3°. If the s.w.r. is to be optimized, the angle $\in$ should be varied somewhat, while input impedance is plotted on a Smith Chart, over the antenna's frequency range. With 50 ohm line, it is possible to obtain an s.w.r. below 3 to 1 over the frequency range of such an antenna. A frequency range of 10 or 15 to 1 is easily possible, and the horizontal and vertical patterns hold shape remarkably well over the entire range. This type of antenna is an excellent one for those who wish to cover a wide range of frequencies, with transmission and reception in a particular direction. Again I repeat that the longer the antenna, the greater the number of teeth, and the larger the design ratio τ, the higher will be the gain and the front-to-back ratio. For the one shown in fig. 71 I have not shown any dimensions. Dimensions will depend on the frequency range to be covered. Obviously an antenna for a range of 2 to 30 mc will be longer and have more teeth than one for a range of 7 to 30 mc. The parameters will be the same, however.

The actual construction is quite simple. The teeth, made of wire, can be supported on a catenary suspended from one tall pole or tower to an anchor block in the earth, as shown in the sketch of fig. 72. The ground system can be a buried wire mat of the type shown in fig. 73, with a center buss of two inch wide copper strap, to which the bottom ends of the teeth must be bonded.

The teeth of the log-periodic do not have to be of trapezoidal shape. They can also be triangular in shape, as shown in fig. 74. In this case, the following equations apply:

$$\tau = \frac{R_n + 2}{R_n} \text{ and}$$

$$\sigma = \frac{R_n + 1}{R_n} = \sqrt{\tau}$$

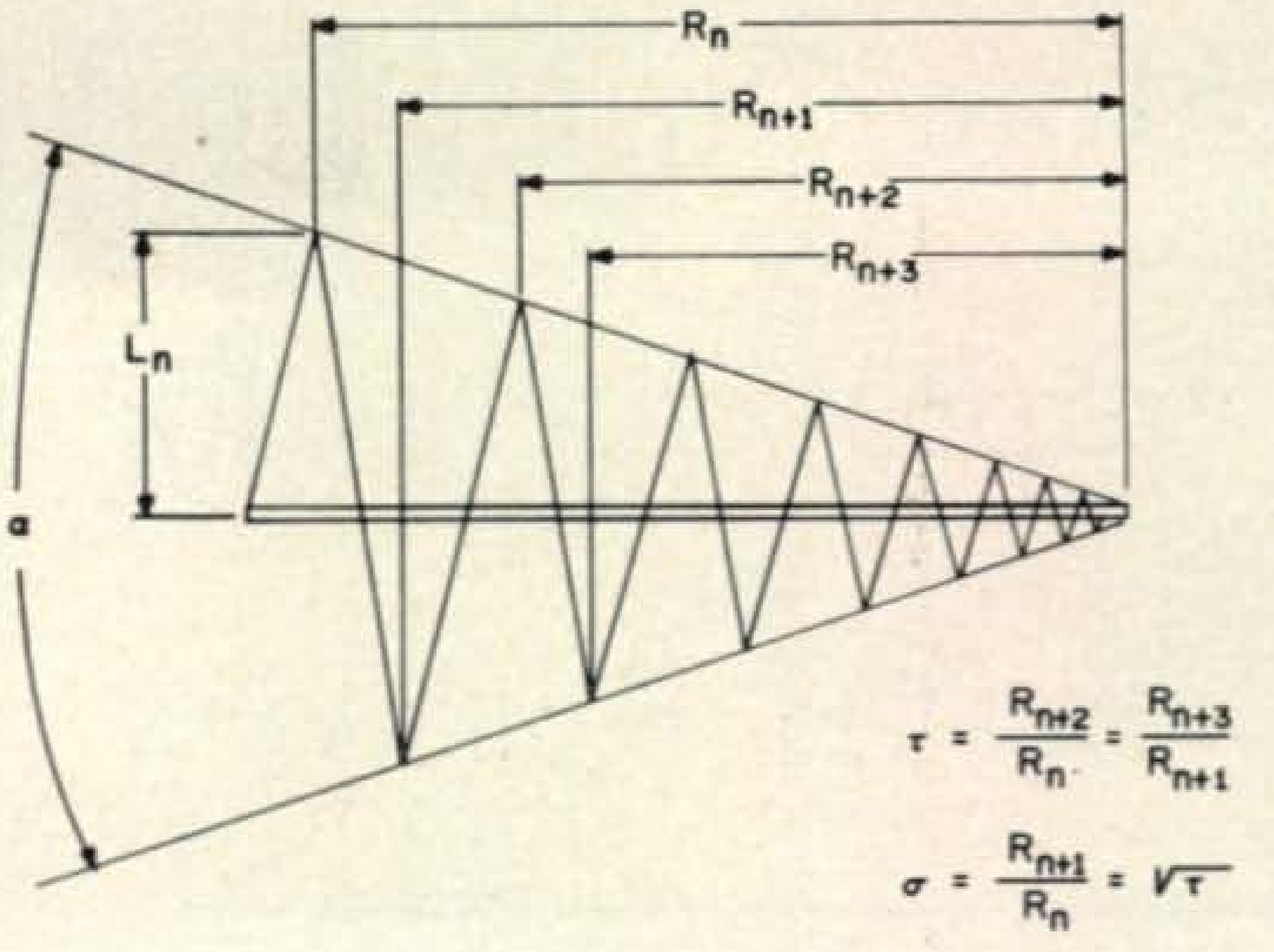

Fig. 74—Log periodic with triangular teeth.

As in the case of the trapezoidal teeth, the design ratio τ must not be less than about 0.7 for good gain and low back lobes.

$$\textit{Spacing } S_n = R_n - R_{n+1} = R_n (1 - \tau),$$

and the length of the n-th element is:

$$L_n = R_n \tan \frac{\alpha}{2},$$

and the element spacing-to-length ratio; therefore, is:

$$\frac{S_n}{L_n} = \frac{1 - \tau}{\tan \frac{\alpha}{2}}.$$

As in the previous case, this should not exceed a value of 1.30 for proper operation of the antenna. And as in the previous case,

$$\tau_{min} = 1 - 1.3 \tan \frac{\alpha}{2}$$

For the case of the triangular tooth structure working against ground, one must actually design the structure of fig. 74, and

[*Continued on page 118*]

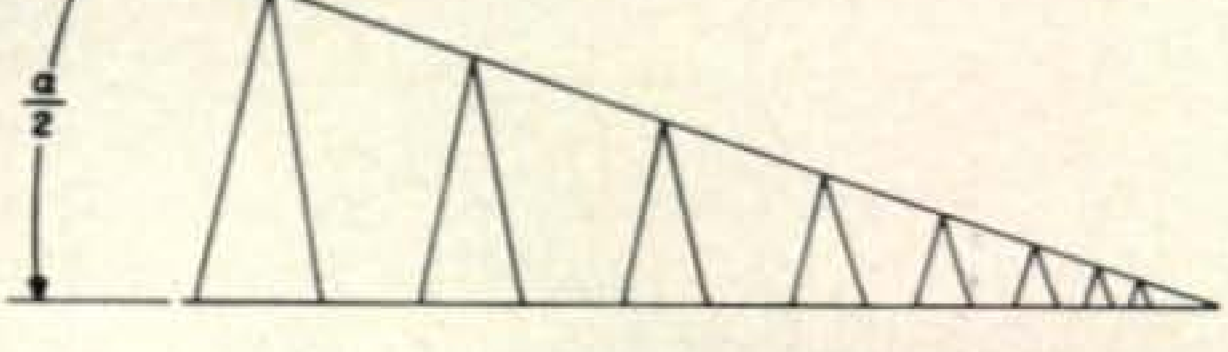

Fig. 75—Log periodic with triangular teeth for operation against ground.

More On Updated Improvements for the 51J Receivers

BY WILFRED M. SCHERER,* W2AEF

HAVING commercially operated quite a few of the Collins 51J-type (or R-381/388/URR) series of 0.5-30.5 mc receivers and especially since coming into personal possession of one of these, a number of shortcomings therewith have been found quite evident. This is particularly true in respect to s.s.b. reception, a mode for which their operation was not intended, since they were designed prior to the era when s.s.b. came into general use.

As a consequence, a number of roll-your-own modifications have been described, all which do much to improve an otherwise fine receiver. From time to time requests are received for past articles on the subject, so we'll review some of the data presented in two of these and also shall describe additional changes as a result of our own experiences.

Before doing so, it might be well to point out that some of the difficulties might not appear in all of these receivers, because of variations that may be found in the different models or production runs. The suggested modifications therefore apply only if the faults mentioned herein are encountered in the particular receiver of concern.

Let us first discuss some of the modifications previously described.

*Technical Director, *CQ*

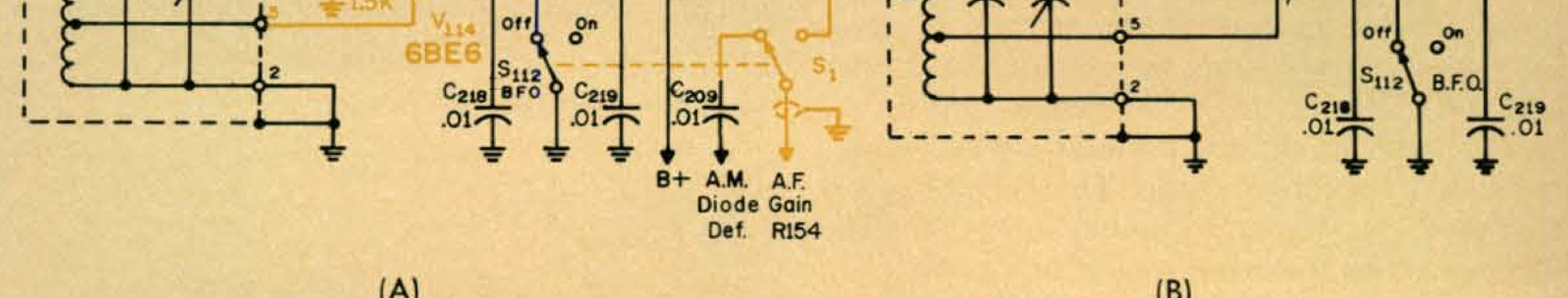

Fig. 1 (A)—Circuitry of b.f.o./product detector for use in 51J receivers. New components are identified by color. S_1 should be part of S_{112} as explained in text where other details also are given. (B)—Original circuitry for 6BA6 b.f.o. in the 51J's. R_{160}, R_{161}, R_{162} are lower values in the 51J-3 (100K, 33K, 2.2K, respectively), and will provide slightly higher output and a bit better signal-handling capability. These values also may be incorporated in the 51J-2, if desired.

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Product Detector

The most obviously needed modification for s.s.b. reception is the inclusion of a product detector. A simple and easily installed one was described in one of the references[1]. It employs a 6BE6 converter tube installed in place of the existing 6BA6 b.f.o. tube (V_{114}). The oscillator section is employed for the b.f.o. and the signal section for the detector. Its inclusion in our 51J-2 proved it to be excellent as far as product detection goes; however, with the new circuit constants as specified, the b.f.o. amplitude was found to be so high that strong harmonics therefrom appeared at every 500 kc point on the bands up through 7 mc.

Should this occur in other cases, it can be rectified by using the original component values for the b.f.o. (plate and screen resistors) to reduce the b.f.o. amplitude to normal. This then necessitates cutting down the i.f. signal level to the detector for the proper ratio of signal-to-b.f.o. voltage needed to avoid distortion or intermodulation.

The modified setup is shown at fig. 1(A). The i.f. signal is attenuated by the use of a small-size coupling capacitor (C_{206}, 5 mmf an original component in the set) which in conjunction with a relatively low-value grid resistor (R_2, a new component) forms a voltage divider. The a.f. output level from the detector under these conditions is still entirely adequate; in fact, it is about the same as that from the a.m. envelope detector.

Installation

By comparing the original b.f.o. setup shown at fig. 1(B), with the revised modification at fig. 1(A), it will be seen that little rewiring is needed at the socket for the b.f.o. tube (V_{114}).

Pin 2 now goes to the cathode tap on the b.f.o. inductor (T_{106}). C_{206} now goes to pin 7 (the capacitor lead will have to be spliced) where R_2 also is to be connected. The r.f. filter (C_1, C_2, R_1, new parts) connects to pin 5. It may be installed along with C_3 on a new terminal strip (4 lugs with one grounded) held by the mounting screw for the rectifier-tube socket bracket (the screw nearest T_{106}).

In our 51J-2, S_{112} is one section of a d.p.d.t. switch, thus making it possible to use the other section for S_1. A new switch will have to be accordingly installed on receivers not already so equipped.

[1] Lee, P. H. Cpt., "A Single-Tube Product Detector," *CQ*, April 1961, p. 50.

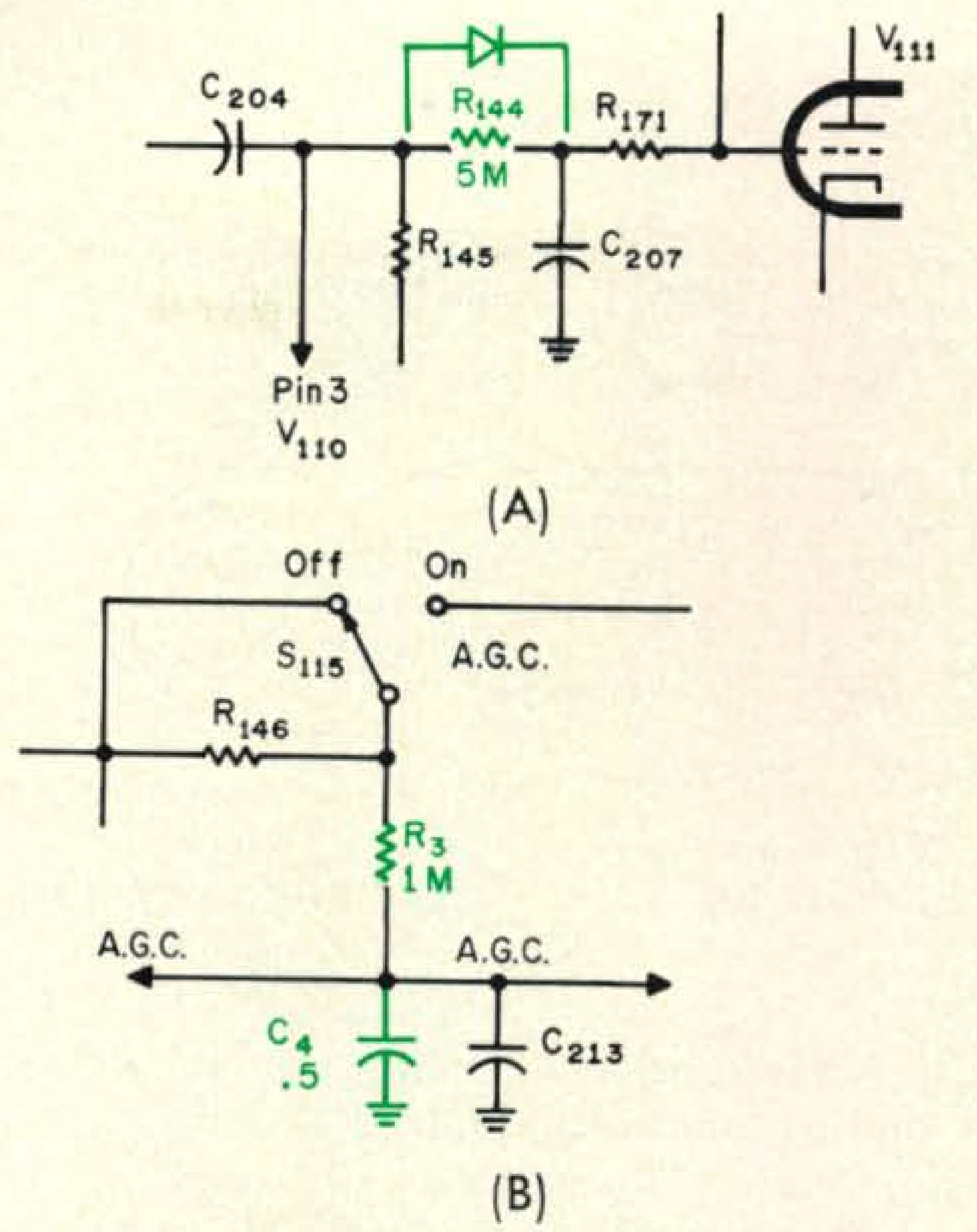


Fig. 2 (A)—Circuit for improved a.g.c. operation in the 51J's. R_{144} is changed to 5 meg. It is shunted by a diode to hasten the attack time. The diode should have a very high back resistance. A conventional silicon top-hat rectifier diode will do. (B)—A.g.c. circuitry with R_3-C_4 added to the a.g.c. line to increase release-time constant to about 1 second. Faster or slower decay times may be had by smaller or larger values, respectively, for C_4. The modification may be made at the a.g.c.-line tie-point strip between the v.f.o. and the slug screw for T_{103}. An ohmmeter may be used to identify which wire at this point goes to the a.g.c. switch.

If desired, the b.f.o. may be wired for crystal-controlled operation with u.s.b., l.s.b. and c.w. crystals as described in the reference. We use the tunable arrangement, inasmuch as instability was not a problem therewith and it allows convenient placement of the b.f.o. frequency at any point in relation to the i.f. passband to meet various needs, a particularly desirable feature for use with c.w. and the sharp single-crystal filter.

No special adjustment should be needed for the product-detector modification, except possibly retrimming the b.f.o. slug for 500 kc. A test often suggested, is that no output of any sort should be heard from an s.s.b. or a.m. signal when the b.f.o. is inoperative (such as may be obtained by shorting the cathode to ground); however, this is not necessarily a valid indication of proper performance, at least with this type product detector, since disabling the b.f.o. changes the operating conditions for the 6BE6 from the normal state under which proper operation may

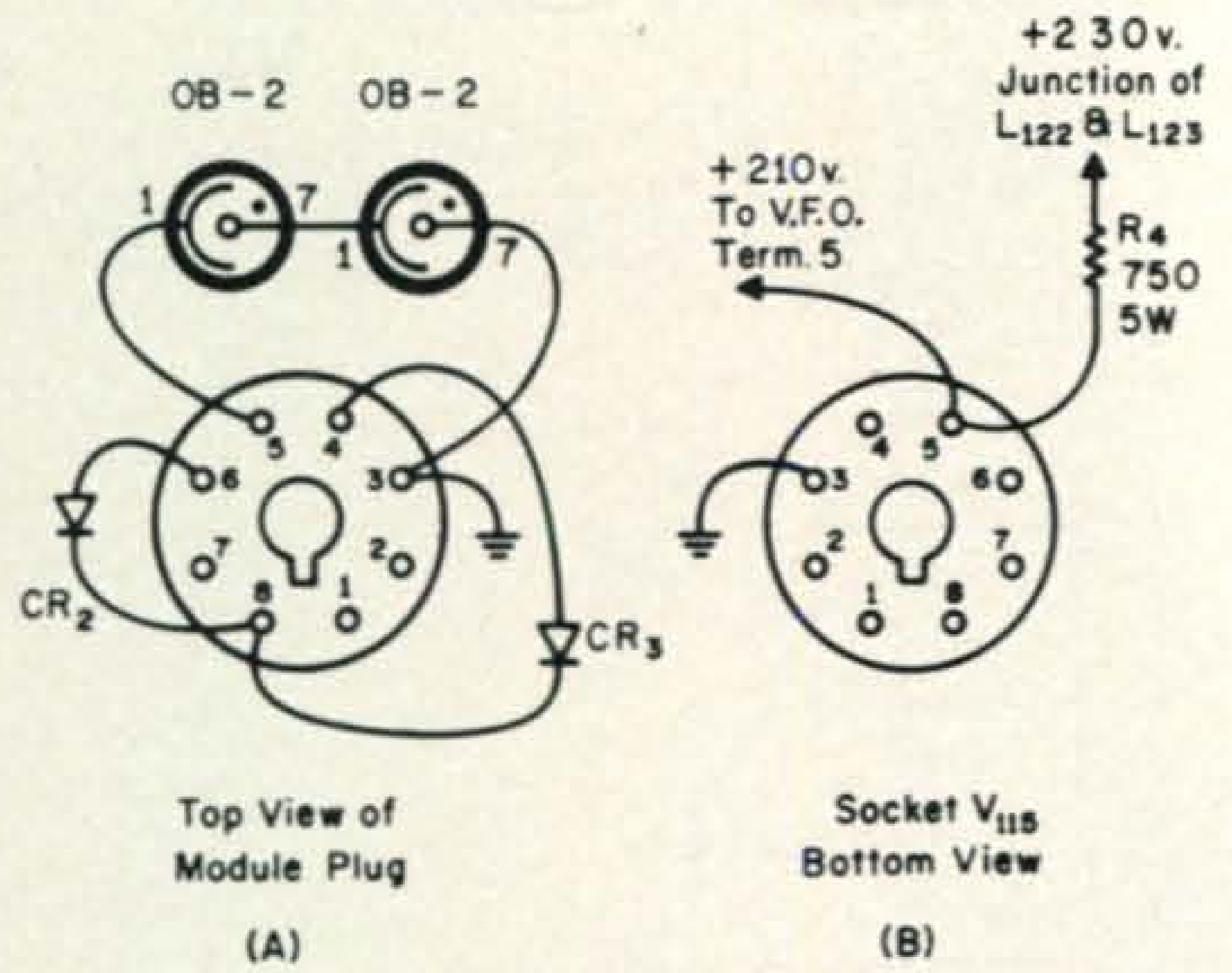


Fig. 3 (A)—Wiring connections for silicon rectifier diodes and regulator tubes installed in plug-in module. CR_2 and CR_3 are rated at 750 p.i.v. at 200 m.a. (B)—Additional wiring needed at the receiver's rectifier-tube socket (V_{115}). The B-plus lead for the v.f.o. must be removed from the junction of R_{174}-C_{223}, and then be connected to pin 5 of V_{115} socket as shown here. R_4 is a new component.

otherwise be realized. Some output may or may not be heard, depending on the specific abnormal operating conditions with the b.f.o. inoperative.

On the other hand, you're in good shape if oscilloscope observations of the detector output indicate an undistorted sine wave with a 150-200 c.p.s. beat note from a steady strong signal; and if tuning an a.m. signal to *other* than zero beat, yields an a.f. output response of *only* the Donald Duck or Mortimer Snerd variety (such as with an s.s.b. signal) *without* any audible underlying natural-sounding a.f. response (a.m. detection) at the same time.

Selectivity

Another good change for s.s.b. operation is the installation of a crystal-lattice bandpass filter as described in the latest reference[2]. This is a well thought out modification in that besides providing a desirable bandpass for s.s.b., it also can be switched to bypass the bandpass filter for a.m.[3] or to use one filter crystal with three degrees of sharp selectivity for c.w. along with the use of the phasing control for obtaining a rejection notch.

A.G.C.

Another modification suggested in the first reference[1] is altering the a.g.c. time constant for better action with s.s.b. This involved changing R_{111} from 470K to 5 meg. In our case this slightly increased the a.g.c. release, but at the same time noticeably delayed the attack, resulting in an unpleasant and hard a.g.c. action.

The difficulty was corrected by shunting R_{111} (now 5 meg.) with a diode gate as shown at fig. 2A. On the attack a momentary positive voltage appears at the diode anode, causing it to conduct and short out R_{111}, thus allowing C_{207} to quickly charge and provide fast action. On the release, the charge on C_{207} reverse-biases the diode into non-conduction and permits C_{207} to then slowly discharge through R_{111}.

The a.g.c. attack with this setup turned out smoother and better than with even the original arrangement in the set, but the release time was still somewhat too fast for our liking. This was rectified by installing a 1 meg resistor and a 0.5 mf capacitor on the a.g.c. line as shown at fig. 2B. This adds a 1/2 second time constant, making the overall decay about 1 second. By changing the a.g.c. switch to a two-pole type with more positions, C_1 may be switched out or to other values to provide a choice of release times.

This modification raises the impedance of the a.g.c. line and thus theoretically defeats the purpose of the original low-impedance line towards minimizing the possibility of cross modulation, etc.; nevertheless, cross-modulation, intermodulation, overload and desensitization measurements indicated no deterioration in these respects.

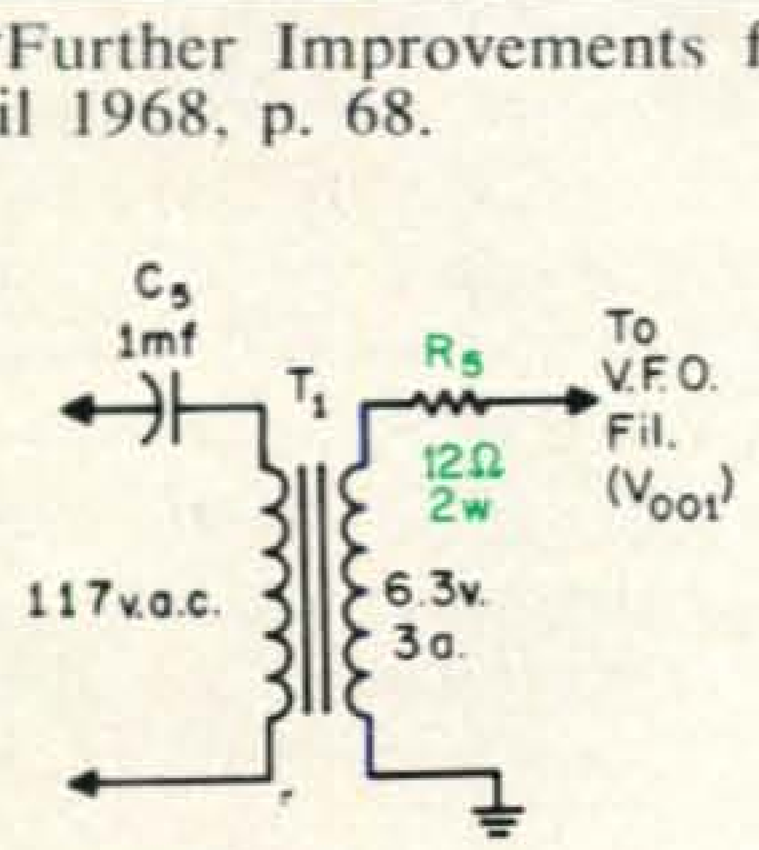
First Mixer

Another good modification for improved receiver performance in general, is installation of a 6DJ8 dual-triode mixer in place of

[2] Lee, P. H. Cpt., "Further Improvements for the 51J," *CQ*, April 1968, p. 68.

[3] Except when the going gets real rough, with proper setting of the b.f.o. frequency the normal i.f. selectivity is adequate for s.s.b. reception for which its use produces nice-sounding a.f. quality. Also, where the bandpass filter is not available, use of the original crystal filter will be helpful in combating QRM, although the a.f. response does suffer therewith.

Fig. 4 — V.f.o. regulated-heater supply. T_1 is Allied no. 54-F-2031. Two tubes are used in the 51J-3 v.f.o., so shunt R_5 with 10 ohms, (2W) and make C_5 1.25 mf.



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the 6BE6 first-mixer setup[2]. According to the reference, it should provide an improvement in gain on the 21 and 28 mc bands.

This change was not made in our unit, since after careful realignment, the band-to-band gain for all bands on our 51J-2 was within ±2 db (referred to 14 mc) with an s.s.b./c.w. sensitivity of better than 0.2 μv for 10 db $S+N/N$ and with a 50 μv signal's producing a meter reading near mid scale (the 35 db point) in each case. We're probably pretty lucky in this respect, as we've found some of the 51J's with relatively poor sensitivity and lower gain. Nevertheless, we do plan to eventually install the 6DJ8 mixer, as from other experiences with it, at least a 10 db improvement in cross-modulation, *etc.*, characteristics should result therewith.

Voltage Regulation

One of the most annoying characteristics of some of the 51J's is frequency variations with changes in plate and heater potentials to which the v.f.o. is quite sensitive.

That related to plate potential is most noticeable with a strong s.s.b. signal at which time the varying a.g.c. voltage simultaneously changes the plate current of the stages controlled thereby, thus fluctuating the load and the voltage on the B-plus line which also supplies the v.f.o. The resulting frequency variations of the v.f.o., although only slight, produce a degree of frequency modulation of the signal[4].

This might not be observed by the untrained ear while listening to an s.s.b. signal, but it will be more evidenced by tuning in a strong s.s.b. signal with the r.f. gain at maximum, then reducing the gain and noting if the pitch of the voice shifts. If it does, you can be sure frequency modulation will be present when the a.g.c. is in full operation.

Another way to check the situation is to tune in the crystal calibrator for a beat note and observe if there is a difference in the beat as the r.f. gain is varied between maximum and about half-way on.

