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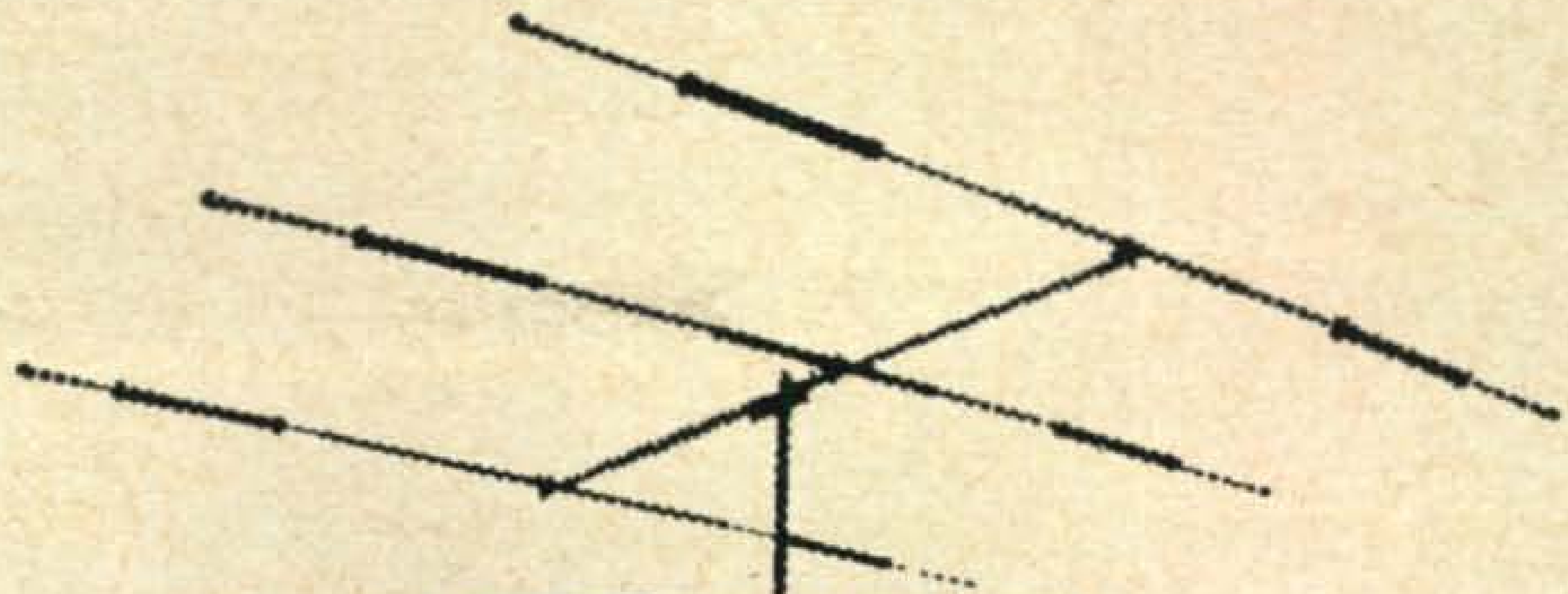
CQ

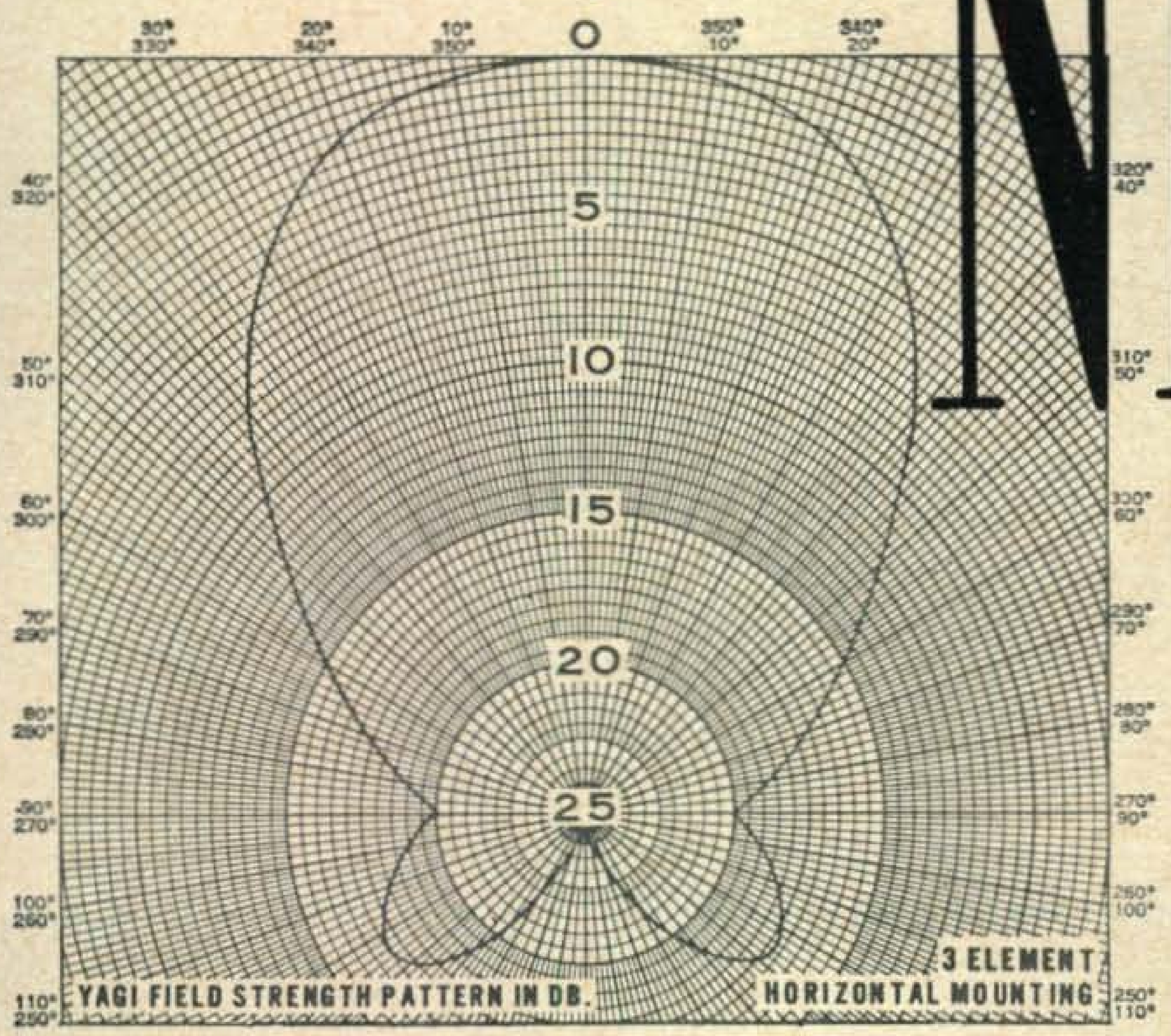
January 1967

75¢

HAPPY NEW YEAR

The Radio Amateur's Journal





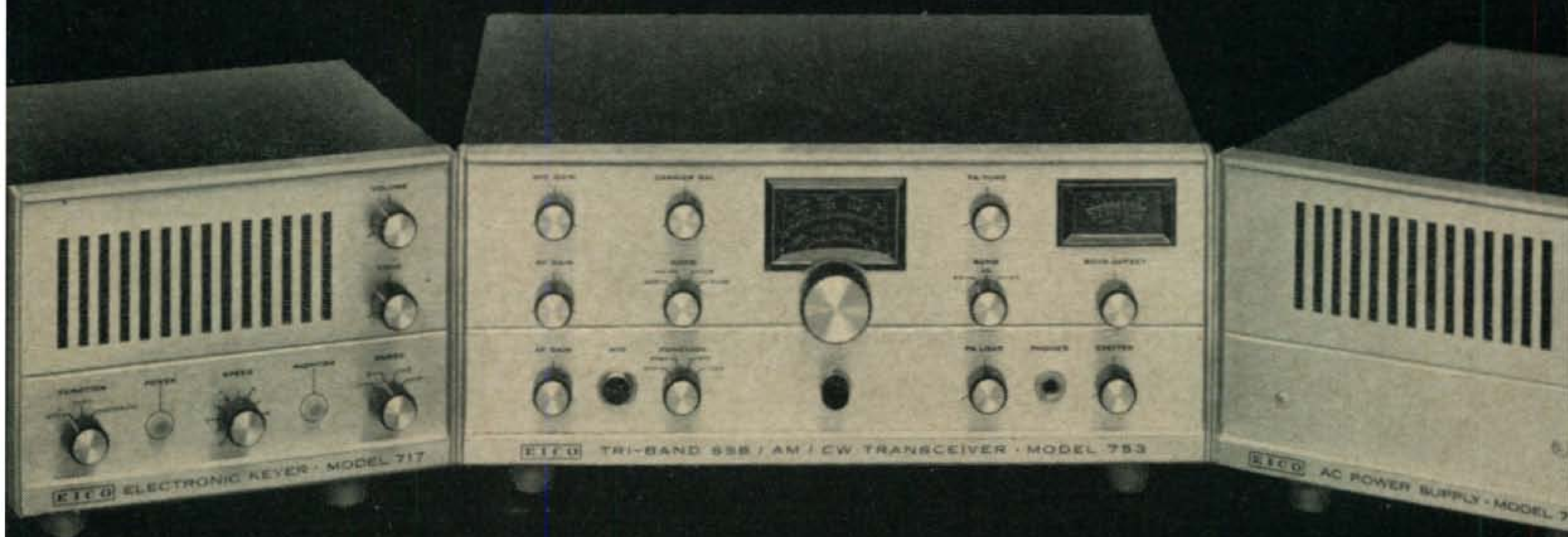
For further information, check number 6, on page 110

A 3-band SSB Transceiver Kit for $189.95

An Electronic Keyer Kit for $49.95

A Solid-State AC Power Supply Kit for $79.95

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



Who else but EICO

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

The EICO 753 is a complete 3-band transceiver, offering SSB/AM/CW operation with conservatively rated 200 watts PEP on all modes (rated for maximum efficiency rather than maximum possible input power). A new Silicon Solid State VFO provides full coverage of the 80, 40, and 20 meter bands. Assembly is made faster and easier by VFO and IF circuit boards, plus pre-assembled crystal lattice filter. Rigid construction, compact size, and superb styling make this rig equally suited for mobile and fixed station use. The EICO 753 is at your dealer now, in kit form and factory-wired.

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

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

SPECIFICATIONS: Output Voltages: 750 volts DC at 300ma, 250 volts DC at 170ma — 100 volts DC at 5ma, 12.6 volts AC at 4 amps. INPUT VOLTAGE: 117VAC.

EICO Model 752 Solid State Mobile Power Supply: (Not Shown). For use with 12 volt positive or negative ground systems. Full protected against polarity reversal or overload. Output voltages identical to Model 751. Input voltage 11-14 volts DC.
Kit $79.95 Wired $109.95

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

FEATURES: Output Contacts — 25 volt-ampere dry-reed SPST relay. Built-in adjustable tone and volume oscillator with a 3 x 5 inch speaker for monitoring. Can be used as a code practice oscillator.
Kit $49.95 Wired $69.95

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

For further information, check number 19, on page 110

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The Radio Amateur's Journal

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DEPARTMENTS

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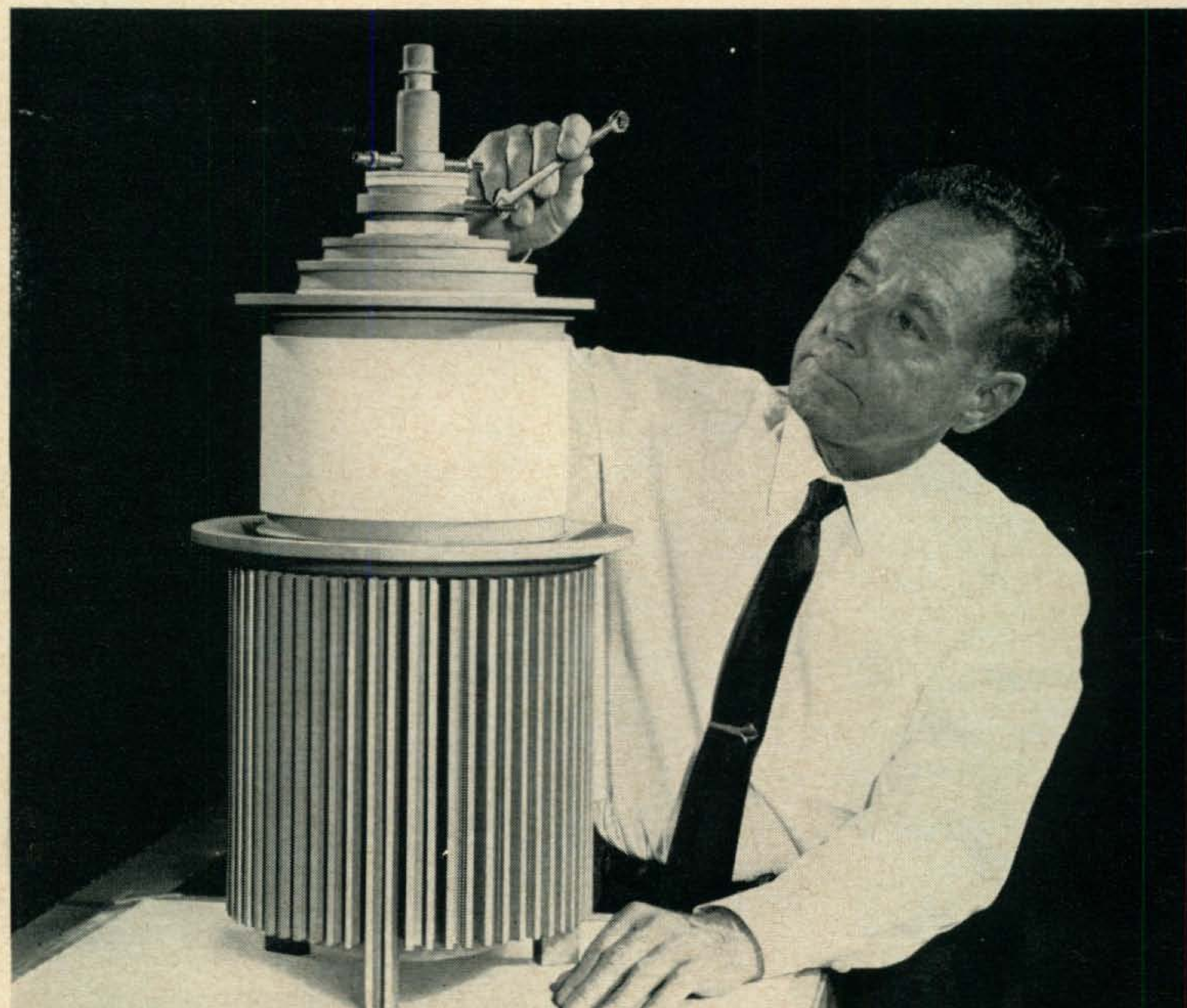

For further information, check number 3, on page 110

ZERO BIAS

ASIDE perhaps from our hassle with the DX world early last year no series of editorials has brought as much mail to *CQ* as has our recent attempt to breach the gap between Amateur Radio and the CB operator. Nothing could please us more. It indicates that many amateurs have at last allowed themselves the luxury of an open mind on the subject.

The result has been that many fellows have actually come to the conclusion that thousands of operators now dead-ended on the 11-meter band could become hams instead to the benefit of both services. More important, efforts *are* being made by individuals and clubs to invite CB operators to witness Amateur Radio in action. The results have been moderately gratifying. Let's hope we have more of the same.

To aid those amateurs in their campaign to recruit and guide new hams from the CB ranks, *CQ* is preparing a small booklet, supported by several key amateur manufacturers, which will attempt to explain the nature of the hobby to the uninitiated. The booklet, *CQ Junior* #2, is the second of a planned series of beginners aids, suitable for distribution by clubs to newcomers. The first *CQ Junior* was intended to help a particular segment of the newcomers to amateur radio: the Novice who is bewildered by the vast array of equipment offered to him, and the dozens of unusual and highly-touted antennas described in the ham magazines and handbooks. The 24-page booklet, published last September, is available to clubs and individuals for only a postage and handling charge of 10¢ per copy.

This being our first attempt at preparing educational material of this type, there is surely some room for improvement, but it does represent a sincere effort, on the part of *CQ*, and the several supporting advertisers, to do something tangible and constructive to keep Amateur Radio growing. Write for a copy of *CQ Junior* #1.

The second *CQ Junior* will be a layman's-level description of what Amateur Radio is, what amateurs can do, how the hobby came to be, and how a fellow can go about becoming an amateur. Special emphasis will be placed on the tremendous opportunity Amateur Radio offers to the CBer with a desire to experiment and communicate.

The *CQ Junior* project was *not* intended to be a profit-making venture, and it certainly hasn't voided our intentions. The booklets are expensively prepared on fine-quality coated stock with a full-color front cover. The size is 6″ × 9″. However, despite the financial liability involved, we, and *CQ Junior's* advertisers, feel that it's about time someone stopped *talking* about promoting Amateur Radio and began *promoting* it! That's what we're doing.

If you really feel strongly about the need for a steady flow of new blood into Amateur Radio, you should consider financially supporting the *CQ Junior* project, or at the very least, taking advantage it's financial supporters to expand and invigorate our hobby. Look for the announcement of *CQ Junior* #2, shortly.

Off On A Tangent

Got to thinking the other day about how the Amateur Radio business has changed. Time was when a newcomer could get started on the air for under $100 in equipment. Inflation being what it is, this quickly grew to around $200 minimum for an all-commercial rig, still within the financial capabilities of most newcomers. But look around you now. Taking the ads in *CQ* as an example, the amateur is led to believe that only by spending a fortune could he work out worth a darn? Only six years ago five of the biggest receiver manufacturers offered a good receiver for the beginner for $150 or less. Five of the biggest transmitter manufacturers offered a good Novice transmitter kit for $100 or less. Heck, they didn't just *offer* them, they *pushed* them in their advertising—and they sold them like crazy and made a pot full of money doing it. And two dozen other small-scale businesses did likewise.

Ah, but we've made progress, haven't we. Now the casual reader of a ham magazine can't help but get the idea that for less than a half a grand, he couldn't possibly get out of his backyard. And he's sold beautifully sophisticated stations that cost five-hundred bucks and last forever and now we've got ten, maybe eleven major equipment manufacturers in the business, and all but three or four of them on the verge of losing their shirts in it. I don't know about you, but *I* think the equipment people made a wrong turn somewhere back down the road a half dozen or so years ago. Is it too late to turn around?

73, Dick, K2MGA

OUR READERS SAY

The CB'ers Among Us

Editor, *CQ:*

I have been following with a great deal of interest your editorials and letters to the editor on the subject of CBers versus hams. From my standpoint as a CBer, you are doing a commendable job of facing this subject squarely while ducking brickbats from both directions.

It doesn't seem logical to lower the gates to Hamdom for a CBer. He has a built-in start and advantage over the uninitiated in that he has had exposure to some of the regulations, procedures, etc. However, I believe there are many CBers who should not, for various reasons, become ham license holders. Too many of us abuse regulations and do not understand the sacred division of the frequency spectrum.

If I am able to make the grade, it will be because of my love of radio and the desire to make new friends, not because I feel CB radio is now too small for me or that it should be frowned upon.

R. Perry Mercurio, KMA-9784
Kingfield, Maine

Editor, *CQ:*

Reference your remarks in August ZERO BIAS, the idea of club to club contact between hams and CBers is good, but does it go far enough? Nothing can be compared to an evening spent in the comfort of the home shack where the really "heavy artillery" is.

Put on a pot of coffee and let your prospect talk to the locals. Check into a traffic net, or work a little DX to show him several sides of the hobby, then take him to a meeting as your personal guest, introduce him around, let him join in the conversation and answer his questions if he's sincerely interested, he'll be back for more.

On another subject, an "arm chair warrior" watching his TV set stated in LETTERS "nobody uses c.w. in Viet Nam" well, speaking from the slightly better vantage point of a ground radio op here in Viet Nam, c.w. is definitely *not* dead, and is used by both ARVN and Allied personnel about on a par with s.s.b. and RTTY. Keep up the good work Dick es 73 to all.

A/1C A. D. Cook, K2MPE
Quang Tri, Viet Nam

Editor, *CQ:*

Re all comments on CB, I think too many—ham and CBer alike—are looking at this from the wrong angle. We all seem to place the two services in the same category when making comparisons. If CB was used as intended, we could compare it better with the telephone. In fact, it is something like the old country phone line with many parties, who all listened in and sometimes made comments.

It is that CBer who didn't think he could pass the amateur exam and so settled for CB that has made us compare our services. If everyone on CB used it as intended, there would be no friction between CB and ham.

I have taught a code and theory class for several years and have had CBers in class. One thing that stops most of them from completing the course and getting a ham ticket is that CB is a husband and wife affair and most of the women don't really care to be hams. Therefore, both drop out. It appears there may be a need for a CB ham-type band for couples.

In the meantime, we are still trying to sell all interested radio-minded people on amateur radio. The reason we get less now may be due to the fact that there is less need for this activity in our times, where there are so many things to do and time is at a premium for some people.

You can't push people into learning if they don't really want to learn and if they want it they will come to you. We must advertise that we are ready to teach and then be willing to help when they are ready . . . from letters seen in many publications there are many who don't know where to look for help, so radio clubs and groups need to let the public know they are there and ready and willing to help. This, I believe, is the best way to swell our ranks with interested people, CBer or otherwise.

Clayton W. Dewey, K8CKD
Ludington, Michigan

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

The Cult

Editor, *CQ:*

You know, I get a kick out of reading the letters to you each month. The private struggles, battles and indignities that they reveal, if viewed by an outsider, would tend to make him think that our entire lives are devoted to ham radio.

That first paragraph was phrased as it was to make my point. Did you notice that I used the word *outsider?* It should have been noticed, because if it wasn't, then it serves as a good argument for this line of thinking: when a person begins at the hobby of ham radio, he is actually joining a select group of fanatics who devote their lives to the "betterment" of that sect. When you think about it, it's sort of ridiculous. The ham begins to value the "friendships" on the air more than his personal relations with people who live around him. They, of course, enjoy talking to another person on the air, but they read his name in Silent Keys and say, "Gosh, I used to talk to him." No grief. Just the feeling that the group has lost a faithful member.

I think it is bad for a man to devote most of his social life "talking" (which means exchanging RST's, QTH's, how-do-you-do's and other little goodies) to a voice from heavens knows where. I don't, by any means, want to downgrade the hobby, but just to mention the effect of putting too much time and emphasis on it. A man needs to have something more than those intangible acquaintances. I hate to see someone become a social ingrate. Let's put ham radio in its proper place.

Mark Hopkins, WB2JWS
Sparta, New Jersey

Kudos

Editor, *CQ:*

It is not often that credit is given when it is due and when one considers the amount of fiddling detail such as picture captions, footnotes, small advertisements, schematic diagrams to be checked, etc., etc., involved in publishing a magazine containing over a hundred pages, one boggles with stupefied admiration for the way in which, the magical way indeed in which each month's issue of *CQ* thuds into one's letterbox.

Then there is the business of balancing the preferences of the multitude of hams some of whom hate DX listings and some who read little else. Some who inhabit 2 meters day and night and some who never heard a dead band. Some who make even their own tubes and some who can't take a knob off. Some who pride themselves on a 30 w.p.m. bug and some who think a bug is something you squirt an aerosol at. Some who use the magazine for stopping their old typewriter wobbling and some who reverently bind each issue in a gold stamped leather binding case.

How does a group of human beings involved in all this aforementioned detail work manage to keep its head and present a balanced book?

We, the readers, can only guess with or without authority. For if we are in the publishing business ourselves then our sympathy is 100%, (and of course our criticism can be just as great, if justified). (*Cont. on P.* 99).

Announcements

Gary, Indiana

The 14th annual banquet of the Lake County Amateur Radio Club, Inc., will be held at Teibel's Restaurant, located at U.S. Highway 30 & 41 (Schererville, Ind., near Gary) at 6:30 P.M. CST, Feb. 11, 1967. Entertainment, speakers, prizes. Tickets are $4.00 each from Herb Brier, W9EGQ, 385 Johnson St., Gary, Indiana, 46402.

Brooklyn, N.Y.

The Amateur Radio Club of Canarsie was recently formed with Morty Libowitz, K2BDQ as President. The club meets the first and third Fridays of each month at the Isaac Bildersee J.H.S. The club is looking for members. All those who are interested can contact Fred Froewiss, WB2PHT, 1512 E. 94th St., Bklyn, N.Y., 11236.

Pointe A Pitre, Guadeloupe

Several hams were forced to go QRT because of the damage done by hurricane "Ines" this past Sept. The Radio Club of Guadeloupe is requesting parts and components which could be used to repair or rebuild the damaged stations. They will distribute whatever is donated. Send what you can to The Radio Club of Guadeloupe, P.O. Box 387, Pointe A Pitre, Guadeloupe.

18th Annual YL-OM Contest

Time: Phone–Sat. Feb. 25, 1967, 1300 EST (1800 GMT) Sun. Feb. 26, 1967, 1300 EST (1800 GMT)
CW–Sat. Mar. 11, 1967, 1300 EST (1800 GMT)
Sun. Mar. 12, 1967, 1300 EST (1800 GMT)

Eligibility: All licensed OM, YL and XYL operators throughout the world are invited to participate.

Operation: All bands may be used. Cross band operation is not permitted.

Procedure: OMs call "CQ YL." YLs call "CQ OM."

Exchange: QSO number, RS or RST report, ARRL section or country. Entries in log should show band worked at the time of contact, time, date, transmitter and power. (ARRL Section list for SASE to V.P.)

Scoring: (a) Phone and CW contacts will be scored as separate contests; submit separate logs.
(b) One point is earned for each station worked, YL to OM or OM to YL. A station may be contacted no more than once in each contest for credit.
(c) Multiply the number of QSOs by the number of different ARRL Sections and Countries worked.
(d) Contestants running 150 watts input or less at all times may multiply the results of (c) by 1.25 (low power multiplier).
(e) SSB contestants running 300 watts P.E.P. or less at all times may multiply the results of (c) by 1.25 (flow power multiplier).

Awards: 1st place phone: YL–Cup OM–Cup
1st place CW: YL–Cup OM–Cup
The winner of the phone cup is also eligible for the CW cup. Certificates will be awarded to high place CW and phone winners in each ARRL District and Country.

Logs: Copies of all phone and CW logs, showing claimed scores and signed by the operator must be postmarked no later than Mar. 20, 1967, and received no later than Apr. 10, 1967 or they will be disqualified. Please file separate logs for each section of the contest. NO LOGS WILL BE RETURNED. BE SURE IT IS A LEGIBLE COPY OF YOUR LOG. Send copies of logs to YLRL Vice President Marte Wessel, KØEPE, P.O. Box 756, Liberal, Kansas 67901.
Note the change in time of the contest–24-hour periods only to give all areas one daylight and one nighttime operating period.

◀ For further information, check number 15, on Page 110

THE RECEIVER THAT PERFORMS THE WAY *YOU EXPECT A RECEIVER TO PERFORM*

FEATURES:

- **Complete ham-band coverage 80-10 meters and portion of 6 meters**
- **Standard-equipment 9.5-10.5 Mc band provides WWV and 31 meter SWL band**
- **Three-position selectivity for optimum fidelity and QRM rejection**
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- **Rugged, stable extruded aluminum chassis for extreme stability; textured grey metal cabinet; FULLY GUARANTEED**

THE DAVCO DR-30

Get the receiver that does the job! Feature for feature the DR-30 is your best buy.

HERE'S WHY:

• All solid-state featuring Field-Effect transistors in RF stages • Most compact receiver on the market today but big enough to do the job • Makes overloading and cross-modulation a thing of the past • Unbelievable sensitivity — really pulls in the weak ones • Contains all of the features you want at a price that's right •

All of the advanced capabilities ever wanted in a receiver are now available at a price within the range of every serious amateur. The all-transistorized Davco DR-30 is a compact (4"H X 7⅛" W X 6"D) amateur-engineered receiver designed to provide exceptional performance under extreme environmental operating conditions. Sensitivity you won't believe, superior image rejection and extreme freedom from cross-modulation and overloading on strong signals are only a few of the reasons why the DR-30 is the receiver that does the job! Ask the ham who is using one now, check the many features included at no extra cost and you'll discover why the Davco DR-30 should also be your receiver. Many professional and commercial users have already discovered for themselves.

DAVCO DR-30 $389.50

DAVCO

For further information and illustrated brochure, write:

DAVCO ELECTRONICS, INC.
P.O. Box 2677, 2024 S. Monroe St.,
Tallahassee, Florida 32304

For further information, check number 4, on page 110

For further information, check number 16, on page 110

Feenix, Ariz.

Deer Hon. Ed:

I not knowing when Scratchi being so upset. In fackly, are downrite mad and confused. Mad on acct. not getting satisfackshun from your Hon. Mag. and confused on acct. not knowing what going on.

Here it goes. Are starting at the beginning and giving you one last chance, Hon. Ed., so listening carefooly.

As you recalling, I riting you last month and asking you if maybe you thinking I QSO'ing Flying Sawser or maybe a Computer. Are buleeving you riting me back reel post hasty on acct. of erth-shattering thing I are doing.

So, I keep watching Hon. Male Box every day. For few days nothing, then one day getting postcard from Hon. Mag. saying you have reseeving my manuscript and are sorry you cannot using it. It signed "Hon. Seek-You Magazine."

I thinking this very strange, as riting letter to getting answer, not manuscripting anything. So, reel quick-like I riting you a letter, Hon. Ed., explaneing how all I wanting is answer to my first letter. What happening next? Couple days later getting airmale postcard from your Hon. Rag.

You should seeing this postcard. Have more numbers and letters on it than FCC license applikayshun form. But, all it saying are that my subscripshun to Hon. Seek-You are expiring and I should sending more bux.

At this point I beginning to think that you not paying attenshun to your male, Hon. Ed., but I are still holding temper and again riting letter back, saying that subscripshun not expiring, as having hole year to run. Even putting on postscripty asking how much are Hon. Lifetime Subscripshun.

In no time are getting back letter from your Hon. Rag. At least I thinking it are letter until I opening it. It starting off like this: "Deer 3800001000300584930SCR970JAN0047." Next it saying Hon. Publishing Co. thanking me for order and will I sending the 6,000 bux I owing in ten days.

Now Scratchi are beginning to get a little irritated. Not that are worried about 6,000 bux, but more I riting less I finding out and more monies I owing. Desiding have to calling you on landline and having heart to heart talk.

Picking up fone, dialing all way cross country, heering one ring, then nice femalely voice saying "Hon. Seek-You Magazine. This is a recording. I'm sorry, but nobuddy in office now, but if you leeving name, somebuddy will calling you. After the bell you having sixty seconds to leeving message."

Well, Hon. Ed., I hoping no female heering what I saying to you in that sixty seconds. Matter of fackly, maybe it burning up tape when trying to record message. At leest, nobuddy calling me back.

As if that not bad enuf, today getting another letter saying my 6,000 bux are overdew and if not paying, my subscripshun being cancelled. That are last straw. I giving you last chance to answering this letter.

I not owing 6,000 bux. If maybe lifetime subscripshun are 60 bux, I willing to paying that. Pleese answer.

Note: If you not answering, I telling everybuddy I talking to on air that Hon. Ed. of Seek-You are not human being, but a computer. Yes indeedy, Scratchi are thinking now for some time that there are no Hon. Ed.—just a big computer sitting there in office. A reel honest-to-goodness 1/c computer.

So, answering or else. If you wanting to prove you reel human being, sending pickshure of Hon. Self. And, it better not showing any pilot lights or knobs or switches.

Respectively yours,
Hashafisti Scratchi

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3. At the top of the correspondence side (when placed horizontally) write a date (month and year only) when you want the card mailed.
4. When this month arrives, the card will be mailed.

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

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Lake Drive, Cape St. Clair
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A 2 KILOWATT 3-400Z LINEAR FOR SIX METERS

BY WILLIAM I. ORR, *W6SAI

The Six Meter DX operator literally twitches in anticipation as he watches the sunspot cycle slowly and inexorably rise from the 1964 low. Will the sunspot count rise high enough to permit the wild DX era of 1958 to be repeated—the era when international 50 mc DX was relatively commonplace? Or will the peak of the forthcoming cycle fall short of the last record-breaking maximum? At this stage of the cycle, no one can be sure of the coming events, and the F_2 propagation history for the future of the six meter band remains a tantalizing speculation.

Even so, other forms of long distance propagation lurk just around the corner of this fascinating band, and the avid six meter DX enthusiast cannot afford to relax, as propagation surprises await the operator who has the equipment, antennas, and "know-how" to fully exploit the interesting possibilities that abound in "Channel One."

The trend to sideband, while slower than on the d.c. bands, seems to be taking place at an accelerated rate on six meters. The advantages of s.s.b. which are apparent on lower frequencies apply equally well to six meters. It is the writer's opinion that the use of a.m. on six meters will gradually be eclipsed by s.s.b. during the forthcoming ascendency of the sunspot cycle. In support of six meter s.s.b. and in anticipation of the forthcoming DX seasons on six meters, this article is presented. Let's go six!

S.S.B. exciters and linear amplifiers are becoming commonplace on six meters. This amateur band, existing in the twilight area between h.f. and v.h.f., exhibiting the characteristics of both, poses some unique problems in the design of suitable transmitting equipment. While v.h.f. construction techniques apply to this band, their unqualified use is somewhat limited as cavities and tuned lines are just too large to be used comfortably at 50 megacycles. On the other hand, employment of conventional h.f. circuit techniques may be "asking for trouble" on this quasi-v.h.f. band. Conventional h.f. components and techniques often turn out to be cranky troublemakers at six meters, bypass capacitors resembling blocks of wood, tank coils overheating and melting to a pasty blob, tubes seemingly difficult to drive and conservative circuitry exhibiting an aggravating degree of instability. Parasitic oscillations race through proven circuits and, if proper design techniques are not used by the would-be six meter enthusiast, he is apt to become discouraged and call it a day, returning to the more serene pastures below 10 meters. In other words, he is forced to "drop the fiddle and the bow: take up the shovel and the hoe."

*Manager, Amateur Service Dept., Eimac Division of Varian, San Carlos, California.

In no area of the amateur radio spectrum is circuit *finesse* demanded more than in the design of v.h.f. s.s.b. equipment wherein the requirements of amplifier linearity are combined with the problems of circuit stability. It would be fatuous to assume that this combination of problems does not exist at six meters.

This article describes the "case history" of conversion of a 3-30 mc h.f. linear amplifier to six meter operation and, in addition, points out some of the circuit problems that were overcome in the conversion of "conventional circuitry" to quasi-v.h.f. operation. While modification of a specific amplifier package is shown, the discussion applies equally well to similar gear, or to construction of six meter amplifiers in general, and grounded grid amplifiers in particular.

The Grounded Grid Linear Amplifier

The grounded grid amplifier has attained unprecedented popularity for s.s.b. linear service in the high frequency amateur bands. As the name implies, the circuit is one in which the grid of the amplifier tube is at r.f. ground potential and the drive signal is applied between cathode and grid, either element being at the necessary d.c. bias potential. Another (more accurate) name for the circuit is *cathode driven*, as the term "grounded grid" implies the grid is actually grounded to both r.f. and d.c. potentials. This may not be the case when d.c. bias is required, or if r.f. feedback is introduced in the amplifier to enhance the intermodulation distortion figure.

A simplified schematic of a typical h.f. grounded grid amplifier is shown in fig. 1. The circuit possesses definite advantages over the grid-driven triode and tetrode circuits. For example, neutralization of the grounded grid circuit is either not required (depending upon the frequency of operation) or, if required, is simply added and easily adjusted. An economy of circuitry is achieved by the use of high-mu triodes that do not require costly screen and bias power supplies. The drive power of the grounded grid stage, moreover, is compatible with the power output of today's s.s.b. transmitters and transceivers and—best of all—a portion of the drive power shows up as "free" power in the output of the grounded grid stage.

In a conventional grounded grid amplifier, such as illustrated, the grid element of the tube is at r.f. ground potential and acts as a shield between the plate circuit and the input circuit. A careful observer will note that this configuration is similar to that of an oscillator and might suspect that the ground grid amplifier will perform admirably as an oscillator if the shielding action of the grid is insufficient to prevent undue feedback of energy from the plate to the cathode circuit. This suspicion is well founded, for this is exactly what happens in the upper reaches of the h.f. spectrum with many grounded grid amplifiers where feedback paths are difficult to control.