Such undesirable performance can be cured by providing plate-voltage regulation using two OB2 gaseous regulator tubes. This modification also includes the use of silicon rectifiers in place of the 5V4 vacuum tube, thus eliminating a source of heat. Removal of the 5V4 also allows the regulator tubes,

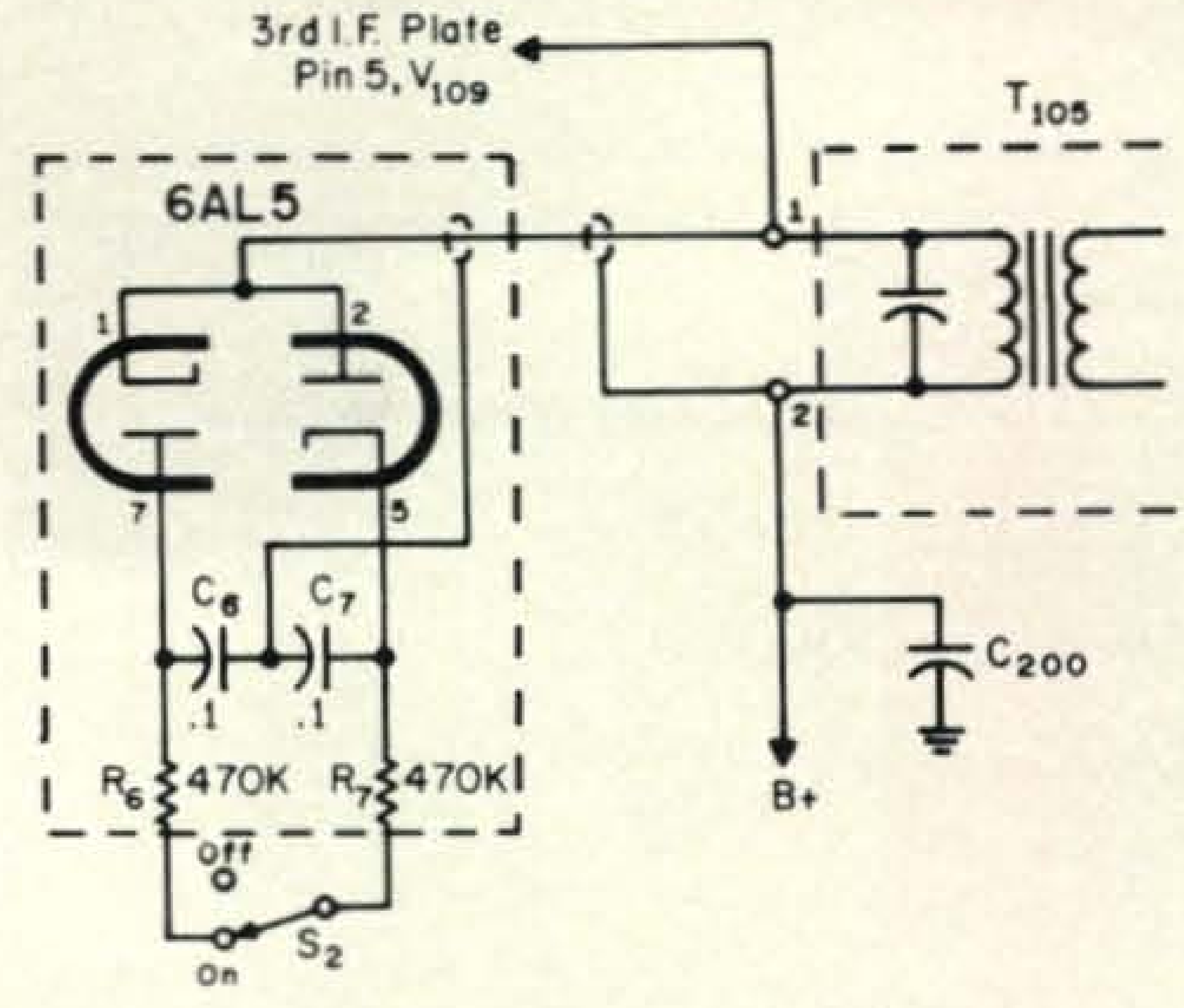

Fig. 5—Circuitry of s.s.b./c.w. i.f.-type noise limiter for use in the 51J's. It is built in a 2¾" × 2⅛" × 1⅝" minibox that is fastened to the top of T_{105}. If clearance is requried for a sloping cover on the receiver, the unit may be installed on top of T_{103} instead. A 3/8" diameter hole is drilled through the center of the top and bottom of the box to provide access to the transformer tuning slug. All components, except the switch, should be installed in the box. A shielded lead, passed through a new hole in the chassis next to V_{109}, is used for connection to the i.f. transformer. One end of the shield is connected to junction of C_6-C_7 and the other end to terminal 2 on the transformer. Do not ground the shield. Use twisted leads (with high-quality insulation) to the switch which may be a toggle type mounted between the two b.f.o. controls on the panel, or the original limiter switch may be changed to a two-pole three-position pob to provide one switch with a choice of either limiter. Also twist the heater leads and make *both* connections at V_{114} socket. The limiting level may be changed by altering the values of R_6-R_7. After installation, repeak the top slug of T_{105}.

along with the diode rectifiers, to be installed in a module unit that can be plugged into the rectifier-tube socket. If the silicon rectifiers should fail, a 5V4 may be temporarily reinstalled in the socket to provide emergency operation.

The module consists of a 3¼" x 2⅛" x 1⅝" minibox with the regulator tubes installed on one end, an octal plug on the other end and wired as indicated at fig. 3(A). In cases where the sloping cover is used on the receiver, the tubes may be installed on one side, right near the top of the box, so they are positioned horizontally instead of vertically, to provide clearance for the cover. A simple wiring change on the receiver is required as shown at fig. 3(B).

[4] This is not likely to occur with the 51J-3, since plate-voltage regulation for the v.f.o. is provided on these models.

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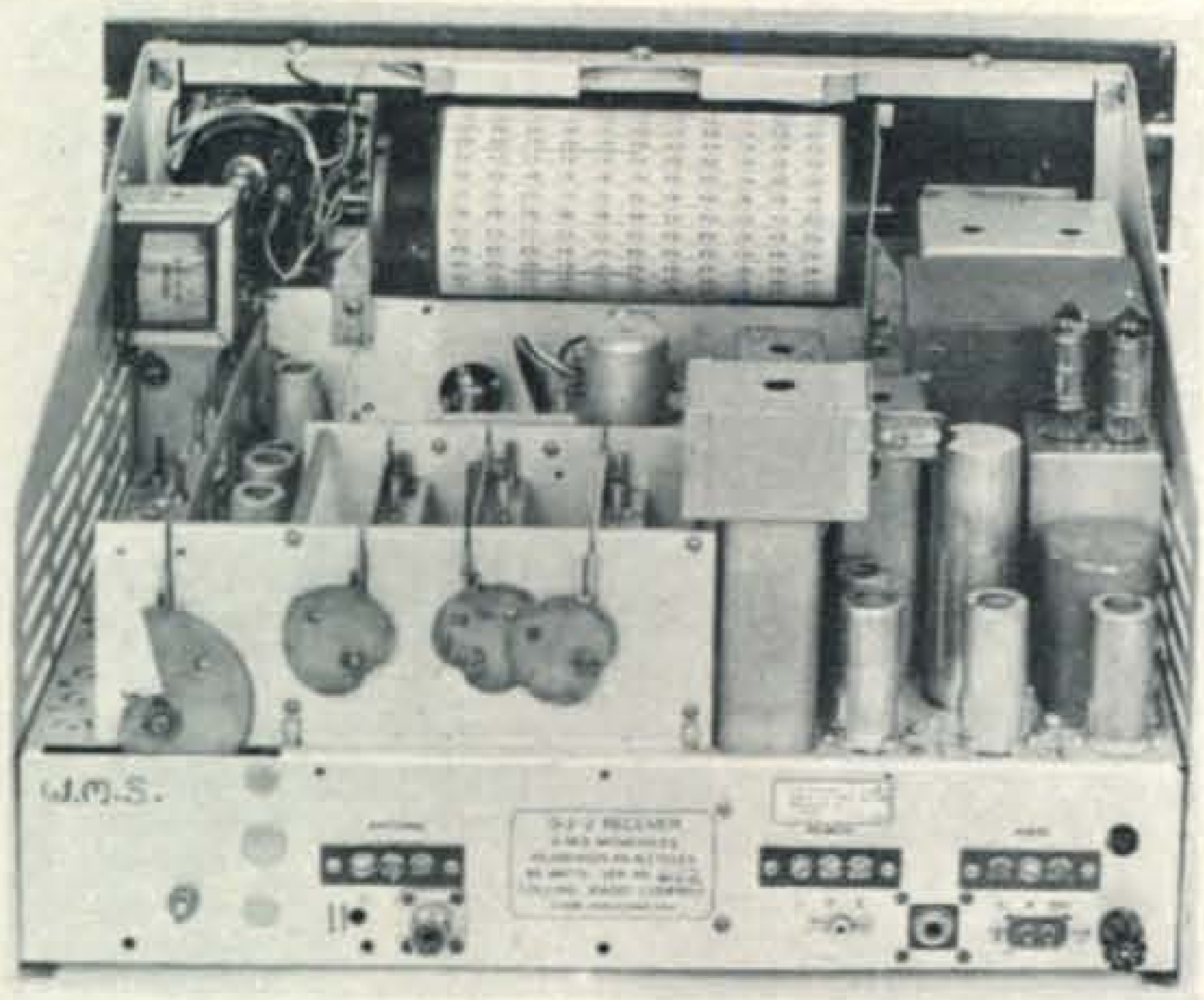

Rear view of the 51J-2 with the regulated transformer for the v.f.o.-tube heater mounted on side bracket at left. The silicon-rectifier/regulator-tube module is at the right with the two Ob-2's on top. The s.s.b./c.w. noise limiter is attached to the top of the i.f. transformer in the foreground at right of center.

Heater Regulation

At our location recurrent a.c. power-line voltage variations are continually experienced, and since the v.f.o. is also sensitive to heater voltage, keeping s.s.b. signals tuned on the button under such conditions is another annoyance.

This difficulty was remedied by providing a regulated 6.3 v.a.c. heater potential for only the v.f.o. using the regulated-transformer scheme recently described in *CQ*[5]. The setup for this application is shown at fig. 4. The transformer and associated components are mounted above the chassis on the right side bracket.

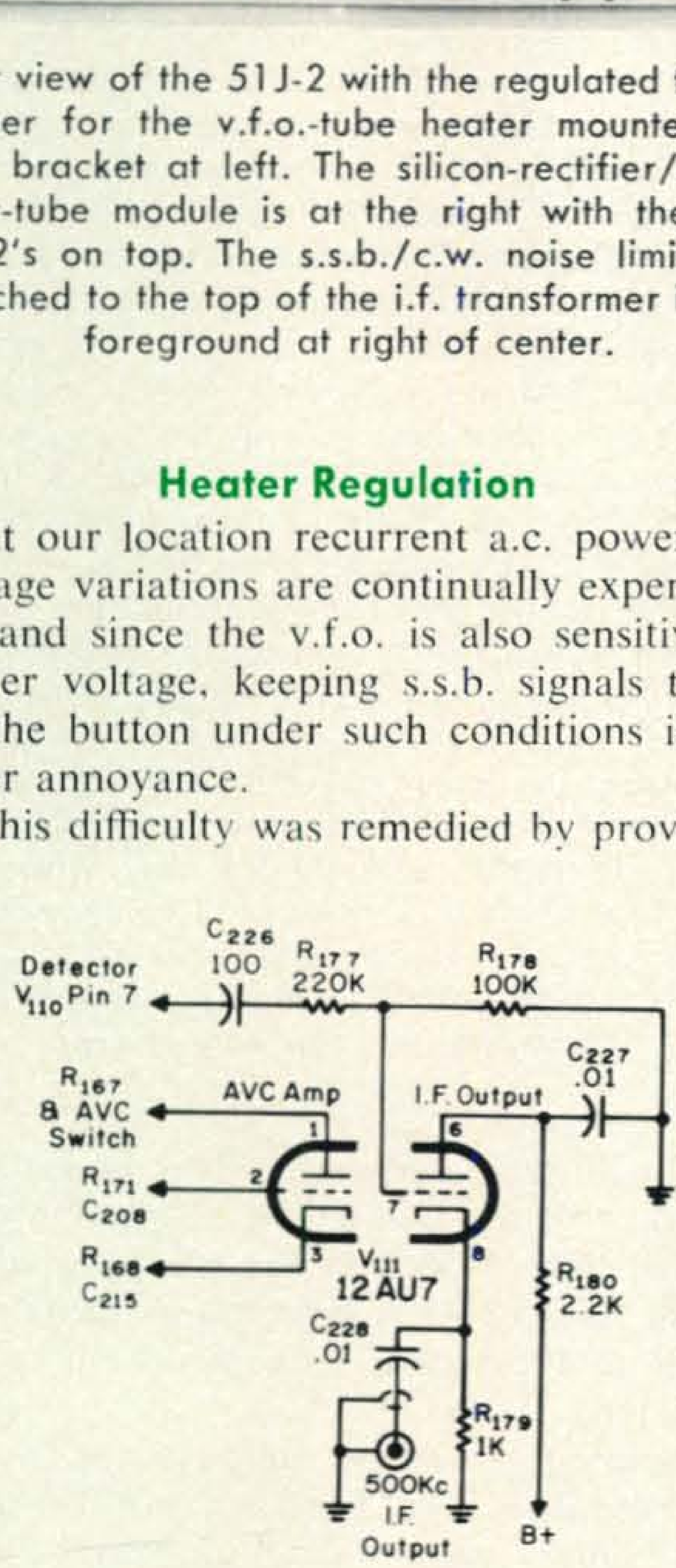

Fig. 6—Change in V_{111} circuitry to provide a 500 kc i.f. output for external use with the 51J-2. The two halves of V_{111} normally are wired in parallel, so pins 6, 7, 8 must first be disconnected from pins 1, 2, 3 respectively. Pins 1, 2, 3 should be connected to the a.v.c. amplifier components as indicated (refer to 51J-2 schematic). Rewire pins 6, 7, 8 as indicated here. Change V_{111} to 12AU7. Component identifications for the i.f. output are those shown on the 51J-3 schematic.

S.S.B./C.W. Noise Limiter

The noise limiter furnished on the 51J's functions well with a.m. only, but it is useless with s.s.b. and c.w. A simple and effective noise limiter for the latter two modes may be installed at the i.f. strip as indicated at fig. 5[6]. It employs a 6AL5 dual diode. Certain type of high back-resistance diodes may be used instead to conserve space and simplify installation, but we have yet to find any that come up to the performance of the vacuum tube for this application.

Alignment

Proper alignment is a must if the most is to be realized from the receiver. The instructions, set forth in the manual, should be followed closely, but one exception we experienced in this respect is the adjustment of the trimmers for the crystals for the bands above 14 mc. Rather than setting these for the specified voltage measured at the check point as indicated in the manual, we adjusted these for maximum signal level while using the crystal calibrator for a signal source. This may be one reason why our band-to-band gain holds up at the higher frequencies.

When conducting the alignment of the coil racks for tracking (maximum signal level) between the extremes of the particular range involved, it was found best to do one circuit at a time with each range; that is, first setting only the oscillator inductor slug and trimmer capacitor for optimum tracking, next going back over the sequence and adjusting only the mixer slug and trimmer; then conducting the same procedure, this time adjusting only the r.f. slug and trimmer. Final touch up should be made repeating the foregoing steps.

Low Gain

A difficulty experienced with our 51J-2 was low gain, the cause of which is described here, in the event its uniqueness should turn up in other cases.

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[5] Scherer, W. M., "Simple Heater-Voltage Regulation," *CQ* November 1968, p. 75.

[6] Scherer, W. M., "IFNL—An S.S.B. I.F. Noise Limiter," *CQ*, June 1960, p. 42., also "More on The IFNL," *CQ*, November 1960, p. 62.

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After checking the gain for each stage of the receiver, it was found that the 2nd i.f. stage (V_{108}) had a voltage gain of only 1 (actually no gain at all). Operating voltages checked OK, new tubes were tried and tuning the slugs of the output transformer (T_{104}) appeared to peak the signal. A subsequent check for the resonant frequency of the transformer revealed that the primary winding would not tune to a frequency lower than 560 kc, a considerable difference than the required 500 kc.

Removal and examination of the transformer then turned up an incorrect value capacitor across the primary. Installation of the proper size (330 mmf) then permitted correct resonance to be obtained with a restoration of the right gain through this stage.

The apparent peaking with the tuning of the transformer during the defective condition was deceiving in that it occurred at the slug position that provided the lowest frequency which was such that allowed at least some signal to pass.

In cases where low gain is evidenced, it might therefore be well to check the gain of each i.f. stage which should be at least 10 (measured between grid and plate).[7]

Antenna Trimmer

An antenna trimmer capacitor, installed as described in one of the references[2], also is a good addition for the 51J-2. Such a trimmer is already included on the 51J-3.

I.F. Output Facility

Another feature of the 51J-3, not provided on the 51J-2, is an i.f. output feed to a rear apron jack for external use. This may be had by employing one half of the a.g.c. amplifier tube (V_{111}) as a cathode follower. Both halves of this tube are connected in parallel, so by using only one section for the a.g.c. amplifier, the other can be used for the i.f. output facility as shown at fig. 6.

Mechanical

Several mechanical difficulties also have been experienced with some of these receivers. An annoying one frequently found is that when the tuning knob is rotated counter-clockwise, it tends to jump slightly in the the opposite direction when hand pressure is released, resulting in a rubbery action and a frequency shift of about 100 c.p.s.

[7] See 51J Manual for "500 kc I.F. Performance Measurements."

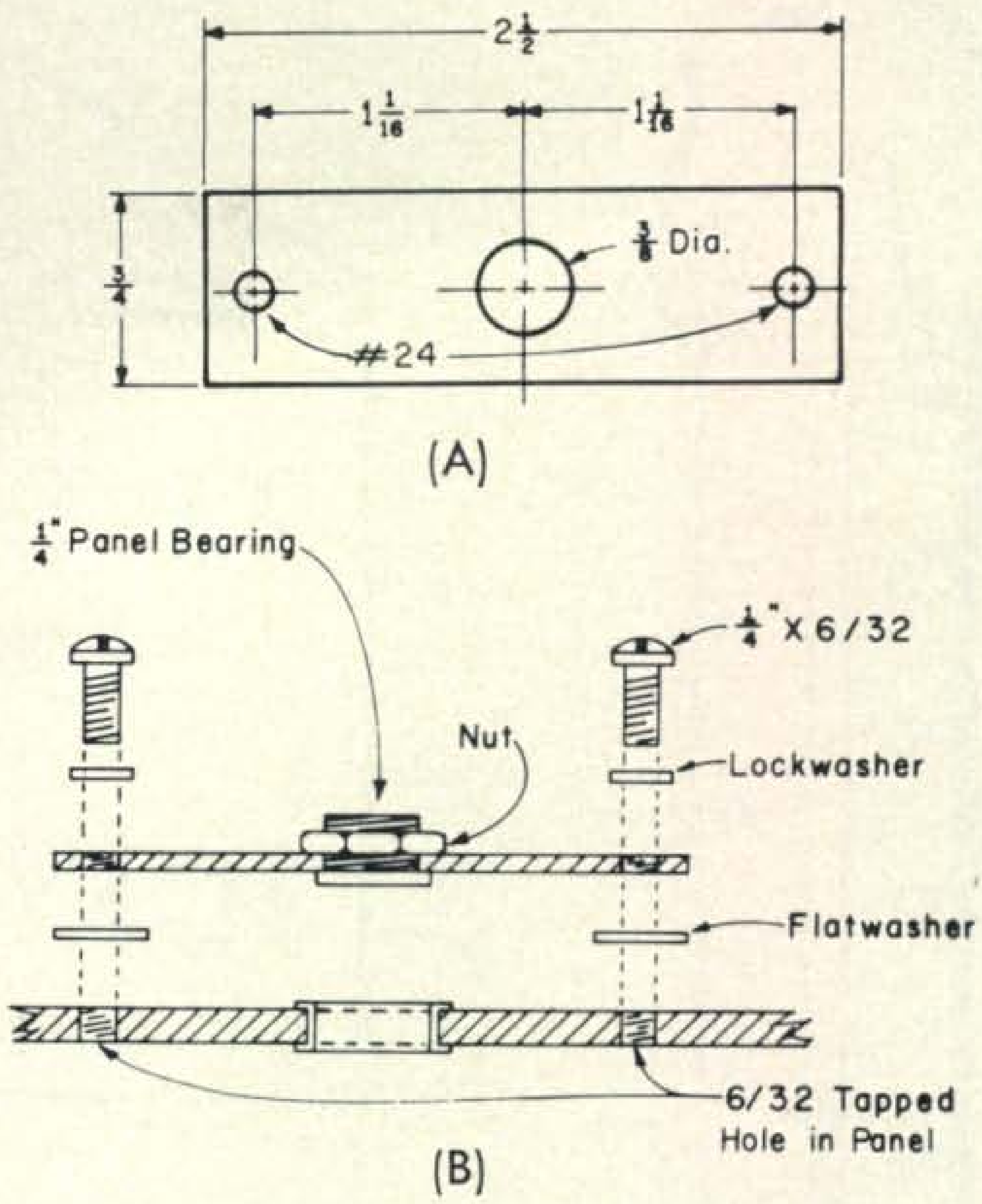


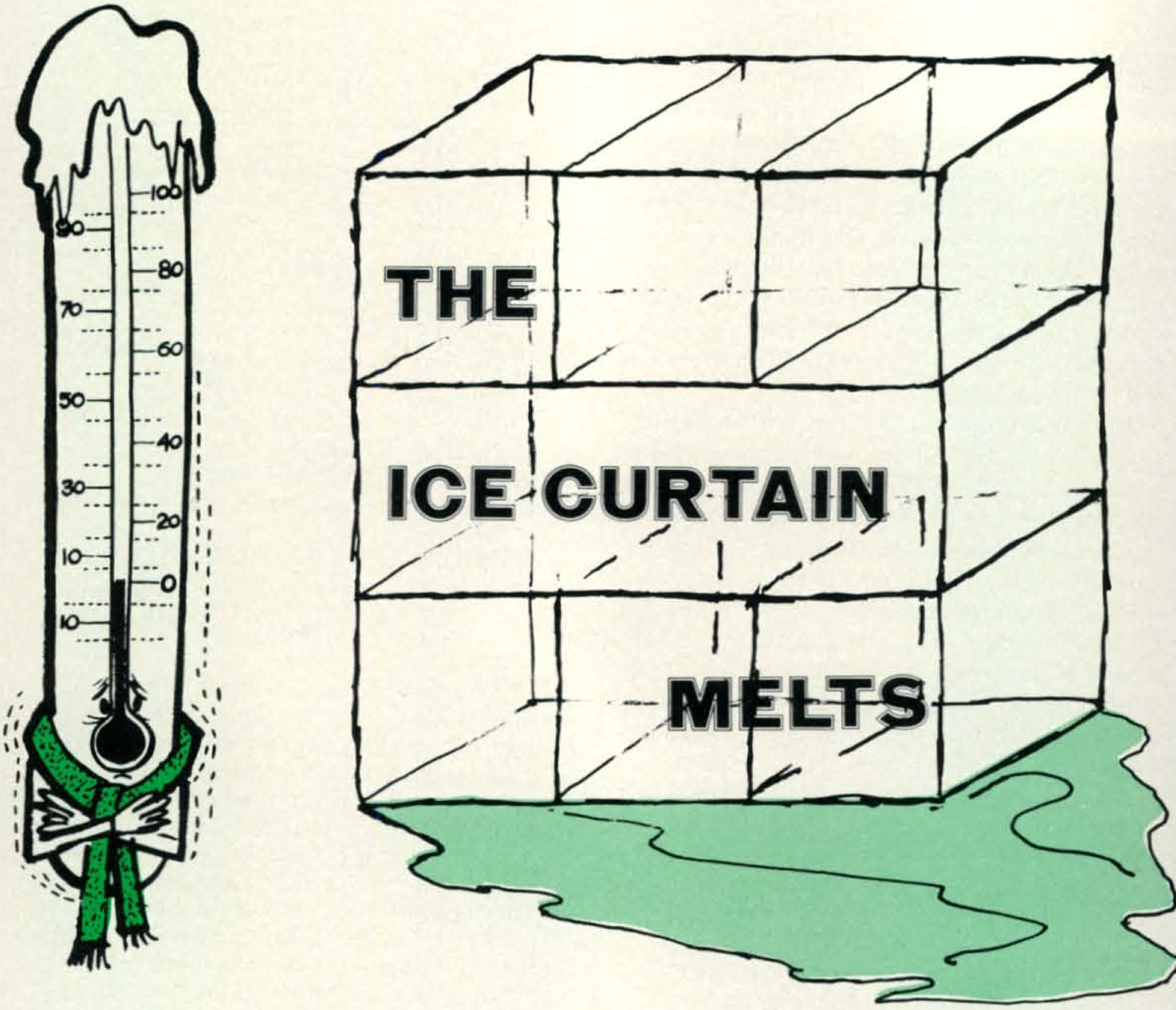
Fig. 7—Panel-bearing setup for tuning shaft. (A)—Dimensions for the mounting plate. (B)—Method of mounting bearing on the plate. The bearing lip must be undercut to fit within the panel hole. After it is installed on the mounting plate, cut off excess threads to allow room for the tuning knob. The plate is mounted parallel with the bottom of the panel and centered with the tuning-shaft hole. Mounting holes, to be drilled and tapped in panel, may be accurately located using the plate as a template while the tuning shaft is passed through the bearing on it. Mounting holes in the plate are slightly oversize to allow best positioning for easy rotation of the shaft without binding. If plate is made of steel or brass, the threaded bearing may be omitted by drilling only a 1/4" clearance hole in the plate, which will then serve as the bearing.

This occurs, because the spring loading on the large split gear driven by the tuning shaft, coupled to the v.f.o., is not sufficient to overcome the drag of the gear-box train with c.c.w. rotation the free-wheeling half of the split gear moves so that the teeth of both halves of the gear are in line and uniformly engaged with the tuning-shaft gear. When operating pressure is released, the loading springs then cause the free-wheeling half of the large gear to slightly rotate and turn the tuning shaft.

The problem can be solved by removal of both loading springs from the split gear. This change introduces no deterioration of operation in other respects, since the spring loading is ineffective and actually unnecessary

[*Continued on page 116*]

THE ICE CURTAIN MELTS



As P.R.O. of the Radio Society of Great Britain, I must project the image of amateur radio to the public. I try to do this so that, for instance, an irate householder, whose TV is being cut up by a radio amateur's cavortings, won't be tempted to set up a lynching party and hang the amateur from his own antenna, but will approach the amateur with sweetness and light, knowing he will be received with corresponding sweetness and light.

"So expert a technician and obliging a neighbour is your radio amateur, that not only will he correct the interference, but he'll adjust your TV installation so that you'll get the best reception you've ever had . . .!" I burble.

Well, it could be true. It has happened, hasn't it? Occasionally. And who's to prove me wrong? Politicans in election campaigns get away with worse teminological inexactitudes.

At Rotary meetings, women's clubs, senior citizen's and youth clubs, at community centers, church groups, professional societies, all over Britain, wherever we can, my R.S.G.B. Speakers' Team preaches the Gospel according to St. Ohm. And we stress that the radio amateur is a conscientious, law-abiding citizen, patriotic, altruistic, dedicated, drip-dry, heterosexual. He pays his taxes, uses deodorants, gives to charity, loves animals, is kind to his mother, remembers his wife's birthday and attends P.T.A. meetings on behalf of the two-and-a-half children the statisticians allow him.

You and I know better, of course. We know that radio amateurs are people with people's faults, quirks and doubts, but that's our business, not the public's. Presidents boob, saints swear, monarchs burp, film stars sin, but the image the public cherishes of its idols ignores such trivia. So the radio amateurs I present to the public are perfect, flash frozen, polythene wrapped, for human consumption.

Part of my presentation, which has 'em moist-eyed, describes the international fraternity that radio amateurs practice.

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

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"*Amateur radio crosses every border, social, political, ideological. Amateur radio knows no barrier of race, religion or creed!*" I blather.

And the audiences love it. For people want to be told of a Pollyanna Never-Never-Land, where nobody is bigoted or self-seeking or vicious. They lap up my vistavision, technicolor dreamscape and sometimes I find myself believing what I say.

I tell, for instance, of Marek.

On 24 February, 1968, at 1600 GMT, HB9PJ, Fernand Dubret, answered a c.w. Mayday on 14080, from SP3AUZ, calling for a contact with HB, DJ or G. The SP explained that a neighbours' son, Marek, 4 years old, was gravely ill with a cancer condition called Willm's tumour. Only a major operation could save Marek, but the Polish surgeons needed first a new American drug to treat the boy and that must be administered within 24 hours. The drug was manufactured under license in Switzerland, West Germany and Britain.

Fernand's doctor had never heard of the drug. A pharmacist friend had heard of it but had no stocks. Then Fernand conscripted the help of a leading Swiss newspaper, *La Suisse*, knowing that newspapers have more influence sometimes that do ordinary citizens. The paper discovered that a Geneva hospital had the drug, but would not issue it without a precise prescription. The HB9 contacted the SP again, who got the Polish surgeon's instructions. The hospital released the drug, but the last plane had left Geneva for Warsaw 15 minutes earlier.

Fernand Dubret then called airports in 7 European countries, at his own expense, to find out when the next plane was going to Poland. A Russian flight was leaving Paris at 9 next morning. He contacted the *Aeroflot* pilot in his hotel. The pilot agreed to carry the drug, but must have official permission first.

Dubret contacted the Polish Mission to the U.N. in Geneva and the Ambassador consented to call the Russian Ambassador in Paris, asking him to give the order. The drug left Geneva for Paris, in the care of an *Air France* hostess.

HB9PJ contacted SP3AUZ once more and told him the good news. The Pole informed his local police, who informed Warsaw. As the Russian plane touched down in Warsaw, the drug was taken off and rushed the 150 miles to Marek's village.

If only the politicians would copy the radio amateurs! l. to r. YV1YD, SP5HS, DL9RE (President of D.A.R.C., the German national amateur radio organization), W6GTE.

Marek's life was saved. Dubret received commendations from the Polish Government, the Swiss P.T.T. and, for some reason I haven't yet discovered, but it makes a happy ending to a smashing story, from President de Gaulle's Personal Assistant!

A child's life had been saved because of the resourcefulness and dedication of two radio amateurs, on either side of the Iron Curtain. It was a tale custom-built to charm audiences into accepting amateur radio.

"*There is no Iron Curtain in amateur radio!*" I croon. Also a smashing story!

During the Israeli-Arab War of 1967, we heard one night on 20 meters a W4 in QSO with a YV. Copy was so clear we thought at first it might be a commercial station, one of those who manage (quite by accident) to stray onto the amateur frequencies. What was being said contributed to the illusion. The W4 was giving a blow-by-blow of the Israeli campaign. We listened, fascinated and appalled, for the British amateur licence specifically forbids any mention of politics on the air.

Not only was the W4 lady well informed and articulate, she had opinions, and she was voicing them, 5/9 plus umpteen, for all the world to hear. It has been estimated that, for every QSO, there are at least 1,000 listeners, not only official monitors, but other transmitting amateurs and, of course, s.w.l.'s of all nationalities. If anybody hearing that QSO were not of the same persuasion as the W, he would be within his rights to complain to the authorities: "Here are radio amateurs using their privileges to disseminate political progaganda!"

It happened that our personal views were entirely in line with the W's, but that was

SP5HS, Krzysztof J. Slomczynski, centre, with the author standing on his left.

irrelevant. She had no business, no business at all, to air them on the air. Voltaire said: "I disapprove of what you say, but I will defend to the death your right to say it!"

In this case we approved of everything the lady was saying, but we challenged her right to say it where she said it.

When I was in the U.S. later that year, I mentioned this incident in the *CQ* offices and they dug out a copy of the U.S. amateur license, to prove to me that non-political clause exists for U.S. amateurs. Smugly I pointed out that politics are forbidden by most signatories to the I.T.U. Convention and that this was a good thing. I should have kept my big mouth shut, in the light of the shameful events that were to occur a year later in Europe.

In the Spring of 1968, my love affair with amateur radio, doing nicely already for a girl who doesn't believe Ohm's Law, was even further committed when I became a regular contributor to a B.B.C. World Service Program called *World Radio Club*. This is a program about communications, which goes out four times a week, all over the world. It caters mainly for broadcast DX-ers–if you think amateurs are nuts, you want to meet this other kind! But most weeks there is a 5-minute amateur spot.

By August the Producer had cajoled, sweet-talked, bullied, Svengali-ed and Higgins-ed me into some semblance of broadcast professionalism. Like Pavlov's dogs, I was beginning to respond nicely to the dinner bell.

On August 23, the Producer exploded into the studio, all brilliance, inspiration and erotic after-shave. "We're changing today's program. I'm going to concentrate on the free radio stations in Czechoslovakia . . .!"

He flung at me the day's paper. A radio amateur in Holland had already been in contact with a secret amateur station in Prague. I was to find out more about that station.

My elder son, Laurie, G3UML, was home from school. It was 10:30 A.M. and that's early in the day of an 18-year-old, but his younger brother might already be awake. I called home.

"Jonny, wake Laurie. Never mind that he'll beat you for waking him so early. Tell him I told you to do it, me, his *mother!*" I was pushing my luck, but what the hell. "Do it for me, darling. Remember how you like your mother to be on the B.B.C. because it raises your stock with the other boys. Well, Jonny, if you don't get Laurie out of bed and to the phone within seconds, your stock will dip . . .!"

Laurie came to the phone.

"Get on the air!" I implored, "I don't care if you were up until 5 building that 2 meter converter. It'll never work, anyway. Get on the air and listen out for Czech amateurs and call me back. No hurry. You can take all of 5 minutes."

Laurie called back. There was a Czech station calling itself OK7CSR, who said he was operating in secret. He was asking radio amateurs the world over to excommunicate amateurs of the Warsaw Pact countries.

Within an hour we had put together a topical, accurate and authoritative program for *World Radio Club*, discussing the "Free Prague" broadcasting and amateur stations.

Later that hectic morning I had to do a routine, person-to-person interview, for a subsequent program, with 5Z4KL, Andre Saunders, Head of the Physics Department at Kenya High School, Nairobi. Andre runs a very successful radio club for his students. He was intrigued by the drama and excitement at R.S.G.B. that day, and the way the Press were already flooding us with calls about the clandestine Czech stations.

"Nothing like this ever happens in Kenya," he complained, "but then the East African Radio Society doesn't have a P.R.O.!"

Big deal! As if it had been me invaded Czechslovakia!

At home there was already an accumulation of messages from leading papers and press agencies, to call them back immediately. Everybody wanted priority. Everybody wanted an exclusive. I felt like the girl whose best friend had told her at last and she started using Lifebuoy. News Editors who, up to now, didn't want to know about ama-

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teur radio, except to take sly kicks at TVI cases, offered me drinks and lunches and worse, if only I would come clean with news from Prague. There was a complete blackout on normal news channels from the city and the only source of information was from the clandestine stations.

Then R.S.G.B. members joined in. I had calls from all over Britain, from members who, too, were being plagued by the press. How were they to answer? Should they commit themselves? Refer them all to me, I replied, then at least we'll have a united front and all tell the same tale.

But what tale to tell? This was my problem. I couldn't advise our members, because I didn't know what to say, nor what to do with this very hot potato that had dropped into my cringing lap.

What worried me was the gullibility of the press. They were news-starved and they'd publish anything to fill that front page. Already they had featured a port, via the Dutch amateur, that Dubcek was dead, a suspect gem of information from the first. A very dangerous situation for amateur radio could have developed. Any *agent provocateur* could have phoned a paper and "reported" that he had been told by a Czech amateur that:

a) Kosygin had been assassinated in Prague by Doris Day disguised as a Sioux Indian.

b) Moshe Dayan had signed a non-aggression pact with Red China.

c) de Gaulle had taken over the White House.

The papers had already published one bit of highly doubtful news, about Dubcek, on the say-so of a Dutch amateur. Now OK7CSR was telling his contacts that a train carrying rocket-firing equipment had just crossed the Russian-Czech border. Carefully placed and briefed, mischief makers could cause infinite trouble by exploiting amateur radio. Afterwards, in the traditional way of the press, radio amateurs would be blamed for whatever happened.

So I instructed the R.S.G.B. members to play it cool. No statement! We're just good friends!

OK7CSR came on every hour on the hour, for about 10 minutes. "George" the operator, claimed to be moving around, to avoid detection. Soon there was a queue of amateurs waiting to work him, as if he were rare DX. We had the whole circus, the jostling, the squabbling around the frequency (and on the frequency), the invective, the Born Leaders,

l. to r. YV1YD, ON4UN and PJ2AA

who took over the whole production. An Italian told the Czech that what he said was being channelled straight into the Italian national broadcasting system. A Roumanian promised to arrange a hook-up on the next QCO with the Roumanian network. European radio amateurs, hysterical with excitement, declared an amnesty against I.T.U. regulations—except that I.T.U. weren't told of the amnesty. Credit should be given to American amateurs, who, in the main, stayed aloof and kept their noses clean.

The response to the Czech request for a boycott of Warsaw Pact amateurs turned the situation into a Keystone Cops scenario. An Italian was talking to a Hungarian, when a Swede broke in:

"Haven't you forgotten something?" he asked, in English.

"Oh—sorry!" replied the I1, then to the HA, "I forgot. I mustn't talk to you. I'll sign, then, old man!"

It was Cowboys and Indians, yet the whole principle of amateur radio was at stake.

"Is it true," journalists asked me, "that there's a world boycott of Iron Curtain countries by the rest of the world's radio amateurs?"

Even a caution: "There does seem to have evolved a certain spontaneous uprising among a section of amateurs, but it's by no means official . . ." would have been misinterpreted. John Graham, G3TR, President of R.S.G.B., was receiving similar treatment from the press, but, after the first half-dozen phone calls, he told the press go jump in the lake.

I asked the opinion of several distinguished radio amateurs and they agreed they wouldn't respond to OK7CSR's request. Dr. John Allaway, G3FKM, who tops the Honor Roll, said: "There are Iron Curtain stations I've been talking to for 20 years. Nobody is going to tell me when to ignore my friends. Amateur radio should be like medicine or art, a science above such nonsense."

Eventually the Czech crisis simmered down and OK stations began to re-appear on the bands, conducting normal QSO's. The party was over, yet it left a nasty taste in the mouth.

In mid-September we went to the International Amateur Radio Convention, in Knokke, Belgium. This is always a splendid affair. The Knokke Group of *Union Belge Amateur* have their fine town well tied up and Knokke compares favorably with many more pretentious amateur radio events I have attended. One of the Knokke Committee, Bob Fevery, runs a small, superb hotel, the *Albert Plage*, at which the luckiest conventioneers are accommodated.

"What overseas guests do you have this year, Bob?" we asked, as he welcomed us.

"A good selection," he replied, "Europeans, of course, "Venezuelan, Americans, Canadians and one who will perhaps surprise you."

It did surprise me, and a lot of other people. If it hadn't been so sad, it would have been funny, but you would have to be outside amateur radio, outside humanity, even to get a belly laugh out of it.

At these events, radio amateurs, on meeting, look at the callsign almost before they look at the face, because, often, the callsign means more than the face does. A callsign is a personality you might have known for years, a face is an optional extra. So I watched, wryly, amateurs of a dozen nations, as they peered at the unusual visitor's callsign. Then they would hesitate, outstretched hand suddenly limp, faces frozen into a grimace part astonishment, part antagonism, turning the friendly amateur grin beneath into curdled custard. The Czech crisis, with all its explosive emotional associations, was only days behind us, yet here we were, put to the ultimate test of the radio amateurs' creed.

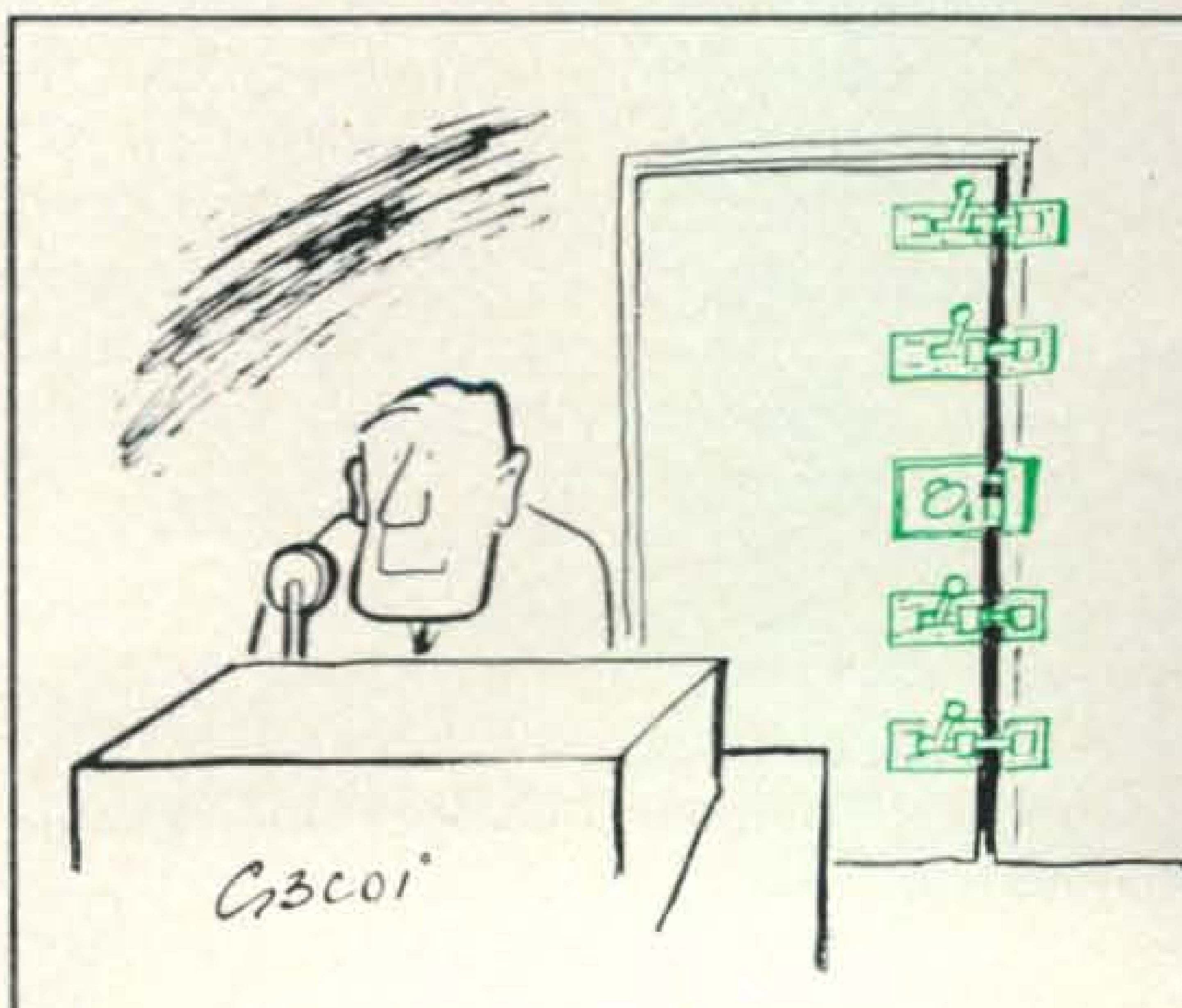
SP5HS, Krzysztof Slomczynski, a member of F.O.C., Secretary of *P.Z.K.*, the Polish national amateur radio society, had come to the Convention. This man had come among us, representative of the aggressors. His government had turned once more to armed force. They had put the clock back a generation. Even their own supporters, throughout the world, had condemned their action. Yet he was a man alone. Not for him the buttress of Embassy spokesmen, watchful, cold-eyed bodyguard, of diplomatic protection. He had braved what he must have known would be an *Ice Curtain* of public disapproval, to represent his country, the radio amateurs of his country, in good faith. Above all, he was a radio amateur.

Later I talked with Krzys. He admitted he had known doubt, even some fear, before coming to Knokke that weekend. About the Czech crisis? "For five days in Poland we know nothing of what was happening. All we Polish amateurs did know was that, for no apparent reason, nobody came back to our CQ's."

It made me a little ashamed of our radio amateurs. That's why I was so glad that things happened at Knokke the way they did.

A sensible nation, the Belgians. Goodness knows they've had their share of invasion and merciless oppression, twice in two generations. Perhaps that's why they could understand and forgive one Polish amateur for the sins of his masters. At the Convention Banquet, they presented SP3HS with a silver, engraved tray, to commemmorate his visit. And we all clapped, so loudly that strangers in the hotel peered in to see what all the noise was.

I clapped too and had to search in my purse for a handkerchief, for some fool bit of dust seemed to have got into my eye. Or maybe I was weeping for the Czechs and the Poles and for us, the lucky ones, *who are without sin*, and for radio amateurs and for the whole foolish predicament of the human race. ■



"TVI doesn't worry me..."

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DX

BY JOHN A. ATTAWAY,* K4IIF

De Extra

The following was largely prepared by WPX Manager, Howard Kelley, K4DSN, with the aid of some slight "proof-reading" by K4IIF. Howard consulted Gerry Clayton, K4IDD/WB6ZKM, who teaches comparative world governments at the University of California and recognized geographers and incorporated their views in his essay. It is excellent reading for anyone interested in clearing up the disorganization which presently exists in DX affairs.

A New Approach to Country Status

"How in the world can you call Boogooloo Reef a country?" queried my puzzled shack visitor. "It has no government, no towns, and no inhabitants, only turtles . . . and even they show up only during mating season."

"Ah, yes," I feebly defended, "but Boogooloo is 200 air miles from the nearest land."

I had barely cleared the thought from my mind when my visitor sarcastically retorted, "What does that have to do with the price of goat's milk in Bessarabia!"

I replied that the currently accepted amateur radio definition of what constitutes a "country" is a rather liberal generalization of world geography which fails to take into account the criteria normally recognized as essential to country definition. Because of this there have been some pretty rough spots in interpretation, particularly where the sorting out of islands and atolls scattered about the oceans is concerned.

Geographers agree that at the very least two conditions must exist before anything can be termed a country. There must be *land* and there must be *people*. These basics are embellished somewhat before a "country" is recognized by the world community. In a modern sense this means country status is equated as a political unit. However, amateur radio has generally steered clear of political entanglements, although governments do control ham radio in their respective countries, and those governments participate together in the International Telecommunications Union.

Going to an extreme to get a sensible country list is futile. The suggestion was made that only member nations of the U.N. be recognized. While there are now 125 U.N. members, enough for everyone to make the customary 100, there are still a few holdouts which are certainly countries in their own right. In addition there are many "countries" that are still not completely sovereign.

All land areas of the globe can be grouped into three general political classifications – A) Sovereign Nations; B) Colonial or Dependency Governments; and C) Military Administrations and Trust Territories. The first two of these come in many different forms.

*P.O. Box 205, Winter Haven, Florida 33880.

S.S.B. DX Honor Roll

W9ILW	322	W0QVZ	305	K8RTW	288	K8ONV	270
W2TP	319	W6YMV	305	W6EUF	287	MP4BBW	270
VK3AHO	318	W2BXA	304	W9EXY	286	W2MJ	267
TI2HP	315	G3AWZ	303	W1LLF	282	G2PL	266
WA2RAU	315	G6TA	303	W3KT	282	G2BVN	264
G3FKM	313	W3DJZ	303	W6UOU	282	DL3RK	261
WA2IZS	313	W8DE	303	K4OEI	280	G3DO	261
W3NKM	313	W4PAA	301	K4HYL	277	W4RLS	260
WA8AJI	312	5Z4ERR	301	W7DLR	277	W6WNE	260
W4OPM	311	K2DX	300	DL1IN	276	WA2EOQ	259
DL9OH	310	XE1AE	300	HB9TL	276	PJ2AA	258
G8KS	310	W4QCW	300	W4IC	276	K1SHN	257
KP4CL	310	W8EVZ	300	K9LUI	275	W6BAF	254
W2RGV	309	W4SSU	299	PZ1AX	275	K6CAZ	254
I1AMU	308	W8BT	299	W6RKP	274	PA0SNG	252
W5KUC	308	W4UF	297	K9EAB	274	W1AOL	250
K6CYG	308	W2FXN	294	W2LV	271	K6LGF	250
W2ZX	307	K1IXG	289	G3NUG	270		

Famous German DXer Karl Muller, DL9OH, and XYL. Karl holds a formidable array of DX Awards including WAZ C.W./F #1823, WAZ Fone #210, WAZ S.S.B. #201, CQ S.S.B. 200 countries award #136, and CQ S.S.B. 300 countries award #31. He is also on the DXCC Honor Roll.

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DM3XI, Klaus Kessler, chief operator of the Erfurt district club station. Actively searching for DX, the club operators use their homemade receivers and transmitters on all bands. They take great pride in a tri-band, two-element quad. *(Photo via K4DSN).*

For example, sovereign nations may fall under any of the following sub-classifications: Commonwealth, Grand Duchy, Monarchy, Principality, Republic, Sheikdom, or Sultanate. A colonial or dependency government may be classed as a Baliwick, Colony, Condominium, Dependecy, External Territory, Mandate, Overseas Department, Overseas Province, Overseas Territory, Possession, Protected Monarchy, Protectorate, or Self-Governing Territory.

There should be no objection to Group A in anybody's country list. However, B and C require a critical eye. In order to justify any land area as a country there must be some understanding of how it stands politically, *not* where it is located geographically. Colonial or dependency governments, according to U.N. interpretation, should be thought of in terms of "junior" countries that some day are destined to become full-fledged countries. They are self-governing in regards to internal affairs, while international representation is carried on by the mother country. Military administered governments such as those in the Pacafic are countries too, but like Group B are often vastly dispersed. No one single island is treated as *the* country, but rather a member of the total military government which can include one or many islands regardless of how they might be scattered across the sea.

Carrying this approach to its conclusion here are some representative examples of how country lists might be affected. First, some possible deletions. The United Kingdom's Dependency of St. Helena is spread out over thousands of miles in the Atlantic Ocean. There are two major islands and one island group in the dependency. There are St. Helena (ZD7), Ascension (ZD8), and Tristan da Cunha (ZD9) which includes the Inaccessible, Gough, and three Nightingale Islands. There is but one government which is of the colonial order. No single island is a country in itself, but is part of the Dependency of St. Helena which in total carries the rank of country. Working any one of the members would count only for the total and the islands would not be separated because of their distance from one another.

Northern Ireland, Scotland, and Wales do not fit into separate country status either. They are administrative divisions of the United Kingdom, politically in a class of a state or province. The same applies to such areas as Corsica which is an integral part of France, and of course to Alaska and Hawaii which are states of the U.S. just like California.

Those controversial islands in the Indian Ocean such as Chagos, Diego Garcia, Aldabra, Farquhar, and Des Roches are politically administered as the British Indian Ocean Territory. No one island is considered a country, but a member of the BIOT which is a political structure which can be called a country under international law.

There would be some additions to the list as well. For example, Germany would be divided into the two republics that currently exist. Likewise for Korea and Viet Nam which maintain separate republics. The fact that the United States does not have missions in these countries has no bearing on their exitence.

Certainly more can be said about this approach to country status, particularly about the ramifications of what would happen to current standards if this approach were recognized. That will be explored later.

DXpeditions

Gus – As mentioned in this column last month, the new W4BPD/W4ECI DXpedition is still go for early 1969. The target date looks like Feb. 1, right after Gus appears at the Fresno DX Convention on Jan. 25-26. For additional details see last month's column.

Canadian DXpedition–The boys were still on the move as of our mid-October deadline. British Phoenix for the *CQ* Worldwide DX Phone Contest was projected for the next stop. QSLs are being handled by George E.

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Sargenia, VE6AO, 3211 Kenmare Cres S.W., Calgary, Alberta, Canada. George cautions you to send SAE with Canadian stamps or IRCs. U.S. stamps will *not* do the trick.

St. Peter and Paul Rocks – PY7AKW writes that the Brazilian gang is returning to the rocks in November or December for a 72 hour operation. No information on dates and frequencies is available as of Oct. 15.

Fresno DX Convention

The annual NCDXC-SCDXC joint DX conference will be held the weekend of January 26-28, 1969 at the Hacianda Motel in Fresno. Gus Browning, W4BPD, will be the main guest speaker. He has delayed the start of his next major DXpedition so as to take part in this meeting. Fred Laun, ex-HI8XAL and now in HS1-land will send tapes of west coast stations operating as heard in Thailand. *CQ* DX Editor K4IIF hopes to be present, but the trip may be pre-empted by a new arrival in the family.

160 Meter News

The big item on top band this month is announcement of the Transatlantic and Transpacific tests for the new season:

Annual Transatlantic 1968/1969 160 Meter DX Tests

DATES: Dec. 1, Dec. 15*, Dec. 29, Jan. 12, Feb. 2*. Feb. 16 & March 2*.
TIMES: 0500-0730 GMT.
FREQUENCIES: W/VE, eastern U.S. and Canada, 1800-1820 kc. W/VE, western U.S. and Canada, 1976-2000 kc. Europe, 1823-1830 kc and 1851-1861 kc.
CALL: CQ DX Test, alternate 5 minute periods with W's leading off. Set clocks accurately. Keep to periods exactly unless in QSO.
REPORTS: To W1BB and/or your favorite news media.
*NOTE: Asterisked dates indicate first timers tests for those who have never made a transoceanic QSO on 160. Dec. 15 is for European first timers, January 5 for W/VE first timers, Feb. 2 again for Europeans and March 2 for W/VE.

Second Annual 1968/1969 Transpacific 160 Meter DX Tests

DATES: Nover. 30, Dec. 14, Dec. 28, Jan. 11, Feb. 1, and Feb. 15. GMT dates!!!
TIMES: 1330-1600 GMT on Saturdays.
FREQUENCIES: W/VE, western U.S. and Canada, 1975-2000 kc. W/VE, eastern U.S. and Canada, 1800-1810 kc. JAs, 1907.5-1912.5 kc. ZLs, 1876 kc. VKs, 1802 kc.
CALL: CQ DX Test, alternate 5 minute peritening between calls. W/VE's lead off first period on hour and/or half-hour.
SPECIAL JA/SUNSET TESTS: Same dates but 0730-1000 GMT Saturday.
Anyone desiring further details should send an s.a.s.e to W1BB requesting the 160 Meter DX Bulletin.

Manoel R. A. DeCastilho, PY7BGL, one of Brazil's leading DX'ers. Manoel recently qualified for the WAZ award. He uses dipoles and a ground plane on 80 and 40, a 3-element widespaced Yagi on 20, and a 3-element duobander on 21 and 28 mc.

The Northern California DX Club

(This is another in the series of articles about famous DX clubs. The information was furnished by Dave Baker, W6WX, a long-time member of the club. Dave is the club's representative on the CQ *DX Award's Advisory Committee.)*

The Northern California DX Club (NCDXC) claims to be the oldest DX club in the world today. It was established as a club exclusively dedicated to DX activity on December 12, 1946 by eleven charter members. It has since grown to its present roster of 134 members (plus 2 honorary members including Gus, W4BPD). Amateurs who reside in Northern California and who can prove two way amateur radio communication with 100 countries on c.w. phone or 75 countries exclusively on phone may apply for membership.

Present officers are: President, W6RGG; Vice President, W6NEQ; Secretary-Treasurer, WA6AUD; Board of Directors, K6CQF, W6CUF, W6ERS. Meetings are held on the second Friday of each month at a location

Ian, VK6XX, at the station of Gay Milius, W4NJF.

selected by the President, or by a committee. The business meeting is preceeded by a cocktail hour and dinner, and for the stalwarts is followed by a monkey business session! Visitors intereted in DX are encouraged to attend. Since the meeting place changes from one month to the next, it is suggested that those who may be in the Bay Area and who wish to attend contact club Secretary, Hugh Cassidy, WA6AUD, 77 Coleman Drive, San Rafael, telephone 415-453-5640.

The club promotes and sponsors the coveted California Award which is available to amateur stations outside of the United States (but includes KH6 & KLZ). The award, an attractive certificate with a Northern California motif, is issued to eligible amateurs who have contacted 200 California stations plus 20 members of NCDXC. A list certified by a responsible official of a radio club is sufficient to qualify. There is no charge. W6GPB is the present award Chairman.

All forms of DX activity are encouraged by the club, not only on the part of its members, but by the DX community in general. Toward this end, the club publishes a monthly bulletin entitled *The DXer*, edited by K6CQF, which is sent to all members and, on an exchange basis to other clubs and organizations publishing DX information. To stimulate DX activity on the local level the club maintains a highly active two meter net dubbed "The CATS Net" which was made famous by fellow member Jack Troster, W6ISQ, in one of his early *QST* articles. (CATS=Chatter and Talking Society).

NCDXC-W6TI Bulletins—For the benefit of all DXers the Northern California DX Club station, W6TI, broadcasts bulletins of up-to-the-minute DX information. These are sent on 14002 kc on either Sundays at 1800 GMT or on Mondays at 0200 GMT. The Monday time is being used most often as the present W6TI trustee, W6RGG, has a job which requires his presence occasionally on Sundays during either the night or day shift.

Although not specifically a club activity, it is interesting to note that the entire staff of the very successful new *West Coast DX Bulletin are* Marin County members of the Northern California DX Club. NCDXC members supply them with not a small amount of their DX data.

The WAZ Program

The new WAZ certificate winners this month are as follows:

WAZ S.S.B.: W5ENE–598, PY1CK–599, W8DE–600, W3PH–601, W7EPA 602, W4EEE –603, W4AXE–604, and DJ2UU–605.

WAZ C.W./Phone: W1JBW–2498, WB2KTO –2499, DJ6TK–2500, WØTDR–2501, WØDGH –2502, W1FPS–2503, K3BNS–2504, JA1TD–2505, W6MTP–2506, WA8PYL–2507, W6EJJ –2508, W6DYJ–2509, JA1MUZ–2510, and K4IIF–2511.

WAZ Phone: JA1NDO–389, JA1MHV–390, DJ2UU–391, and I1CMO–392.

The WPX Program

WPX certificate and endorsement winners were the following:

WPX C.W.: DJ4VX–873, K7PJF–874, K4CK –875, UA3HE–876, UA6KAE–877, UA4LN–878, UA4KKC–879, DK1HA–880, and W6LJH –881.

WPX S.S.B.: JA1NDO–359, and GM5AHS–360.

WPX S.S.B. Contest: XE8AX-11.

WPX Mixed: K7PJF–176, W6VK–177, WA6CAL–178, and DJ7CX–179.

Endorsements: *Continent* – Europe: CX960, Africa: DJ7CX, K4ZCP, K4IEX. Asia: DJ7CX, DJ7CX, K4ZCP, UA4KKC, UA4LN, K3PDC. UA4KKC.

Band – 21 MC: DJ7CX. 14 MC: DJ7CX, UA4KKC. 3.5 MC: DJ7CX, SP9ABE.

Mode—MIXED: W4OPM–950 (all time high), DJ7CX–600, CX9CO–450, and W9VNE–450. S.S.B.: CX9COJ 400, YV4QG–350, W1MZB–300, YV7AV–300, YV4UA–250.