While the grounded grid stage is not neutralized in the true sense of the word, the degree of internal feedback through the grid structure of the tube at the lower frequencies is insufficient to permit oscillation to take place. Even so, while the amplifier seems stable, it may still be highly regenerative and, as the frequency of operation is raised, the shielding action of the grid will tend to deteriorate until stage oscillation takes place. This deterioration of intra-stage isolation is primarily due to decreasing cathode-to-plate reactance as the operating frequency rises, and also because of stray electro-magnetic coupling through the interstices in the grid structure itself. In either event, the intra-stage feedback through the grid circuit becomes of increasing importance as the frequency of operation of the stage is raised until, at some critical frequency, the isolation of the grid structure is insufficient to prevent the amplifier from oscillating at a frequency determined by the plate and cathode tuned circuits. In addition, if additional intra-stage coupling exists around the tube, by virtue of inductive or capacitive coupling between input and output circuits, it is possible for the feedback path to be enhanced and oscillation might possibly occur at some lower frequency than normally estimated.

After paying due attention to external feedback paths, oscillation and instability in a grounded grid amplifier may be suppressed by the use of a suitable neutralizing circuit that feeds energy back from the plate to the input circuit so that it is out of phase with the r.f. energy fed back through the grid structure of the tube. A satisfactory neutralizing circuit for a grounded grid amplifier is shown in fig. 2. The

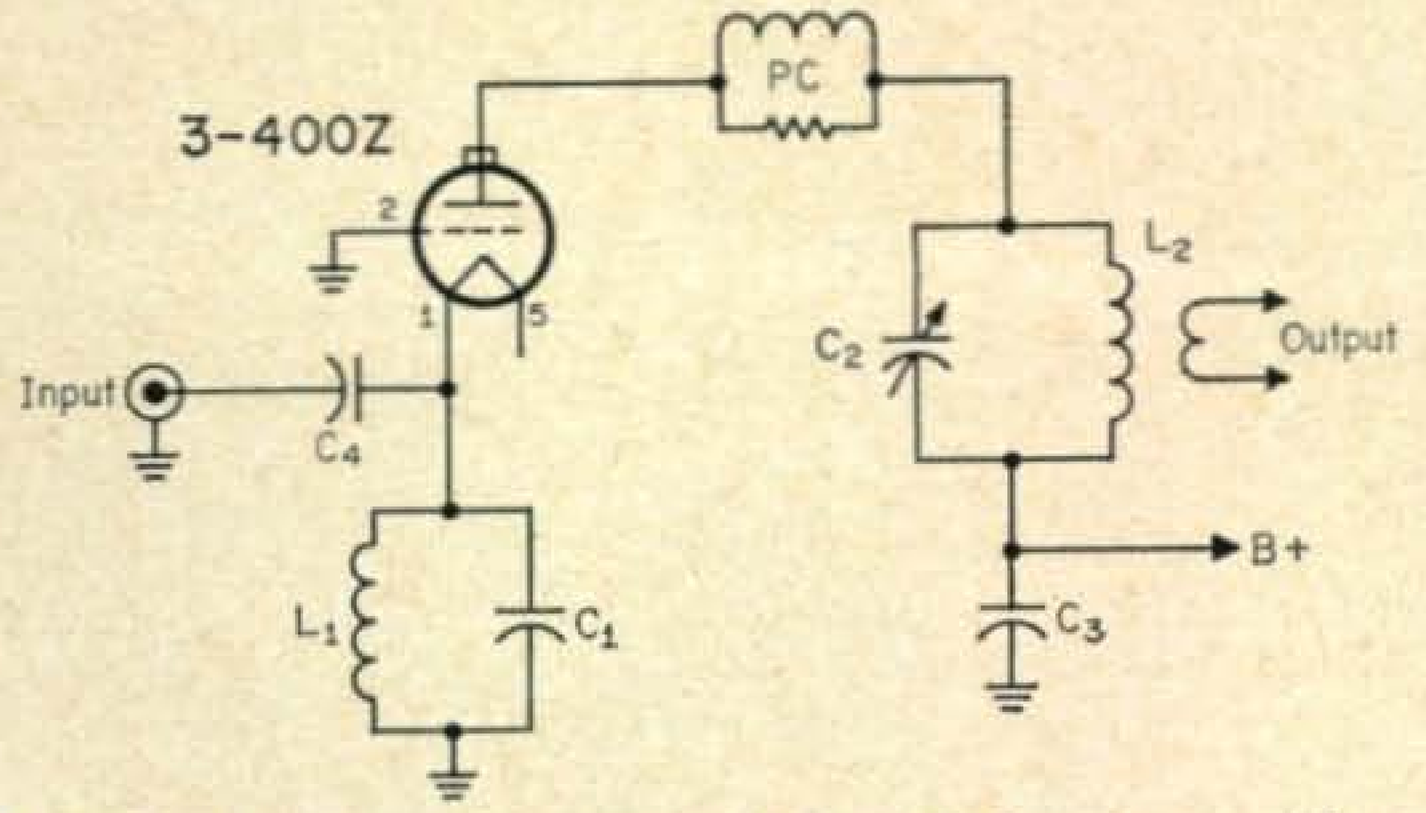


Fig. 1—Circuit of a grounded grid linear amplifier. The input signal is applied to a tuned cathode circuit, L_1, C_1. The circuit is adjusted to resonance with C_1 value of approximately 20 mmf per meter of wavelength (*i.e.*: for 20 meters, C_1 is about 400 mmf). Coupling capacitor C_4 and tuning capacitor C_1 should be able to stand circulating r.f. currents that exist in this circuit. The use of 1250 volt fixed mica capacitors is recommended. A value of 0.001 mf for C_4 is satisfactory for all bands between 80 and 6 meters. Parasitic suppressor PC is made of a noninductive composition resistor placed across a small inductance in the plate lead. For six meters, the inductance consists of a section of the plate strap material (see parts list). If the inductor is too large, the resistor will run hot.

neutralizing coil is connected in such a way as to "buck" the feedthrough voltage and neutralization may be accomplished by adjustment of the neutralizing capacitor or the coupling between the neutralizing coil and the cathode coil.

The Prototype Six Meter Amplifier

When the experimenter "designs from scratch" all the exotic v.h.f. circuit techniques may be employed as desired. However, when an existing design is modified, the builder may be restricted in his attempts at redesign because of various features or peculiarities of the amplifier in question that do not readily fit into the scheme of things to come. Luckily, in this case, the amplifier to be modified proved to be very accommodating as far as the need for radical cir-

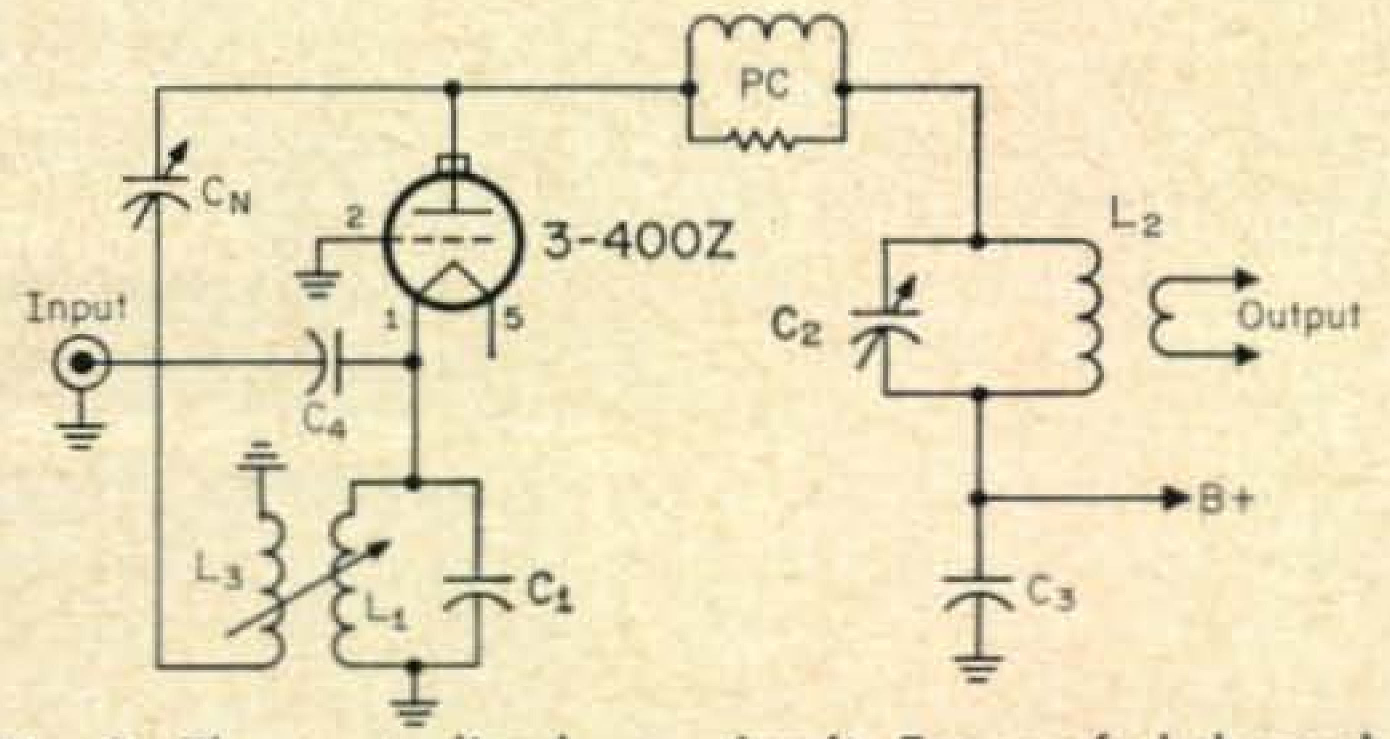
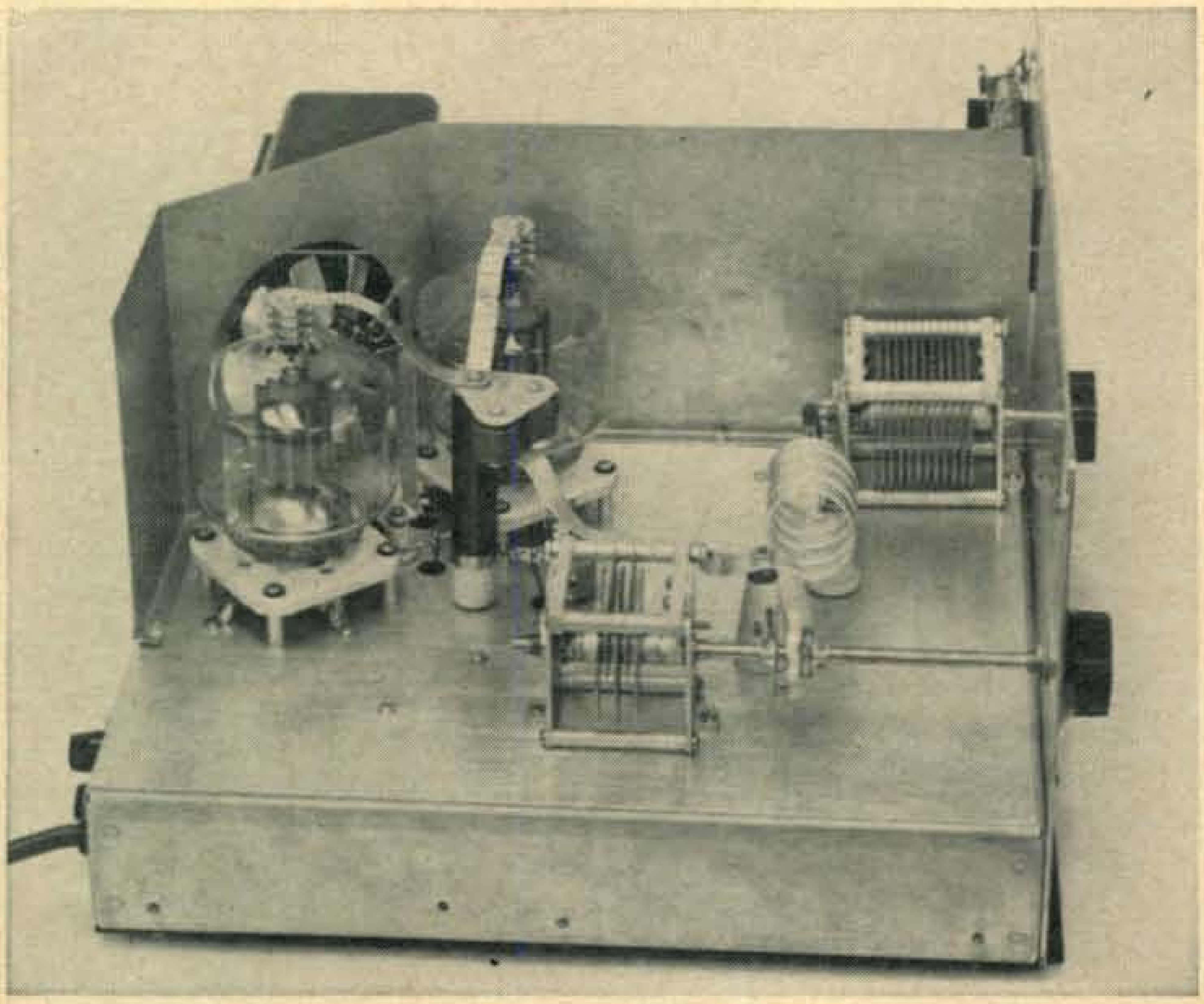


Fig. 2—The neutralized g.g. circuit. Energy fed through from plate to input circuit may cause the grounded grid amplifier to exhibit instability. The addition of a simple neutralizing circuit (C_N, L_3) permits energy to be fed back out of phase with the energy passing through the incompletely shielded grid structure. Neutralizing capacitor C_N is of the order of a few mmf. Neutralizing coil L_3 may be two or three turns placed in the coil of the cathode circuit. Adjustment of coil coupling or capacitance of C_N will neutralize the circuit. Neutralization is achieved when maximum grid current, minimum plate current and maximum power output coincide at one setting of the plate tank circuit.



Side view of the modified SWAN six meter linear amplifier. Conventional low frequency bandswitching circuitry is removed and replaced with six meter pi network tank. The plate tuning capacitor (C_2) is in the foreground. An insulated coupling connects the capacitor to the tuning dial, otherwise the metal shaft extension forms a closed loop closely coupled to the plate tank coil. The loading capacitor (C_3) is at the rear. The connection between the loading capacitor and the coaxial receptacle on the rear of the chassis is made with a short length of RG-8/U coaxial cable. In the modified amplifier, the original antenna changeover relay was used, remounted near the antenna receptacle to reduce lead length.

The three parallel connected 100 uuf, 5 kv plate blocking capacitors are suspended from the top of the plate r.f. choke. One of the parasitic suppressors may be seen above the glass envelope of the left-hand 3-400Z. While Eimac air-system sockets and chimneys are usually recommended for the home constructor, the Swan amplifier used special Johnson sockets (modified for the 3-400Z by reducing spring tension) and a special air scoop and blower system to cool the tubes.

cuit changes: nothing was required that could not be handled in the home workshop with a minimum of tools and test equipment.

The "victim" amplifier chosen for modification to six meters was the *Swan Mark I* linear amplifier covering 3.5-29.7 mc. It makes use of two Eimac 3-400Z tubes connected in parallel with a conventional pi-network circuit. The amplifier is rated for the so-called "two kilowatt p.e.p. level" and had a self-contained power supply. The modification consisted of removing the h.f. input and tank circuitry and substituting six meter circuitry, plus other minor circuit changes that resulted in a stable, maximum power linear amplifier, capable of smooth operation at six meters.

The first step was to simply drop in six meter tuned circuits in the input and plate tank configuration, modify the plate parasitic chokes for 50 mc operation, and apply the "smoke test." As might be expected, the amplifier responded in predictable fashion by "taking off like a bird" with a robust 50 mc parasitic oscillation that brought roars of protest from the small fry, their eyes and ears glued to a TV cartoon program on Channel 2.

The amplifier was immediately disconnected and the various circuits explored with a grid-dip oscillator. Resistance tests indicated that the numerous ceramic disc bypass capacitors in the amplifier, while satisfactory at 10 meters and below, were ineffective at six meters. Replacing or shunting these capacitors with 750 mmf mica units whose self-resonant frequency was above 54 mc was the first step in making the amplifier operable. A transmitting type ceramic capacitor having low internal inductance was substituted for the high voltage disc capacitor at the B-plus end of the choke. The final step was to clean the paint from the chassis, bottom plate and cover shield at the points of contact to insure hat a minimum of r.f. intra-stage leakage existed through the cabinet via the various joints and seams.

During this modification, it was discovered that the primary power cord was "hot" with 50 mc r.f., so the input terminals of the line were bypassed at the fuse connections.

After this series of simple modifications, the amplifier was turned on and loaded to maximum input into a dummy load. With excitation removed and no cutoff bias on the tubes, it was still possible for a weak 50 mc parasitic oscillation to take place, indicating that complete stability had not been achieved. The oscillation was noted by a slight show of grid current at random settings of the plate tuning and loading capacitors and by the fact that maximum grid current, maximum power output and minimum plate current did not coincide at the same tuning condition when the amplifier was in operation. Small indications, it is true, but symptoms that more work remained to be done on the amplifier.

The Neutralizing Circuit

The point had been reached where further modifications to the amplifier would be rather extensive and basic if it was desired to completely stabilize the unit by improving the intra-stage isolation. The 3-400Z is used in grounded grid circuitry in commercial f.m. transmitting equipment up to 100 mc or so without the need of neutralization, but sophisticated shielding and bypass techniques appropriate to those frequencies are a necessity, and probably would be incompatible with the simple and uncomplicated design of the Swan amplifier, which is typical of

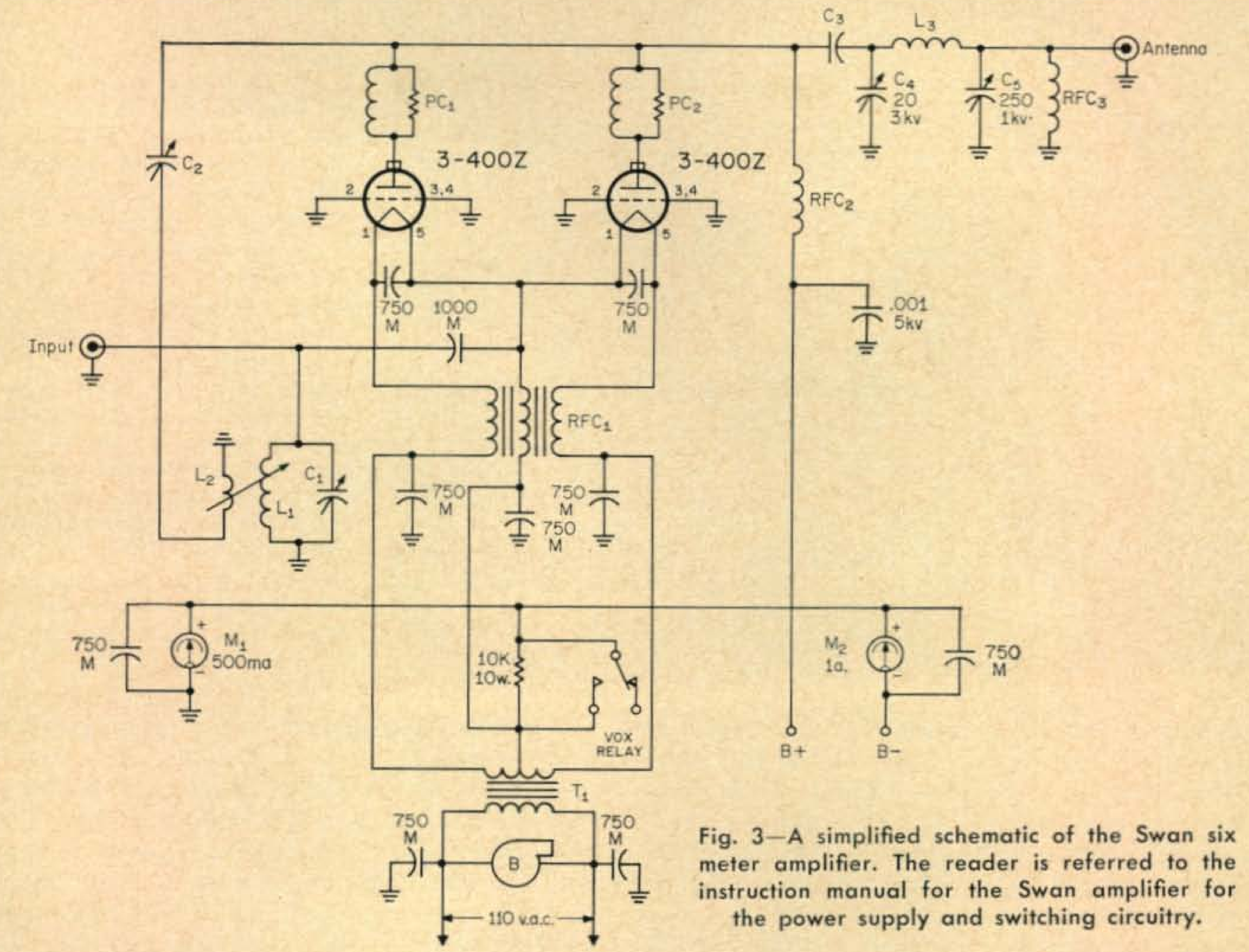


Fig. 3—A simplified schematic of the Swan six meter amplifier. The reader is referred to the instruction manual for the Swan amplifier for the power supply and switching circuitry.

C_1—50 mmf variable mica capacitor. Adjust coil L_1 to obtain resonance with the capacitor 90% compressed.

C_2—Neutralizing capacitor. Copper strap 3½" long and ½" wide mounted on a feedthrough insulator placed between the 3-400Z tubes. The capacitor "sees" the anodes of the tubes. The tubes are mounted about two inches apart, with the capacitor centered between them.

C_3—Three 100 mmf, 5 kv Centralab #850 capacitors in parallel bolted to a triangular aluminum plate atop RFC_2. See photograph.

C_4—20 mmf, 3 kv. Johnson 154-11, reduced to 3 rotor and 2 stator plates. Panel driven with insulated coupling.

C_5—250 mmf. Johnson 154-1.

L_1—3 turns #14 wire, ½" dia., ⅝" long.

L_2—2 turns #18 insulated hookup wire, ½" dia., placed between adjacent turns of coil L_1. Observe the polarity as shown. Adjust the coupling for proper neutralization.

L_3—4¼ turns of copper strap, ⅜" wide, 1⅜" dia., 2½" long.

PC_1, PC_2—50 ohm, 2 watt composition resistor shunted across 1½ of the plate lead (½" wide copper strap). Place a suppressor close to plate cap of each tube.

RFC_1—3½" long by ½" dia. ferrite rod (Lafayette Radio Co., N.Y. MS-333). File a nick in the rod at the correct length and break off remainder. Make triple winding (two #12 e., one #18 e.) consisting of 12½ turns. Wind all three wires at once, under tension. Coat with epoxy cement or nail polish to hold windings in position. (Equivalent of original Swan choke).

RFC_2—140 turns #22 e. wound on a ¾" diameter ceramic form. The winding length is about 3. (Equivalent of original Swan choke).

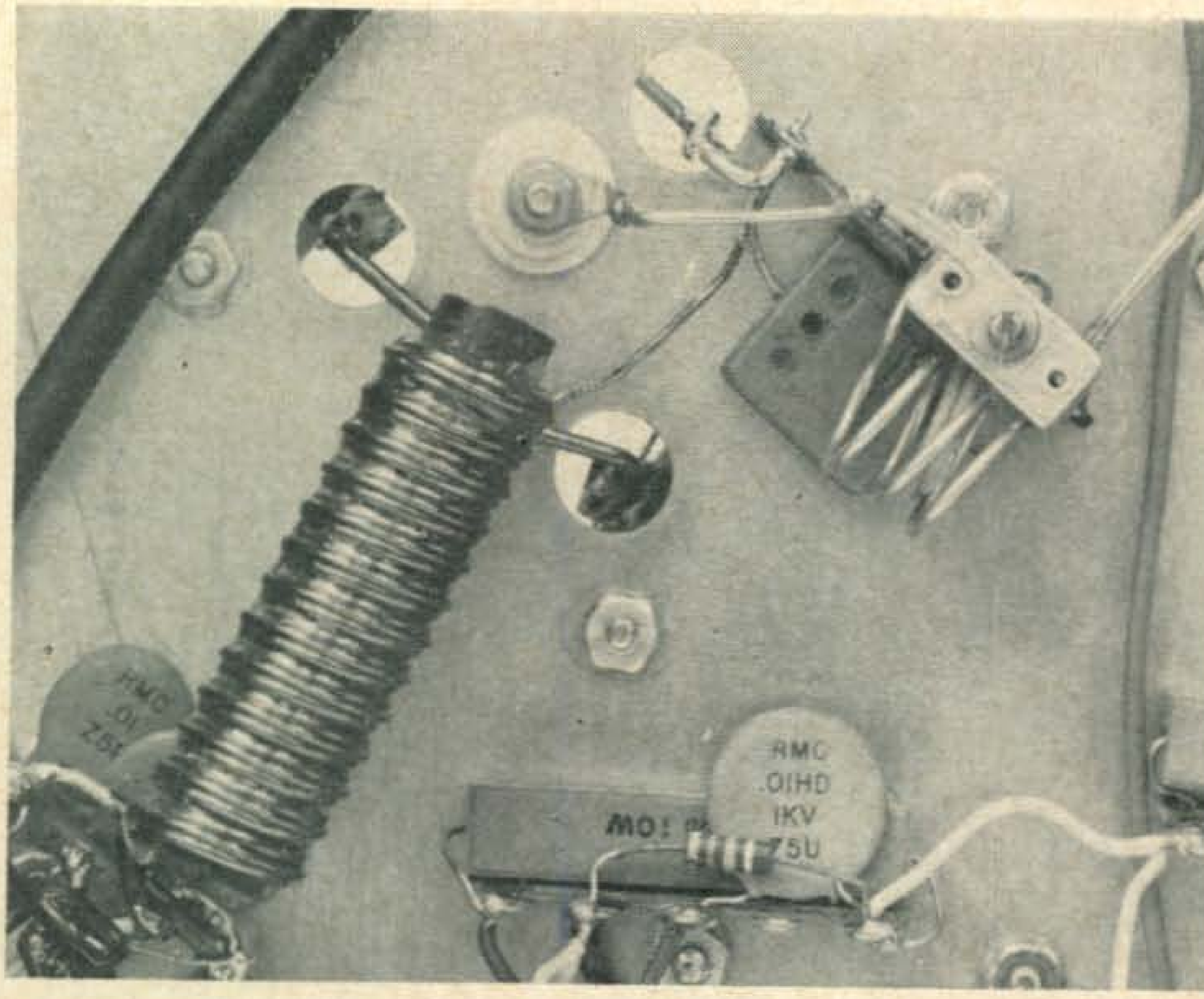
RFC_3—Ohmite Z-50.

T_1—10 volts at 15 amperes. Thordarson 21F146 or equiv. Blower—See text.

good amateur practice below 10 meters. Under the restrictions imposed by the circuit layout and assembly, therefore, it was decided to leave well enough alone as far as intra-stage isolation was concerned, and to complete the job of stabilizing the amplifier by the addition of a neutralizing circuit. The circuit of fig. 2 was chosen and installed. The neutralizing capacitor was fabricated from a length of copper strap mounted mid-way between the 3-400Z's on a ceramic feedthrough insulator. The strap provided a small capacitance to the anodes of the tubes by virtue of its position. The under-chassis terminal of the feed through insulator was connected to a small link coil inserted into the cathode coil, as shown in the photograph. The neutralizing coil was mounted so that the polarity of the coil connections could be changed, if need be. Once neutralized, the amplifier proved to be a "winner" and tuned up and operated just as if it was on the "d.c. bands." The whole modification and tuning program took less than six hours and was well worth the effort.

Neutralizing and Tuning Adjustments

Neutralizing and tuning are no problem in the modified six meter amplifier, the schematic of which is shown in fig. 3. The cathode circuit is tuned to 50 mc with a grid-dip oscillator with the tubes in place in the sockets, after which this



Under-chassis view of the cathode circuit of the 6 meter linear. The tuned cathode circuit is at the upper right, mounted to a five lug terminal strip. Directly to the left is the ceramic feedthrough insulator, atop which the neutralizing capacitor is mounted. To the left is the three-winding (trifilar") filament choke. The five volt filaments of the two 3-400Z tubes are connected in series to reduce the filament current passing through the choke. A third wire to the common filament point is required to insure that equal voltage appears across each tube. Additional mica bypass capacitors are placed across original .01 mf disc ceramic capacitors at the cold end of the choke. The coaxial output cable running to the antenna receptacle cuts across the upper left of the photograph.

adjustment may be forgotten. The next step is to place the output loading capacitor at full capacitance and tune the plate tuning capacitor to approximate resonance using the grid-dip oscillator. The amplifier is turned on with appropriate filament and plate voltage but without excitation. The plate tuning and loading controls are varied at random from their previous settings and the grid meter of the amplifier is observed for signs of grid current. Without excitation, grid current is zero, but under conditions of oscillation, ten to twenty milliampere of grid current will be observed[1], and the resting plate current will climb a few milliamperes. With the amplifier oscillating, the neutralizing coil is moved about in the cathode coil until a point is found at which grid current disappears and oscillation stops.

In this operation, the bottom plate must be on the amplifier to complete the r.f. shielding and also to force the moving air through the tube sockets, if air-system sockets are used[2]. These special sockets are not used in this amplifier, but the problem of intra-stage r.f. leakage remains. As the link adjustment is simple, a modification was made that permitted the bottom plate to remain in place. A small hole was drilled in the bottom plate of the amplifier directly below the cathode circuit, and the neutralizing link was moved about by pushing it from below, using a wooden stick as the operative tool. Adjustment took about thirty seconds. The point of neutralization was found to be quite broad and noncritical. Once the correct coil placement was found, the coil was immobilized in position with a drop of "airplane cement," or "coil dope."

As could be guesssed, Kelly's Law[3] was in effect and the coil was first polarized improperly and the amplifier oscillated in a robust manner until the coil connections were reversed. When properly polarized and placed, the little neutralizing coil did the trick: the amplifier was completely stable and maximum grid current, maximum output and minimum plate current all coincided at one tuning adjustment.

Once the amplifier is neutralized, it should be properly loaded to the recommended grid and plate currents. In this case, at about 2500 volts plate potential, the peak (carrier) plate current was 800 milliamperes for two tubes, with about 300 milliamperes grid current. The Swan six meter s.s.b. transceiver had ample output to drive the linear amplifier with power to spare.

Final Thoughts and a Word of Warning

The modified Swan six meter amplifier certainly has proven to be a success, and this modification is recommended to those hardy souls who do not mind "butchering" a piece of commercial gear. For others, the circuitry is satisfactory for home construction from scratch. It must be pointed out, however, that the ventilation system used in the Swan amplifier is of a special design, in which the physical layout of the ventilation fan, the air scoop and the cabinet provide proper air cooling to the base and plate seals of the 3-400Z tubes. Unless the prospective builder has the means at hand to measure the temperature of the glass envelope of the tubes, it is recommended that the standard Eimac air-system sockets and tube chimneys be used, in conjunction with a squirrel cage blower for proper ventilation. Suggested blowers are the Dayton 1C-180, Ripley 81 or Ripley 8472. ■

[1] If vox operated cathode bias is used, such as shown, the bias resistor will have to be shorted out for these tests. The relay may be energized, or the resistor temporarily jumpered with a length of wire.

[2] The Eimac air-system sockets provide improved intrastage isolation and insure maximum cooling. Their use is recommended. In any case, the amplifier should not be turned on its side when the filaments of the tubes are lit as the 3-400Z's are designed only for vertical (base up or down) operation.

[3] Kelly's Law*: If something *can* go wrong, it *will* go wrong.

**Also known as Murphy's Law. Ed.*

The Galaxy 2000+ Linear Amplifier is a compact table-top affair.

CQ Reviews: The Galaxy 2000+ Linear Amplifier

BY WILFRED M. SCHERER,* W2AEF

THE Galaxy 2000+ Linear Amplifier is a table-top affair designed for use with a 100-watt output exciter to provide a p.e.p. input of 2000 watts on s.s.b. and the maximum legal input of 1000 watts for c.w. and RTTY on the 80 through 10 meter amateur bands. It is a compact and moderately-priced unit made possible by the use of TV horizontal-deflection tubes operated with a plate potential of only 800 volts.

The setup consists of two units: the amplifier which measures only 6" × 10¼" × 11½" (H.W.D.) and a power supply that is 7" × 9½" × 7½" (H.W.D.) and which weighs only 30 lbs, making it easy to cart around.

Technical Details

Referring to fig. 1, ten parallel-connected type 6HF5 tubes in grounded-cathode circuitry are used in the amplifier. The grid-input circuit is untuned with the r.f. input connected directly through to the tube grids which are shunted with R_1, a 50-ohm non-inductive 100-watt Globar resistor, that presents the proper load to the driver and ensures good regulation. On 10 and 15 meters the input capacitive reactance of the tubes becomes significant, so for these bands S_1, (which is linked to the bandswitch), closes and shunt-connects L_1 to counteract the tube reactance. Since the grid circuit is heavily swamped by the 50-ohm resistor, stability at the operating frequency is obtained without neutralization. Parasitic oscillations are avoided with a suppressor installed in the plate lead to each tube.

The output circuit consists of an adjustable Pi-network for matching to loads of 40-90 ohms. Use of the large number of parallel-connected tubes, operating with low plate voltage and high current, requires a very low-impedance plate load. A conventional Pi configuration would then have to be a very high-*C* affair with an abnormally small value tank inductor and unusually large variable capacitors for tuning and loading over the whole range of the lower-frequency bands. In addition, the coil would have to be wound with a larger size conductor than usual in order to keep down losses and the extra heat that would be introduced as a result of higher circulating current due to the low circuit impedance. An inductor of impractical physical proportions would then be needed, as well as heavier switch contacts.

In order to avoid these consequences, a higher-impedance tank circuit is used in the Galaxy 2000+ and the proper plate load is obtained by connecting the tubes across a lower-impedance portion of the circuit. This is accomplished using a capacitive divider consisting of C_1 and C_2 in an arrangement similar to the familiar one often employed for matching a low-impedance line to the input or output of a receiving converter. The principle is the same as tapping an inductor for the desired impedance point.

C_1 and C_2 are ganged together using a multi-section variable capacitor and thus constitute the plate-tuning capacitance for the Pi-circuit while maintaining the matching-impedance ratio at the same time.

R_1 connected across C_2 is a simple and inexpensive protective measure that drains off the charge across the relatively large size coupling capacitor. Also, since the resistance of R_1 is low, compared to the leakage reactance of the coupling capacitor, it thus prevents high voltage from appearing on the capacitor rotor shaft to which the tuning knob is attached. Then too, it minimizes the possibility of voltage breakdown across the capacitor, permitting the use of moderate capacitor-plate spacing.

Linearity Control

Non-linearity is often an inherent problem when more than one tube is used in a linear amplifier, because of the difficulty in obtaining perfectly matched tubes that each have identical gain at all power levels. In order to counteract this situation the Galaxy 2000+, which employs a large number of tubes normally operating in class AB_1, incorporates a compensating bias-regulating system designed to automatically maintain linearity at various power levels and thereby minimize distortion products.

Operation of the linearity-control system is as follows: samples of the r.f. input and output volt-

*Technical Director, *CQ*.