C.W.: W8LY, DJ7CX–550, K4IEX–550, DK1HA–400, UB5WK–400, W6FLT–400, W9HDR–400, DJ4VX–350, UA3GO–350, UA4KKC–350, UA4LN–350.

PHONE: K3PDC–350.

The 950 prefixes racked up by Joe Hiller, W4OPM, in the category of Mixed WPX is

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an *all time high*. The 950 cards were subjected to a routine audit and passed the test. Mr. Hiller certainly ranks among the top DXers in the history of the sport.

The new WPX Honor Rolls based only on current prefixes will soon be ready. In the meantime, here are the all-time WPX Phone and WPX C.W. Honor Rolls:

All-Time Leaders as of Sept. 1968

	PHONE	
1 CT1PK	Manuel Fragoso	812
2 W9WHM	John R. Leary	791
3 G3DO	D.A.G. Edwards	703
4 W9UZC	James H. Carnett	671
5 PAØSNG	Gerrit Mulder	652
6 W3DJZ	Arden B. Hopple	614
7 CT1HF	Sergio Vieira	605
	CW	
1 W4OPM	Charles Hiller	850
2 W5KC	Vincent Rosso	802
3 W8KPL	W.W. Simpson	800
4 W2EQS	Charles O'Brien	764
5 W8LY	Michael A. Bakos	758
6 W2HO	Willibald Vollkommer	712
7 W2AIW	Charles W. Rogers	686
8 SM5CEU	Leif Lindberg	676
9 K1SHN	George Banta	671
10 OK1SV	Vladimir Srdinko	670
11 K2CPR	Jack duBois	658
12 W9GFF	Bud Frohardt	656
13 ON4QX	Bob Berge	654
14 G2GM	F.D. Cawley	653
VK3AHQ	Henry Denver	653
15 W9UZS	Walter Johler	647
16 G3HDA	Michael Bazley	646
17 IT1AGA	Giuseppe deLuca	635
18 JA7AD	Sakae Kamio	624
19 HB9TT	Alfred Jenk	617
20 K2ZKU	Edward Gaudet	616
21 SP6AKK	Josef Cygar	614
WØAUB	W.J. Bergmann	614
22 OK2QR	Rudolf Staigl	610
23 W9DWQ	Edward Goodbout	606
24 W5LGG	L.G. Parsons	605
25 UC2AR	George Radion	602
W3GJY	John Wojtkiewicz	602
YU1AG	Djuro Borosic	602
26 SM7MS	Rune Rasmusson	600
W2KIR	Alex Ekblad	600
W3PVZ	Joseph Olnick	600

Ronny, DL7LQ, at the mike of 4U1ITU.

The S.S.B. DX Award Program

New S.S.B. DX Award certificate winners are the following:

100 Countries: WA3APO/4–523, DL2CG–524, DL8LH–525, WB2CDZ–526, K7UXS–527, WA8VFK–528, and W9CCK–529.
200 Countries: no winners.
300 Countries: XE1AE–37.

Dave Thurber, WA1HXU, P.O. Box 634, Springfield, Vt. 05156, would like to offer his services as QSL Manager for a DX station.

New Oversea's Checkpoints

The following have been approved as authorized to check the QSLs of amateurs from their respective countries for *CQ* DX Awards:

HUNGARY–Central Club of the Hungarian Radioamateurs, P.O. Box 214, Budapest 5, Hungary.

JAMAICA–Alex A. Hugh, 6Y5AH – 38 Brentford Road, Kingston 5, Jamaica.

RHODESIA–Molly E. Henderson, ZE1JE, Radio Society of Rhodesia, P.O. Box 2377, Salisbury, Rhodesia.

Change in KP4 QSL Bureau

KP4CL is now QSL Bureau Manager for Puerto Rico. Her address is: Alicia G. Rodriguez, P.O. Box 73, Hato Rey, Puerto Rico.

Plea from a Bureau

The following is from the San Diego DX Club who handle the W6 bureau. What they have to say applies to all call areas and bureaus:

"Each month the San Diego DX Club receives over 50,000 DX QSL cards for forwarding to California hams. Unfortunately not everyone claims their cards. In accordance with ARRL policy all cards held unclaimed for one year are destroyed. Although

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over 15,000 are discarded each month, the number on hand always remains in excess of 100,000. While some of the top DXers of California are prime offenders, the worst is the casual DXer who works a DX station now and then but doesn't keep an envelope on file in the QSL bureau.

"The ARRL QSL Bureaus are operated for *ALL* amateurs, not just league members. To receive your cards all that is necessary is to send a self-addressed, stamped envelope (5 x 7 manila preferred) with your call in the upper left hand corner. Each month your card will be mailed to you. Send several envelopes at a time and don't be afraid to attach extra stamps with a paper clip–any unused postage will be returned.

"The address of the 6th Call Area QSL Bureau is: San Diego DX Club, P.O. Box 6029, San Diego, California 92106."

Here and There

A2, Botswana: Botswana has received the ITU callsign block allocation A2A-A2Z. A2CAQ (ex-ZS9Q) has been heard on 20 meter s.s.b. *(Tnx VQ8CC).*

AP2, East Pakistan: Don, W4UDF/AP2 was active from Chittagong with a big signal on 15 and 20 meter s.s.b. His present status is uncertain. QSL to WA9KMD. *(Tnx VQ8CC).*

AP2DI is also active from East Pakistan. Listen on 14050, 14205, and 21305 around 1200 GMT, and between 1400 and 1800 GMT. *(Tnx VERON).*

CR8, Portuguese Timor: Billy Nielsen, WB4APC/DL5KS, writes that his trip to Timor is off as a one-year residency is a prerequisite to licensing.

FB8, Crozet Island: Claude, FB8WW, has been logged in on 14020 kc c.w. at 0605 GMT, and on 14227 kc s.s.b. at 1210 GMT. *(Tnx Watts).*

FR7, Europa Island: Difficulties with the customs in Reunion Island prevented VQ8AD from loaning the Swan-120 for use on Europa so no operation will now take place. *(Tnx VQ8CC).*

JW2 & JX5: N. R. R. L. has informed POϕTO that JW2AP and JX5J were pirates. *(Tnx VERON).*

MP4, Trucial Oman: MP4TCF will be active for several months. His favorite band is 15, and he has been reported on 21225, 21282, and 21336 kc s.s.b. at 0800, 1200, and 1800 GMT respectively. *(Tnx WCDXB).*

ON/F Belgium: Belgian stations operating from exhibitions are required to sign their calls /F. It does not mean that they are in France as some have erroneously assumed. *(Tnx ON4TJ).*

SU1, Egypt: Ibrahim, SU1IM, has been heard on 14008 kc c.w. at 2110 GMT. Apparently Egypt has lifted the ban on amateur radio. *(Tnx WCXB).*

SVϕ, Crete: Only 2 stations are presently active, SVϕWN on 40-10 meter s.s.b. and c.w., and SVϕWCC on 15 and 20 meter s.s.b. After Jan. 1 SVϕWCC will be leaving so only SVϕWN will be active from this rare lisland country. SVϕWN's favorite frequencies are 7005, 7055, 14025, 14210, 21205, 21300, and 28615. He is on the 10 meter frequencies daily at 1600 GMT. *(Tnx SVϕWN).*

TU2, Ivory Coast: TU2AF has been reported on 14198 kc listening 14202 at 0000 GMT. *(Tnx LIXA).*

VS5, Brunei: Slim, VS5TJ, is active around 14210 kc s.s.b. at 1200 GMT. He also likes 21300 kc s.s.b. on weekends. Do not break into his QSO's with friends as he considers this practice very rude. Wait until the QSO is over. *(Tnx VERON).*

YBϕ, Indonesia: YBϕAR is said to have worked U.S. stations. As far as we know Indonesia is still on the banned list for U.S. amateurs so contacting this station is strictly forbidden. *(Tnx WCDXB).*

ZL, Callsigns: To make identification easier in the future, the stations on Auckland and Campbell Islands will sign ZL/A, on Chatham Island ZL/C, and on Kermadec Island ZL/K. *(Tnx VERON).*

4Jϕ, Siberia: 4JϕAH was a special call used from Siberia during the WAE contest. *(Tnx WCDXB).*

5V, Togo: Amateur radio stations are apparently banned at this time. DXers have been advised not to send cards to Togo or to QSL Managers in Germany who are unable to obtain logs. *(Tnx Watts).*

7Q7, Malawi: Andrew, 7Q7LX, was worked on 21263 kc at 1753 GMT, and on 21305 at 1950 GMT. QSL to PO Box 13 Mzuzu, Malawi. *(Tnx LIDXA).*

7Xϕ, Algeria: The departure of 7XϕAH made this country fairly rare, but 7ϕAP has been logged by several ops on 14034 and 14056 kc c.w. *(Tnx VERON).*

8R1, Guyana: Dave, 8R1S, went QRT in October and is enroute to 5H3-land. 8R1P, 8R1T, and 8R1X remain active. *(Tnx Long-Skip).*

9V1, Singapore: Dick, 9V1LK is QRV

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between 7005 and 7015 kc c.w. daily between 2300 and 2400 GMT. He will be glad to arrange skeds for 40/80 meters. Write R. L. Halls, 12-B Robin Road, Singapore 10. *(Tnx Watts).*

A top prefix chaser from north of the border, Peter Victor Travis, VE3PV, of Hamilton, Ontario. This OM holds WPX Phone award #89, WPX S.S.B. #138, WPX Mixed #71, and WPX C. W. #499.

QSL Information

AP2DI—Via W4UDF
CE9AT—To CE3ZN
CM2DC—Box 6996, Havana, Cuba
CM2KW—Box 6996, Havana, Cuba
CT2AA—c/o WAØOMN
CT2AR—Via WA4WIP
CT2AS—To K2AGZ
CT2BO—c/oW6NJU
DU1UP—Via WB6GFJ
EA6AR—To DL7FT
EAØAFG—c/o HBØAFG
EP2EE—Via American Embassy, Box 500, Teheran, Iran
FØXI—To G2DHV, 28 Longlands Road, Sidcup, Kent, Eng.
FB8WW—c/o W4MYE
FR7ZG—Via P.O. Box 592, Saint Denis, Reunion Island
HI8XJA—To VE3DLC
GB3UCL—c/o G3UCL
GC5AGA—Via W.G. Baird, 1018 Woodburn Rd., Spartanburg, S.C. 29301
HS1EL—W.E. Fells, P.O. Box 1930, Bangkok, Thailand. This country on U.S. banned list.)
IPIDK—To IT1ZGY
K1DWQ/LX—c/o K1DWQ
K5FKT/KP4—Ray Mote, P.O. Box 279, A.P.O. N.Y. 09845
KGARQ—Via WA8DBI
KL7GKA—P.O. Box 395, Amchitka, Alaska 99541
KP4DED—Doreen McDaniel, 10 Harrison Drive, APO, N.Y. 09845.
KV4AD—Box 2126, St. Thomas, Virgin Islands
KW6AA—To WB6YCT
VQ8CC—To Steven Gibbs, Box 14, Curepipe, Mauritius. (Not via VQ8AZ)
VQ8CJ—Jimmy Hassam, 22 Trotter St., Beau Bassin, Mauritius
VQ8CS—Jules Labat, Commercial Centre, Rose Hill, Mauritius
VR1L—c/o K6UJW
VR6TC—Tom Christian, P.O. Box 1, Adamsville, Pitcairn Island
W4UDF/AP—Via WA9KMD
W8IMZ/LX—To W8IMZ
WØVXO/KV4—Box 310, Christiansted, St. Croix, Virgin Islands
WA6AHF/HKØ—c/o WA6AHF
XEØGEN—Via W6GEN, 1325 Cambrin Road, Pomona, Ca. 91766
YA1DAN—To KP4CL is *not* QSL Manager for any other YA stations)
ZD5R—c/o VE4OX
ZD9BE—Via GB2SM
ZS3D—To K4RTA, P.O. Box 404, Hendersonville, Tenn. 37075
3A2CN—c/o DL7FT
3AØEK—Via DL2WB
3C8BB—Box 954, Yellowknife, N.W.T., Canada
4JØAH—To UA3AH
6Y5CB—c/o VE3DLC
6Y5GB—Via VE3DLC
6Y5RM—To VE3DLC
7P8AR—Via W4BRE
8P6AH—To VE3DLC
8P6AZ—c/o VE3DLC
8P6BM—Via VE3DLC
8P6BN—To VE3DLC
8P6BX—c/o VE3DLC
8P6CD—Via VE3DLC
8P6CD—Via VE3DLC
MP4TCE—c/o G3HSR
MP4TCF—Via G3WET
OM3BU—c/o Ing. Juraj Blanarovic, OK3BU, PRESOV, KSVD, Box 22, Czechoslovakia
OM3OM—Via OK3BU (above)
OM3PX—To OK3BU (above)
OM3ZAA—c/o OK3BU (above)
ON6AF—Via ON4TJ, 43 H. Conscience Straat, Merelbeke, Belgium
ON8IR—To G2DHV
OX5AY—c/o VE3DLC
PAØDHV—Via G2DHV
PX1CW—P.O. Box 86, Zaragosa, Spain
PY1CK/Ø—(Fernando de Noronha, 1958—PY1CK, C.P. 1044, Rio de Janeiro, GB, Brazil
PYØAPS—PY7APS, P.O. Box 2177, Recife, Pe., Brazil
PYØARM—To PY7ARM, P. O. Box 1998, Recife, Pe., Brazil
PYØNA (Trindade, 1958)—c/o PY1CK.
SK2AZ—Via SM2BHX.
SK3AK—To Box 72, S-83100, Ostersund, Sweden (Not via SM3CZS)
SVØWN—c/o K3EUR
TA3AR—Via WA7GQA
TL8GL—North American QSOs confirmed by VE2DCY
VK9RD—To WA7BTW.
VP1FW—c/o VE3DLC
VP2GBG—Via VE3DLC
VP2GBH—To VE3DLC
VP2GN—c/o VE3DLC
VP2KF—Via VE3DLC
VP2KL—To WB6GFJ
VP7NA—c/o K9GZK
VP8JT—Via VE1ASJ
VP8KE—c/o W4NJF, 1416 Rutland Drive, Virginia Beach, Va. 23454
8P6CE—To VE3DLC
8P6CL—c/o VE3DLC
8P6CP—Via VE3DLC
8R1X—To VE3DLC
8Z4AB—c/o W4MQR
9G1KT—W7KTL, 4324 W. Janice Ave., Spokane, Va. 99208
9K2BV—Via W5GM
9Q5EP—To VE3DLC
9X5AA—c/o W1YRC
9Y4AT—Via KV4AM

73, John, K4IIF

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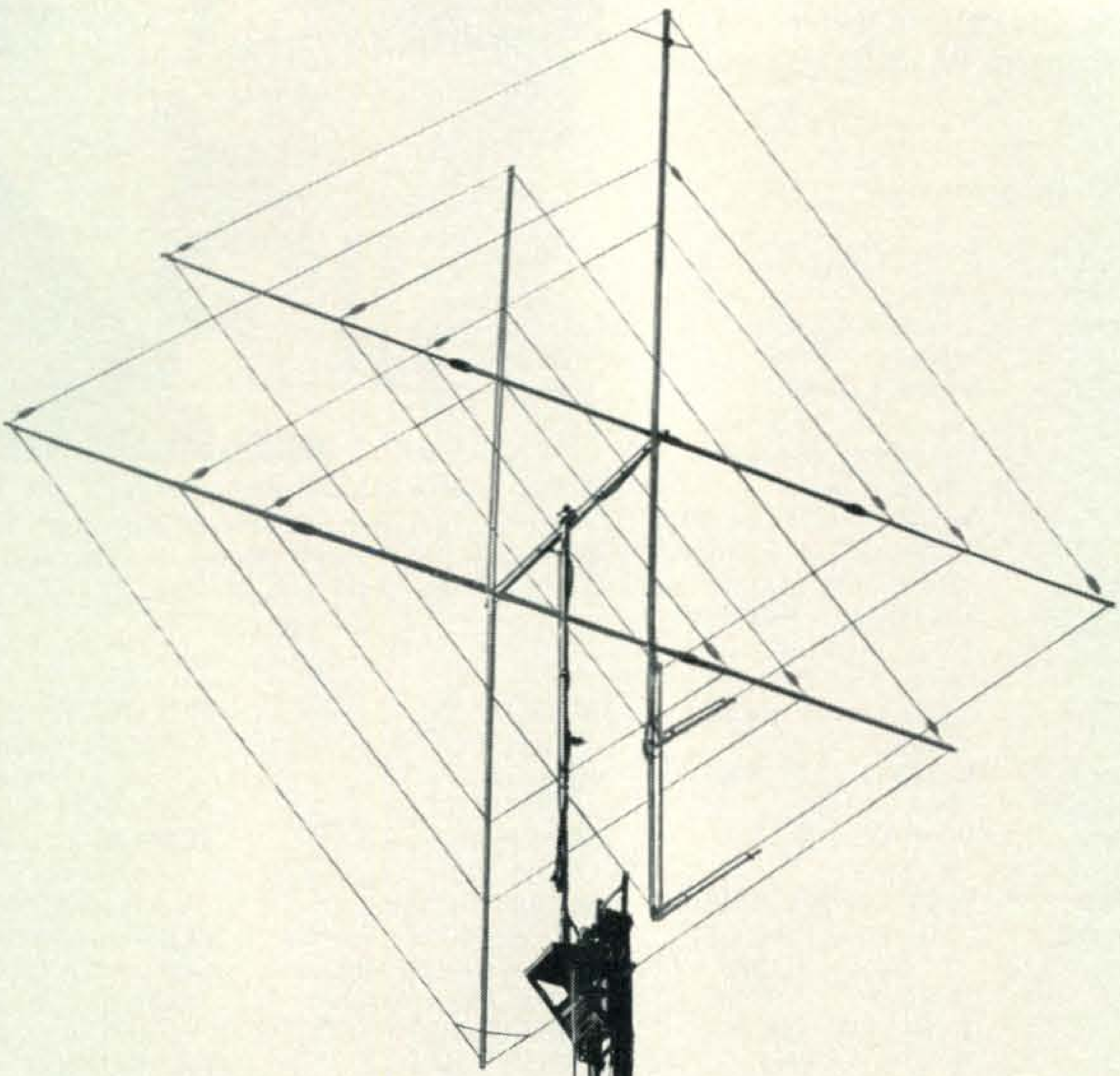

The Quad that made all others obsolete!

Hy-Gain's all new Hy-Quad will outdo all other quads because it's engineered to do just that. The Hy-Quad is new, it's superior, it's complete. It's the first quad to have everything.

- The Hy-Quad has all parts including those not supplied by others, like a boom, wire and all hardware.
- The Hy-Quad is constructed of aluminum. Spreaders are broken up at strategic electrical points with cycolac insulators.
- Tri-band 2 element construction with individually resonated elements with no inter-action.
- Hy-Quad requires only one feed line for all three bands.
- Individually tuned gamma matches on each band with Hy-Gain exclusive vertex feed.
- DC grounded elements to drain off precipitation static. Provides low-noise operation.
- Full wave element loops require no tuning stubs, traps, loading coils, or baluns.
- Heavy duty mechanical construction of strong swaged aluminum tubing and die formed spreader-to-boom clamps.
- Extra heavy duty universal boom-to-mast bracket that tilts and mounts on any mast 1¼" to 2½" in diameter. So get in Hy-Gear to get a Hy-Quad from the best distributors under the sun—he's the one that stocks Hy-Gain!

Specifications

Overall length of spreaders	305"
Turning radius	13'6"
Weight	42 lbs.
Boom diameter	2"
Boom length	8'
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Forward gain	8.5 db
Input impedance	52 ohms
VSWR	1.2:1 or better at resonance on all bands.
Power	Maximum legal
Front to back ratio	25-35 db depending upon electrical height

FOR THE STRONGEST SIGNAL UNDER THE SUN!

The Hy-Quad from Hy-Gain

HY-GAIN ELECTRONICS CORPORATION
Highway 6 at Stevens Creek,
Lincoln, Nebraska 65501

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Propagation

BY GEORGE JACOBS,* W3ASK

Although it now appears that the present sunspot cycle has begun to decline, a higher level of solar activity is expected this month than has been observed during any December since 1959. This, coupled with the fact that daytime F-2 layer maximum useable frequencies are at or near their highest values of the year in the northern hemisphere during December, should result in excellent daytime DX conditions on the 10, 15 and 20 meter bands. During December, DX conditions on 40, 80 and 160 meters also continue to improve because of the longer hours of darkness and lower static levels in the northern hemisphere. In short, optimum DX conditions to many areas of the world are expected on all h.f. amateur bands during December.

Good-to-excellent openings are forecast to most areas of the world on 10 meters from shortly after sunrise through the late afternoon hours. Excellent openings are also expected on 15 meters from shortly after sunrise through the late afternoon and early evening hours. During most of the daylight hours it will be a toss-up between 10 and 15 meters for DX propagation honors.

Good-to-excellent DX propagation conditions are also forecast for 20 meters. This band is expected to open at sunrise, and remain open to one area of the world or another through the daylight hours and into the early evening. To some areas of the world, the band may remain open during the hours of darkness as well. Optimum DX conditions are expected on 20 meters during the sunrise period and again during the afternoon and early evening hours.

DX propagation conditions on the lower frequency bands are generally optimum to many areas of the world during the winter months. Static levels should be lower, signal levels higher, and the bands open for DX longer than during any other season. DX openings on 40 meters are expected to begin during the late afternoon hours, and the band should remain open to one area of the world or another through the hours of darkness and until shortly after sunrise. Fairly good 80 meter DX openings are forecast to many areas of the world during the hours of darkness, and some 160 meter openings are expected to take place during the same period.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for Dec. 1, 1968 through Jan. 15, 1969 (color).

Days	Forecast Rating & Quality (4)	(3)	(2)	(1)
Above Normal: 2, 11, 15, 18, 31, 1, 6, 8, 14	A	A-B	B-C	C
Normal: 1, 3-4, 8-10, 12, 14, 16, 19-22, 27-30, 4-5, 7, 9-10, 12-13, 15	A-B	B-C	C-D	D-E
Below Normal: 5, 7, 13, 17, 23-24, 26 2-3, 11	C	C-D	D	E
Disturbed: 6, 25, None	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 foercast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 8 and 13 days; (1) less than 7 days.

3—With the forecast rating noted above, start with the numbers in parenthese 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 and considerable fading and noise; E—poor opening, or none at all.

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

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

6—The Eastern USA chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9, and 0 areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid from Dec. 1, 1968, through Jan. 15, 1969, and are prepared from basic propagation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

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160 Meter Propagation Tests

Since 1932, except for the war years, 160 meter DX propagation test have been held annually during the winter months. Until last year, these tests were conducted primarily across the Atlantic between Europe and North America. Last year, the tests were expanded to include the Pacific and other areas of the world.

Full details for the 1968-69 tests have been received from Stew Perry, W1BB. They are as follows:

The *trans-Atlantic* tests will be held this year on the following *Sunday* mornings between 0500 and 0730 GMT (12 Mid.-2:30 A.M., EST):

December 1, 15 and 29th
January 12th
February 2 and 16th

Frequencies will cover 1800-1820 kHz (E. coast W/VE), 1975-2000 kHz (W. coast W/VE), and 1823-1830 and 1851-1861 kHz for European stations. Call "CQ DX Test" on alternate five minute periods (W's call for 1st, 3rd, 5th, etc., five minutes of each hour, Europeans during the 2nd, 4th, etc., five minute periods). Keep to these periods exactly, except if in QSO.

The December 15th and February 2nd mornings are "First Timer's" tests, and those in Europe and the eastern hemisphere who have already had a successful trans-Atlantic QSO are asked to stand by to assist those who have yet to make such a contact. A similar "First Timer's" event will be held for stations in the western hemisphere on the mornings of January 5th and March 2nd.

This year's *trans-Pacific* tests will be held on the following *Saturdays* between 1330 and 1600 GMT (5:30 A.M.-8 A.M. PST):

November 30th
December 14 and 28th
January 11th
February 1 and 15th

In addition to the frequencies mentioned for the trans-Atlantic tests, JA's will use 1907.5-1912.5 kHz, ZL's around 1876 kHz, and VK's 1802 kHz. The calling periods will be divided up as in the transAtlantic event, with W/VE's and other western hemisphere stations calling first.

During this year's test periods 160 meter stations in several dozen countries on all continents are expected to be in operation. Special efforts will be made to establish new DX records for this band during the test periods.

The tests are very exciting since many of the stations use very low power, sometimes on the order of only a few watts. DX propagation takes place on the 160 meter band when the transmission path is entirely in darkness, or when part of the path is in darkness and the other part in either twilight or dawn.

W1BB emphasizes that these tests are *not* contests. There is no competition, no prizes, and no scores are kept. The main purposes of the tests are to encourage the use of the 160 meter band to fortify its retention by the amateur radio service, and to develop propagation information throughout a sunspot cycle. There is an excellent possibility that 160 meter DX propagation conditions may be exceptionally "hot" this winter.

Reports of contacts made during the test periods as well as any other observations made on 160 meter reception or propagation conditions should be sent directly to W1BB at 36 Pleasant Street, Winthrop, Mass.

V.H.F. Ionospheric Openings

A major meteor shower, the *Geminids*, is expected to take place during the second week of the month, peaking on the evening of December 13. A second, but less intense shower (the *Ursids*) is expected to occur between December 21 and 23. Some short-skip v.h.f. openings, up to distances of approximately 1000 miles, should be possible for very brief periods of time as a result of the ionization produced by the meteors as they enter the earth's atmosphere during the shower periods.

There is a possibility that some trans-continental F-layer openings may take place on 6 meters during December, as daytime muf's climb towards seasonal peak values. Openings may also be possible between the continental USA and Hawaii and between the USA and Latin America and perhaps other areas of the world as well. The most likely times for 6 meter F layer openings are just before noon, through the early afternoon hours, and when conditions appear to be peaking on 10 meters for a particular transmission path.

TE, or trans-equatorial scatter openings are expected to fall off a bit in the northern hemisphere during December, but some should be possible between the USA and Latin America. The evening hours are the best time to check for TE openings on 6 meters, between approximately 8 and 11 p.m. at the path mid-point.

There is a tendency for sporadic-E propagation to reach a secondary seasonal peak during December and early January (the major peak occurs during the summer months). This should result in a number of short-skip openings, between distances of approximately 800 and 1400 miles, on 10 and 6 meters. Although the early evening hours are generally favored for such openings, they may occur at any time.

Some auroral-type v.h.f. ionospheric openings are also likely to occur during December, especially when ionospheric conditions on the h.f. bands are below normal or disturbed. Check the "Last Minute Forecast" at the beginning of this column for the days that are most likely to be in these categories during the month.

Sunspot Cycle

The Zurich Solar Observatory reports a monthly mean sunspot number of 121 for September, 1968. This results in a 12-month running smooth sunspot number (upon which the sunspot cycle is based) of 105 for March, 1968. As of that date, the present sunspot cycle was still increasing.

A smoothed sunspot number of 100 has been recorded for December, 1967. A smoothed sunspot number of approximately 108 is forecast for this December. Solar conditions during this month, therefore, are likely to be higher than observed during any December since 1959.

This month's column contains DX Propagation Charts for the period December 15, 1968 through February 15, 1969. Short-skip Charts for December appeared in last month's column.

The Editor of this column would like to take this opportunity to extend his warmest wishes to everyone, everywhere, for a Merry Christmas and a very Happy New Year.