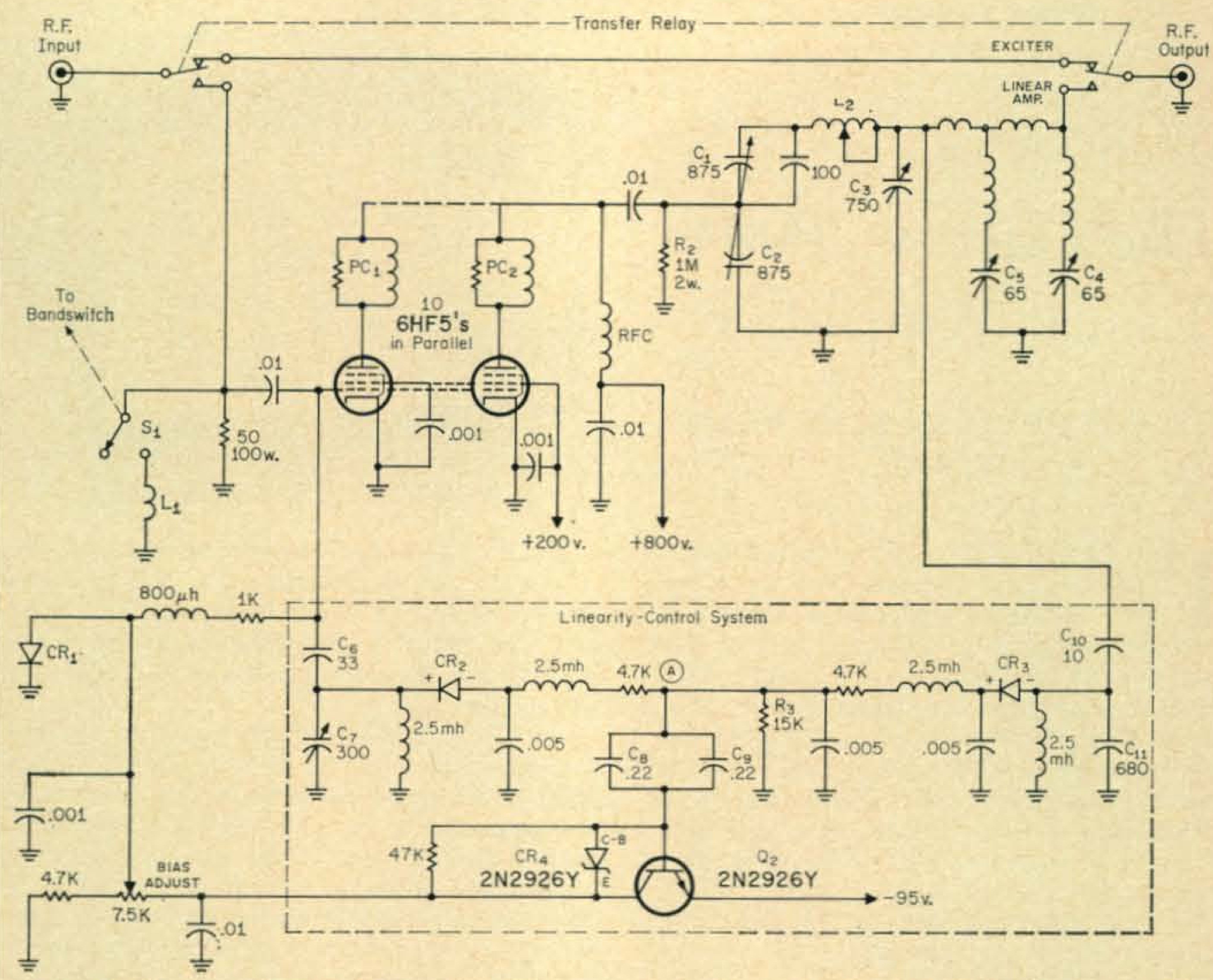


Fig. 1—Basic circuitry for the Galaxy 2000+ Linear Amplifier. The low-impedance plate load for the tubes is obtained by tapping the Pi-output circuit at the proper impedance point which is located at the junction of C_1 and C_2. The maximum capacitance values are shown for 10 meters. Additional capacitors are switched in for the lower frequencies. For 80 meters a maximum capacitance of 1275 mmf is used at C_1, 1175 mmf at C_2 and 2400 mmf at C_3. The bandswitch also selects various taps on L_2. The adjustable t.v.i. filter is comprise dof C_4-C_5 and the associated inductors. Operation of the linearity-control system is explained in the text. Should an arc-over occur in the tubes, CR_1 will conduct and provide a direct path to ground, thereby protecting Q_1 from damage and avoiding possible loss of bias.

ages, obtained from the capacitive dividers C_6-C_7 and C_{10}-C_{11}, are rectified by CR_2 and CR_3. With the amplifier operating at maximum steady-state power, C_7 is factory-adjusted so the rectified voltages are equal and zero voltage thus appears at point A, because the rectifier outputs are of opposite polarity.

When non-linearity tends to occur during modulation, the instantaneous r.f. input and output voltages each vary by a different relative amount and thus produce a net voltage difference at A. This voltage, which will vary at an audio rate, is then applied to the base of Q_1 which functions as a series regulator in the bias-supply line. The bias is thereby shifted toward operation in the class-A region where distortion can be reduced during the required portion of the modulating cycle. CR_4 is a diode-connected transistor that functions as a regulator to limit the bias shift toward class-A operation to about 9 volts.

Antenna Transfer

The r.f. input and output circuits are wired through a transfer relay that permits straight-through operation using the exciter alone or operation with the linear amplifier. With the latter, the antenna is transferred back to the r.f. input side during receive to permit reception with a transceiver type of exciter unit.

Harmonic Filter

A feature of the Galaxy 2000+ is the built-in low-pass t.v.i. filter that is designed to atteunate all frequencies above 40 mc. It is a two-section M-derived type in which the shunt-connected series-resonant arms are adjustable for maximum attenuation on two particular TV channels. The factory settings are for maximum rejection on channels 3 and 6, but if necessary, C_4 may be adjusted for maximum protection of one of the channels between 2 and 5. C_5 may be set for a channel between 6 and 13. The capacitors are accessible for screw-driver adjustment through holes in the side of the cabinet.

Further precautions against t.v.i. have been made by suitable bypassing of all power and control leads at their input or output terminals where additional measures are taken by forming the leads into small r.f. chokes. The panel meter also is bypassed and shielded.

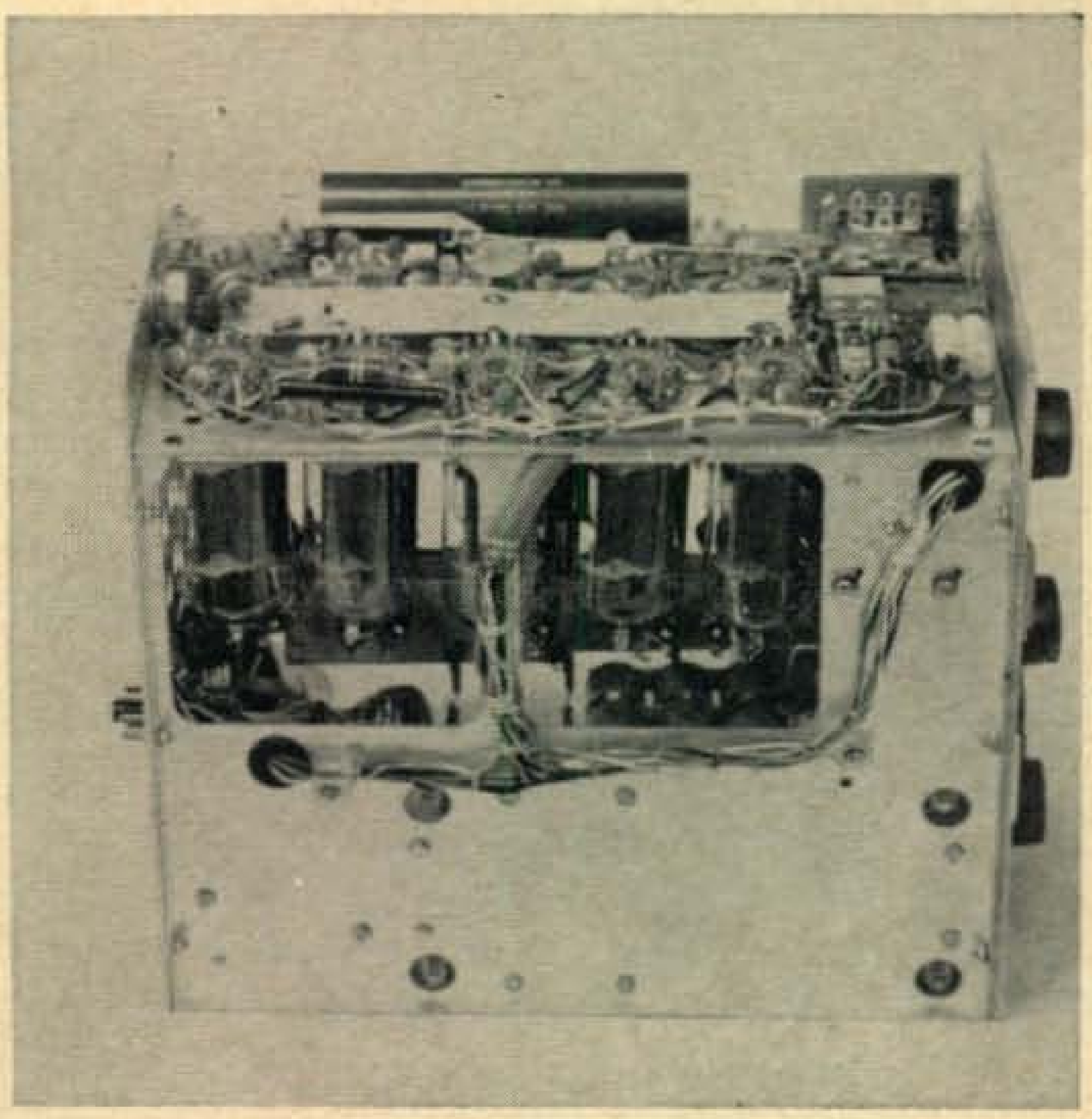
Power Supply

Silicon rectifiers are used in the power supply. The single power transformer has three secondary windings. One supplies —75 v.d.c. obtained through a half-wave rectifier. A tap on the winding supplies 63 v.a.c. for the tube heaters which are wired in series to hold the current drain down to that required for only one tube: 2.25 amperes.

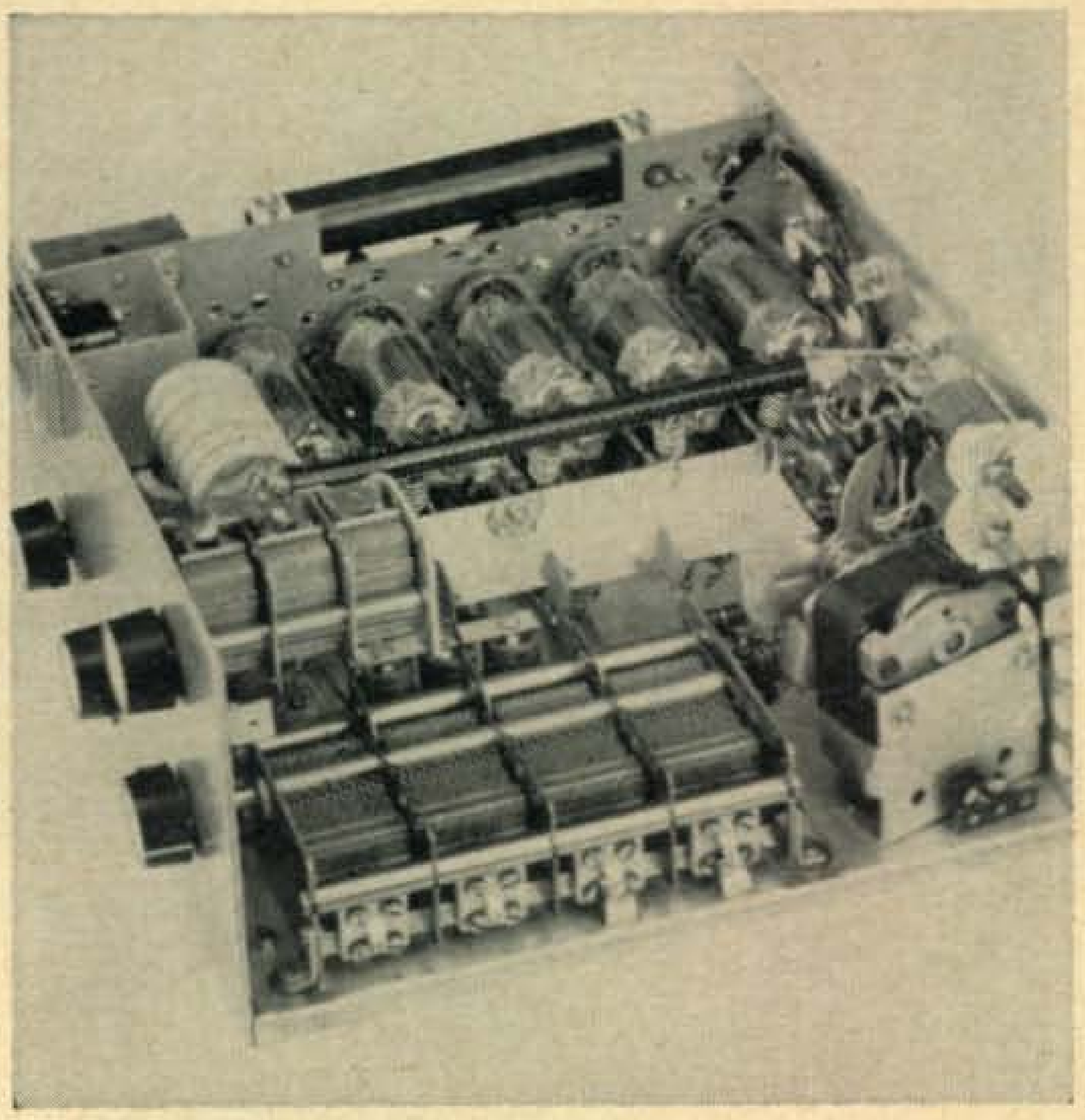
200 volts d.c. is obtained from the second winding using a bridge-rectifier configuration. The negative end is grounded. The third winding, also using a bridge rectifier, furnishes 600 v.d.c. For s.s.b. operation a jumper plug is inserted in a receptacle at one side of the power unit, marked SSB. This then connects the *positive* side of the 200-volt supply to the *negative* side of the 600-volt supply, placing the two sources in series to furnish a total of 800 volts plate potential. A screen potential of 200 volts is obtained at the series connection.

For c.w. and RTTY the plug is moved over to another rectpacle, marked CW/RTTY, which then breaks the series connection and connects the positive side of the 200-volt source through a small voltage-dropping resistor to only the supply line for the tube screens. At the same time the negative end of the 600-volt source is grounded and the available plate potential is only 600 volts to limit the plate input to the maximum legal limit.

Excellent dynamic voltage regulation is obtained using four electrolytic capacitors, connected in series-parallel, that provide 300 mf of filter capacitance, a considerably higher value



Bottom and side view of the Galaxy 2000+. The large square cutouts permit good air circulation for ventilating the tubes visible in the openings. A printed-circuit board with the Linearity-Control system is at the right above the feedthrough grommet for the harness. The wide strip that traverses the tube sockets is the low-inductance bus for connecting the grids in parallel. The 50-ohm 100-watt Globar-type input-terminating resistor is at the top.



Interior view of the Galaxy 2000+. The ten tubes are mounted in two rows of five each. Only the top row is visible. Each tube plate is connected with an individual parasitic suppressor to the wide strip, shown at the center, which is a low-inductance plate bus. The 10-15 meter section of the output tank is the tubing-wound coil near the upper left. The three-section variable capacitor is the output-loading, the four-section job below it is the plate-tuning. The blower is at the lower right, above it is the adjustable t.v.i. filter.

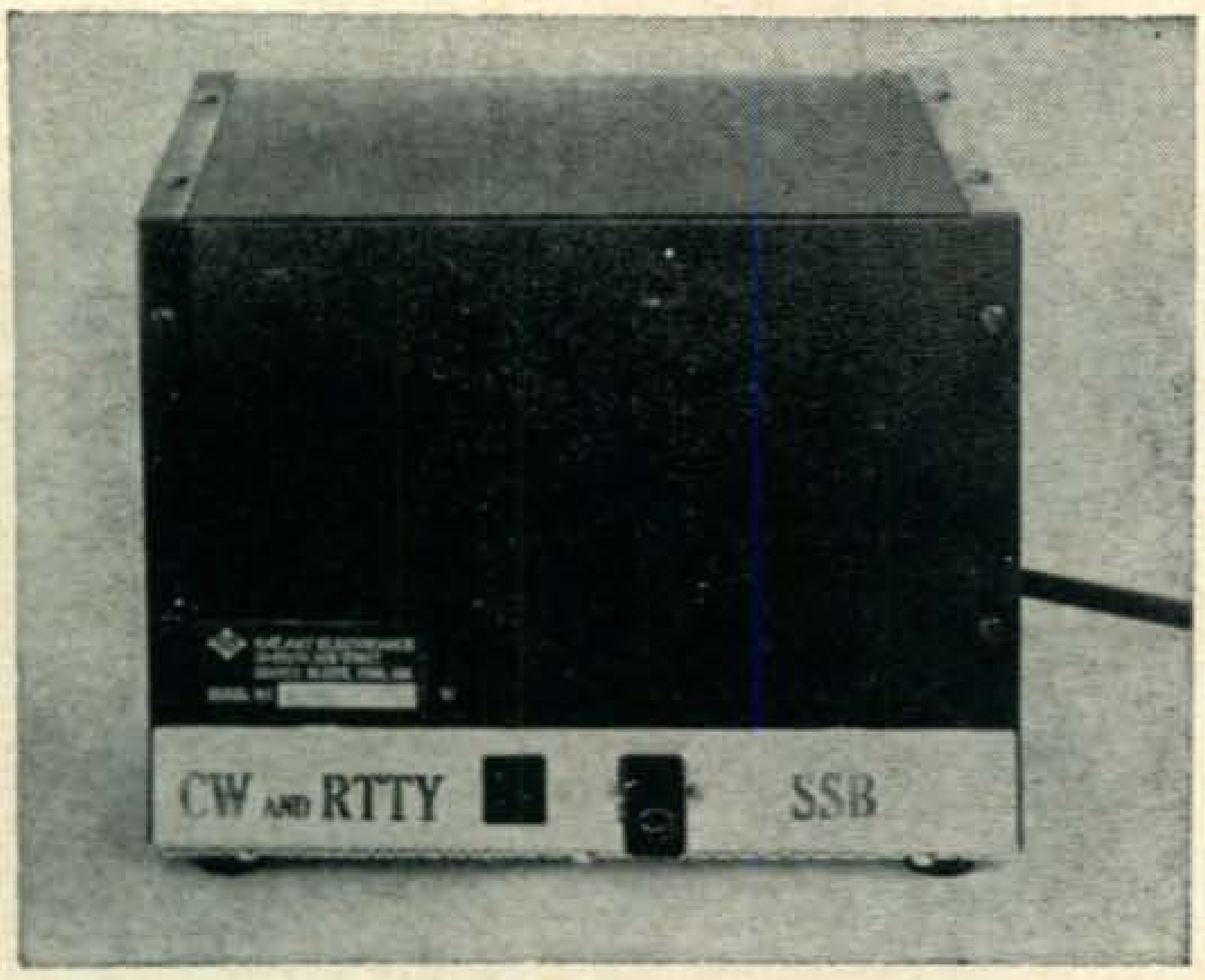
than would be practical with low cost if the customarily higher voltages were involved. Two paralleled capacitors furnish 600 mf for the lower-voltage source.

Peak plate currents run in the vicinity of 2.5 amperes, so although it is relatively small, the transformer is quite husky, wound with heavier-than-usual wire. Two primary windings may be connected in parallel or series for 115 or 230 v.a.c. operation respectively. The maximum total primary-current requirements with 115 volts runs near 20 amperes and 10 amperes with 230 volts. For best line-voltage regulation a 230 volt source is recommended. A 10 ampere fuse in one leg of each primary winding offers equal protection with either 115 or 230 volt operation.

Construction

In the amplifier open framework type of construction is used, supported between the front and rear panels. The portion of the tank inductor used for 10 and 15 meters is wound with ¼" diameter silver-plated tubing. The low-frequency section utilizes #14 wire. Also silver plated are wide strips used as a common low-inductance bus for parallelling the plate and grid connections to the tubes. Individual disc-ceramic bypasses for the screens and heaters are installed directly at each of the ten tube sockets.

Th t.v.i. filter inductors are air-wound with #16 wire and their associated trimmer capacitors are the APC type. The output loading capacitor is a conventional size 3-gang type, while the plate tuning/impedance-divider capacitor is a large 4-section job with its frame mounted on lucite strips to insulate the rotor from ground.



Power Supply for the Galaxy 2000+. The jumper plug is in the s.s.b. position.

Pairs of sections are connected in parallel.

The amplifier is housed in a metal case liberally perforated all around to provide adequate ventilation and cooling which is augmented by a small blower fan within the unit. The styling matches that of the Galaxy line of exciters.

The power supply is built on a chassis with a removable top cover. An interconnecting power cable plugs into the amplifier and is about 5 feet long, allowing placement of the unit in a convenient out-of-the-way location.

Operation

A function switch controls the a.c. power and sets up the equipment for tuneup or normal operation. In the tuneup position, the screen voltage is reduced to maintain a lower power input that prevents off-reasonance damage and holds the power within the maximum legal steady-state value.

At tuneup the panel meter reads plate current and a specific point is marked for the reading that indicates proper tuning which is accomplished using the plate and loading controls. No grid-input tuning is needed. Full-power operation is set up when the switch is set for the meter to indicate either plate voltage or current. An unusual sight on amateur gear is that the plate-current calibrations are in *amperes!* When a.c. power is applied to the tube heaters on standby, a yellow light goes on. A red lamp lights when plate power is applied.

Performance

The amplifier tunes up very simply and easily. When adjusted to the TUNE mark on the meter, the input ran about 700 watts, allowing a good safety margin. Changing over to OPERATE and applying a carrier or single-tone drive of 100 watts, the d.c. plate input amounted to 1700 watts with an output of 1100 watts on all bands (with 230 volts, under full load, measured on the power line). Due to the excellent dynamic volage regulation, the p.e.p. input with voice modulation ran a bit over 2000 watts and the p.e.p. output was 1300 watts, while at the same time the panel-meter peaks read *within* the legal 1 kw limit. This point, by the way, is the one marked TUNE on the meter.

Actually, full peak output was obtained with an average meter swing of less than 1 kw, depending on the voice and microphone characteristics. In any event, continuously kicking the meter to the indicated point will result in flattopping, especially since there is no a.l.c. Optimum operating levels for the cleanest signal are therefore best checked using an oscilloscope.

The 6HF5's apparently are well suited to take the gaff, inasmuch as at no time did the tube plates show color or exhibit other indications of excessive heating or any deterioration, even during prolonged tests with steady-state or two-tone power.

Linearity checks were made with and without the linearity-control system in operation. Oscilloscope observations indicated its effectiveness in straightening out the input/output characteristics, particularly at the knee of the curve. With the system in use the 3rd-order distortion measured just about to the rating of —30 db, as compared to —22 db without it.

The automatic linearity-control system really pays off as may be seen from the two-tone test patterns in the photographs.

The s.w.r. between the exciter and the amplifier input was under 2:1, except on 20 and 10 meters it was 3:1 and 4:1 respectively.[1] If the exciter does not have an adjustable output-impedance matching arrangement to handle this range, some difficulty may be found in obtaining adequate drive for the linear amplifier.

With the power-supply jumper plug in the c.w./RTTY position and with 1 kw input to the amplifier, the r.f. output was 600 watts for these modes of operation. Loading to higher than 1 kw gains nothing; in fact, the power output goes down.

Although the protective measure using R_1 is included, as described previously, we'd like to point out that the high-value filter capacitors discharge very slowly after power is removed (requiring 1-2 minutes). Therefore, if it is necessary to do any service work on the equipment, first disconnect the power-cable from the amplifier or discharge the capacitors by using a screwdriver with an insulated handle to short one of the tube plates to the chassis. If work is to be done on the power supply, similarly discharge each capacitor in the unit.

The Galaxy 2000 Linear Amplifier is priced at $450.00, complete with all tubes and the companion power supply. A replacement set of all ten tubes is priced at $29.95. The equipment is produced by Galaxy Electronics, 10 South 34th Street, Council Bluffs, Iowa 51504. —*W2AEF*

[1] As found using the 34-inch cable supplied with the amplifier. Proper tuning requires a full input of 100 watts. If this cannot be attained with the existing s.w.r. while using an exciter with a fixed or limited output-impedance range, the input cable will have to be lengthened (as determined experimentally) for a reflected impedance that will permit correct loading of the exciter.

Command Set Receivers for All Frequencies— The Easy Way

BY GORDON E. WHITE*

The most widely-used piece of surplus equipment ever to hit the amateur market is the famous Type-K Command Set receiver. Probably thousands have been mauled by the experimenting ham in an effort to change the frequency coverage of an available unit to something more suitable. Below is a wealth of practical, no-nonsense information direct from the manufacturer's files, bound to make the job an easy one.

THE command sets, based on the Type K design, were made in fabulous numbers during WW II. Korean War and civilian versions pushed the production record to about a million receivers alone during the 20 years they were manufactured.

Such a vast outpouring, plus the high inherent quality of the command design has made the sets the most popular items in the long postwar history of amateur use of former military gear.

Unfortunately, despite the larger numbers of command sets made, there was a wide disparity in the production rate of the receivers in the different bands. Although there were eight l.f.-m.f.-h.f. receivers designed, only five are still common, and only three saw really massive production. (The tuneable v.h.f. sets are a story to themselves, and the author hopes to deal with their excellent qualities and detailed specs in a subsequent article.)

While more than 450,000 "beacon" band command receivers were made, covering 190-550 kc, only 46 sets were built for the 9-13.5 mc band. Well over 200,000 sets were built in both the 3-6 mc and 6-9.1 mc bands, but fewer than 150 were manufactured for the 13.5-20 mc and 20-27 mc segments.

The Army bought the BC-946 broadcast band (520-1,500 kc) set chiefly to be used with the ZB homing adapter, and only 11,000 were made. The Navy procured another 18-20,000, making these sets relatively scarce and costly today. There was no Army production, and fewer than 50,000 Navy sets in the 1.5-3 mc marine frequency band, also a rare unit now.

*516 North King's Highway, Alexandria, Virginia.

The above figures show the prudence of conversion of the more plentiful sets to cover the rare frequencies for amateurs who covet the simplicity, stability, and tuning accuracy of command receivers in other than 190-550 kc, 3-6 and 6-9.1 mc bands.

Conversion Data

The author has uncovered original design data on the entire line of command receivers, from the 1939 prototypes through the 1961 civilian production. The tables in this article cover the r.f. the i.f. and b.f.o. transformers.

These specifications will provide all the parameters necessary to build receivers in any of nine bands, including the 3.5-7 mc prototype of the original SCR-274, which was never built in quantity. Performance of these conversions should match the original recievers, with a great saving in trial and error labor.

In the past, conversion data has been published which attempted to achieve similar ends, but in most of these the writer has not had the time or test equipment to optimize the conversion. This set of tables comes directly from the meticulous designs of Dr. Frederick H. Drake, Paul O. Farnham, and Norman J. Anderson in the Boonton, N.J. laboratories of the Aircraft Radio Corporation.

TABLE I – Similarities & Differences									
Range		190-550	520-1,500	1.5-3.0	3-6	6-9.1	9-13.5	13.5-20	20-27
Navy No.		46102	46103	46104	46105	46106	46107	46108	46109
C_1 (mmf)		11	11	11	11	8.5	6.5	6.5	6.5
Loop Input		Yes, except ARA, SCR-274-N	Yes, except ARA; SCR-274-N	No	No	No	No	No	No
C_4 No.		3936	3936	4601	4601	6558	6558	6558	4609
C_4 Max. (mmf)		346	346	147	147	62	62	62	41
$C_{4F/G}$ Cap.		min./½	min./½	½/½	½/max.	½/max.	½/max.	½/max.	½/½
C_{10} (mmf)		690	670	365	365	240	240	340	300
R_6 (Meg.)		.51	.30	.20	.20	.15	.10	.10	.10
C_{39} across L_2		120mmf	None	None	None	None	None	None	None
I.F. (kc)		85	239	705	1415	2830	4200	4200	4200
Tuned I.F. Ckts.	274-N	2 (var.)	2 (var.)	2 fixed	2 fixed	1	1	1	1
	ARC-5	2	2	2 fixed	2 fixed	2 fixed	2 fixed	2 fixed	2 fixed
Tapped I.F. Coils		L_8–L_{11}	L_8–L_{11}	L_{10}, L_{11}	L_{10}	None	None	None	None
Iron Core I.F.	274-N	No	No	Yes	Yes	No	No	No	No
	ARC-5	No	No	Yes	Yes	Yes	Yes	Yes	Yes
R_{12}		510	510	510	510	510	390	390	390

Table I—Similarities and differences in the RAV series of command receivers covering 190 kc to 27 mc.

R.F. Problems

One or two cautions are in order. First, the 20-27 mc receiver was built with the same circuit and tubes as the lower frequency sets. It was satisfactory for short, direct, plane-to-plane work, but definitely lacks the sensitivity for long range reception. In fact, it was replaced by the General Electric RAX set in liaison use for Navy patrol aircraft early in the war. A single 12SK7 tube just cannot function as well above 20 mc as it does at six or nine megacycles.

The author has at least partially solved the sensitivity and noise problem in his own RAT-1 sets by substituting a 6AB7 for the r.f. tube. The filaments have been wired for 12 volt parallel operation, with the exception of the r.f. and audio tubes. Wiring these in series allows the use of a 6V6 output tube which nicely matches the filament current of the 6AB7.

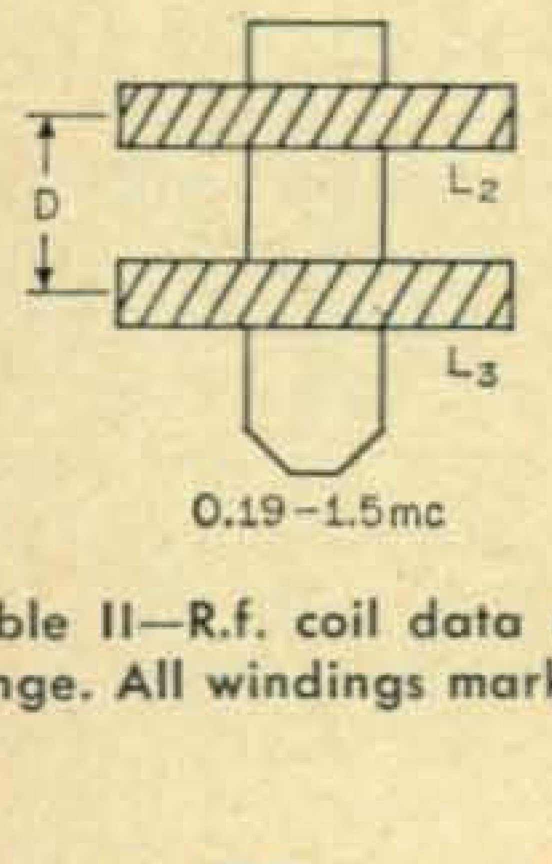
Running the heater wiring directly from the r.f. to the audio gave no trouble, but dress of wiring involved could in some causes cause feedback. This applies particularly to the plastic wiring in the later AN/ARC-5 sets.

The 6AB7 of course required a screen voltage boost to 200 volts from 85 in the original circuit. A 200 ohm cathode resistor should replace the standard 620 ohm unit.

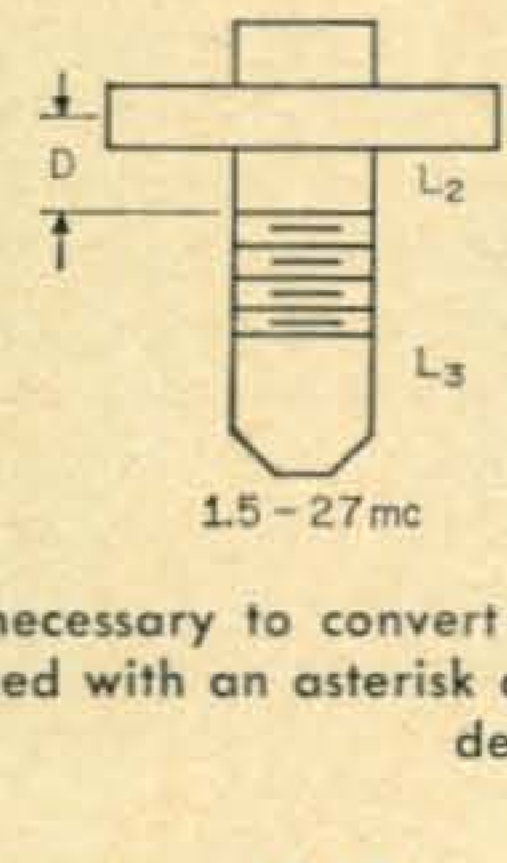
I.F. Changes

In the SCR-274-N and ARA sets, and the older

TABLE II – R.F. Coil Data									
Range (mc)	Antenna L_1	Mixer L_2	f (kc)	Mixer L_3	Oscillator L_4	Oscillator L_5	Loop L_{16}	D (Inches)	Winding Data L_1, L_3, L_5
0.19-0.55	* 285 t. ① #36 SSE	* 720 t. ③ #38 SSE	147	* 255 t. 5-41 Litz	* 50 t. #36 SSE	* 235 t. 5-41 Litz	28 t. ④ #36 SSE	0.500	U.W.
0.52-1.5	* 102 t. ② 7-41 Litz	* 743 t. #38 SSE	394	* 104 t. 7-41 Litz	* 20 t. #36 SSE	* 83 t. 7-41 Litz	15 t. ④ #36 SSE	0.469	U.W.
1.5-3	* 61 t. 5-41 Litz	* 219 t. #36 SSE	1125	* 61 t. 5-41 Litz	7½ t. #36 e.	* 48 t. 5-41 Litz	N.A.	0.219	U.W.
3-6	31⅛ t. #30 e.	* 110 t. #34 SSE	2250	31⅛ t. #30 e.	6 t. #32 e.	26 t. #30 e.	N.A.	0.219	52 t.p.i.
3.5-7	22⅛ t. #26 e.	* 75 t. #34 SSE		23⅛ t. #30 e.	6 t. #32 e.	21 t. #30 e.	N.A.	0.219	52 t.p.i.
6-9.1	20⅛ t. #26 e.	* 50 t. #34 SSE	4550	20⅛ t. #26 e.	2½ t. #32 e.	17 t. #26 e.	N.A.	0.219	36 t.p.i.
9-13.5	13⅛ t. #24 Tin	* 33 t. #34 SSE	6665	13⅛ t. #24 Tin	2½ t. #32 e.	10⅛ t. #24 Tin	N.A.	0.219	24 t.p.i.
13.5-20	8⅛ t. #24 Tin	* 20 t. #34 SSE	9450	8⅛ t. #24 Tin	2½ t. #32 e.	7⅛ t. #24 Tin	N.A.	0.219	18 t.p.i.
20-27	6⅛ t. #24 Tin	* 14 t. #34 SSE	14,900	6⅛ t. #24 Tin	2½ t. #32 e.	5⅛ t. #24 Tin	N.A.	0.219	17 t.p.i.
27-40	← EXPERIMENTAL →						N.A.	0.219	14 t.p.i.



0.19–1.5mc



1.5 – 27mc

NOTES:

① RAV, ARA and AN/ARC-5 series, tapped at 198 t.

② RAV, ARA and AN/ARC-5 series, tapped at 71 t.

③ Paralleled with a 100mmf capacitor.

④ Wound on L_1 for low impedance loop antenna input.

f—Resonant frequency of L_2, cold, with tubes in place.

D—Coil spacing between L_2 and L_3.

SSE—Single silk wound enameled wire.

U/W—Universal wound.

N/A—Not applicable.

e—enamel.

Table II—R.f. coil data necessary to convert the more available command sets to cover any desired frequency range. All windings marked with an asterisk are universal wound; the others are single layer windings. Chart term definitions are listed above.

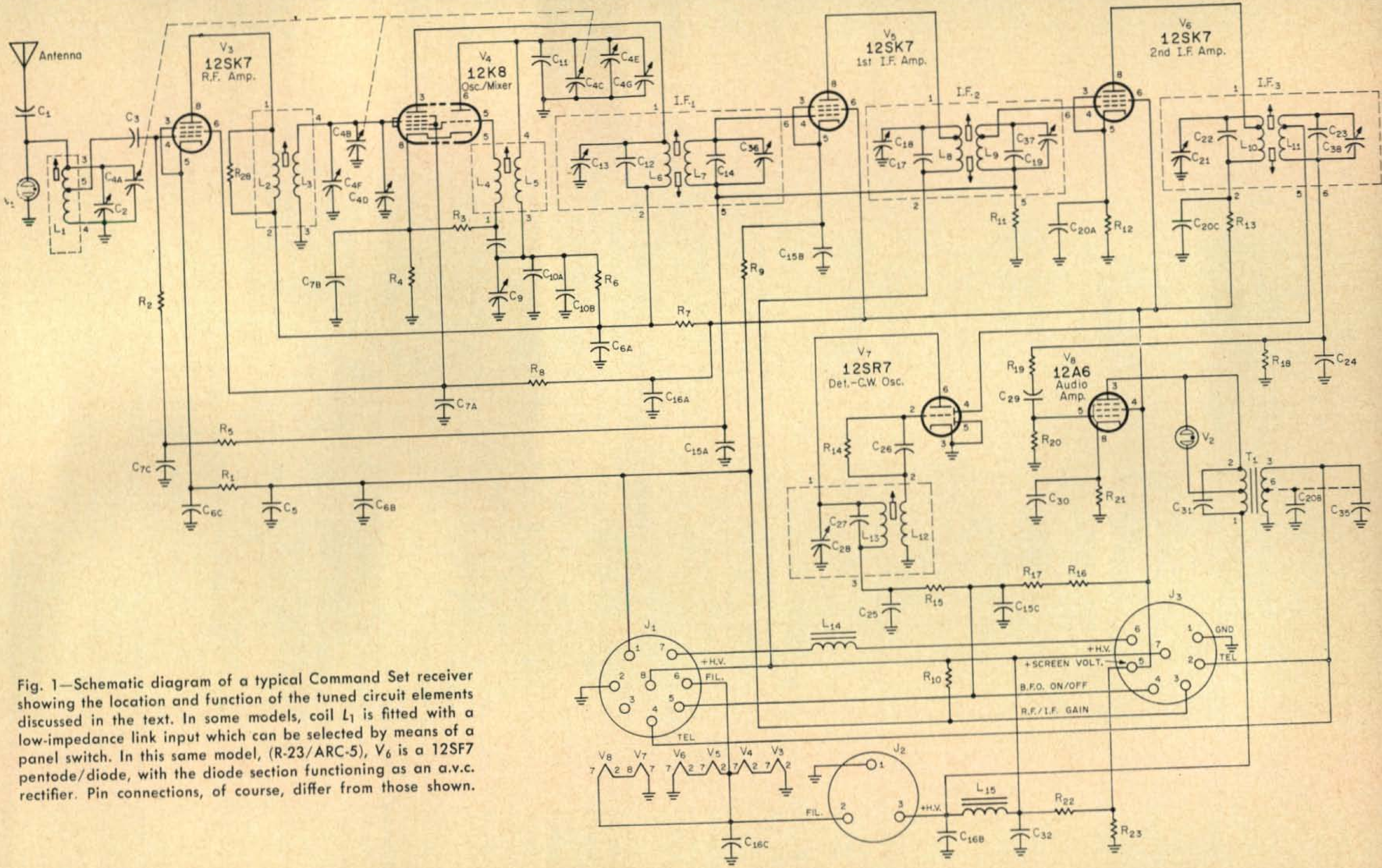


Fig. 1—Schematic diagram of a typical Command Set receiver showing the location and function of the tuned circuit elements discussed in the text. In some models, coil L_1 is fitted with a low-impedance link input which can be selected by means of a panel switch. In this same model, (R-23/ARC-5), V_6 is a 12SF7 pentode/diode, with the diode section functioning as an a.v.c. rectifier. Pin connections, of course, differ from those shown.

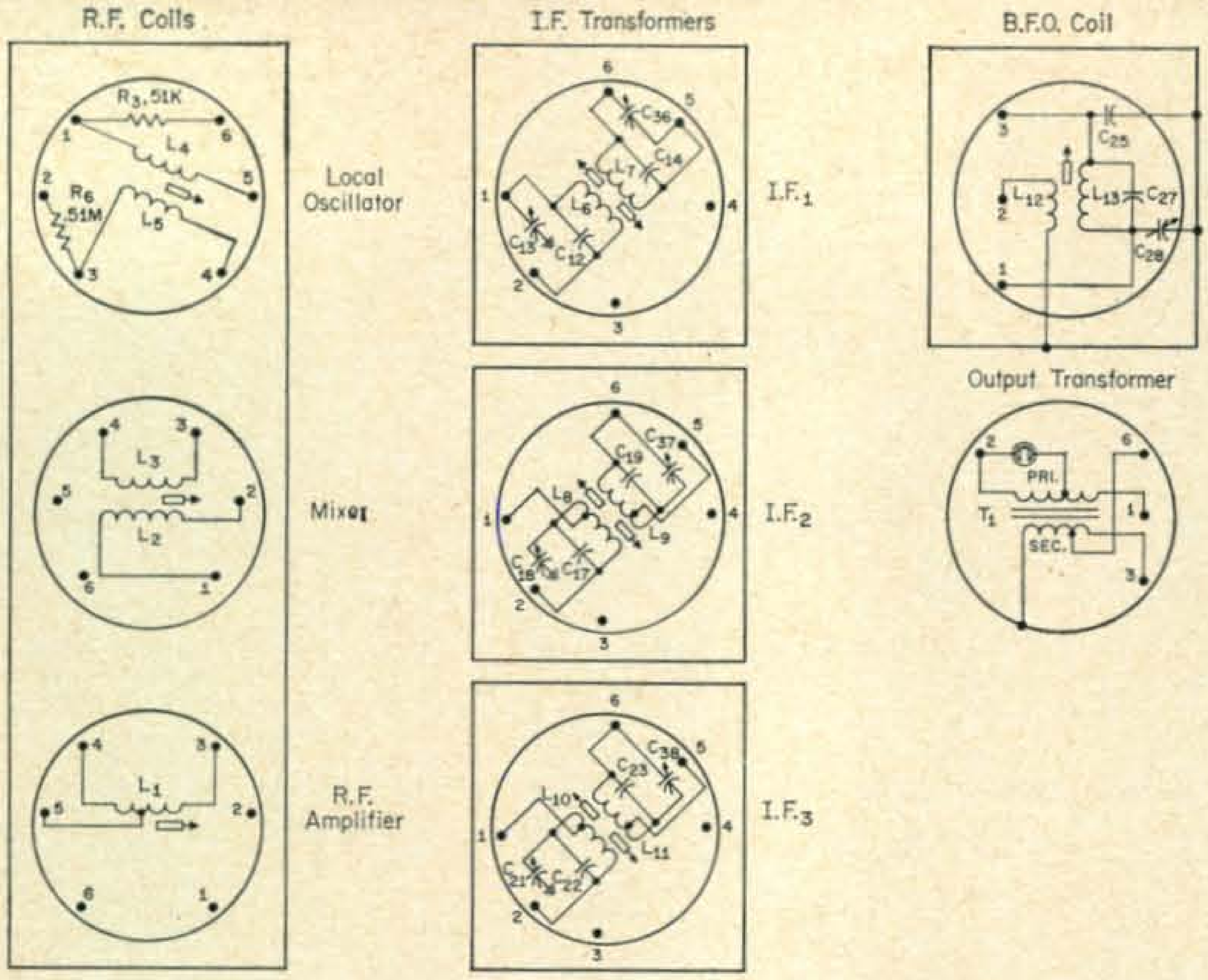


Fig. 2—Circuit data for the r.f. coils of the ARC-5.

RAT and RAV versions, 6AC7 tubes can be used in the i.f. versions, with appropriate filament changes and set realignment. The sharp cutoff characteristics of the 6AC7 does not harm the pseudo a.v.c. action in these receivers. It would *not* operate properly in the a.v.c.-equipped ARC-5 on postwar units.

The original bands will "track" accurately across the entire tuning range when properly aligned, when the correct i.f. is used and the correct part values installed.

The 3.5-7 mc receiver used an i.f. of 1660 kc, and the units covering the 9-27 mc bands used a 4,200 kc i.f. These are of course broad, but they eliminate most image response and most important, allow good tracking.

The I.F. Coils and the B.F.O.'s

Since the Type K-prototype Command Sets were the first superhetrodyne receivers used as standard quipment in the majority of U.S. combat aircraft, the design of the intermediate frequency circuits necessarily required thinking and solutions to problems that were, in 1935, new. Primarily, the receivers needed to combine light weight and small size with good sensitivity, and in the lower frequency sets, selectivity. Conversely, the high frequency receivers needed to be relatively broad because of the inherent drift limitations of airborne transmitters; remember, the command sets were designed for plane-to-plane communications in the 3—20 mc frequencies.

The engineers at Aircraft Radio Corporation had a solid background in commercial broadcast receivers, and had held patents on automatic volume control and "ganged," tracked superhet circuits. In designing for civil aircraft use, cost was secondary to performance. In military aeronautical designs, cost was hardly a factor; thus A.R.C. had great freedom to use the optimum in components and basic design.

Anyone who doubts this should look at an early command set coil: wound meticulously with enameled copper wire on a ceramic form, with all other dielectrics of clear ruby mica, even the small capacitors are specially-made. Such capacitors were, in 1935, unreliable, but Dr. F. H. Drake, at A.R.C. designed a stacked silver-mica capacitor, on a stainless steel screw, which could be adjusted to extremely fine tolerances. This was later converted to the silver-mica bell-shaped "button," for manufacturing convenience.

Images

In order to avoid leak-through of "image" signals, a high intermediate frequency is often used. The Type K design criteria called for an i.f. just under half the lowest tuneable r.f. frequency, thus eliminating all but the strongest images in the final output.

At low r.f. frequencies (190-550 kc; 520-1,500 kc) this Type K criteria gives quite a low i.f. In the military design this was proper because the lower two receivers were used for navigation or homing on ground stations, which could have rigidly controlled frequency standards.

At higher frequencies, above 3 mc, broadness was indicated in order to work with other airborne equipment. This was met admirably by i.f.'s of 1415 kc in the 3-6 mc receiver; 2830 kc in the 6-9.1 set, and 4,200 kc in the remaining h.f. units.

For ground use by amateurs or SWL's today, this broadness is undesirable, but may be eliminated by a variety of methods such as double-conversion into a "*0*-5er," the lowest band command receiver. These devices however do not concern us at present.

TABLE III – I.F. and B.F.O. Coil Data						
INTERMED. FREQ. (KC)	I.F. PRI. L_6, L_8, L_{10}	I.F. SEC. L_7, L_9, L_{11}	SPACING – D_1	B.F.O. L_{12}	B.F.O. L_{13}	D_a
85 (NOTE 1)	1200t. * #38SSE	1210t. * #38SSE	0.250"	180t. * #38SSE	633t. * #38SSE	0.172"
239 (NOTE 2)	420t. * 5-41 LITZ	425t. * 5-41 LITZ	0.875"	70t. * 5-41 LITZ	213t. * 5-41 LITZ	0.172"
705 (NOTE 3)	100t. * 7-41 LITZ	102t. * 7-41 LITZ	0.875"	40t. * 7-41 LITZ	98t. * 7-41 LITZ	0.172"
1415 (NOTE 3)	47t. * 7-41 LITZ	48t. * 7-41 LITZ	0.875"	25t. * 7-41 LITZ	45t. * 7-41 LITZ	0.157"
1660	39t. * 7-41 LITZ	40t. * 7-41 LITZ	0.875"	22t. * 7-41 LITZ	39t. * 7-41 LITZ	$\frac{1}{32}$"
2830	35t. * 7-41 LITZ	36t. * 7-41 LITZ	0.875"	$15\frac{7}{8}$"t. #34e.	$26\frac{1}{8}$"t. #30 DSE	$\frac{1}{32}$"
4200	24t. * 7-41 LITZ	25t. * 7-41 LITZ	0.875"	$12\frac{7}{8}$"t. #32e.	$17\frac{1}{8}$"t. #30e.	$\frac{1}{32}$"
2830	41t. #28e.	300t. * #38 SSE	FOR ARA, SCR-274-N	NOTES ON L_6–L_{11}: 1. TAPPED AT 400t. FROM START.		
4200	$28\frac{1}{2}$t. #24	200t. * #36 SSE		2. TAPPED AT 180t. FROM START. 3. TAPPED AT 30t. FROM START.		

Table III—I.f. and b.f.o. coil data for the command set series. Those windings marked by an asterisk are single layer windings; all others are universal wound.

Tracking

In order to "track" a superhet receiver, the antenna, r.f., and oscillator stages must tune together very closely, with the oscillator frequency differing from the r.f. by the intermediate frequency, in a most constantly accurate fashion. The problems of attaining really good tracking require a combination of carefully taken data on the circuit with a grasp of some intricate mathematics; for most of us, tracking is a matter of luck in home brew superhets.

Since, however, the designers in Boonton worked out tracking solutions for nine bands of command receivers between 190 kc and 27 mc, we can filch their data to build excellent conversions from the more common command receivers.

It is necessary to keep in mind only that the tracking solution remains the same for a given receiving gang tuning capacitor so long as the ratio of the highest tuned i.f. frequency to the lowest tuned frequency remains constant with respect to the i.f.

For instance, using the same 21 gang in the 1.5-3 mc receiver, with its 705 kc i.f., the ratio remains quite close for the 3-6 mc set, with its 1415 kc i.f., and the 3.5-7 mc prototype, with a 1660 kc intermediate frequency. Thus all three should track approximately correctly using the same padders such as C_{10} in the command circuit. This would hold true for any band you might choose, using the same tuning gang, so long as the ratios were about the same. The formula is this:

$$R = \frac{i.f.}{\frac{L+H}{2}}$$

where R is the ratio, *i.f.* is the intermediate frequency, L is the lowest tuned frequency, and H is the highest. Thus, for the 1.5-3 mc set:

$$R = \frac{705}{\frac{1.5+3}{2}} = 313$$

To obtain correct tracking for 3.5-7 mc coverage with the same gang and oscillator padders work it backwards:

$$313 = \frac{unknown\ i.f.}{\frac{3.5+7}{2}}$$

$$i.f. = 313 \times 5.25$$

$$= 1643\ kc$$

This gives an i.f. of 1643 kc, very close to the 1660 "round number" actually used by A.R.C. engineers.

To work out tracking for a different i.f. would require considerably more math. Do it the easy way! Copy their data shown in Table III.

Coil strips for the r.f. section of the command receivers are available in surplus channels, generally in the 6-9.1 mc band, and are easily converted to higher frequencies. The author will supply the three section r.f. coils suitable for conversion at $1.00 per set and 4,200 kc i.f. transformers at 3 for $2, as long as his small supply lasts. Other sources include Rex Radio, 84 Cortland Street, Manhattan—(4,200 kc i.f. cans), Communications Equipment Corp., 343 Canal Street, Manhattan (i.f. and r.f. cans), Aircraft Radio Industries, 85 St. John Street, New Haven, Conn., Ritco Electronics, 7275-C Little River Tpk., Annandale, Va. ■

FLASH! 11,000 Miles Spanned On 144 Mc!

Occuring almost accidentally as an unscheduled shot-in-the-dark, a solid two-way contact was established between VK3ATN in Victoria, Australia and K2MWA of Homdel, New Jersey on November 28th on 144.90 mc which *has been confirmed*. Rendering obsolete the long-standing 5250-mile record between OH1NL and W6DNG, this feat comes very close to matching the 12,000-mile all-time v.h.f. record set achieved in 1956 on 50 mc between Japan and Argentina.

Regular moon bounce efforts between "T.R." Naughton, VK3ATN and the famed WA6LET group came to a halt during the wee hours of November 28th when the Australian learned of an equipment breakdown at the California end. However, with prior knowledge of WA6LET's schedule with the Crawford Hill Radio Club of Homdel, N.J., the 150-watt VK3ATN decided to "go all the way" for a long-haul direct contact with K2MWA. At approximately 5 A.M. EST, his signals were not only heard, but acknowledged, marking the beginning of a new era in long-distance moonbounce communications.

VK3ATN's antenna system, consists of a 50-wavelength rhombic, while the Homdel group, headed by W2IMU, used a full kw into a 60-foot dish.

Formal presentation of statements, correpondence and tape recordings was made to ARRL approximately two weeks later for official documentation and endorsement. — *K2ZSQ*

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

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

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

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

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

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

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

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

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

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

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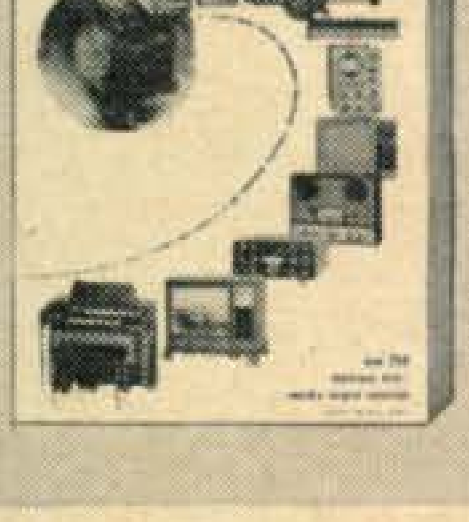

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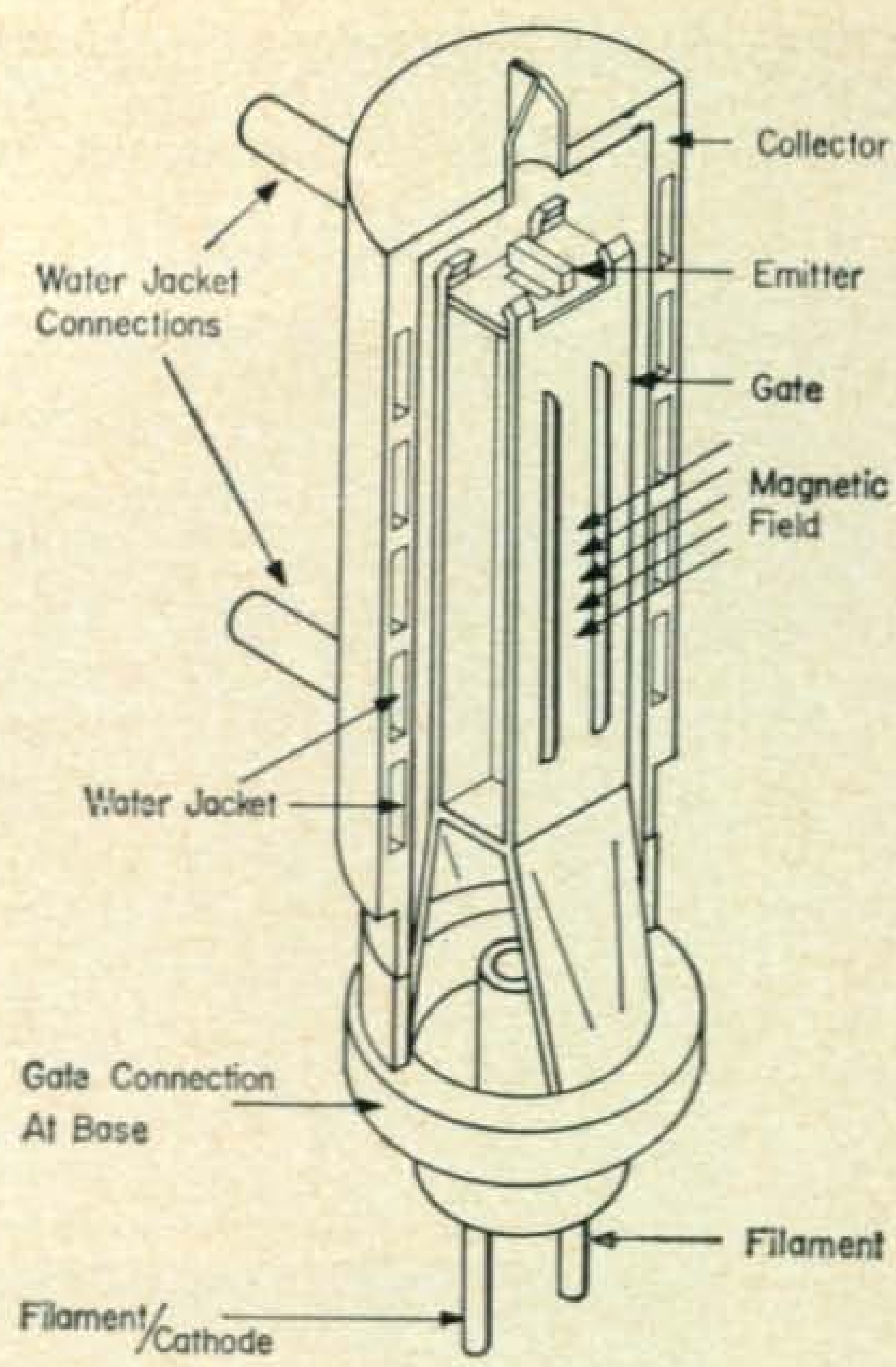
Cutaway view of the new field effect tube developed by Amperex. Connections to the collector and emitter are made by clips. The construction of the base ring is similar to the 4X150A-series of tubes. The filament, and the filament/cathode pins at the base are of unequal length for easy identification.



THE FIELD-EFFECT TUBE

It's hard keeping up. Having just finished a series of articles on "Field Effect Transistors" (FET's) we thought we were up to date on field effect devices. A recent trip to the Hicksville, Long Island, plant of Amperex Electronics, changed our minds. What we saw was a recently developed field effect tube" that will see direct application in amateur radio.

One of the typical proto-type field effect tubes has a rating of 1.2 kw and a plate efficiency of 80-85% with a power gain of 5,000. A gridded triode has a gain of about 40. Linearity is reported to be excellent exceeding many of the best conventional gridded tubes in this respect.

The field effect tube carries promise for compact high power transmitting equipment due to its low drive requirements. Even a small transistorized exciter can develop sufficient driving power to produce field effect tube outputs on the order of 500 watts or more with no intermediate driving stages.

Specifically, the field effect tube can offer high power gain, great power handling ability, and extreme ruggedness by eliminating the fine wire grid found in other vacuum tube devices. The tube consists of a high efficiency cathode or emitter (consuming only 30 watts for 1.2 kw input) located along the axis of a cylindrically shaped plate or collector. The electron stream resulting from the application of the proper potential to the cathode is focused into a flat beam by a magnet. The electron stream is controlled by the electrostatic field between two parallel gate electrodes, providing amplification of the gate signal. This is similar in theory to the field effect transistor which uses a channel of semiconductor material with electrons from a "source" flowing to a "drain." This electron flow is also controlled by a gate which varies the flow in proportion to the applied gate voltage. The elimination of the grid in the field effect tube solves one of the major design problems associated with high power vacuum tubes. Electrons emitted from the cathode strike the grid instead of passing through to the plate, causing secondary emmission, reduced gain and poisoning the cathode.

The gridless triode avoids another problem as well. A tube requires a certain drive level for a given output. When greater output is desired, more drive is also necessary, but the ability of the grid to dissipate the driving power is a limiting factor. The field effect principle allows almost unlimited driving power levels and consequently high power inputs without danger of grid damage. The cooling of the plate and the amount of drive available are the two main limits to the power inputs possible.

The field effect tube is also simpler to construct and because of this Amperex experts predict the tube may be cheaper to manufacture than other high power tubes.

The tubes should be available in early 1967 and *CQ* will bring you an article describing its application to amateur radio. ■

"Supper's ready—start your transmitter!"

Signals From Space

A List Of Transmitting Satellites

BY GEORGE JACOBS,* W3ASK

By the end of 1966, no fewer than 50 American launched satellites were in orbit transmitting radio signals back to earth on more than 115 frequencies in the h.f., v.h.f. and u.h.f. bands. Radio amateurs and space-listeners have been able to receive a large number of these transmissions, often with fairly inexpensive receiving equipment.

The following table lists those frequencies on which orbiting satellites launched by the United States were transmitting radio signals back to earth as of November 15, 1966. Many of these satellites are expected to continue transmitting signals throughout 1966 and beyond.

The USSR has launched 130 satellites to date in their Cosmos scientific series, in addition to dozens of other scientific, interplanetary, lunar and manned satellites. Since most of the Russian satellites remain in orbit or transmit radio signals for only a few days, their frequencies are not shown in the following table. For the most part, however, signals from Russian satellites can usually be heard on either one or several of the following frequencies: 19.540, 19.545, 19.735, 19.775, 19.800, 19.835, 19.994, 19.995, 20.005, 20.035 and 20.084 mc. Russian satellites have also operated on 30.008, 39.986, 89.100, 90.023, 90.158, 90.225, 90.378 and 183.538 mc. The Cosmos satellites are launched on an inclination of 49, 56 or 65 degrees, and have periods ranging between 92 and 104 minutes.

France has launched two satellites to date, but both are believed to be silent. The following frequencies have been used for French satellites in the past: 136.98, 149.7, 252 and 339.92 mc.

The satellites which can be heard with the least difficulty are those which transmit a continuous c.w. signal. These signals, which are often used as tracking beacons, can usually be identified by their steady tone when the receiver's beat frequency oscillator (b.f.o.) is in on the ON position. Telemetry signals are often more difficult to receive, since in most cases telemetry data is transmitted for only brief periods upon command

[*Continued on page 100*]

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

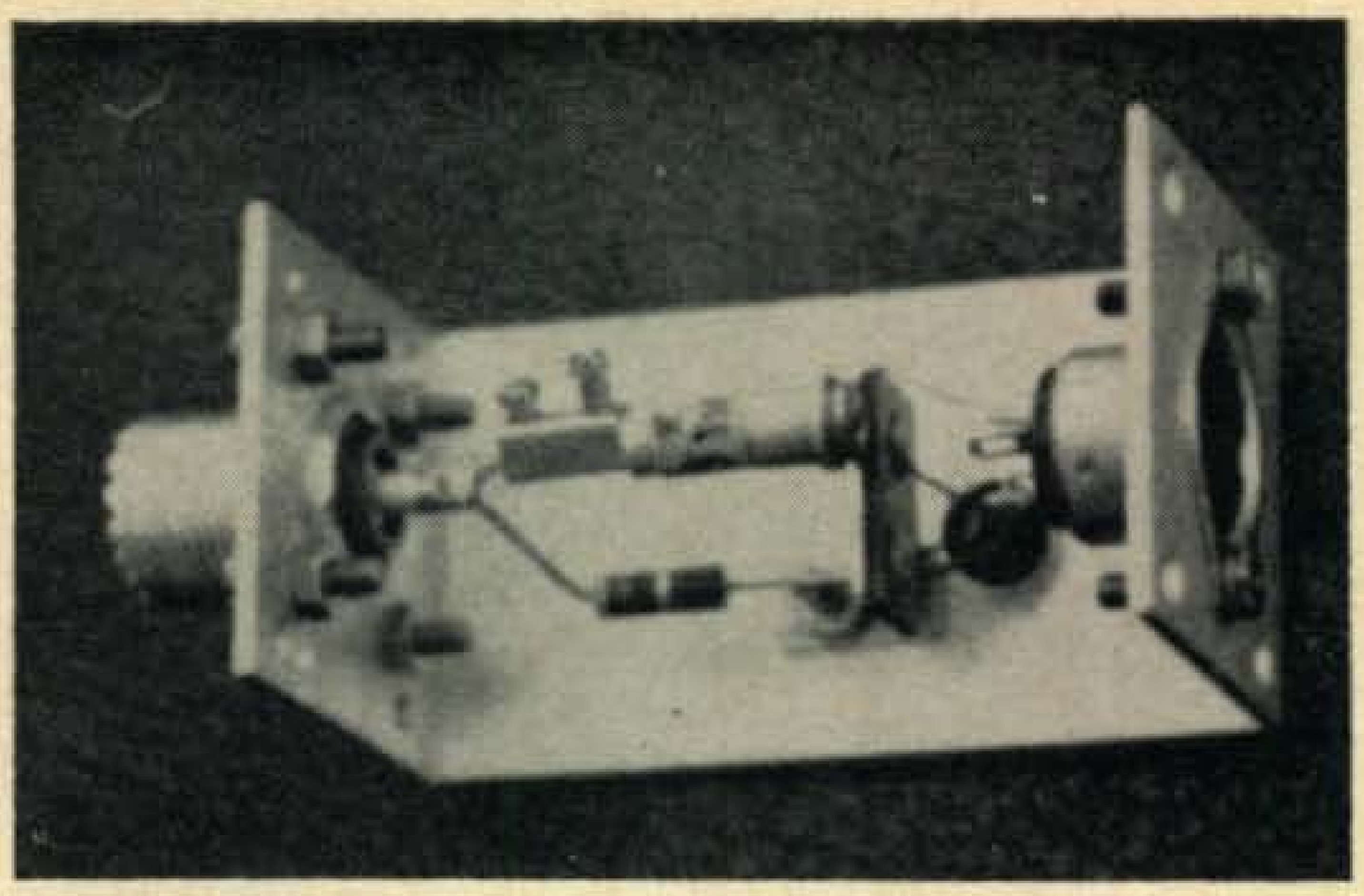
Table I—List of Transmitting Satellites as of November 15, 1966

Freq. (Mc)	*Satellite Name*	*Purpose*	*Period* (Minutes)	*Inclination* (Degrees)	*Remarks*
20.000	EXPLORER—27	Geodetic studies	108	41	Command, c.w. tone modulated.
20.005	EXPLORER—22	"	105	80	"
40.000	EXPLORER—27	"	108	41	"
40.010	EXPLORER—22	"	105	80	"
41.000	EXPLORER—27	"	108	41	"
41.010	EXPLORER—22	"	105	80	"
54.000	TRANSIT—4A	Navigation	104	67	"
136.019	ECHO—2	Communications	108	81.5	Continuous c.w. beacon & telemetry.
136.020	EXPLORER—33	Scientific	22614	7.5	"
136.078	ALOUETTE	Ionospheric studies	105.5	80.5	Command, c.w. and telemetry.
136.080	ALOUETTE—2	"	121	79.8	"
136.125	EXPLORER—28	Interplanetary studies	8559	33.9	Continuous c.w. beacon & telemetry.
136.140	RELAY—1	Communications	185	47.5	Command telemetry
136.142	RELAY—2	"	195	46.3	"
136.170	ECHO—2	"	108	81.5	Continuous c.w. beacon & telemetry.
136.171	EXPLORER—22	Geodetic studies	105	80	Command, c.w. and telemetry.
136.200	OGO—1	Geophysical studies	3842	49	"
136.200	OGO—2	"	104	87.4	"
136.200	OGO—3	"	2915	31.4	"
136.230	ESSA—1	Weather	100	97.9	Command, telemetry, photo and c.w.
136.231	TIROS—8	"	99.4	58.5	Command, c.w. and telemetry.
136.232	TIROS—10	"	101	99	"
136.233	TIROS—7	"	97.4	58	"
136.234	TIROS—9	"	119	96.4	"
136.260	OAO—1	Astronomical studies	101	35	"
136.273	EXPLORER—25	Magnetic Field studies	506	20	Continuous c.w. beacon & telemetry.
136.292	EXPLORER—26	Radiation studies	116	81.4	Command, c.w. and telemetry.
136.320	EXPLORER—32	Scientific	"	64.7	"
136.350	FR—1	Ionospheric studies	100	76	"
136.380	EXPLORER—31	"	121	79.8	"
136.410	PEGASUS—1	Meteoroid detection	97	32	"
136.410	PEGASUS—2	"	"	"	"
136.410	PEGASUS—3	"	95	29	"

Table I—List of Transmitting Satellites as of November 15, 1966 (cont.)

Freq. (Mc)	*Satellite Name*	*Purpose*	*Period* (Minutes)	*Inclination* (Degrees)	*Remarks*
136.440	EARLY BIRD	Communications	1437	1.4	Continuous c.w. beacon & command telemetry.
136.440	OAO—1	Astronomical studies	101	35	Continuous c.w. beacon.
136.440	ERS—16	Radiation studies	115	90	"
136.440	ERS—15	"	168	"	"
136.467	SYNCOM—2	Communications	1436	31	Command, c.w. and telemetry.
136.470	SYNCOM—3	"	1437	0.7	"
136.500	NIMBUS—2	Weather	108	100	Continuous c.w. beacon.
136.530	EXPLORER—30	Solar studies	101	59.7	Continuous c.w. beacon & telemetry
136.560	EXPLORER—32	Scientific	116	64.7	Command, c.w. and telemetry.
136.590	PEGASUS—3	Meteoroid detection	95	29	Continuous c.w. beacon.
136.590	ALOUETTE—2	Ionospheric studies	121	79.8	Command, c.w. and telemetry.
136.591	ALOUETTE—1	"	105.5	80.5	"
136.620	RELAY—2	Communications	195	46.3	Continuous c.w. beacon & command telemetry.
136.621	RELAY—1	"	185	47.5	"
136.653	1963—38C	Radiation studies	107	90	Command, c.w. and telemetry.
136.709	EXPLORER—24	Air Density studies	115	81.4	Continuous c.w. beacon & telemetry.
136.713	OSO—2	Solar studies	96.5	33	Command, c.w. and telemetry.
136.740	EXPLORER—27	Geodetic studies	108	41	"
136.770	ESSA—2	Weather	113.5	101	"
136.770	ESSA—3	"	115	"	"
136.800	FR—1	Ionospheric studies	100	76	Continuous c.w. beacon.
136.800	EGRS—6	Radiation studies	118.5	90	"
136.800	EGRS—7	"	168	"	"
136.831	EXPLORER—29	Earth Mapping	120	59.4	Command, c.w. and telemetry.
136.840	EGRS—3	Radiation studies	103.5	70	Continuous c.w. beacon & telemetry
136.840	EGRS—5	"	122	69.2	"
136.860	EXPLORER—25	"	116	81.4	Command telemetry.
136.889	PEGASUS—2	Meteoroid detection	97	32	Continuous c.w. beacon.
136.890	PEGASUS—1	"	"	"	"
136.890	ALOUETTE—2	Ionospheric studies	121	79.8	Continuous c.w. beacon & telemetry
136.918	TIROS—9	Weather	119	96.4	Command telemetry.
136.920	ESSA—1	"	100	97.9	Command, c.w. and telemetry.
136.924	TIROS—7	"	97.4	58	Command telemetry.
136.924	TIROS—8	"	99.4	58.5	"
136.924	TIROS—10	"	101	98.6	"
136.950	NIMBUS—2	"	103	100	Command telemetry and photo (APT).
136.980	SYNCOM—2	Communications	1436	31	Command telemetry.
136.980	SYNCOM—3	"	1437	0.7	"
136.980	EARLY BIRD	"	"	1.4	Command c.w. and telemetry.
137.200	NIMBUS—2	Weather	103	100	Command telemetry and photos.
137.500	ESSA—2	"	113.5	101	Command telemetry and photo (APT).
150	TRANSIT—4A	Navigation	104	67	Command, c.w. tone modulated.
150	1963—22A	"	100	90	Command, c.w. and telemetry.
150	1963—49B	"	107	"	"
150	1965—109A	Not specified	105	89	"
150	1966—24A	"	"	89.7	"
150	1966—41A	"	104	90	"
162	ANNA—1B	Geodetic studies	108	50	Command, c.w. tone modulated.
162	1963—38C	Radiation studies	107	"	Command, c.w. and telemetry.
162	EXPLORER—22	Geodetic studies	105	80	Command, c.w. tone modulated.
162	EXPLORER—27	"	108	41.2	"
162	EXPLORER—29	Earth mapping	120	59.4	Command, c.w. and telemetry.
324	ANNA—1B	Geodetic studies	108	50	Command, c.w. tone modulated.
324	TRANSIT—4A	Navigation	104	67	"
324	1963—38C	Radiation studies	107	90	Command, c.w. and telemetry.
324	EXPLORER—22	Geodetic studies	105	80	Command, c.w. tone modulated.
324	EXPLORER—27	"	108	41.2	"
324	EXPLORER—29	Earth mapping	120	59.4	"
360	EXPLORER—27	Geodetic studies	108	41.2	"
360.090	EXPLORER—22	"	105	80	"
400	TRANSIT—4A	Navigation	104	67	"
400	1963—22A	"	100	90	"
400	1963—49B	"	107	"	"
400	1965—109A	Not specified	105	89	"
400	1966—24A	"	"	89.7	"
400	1966—41A	"	104	90	"
400.250	OGO—1	Geophysical studies	3842	49	Command, c.w. and telemetry.
400.250	OGO—2	"	104	87.4	"
400.250	OGO—3	"	2915	31.4	"
400.550	OAO—1	Astronomical studies	101	35	"
400.850	OGO—1	Geophysical studies	3842	49	"
400.850	OGO—3	"	2915	31.4	"
400.850	OGO—2	"	104	87.4	"
972	EXPLORER—29	Earth mapping	120	59.4	"

• NOISE • GENERATORS



Simple crystal diode generator constructed in a Minibox. Power supply and output control are external. Useful output extends to about 144 mc, depending on diode quality.

BY JOHN SCHULTZ,* W2EEY/1

This article reviews noise generators and their application to improving receiver performance in the upper h.f. and v.h.f. bands. Two examples of easily constructed generators are also presented, one for general use and one which can be used to measure actual Noise Figure in db.

In v.h.f. work, noise has always been the critical factor in receiver performance. Most amateurs learned quickly that a noise generator and not a signal generator was needed for proper receiver r.f. stage alignment.

The overall noise situation at a given QTH regulates at what frequency the noise properties of a receiver r.f. stage becomes the determining factor for a weak-signal reception. As fig. 1 shows, receiver noise can become a very important factor on 15 and 10 meters in a "quiet" location. With the turning of the sunspot cycle and the return of DX activity to 15 and 10, it seems an appropriate time to review the use of noise generators for both h.f. and v.h.f. receivers.

The Receiver R.F. Stage

The noise which a receiver r.f. stage generates can be thought of as a threshold which masks any signal of lesser intensity fed into the stage. Although with special detection methods signals of somewhat lesser intensity than the r.f. stage noise level can still be detected, the r.f. stage noise level is the determining or limiting factor when conventional detection methods (diode, product detectors, etc.) are employed. The noise generated by the r.f. stage is so important because it determines the noise figure for the entire receiver. As long as the r.f. stage has even only moderate gain, the noise generated by succeeding stages (mixer, i.f., etc.) play only a minor role in determining the overall receiver noise figure.