73, George, W3ASK ■

DEC. 15, 1968-FEB. 15, 1969

Time Zone: EST (24-Hour Time)

Eastern USA To:

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

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

See Page 122 for New Reader Service

Northern & Central South America	07-08 (1) 08-09 (3) 09-12 (4) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-08 (3) 08-10 (4) 10-13 (3) 13-17 (4) 17-19 (3) 19-20 (2) 20-21 (1)	07-09 (4) 09-11 (3) 11-16 (2) 16-17 (3) 17-21 (4) 21-00 (3) 00-03 (2) 03-05 (1) 05-07 (2)	17-18 (1) 18-19 (2) 19-21 (3) 21-04 (4) 04-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-02 (3)* 02-04 (2)* 04-06 (1)*
Brazil, Argentina, Chile & Uruguay	07-08 (1) 08-11 (2) 11-14 (3) 14-16 (4) 16-17 (2) 17-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	13-14 (1) 14-15 (2) 15-17 (3) 17-21 (4) 21-02 (3) 02-04 (2) 04-06 (1) 06-08 (2) 08-09 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-03 (1)*
McMurdo Sound, Ant-arctica	NIL	06-09 (1) 16-18 (1) 18-20 (2) 20-21 (1)	18-19 (1) 19-20 (2) 20-00 (3) 00-02 (2) 02-04 (3) 04-06 (1) 06-08 (2) 08-09 (1)	00-05 (1)

Time Zones: CST & MST (24-Hour Time)

Central USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-12 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (4) 12-13 (3) 13-14 (2) 14-15 (1)	02-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-13 (3) 13-16 (2) 16-19 (1) 19-22 (2) 22-00 (1) 00-02 (2)	15-17 (1) 17-18 (2) 18-01 (3) 01-02 (2) 02-03 (1) 17-20 (1)* 20-01 (2)* 01-02 (1)*
Northern & Central Europe & European USSR	08-09 (1) 09-10 (2) 10-11 (1)	06-07 (1) 07-10 (2) 10-12 (1)	22-00 (1) 00-02 (2) 02-06 (1) 06-08 (2) 08-11 (3) 11-12 (2) 12-14 (1)	17-19 (1) 19-22 (2) 22-01 (1) 19-00 (1)*
Eastern Mediter-ranean & Middle East	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-11 (2) 11-12 (1)	04-06 (2) 06-10 (1) 10-12 (2) 12-14 (3) 14-18 (2) 18-22 (1) 22-02 (2) 02-04 (1)	18-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
West & Central Africa	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-09 (1) 09-11 (2) 11-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-01 (1)	18-21 (1) 21-23 (2) 23-01 (1)
East Africa	08-09 (1) 09-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	08-10 (1) 10-13 (2) 13-15 (3) 15-17 (2) 17-18 (1)	11-14 (1) 14-16 (2) 16-19 (3) 19-22 (2) 22-00 (1)	19-00 (1)
South Africa	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-14 (1)	07-10 (1) 10-11 (2) 11-12 (3) 12-14 (4) 14-15 (3) 15-17 (2) 17-18 (1)	07-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-20 (3) 20-21 (2) 21-00 (1)	18-19 (1) 19-21 (2) 21-22 (1)
Central & South Asia	08-10 (1) 18-20 (1)	07-09 (1) 18-19 (1) 19-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-22 (2) 22-00 (1)	06-08 (1) 19-21 (1)
South-east Asia	09-10 (1) 10-12 (2) 12-13 (1) 16-17 (1) 17-19 (2) 19-20 (1)	09-10 (1) 10-12 (2) 12-14 (1) 16-18 (1) 18-20 (2) 20-21 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-18 (1) 18-20 (2) 20-21 (1)	04-07 (1)
Far East	16-17 (1) 17-19 (2) 19-20 (1)	15-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	15-17 (1) 17-18 (2) 18-20 (3) 20-23 (2) 23-01 (1) 01-03 (2) 03-07 (1) 07-09 (2) 09-11 (1)	02-08 (1) 04-07 (1)*
South Pacific & New Zealand	10-14 (1) 14-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	06-07 (2) 07-09 (3) 09-12 (2) 12-18 (1) 18-20 (2) 20-00 (3) 00-03 (4) 03-04 (3) 04-05 (2) 05-06 (1)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 03-07 (1)*
Austral-asia	08-09 (1) 09-11 (2) 11-12 (1) 15-17 (1) 17-19 (2) 19-20 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-14 (2) 14-15 (3) 15-17 (4) 17-19 (3) 19-20 (2) 20-21 (1)	05-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-15 (1) 15-17 (2) 17-20 (1) 20-22 (2) 22-03 (1) 03-05 (2)	02-04 (1) 04-07 (2) 07-09 (1) 03-06 (1)*
Northern & Central South America	07-08 (1) 08-09 (3) 09-11 (4) 11-13 (3) 13-15 (4) 15-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	06-07 (2) 07-11 (3) 11-15 (2) 15-17 (3) 17-20 (4) 20-22 (3) 22-00 (2) 00-02 (3) 02-04 (2) 04-06 (1)	17-18 (1) 18-19 (2) 19-00 (3) 00-04 (4) 04-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-01 (3)* 01-02 (2)* 02-04 (1)*
Brazil, Argentina, Chile & Uruguay	07-08 (1) 08-11 (2) 11-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	04-06 (1) 06-08 (2) 08-14 (1) 14-15 (2) 15-17 (3) 17-20 (4) 20-02 (3) 02-04 (2)	19-21 (1) 21-02 (2) 02-05 (1) 21-04 (1)*
McMurdo Sound, Ant-arctica	Nil	07-09 (1) 16-18 (1) 18-20 (2) 20-21 (1)	17-19 (1) 19-22 (2) 22-00 (3) 00-02 (2) 02-04 (3) 04-05 (2) 05-06 (1)	22-05 (1)

Time Zone: PST (24-Hour Time)

Western USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	07-08 (1) 08-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-12 (1)	22-00 (1) 00-03 (2) 03-06 (1) 06-09 (2) 09-11 (3) 11-14 (2) 14-16 (1)	18-21 (1) 21-00 (2) 00-01 (1) 19-23 (1)*
Central & Northern Europe & European USSR	07-09 (1)	06-07 (1) 07-09 (2) 09-10 (1)	16-18 (1) 22-00 (1) 00-02 (2) 02-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-13 (1)	17-22 (1) 22-00 (2) 00-01 (1) 19-23 (1)*

[*Continued on page 110*]

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Q AND A

BY WILFRED M. SCHERER,* W2AEF

THIS month rounds out the first year for the present Q & A Column conducted by yours truly, so we take this opportunity to thank all who have made the success of the column possible.

Appreciation is therefore expressed to those who have sent in questions or submitted suggestions and other aid for their fellow amateurs; to those who have patiently waited over long periods for replies to their inquiries, many of which regretfully are still of long standing (luckily we've received only two complaints in this regard!); to those manufacturers who have supplied equipment manuals, service notes or other related data; to our personal acquaintances, both on and off the air, for helpful information on the operation, difficulties and solutions with manufactured equipment not familiar to us; to our editor and the *CQ* staff for their assistance and work in setting up the column for publication each month.

Finally, our special gratitude to those who have taken time out to drop a friendly line as to how they made out with our suggested solutions (good or bad) or expressing their thanks for our aid. Such responses are most encouraging and make the almost endless hours, spent in research and working out solutions to problems of others, so rewarding and well worth the effort.

In this connection, the following quotes are samples taken from our "vanity" folder:

"I have enjoyed your column and have picked up some valuable information from reading your advice to others."

"When I saw your Questions and Answers section in the new *CQ*, I was sure glad that *CQ* had not let such a great idea as a technical service disappear from such a great magazine."

*Technical Director, *CQ*

"Your column is the first thing I read in *CQ* every month."

"I have taken your advice in your Q & A Column in the July issue about reading every issue from cover to cover. I have learned a great deal about radio-electronics in the last few weeks—things I had no excuse not knowing in detail before."

"Many thanks for your detailed letter on the 20-meter conversion of the Heathkit HW-16."

"Thanks very much for supplying me with the information I needed. You really dug back into the files for this one."

"Thank you for your letter regarding alignment of my SX-117 receiver. Your suggestion works very well and took only about 10 minutes to complete. I am trying my i.f. frequency at 51 kc and so far everything works fine. Thank you so-o-o much for the help. I was afraid I was going to have to buy some expensive test equipment."

"Your assistance column is followed rather closely and I admire the effort you put into it—and the results."

"With reference to your letter answering my query on changing the frequency response of my pre-amplifier, I thank you very much for the trouble to which you have gone in an endeavor to help me.

"This department of *CQ* is a very worthwhile undertaking and worth the price of the subscription alone to uninformed persons such as myself.

"I will certainly let you know what success I have in making the modifications you have suggested."

"I wish to thank you for your reply to my request for assistance in locating a literary item."

"Thank you for the reply concerning instability difficulties with my transmitter. As per your suggestion, the trouble was cured by replacement of the p.a. tube."

"Sorry to be tardy and thanking you for your nice note about checking transistors. Then too, I see that you have used the same idea in the current issue of *CQ* and I am sure (as I said) that others have wondered about this also."

"Thanks for the Harvey-Wells Manual."

NOTE: Thanks for the manual are really due to those who forwarded the above manuals to us, as per our acknowledgment in the October Column.

With this we again say thanks and now let us get on with the job at hand.

HW-100 V.F.O.-Tuning Control Operation

For those who may experience sticky operation of the v.f.o.-tuning knob on early models of the Heathkit HW-100 Transceiver, a new lubricant for curing the situation may be obtained from the Heath Company. To determine if you have already been supplied with the new lubricant, it is a clear substance of a heavy oily nature in contrast to the old lubricant which is a whitish jelly-like material.

Antenna-Stacking Distances

QUESTION: I am interested in stacking a 2-meter, 6-meter and a 10-15-20 meter (Tribander) beams together on the same mast. I have heard many views on the subject, but would like to know if you have any ideas on this. I wish to use the closet spacing possible, without interaction between the antennas.

ANSWER: We have had no personal experience in this regard, but according to the Chief Engineer of a leading antenna manufacturer, whom we contacted, install the 6-meter beam six to eight feet above the 10-15-20 meter Tribander and the 2-meter antenna four feet above the 6-meter one.

On the other hand, if the 6-meter job is quite a large affair where better structural balance is needed, reverse the lineup with the 6-meter beam four feet above the Tribander and the 2-meter one four feet above the 6-meter antenna.

These spacing are based on beams with horizontal elements.

Breakdown Voltage of Variable Capacitor

QUESTION: What is the breakdown voltage of the common 365 mmf variable capacitors, such as the ganged ones used for tuning broadcast receivers or t.r.f. circuits.

ANSWER: The garden variety of the capacitors in question have a plate spacing of about .012″. Based on a breakdown potential of 23 volts per .001″ plate spacing with air dielectric, that for the above type capacitors would be expected to amount to near 300 v.d.c.; but in practice, we've found such units to handle up to 500 v.d.c. without breakdown, as long as the air is reasonably dry and the plates are free of dust. The a.c.-voltage breakdown would be somewhat lower, also being dependent on frequency.

Rewiring Solid-State Pre-Amp for Positive Ground

QUESTION: I'm interested in the "Wideband Pre-Amp" that was described on page 70 in August '68 *CQ*. It has a negative ground. Could you suggest any component changes that would permit operation with a Heathkit GC-1A Mohican receiver which has a positive ground?

ANSWER: No component changes will be needed for changing this pre-amp over to a positive-ground system. Simply rewire the pre-amp with the ground connections and bypassing changed as indicated at fig. 1.

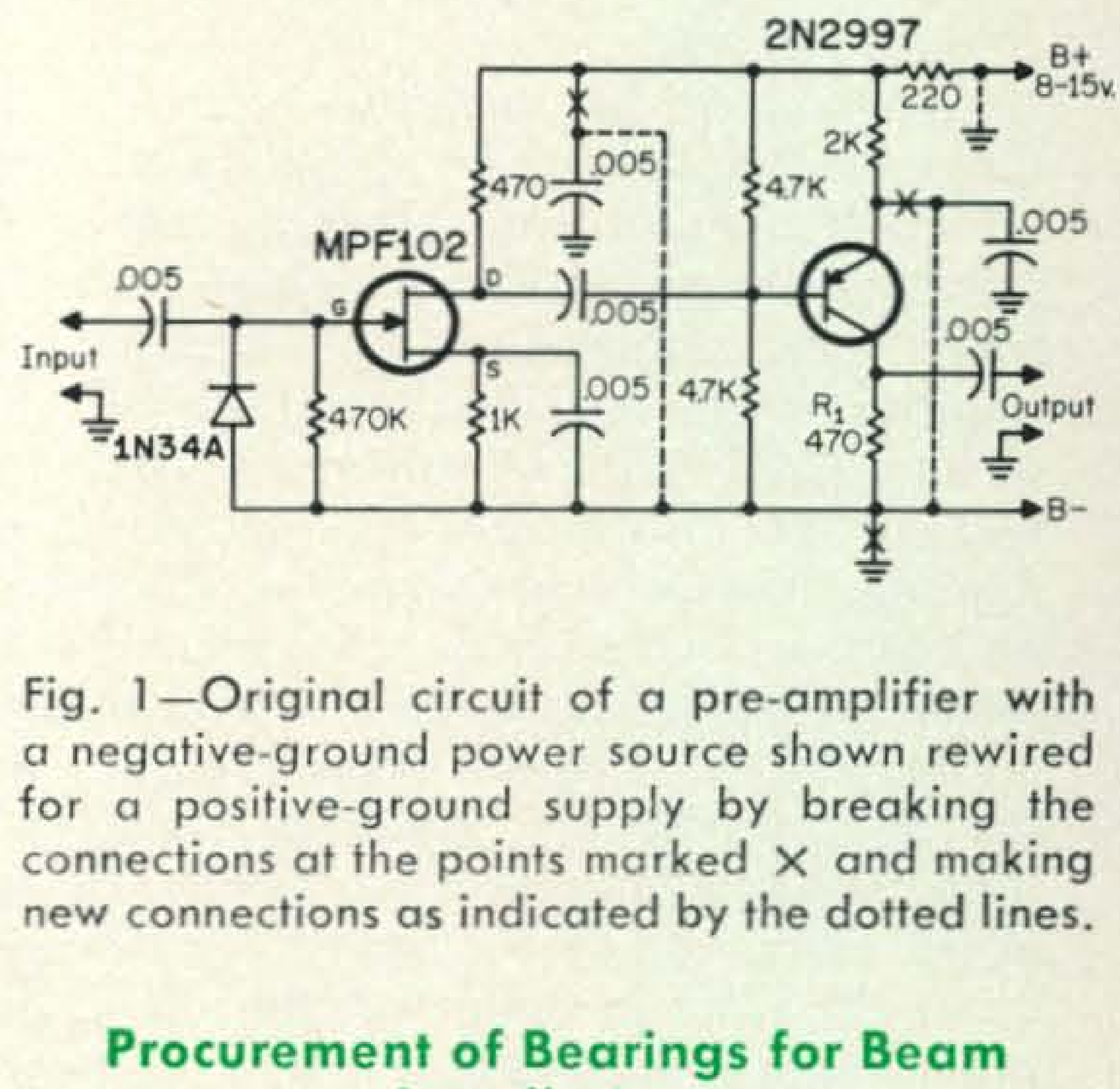


Fig. 1—Original circuit of a pre-amplifier with a negative-ground power source shown rewired for a positive-ground supply by breaking the connections at the points marked X and making new connections as indicated by the dotted lines.

Procurement of Bearings for Beam Installations

QUESTION: I have almost completed a steel tower project to hold my 4-element Hornet beam, but I cannot locate a thrust bearing. Can you give me any information on a sales outlet? Letters to amateur-radio supply sources have resulted in nothing being available.

ANSWER: Bearings for beam installation might be found at an auto-parts supply house or an auto-junk yard. We have been fortunate enough to find both thrust and end bearings, of a suitable size for beam installations, at a "junkie" for a cost much lower than that at a supply house.

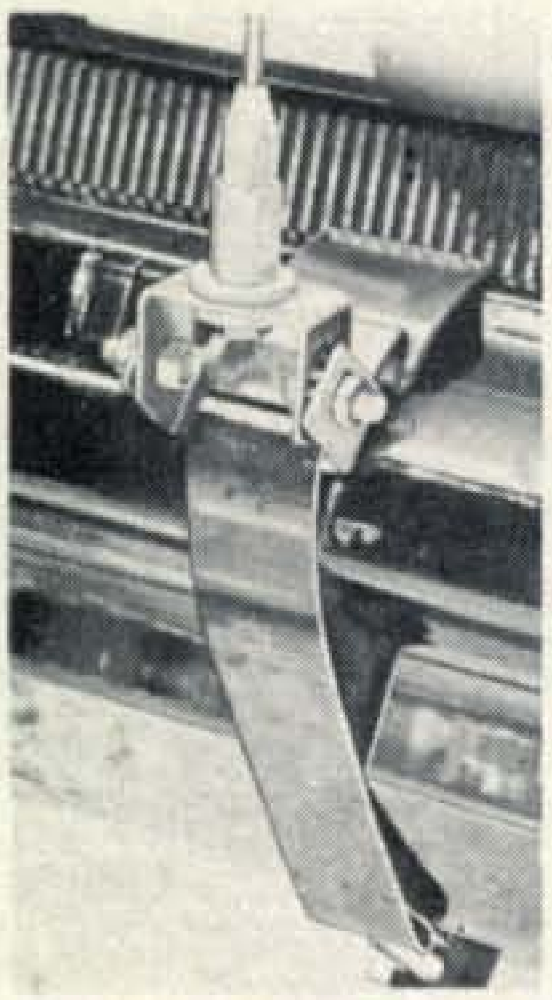
Our Christmas Wish

In concluding this month's column we'd like to wish God's Blessing on all of you this Christmas Season along with peace, joy and good health in the New Year.

73, Bill, W2AEF

See page 122 for New Reader Service

As long as you're buying the best antenna under the sun, you might as well go whole hog and get the best accessories, too.



Heavy-Duty Stainless Steel Bumper Mount. Suited for full sized whip or halo installations. Accepts ⅜" x 24 thread fittings. Will not mar bumper. Doubly long strap.

Exclusive Flush Body Mount. Chrome-plated with cycolac base, rubber body washer, heavy-gauge back-up plate. Rugged support. Accepts ⅜" x 24 thread fittings.

Deluxe Jiffy Body Mount.

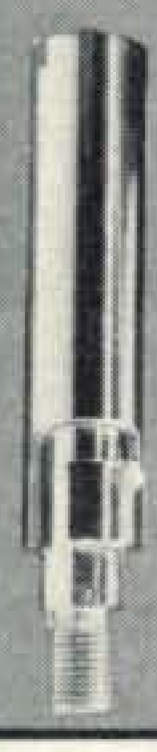
Completely adjustable. Fits on trunk lip. No drilling. Stainless steel. Accepts ⅜" x 24 thread fittings.

Deluxe Mobile Spring. Heavy-duty chrome-plated double-tapered steel spring. Spring ends ground for perfect alignment. Accepts ⅜" x 24 thread fittings.

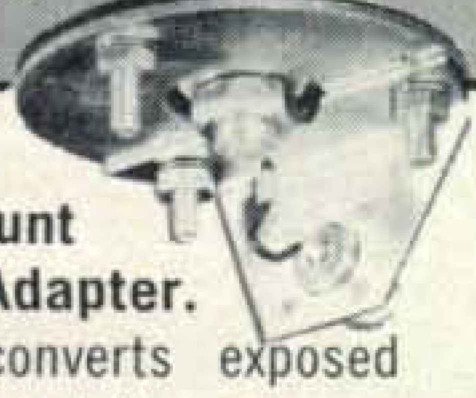
Extra Heavy-Duty Spring. Designed for support of heavy mobile antennas. Same features as Deluxe Spring.

Miniature Spring. Stainless steel. Double tapered design. Handles whips up to 52" long. Accepts ⅜" x 24 thread fittings.

Whip Gutter Clip. Chrome plated. Secures mobile whip for low garaging. Mounts with single screw (no holes) on gutter of vehicles.



Quick Disconnect. Flip-of-the-wrist removal and attachment of mobile whips. ⅜" x 24 thread fittings on both ends for permanent attachments. High-tension spring loading. Heavy chrome plating.

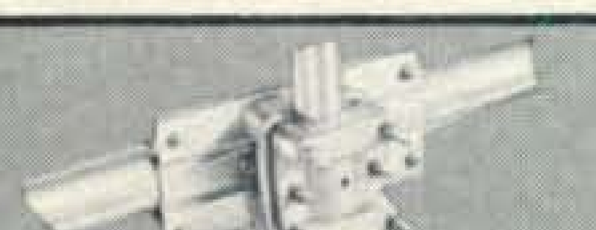


Body Mount Coaxial Adapter. Readily converts exposed ends of mobile antenna body mounts to standard SO-239 coaxial fitting.

Lightning Arrestor. Originally designed to protect military aircraft. Grounds 10 or more lightning strokes. Install on any 52 or 72 ohm coaxial feedline. Reduces static. Won't blow. Lasts lifetime, guaranteed.

Fold-Over Adapter for Mobile Whips. Spring-loaded hinged adapter folds over for easy garaging or when contact made with immovable object. Easily snaps in upright position.

"On-the-Air" Indicator. Internally illuminated red on black, for professional looking shack. Case is gray high impact styron. Mounts atop gear or on wall brackets. Bulb, 6' of cord, included.



Aluminum Tilting Boom-to-Mast Clamp. Fits any mast 1¼" to 2½". Easy one-man installation, maintenance, tuning. Rugged construction. Mast feed-thru for beam stacking.

Broad Band Ferrite Balun. For beam, doublet installation. Couples 52 ohm unbalanced system with 52 ohm balanced system. Use with any beam 3 to 30 MHz.

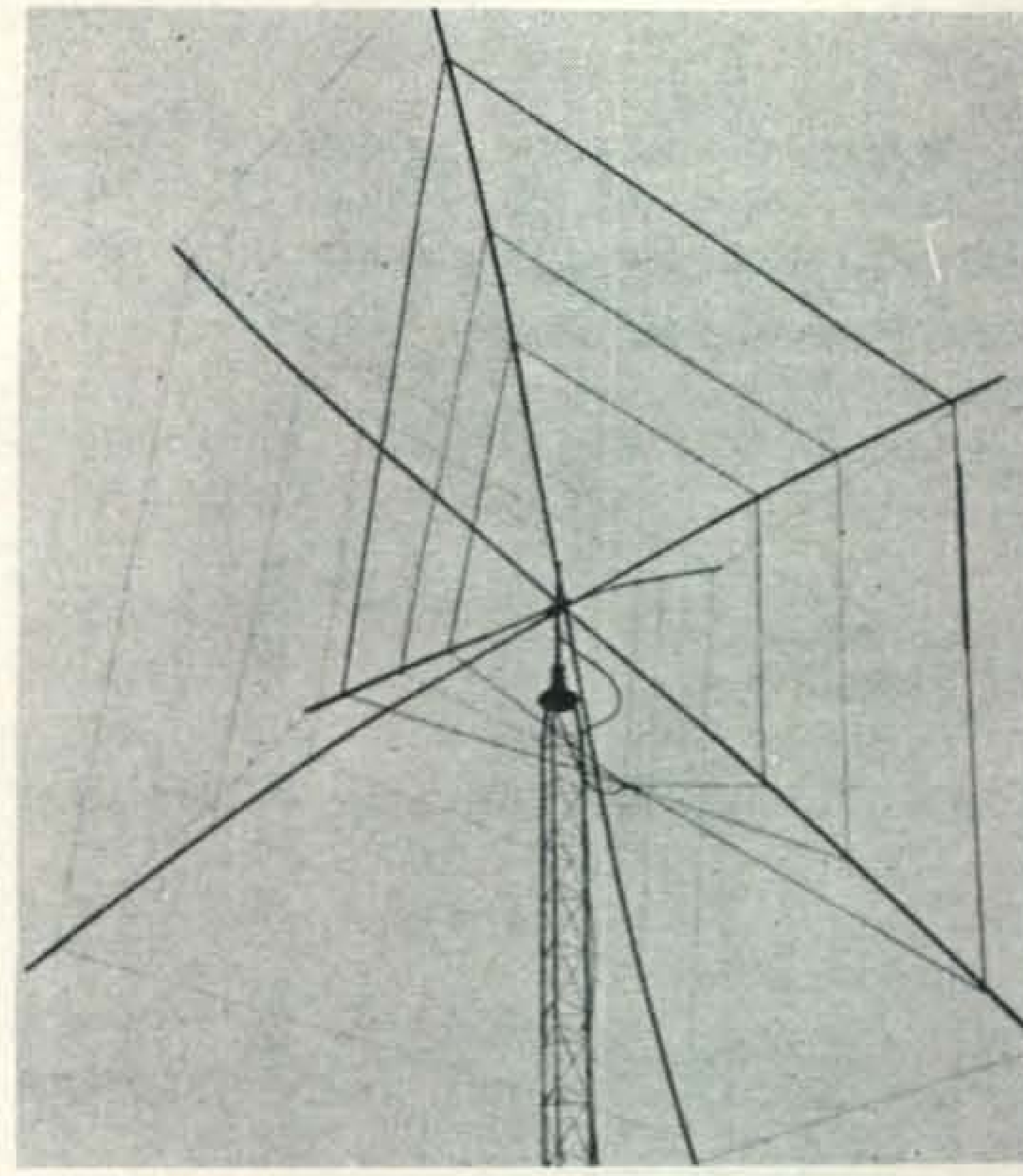
Accessories from Hy-Gain
THE BEST ACCESSORIES UNDER THE SUN
HY-GAIN ELECTRONICS CORPORATION

See page 122 for New Reader Service

1969—THE YEAR OF THE QUAD

There is a certain charisma regarding the quad at this time. Certain it is that the quad satisfies people out of proportion to its characteristics. Perhaps there is something intangible about its geometry or shape, or perhaps it is the substantially lower angle of radiation which accounts for its superior performance. Certain we are that in contact after contact, particularly QSO's with far distant points, that a quad's superiority does show up. This is difficult to explain in contrast to a conventional beam. Recent articles in QST and other periodicals have tended to prove that for a given number of elements, a quad will outperform the beam, despite the difference in gain credited to the beam. Because we carry all kinds of antennas and stock heavily for the amateur, it was felt appropriate that we give some sort of a pro and con picture regarding quads versus beams, and how these facts may apply to you.

First, let it be said that generally speaking, a three band, two element quad is slightly superior to a three band, three element beam; that the average cost of the beam runs $120.00; that the average cost of the quad runs slightly less than this. Second, let it be said that the VSWR hump factor is more pronounced with a beam than it is with a quad. The gain of the quad is slightly less, being a maximum of approximately 5.8, according to information conveyed to Mr. Bill Orr in his popular quad book, page 19. The good front to back ratio of a beam and a quad run approximately 25 db. You can, however, mount a quad at a somewhat lower height with respect to ground than is required for a similar performance on a beam. In other words, the quad can operate at as low as 15 feet above ground, and still do a good job, whereas a beam should be at least a half wave above ground, or approximately 30 feet, in the case of a 20 meter beam. A good quality quad, properly installed, should last 2 to 4 years, whereas a similarly installed, good quality beam should last somewhat longer, say from 3 to 7 years. The chief advantage of our quad, and quads in general, is that they provide the user with the means of radiating a good signal with an approximately flat response across the entire 10, 15, and 20 meter bands, as compared to a rather narrow VSWR characteristic of a beam. The quad does not require a matching balun of any kind. It is its own matching device. A beam, on the other hand, should have a balun in order that the driven dipole be balanced properly to the unbalanced feed line. A quad has more than twice the capture area of a conventional beam. The beam, however, looks more presentable in the family back yard than does the quad. The quad is more difficult to assemble and more difficult to install. But there are tricks about this, too, that can be used to make the job easier. In the case of our Reginair Quad, of which we are the exclusive distributor, the response across the entire frequency range is less than 1.5 to 1—this, by virtue of the constant electrical impedance which is maintained on each of the three operating frequencies. Our quad now is made of all aluminum, but the aluminum is assembled in such a way that there is no resonant length to tangle with the operating frequencies of the antenna. The model



321A Reginair Quad has been designed so that it c be mailed to post offices throughout this country, and A designated offices throughout the world. The weight of o quad is but 39 pounds. The price is $90.00, FOB Harva Mass. The cost for postage to each of the respective zon starting with the 2nd zone, is $3.30, $4.50, $5.50, $5.9 $6.50, $7.50, and $8.20. You should add 40¢ in ea instance for appropriate insurance.

Although we stock all brands of antennas, we do featu our own brand, and for a very good reason. I hope t foregoing description will entice you to make inquiry co cerning our quad. For, more and more quad manufacture are coming out with good products, and apparently 19 will show a marked improvement in overall DX, as a res of the use of our quad. Convince yourself, check the b on the air, send for our literature, and then order one our Reginair 321A quads.

Forward gain over dipole	**5.9 d**
Forward gain over isotropic dipole	**8.0 d**
Front to back ratio	**25 d**
VSWR over 28-29.7 MHz; not more than	**1.5:**
VSWR over 21-21.45 MHz; not more than	**1.5:**
VSWR over 14-14.35 MHz; not more than	**1.5:**
Maximum RF input	**2 k**
Maximum mast dimension	**1¾" di**
Wind resistance	**4.5 sq. f**
Feed line	**52 ohm**
Outside dimensions	**18' x 18' x 1**
Turning radius	**9½**
Net weight	**35 pound**
Shipping weight	**39 pound**
Designed for 100 mph winds; 1/2 inch radial ice	
Frontal lobe	**75**
Price (FOB Harvard)	**$89.9**

HERBERT W. GORDON COMPANY

Woodchuck Hill Road, Havard, Massachusetts 01451

telephone: 617-456-3548

"Helping Hams to Help Themselves"

 See page 122 for New Reader Service

USED HAM GEAR

Here, at long last, is our used equipment listing. We apologize for many delays in getting this listing out. Actually, what had to be done was to prepare a system by which periodic bulletins could be released by our vast inventory.

Because we are the largest exclusive ham distributor in the world, our inventory is likewise very, very broad, and encompasses most every model, from every period in ham radio. Very old sets, or antiques, are not sold, but are kept as flavoring to be seen by our in-the-store customers.

Every set sold by this company is guaranteed for a minimum of 6 months, excluding tubes, fuses and diodes or semi-conductors. (A 10% discount from the stated prices is allowed when each piece is sold on an as-is, where-is basis. Assuming that you were in the mid-west, coming east for a vacation, and you wanted to pick up a piece and take care of its service yourself, the discount would be 10% from the prices quoted.) Competent service men work here day and evening, using the latest in test equipment, to insure that the product leaving here meets the original manufacturer's specifications. To the best of our ability, we supply every set with the appropriate instruction manual. Our sets are checked out before they are shipped. Transmitters are checked for power output, distortion, and keying characteristics on each of their operating frequencies.

The prices quoted are FOB Harvard, Massachusetts, and shipping charges must be added, unless specifically altered by correspondence. We prefer to ship by United Parcel Service to the areas covered by this organization, which for us in New England includes Florida through Maine points, and extending as far west as the Ohio border. In other instances, we prefer to ship by Railway Express. We will, of course, follow your designated shipping instructions whenever furnished.

We do not bait our customers by specifically lowering the price of a particular item below its market value, in order to attract customers. Nor do we sell merchandise which we feel is below the standard of quality which should come from this company. In short, the piece of equipment which has been abused and which is good only as a source of parts, is not sold by this company.