For instance, adding additional i.f. stages may apparently "pep-up" the receiver because of the additional signal amplification and selectivity provided but, it can do nothing to improve the basic weak-signal reception ability of the receiver r.f. stage. Likewise, a preselector added to a receiver may improve overall signal amplification and improve image rejection but it *can't* improve weak-signal reception unless its noise figure is lower than that of the receiver r.f. stage.

The amount of noise an r.f. stage develops is dependent upon component (tube, transistor, coils, etc.) qualities and the tuning of the stage. Component developments have lead to a variety of low-noise elements, such as the diodes used in parametric amplifiers, which may have noise figures of only 1 - 2 db. Noise "figure" or "factor" compares the noise a stage generates to

*40 Rossie Street, Mystic, Conn. 06355.

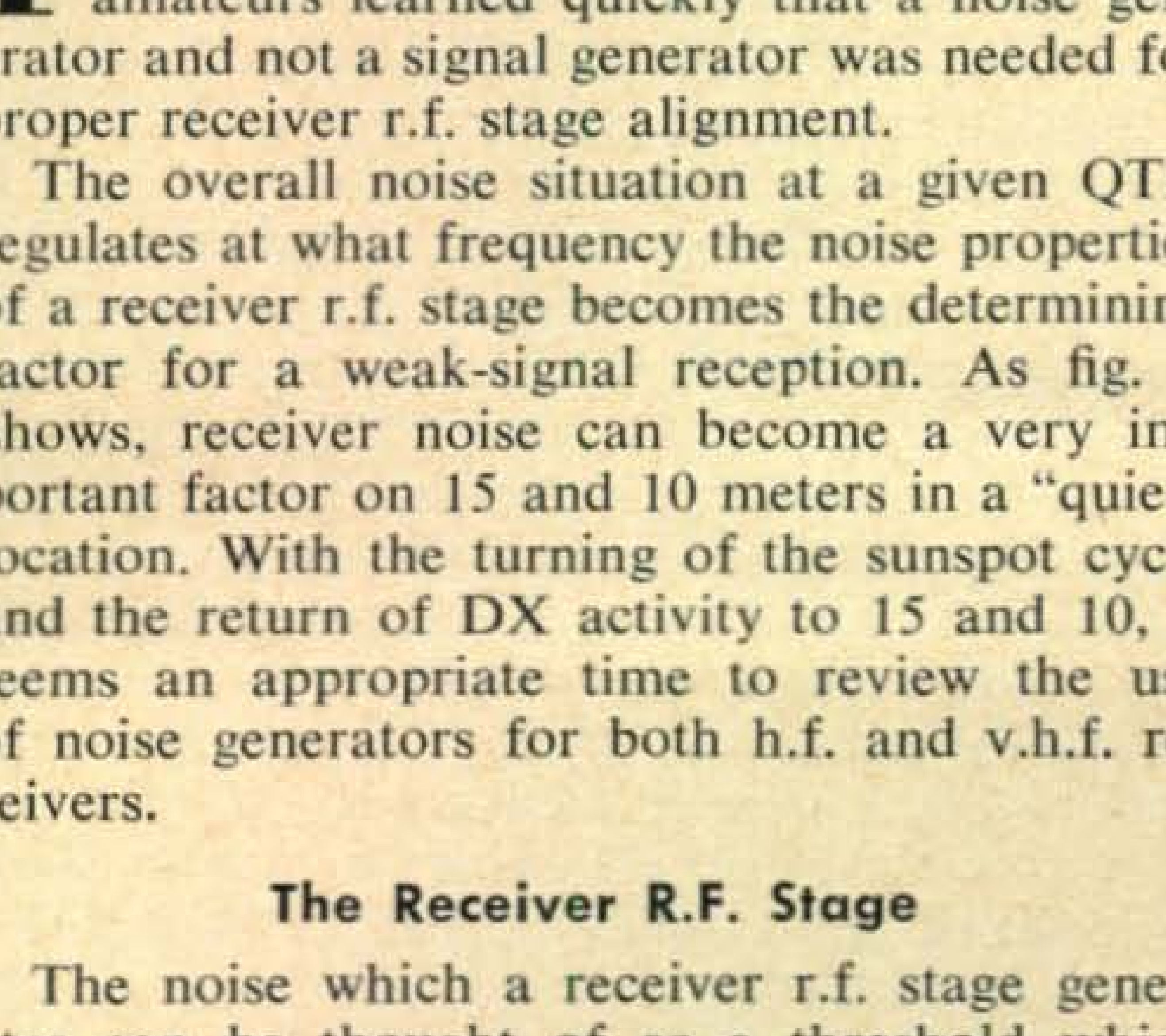


Fig. 1—Typical noise levels, 40° latitude, 6 kc bandwidth. Noise levels in the tropics may be up to 20 db higher and in arctic regions 20 db lower.

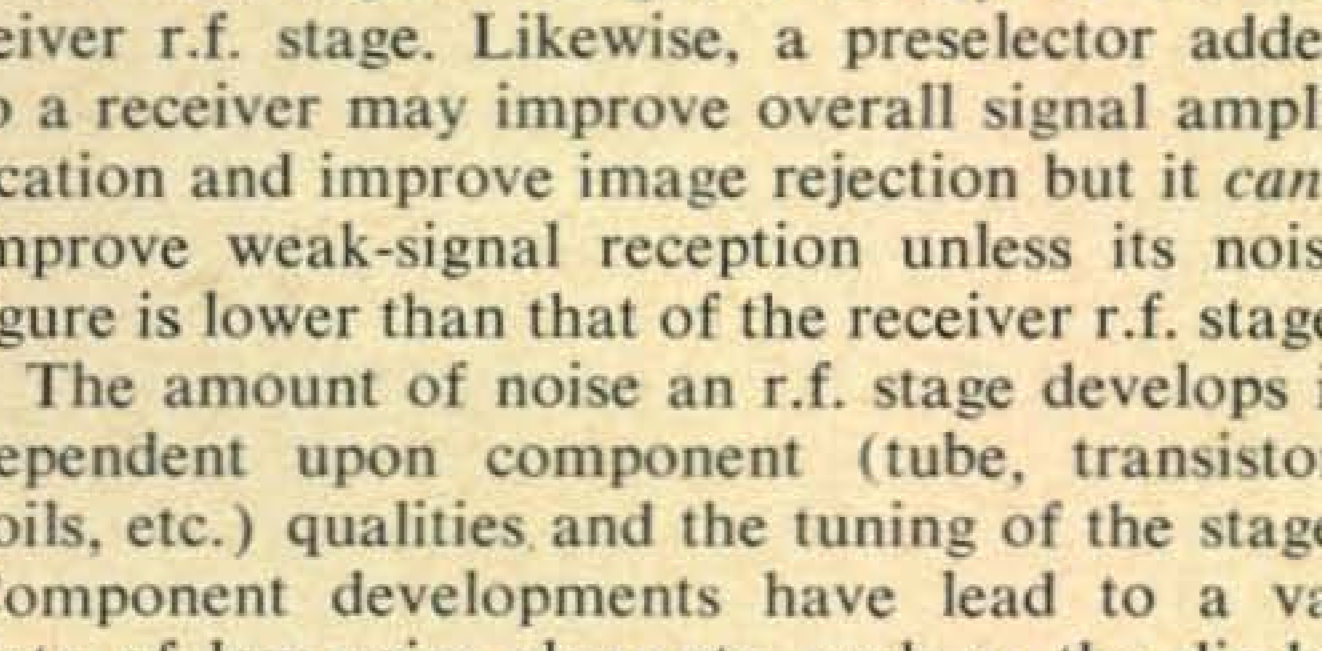
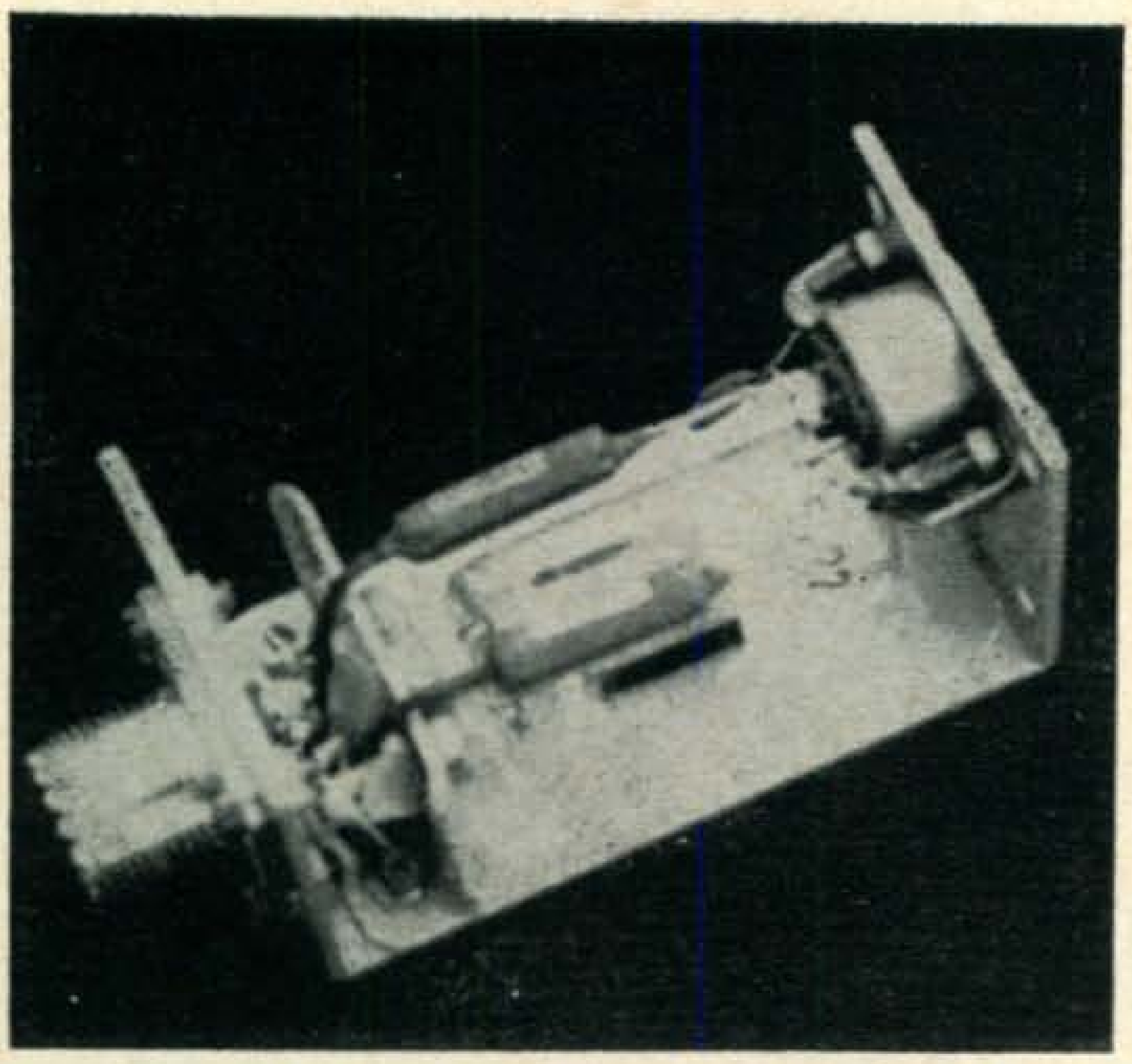


Fig. 2—Receiver input circuit parameters. R_a is the impedance reflected from the antenna coupling circuit and R_z is the resonant impedance of the input circuit.



A 5722 diode noise generator constructed so that it can be mounted directly on receiver input connector. Power supply and indicating circuitry are external. With the Ohmite Z 144 filament chokes shown, useful range is 80-200 mc. With other chokes the useful range is from 10 mc to 400 mc.

a theoretically noiseless amplifier (0 db noise figure). A broadcast receiver r.f. stage may have a noise figure of 30-40 db while a very good amateur 80-10 meter receiver will run 10-15 db.

How tuning may affect noise figure for the case of an otherwise noiseless amplifier is shown by the simplified formula:

$$\textit{Noise factor} = 1 + \frac{Ra}{Rz}$$

where R_a and R_z are as shown in fig. 2. To achieve maximum amplification or signal transfer, R_a should equal R_z. (This adjustment is effected when the circuit is peaked for maximum output using a signal generator.) This condition results, however, in a noise figure of 3 db ($1 + 1/1 = 2$ or 3 db) for the theoretical case and possibly more for a practical amplifier. The old empirical design rule of keeping the receiver antenna link coupling as loose as possible is partially a reflection of the foregoing.

The Noise Generator

A noise generator is needed to align an r.f. stage for minimum noise generation. The i.f. section of the receiver is first aligned with a signal generator and the r.f. stage tuned circuits approximately peaked for maximum output also using the signal generator. The noise generator is then connected as directly as possible to the receiver antenna input terminals and the r.f. stage tuned circuits adjusted alternatively for maximum noise amplification, always using the minimum discernible noise generator output.

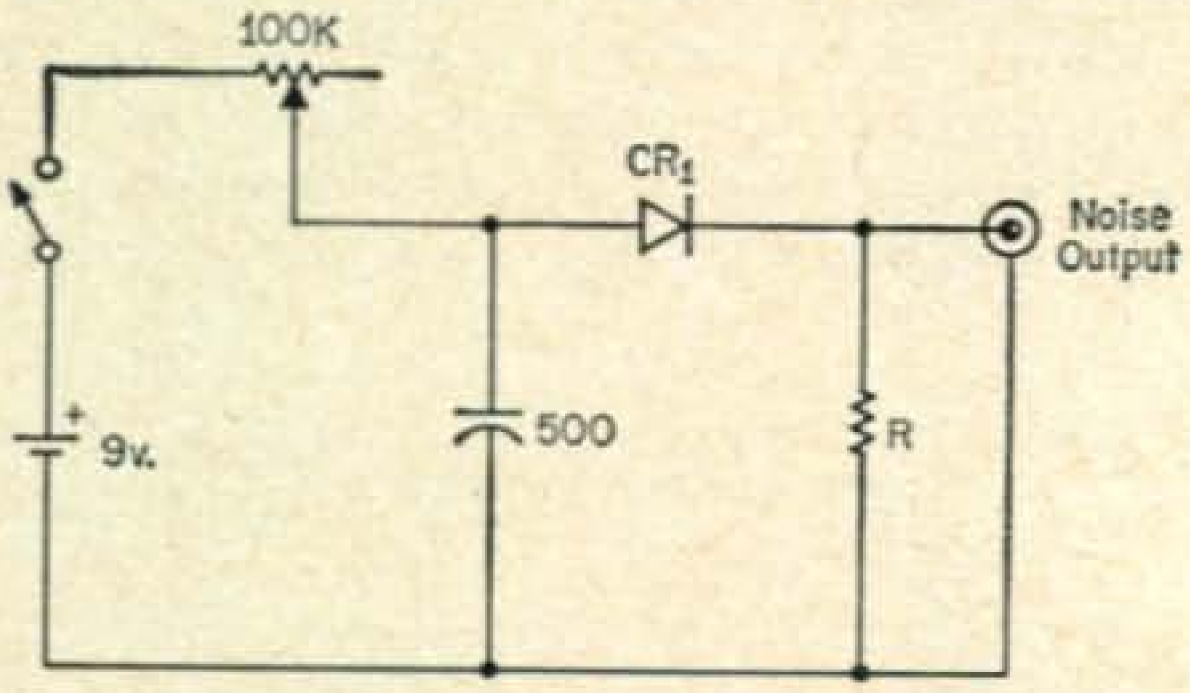


Fig. 3—Simple crystal diode noise generator. Suitable diodes are 1N 21, 23, 24 or 82. The diode can be tried reversed if the output is not sufficient. R is equal to the receiver input impedance. The 100K pot should have a log taper and the 500 mmf capacitor should be disc type.

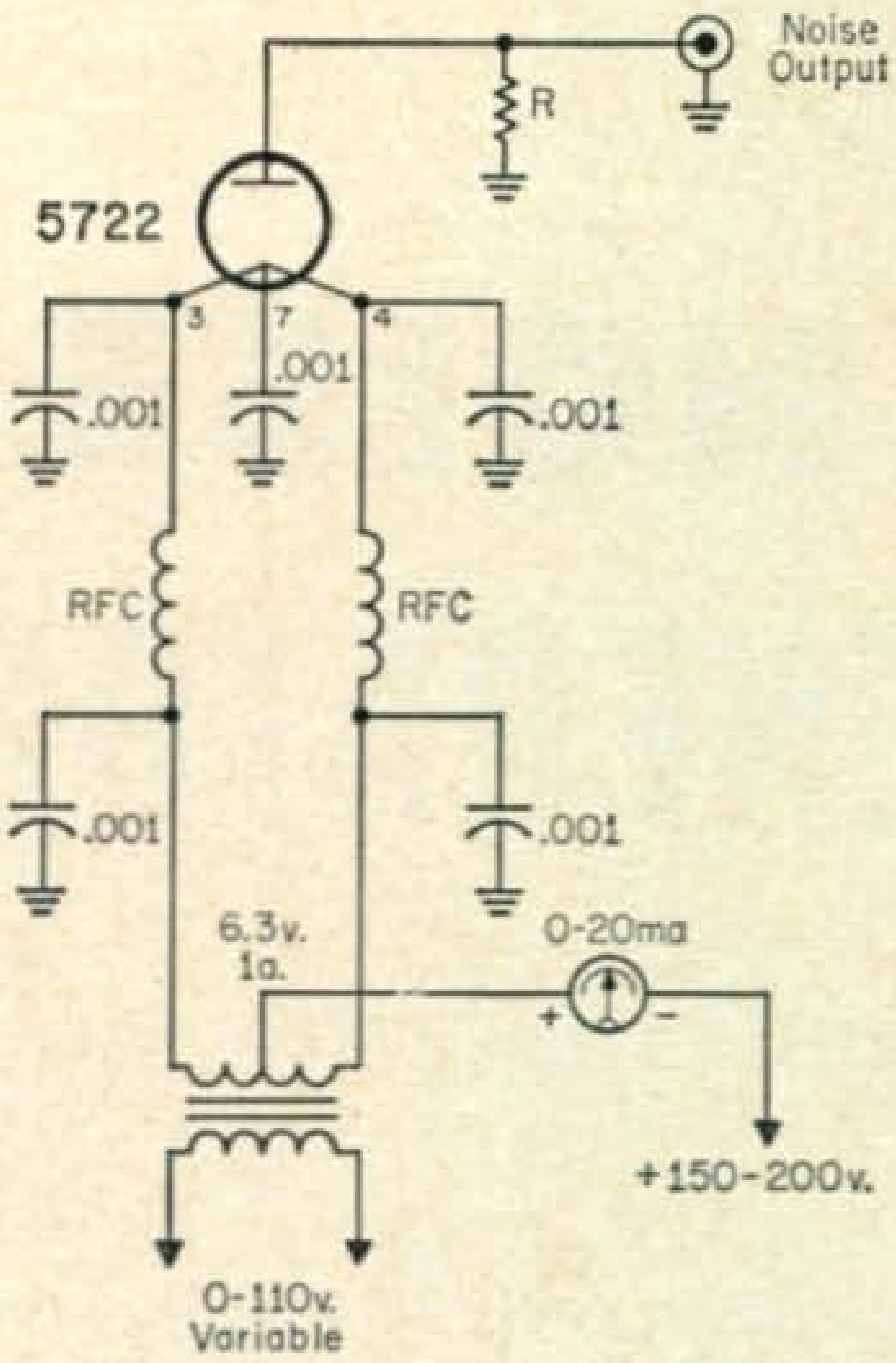


Fig. 4—Tube-type noise generator. All capacitors are .001 mf disc. R is the same as in fig. 3. R.f.c. is chosen to cover the frequency range desired. (Ohmite "Z" series or Miller "RFC" series).

This procedure may, at first, appear contradictory to the idea of adjusting an r.f. stage for minimum noise generation. It is, however, based on the idea that in tuning an r.f. stage for maximum noise output or amplification, internal noise must necessarily be made a minimum. One could attempt the alignment using only antenna noise but the results are likely to be poor since atmospheric noise intensity and frequency distribution are both variable. A noise generator, on the other hand, produces a level amount of noise over a certain frequency range.

Two Simple Noise Generators

A generator which can be built for about 2 dollars but is still useful up to 144 mc is shown in fig. 3. It would be useful to construct it with a male coax chassis connector to allow its direct connection to a receiver input.

The generator cannot be used to measure the actual noise figure of a stage, however, because the output level of different diodes for the same d.c. voltage is not constant. Noise figure can, however, be measured with the tube-type generator shown in fig. 4. The tube is always operated in a saturated condition and the filament voltage is varied to regulate the output.

Measuring N.F.

To measure noise figure, the receiver noise output with the generator turned off is noted.

[*Continued on page 99*]

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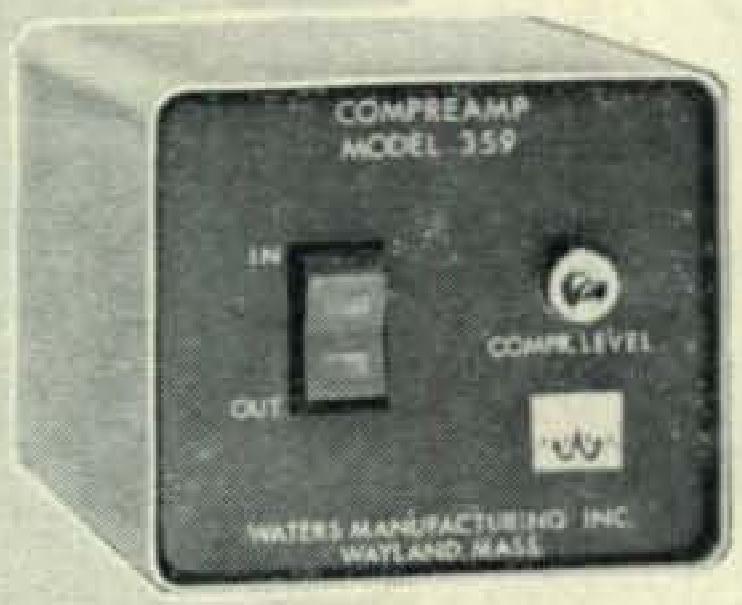

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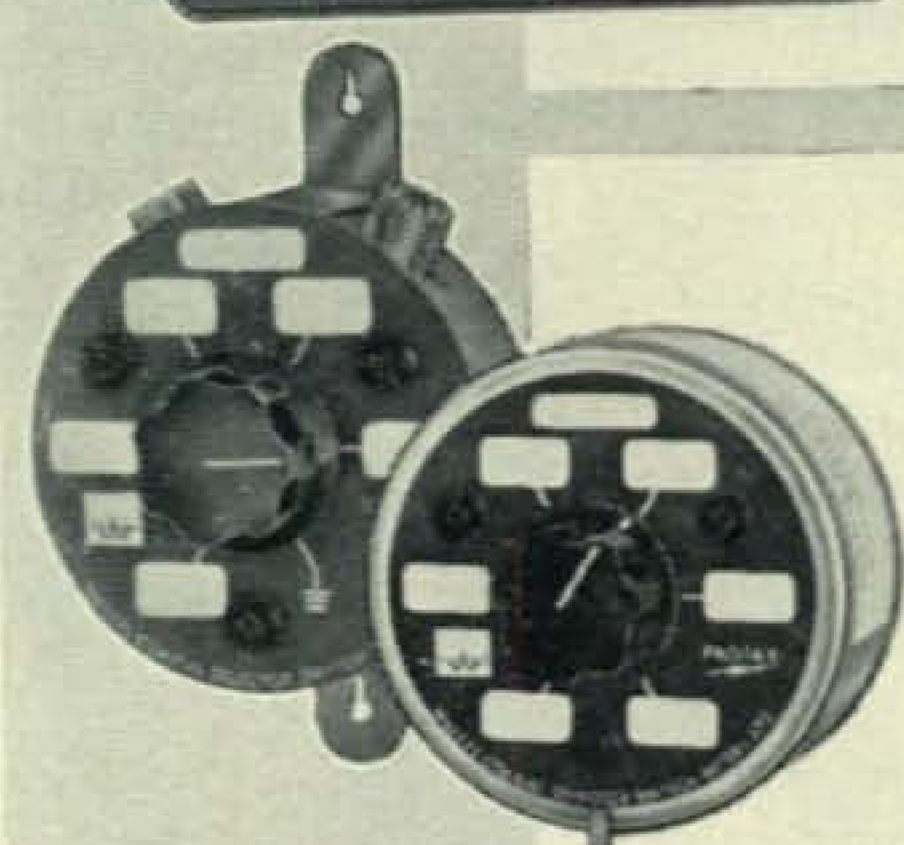

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For further information, check number 1, on page 110

BY MARVIN K. COOK,* WA2RDO

AFTER attempting virtually all modes of operation on the ham bands, I at last strove for the ultimate, a fully equipped (working) RTTY station. Mention RTTY problems over either the h.f. or v.h.f. bands and countless strong minds, hands, and I might add, weak backs are proffered freely, in a touching (almost maudlin) display of ham spirit. With the incalculable help of experienced RTTY men, I was eventually able to make the much-modified W2JAV perform quite well, in conjunction with the S-line and the SB-200 Linear.

It was not long before I found that they were quite right in their dire but unheeded prediction that running RTTY even at 50% reduced power was brutally damaging in regard to the effect on exciters, linears and antennas designed intrinsically for intermittent s.s.b. operation.

While operating RTTY on the 20 meter band one Saturday, I noted that the s.w.r. suddenly soared to maximum on my bridge. The linear was excessively hot and proved unresponsive to loading and tuning. At first, I thought the antenna had gone west but a dummy load confirmed the same unhappy condition.

The 20 meter traps in my inverted V had overheated under continuous RTTY operation and the epoxy protective coating under this barrage eventually split and allowed moisture to enter. The 20 meter tank coil section of the SB-200 had also shown definite signs of overheating, as the coil form was charred and the coil itself had shifted which resulted in a marked frequency change. Catastrophe!

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Plating

After a few other checks, it was decided to replace the 20 meter coil section with a ruggedized version comprising ⅛ inch o.d. hollow copper automotive tubing which I purchased locally (oil gauge tubing). In order to silverplate the new coil, I scrounged around until I hit upon an ideal electrolyte that was simple, cheap, safe and effective. This product is known under the name of Dan-Dee Dip Silver Cleaner[1] which is an excellent oxide and sulfide remover. It also has a built-in detergent which serves as an effective penetrant and aids in rinseability. Most important, it is safe to use around the house or shack which is certainly not the case with the deadly cyanide salts, compounds I dislike keeping even in the laboratory.

Electroplaters attach great importance to the cleanliness of an article to be plated. Dan-Dee Dip appears to clean as it plates, eliminating the tiresome task of stripping down the metal. The copper tubing was straightened out to a length of approximately 2½ feet which was around 10% longer than the original.

Since I had no tank to handle this particular length of copper tubing (not to forget that I didn't want the inside wet), it was decided to brush plate the copper. An old combination 6 and 12 volt battery charger was located and the positive lead was clipped to the copper tubing. The negative insulated alligator clip was attached to a thin piece of pure silver foil (an *old* style dime should serve equally well). Over this was slid a slotted piece of synthetic sponge rubber. The rubber may be held to the alligator clip with a couple of rubber bands or a clip could serve in clamping the whole works together.

The sponge was then saturated with Dan-Dee Dip and plating was started at 6 volts, using a slow up and down brushing action, while the tubing was turned. The solution cleaned very nicely as it plated but it proceeded to deposit the silver rather slowly. On the spot experimentation uncovered an accelerator[2] which speeded up the process considerably. A remarkably uniform silver deposit was achieved within 10 minutes. After this, the plated copper tubing was wiped with a dry piece of paper toweling and rubbed gently until the silver developed a high sheen.

Tuning

The original 20 meter coil section was clipped out from the SB-200 and the new coil (which was

[1] Twin City Shellac Co., 340 Flushing Avenue, Brooklyn, N. Y.

[2] The accelerator is Ethylenediamine tetraacetic acid, a harmless organic chemical compound. Companies which manufacture this product would be disinclined either to sell small quantities or send samples. I will send a small quantity to any *ham*, gratis, if the request is accompanied by an sase.

10% longer than the original and thinner tank coil) was soldered into position. Loading and tuning of the linear proved to be exactly as before, particular in regard to the capacitor settings and this was true of all bands. I immediately noted that the 572 B's ran appreciably cooler and neither the tank coil nor the tubes showed any signs of overheating, even with key down for 15 minutes!

Cooling

While the small ventilating fan in the SB-200 is quite adequate for heat dissipation under intermittent SSB service, it is virtually useless for the steady key-down conditions imposed by RTTY. To achieve better cooling, I took two old phonograph motors that were gathering moss in my meager junk box and attached to each, a 3-bladed nylon model aeroplane propeller which was picked up at a local hobby shop. These inexpensive blades are ideal as blower fans as they are dynamically balanced and very light. They come in a variety of sizes and sometimes, with different pitch arangements. The ones I used were made of black nylon and had blades that measured 2½ inches from the hub. The holes in the hub were enlarged slightly with an electric drill and gently tapped on to the shaft of the phonograph motor. A dab of plastic glue or epoxy will help to eliminate spin-off. The prop and motor combination may be used either in the normal forward position to *pull* air or in the reverse position, to *blow* a steady stream.

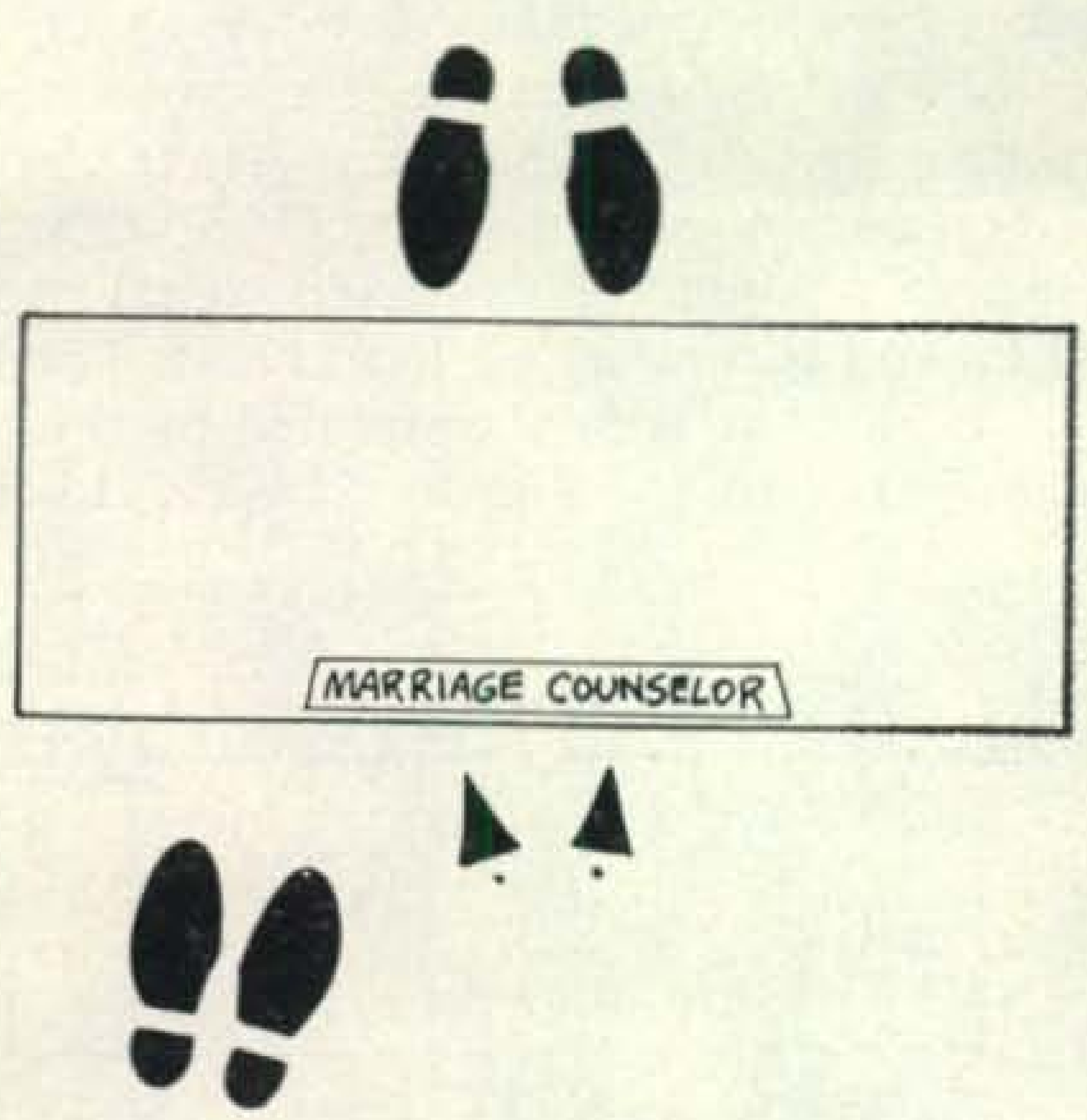
A surprisingly strong current of air is generated by this simple and inexpensive system and the motor runs cool and virtually noiseless. One fan, set to pull air, was mounted approximately 6 inches above the SB-200 tube compartment. The other was placed to blow air into the 32S-1 final tube compartment. Actual temperature readings showed that under RTTY conditions, the 32S-1 was running cooler than room temperature while the SB-200 was only 20°F. above ambient temperature.

Subsequently, I plated a number of other components with equally good success. Some years ago, I constructed a 2 meter transceiver and I removed the tank coil from same and plated it with silver, using the same procedure as before. I also plated the copper strip tank detector with excellent results.

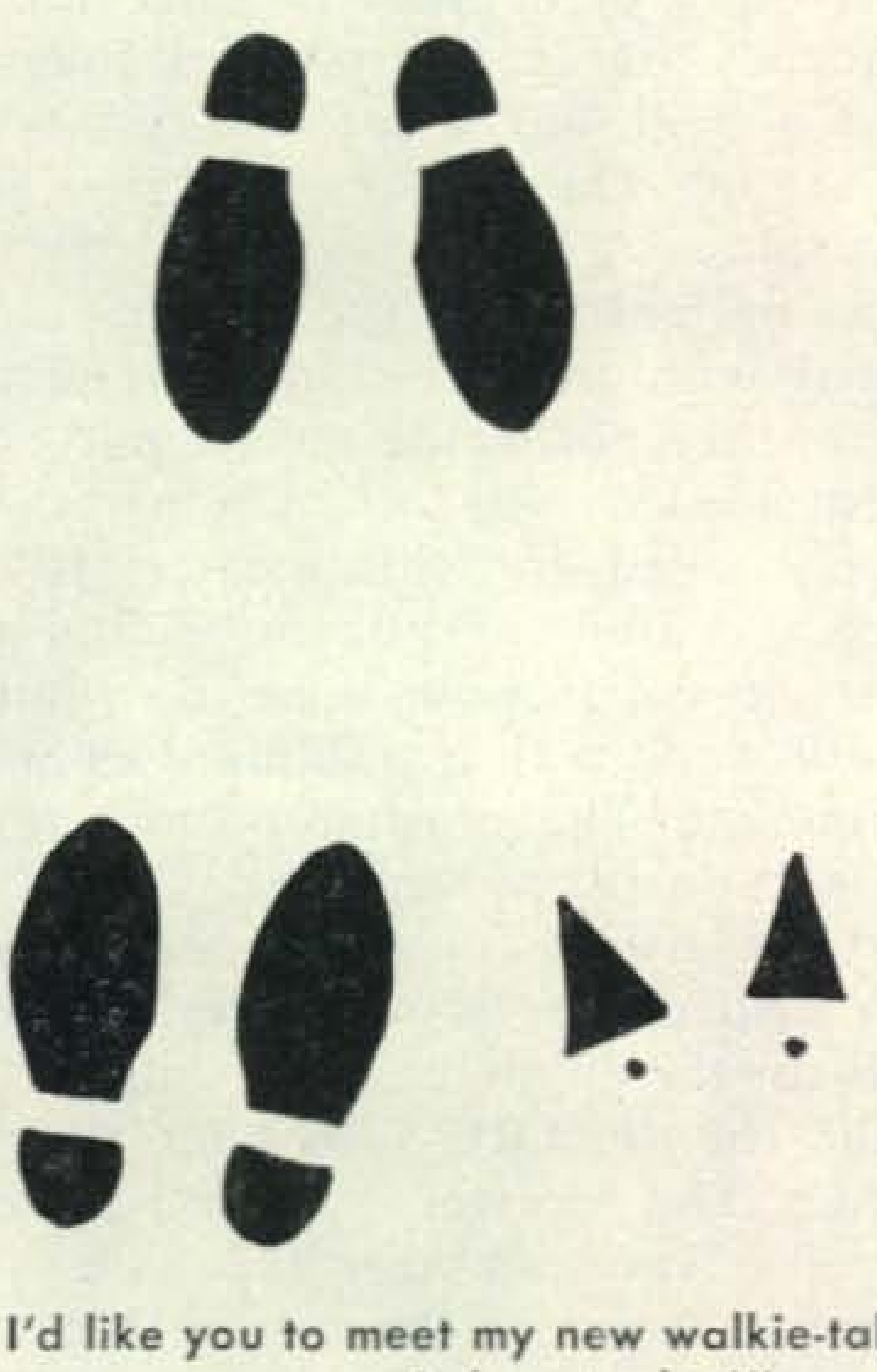
The outcome of all these efforts was that I have a real cool running station that has withstood continuous RTTY operation for hours at a time. Incidentally, the Dan-Dee Dip is terrific for removing the tarnish from TD commutators. ■

"Footsies"

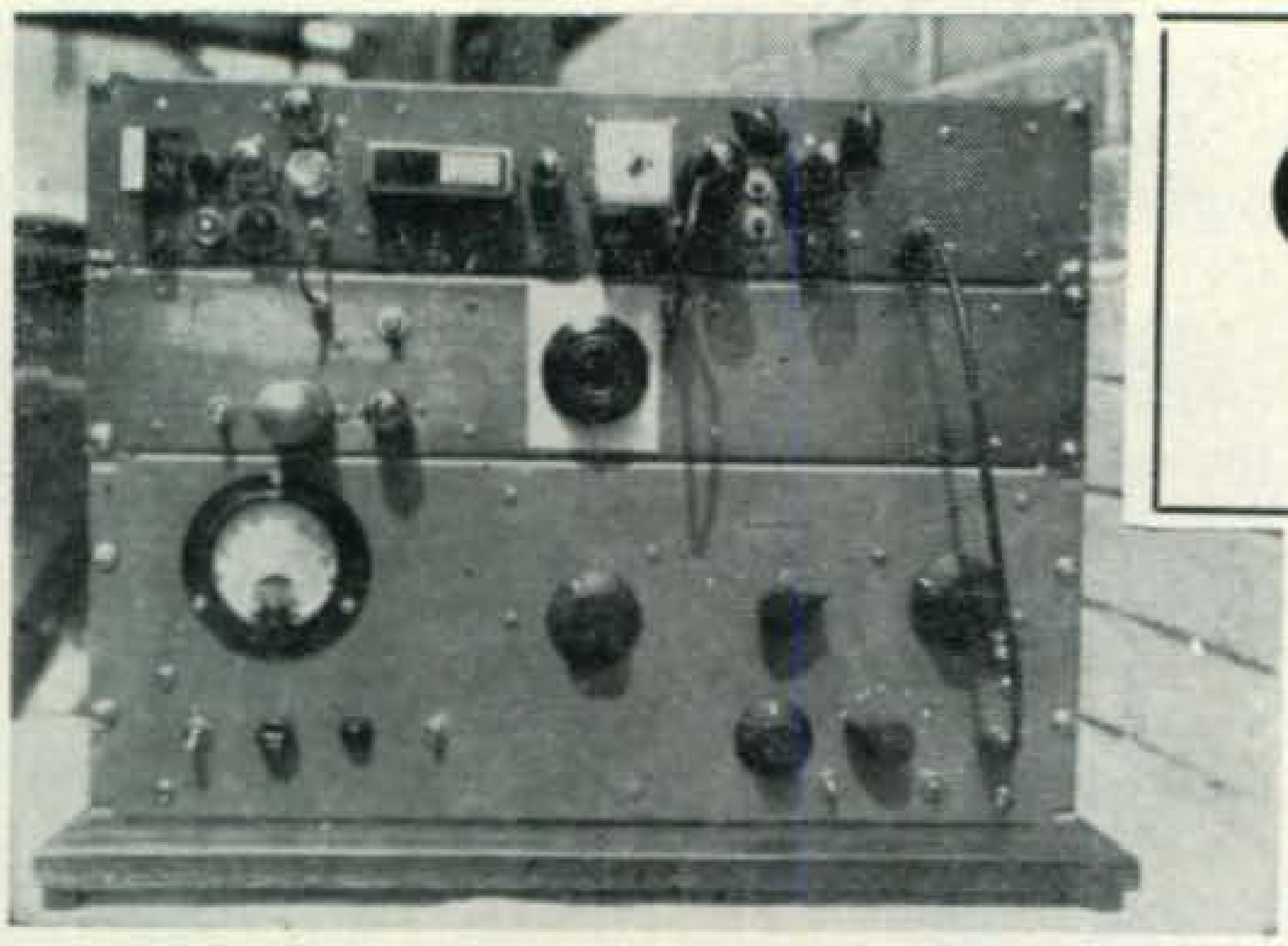
BY BILL SHELLY



"He's an amateur radio operator . . . need I say more?"



"Harry, I'd like you to meet my new walkie-talkie . . . we were married yesterday!"



Front view of the 80 meter s.s.b. transmitter. The linear and power supply share the bottom deck. The vox and the v.f.o. are in the middle section while the crystal oscillator, speech amplifier, filter, r.f. and driver stages are on the top deck.

OLD RELIABLE

An 80 Meter S.S.B. Transmitter

BY E. H. MARRINER,* W6BLZ

Described below is an 80 meter 100 watt p.e.p. s.s.b. transmitter. The exciter section is strictly for 80 but the linear may be operated on all bands with other exciters, if desired. Here is a sectional approach to homebrewing your own s.b. rig.

THIS is a description of an 80 meter, 100 watt, p.e.p. s.s.b. transmitter. It operates from 3.8 mc to 4.0 mc. It will not operate on any other ham band unless the output is fed into another mixer circuit; a description of this is beyond the scope of this article.

The rig was designed to show the way for those who want to try their hand at building their own equipment; it is an opportunity to get away from the "buy it yourself" attitude, which prevails in amateur radio today. It must be realized the components indicated are only approximate values and the constructor will have to have an assortment of fixed capacitors in the junkbox. Most of the parts are not too critical and can be substituted, and the constructor can improvise to obtain coil resonances.

The most expensive part is the mechanical filter, and it can be obtained from the Collins Radio Co. for $26. The low frequency oscillator crystal is more of a problem since the surplus low frequency market is drying up. International Crystal Co. will sell a set of crystals for the filter at $16.00. The rest of the exciter parts are mostly surplus.

It must be frustrating for the amateur, when confronted with the decision of how to build an s.s.b. exciter, to decide on the parts and test equipment needed. Not too many parts or equipment are needed for this exciter; it's mostly using the old amateur noggin to find ways to substitute. If you follow these instructions the circuit will work with a minimum of work and test equipment. The most important thing is a v.t.v.m. with an r.f. probe.

A suitable circuit for the probe is shown in fig. 1. A grid dipper is necessary to adjust the slug coils for the 80 meter band. Another helpful item might be an ARC-5 receiver tuning from 200-500 kc. The receiver is a good piece of test gear because you can hear the s.s.b. signal at 455 kc before finishing the exciter. Most dippers have a diode position; if not build a full strength meter that can be used to peak up the tank coils. A ham band receiver could be used.

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Each circuit can be made to function by itself before assembling the whole thing. This was the idea of the rig; it could be used as an s.s.b. test set, when building other equipment, by interchanging units.

Theory

All things have to start someplace and ours starts with the low frequency oscillator. It contains two crystals. The frequency of the crystals is located at a point that is 20 db down on either slope of the mechanical filter response. Switching crystals changes the sideband operation either to upper or lower. The crystal oscillator signal is then fed into a balanced mixer composed of four diodes and the carrier is balanced out by adjusting the BALANCE potentiometer.

The voice signal is now mixed with this balanced out carrier to produce double sideband suppressed carrier at 455 kc. The signal is now presented to the mechanical filter which eliminates one of the sidebands. This signal is then amplified by the intermediate stage amplifier and then combined in the 6AG7 mixer with the 3.3 mc v.f.o. signal. This mixed signal produces 3800 kc and is now in the ham band. The mixed signal at 3800 kc is now amplified by the output tube a 6AG7 to a value of 3 watts. Each side

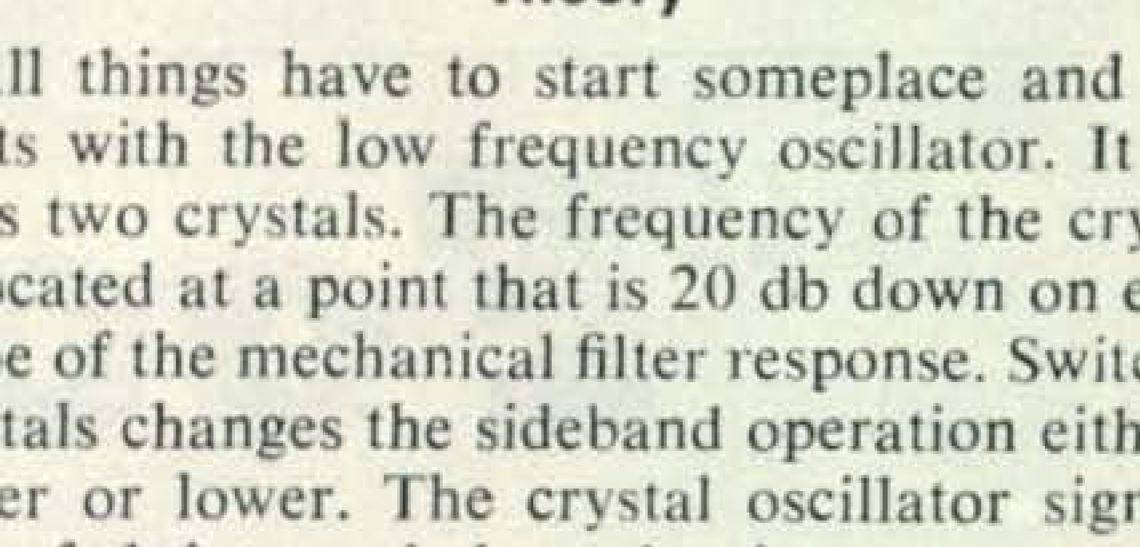


Fig. 1—Circuit of an r.f. probe used for alignment and testing of the s.s.b. transmitter. The unit is constructed on a 7 pin miniature tube socket. The probe point is a heavy wire soldered to the center post; the lugs are all clipped off. A tube shield is slipped over the parts and the coax is passed out the end hole through a grommet.

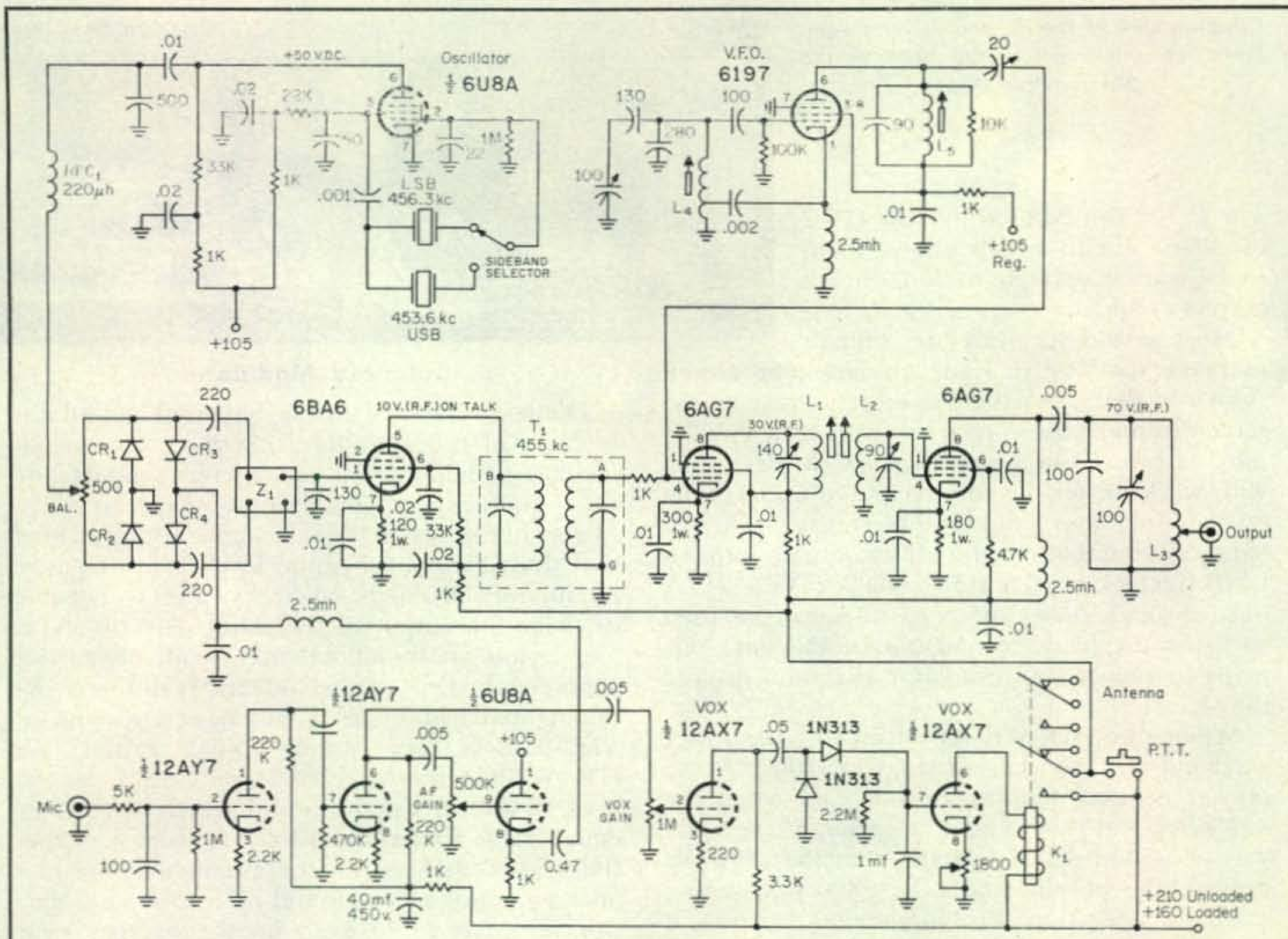


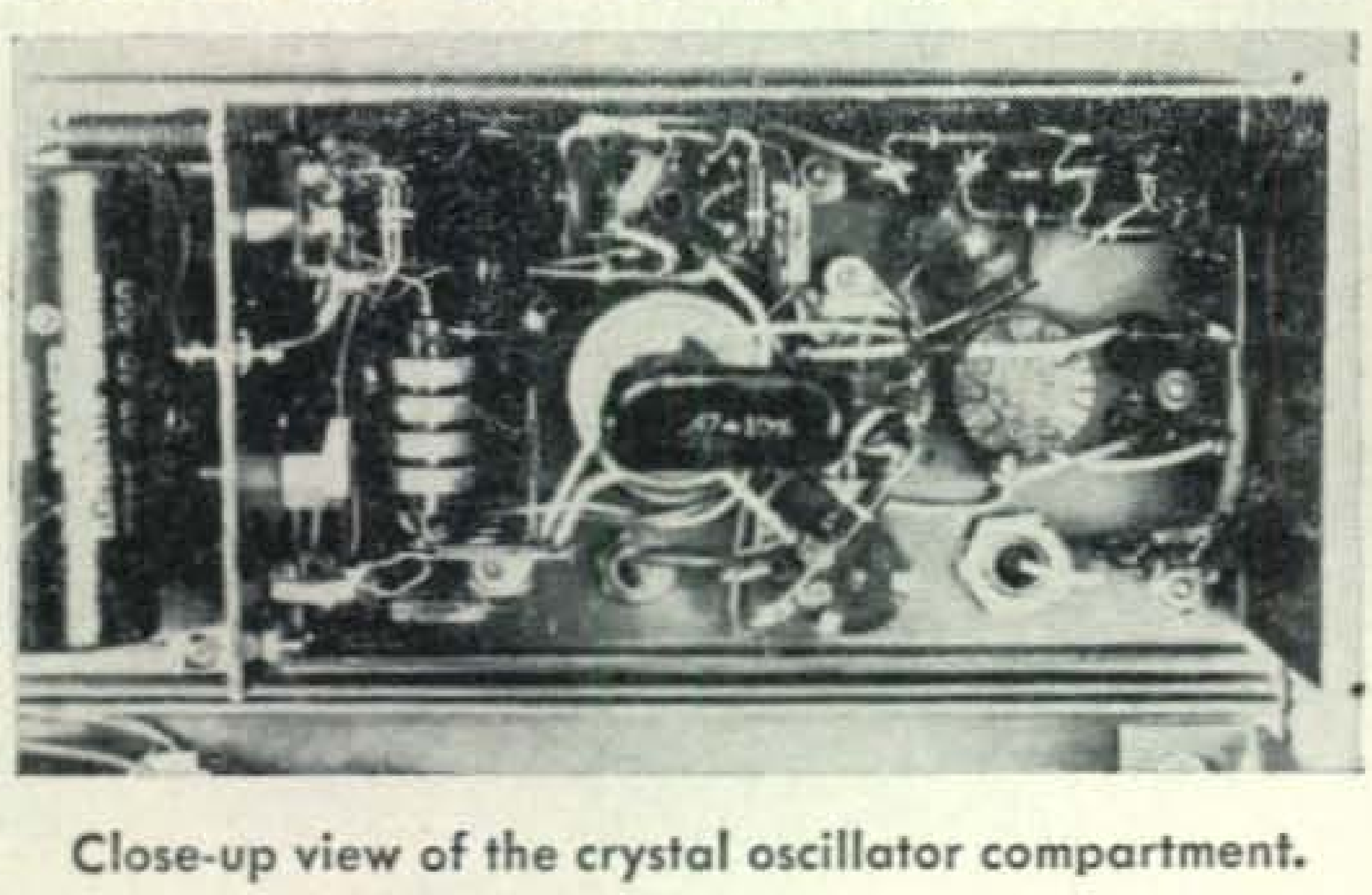
Fig. 2—Circuit of the exciter portion of the s.s.b. transmitter. All resistors are ½ watt except where noted. All capacitors are silver micas except the higher values (0.01 0.02 etc.) which are disc ceramics. Capacitor values greater than one are in mmf, less than one in mf unless otherwise noted.

CR_1, CR_2, CR_3, CR_4—1N34 1N277 or GE-AO79. See text.
K_1—10K d.p.d.t. relay.
L_1—38t #26 e. closewound on a National XR-50 slug tuned form.
L_2—38t #26 e. closewound on a National XR-50 slug tuned form located very close to L_1 for maximum coupling.
L_3—21t Air-Dux 1216, 1½" dia., tapped 3t from the bottom.
L_4—38t #26 e. on a National XR-50 slug tuned form tapped 6t from the bottom.
L_5—38t #26 e. on a National XR-50 slug tuned form.
RFC_1—220 microhenries. J. W. Miller 913-C1 or equip.

of this 3800 kc signal and 455 kc away is an image signal that must not pass through to the antenna. On eighty meters the grid and plate tank coils of the output tube are selective enough to reject this spurious signal but would not be selective enough if the rig were operating on 40 meters. It would be necessary to have more tuned circuits.

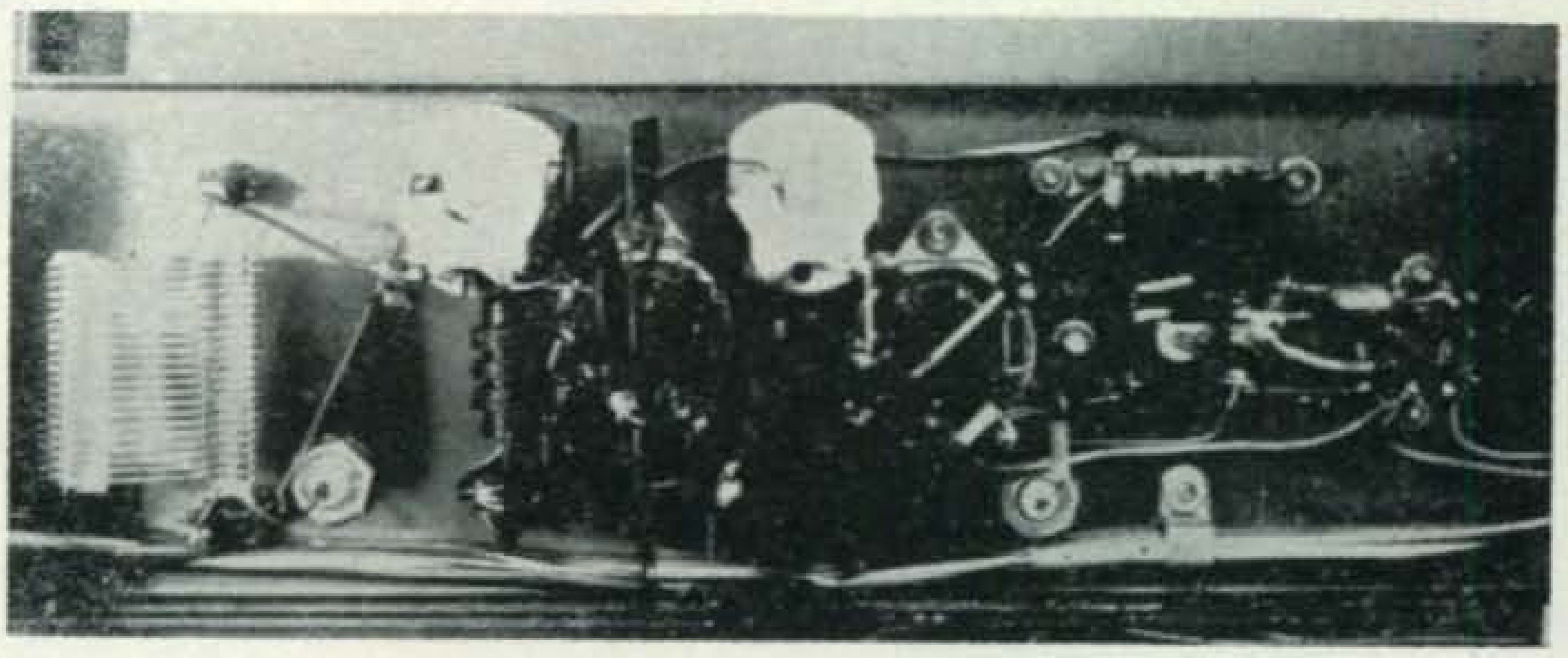
Low Frequency Oscillator Section

Collins mechanical filters come with a data sheet that specify the proper crystal frequency to use for that particular filter; these frequencies are generally close to 456.360 kc and 453.680 kc. A few cycles deviation from these frequencies will not actually be too noticeable. Surplus crystals can be used for the crystal oscillator. Channel 45 is 453.748 kc and Channel 326 is 452.777 kc. If an assortment of these crystals were measured on a checker it would be noted they vary from the above frequencies sometimes by 200 cycles and if you are lucky one may fall on the frequency needed. It is possible to hold the Channel 326 crystal with tweezers and carefully edge sand the crystal to increase the frequency enough so it will fall on to the correct value. These surplus crystals are advertised in *CQ* Magazine by various companies, although they are fast disappearing from the market.



Close-up view of the crystal oscillator compartment.

Commercial low frequency crystals are expensive because of the amount of time it takes to process them. Mr. P. M. Freeland, of the International Crystal Co., 18 North Lee St., Oklahoma City, Okla., was alerted to the problem and has agreed to sell amateurs the F-700 type crystals for $16.00 a pair. They normally cost $26.00 when ground to a specific frequency.



Close-up view of the i.f. and driver stages. Note the shield across the base of the 6AG7 output stage.

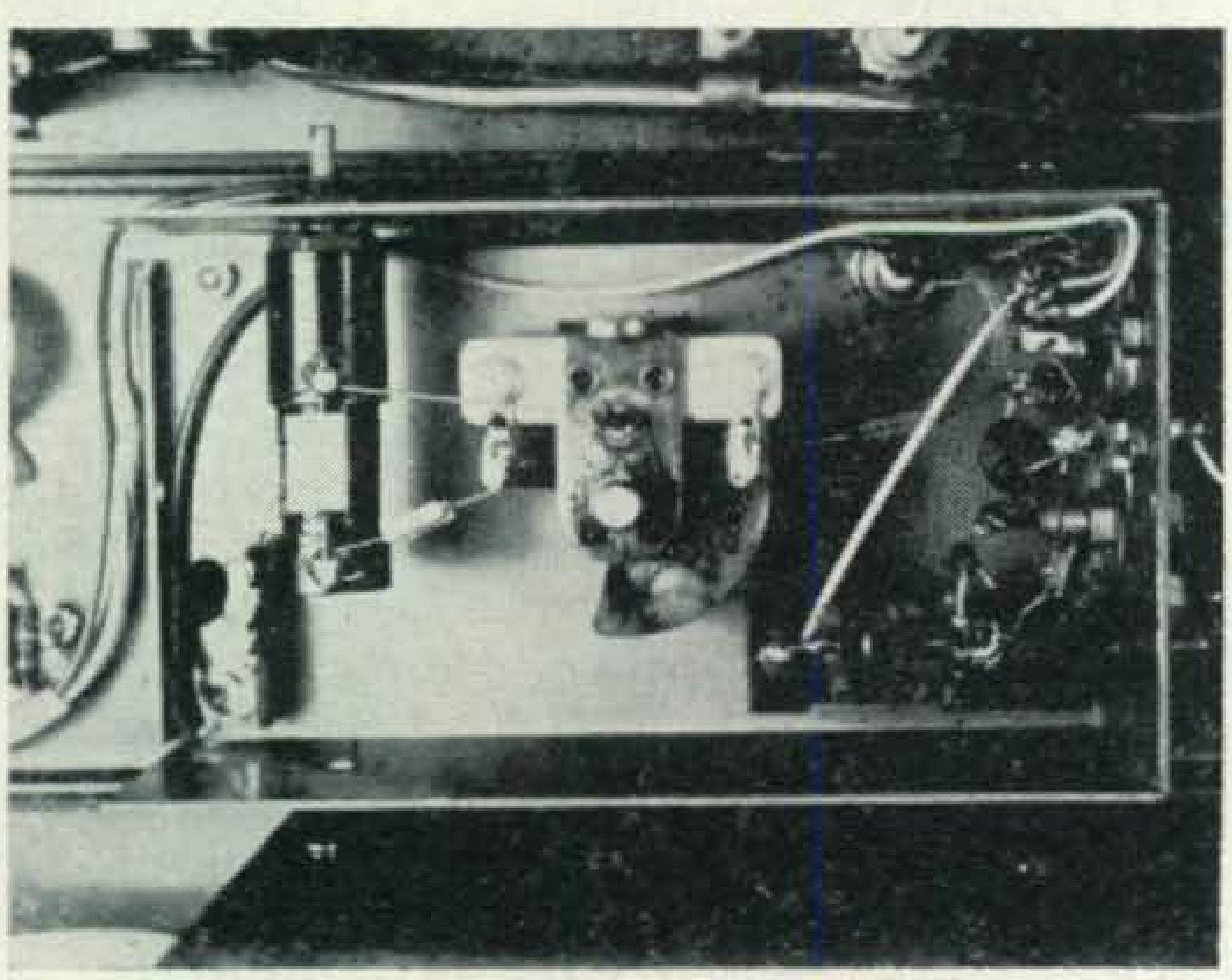
The F-700 can be used in their OT-2 oscillator circuit which allows them to be varied enough to fall on the correct frequency.

Most surplus crystals are difficult to make oscillate in some circuits. The circuit shown in the schematic has an r.f. choke in the screen to make the crystal oscillate easier. A 2.5 mhy will work but a 60 mhy, J. W. Miller #958 will work better if you have the room. The crystal oscillator and audio stages with the balanced modulator are all crammed into an LMB sidelock box LS #532, 5¼" × 3" × 2⅛". Feed-through 0.001 mf capacitors can be used to bring the leads in and out of the box; this helps to reduce any oscillator radiation around the shack.

When this exciter is on 80 meters, the lower sideband will be transmitted when the 456 kc crystal is used, and upper sideband when the 453 kc crystal is switched into place. If the v.f.o. was on 3347.0 kc and mixed with the 453.3 kc crystal, the output would be 3800.3 kc upper sideband operation. For alignment purposes it would be a good idea to have a 455 kc crystal to plug in to align the i.f. at the center frequency of the mechanical filter, but this is not absolutely necessary because the i.f. is rather broad tuning.

Audio Stage

The audio stage uses a 12AY7 because it has low leakage hum and a gain of 1750 micromhos. A crystal microphone was fed into the first grid through an *RC* network to prevent r.f. feedback. The output of the audio is coupled into a ½ of a 6U8 used as a cathode follower and is then fed to the balanced modulator. The follower isolates and prevents interaction between the audio and balancing. With transformer coupling, the gain control affected the carrier balance.



Rear view of the v.f.o. shows the parts location. The grid coil is placed vertically and the plate coil horizontally. The oscillator tube is on the left. Note the use of feedthrough capacitors.

Balanced Modulator

Diodes were used in the balanced modulator in place of tubes because they have several advantages; high stability, long life, compact and little maintenance. Diodes are made to work like switches using the r.f. signal for switching that must exceed the audio level. The ring type modulator has high efficiency and is capable of twice the output of the shunt or series type, and it has an initial balance of 40 db carrier suppression. One of the difficult features is obtaining matched diodes; good ones are expensive. The best, if they can be found surplus, are GE AO79. Otherwise, 1N34 or 1N277 can be used if several can be found which are nearly equal in the forward and back resistance. Sometimes after they are in the circuit and the balance potentiometer is found off to one side; they can be swapped to even up the balance near the middle of the range.

Many things affect the carrier balance; most of it is capacity of the components or wiring to ground. The metal cover on the balance potentiometer or the cover on the mechanical filter also tend to unbalance the diodes. Thus it is a good idea to get the balanced modulator part of the exciter working before proceeding with further construction.

The crystal oscillator should supply 3 volts r.m.s. to the arm of the balanced modulator potentiometer. The voltage can be measured with the r.f. probe described in fig. 1. A 500 ohm potentiometer was used so that more of a range could be covered until the proper diodes are installed. With a smaller value of pot or if 100 ohm type were used with fixed resistors on each side, the null might appear far off to one side and could not be located.

The GAIN control should be off whenever balancing is done. Complete balancing can be best done by pulling out the cathode follower tube in the initial adjustments. No carrier insertion control was used because this is just another source where leads can carry the carrier signal around the filter. To tune the exciter the carrier can be unbalanced or an adjustable audio tone can be fed into the microphone input. I just unbalance the balance potentiometer and null it out by watching my plate meter or listening on the receiver.

Any hum or noise on the audio line will appear as carrier that cannot be nulled out. Many times when using diode rectifiers in the power supply, the switching transients appear through the ground system, being picked up on the

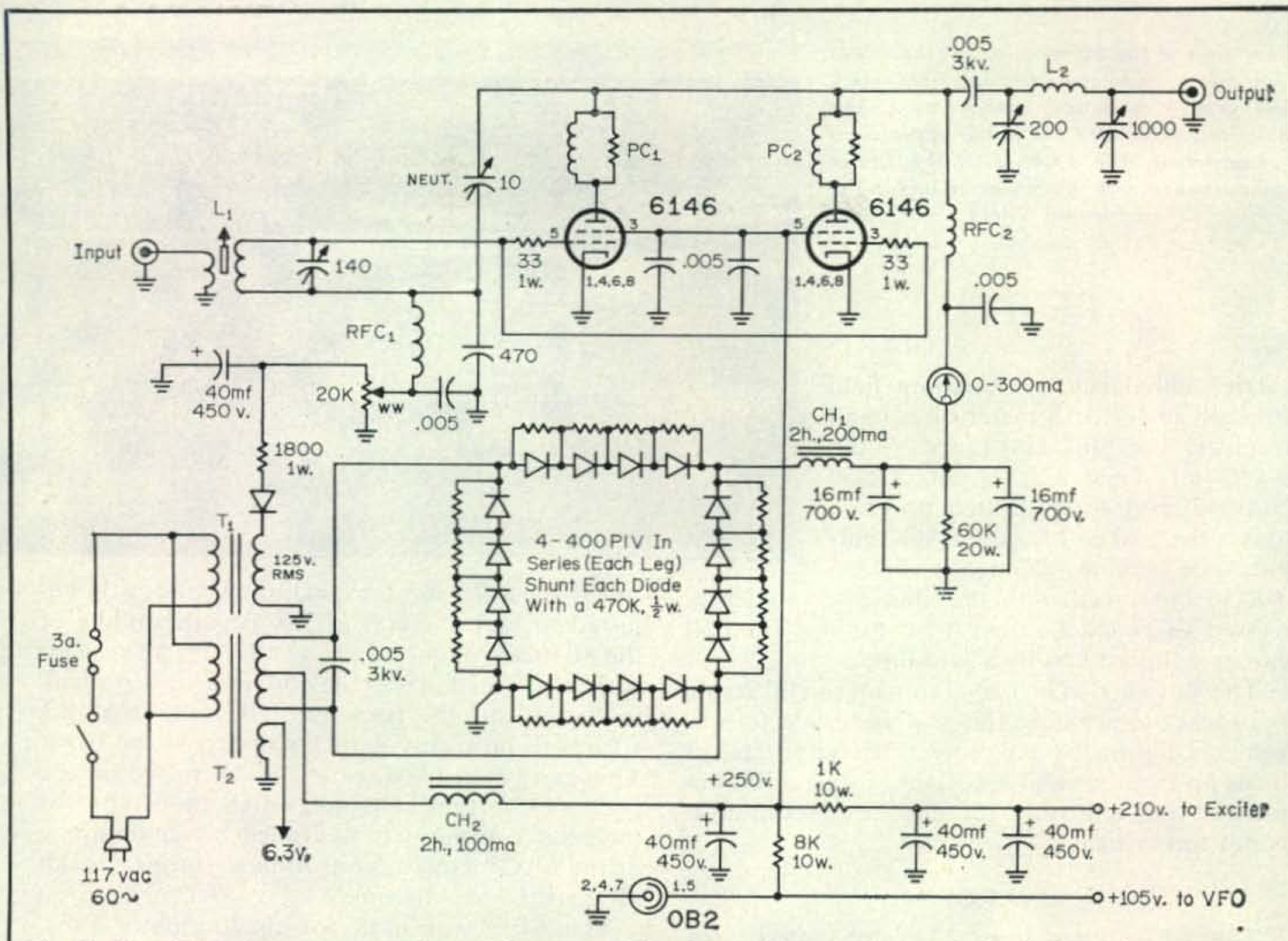


Fig. 3—Circuit of the power supply and linear amplifier located on the lower deck of the s.s.b. transmitter. All the diodes are 500 ma, 400 p.i.v. and those in the bridge circuit are shunted with 470K ½ watt resistors. All capacitors greater than one are in mmf, less than one in mf except where otherwise noted.

CH_1—2 hy, 200 ma, Stancor C-2325 or equiv.
CH_2—7 hy, 150 ma. Stancor C-1710 or equiv.
L_1—30t #26 e. closewound on a National XR-50 slug tuned form. A 3 turn link of hookup wire is wound on the cold end.
L_2—33t Air Dux #121206.
PC_1, PC_2—6t #20 wound on 47 ohm noninductive res.
T_1—125 v.a.c. at 15 ma. Stancor PS-8415 or equiv.
T_2—540 v.c.t. at 210 ma, 6.3 v at 9 amps. Olsen Electric Co. #T-318 or equiv.
RFC_1—1 mhy, J. W. Miller #4652 or equiv.
RFC_2—7.0 mc choke J. W. Miller RFC-7 or equiv.

microphone braid and inserted as a carrier. It is necessary to have good power supply filtering or use a vacuum tube rectifier to avoid trouble.

At this point in the construction we should have the carrier balanced out. If there is any difficulty doing this, just try the first two diodes across the potentiometer and then add the other two. This balanced out signal is fed into the mechanical filter which is tuned by the 220 mmf in series with each lead.

Although it was not found necessary in this rig, carrier balance can be increased by adding a fixed 25 mmf capacitor on one side of the balanced modulator, and a variable on the other side to ground. The variable 50 mmf can be tuned to decrease any residual carrier after the pot is balanced.