If we run out of stock on the item in which you are interested, we will advise you by correspondence, advising as to what the delay will be before we can furnish the next such item. We do not make a practice of keeping your money against an intangible future when we might again have that piece. The Herbert W. Gordon Company maintains a new stock of all reputable manufacturers dealing in ham equipment, including Hammarlund, Hallicrafters, National, Swan, Drake, Collins, Ameco, Gonset, etc. We maintain and stock large quantities of accessory equipment, such as coaxial cable, beams, vertical antennas, dipoles, baluns, coaxial connectors.

We maintain and stock large inventories of popular ham components, such as resistors, condensers, diodes, transistors, tubes, transformers, filter chokes, etc.

We maintain stock of all the latest magazines dealing with our subject, including *CQ*, *Ham Radio*, *73*, and *QST*. Therefore, we can be used to check a source of reference when you are concerned about the operation or construction from a particular article which appeared in these magazines. To those of you who are interested in looking for certain magazines to fill in your own libraries, we have hundreds of copies of *CQ*, *QST*, *73*, etc., in our stock, and would be glad to sell them to you at very attractive prices, so as to make your library that much more complete.

Also, the Herbert W. Gordon Company offers credit to those deserving of it. Please ask for our credit application blank, and when you receive this, fill it out as carefully as possible. Usually we prefer to finance through the General Electric Credit Company, which has offices throughout the United States.

We are, to our knowledge, the only ham distributor having an immense antenna array, including 44 antennas on towers up 100 feet in height. These antennas are all fed through a master coaxial system using heliax, into our building, where they can be used to demonstrate any and all of our equipment. We invite you to shop by comparison, not only with respect to price, but particularly with respect to quality. In short, we want to be known as the ham's own ham supply house—run by hams for hams, for the benefit of hams. We exist solely for your particular purpose. We are not in any other field of endeavor and our store hours are keyed to take care of your personal requirements. We are open at 8:30 a.m. until 4:30 p.m., and then again from 7:00 p.m. until 10:00 p.m., each working day. Saturday we are open from 8:30 a.m. until 4:30 p.m. We can even be reached for special appointments on Sunday and holidays, if the need is urgent.

The Herbert W. Gordon Company maintains a large stock of test equipment, and will shortly bring out a circular, such as this, on test equipment alone. If you are interested in test equipment and would like to receive a bulletin on test equipment, please write to us separately, asking for the same.

We especially welcome foreign business. You will find us prompt and accurate in the handling of all your inquiries.

HERBERT W. GORDON COMPANY

Woodchuck Hill Road, Harvard, Mass. 01451

"Helping Hams to Help Themselves"

See Page 122 for New Reader Service

ALCO
RF Field Indicator $ 9.00

ALDEN
Systems Work Ctr Bench 40.00

AMECO
CN50 converter 25.00
PS power supply 9.00
PV preamp 6 meters 8.00
TX62 transmitter 110.00
TX86 transmitter, with power supply 50.00

ASTATIC
D104 mike, no stand 12.00
D104 mike, with stand 15.00
D104 mike, with G stand 22.00
JT30 mike 5.00
PTT mike 5.00

ARGONNE
Dual impedance mike 10.00
AR54 mike 6.00

AUTOMATE
K5/50 keyer 60.00

AUTOMATIC INSTRUMENTS CO.
VTVM 20.00

BABCOCK
DXmitter 30.00

B&W
600 dip meter 65.00
5100 transmitter 175.00
5100B with 51SB-B 225.00
6100 425.00

BRETTING
Model 12 receiver 195.00

CARDWELL
6 meter exciter 7.00

CENCO
PTT hand-held mike 5.00

CENTRAL ELECTRONICS
10A Exciter 55.00
10B Exciter 60.00
100V Exciter w/160 meter band 500.00
200V transmitter 450.00
458 VFO 25.00
600L linear 250.00
Model A sideband slicer 70.00
Gated compression amplifier 80.00
RF analyzer, no tube 50.00

CLEGG
22er transceiver 180.00
99er, late model 120.00
416A power supply 79.00
418 DC power supply and modulator 100.00
Apollo 6 linear 240.00
Interceptor B receiver 350.00
Interceptor all-bander 75.00
Interceptor receiver 300.00
Thor transceiver 250.00
Thor AC power supply/mod. 100.00
Venus transceiver/pwr sply. 400.00
Zeus with power supply 500.00

CLIMASTER
Zeus with power supply 375.00
Zeus 331 transmitter 350.00

CESCO
Transicheck 35.00

COLLINS
30S1 linear 1295.00
32S1 with 516F2 pwr supply 600.00
32S1 with 516F2, late 625.00
32V2 transmitter 175.00-200.00
32V3 transmitter 225.00
51J2 receiver 400.00-600.00
51J3 receiver, repairable 400.00
51J3 receiver 775.00
51J4 receiver 995.00
75A1 175.00-185.00
75A3 325.00
75S1 receiver 350.00
75S3 receiver 550.00

COLLINS
KWM2 transceiver 900.00
KWM2 transceiver/Waters 850.00
KWS1 transmitter 995.00
R389 receiver 1475.00
R390 receiver 1075.00
R390A receiver with product detector 1533.00
R391 receiver 1995.00
30L1 linear amp 420.00
402C3 directional watt 100.00
312B4 station console 150.00
32S2 transmitter 540.00
516E1 DC supply 125.00
516F2 AC supply 115.00
51S1 receiver 1200.00
75S2 receiver 395.00
Speaker, matches 75A4 15.00
Tuneable VFO & Dial 40.00

CONTEX
6706 6 meter linear 100.00

COMAIRE
ED27M Citizens band 50.00

CUSHCRAFT
2 meter stacked halos 10.00

DRAKE
2A receiver 175.00
2B receiver 200.00
MS4 120.00
R4A receiver 375.00
T4 reciter 290.00
T4X transmitter 360.00
TR3 transceiver 375.00

EDDYSTONE
Model 659 receiver 90.00

EICO
720 transmitter 55.00
723 transmitter 45.00
730 p.s./modulator 55.00
771 CB transceiver 45.00

ELECTROVOICE
600E mike 7.50
619 mike 25.00
623 mike 25.00

ELECTROVOICE
630 mike with stand 15.00
636 mike 30.00
664 mike 40.00
717 PTT mike 12.00
915 crystal mike 6.00

EIMAC
4-1000A tube 75.00

ELDICO
SSB100F complete station 600.00

ELMAC
AF54H transmitter 60.00
AF67 transmitter 65.00
AF68 exciter 95.00
M1070 supply 45.00
PMR6A receiver 70.00
PMR7 receiver 65.00
PMR8 receiver 90.00
PSR6 receiver supply 20.00
PS2V/supply AF-67 45.00

FENTONE
FBT150 mike 4.00

GONSET
Communicator III 2 meters 200.00
Communicator III 6 meters 190.00
Communicator III 2m/CD 160.00
Communicator IV 6 meters 200.00
Commander transmitter 35.00
G28 communicator 125.00
G33 receiver 75.00
G43 receiver 90.00
G66B receiver 75.00
G76 DC power supply 50.00
G77 transmitter 95.00
G77A xmitter, repairable 75.00
GSB100 ssb exciter 220.00
Super 6 converter 35.00
Super 12 converter 30.00
500 watt RF amplifier 150.00
Comm. III, less cabinet 125.00

HALLICRAFTERS
CB1 citizens band 90.00
CRX3 60.00
HA6 transverter/p.s. 125.00
HT18 exciter 35.00
HT32 transmitter 300.00

HALLICRAFTERS
HT33 linear amplifier 400.00
HT37 transmitter 290.00
HT40 transmitter 55.00
HT44 transmitter 290.00
R465 speaker 15.00
S27 receiver 90.00
S36A receiver 125.00
S38B receiver 30.00
S82 civic patrol rcvr. 35.00
S85 receiver 80.00
S95 receiver 40.00
S107 receiver 70.00
SP44 panadaptor 55.00
Sky Champion receiver 35.00
Superskyrider receiver 100.00
S40B receiver 60.00
SR500/supply, display 425.00
SX28 receiver 125.00
SX42 receiver 145.00
SX99 receiver 90.00
SX100 receiver 190.00
SX140 receiver 70.00
SX101 receiver 175.00
SX101A receiver 200.00
SX110 receiver 125.00
SX111 receiver 170.00
SX111, new in opened box 190.00
SX117 receiver 275.00
HA4 keyer.vibroplex key 60.00

HAMMARLUND
ASP794 145.00
BC779 with power supply 125.00
HQ100 receiver 135.00
HQ100A receiver new 239.00
HQ110 receiver 150.00
HQ110A receiver 260.00
HQ110AC receiver 190.00
HQ129X recevier 120.00
HQ110C receiver 165.00
HQ140X receiver 170.00
HQ160 receiver 240.00
HQ170 receiver 240.00
HQ170AC receiver 295.00
HQ170C receiver 250.00
HX50 transmitter 250.00
HX500 transmitter 350.00
Pro 310 receiver 500.00
SP600 receiver 375.00
S100 speaker 15.00

HARVEY WELLS
R9A receiver 70.00
T90 transmitter 50.00
TBS50 transmitter 35.00
TS90 transmitter 65.00
Bandmaster with VFO 45.00
Power Supply 75.00

HEATH
AC1 antenna coupler 10.00
Apache transmitter 150.00
Audio generator IG-72 65.00
Cheyenne transmitter 70.00
Conelrad alarm 6.00
DX40 transmitter 40.00
DX100B transmitter 120.00
DX60B transmitter 70.00
DX100 transmitter 100.00
Comanche receiver 70.00
DX20 transmitter 30.00
DX35 transmitter 35.00
HG10 VFO 30.00
HG10B VFO 35.00
HP20 power supply 40.00
HR10 receiver 55.00
HR10B receiver 60.00
HR20 receiver 120.00
HS24 speaker 6.00
HX20 transmitter 160.00
Marauder transmitter 240.00
Mohawk receiver 240.00
Mohican receiver 75.00
QF1 Q multiplier 5.00
SB10 sideband adapter 70.00
SB110 6m/with supply 400.00
SB300 receiver 250.00
SB400 transmitter 250.00
SB630 console 65.00
Shawnee 6m transceiver 170.00
VF1 VFO 10.00
VX1 VOX control 7.00
V7A VTVM 22.50
VHF 1 Seneca 170.00
6er transceiver 35.00

See page 122 for New Reader Service

HERBERT W. GORDON CO.
- Bread & butter supply — 75.00
- Meat & potatoes supply

HERALD
- Guitar amplifier — 45.00

HOMEBREW
- Audio modulator — 15.00
- High pwr transmitter — 60.00
- Linear amplifier/813 — 100.00
- Exciter/all band — 75.00
- Mobile transmitter — 20.00
- 2 meter conv/21 mc — 20.00
- Kilowatt linear amp — 100.00

INTERNATIONAL
- Executive Citizens Band — 70.00

JOHNSON
- 122 VFO — 12.00-15.00
- Adventurer transmitter — 50.00
- Challenger transmitter — 90.00
- Electronic TR Switch — 25.00
- Invader 200 — 350.00-400.00
- Messenger CB — 55.00
- Phone patch — 35.00
- Ranger I — 125.00
- Ranger II — 240.00
- Valiant I xmitter — 175.00-190.00
- Valiant II — 275.00-300.00
- Viking 6 & 2 xmitter — 95.00
- Viking Challenger — 85.00-90.00
- Viking II — 120.00
- Viking 500 with power supply & modulator — 300.00
- Electronic TR switch — 30.00
- 250 watt matchbox — 50.00

JONES, M.C.
- Micromatch indicator and coupler, model M4 — 20.00
- Micromatch indicator and coupler, model MM. — 30.00
- Micromatch 263.3 SWR with coupler — 70.00
- Micromatch with coupler — 35.00
- Model 711N — 35.00

KNIGHT
- R55 receiver — 50.00
- R100 receiver — 50.00-65.00
- R100A receiver — 55.00-70.00
- T50 transmitter — 35.00
- T60 transmitter — 40.00-55.00
- T150 transmitter — 85.00
- T150A transmitter — 75.00-85.00
- TR108 2 meter transceiver — 125.00-135.00

LAFAYETTE
- HE62 10 meter VFO — 15.00
- HE74 VFO — 20.00
- HE80 receiver — 110.00-120.00
- HE80A receiver — 110.00
- PA76 mike — 3.00
- 6 meter transceiver — 40.00
- Starflight transmitter — 75.00
- Field strength indicator — 7.00
- HA650 transceiver — 90.00
- HA1200 2 meter transceiver — 125.00
- HE30 receiver — 70.00
- HE45B transceiver — 70.00-80.00
- HE50 10 meter transceiver — 25.00
- HE50A 10 meter transceiver — 45.00

LETTINE
- Model 240 amplifier — 25.00
- 242 transmitter — 30.00

LINEAR SYSTEMS
- Century DC-DC Converter — 90.00

LINK
- Type 1498 6 meter FM xmtr — 75.00

MACKAY RADIO
- Model 128 — 90.00

MALLORY
- Vibrapack 6.3 volts input — 10.00
- Vibrapack 12.6 volts input — 10.00

MCMARTIN
- LT80B transistorized amp. — 40.00

MILLEN
- 50 watt exciter — 60.00
- 90932 Monitor Scope — 75.00

MONARCH
- Field strength indicator — 5.00

MORROW
- 3BR5 receiver — 25.00
- 5BR2 receiver — 25.00
- PW6 — 35.00

MOTOROLA
- Transistor dynamic hand-held mike — 30.00

NATIONAL
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- HRO50R — 150.00
- HRO50R1 — 150.00
- HRO60 w/A, B, C, D coils — 330.00
- HRO60T receiver — 495.00
- NC44 receiver — 35.00
- NC57B receiver — 50.00
- NC66 & RDF66 — 100.00
- NC88 — 70.00-75.00
- NC98 receiver — 75.00-90.00
- NC100X with speaker — 125.00
- NC101 XA — 145.00
- NC105 receiver — 85.00
- NC109 receiver — 80.00-105.00
- NC125 receiver — 80.00-90.00
- NC156 receiver — 150.00
- NC156-1 — 105.00
- NC173 receiver — 75.00
- NC240D receiver — 150.00
- NC270 receiver — 150.00
- NC300 receiver — 160.00-185.00
- NC303 receiver — 250.00
- NC400 receiver — 450.00
- NCL2000 — 510.00
- NCX5 transceiver — 410.00
- NCX5 Mark II — 410.00
- NCX200 — 359.00
- NCXA AC supply — 75.00
- R459/UR receiver — 200.00
- Speaker — 15.00
- Speaker, Cosmic Blue — 8.00
- Speaker, new style — 15.00
- Speaker, old style — 10.00
- VFO62 — 10.00
- VX501 VFO — 75.00

NO-VAR
- Nuvista preamp — 5.00

NUMECHRON
- Timeter 24 hour clock — 25.00

PANADAPTOR
- Model PCA-2 — 100.00

PANORAMIC
- RBW-2M — 65.00

PARKS
- 50-1 6 meter converter — 38.50
- VHF/UHF Marker Generator — 25.00

PEARCE-SIMPSON
- 23 channel citizens band — 270.00

PEARSON
- Communications Receiver — 195.00
- KE93 with supply — 195.00

P&H
- 600A with power supply — 145.00
- LA400A linear amplifier — 170.00

PHILMORE
- Shortwave receiver — 15.00

POLYCOM
- 6 meter transceiver/mike — 200.00

RACAL
- RA17C/sideband slicer — 2595.00

RADIAPHONE
- Bandscanner — 200.00

RAYTEL
- TWR2 — 50.00

RCA
- AR88 receiver — 250.00
- AVTG-200X UHF transmitter — 350.00
- SSB1 transmitter — 120.00
- 508 dynamic mike — 15.00

REALISTIC
- RP148-175 — 45.00
- Sola 2 speakers — 25.00

REGENCY
- World Traveler Receiver — 60.00

RME
- 4350 receiver — 125.00
- VHF126 converter — 220.00
- VHF152A — 40.00-45.00
- Speaker — 15.00
- DB23 preselector — 40.00

SBE
- SB1LA linear amp — 175.00
- SB34 transceiver — 325.00

SHURE
- S20A mike — 7.00

SIGNAL CORPS
- T17D mike — 3.00

SKILLMAN
- Semi-automatic key — 10.00

SONY
- CR4 radio mike with case — 150.00

STARLITE
- 4 transistor tape recorder — 25.00

SUPREME
- AF100 transmitter — 120.00

SWAN
- 14X DC supply — 50.00
- Model 22 — 18.50
- 117AC power supply — 55.00
- 120 transceiver — 150.00
- 140 transceiver — 140.00
- 175 transceiver — 140.00
- 240 transceiver with TCU control unit — 300.00
- 500 with 117XC supply — 450.00

TAPETONE
- Converter preamp 432 mc — 75.00
- XC50C converter — 25.00
- XC50N converter — 30.00

TECRAFT
- 6 meter transmitter — 60.00
- CC5-220 converter — 60.00

TELCO
- 6 meter transmitter — 75.00

TOPAZ
- Univerter Model 300XO — 95.00

TRAM
- Titan Citizens Band/mike — 434.00

TUCK
- RTTY converter — 275.00

TURNER
- Citizens Band mike PTT — 8.50
- S22X mike — 7.00
- 33X crystal mike — 15.00

UTICA
- 650 6 meter transceiver — 100.00
- 650 with VFO — 100.00

VOCALINE
- Citizens Band transceiver — 47.50

WRL
- Globe Champion 300 — 75.00
- Globe Chief 90 xmitter — 40.00-50.00
- Globe Chief 90A xmitter — 55.00
- Globe Scout 65 — 60.00
- Globe Scout 680 xmitter kit — 30.00
- Globe Scout 680A — 60.00-65.00
- Globe Scout Deluxe — 90.00-100.00
- Globe Star Citizens Band — 75.00
- Highbander VHF 62 — 120.00
- Sidebander DSB100 — 60.00
- Sidebander transmitter — 60.00
- VHF 62 highbander — 100.00
- 6-2 VFO — 30.00
- 755A VFO — 25.00

YAESU
- FTdx400 — 600.00

ZENITH
- All transistor transoceanic radio — 95.00

See Page 122 for New Reader Service

VHF TODAY

BY ALLEN KATZ,* K2UYH

IT is now possible to call CQ on the 1296 mc band and more times then not have someone come back to you. At least that is the way it is in this section of the country. We can remember the thrill of working WA2VTR with an APX-6 and how overjoyed we were at barely copying Walt, K2JNG's c.w. signal over the 20 mile path between his QTH and ours. 1296 has truly come a long way in the two years since that APX contact with Dolf. Today everyone is on crystal control. K2JNG is regularly bridging the gap between New York and the Philly area. And the strange thing is that the fellows on 1296 are not all microwave engineers or located at extraordnary DX locations. Take Walt for instance; he lives in a three story apartment house and runs only about 30 watts out. The station in the Philadelphia area which he hears most often (W2IOE) runs only 5 watts out of a varactor tripler.

Increased DX

You may wonder why the sudden increase in activity and average distance worked. It certainly is not due to a new revolutionary transmitter design. Most stations use 2C39's which were already popular in the early fifties. These tubes (now, as then) are just about the only decent thing available for 1296 amateur use. Antenna size has increased somewhat. But the use of bigger antennas is more a result of the increased activity — then the activity a result of the better antennas. When you cannot work anyone there is no urgency to improve your antenna system. It is when you are working out that the desire for improvement comes.

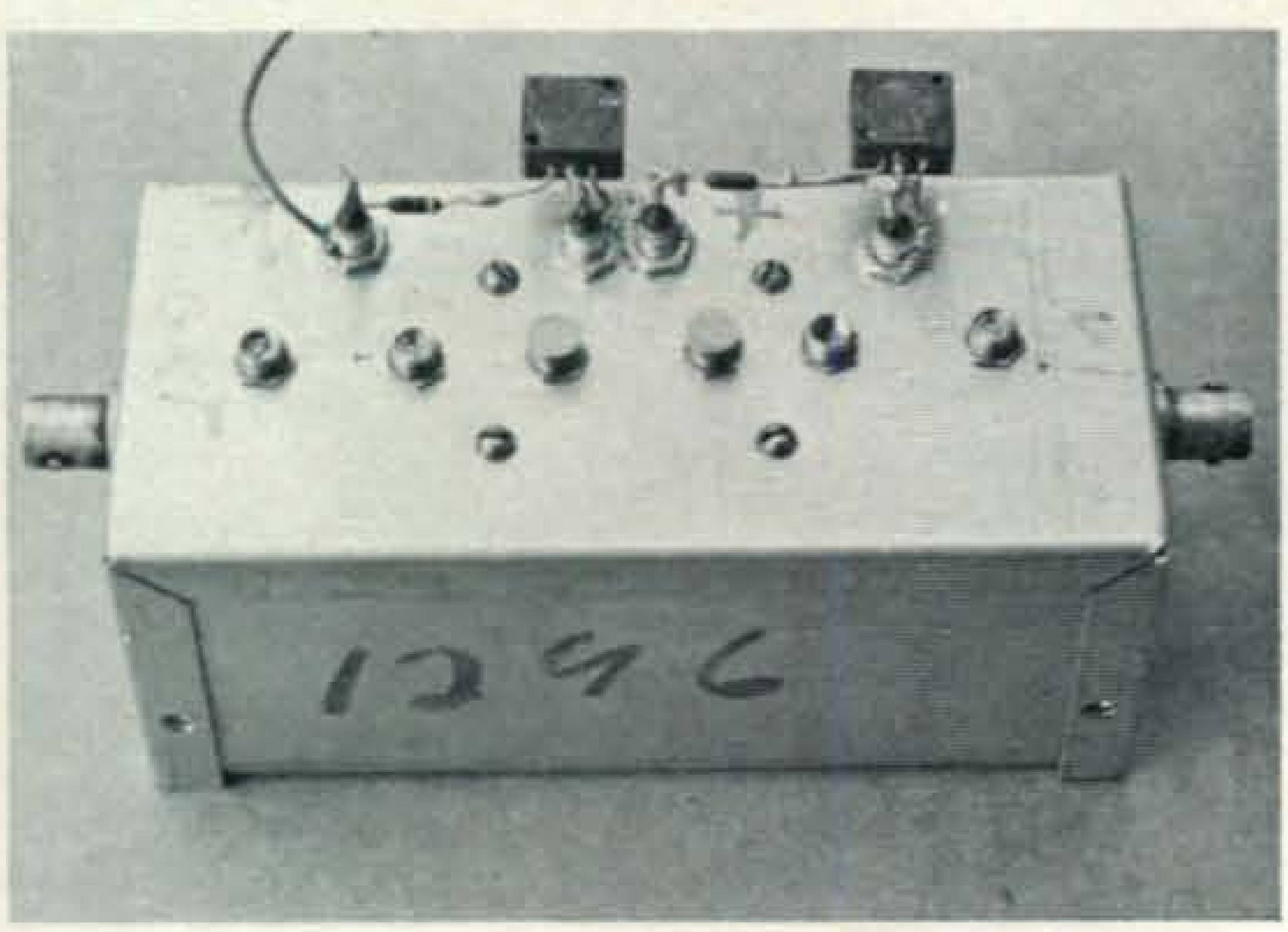
What major changes have occurred, have occurred in the receiver. Two years ago all stations (in this area) used diode mixers. Today all stations use transistor preamps.[1] The difference is significant. Many of the diode mixers had noise figure in excess of 15 db, while transamps can be tuned up (in a matter of minutes) to produce better than a 6 db noise figure on 1296. Preamp construction is ridiculously simple when compared to classical microwave hardware. And the price of transistors is not that dear.[2] In short, if you are on 1296 mc and do not already have a transamp, build one.

There are many designs for transistor preamplifiers around. Those designs that use pi-network input and output tuning plus KMC 5200 series transistors have been found by the fellows around here to perform the best. Because of high mixer noise, two stages of amplification are usually a must for optimum results. To cut down on the number of tuned circuits, designs similar to the one shown in fig. 1 are normally used. This circuit is the one employed by us on 1296 mc. To isolate

*66 Skytop Road, Cedar Grove, N.J.

[1]Cliff, W2CCY is using a paramp on 1296 mc, but he follows it with a transamp. The transamp allows him to run the paramp at lower gain, thus obtaining better stability and overall performance.

[2]Information about the purchases of K-5200 transistors by amateurs may be obtained by writing to Samuel G. Nelson, W2MHK, Reaville Associates, RFD 1, Box 200, Flemington, N.J. 08822.



Exterior view of the 1296 mc preamplifier.

Interior views of the 1296 mc preamplifier.

See page 122 for New Reader Service

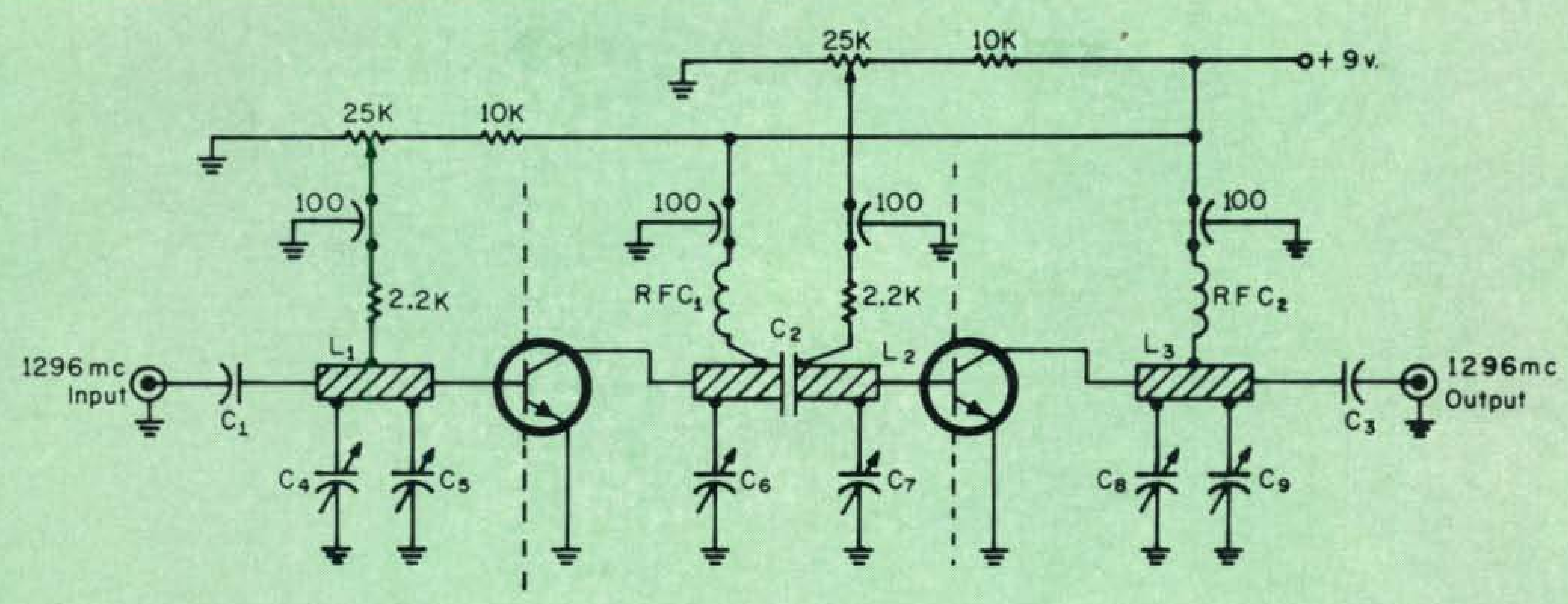


Fig. 1—Two stage 1296 mc preamplifier that exhibits a measured gain of 20 db and a measured NF of 5 db.

C_1, C_2, C_3—0.001 disc ceramic modified as described in the text.

C_4, C_5, C_6, C_7, C_8, C_9—0.8-5 mmf tubular glass piston trimmers.

L_1, L_2, L_3 — Copper flashing straps 3/8" × 7/8".

RFC_1, RFC_2—5 t #28 e, 1/4" dia.