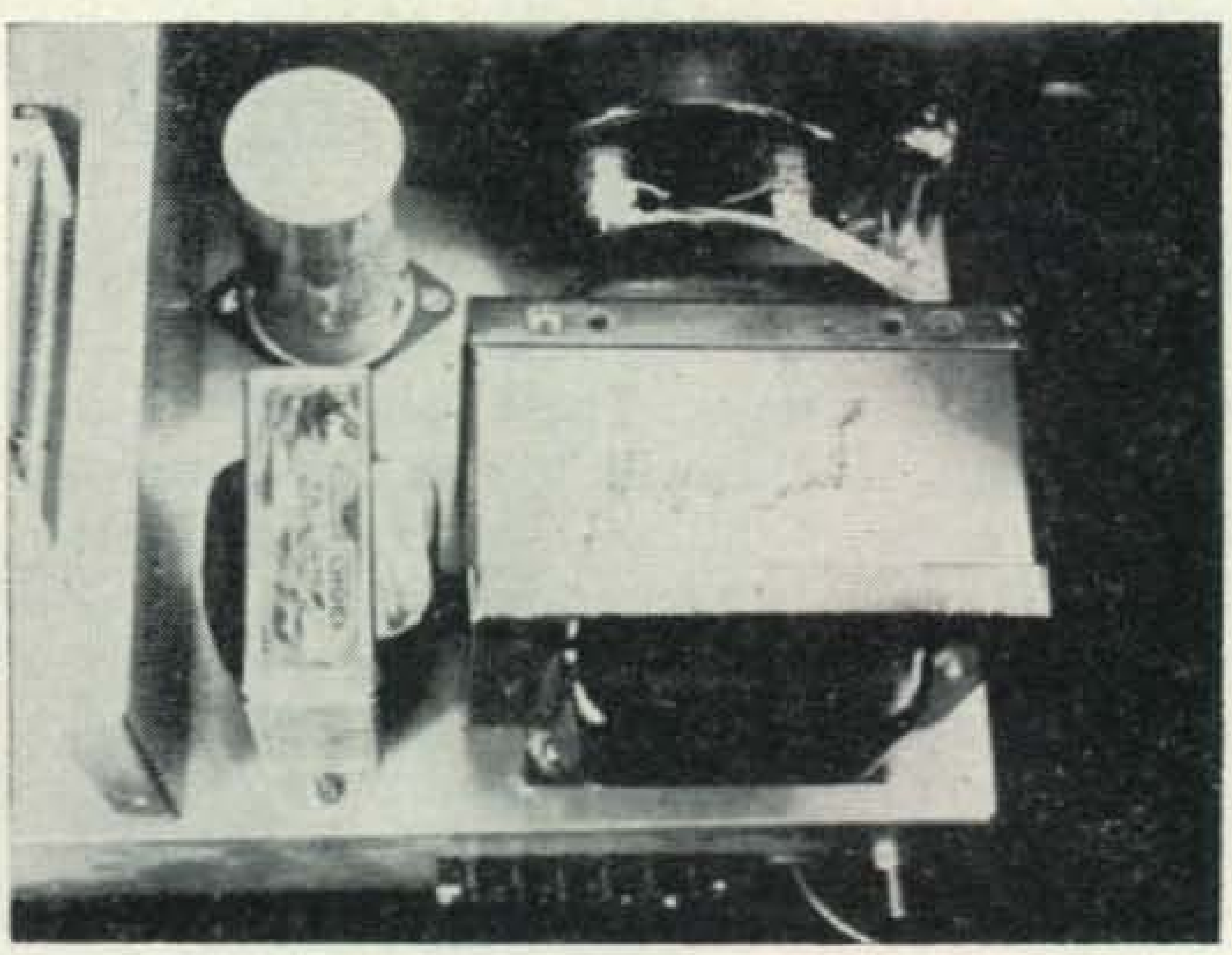
I.F. Amplifier

The signal leaving the mechanical filter is tuned by a fixed 130 mmf capacitor and fed into a 6BA6 amplifier. The peak output signal on talk is 10 volts r.f. and is fed into a 455 kc i.f. This signal is fed into a 6AG7 power mixer and combined with the v.f.o. signal.

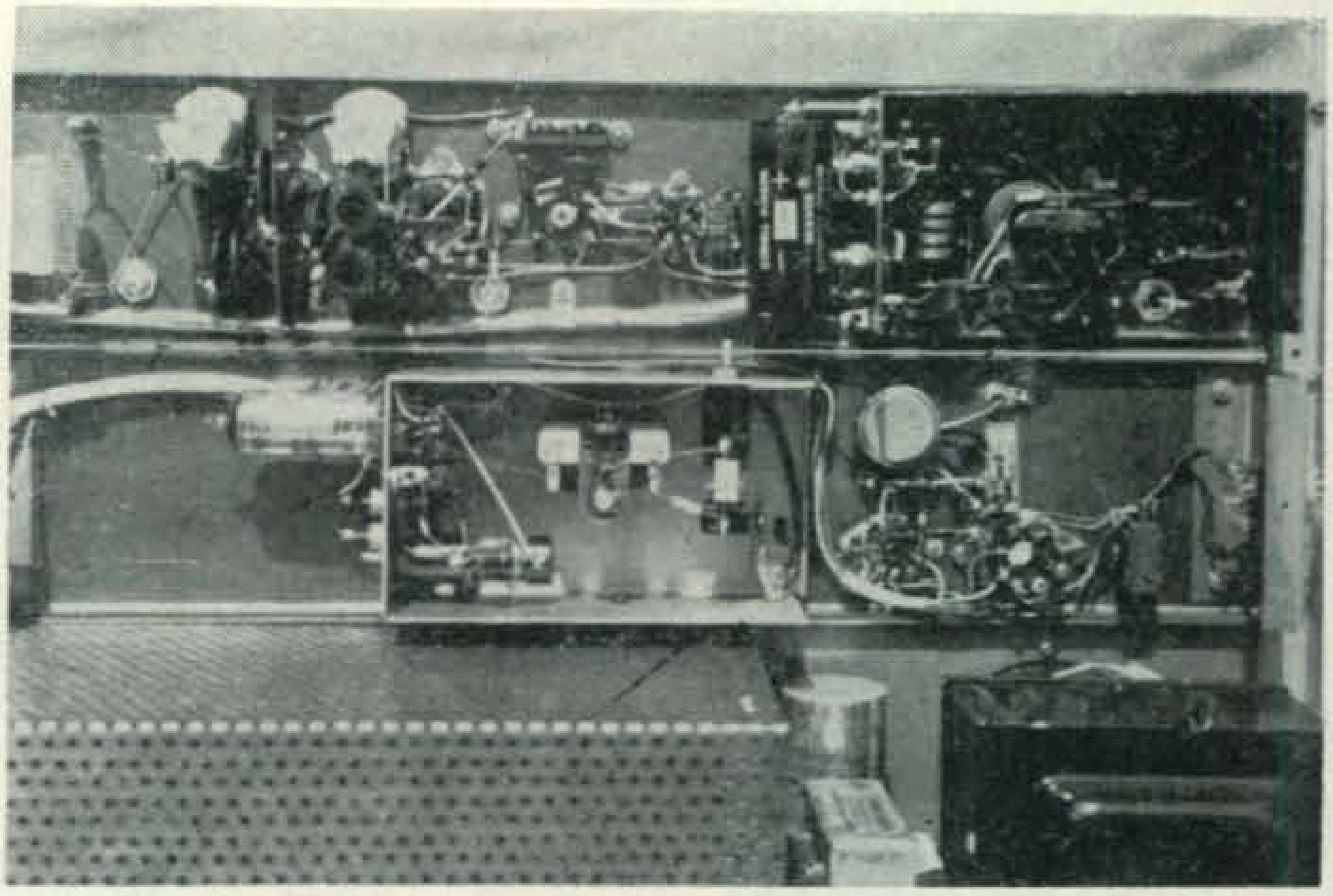
Mixer and Amplifier

It takes 4 to 6 volts r.m.s. from the v.f.o. to make the 6AG7 mix with the 455 kc signal. This voltage can be set by adjusting the 0-20 mmf trimmer and when the proper value is found a fixed mica can be substituted if desired.

The tank circuit of the mixer can be set at 3800 or 3900 kc and peaked up with a slight



Top view of the power supply. The low curent choke and the diode bridge are under the chassis.



Rear view of the 80 meter s.s.b. transmitter with the shielded compartments uncovered. The crystal oscillator, speech amp, and balanced modulator are in the upper right compartment. The v.f.o. is in the center compartment and the linear is under the perforated shield.

carrier unbalance by watching field strength meter or S meter on a band receiver. The tank coil tuned by the 0-140 p.f. condenser is an XR-50 National coil form. Butted up close to it is the grid coil for the 6AG7 output tube wound identically on an XR-50 but tuned with the slug after soldering a fixed silver mica across it for tuning. The coil can be adjusted first by a grid-dipper.

The output 6AG7 has a copper shield across the socket to separate the grid and plate to prevent oscillation by coupling. The output tap 3 turns up from ground was found using a 50 ohm resistor and adjusting for maximum output. It is not too critical.

V.F.O.

The v.f.o. tunes from 3345 to 3545 kc for injection to the 6AG7 mixer. Three to four volts are necessary on the grid of the 6AG7 for mixing action. The v.f.o. actually has an output of about 10 volts r.m.s. and the output is reduced by a series variable capacitor. Calibration of the v.f.o. and coil adjustments are critical and time consuming and it might be better to substitute a crystal oscillator during the preliminary trials until adjustments can be made with more confidence.

The v.f.o. described is the old Hartley oscillator circuit. The grid coil tunes to 1672-1777 kc and doubles in the plate circuit to give the most stability. The grid could have been put on 3345-3545 kc and an r.f.c. used in the plate circuit but the stability would not have been as good and the r.f.c. does not discriminate against spurious signals.

The grid coil is composed of 35 turns of #26 wire wound on an XR-50 National coil form tuned with a fixed mica 285 mmf capacity and a 100 p.f. variable which has 7 stator and 7 rotor plates. To band spread the tuning dial a 130 mmf capacitor was inserted in series with the 100 mmf variable. These values are critical to duplicate and it will b enecessary for the constructor to set the coil with a grid dip meter for approximate tuning range and also watch the output on an indicating device such as a receiver or f.s. meter. Adjustments of the slug and components are tricky and until you have the time to work with it, a crystal oscillator would be easier to use.

The plate circuit of the v.f.o. is also 35 turns of #26 wire on an XR-50 coil form, and it is tuned by a 75 mmf capacitor. The slug is adjusted to tune the coil at 3.9 mc, the middle of the 80 meter phone band. A 10K ½ watt resistor is then soldered across the coil, after it is peaked, to flatten out the response. The output of the v.f.o. will now only vary 1 volt across the band. This can be checked using the r.f. probe on the plate of the tube. Do not watch the output of the exciter or you will be fooled by the detuning of the 6AG7 tank circuits, unless you peak each of them for maximum.

The 6197 was used for the oscillator tube, although, a 6CL6, or 6AQ5 would work as well. The unit was built using the LMB Flangelock box number EL-532, it is 5¼ inches long, 3 inches wide and 2⅛ inches deep.

Power Supply

The power supply was constructed on a California A-145 Aluminum chassis, 6 × 17 × 3 inches. The panel is a breadboard type 8¾ × 19 manufactured by OPCO and handled by Yale Enterprises, P.O. Box 536, La Mesa, California. The rest of the parts are surplus at a cost of about $10. The power transformer ($2.95) is rated at 270 volts r.m.s. each side of center tap at 210 ma. Since the current is only drawn on voice peaks it can be overloaded just as long as it does not overheat. The filament winding has a 9 amp capacity, enough to supply all of the exciter filaments.

To protect the diodes from line transients, each one is shunted with a 470K ½ watt resistor. If you can stretch the pocket book, it is a good idea to put a 0.001 disc capacitor across each resistor. A buffer capacitor of 0.005 mf 3 kv is shunted across the entire secondary of the transformer to help chop off any transients that might appear and save the diodes from puncturing.

The low voltage is taken off from the center tap and the 105 volts regulated is set by an 0B2 tube. If another type of transformer with a different voltage value is used, the 8K resistor in series with the 0B2 might have to be changed. Measure the current through the 0B2 with no load and determine if no more than 25 ma is flowing through it. Under load there must be at least 5 ma flowing. For best operation set the current at about 16 ma under load and not to exceed 25 ma no load.

Linear Amplifier

The linear amplifier is built on the same chassis as the power supply. It was built as a separate unit so that other exciters could be plugged into it. For the purpose of this article only the 80 meter band is shown, and thus only 33 turns of the Air Dux PI #1212D6 coil was used, and the other turns removed. If the amplifier is used on the other bands the pi-coil can be shorted out with a shorting switch leaving 12 active turns on forty meters, 7 turns on 20 meters, 4 turns on 15 meters and 3 turns on ten meters.

The grid coil is wound on a National XR-50 coil form. Eighty meters uses 30 turns of #26 wire, 40 meters is tapped at 15 turns on the same coil. A separate coil was used for 20 meters and wound with 10 turns of #20 enameled wire. A three turn link of hookup wire was wound on the bottom end of each coil for coupling.

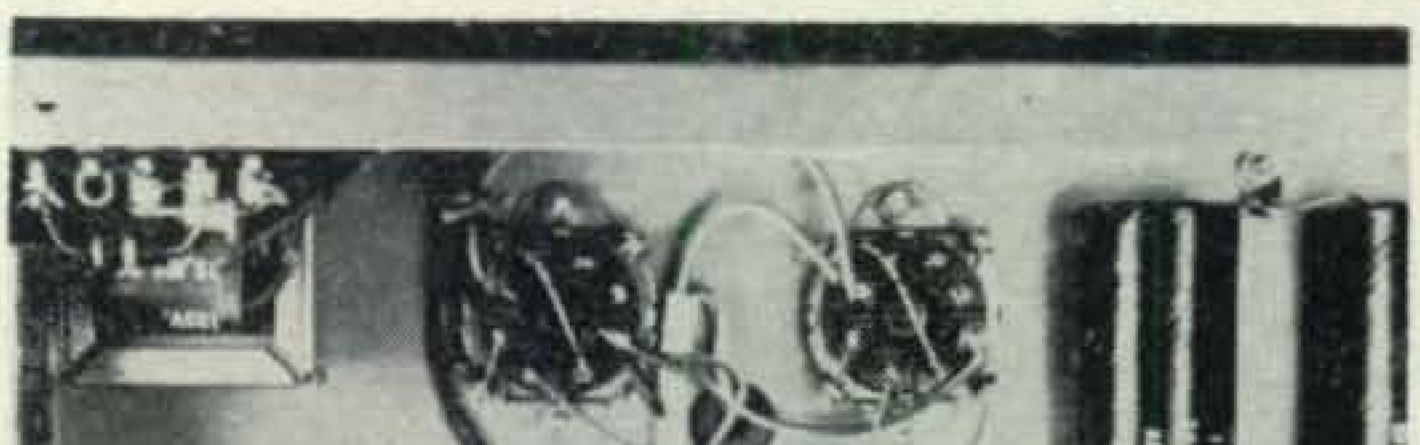
The amplifier was neutralized after it was finished, by disconnecting the screen and plate supply voltage. A signal was fed into the grid circuit with just the filaments lighted. A signal was picked up on an f.s. meter by coupling it close to the tank coil, and the neutralizing capacitor varied until the f.s. meter dipped to a minimum.

Before connecting the amplifier to the antenna it is best to check it out by connecting a 50 ohm non-inductive resistor to it. Tune up and mark the dial. If the antenna system is close to 50 ohms, the dial settings will read about the same value as marked. The output coil tapped at 3 turns is about right. It can be adjusted back and forth for maximum output.

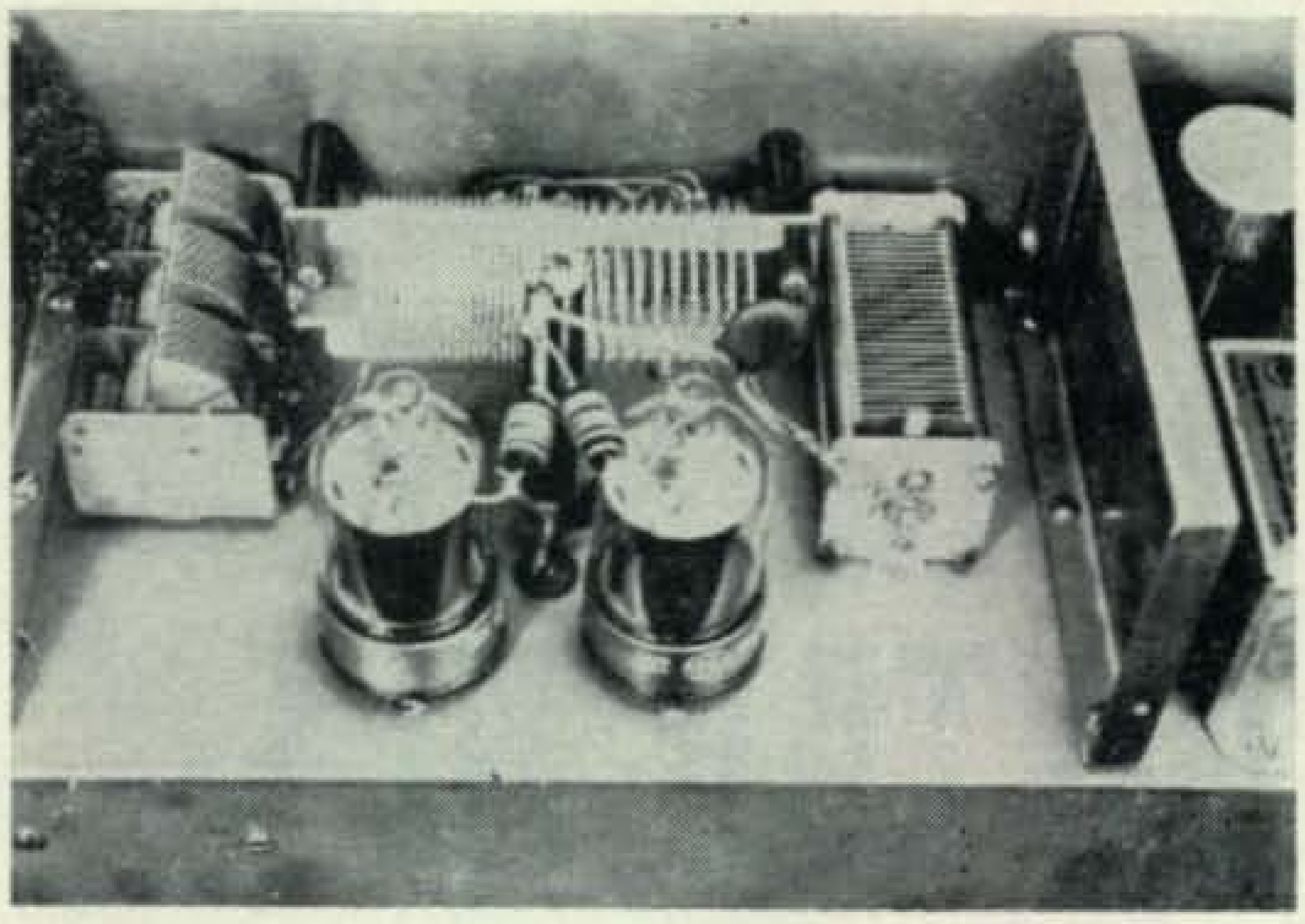
Without excitation the bias control can be adjusted to 50 volts to set the idle plate current at 50 ma, when talking the meter will flip up to 250 ma if the pi-network is loaded properly.

VOX

The vox circuit operates the send-receive re-



Bottom view of the linear section. The bias transformer, T_1, is in the upper left corner and the power supply is to the right. The grid coil and grid tuning capacitor are mounted on the front panel.



Interior view of the linear amplifier shows parts placement. The three gang broadcast variable is paralleled to provide the 1000 mmf.

lay. The circuit consists of one 12AT7 with one part of the tube acting as the amplifier, and the other half as the relay control. Audio voltage is picked off from the speech section and fed into the VOX GAIN control, amplified, and rectified to a positive voltage which allows the relay part of the tube to conduct, closing the relay. The length of time the relay stays closed depends upon how long it takes the holding capacitor to leak off through the 2.2 meg resistor. This time constant can be varied to suit the operator by adjusting the value of the capacitor.

The only critical components appear to be the diode rectifiers; they must have low forward resistance and high back resistance. Most of the top hat variety work well but the 1N34 and 1N277 seem to have too much leakage. If you have other diodes in the junk box try them; if the leakage is too great the relay will not hold in.

If the relay does not close, check the d.c. voltage at the grid of the relay tube and determine if the audio voltage is being rectified. The amount of voltage can be controlled with the VOX GAIN CONTROL which is advanced until the relay closes. The cathode resistor may have to be varied slightly until the relay makes and breaks easily; 1800 ohms appears to be the right value. Some relays just won't work in the circuit because of the heavy spring tension but the old open double pole, double throw, 10K coil type seems satisfactory.

No attempt has been made to feed the 80 meter exciter into a high level mixer to put the rig on other bands because of the lack of crystals. There is no reason why a separate crystal oscillator could not be built and the 6AG7 type mixer used to set the rig on the other bands. A more sophisticated type balanced mixer might be better to help eliminate the signal which would then be 3.8 mc each side of the carrier frequency. On forty meters a 3.4 mc crystal could be used, and on 20 meters a 10.4 mc. I am sure there will be many modifications to this basic circuit by hope it gives a clearer understanding of how a filter exciter is put together. Have fun! It's those who set out to construct the exciter. This completes the discussion of the s.s.b. exciter, I easy. ■

YLs IN THE '66 AWTAR NET

BY LOUISA B. SANDO,* W5RZJ

AWTAR radio net chairman at Cheyenne, Wyo., was Beth Selman, W7YGV.

As it has done every year since 1953, the AWTAR Amateur Radio Nework again furnished communications during the All Woman Transcontinental Air Race held in July. Start, finish and all enroute airports were equipped with amateur gear. Chairmen for the route included: Seattle, Wash. (start), W7GRM, Ray Stekly; Pendleton, Ore., W7FPT, Jim Bostwick; Boise, Idaho, W7CRE, Bessie Wittell; Pocatello, W7GGV, Helen Maillet; Rock Springs, Wyo., W7PJX, Grant Brown; Cheyenne, K7YGV, Beth Selman; Kearney, Neb., WØBNF, Glen Byars; Kansas City, Kans., KØOXK, Cecil Oesch; Cape Giradeau, KØQGU, Ronald Hale and KØYIM, Lloyd Corvick; Chattanooga, Tenn., W4RMT, Dr. Durwood Kirk; Augusta, Ga., WA4WQU, Jack Garrison; Lake City, Fla., W4TWC, Dr. Paul Snyder, and Clearwater (terminus)W4IRA, Herb Tuell. Overall chairman for the net was Carolyn Currens, W3GTC, serving her ninth year in this post. (From 1953 through 1957 it was headed by Vi Grossman, W2JYX.)

Delayed two days because of unfavorable weather, the race finally got under way on July 4, with 82 planes participating. Take-off times were relayed from Seattle and copied by Betty, W7GUQ, whose signal was picked up by Helen, W7GGV, at Pocatello. Helen relayed to Beth, K7YGV, at Cheyenne, who relayed east.

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

At Boise, Idaho, Bessie, W7CRE, and Alfred, W7YUX, used a 2-meter rig to relay from the airport to Betty, W7GUQ, at Deer Point, a hill top 20 miles north of Boise. Bessie said their biggest hitch was in getting official arrival and departure times from the timers (via a field phone borrowed from National Guardsmen). She adds: "We were located at a little used gate with a tarp rigged up for shade. It was a *hot* day in Boise, but we were all so busy no one noticed it!" Five planes filed RONs (remain over night) for Boise.

At Pocatello Airport W7GGV set up her Swan 400 in a hangar near the hospitality room for Derby contestants. The timing crew was located on a platform about a mile from the hangar and Helen's OM, Pop, K7CXP, had a 2-meter rig to relay arrivals and departures to a 2-meter rig in the hanger and also the tower. Gary, K7NEY, and Helen worked the 40 and 80 meter bands, while Wes, K7LCW, and Pop kept in contact with their 2-ers. Each day they set up the rigs only to learn of cancellations on the first two days. Thanks to ham radio, others concerned, such as crews from the hangar, timers, 99ers, etc. were kept informed from Seattle.

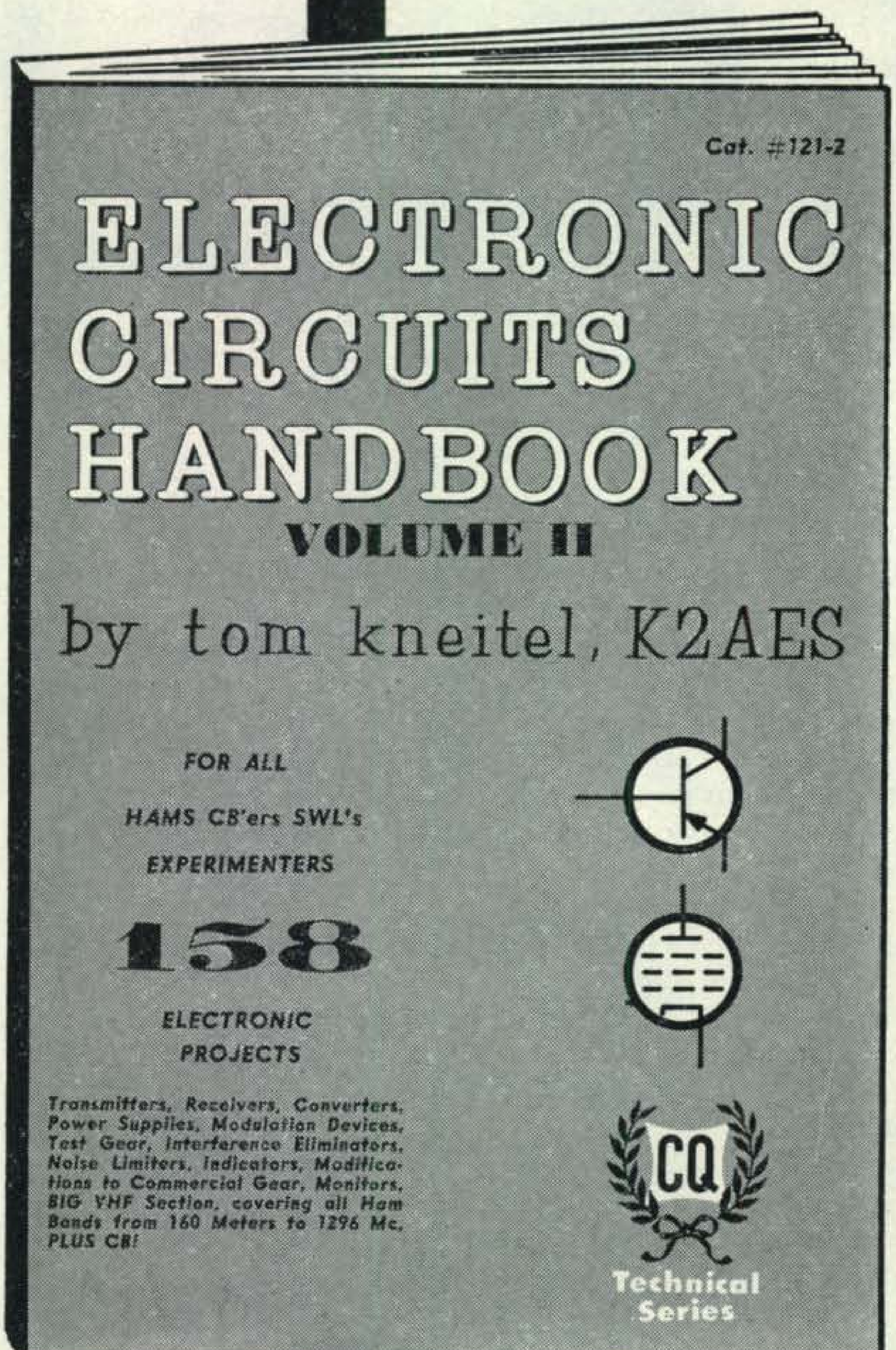
Pocatello had 31 planes staying over night. Net operators had to be on hand early for take off time was 0500 MST. By 0900 MST Tuesday morning the last plane was off the ground and Pocatello hams broke up operations.

Beth, K7YGV, reports communications in

YLs who participated in the AWTAR net from the Boise, Idaho, area, l. to r., Betty Fine, W7GUQ, and Bessie Wittell, W7CRE, chairman for Boise.

Daughters of Ellie, K4RHL, and John, K4YBL, were TAR entry #26. L. to r., Elaine Loening, pilot, and Katharine Gahagan, co-pilot.

ONE MORE TIME



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The 1966 AWTAR was of special interest to Ellie Horner, K4RHL (left) as her two daughters entered the race as TAR #26. At right is Elaine, who was the pilot and who was flying her seventh TAR.

AWTAR radio net chairman Carolyn Currens, W3GTC (right), flew to Clearwater, Fla., terminus of the race, to take part in net operations. Here she is pictured with the net chairman for Clearwater, Herb Tuell, W4IRA.

Cheyenne worked very well, thanks to the Cy-Wy Radio Club. They operated from the club station, K7AYF, at the airport on July 2, 3 and 4, but the fellows had to go back to work on the 5th so Beth operated her station from home with a 2-meter relay from the airport by Lois, W7COJ, and Bennie, W7SQT. They had 22 girls RON in Cheyenne the night of the 4th. Beth adds she spent much of that evening with the Ninety-Nines greeting the girls as they came in and getting official times from the timer while her OM Bob, K7YGW, and Glenn, K7NQX, did the bulk of the operating.

The *Ham Hill News* (Pocatello) report on the Derby comments: "It all sounds so easy, but for the relaying hams it was all but easy. With one ear to the receiver, one hand on the mike and the other flipping pages to record times according to the charts supplied, the other ear listening to RONs and requests for landing times, it was nerve-wracking!!"

Net chairman, Carolyn, W3GTC, flew by jet to Clearwater, Fla., race terminus, where she did quite a bit of operating. When the AWTAR was over, Carolyn was flown home by Betty Gillies, W6QPI, in her Cherokee 180. Betty, who was overall AWTAR chairman from 1952 to 1961, was TAR contestant #12.

TAR entry #26 is of special interest. The pilot was Elaine Loening and the co-pilot Katharine Gahagan, both of whom are daughters of Ellie Horner, K4RHL! Proud Mama reports her gals finished fourth overall in the race (Elaine placed third in 1963), won the leg from Seattle to Boise, and were second in the Cheyenne-Augusta leg. "Lainie," who was flying her seventh TAR, has two jr. ops. "Kitten," who was flying her third TAR, has four jr. ops.

K4RHL kept in constant touch with TAR #26 via the net and also with Seattle, as her Loening grandchildren wanted to see their mother take off in Seattle and land in Clearwater and Ellie met them in Florida. (Ellie, by the way, tells us she had her private pilot's license at age 16, but it lapsed during WW II.)

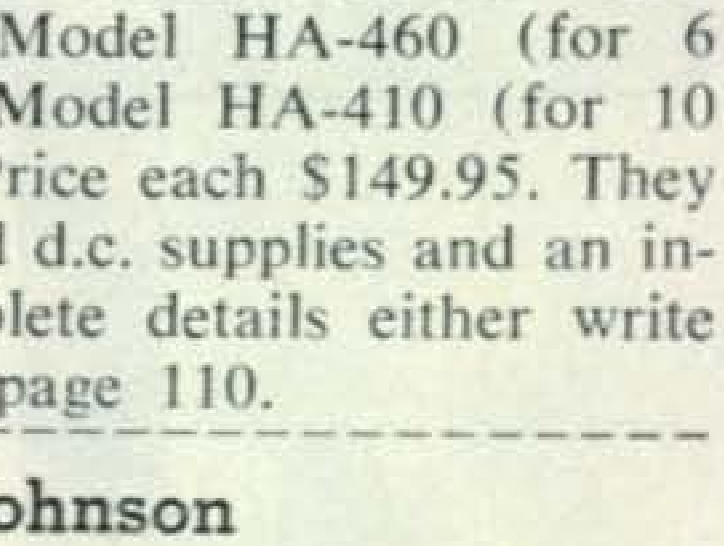
In summing up the AWTAR radio net operations, chairman Carolyn, W3GTC, comments: "The Derby net worked better than it ever has before. In spite of its starting two days late, everyone managed to be on and get the information through."

Though there is no space to mention them all, our congratulations to everyone who participated in the net and made it the success it was.

—*W5RZJ*

New Amateur Products

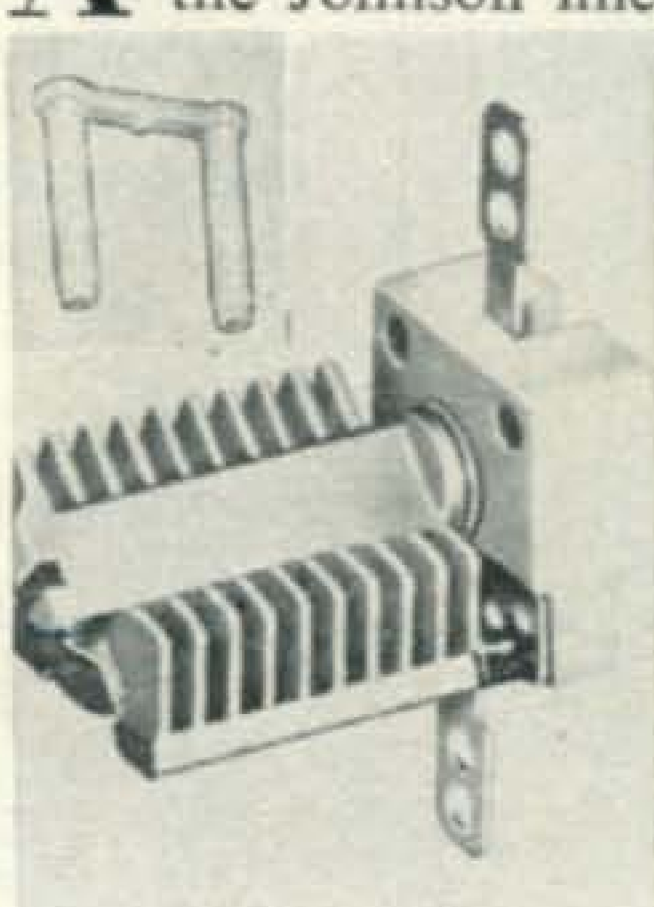
Lafayette



Lafayette Radio Electronics Corporation, 111 Jericho Turnpike, Syosset, L.I., N.Y. 11791 announces a new line of amateur radio 20 watt transceivers for 6 and 10 meter operation. Model HA-460 (for 6 meters) 99-2579WX, Model HA-410 (for 10 meters) 99-2575WX. Price each $149.95. They feature built in a.c. and d.c. supplies and an internal v.f.o. For complete details either write direct or circle 65 on page 110.

E. F. Johnson

A new type of capacitor has been added to the Johnson line. The type "U" offers up to 24.5 mmf in single section units that require .2 square inches for mounting. A push through acetal fastener provides quick two hold mounting. For complete specs write to E. F. Johnson, Waseca, Minnesota, or circle 66 on page 110.



Front view of the Cookstove. The left panel houses the a.c. line controls. On the top is the line monitor switch followed by a Variac for the 450TL filaments, a 0-150 v.a.c. line meter and a Variac for the 3 kv power supply. The right hand panel houses the meters and controls.

THE COOKSTOVE LINEAR

BY ARTHUR H. HALLAM,* W5PKS

THERE is nothing that equals the satisfaction of designing, building and refining of one's own radio equipment. Indeed, this is a main purpose of the amateur radio service. This article shows only one of almost an infinite number of ways that the amateur can build his own transmitter.

The "Cookstove" is a high power amplifier amplifying a.m., c.w., or s.s.p. signals. Figure 1 covering from 3.5 to 29.5 mc. It is capable of shows a block diagram of the amplifier and associated power supplies.

Features

One novel feature of this amplifier is the changeover system. The changeover system is designed so that in a.m. or c.w. use, the key transmit switch causes plate voltage to be applied to all plates and also energizes the antenna changeover relay, the receiver silence relay, and the exciter plate relay. If the amplifier is to be used with an s.s.b. exciter, a switch on the front panel of the amplifier is thrown from MANUAL to VOX.

Now, the transmit key on the amplifier energizes only the plates. Control of all the changeover relays is looped through to a terminal strip on the back of the amplifier so that these changeover functions can be triggered by the vox circuit of the s.s.b. exciter.