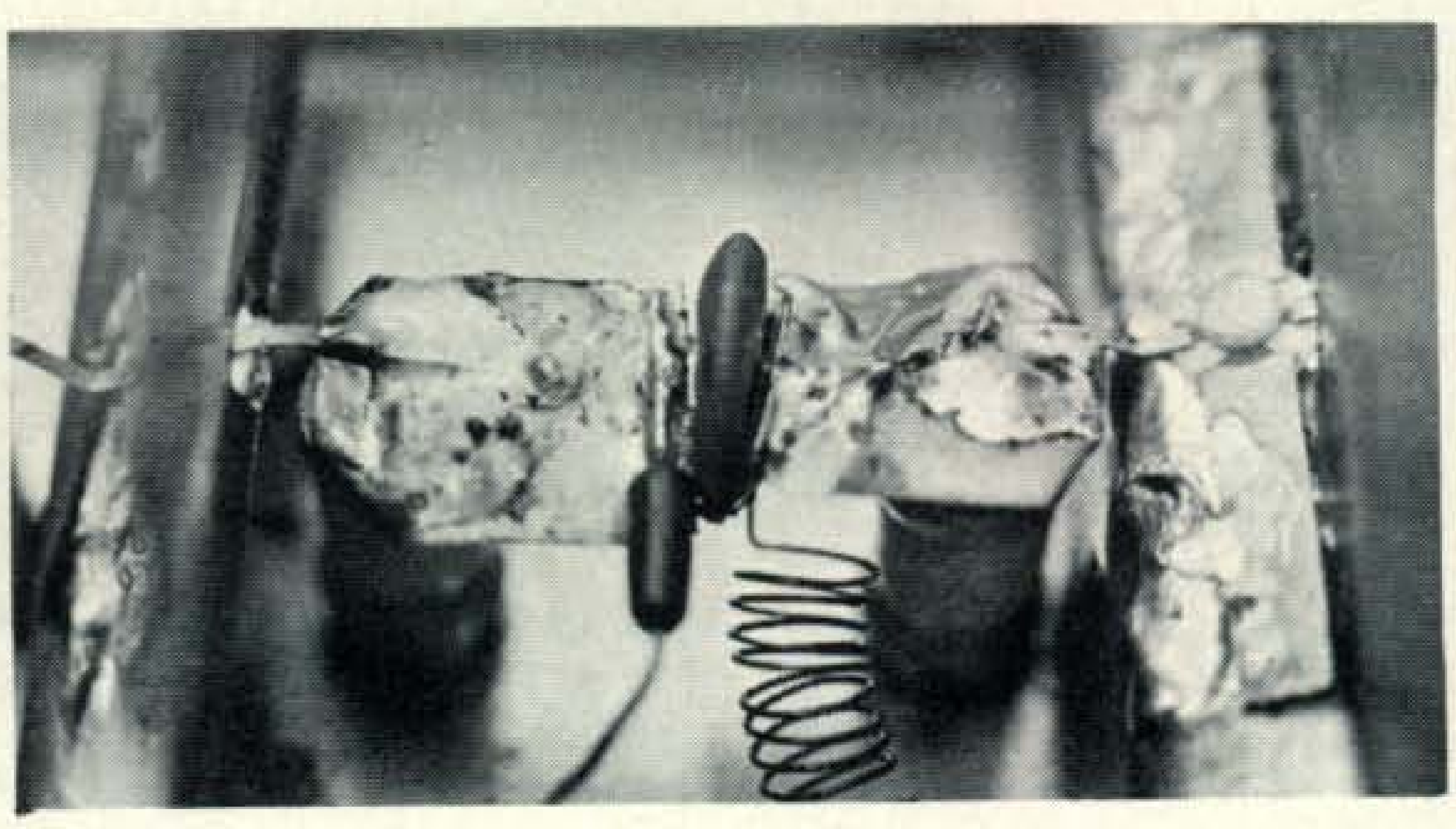
the first and second transistor, d.c. wise, a capacitor was placed in the center of the middle tuned line—see the photographs. The high lead inductance of most disk ceramic capacitors makes it necessary to modify them for use on 1296 mc. This modification is accomplished by carefully filing off the ceramic on both sides of the capacitor and soldering directly to the metal shell inside. The tuning capacitors used in the amplifier shown in the photos are rather hard to obtain; however, almost any low capacitance tubular glass trimmers may be used in the circuit provided the lines are soldered directly across their tops.

Several of the local gang have experimented with common base amplifiers. Although this configuration will yield more gain than a common emitter stage, it tends to be unstable and thus impractical for 1296 use. Pat, K2PPZ, is using a 1296 mc amplifier whose circuit looks very similar to that of fig. 1. The second stage in Pat's amplifier, however, is run common base. This arrangement apparently stabilizes the common base amplifier by isolating it from the antenna, and the over-all amplifier performs extremely well. Bill, K2TKN, has come up with a two stage circuit which completely eliminates the middle tuned circuit. He accomplishes this by running the two transistors in a cascade arrangement. Although we have not personally tried his design (yet), it appears to offer a considerable saving in parts with no sacrifice in noise figure or gain.

Tuning

Tuning up KMC type transamps is simple. Adjust the individual stage collector currents to about 1 ma; then adjust the tuned circuits for m.d.s. (minimum detectable signal). That is, apply an adjustable level signal source to the input of the amplifier and adjust the signal source level to the point where it is just audible. Then adjust the amplifier tuning until the received signal strength improves. Readjust the signal source level to the point where the signal is just audible again and repeat the process until the point is reached where no more improvement can be obtained. This setting is the m.d.s. adjustment and should correspond to minimum noise figure. In practice for a collector current of 1 ma, m.d.s. should occur very close to the optimum gain adjustment. Do not be afraid to readjust the collector current up to a few

[*Continued on page 114*]



Close up view of the middle tuned circuit showing a modified capacitor.

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See page 122 for New Reader Service

See page 122 for New Reader Service

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

December	7-8	CHC International C.W.
December	14-15	CHC International SSB
January	11-13	Arkansas QSO Party
January	18-19	Louisiana QSO Party
January	**25-26**	***CQ* WW 160 C.W. Contest**
January	24-26	Old Old Timers QSO Party
February	1-2	ARRL DX Phone Contest
February	8-9	QCWA QSO Party
February	8-10	Arizona QSO Party
February	15-16	ARL DX C.W. Contest
February	22-23	YL/OM Phone Contest
March	1-2	ARRL DX Phone Contest
March	8-9	YL/OM C.W. Contest
March	8-9	RSGB BERU Contest
March	15-16	ARRL DX C.W. Contest

CHC International Contest

C.W.–Dec. 7-8. **S.S.B.**–Dec. 14-15.
Starts: 0001 GMT Saturday
Ends: 2400 GMT Sunday

This is the first of what will be an annual affair the first two weeks of December.

It's a world wide type contest in which you can work anyone. QSO point value varies according to the membership of the station you work. Complete rules in last month's CALENDAR.

Your c.w. logs go to: Al Kemmesies, K1QHP, 76 Garden Street, Ansonia, Conn. 06401, January 15th is the deadline.

The s.s.b. logs go to: Clifford A. Taylor WB4FBS, General Delivery, Stinnett, Kentucky 40868, January 31st mailing deadline.

Arkansas QSO Party

Starts: 2200 GMT Saturday, January 11.
Ends: 0400 GMT Monday, January 13.

This will be the 4th annual party sponsored by the North Arkansas A.R.S. The same station may be worked on each band and mode.

EXCHANGE: QSO no., RS/RST and QTH, county for Ark. stations; state, province or country for all others.

SCORING: Ark. stations, 1 point per contact, multiplied by sum of states, provinces and countries worked. All others, 5 points for each Ark. QSO, multiplied by number of Ark. counties worked (max. of 75).

FREQUENCIES: C. w. – 3525, 7025, 14025, 21025, 28025, A.m. – 3825, 7225, 14225, 21220, 28560. S.s.b.–3975, 7275, 14325, 21425, 28650. Novices–3735, 7175, 21110.*

AWARDS: Certificates to the top scorers in each state, Canadian province and foreign country (min. of 100 points).

Mailing deadline for logs is January 30th, and they go to: North Arkansas ARS, Att: Robt. E. Townsend, W5HYZ, P.O. Box 333, Harrison, Ark. 72601.

Louisiana QSO Party

Starts: 1800 GMT Saturday, January 18
Ends: 2200 GMT Sunday, January 19

This is the 4th annual QSO party sponsored by the Lafayette A.R.C.

EXCHANGE: QSO no., RS/RST and QTH. Parish for La. stations; state, province or country for all others.

SCORING: Each QSO counts 1 point. La. stations multiply total QSO points by sum of states, Canadian provinces and countries worked. Others use Louisiana parishes for their multiplier.

The same station may be contacted on each band and mode for QSO points, and La. stations are permitted to work other La. stations.

FREQUENCIES: 3600, 3910, 7075, 7260, 14075, 14300, 21075, 21400, 28100, 28700.

AWARDS: Certificates to the top scorers in each state, VE call area and country, and the 1st, 2nd and 3rd place winners in Louisiana. There is also a Trophy to the top scorer in Louisiana. (Winners must have a minimum of 50 points if in the U.S.A. and 25 points if a DX station.)

Mailing deadline is February 28th. Mail to: Lafayette A.R.C., 123 Normandy Road, Lafayette, Louisiana 70501.

*14 Sherwood Road, Stamford, Conn. 06905.

*Non-Extra class operators check new frequency regulations.

See page 122 for New Reader Service

CQ WW 160 DX Contest

Starts: 0000 GMT Saturday, January 25
7 P.M. EST Friday, January 24
Ends: 1500 GMT Sunday, January 26
10 A.M. EST Sunday, January 26

No changes in rules, everything same as last year. Now if conditions will also be the same as last year, we've got it made.

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

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

3. For all other countries: 2 points per QSO with stations in the same country, 5 points with stations in other countries, except for contacts with W/VE/VO stations which are worth 10 points.

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

5. Final score: Total QSO points multiplied by the sum of the multipliers.

6. Exchange: Six figures; RST plus a 3 figure progressive QSO number starting with 001 for the first contact, followed by your state or province. (DX stations do not have to send their QTH.)

7. Disqualifications: Violations of the rules and regulations for amateur radio in the country of the contestant, or the rules of this contest, or unsportmanship conduct, or taking credit for duplicate contacts in excess of 3% of the total made, will be deemed sufficient cause for disqualification.

8. Awards: Certificates to the top scoring stations in each State, Canadian province and foreign country. Additional awards will be given if participation warrants or at the discretion of the Committee.

Hawaii and Alaska are considered "foreign countries" for QSO and multiplier credits. The District of Columbia counts same as Maryland. And don't forget, VE1 is divided into three provinces, Nova Scotia, New Brunswick and Prince Edward Island. And VE8 has two provinces, North West Territory and Yukon.

With the increased frequency and power allocations now in effect, it is advisable to check the assignments for your particular area (New list available from *CQ*.)

The new regulations should definitely aid the fellows in the United States. What it will do to DX is another story. "DX Alley" the 5 kc between 1825 and 1830, is now open to

Katashi Nose, KH6IJ was completely surprised when Norman Young, W1HX presented him with the Larry LeKashman, W9IOP Trophy he won in the 1967 CQ WW DX C.W. Contest. Katashi was the guest speaker at the annual New England DXCC Dinner held last October.

US hams. So where will the DX go now? Working DX on 160 thru the stateside QRM is murder. Maybe Stew Perry, W1BB will have a suggestion for us in next month's CALENDAR.

The usual s.a.s.e. will get you a supply of log sheets and frequencies list.

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

Old Old Timers QSO Party

Starts: 2200 GMT Friday, January 24
Ends: 2200 GMT Sunday, January 26

This is the second annual Old Old Timers Club QSO Party, sponsored by the New Orleans chapter. The affair is for OOTC members only, and only contacts between members will count.

A station may be contacted once on each band and mode. Operate any 24 hours out of the 48 hour contest period.

EXCHANGE: QSO no., state, province or country, name and OOTC number.

SCORING: 1 point per QSO between stations in the US and Canada, 3 points if its with a DX station. For DX stations, 1 point with stations in own country, 5 points for all other contacts.

A multiplier of 1 for each state, province and country worked.

FINAL SCORE: total QSO points multiplied by sum of the multiplier.

[*Continued on page 110*]

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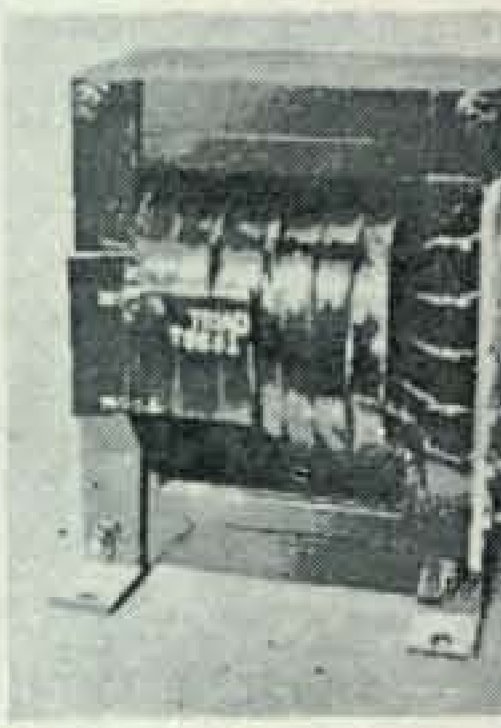

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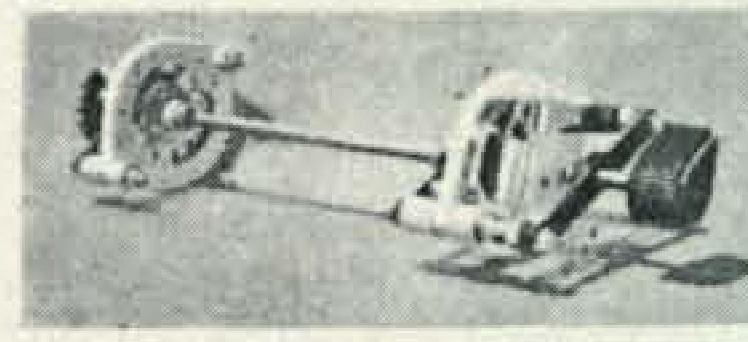

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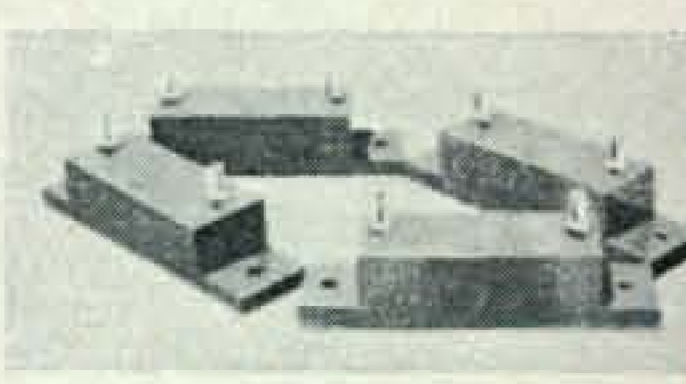

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"World's Largest Distributor of Amateur Radio Equipment"

 See page 122 for New Reader Service

THE awards PROGRAM

BY ED HOPPER,* W2GT

Stephen J. Johnson, K3LXN

STEVE'S present USA-CA score is 2750 counties confirmed out of a total of 2770 worked. Of these, over 2500 are for 2 × SSB, over 2300 for mobiles and about 1100 for fixed or portable operation—he thinks the ultimate would be 3079 worked, all fixed or portable, no mobiles.

USA-CA-500 Award #212 was obtained in April 1963; USA-CA-1000-#39 in May 1964; USA-CA-1500-#24 in January 1965; USA-CA-2000-#27 in March 1966 and USA-CA-2500-#31 in June 1968. Naturally Steve was happy to catch Kalawao county, Hawaii, the rarest of them all.

Interest in radio started as an s.w.l. before WW2. Membership for many years in various s.w.l. clubs included, Newark News Radio Club, National Radio Club, Canadian DX Club and others. Steve was a Broadcast Band DXer for a long period of time and confirmed 75 countries on the Broadcast Band. The Canadian DX Club contains quite a number of County Hunters, both amateur and s.w.l.

During WW2, Steve was a radio operator and radio repairman. His interest in amateur radio came through the efforts of W4FUI while in the army and later through W3KLA who gave him the Novice test in 1960, while working for the Martin Company in Baltimore, Maryland.

While still a Novice, an interest in award collecting was developed and 49 states were worked but the elusive one was South Dakota. Several months after a General ticket was received, three South Dakota stations were worked in one evening. After WAS, came DXCC, WPX and others—but that rare Zone 23 is still needed for WAZ, but that is tough to get without a beam.

When USA-CA was started, Steve found that he needed 50 for that magic 500, but the 50 were soon worked for that USA-CA-500 Award #212 for All CW operation. Up to this

*103 Whittman St., Rochelle Park, N.J. 07662.

Looking down at Kalawao County

Steve, K3LXN

MARC Certificate

time, not one single fone contact had been made.

Steve thought he would never reach the 1000 mark, but one day he happened to tune across 40 meters and found the County Hunter Net on 7220 (later 7223), he has had little chance to work c.w. since that day.

Since that day, many pleasant hours were spent on this net, and with two trips to the Dayton Hamfest (1966 and 1967), many of the fine County Hunters were met. Steve says he has never met a finer group of people. The 14336 Net has taken over since then, and has done a fine job for both the "old" and newer County Hunters.

At present, Steve is working for the Department of the Army at the Aberdeen Proving Grounds, Maryland, as a Computer System Analyst. He credits Hal, W9VW, for this —by giving the necessary advice and encouragement when it was most needed. So, chalk up another one for the County Hunters. Although Hal, W9VW, was never a serious County Hunter, he was always on the 40 meter net and gave out many counties while operating mobile. Steve says Hal is a fine gentleman, as we will all agree.

A total of over 350 awards are held by Steve, and he is a member of ISSB (#1835), NAHC, AHC, ARAC, CAC and others.

When Steve was working in Army Communications – shift work – a lot of daytime operating was possible, but with his present job and hours of 8 A.M. to 4:30 P.M., only sporadic activity is possible and this is mostly on weekends–so that goal of 3000 and then 3079, seem a long way off.

Letters

Al, K5HKG/IT1, writes: "Please send me a copy of the USA-CA rules and other data regarding the *CQ* county program. I have over 2500 counties confirmed, most of them on 20 and 75 s.s.b.

I started hunting counties in the fall of 1964, shortly after returning from Okinawa (KR6JP) and Hawaii, and being at Corpus Christi, Texas.

Back in February, the Navy sent me to Brunswick, Maine for a month and then over here to the Island of Sicily.

My Naval Air Patrol Squadron will be returning to the states soon, then I should have some free time to list all my confirmed counties.

I greatly enjoy mobile operation and Ben, K5DRF and I gave out over 220 Texas counties. I have been mobile in hundreds of other counties in 21 other South and Eastern States. The rig was a Drake TR-3, then later a TR-4.

I also do aeronautical mobile operation as often as I can from the aircraft that I work on and fly in. I am an Aviation Electrician First Class and Radio Operator in the U.S. Navy."

Jeffrey, KØWNV, writes: "Enclosed is my application for USA-CA-500, endorsed All CW. After collecting somewhere around 400 counties at my home QTH back in the early 60s, college brought to a halt my radio work. I was completely off the air from June 1965 to January 1968, the first 2½ years of graduate school down here in Ames, Iowa. Now after completing all my course work and passing preliminary exams, I brought the rig down here for my last 1½ years of graduate school.

All my contacts made at my home QTH, New Ulm, Minnesota, were made with my Ranger, 75 watts c.w., HQ-110 and a five band trap dipole antenna. The rig here in Ames is the same except for the antenna which is now a Gotham V-80 vertical.

All contacts have been results of just ragchews and contest work. It was nice meeting you, though short, for the two contacts in the 1968 County Hunter CW QSO Party. Thanks for the QSLs, hope you received mine OK. I certainly enjoyed the QSO Party, the contacts from it brought me over the 500 county mark.

Thanks for the information, and for the PROGRAM, it is very enjoyable working on it."

Herb, W2AQG, writes, "Due to the pressure of business for the past two years, I've found little time to devote to amateur radio. Presently with the pressure somewhat relieved, I find myself with a little more time and an interest to become active again.

At the time of my leaving the air, I was

See page 122 for New Reader Service

actively engaged in obtaining QSLs for the County Award Certificate. As that was some time ago, please send along the latest data/rules on the *CQ* USA-CA Program.

Also, in passing, Maplewood (N.J.) issues a certificate for out-of-town amateurs working 2 meter stations. Maplewood's C-D Net is the oldest active 2 meter net and we have quite a few fellows on 2 meters." *(Send along a copy of the certificate and rules and I will use in a future column, Ed.)*

Awards

MARC Certificate: The Montreal Amateur Radio Club Inc. is pleased to announce the formation of an Awards Committee and issuance of an attractive bilingual certificate, open to all licensed radio amateurs and s.w.ls. meeting the following general rules and conditions: Efective date is January 1, 1967. Canadian and U.S.A. Amateurs must produce evidence of having made two way communications with 15 or more MARC members in good standing on each of two (2) bands (30 contacts). DX and *all* Others must produce evidence of having made two way communciations with 15 or more MARC members in good standing on any band or combination of bands (15 contacts), s.w.ls. same as afore mentioned rules, but having heard, not QSOs, Hi). Modes: Phone or c.w. or mixed with minimum reports of 439 or RS 43. Send a list only of stations worked, NO QSLs, and have it certified by two other amateur radio operators or an officer of a Radio Club or have it notarized (GCR Rule). The list must show the stations claimed, mode of operation, date and band/bands used. All stations must be land stations, Fixed or Mobile. The cost is $1.00 Canadian Funds or 7 IRCs. This fee includes return postage. It is payable by postal or bank money order and should be addressed to: Awards Chairman, Montreal Amateur Radio Club, Inc., 535 Lansdowne Ave., Montreal 6, Canada. The Awards Committee reserves the right to reject any application failing to submit requested confirmations within one month of receipt of request (except for remote countries where postal service is slow) or if the committee for any reason has any doubt about the authenticity of the submitted verifications. Endorsements will be issued for each additional group of ten (10) stations worked or heard to all applicants providing the necessary proof and an s.a.s.e. or 1 IRC. All certificates will be recorded and numbered consecutively and eligible stations will be published from time to time in MARCOGRAM. In the case of any dispute concerning a claim, the decision of the committee shall be final.

Portable Operators Award

Portable Operators Award: Issued by Boy Scout Troop #94, Scituate, Massachusetts and is actually two certificates. One may be earned for having worked portable stations and one may be earned for having operated portable. The requirements for each award are entirely different, and each award is issued in three classes and will be endorsed for one band and mode.

For *working* Portable Stations: Class C for working 33 portable stations in at least 16 counties. Class B for working 66 portable stations in at least 33 counties. Class A for working 100 portable stations in at least 50 counties. You must have confirmations on these contacts. Mobiles do not count. Submit a GCR list with your application. The same station may be claimed more than one time if he was operating from a different town.

For *operating* Portable: Class C for operating portable from 6 different counties. Class B for operating portable from 12 different counties. Class A for operating portable from 18 different counties. You must have made at least one valid contact from the portable location. Submit log data including location and county from which you operated portable, witnessed by two licensed amateurs of any class. Fee – for either basic award is $1.00. Higher class seals for s.a.s.e. No date or time limits. All profits over and above printing and postage costs benefit Boy Scout Troop #94. If a new band or mode endorsement is desired, fee is 25¢ as a new certificate will be issued. Awards Custodian is: Robert W. Jennings, W1DKD, 15 Cliff Ave., Scituate, Mass. 02066. PORTABLES DEFINED: A station operating away from his home address as specified in his station license. Mobiles do not count. A basic mobile installation is considered portable *provided* the station cannot get underway while receiving or transmitting. Examples: Operating from 110 volt landline power; operating with power from a gasoline generator set on the

See Page 122 for New Reader Service

Carey Moraine Award

ground; operating a mobile installation into a fixed antenna system separate from the mobile unit; operating while the mobile unit is attached to a driven ground system.

Worked All Whittier: This award is sponsored by the Whittier Radio 50 Club of Whittier, California. The award is offered free for working the required number of stations in Whittier, and no confirmation is necessary, just send GCR list to The Whittier Radio 50 Club, 333 E. Penn St., Whittier, California 90603. Requirements are: For stations outside the continental USA you must work 3 Whittier stations. For stations located in the USA, except Whittier, you must work 5 Whittier stations. For stations located in Whittier, you must work 10 Whittier stations.

Carey Moraine Award: A short time ago, the amateurs in Lincoln county formed the Lincoln Amateur Wireless Society of Wisconsin and immediately set up an awards program. The award is the Carey Moraine Award, so named from the location of the club operating and meeting site which is on the top of one of the highest hills in the Carey Moraine–the terminal moraine of the ancient Wisconsin Glacial Ice Cap. The award is available to all of Hamdon throughout the world, (also s.w.ls) for confirmed contacts with Wisconsin counties through which the Carey Moraine line lies, which includes the following counties: Adams, Barron, Brown, Chippewa, Columbia, Dane, Door, Fond du Lac, Kewaunee, Langlade, Lincoln, Manitowoc, Marathon, Milwaukee, Oneida, Polk, Portage, Price, Rock, Rusk, St. Croix, Sauk, Sheboygan, Taylor, Walworth, Washington, Waukesha, Waushara (28). The award will be issued in five classes:

Worked All Whittier

	8/9/∅ & VE3 Stations need	All Others need
CLASS D	7/5	2/1
C	14/11	3/2
B	21/17	4/3
A	28/24	5/4
AA	28/28	5/5
PLUS CLUB STATION		

The requirements for the club station may be filled by confirmed contact with any one club member operating portable or mobile from the club site on Irma Hill in Lincoln county.

FEE is $1.00 or 10 IRCs, with endorsement seals for 10¢ or 1 IRC, AOMB, TRC, available to s.w.ls, Free B/P. Application plus GCR to Club Awards Custodian, F. L. Jaeger, WA9SQN, Route 2, Box 107, Merrill, Wisconsin 54452. Although not required, a special application form is available for 1 IRC or s.a.s.e.

Notes

A *late* letter from Molly, ZE1JE regarding the BULAWAYO 75th Anniversary Award sponsored by the Radio Society of Rhodesia. Issued for contacts with at least three (3) BULAWAYO stations, two way c.w. or two way phone, any amateur band. Contacts must be made during the period 1st to 30th November 1968, inclusive. Claims for the award, in the form of a certified log extract, together with three (3) IRCs to be sent to: Matabeleland Branch, Radio Society of Rhodesia, P.O. Box 1372, Bulawayo, Rhodesia, Africa or R. S. R. QSL Bureau, P.O. Box 2377, Salisbury, Rhodesia, Africa. Application must be postmarked not later than 31 December, 1968.

Many thanks to Norm, KH6FQB/W5NXF for his *many* FB letters and his air foto of the rarest of them all – Kalawao county, Hawaii.

Also many thanks to Gil, W5QPX for sending along a POD 26 to JA2WB and a POD 26 to AP5HQ.

Some time ago, Joe, W3PVZ wrote for data on the *Padre Award*, which apparently has been discontinued as NO reply has been received to letters sent to W∅OTU and W∅YZH who used to issue this award a few years ago.

Again, many thanks for all your encouragement and letters, without *YOU*, this column would be empty, so be sure to write and tell me–How was your month? 73, Ed., W2GT.

See page 122 for New Reader Service

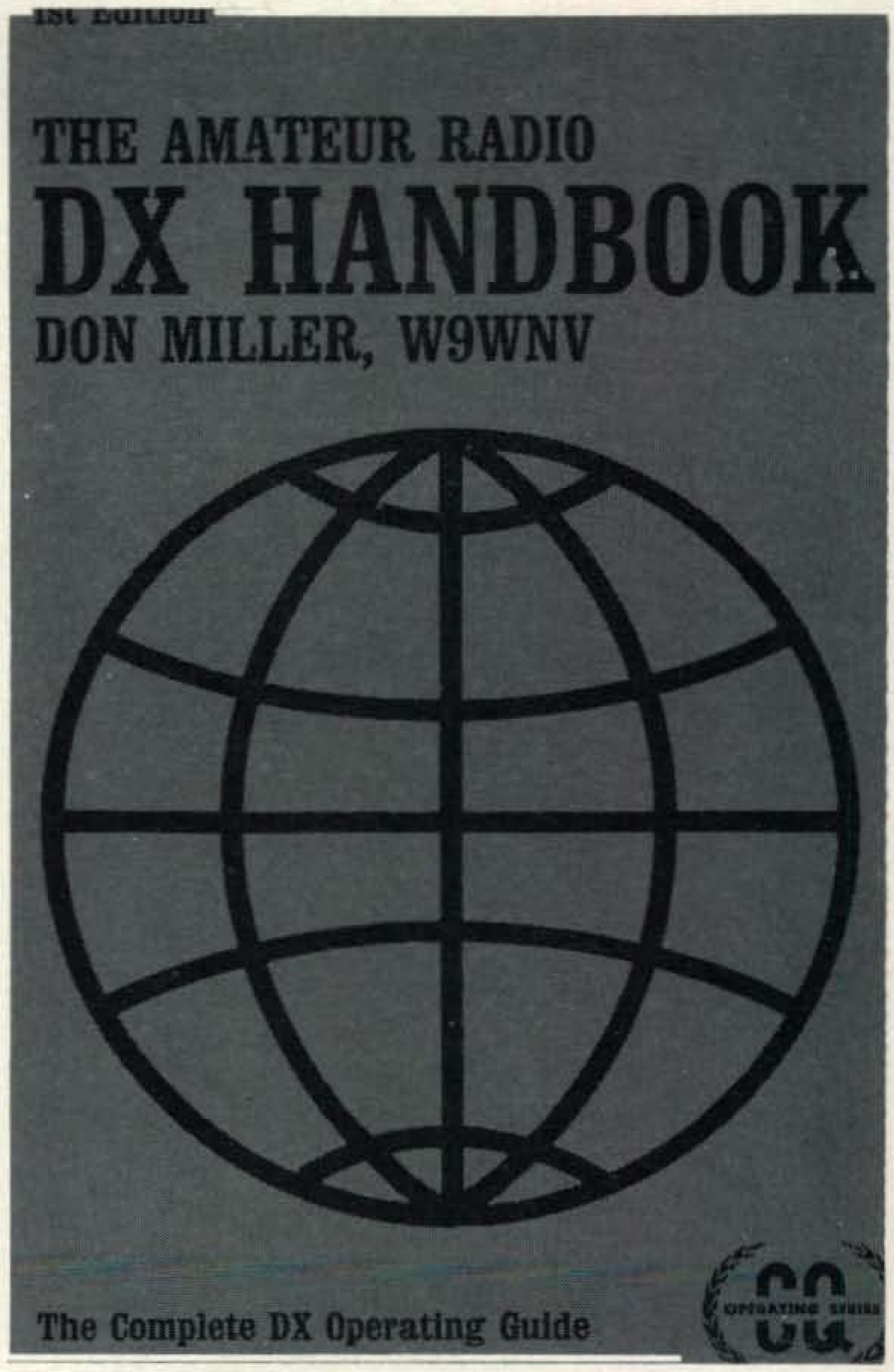
SPECIAL NOTICE

The Amateur Radio DX Handbook is off the presses and in the mail. CQ readers who ordered their copies direct from the publisher will have their copies as this issue of CQ is being prepared. Hundreds of local distributors and book stores will also have copies in stock.

This book is the absolute, most comprehensive sourcebook available on DX to the Radio Amateur. It contains every conceivable piece of information he'll need toward working better DX.

The chapter headings are listed below, although they don't come close to doing this fantastic volume the justice it deserves. You have to see a copy to appreciate just how valuable it is.

We anticipate that our first print run will be exhausted within the next month. To make sure you get your copy while they're still available, check your local distributor or order direct from the publisher. The price is $5.00 for 200 pages of priceless reading.



Introduction

- Dx Propagation
- Amateur Frequencies and the DXer
- The DXer: International Factors and Local Regulations
- The DX Station
- Working DX From the Home Station
- Mobile DXing

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SURPLUS sidelights

BY GORDON ELIOT WHITE

I have had a bit of mail in the last few months from readers who have picked up MAR sets, a Navy u.h.f. transceiver covering the 225-399 megacycle military aircraft bands. This is an oldie, but apparently a batch has come along in surplus in recent months.

The schematic is in the *CQ Surplus Schematics Handbook*, page 82-83, together with some information on the unit. The transmitter section is of little use, although it could be converted to cover the 220 mc amateur band. The receiver section, known under nomenclature RDR, is apparently used mostly for listening to military aircraft, a pastime indulged in by a good many hams to judge from my mail. It is good enough for such work if the ten available crystal channels are set up to cover ten of the most interesting or most active frequencies in your area. The Air Force uses newer sets these days which cover *all* the assigned 1750 channels in the u.h.f. bands, but these, the AN/ARC-27, AN/ARC-33, etc. are much more expensive and complex transceivers than the RDR.

The schematic in the Surplus Handbook shows how to hook up a control unit and to power the RDR; normally a 12 or 24 volt dynamotor was used, but an a.c.-run power supply could be built up easily enough for the RDR.

Crystals for the RDR lie in the 4814.815 to 7777.778 kc range, and the i.f. is 30.2 mc. Multiplication is 48 times from the crystal fundamental to the incoming channel frequency less the i.f.

The RDZ, incidentally, cover the same band. It is a heavier u.h.f. receiver, which I covered in this column, December, 1966 page 88, including conversion of the crystal oscillator to tuneable operation. The RDR might also lend itself to tuneable mode, by adding enough feedback between plates and grid of the oscillator tube (V_{501}, a 6AG7) to make it take off on its own. About 100 mmf worked on the RDZ. Of course apparent sharpness becomes incredibly greater with tuneable operation, since you can get off frequency rapidly. With a crystal oscillator, the crystal will oscillate quite a bit each side of the proper tuning point, giving broader tuning, in effect.

The antenna for a u.h.f. monitor ought to be omnidirectional of course—if you are near a military airfield you can use a more directional skyhook—and even a simple dipole on the roof will pull in a great many signals.

Most of the traffic you can find in the 225-400 mc area is air traffic control. The Federal Aviation Administration operates scores of u.h.f. channels to work military aircraft, and in fact the FAA traffic centers and towers will give you the local u.h.f. frequencies to help you choose useful crystals. (Tell them you are doing some receiver testing.) In the Washington area, Air Traffic Control operates en route u.h.f. frequencies from two remote locations, using 269.3 mc, 290.3 mc, 319.8 mc, 351.8 mc, and 363.3 mc. The Washington National Tower uses 257.9 mc for ground control and 269.0 mc for radar approach control. The main tower u.h.f. frequency is 257.6 mc. In most cases a u.h.f. channel is paired with a v.h.f. channel in the 108-135 mc civil aircraft band, and if you have a low band receiver you can hear both transmitters being keyed with the same mike as the controller talks to the pilot. This whole double-band setup is required because military planes, in the common traffic system, often carry no low-band equipment. The standard u.h.f. emergency channel is 243.0 mc.

Transmissions are short and terse in air traffic work, and quite cryptic to the uninitiated. You may hear "Air Force 21 cleared to Andrews, contact Andrews tower on 279.3" —a typical conversation in its entirety, plus many less intelligible messages. In the Washington area it is not at all uncommon to hear "Air Force One, contact Andrews Approach" as the President flies in from the Texas ranch, then a little later "Army One, (a helicopter) off Andrews at 59 en route Hotel" (code name for the White House).

My mention last summer of the Rixon RTTY speed meter attracted quite a bit of interest. (August, p. 106) As I indicated in that column, I did not have a circuit available that would enable the instrument, a reed-type frequency meter, to be tied directly

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

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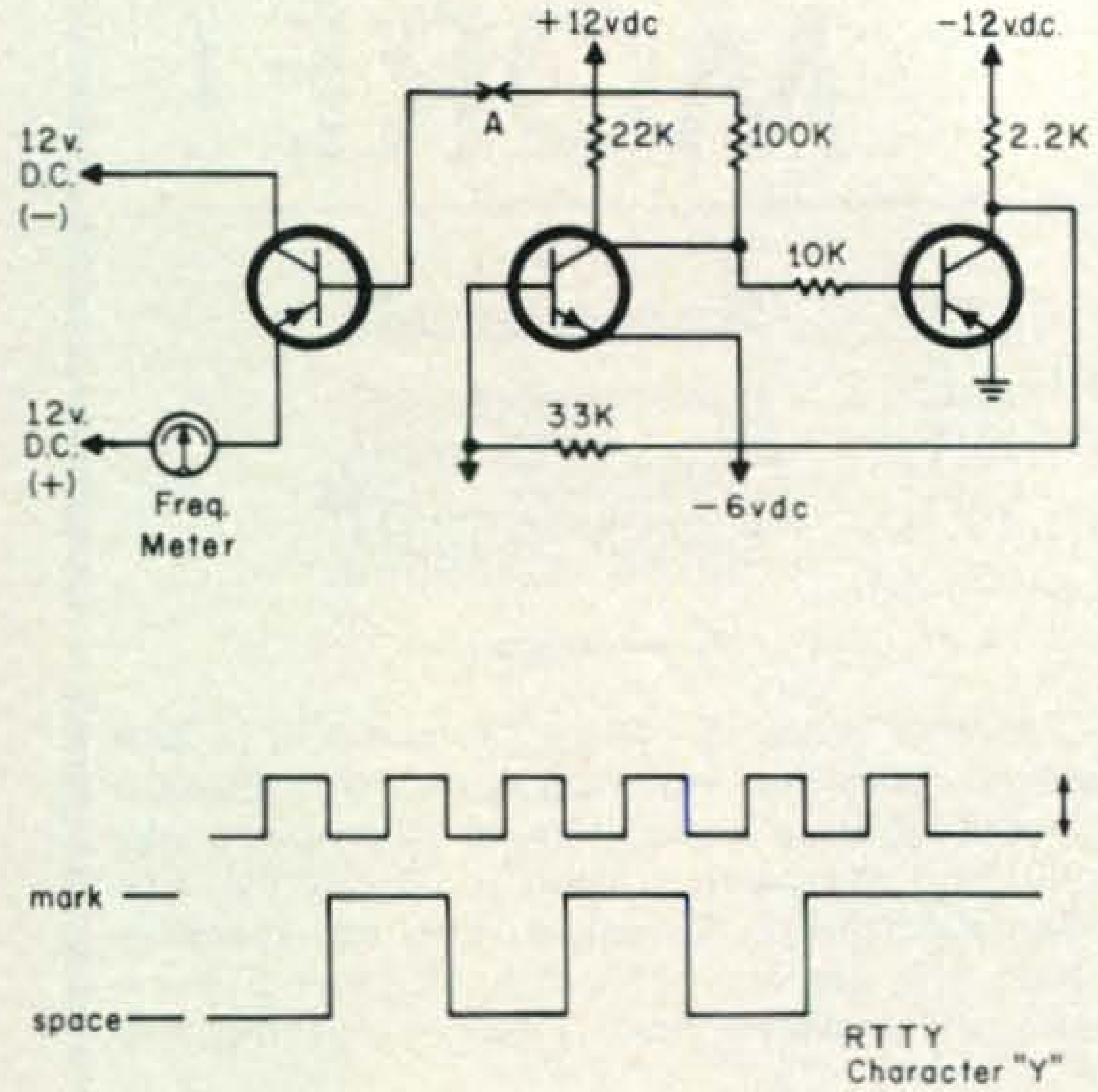

Fig. 1—The original driver circuit for the Rixon RTTY frequency meter.

to an RTTY loop. Well, I now can report that I have available the original circuit in which the Rixon speed meter was used, in the AN/UGC-1, a transistorized multiplex system. As Fig. 1 shows, a sine wave from the transmitting stop-start oscillator is applied to a "squaring amplifier" or slicer, to put out a square wave, and a driver, Q_{102} drives the meter from a 12 volt d.c. supply.

Complicating the application of the meter to a simple RTTY receiving loop is the fact that the UGC-1 system took the transmitting oscillator signal, *before any information was applied to it,* and *read* its "speed." Note that the timing diagram in fig. 1 *shows a complete square wave* for each segment of the 7.42 unit RTTY character. Normally a 60 w.p.m. RTTY signal is considered to be made up of 22 millisecond pulses, but the meter requires a square wave signal at the *Baud rate, i.e.* it indicates 60 w.p.m. (45.5 Baud) when it receives a 45.5 cycle per second signal. But steady "Y" characters run to only an effective speed of 22.7 360 degree cycles per second!

Now of course run-of-copy material will vary in apparent "speed" but the inertia of the reed-type meter ought to permit reading of a more-or-less average value. The trick is to show the meter a frequency double the apparent incoming speed. I suppose that a secondary oscillator could be designed to "follow" the "speed" of the loop square wave and double the frequency which would then be fed to the driver transistor.

I am not sure just how this might be done, on a practical basis, and I hereby solicit the assistance of my highly technical minded readership to come up with a solution.

Of course there are a number of other ways to read the speed of an unknown RTTY speed. One suggestion was to set up a large number of speeds in a stop-start oscillator and when you synchronized the unknown signal (presumably on a scope) you would read the stop-start oscillator's speed on your meter. This strikes me as being overly complex.

It might be simplest to take a distortion meter such as the Atlantic Research DMS-1, and fiddle with its speed dial until you found a point where the meter showed zero distortion. By reading the speed indicated, you presumably identify the speed of your signal. This will work with other distortion meters, but Atlantic Research tells me that it does not work on comparing-type distortion alarms which do not read speeds but only compare mark length with space length.

You could of course set up a calibrated triggered scope sweep adapter, which you read in Baud. After synchronizing the trace to give a stable character, you then read the speed on your sweep dial. This would be a very nice thing to have for reading all sorts of distortion. The commercial version of this type of thing is the Stelma DAC-V, a beautiful instrument. For a more technical discussion of the DAC-V display, RTTY enthusiasts should see *RTTY Magazine*, September, 1968, page 9.

Today there must be a simple ten-dollar way to set up a really useful RTTY scope adapter, but for reasons that escape me, there is not even a commercial unit for under four Kilobucks, containing of course, several thousand transistor circuits and platinum-plated knobs. I challenge SURPLUS SIDELIGHT readers to suggest a solution to this obvious need. Indeed, a good device would have obvious commercial possibilities, as my acquaintenances on commercial RTTY are just as much in need of an RTTY distortion display as are amateurs and RTTY s.w.ls. ■

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Propagation

Eastern Mediter-ranean & Middle East	07-09 (1)	07-08 (1) 08-10 (2) 10-11 (1)	22-00 (1) 00-03 (2) 03-07 (1) 07-10 (2) 10-14 (1) 14-16 (2) 16-18 (1)	18-21 (1)
West & Central Africa	08-09 (1) 09-11 (2) 11-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-08 (1) 08-11 (2) 11-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	05-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-21 (1) 00-03 (2)	18-22 (1)
East Africa	09-10 (1) 10-12 (2) 12-14 (1)	08-10 (1) 10-12 (2) 12-15 (3) 15-16 (2) 16-17 (1)	08-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-20 (1)	18-20 (1)
South Africa	08-10 (1) 10-12 (2) 12-14 (1)	07-09 (1) 09-12 (2) 12-15 (3) 15-16 (2) 16-17 (1)	07-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-19 (3) 19-20 (2) 20-21 (1) 00-02 (1)	18-20 (1)
Central & South Asia	17-19 (1)	07-10 (1) 16-17 (1) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-22 (1)	05-07 (1) 17-20 (1)
South-east Asia	09-11 (1) 14-15 (1) 15-17 (3) 17-18 (2) 18-19 (1)	08-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-18 (3) 18-19 (2) 19-21 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-14 (1) 18-19 (1) 19-21 (2) 21-22 (1)	03-08 (1) 04-06 (1)*
Far East	14-15 (1) 15-16 (2) 16-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	13-14 (1) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	02-04 (1) 07-08 (1) 08-11 (2) 11-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-20 (3) 20-21 (2) 21-22 (1)	00-01 (1) 01-03 (2) 03-06 (3) 06-08 (2) 08-10 (1) 02-08 (1)*
South Pacific & New Zealand	10-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-19 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	02-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-17 (1) 17-18 (2) 18-20 (3) 20-23 (4) 23-00 (3) 00-02 (2)	22-00 (1) 00-03 (2) 03-06 (3) 06-07 (2) 07-08 (1) 00-06 (1)*
Austral-asia	10-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-20 (1)	08-09 (1) 09-12 (3) 12-15 (2) 15-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	18-20 (1) 20-22 (2) 22-02 (1) 02-05 (2) 05-06 (1) 06-08 (2) 08-10 (4) 10-12 (2) 12-14 (1)	01-03 (1) 03-06 (2) 06-08 (1) 01-03 (1)*
Northern & Central South America	07-08 (1) 08-09 (2) 09-10 (3) 10-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (2) 07-09 (4) 09-13 (2) 13-15 (3) 15-19 (4) 19-20 (3) 20-00 (2) 00-06 (1)	17-18 (1) 18-19 (2) 19-23 (3) 23-03 (4) 03-04 (2) 04-05 (1) 19-20 (1)* 20-22 (2)* 22-00 (3)* 00-02 (2)* 02-04 (1)*
Brazil, Argentina, Chile & Uruguay	07-08 (1) 08-11 (2) 11-13 (3) 13-15 (4)	06-07 (1) 07-09 (2) 09-13 (1) 13-14 (2)	12-14 (1) 14-16 (2) 16-17 (3) 17-19 (4)	20-22 (1) 22-01 (2) 01-04 (1) 22-02 (1)*

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McMurdo Sound, Ant-arctica	Nil	06-09 (1) 14-16 (1) 16-19 (2) 19-21 (1)	16-18 (1) 18-20 (2) 20-00 (3) 00-04 (2) 04-06 (1) 06-08 (2) 08-10 (1)	23-05 (1)

Contest Calendar [*from page 99*]

FREQUENCIES: C. w. – 3560, 3760, 706 14060, 21060, 28060. A.m. – 3860, 723 14240, 21340, 28900. S.s.b.–3880, 396 7260, 7290, 14260, 21360, 21440, 2866 DX, s.s.b. & a.m. – 14175-14190, 2122 21250, 28400-28500. DX stations will indi cate where they are listening.

AWARDS: Certificates to the highest scorer in each state, province and continent. A min imum of 25 contacts must be logged for th state and province awards. There is a Troph for the "Top Banana" in the contest.

Log sheets are available from the OOT publication *Spark-Gap Times*. Mailing dead line for contest logs is March 15th, and the go to: Bob Robertson, W5BUK, 2609 Halse Avenue, New Orleans, Louisiana 70114.

By the time you will be reading this th Contest will be over, however at this writin we are looking forward to the two WW con test week-ends. All the advanced announce ments, in the weekly DX Bulletins, of th many planned phone contest expeditions, in dicate that we will probably have the bigges turn-out yet.

However, we are not too optomistic for th c.w. week-end. The big question mark, wha effect will the new frequency restriction (which go into effect November 22nd, the da before the contest) have on the activity i the USA. Especially on 80 and 40 where th DX has always crowded the lower 25 k of each band.

I predict that the returns for the phon contest will set a new record, but if we hol our own in the c.w. section we will be mor than satisfied. It will be interesting to se what happens.

Keep those logs coming fellows, but kee 'em neat and all scored. Remember, we hav almost 3000 to check, you only have 1, you own.

All the best to you and yours for th coming year, and may your Christmas Holi day be a very happy one.

73 for now, Frank W1WY

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VHF [*from page 95*]

ma. Higher current settings wil give you more gain, but usually at the expense of noise figure.

Antenna Measurements

Sorry that we did not get back to the subject of antenna measurement this month. Perhaps we will get back to it next month. Until then 73—Allen Katz, K2UYH. ■

CQ Review: HW-18 [*from page 28*]

The receiver section measured up to the following rated specifications: Sensitivity: 0.5 μv for at least a 10 db S+N/N ratio. Selectivity: 2.1 kc at 6 db down, 6 kc at 50 db. Image Rejection: 80 db I.F. Signal Rejection: 50 db. A. F. Response: 400-3000 c.p.s. A.F. power Output: 1 watt.

The transmitter carries a rating of 200 watts p.e.p. input (100 watts d.c.) for s.s.b., and 40 watts minimum carrier for compatible a.m. The p.e.p. s.s.b. output at rated input measured 80 watts. Low-level carrier output was 20 watts. Other tests came up to the following specifications: Overall Frequency Accuracy: To within .005%; Clarifier Range ±250 c.p.s. Unwanted-Sideband Suppression at 1 kc and Carrier Suppression: 45 db below peak output.

The rated ambient temperature range is +10 degrees to +110 degrees *F*. The size of the transceiver is 6¼"x12¼"x10" (H.W.D.) and it weighs 12 lbs.

The Model HW-18-1 (CAP) is priced at $119.95 (kit). A wired unit, the HWW-18-1 is available for $179.95. Prices include crystals for any *two* of the following channels: 4467.5, 4585, 4602.5, and 4630 kc. Additional crystals are $4.95 each.

The HW-18-2 (MARS) is priced at $109.95 (kit), less channel crystals, but with u.s.b. or l.s.b. carrier-osciliator crystal as specified. Channel crystals, priced at $4.95 each, are available as follows: 4451.5, 4518.5, 4558.5, 4581.5, 4591.5 and 4595 kc.

The HW-18-3 (160 meters) is priced at $109.95 (kit), less channel crystals. Crystals are available for the following frequencies: 1805, 1809, 1813, 1817 and 1821 kc. Price: $4.95 each.

A gimbal bracket for mobile installation is available for any of the models.

These are products of The Heath Company, Benton Harbor, Michigan 49022. ■

[2]It should be noted that the 1805 kc frequency is that used by W1AW for transmitting code

See page 122 for New Reader Service

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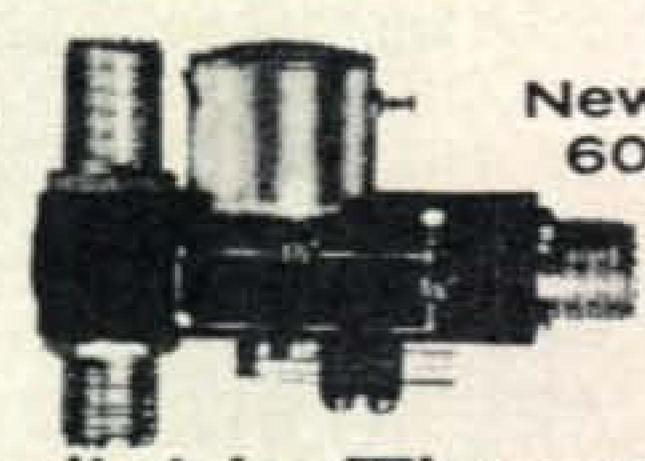

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See page 122 for New Reader Service

practice. Also, the listed frequencies are not permissible for use in many of the Western States. As of this writing, other crystals are not available from the Heath Company, so they must be obtained elsewhere. The HW-18-3 is designed to cover the 1800-2000 kc range, but if operation is desired at the upper end of the band, the low-level stages will have to be realigned, as might a change be required in the p.a. fixed capacitance for the plate circuit.

51J Improvements [*from page 69*]

anyway, as far as driving the slug racks goes.

When our 51J-2 was acquired, the tuning shaft was slightly bent, causing the dial to wobble and upsetting the linearity of the frequency readout. This is the shaft attached to the gear box. It extends some distance between its bearing on the gear box and the knob at the front of the panel where there is no bearing. As a consequence, any excessive lateral pressure on the knob tends to bend the shaft, which in our case may have been due to the use, by a former owner, of a crank type knob.

The first step was to secure a new shaft, but this had to be made to order at quite an expense and a long waiting period, so we got up our nerve, removed the shaft and straightened it ourselves. Fortunately, this required removal of only the front plate of the gear box, thus limiting the number of gears which had to be displaced or removed.

For anyone contemplating such a move, we suggest that the manual instructions be followed closely, particularly that relating to properly marking the gears and measuring a small loading spring, before removal. We neglected to mark one gear, so it took two evenings of study to figure out how the whole mess is supposed to function. Luckily, the right combination was made on the first attempt at reassembly!

In order to prevent the possibility of again damaging the tuning shaft, a panel bearing was installed as shown at fig. 7. The setup is now rugged and has a solid feel.

Conclusion

In conclusion, we'd like to again stress the fact that all the problems mentioned herein may not turn up in every case, but where they do so, the suggested changes described here, as well as those given in the references, will provide more useful and enjoyable operation with the 51J receivers. ■

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Continuous Motion TV

is given by Eq. (1) in Part I. The proper viewing distance is 750 times the average center-to-center spacing between elements. If this is combined with Eq. (1), we find that the proper viewing distance is approximately given by:

$$\text{Viewing Distance} = 375D\sqrt{\frac{F}{W}} \qquad (2)$$

where D is the picture diagonal (in the same units as the viewing distance), F is the frame frequency, and W is the bandwidth. ■

Vertical Antennas [*from page 63*]

then cover up one half of it with a plain sheet of paper, leaving only the configuration shown in Fig. 75. The teeth of this one can be supported by a catenary, with single point suspension for each tooth. This triangular tooth model is perhaps somewhat easier to rig than the one with trapezoidal teeth. It can be fed in the same manner as shown in fig. 71, with coaxial line with broken outer conductor acting as sections of a capacitor.

It is possible to build an array of antennas of this type by using one common center supporting pole for the catenaries, and extending the catenary cables for two, three or four of these antennas out in the desired directions of transmissions. Each one would have its own feed cable, and thus the station operator would have a choice of directions by switching antennas. In a case of this kind, the ground systems should be connected together where they intersect.

In addition to the references listed [64, 65], there are many others in the technical literature. Jasik [62] is an excellent source of reference listings on antennas of all types, including the log-periodics.

[*to be continued*]

[64] DuHamel, R. H. and Ore, F. R., "Logarithmically Periodic Antenna Designs," 1958 *IRE National Convention Record,* Part 1, p. 139-151.

[65] DuHamel, R. H. and Berry, D. G., "Logarithmically Periodic Antenna Arrays," 1958 *IRE WESCON Convention Record,* Part 1, p. 161-174.

Varactor Multiplier [*from page 19*]

One check was made in an effort to determine the high frequency limitations of using silicon rectifiers as varactors. Using the same circuit as shown in fig. 2, except for the coil sizes, 7 mc was run up to the six meter band in a single stage septupler. Indicated efficiency was over 30%, so the diodes can be expected to work well throughout the h.f. and lower v.h.f. spectrum. The biggest difficulty in such high order multiplying is rejection of undesired harmonics. If the test rig had been used for transmitting, it would have required a good, sharp bandpass filter in addition to the double-tuned output.

Otherwise, however, it worked fine, and this method shouldn't be overlooked as a quick and easy way of getting a few watts on six. That's all you need for local and f-layer skip work, and the latter is in season these days. Good hunting. ■

Addendum

The MS-10 heat sink comes with some holes already in it. Since none of them is large enough for our purposes, it will be necessary to ream one out (prererably a centrally-located one) in order to take the shank of the diode.

Since the line between exciter and multiplier is not flat, it may be found necessary to vary the padding capacitors and/or the input tank to facilitate matching to the exciter. This is a cut and try procedure.

Dual-Gate MOSFET [*from page 32*]

Summary

MOSFET's should definitely be considered by anyone who is in the process of building a transistorized preselector, v.h.f. converter, *etc*. Most likely, one will find these transistors will outperform and cost less than most simple junction transistors or FET's.

For those who enjoy historical notes, by the way, it is interesting to observe that the basic idea for the MOSFET was patented in the U.S. in 1930 by Julius E. Lilenfeld. He proposed a copper sulfide type construction which was sort of a cross between an NPN transistor and a MOSFET. Needless to say, his idea was never developed. ■

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FOR SALE: Clegg 22er with mike $125. Seneca $125. R45/ARRT RCVR, Tapetone 2 MTR. Converter both for $110. Heath tube tester TT-1a, expertly wired $135. All above in A1 condition with manuals SRI no shipping. Al Schnitzer, Box 36, High Bridge, N.J. 08829

FOR SALE: FSK Demodulators. Tu units. Filters. QRP units any band. Police, Fire converters. J-J Electronics, Communications Specialist, Canterbury, Conn.

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TRANSCEIVERS: S.S.B. AM. CW. Eico 753. 751 A.C. supply/speaker, console. 752 12 v. mobile supply. Excellent. All manuals, cables, etc. Must sell, going into service. Make offer, no reasonable offer refused. S. Allen, 1007 South Trenton Ave., Apt. 23, Pittsburg, Penn. 15221

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TX-62 $100. DX-100 w/RTTY FSK $75. 6N2, EICO 730, PWR SPLY, all for $120. R. H. Johnson, 505 South Elmwood, Waukegan, Illinois 60085.

TA-33 Jr. Bean $35. Heath 5" Scope $20. Viking 6N2 $80. Teletype Loop Supply $10. DX-100 with FSK. $75. R.H. Johnson, 505 So. Elmwood, Waukegan, Ill. 60085.

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FOR SALE: Polycomm PGz ZM XCVR. 117 V AC-12VDC. All original equipment included. Excellent $150.00. John Hoglund, 253-15 139 Ave., Rosedale, N.Y. 11422

FOR SALE: SB400, excellent condition $275. or make offer, S.A.S.E. Jim Minikel, WBGMQE, 517 E. Emerson Ave., Monterey Park, Calif. 91754

FOR SALE: Heathkit HW32 transceiver, HP23 AC supply, 100 KHz standard, $100. Bill Cunningham, 1510 Yardal Road, State College, Pa.

WANTED: 75-S3C, DR-50 with P/S in mint condition. Please state lowest price, will answer all quotes. W. Martin, Box 1304, Hq Fifth Air Force, APO San Francisco, 96525

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FOR SALE: Motorola FMR-13V receiver 30 to 45 mc with i.f. crystal. 12 volts. Ralph Villers, P.O. Box 1, Steubenville, Ohio 43952

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FOR SALE: Poly Comm 6 VHF Transceiver, Good condition. $150. Wib Cartwright, WA8PJZ, 270 Madeira Ave., Chillicother, Ohio 45601

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FOR SALE: Zeus and Interceptor with 2 antenna relays. New spare 4-150 and 2-811's. Mint Cond. $700.00. H. C. McKenzie, WA9LEA, 7101 Barth Ave., Indianapolis, Ind. 46227.

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FOR SALE: Drake R4 $270.00 Monitoradio M-160 $65.00. Mite teleprinter $550.00, Unimat $85.00. All perfect. Tom Perera, K2DCY, 410 Riverside Drive, New York, N.Y. 10025

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FOR SALE: Eico 723 CW Xmtr/Xtals—Cost $95.00, sell for $35.00. Want—20/10 meter beams, rotator, receiver pre-amp. B. Gross, 36 Gerhard Rd., Plainview, N.Y. 11803

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MANUALS: TS-323/UR, TS-173/UR, TDA-2, r-274/FRR, BC-638-A, $5.00 each. S. Gncabo, 4905 Ronne Drive, Washington, D.C. 20021

FOR SALE: 4½" square hickok, Simpson, weston panel meters assorted reanges $6. each postpaid. Send stamp for list. G. Samofsky, 201 Eastern Pky., Brooklyn, N.Y. 11238

FOR SALE: James 1470 Mobile/Home P/S 500/300 VDC, New $30. Hy-Gain 402-B 40 Meter Beam $40. Want: SB-610 monitor and Bird #43 Wattmeter. K6KZT W. J. Davis, 4434 Josie Ave., Lakewood, Mi. 49091

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FOR SALE: Heath Mobile Pair. MR-1 and MT-1. $60. for the pair or $30 each. F. McJannet, 115527 Evanston No., Seattle, Wash. 98133

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VHF-UHF AMATEURS: Want parks converter for 432 and 144 MHz. All offers answered. Need Nov. '62 and June '63 issues of VHF Horizons magazines. Need Dec. '61 and Feb. '62 issues of VHF Amateur magazine. D. R. Etheredge, 12040 Redbank St., Sun Valley, Calif. 91352

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