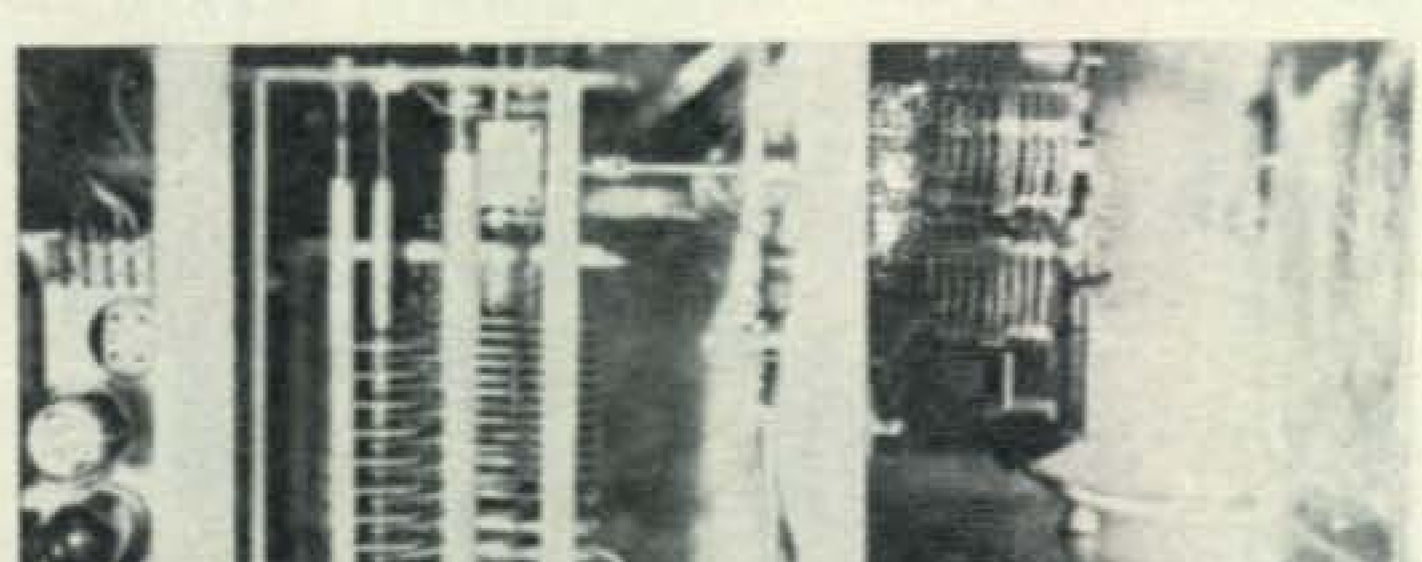
*Box 30066, New Orleans, La., 70130

The r.f. input and output circuits are both bandswitched with the input circuit being a multiband "turret" coil (Needed to obtain necessary phase inversion for neutralizing the amplifier.) and the output being a pi-network designed to feed a load of 52 ohms. Conventional circuit, as opposed to grounded grid, was used since the amplifier was to be operated in the plate modulated a.m. mode, also, as well as in Class C c.w. and Class AB_2 s.s.b. Also, in grounded grid, the 450TL requires a very great amount of drive, even in AB_2.

A Westinghouse mechanical time delay relay is used in the control circuitry so connected that it is impossible to energize the plate circuit until a full minute after the filaments have been turned on. All plate transformers are individually fused and there is an overload relay in series with the B— return circuit. Of course, a blower forces air through the 450TL compartment and additional smaller blowers are located at various other points where there might be a danger of overheating due to insufficient circulation of air.

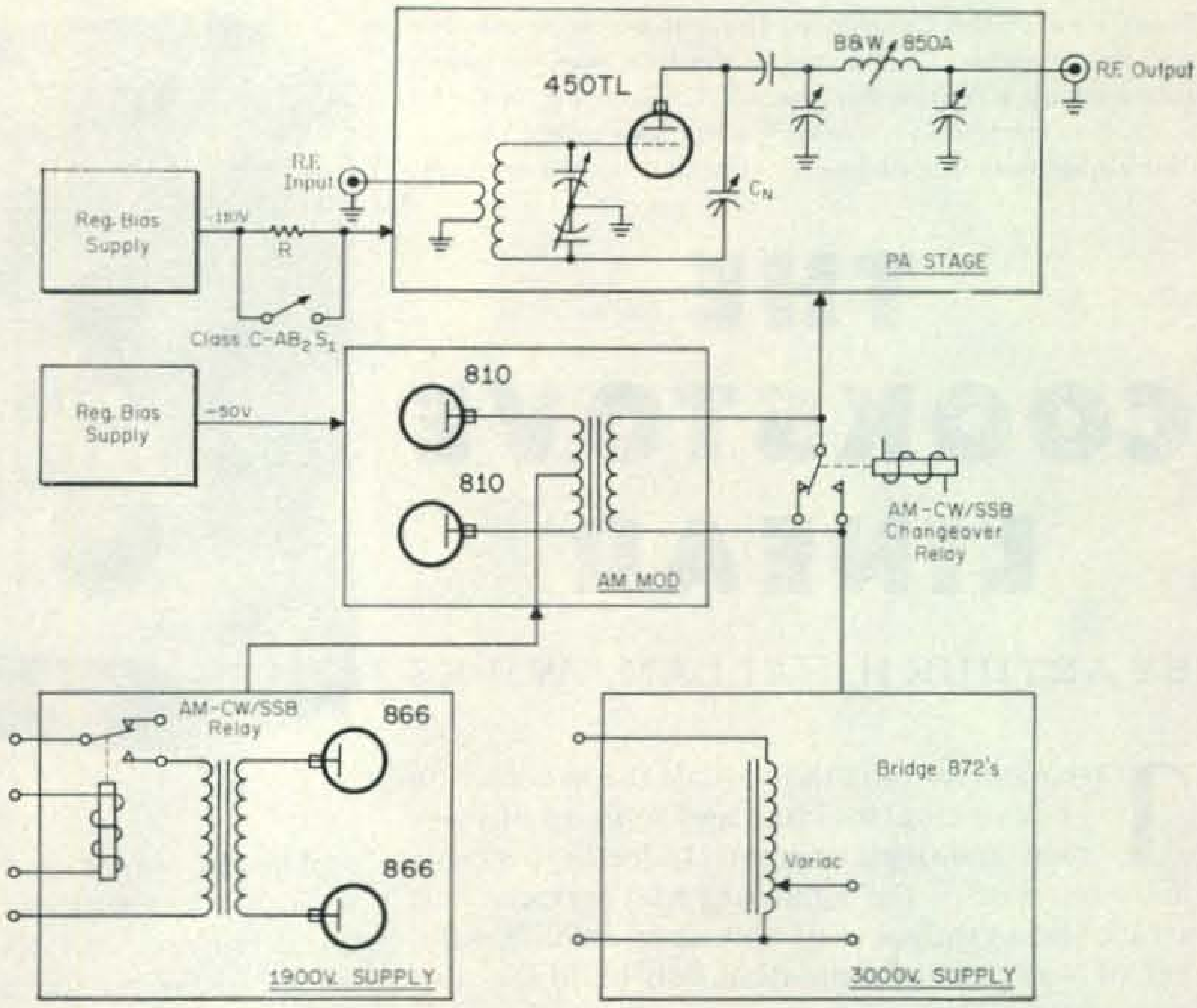
The changeover from a.m. to c.w./s.s.b. is accomplished by two relays. One shorts the secondary of the modulation transformer and the

Rear view of the housing shows the back of the r.f. compartment and below it the time delay relay, fuses and terminal blocks.



Top view of the r.f. compartment shows the bias supplies on the left, the pi-network compartment, the 450TL and below it a partial view of the input turret. The compartment approach to construction provides excellent isolation.

Fig. 1—A block diagram of the "Cookstove," a power amplifier suitable for a.m., c.w. and s.s.b., built into a discarded oven range.



other open circuits the primary of the modulator plate transformer. An H-pad is used on the primary side of the modulator input transformer so that the driver may see a more nearly constant load.

Amplifier Housing

Physically, the casing for the amplifier was originally an electric range found junked in the basement. The original stove was completely stripped and repainted a light grey. The space originally occupied by the oven is now a well shielded cubicle in which the p.a. stage is housed. To the right is the a.m. modulator; and the two electronically regulated bias supplies are built on a chassis to the left of the p.a. cubicle. The weighty high voltage plate supplies for the a.m. modulator and 450TL p.a. are in the bottom.

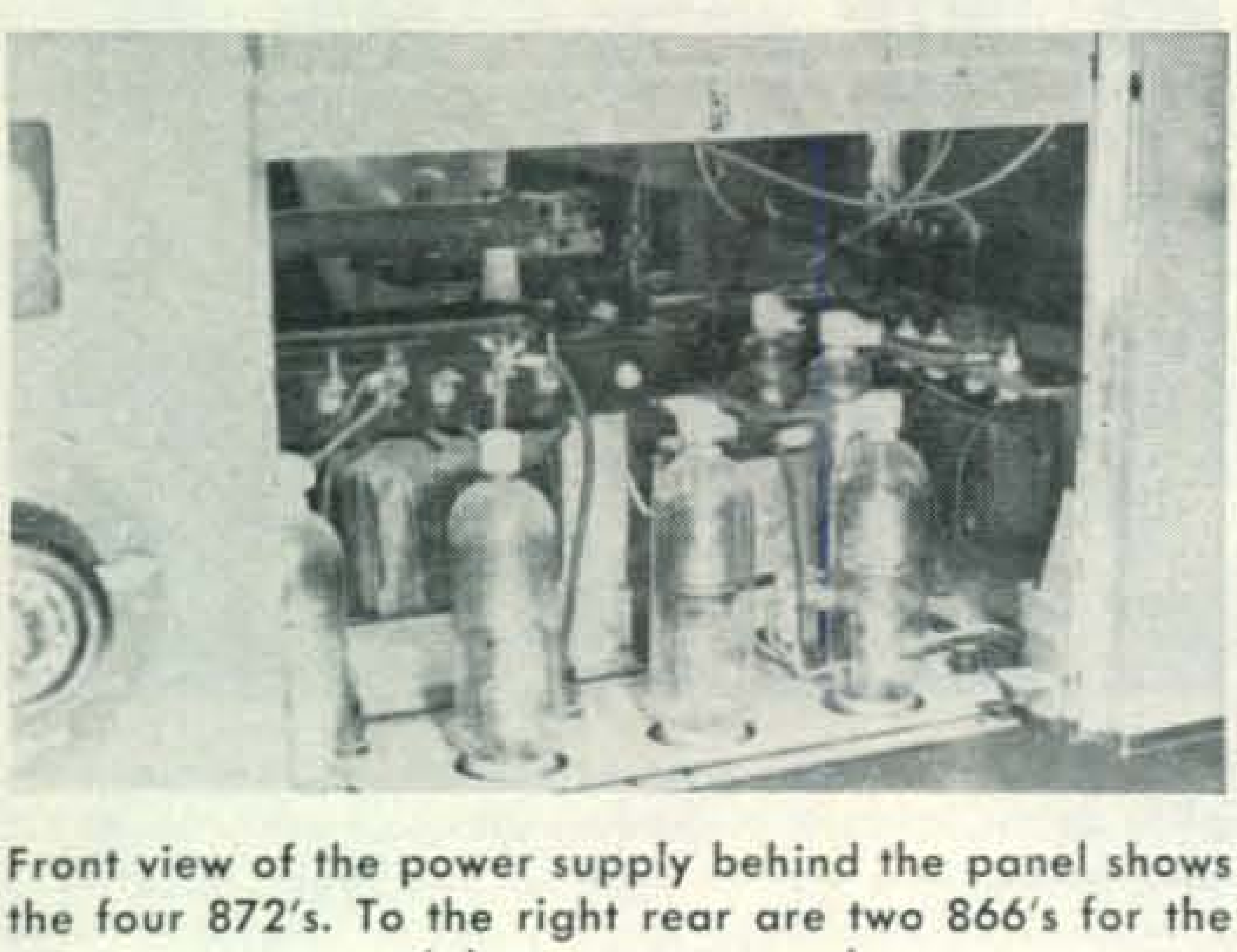
The cookstove frame is especially suited for housing the amplifier as its dimensions are such that it is shallow and wide, thereby putting the center of gravity much closer to the floor and also using much less height than a standard relay rack. Rollers are provided so that the transmitter can be easily moved. Indirect lighting is used to illuminate the various meters and controls.

Problems

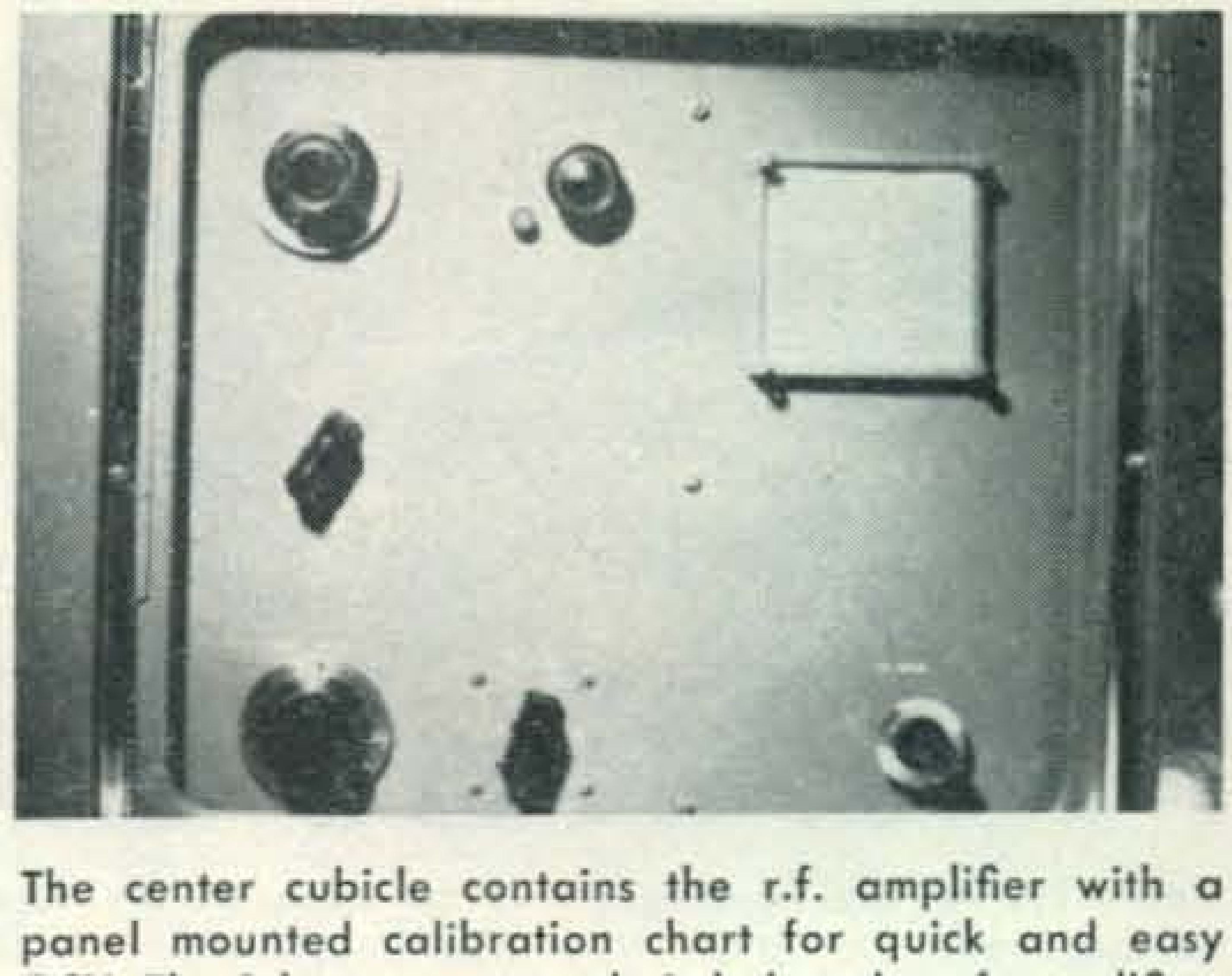
Several interesting problems came up during test of the amplifier. One bug was that the relay in the primary of the p.a. plate transformer would stick closed when the transmit key was turned to the OFF position. Investigation revealed that there was a very heavy arc across the contacts as the relay began to de-energize which welded the relay shut. Installation of a series RC circuit across the contacts greatly reduced this arcing. The transient upon break is now an overdamped waveform of a series RLC circuit rather than a spike caused by the rapidly collapsing transformer field as before.

A low frequency parasitic of about 200 kc showed up. This parasitic was caused by a t.g.t.p. action of the r.f. chokes in the grid and the plate of the p.a. A National R-175 choke is used in the plate circuit and a common 2.5 mh choke *was* used in the grid. The remedy was to install a double section filter circuit in the bias supply feed.

The transmitter is now on the air. Listening tests has shown that the coverage is good and quality is excellent. ■



Front view of the power supply behind the panel shows the four 872's. To the right rear are two 866's for the modulator power supply.



The center cubicle contains the r.f. amplifier with a panel mounted calibration chart for quick and easy QSY. The 3 kv. power supply is below the r.f. amplifier.

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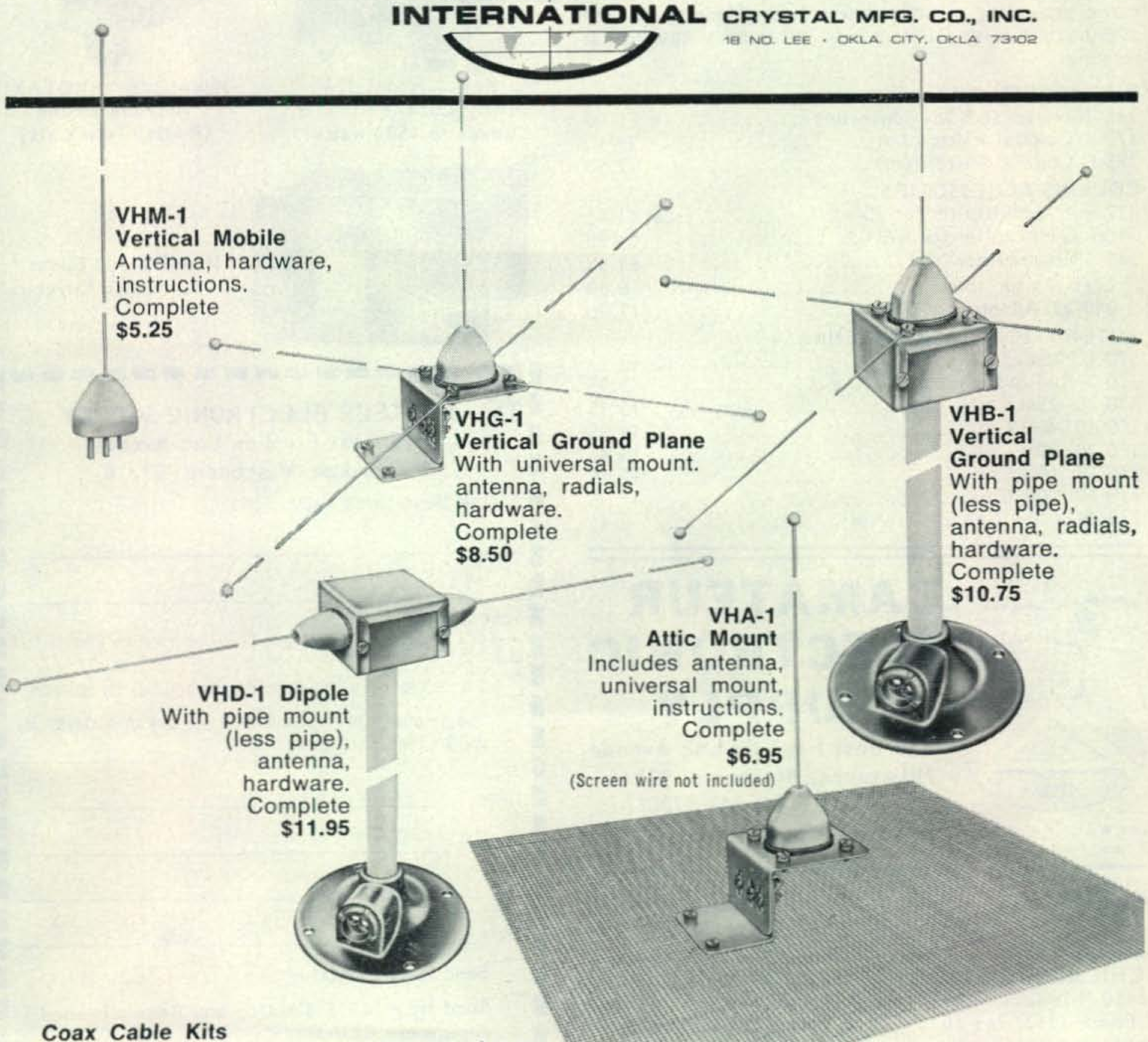

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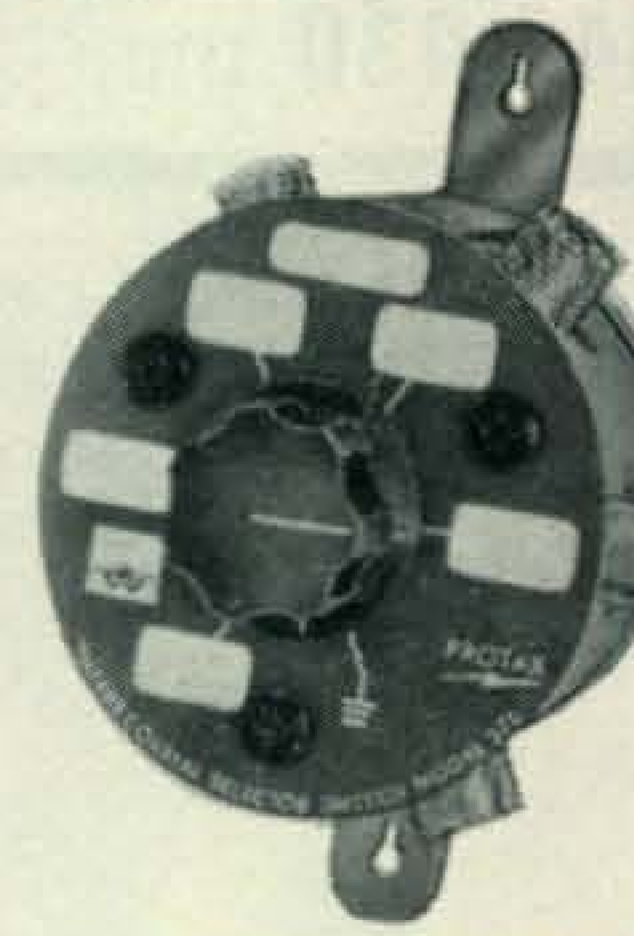

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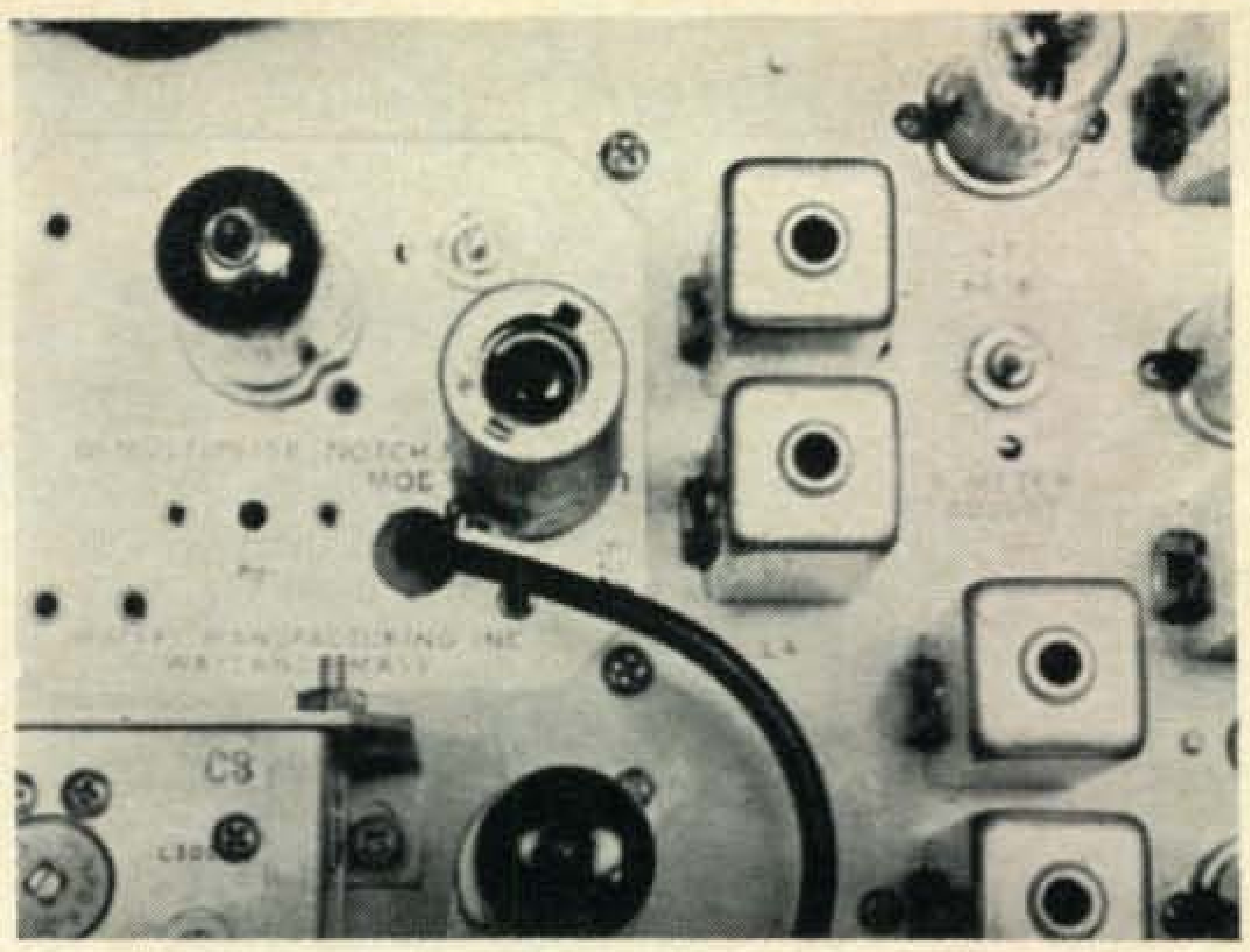
IMPROVING THE 75S-1 ON 10 & 15



Top view of the Waters Q multiplier that has been added in the space for the noise blanker. It shows an additional tube, the 6BA6 of fig. 1, (under the shield) wired to T_1 and L_4 on the right.

BY W. E. LA FARRA,* W5ZCC

The addition of an i.f. stage to the 75S-1 brings up the sensitivity so that 10 and 15 really open up. The addition requires no structural modifications so resale value doesn't suffer.

We had an opportunity to pick up a used 75 S-1 in real good shape to replace an old 75 A-2 that we had been using for a number of years. We were sorely disappointed in its performance especially on ten and fifteen meters. Since we had also heard other hams complain that the receiver wasn't too hot, we thought of ways to improve its sensitivity.

Not many hams want to modify their commercial gear, and rightly so, for the trade-in value suffers but not many times do you find such an easy way of modifying a unit as that presented in the Collins 75S-1.

Modification

Looking over the circuit, it seemed to need an additional i.f. stage, but this would require butchering the chassis and would provide no way for changing back to the original circuit for resale. After a little study we found the solution to the problem. Collins had a first mixer and the output of this fed the second mixer. Coupling these two mixers together were two transformers arranged in a band pass circuit. This circuit was broad banded and was tuned to 3 mc and had to pass 200 kc. Well, this in itself didn't present any great advantage.

Collins cut a large square hole in the middle of the chassis for the addition of a noise blanker circuit. This plate used to cover the hole proved to be the key to the problem of trade-in. Here we could mount a tube socket and associated components and wire them between the two transformers which would be used as input and output. To return the set to its original circuit, remove the plate with the extra tube and its related components, restore the transformer circuits to the original wiring, and replace the plate with a similar piece of aluminum.

*POB 43, McGehee, Arkansas.

We quickly wired up a socket and soldered it into the circuit for a trial. Presto, the set came to life! Out came the plate and the seven pin miniature socket was mounted. The plate was returned to its original position to finish wiring up the circuits.

The 15 mmf capacitor C_{27} is removed from the circuit but left tagged at one end so it will be handy for future use. The secondary of T_1 is connected as the grid coil, leaving terminal 4 grounded and terminal 3 going to the grid pin 1 of the 6BA6. Since L_4 is used as a plate coil. Pin 3 is removed from ground and a lead run from pin 3 to a B+ point. Since the coil now has B+ voltage on it, it has to be kept off the grid of V_{3A}. We at first used the 15 mmf capacitor but later moved R_8 (68 ohms) down to terminal 2 of L_4. We also tried putting terminal 4 of T_1 to avc but found the grounded position better.

Results

We found, when listening to a neighboring ham one block away running a Swan 350, that the avc took care of him with no overload. The change wasn't too apparent on 75 and forty, but signals were stronger. On 15 and 10 it was a completely different receiver, and the performance was very satisfying. We tried every combination for cathode and screen resistor, but they didn't appear to make much difference. Nor could we get the stage to oscillate or show any tendency to take off. In our receiver someone

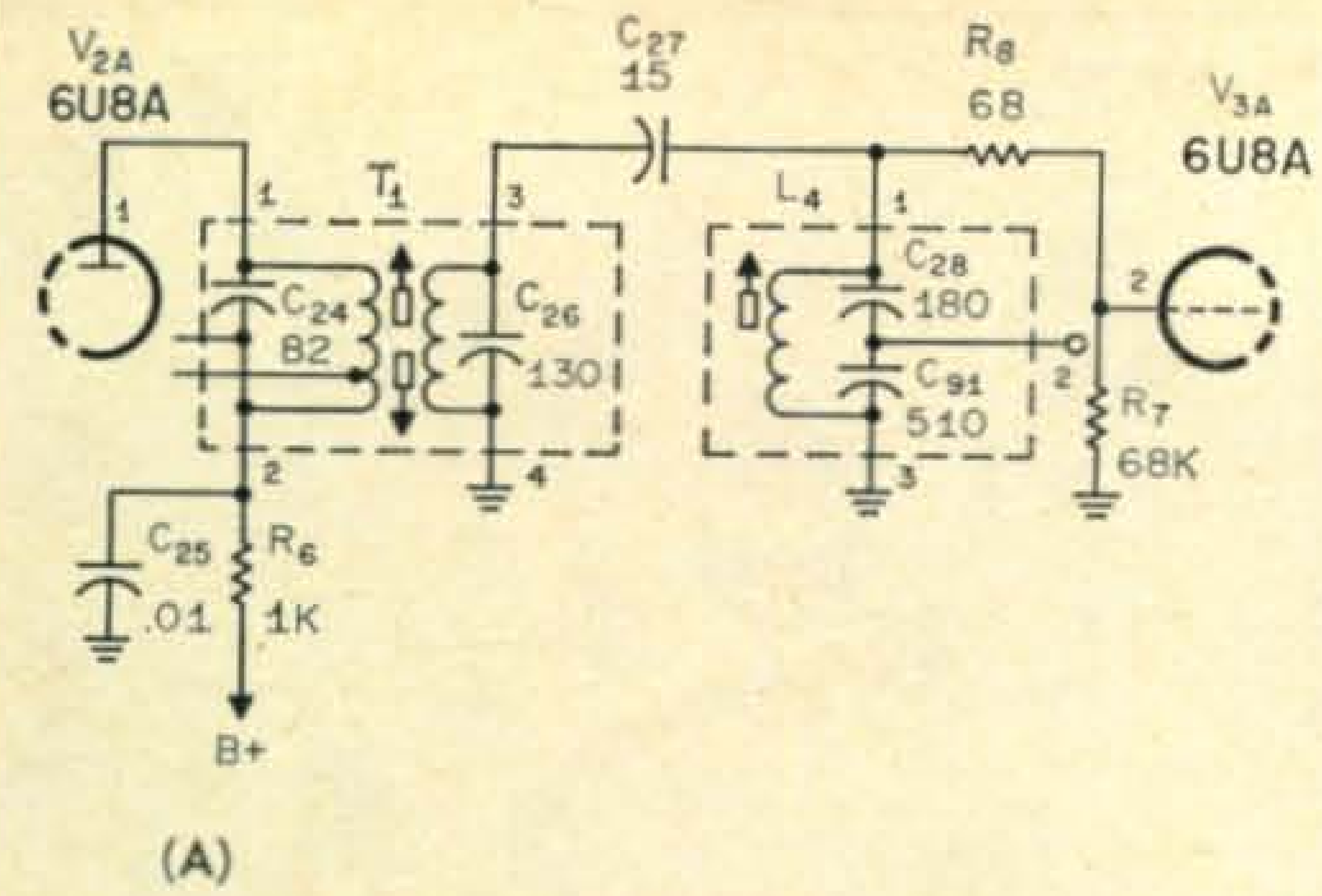
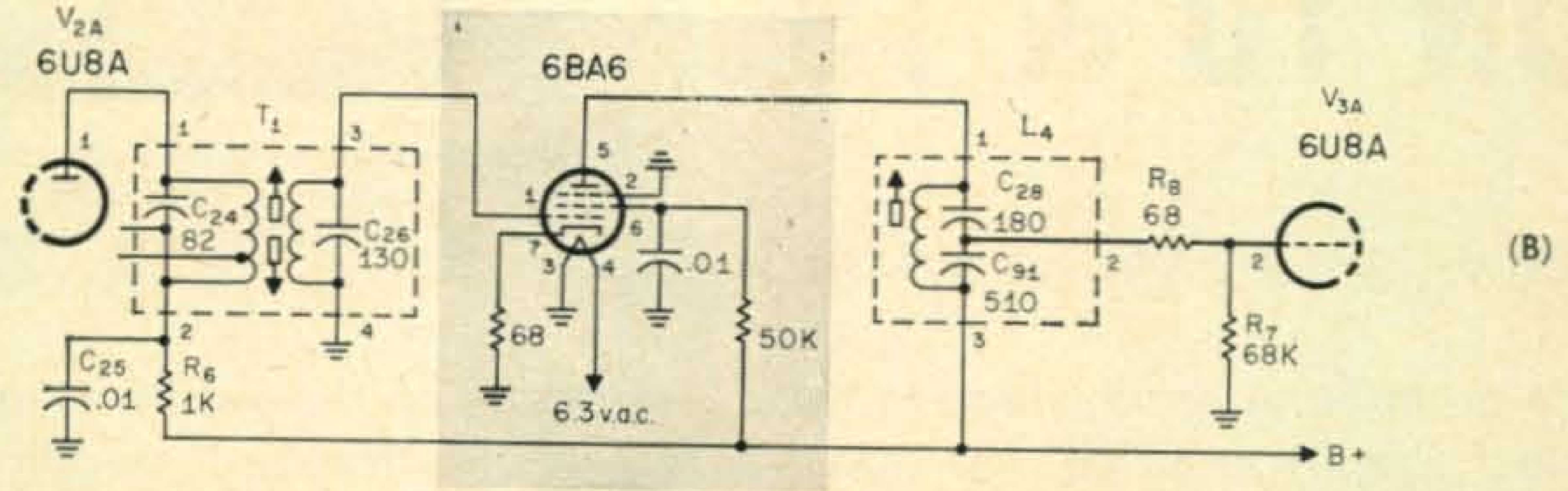


Fig. 1 (A)—Circuit of the bandpass coupler between the first and second mixer of the 75S-1 before modification. (B) Addition of the i.f. amplifier between T_1 and L_4 creates a remarkable increase in sensitivity. Components within the shaded area are mounted on the plate (or Q Multiplier).

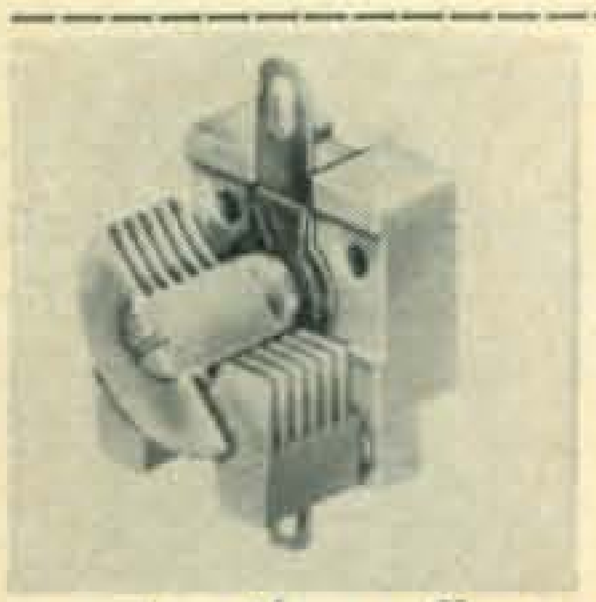


had added the Waters Q multiplier, but there was still sufficient room to mount the additional tube.

Alignment

Transformers T_1 and L_4 should be realigned using the swamping arrangement described in the instruction manual. An alternate method would be to tune in a signal or use the 100 kc calibrator at 0 on the dial and tune primary of T_1 for peak; set the dial to 200, peak secondary of T_1; set the dial to 100 and peak L_4. This stagger tunes the circuits and gives a pretty good band pass arrangement. The rest of the receiver is not affected and the operation is the same. However, the set has more pick-up ability and sounds alive, which it is. ■

New Amateur Products

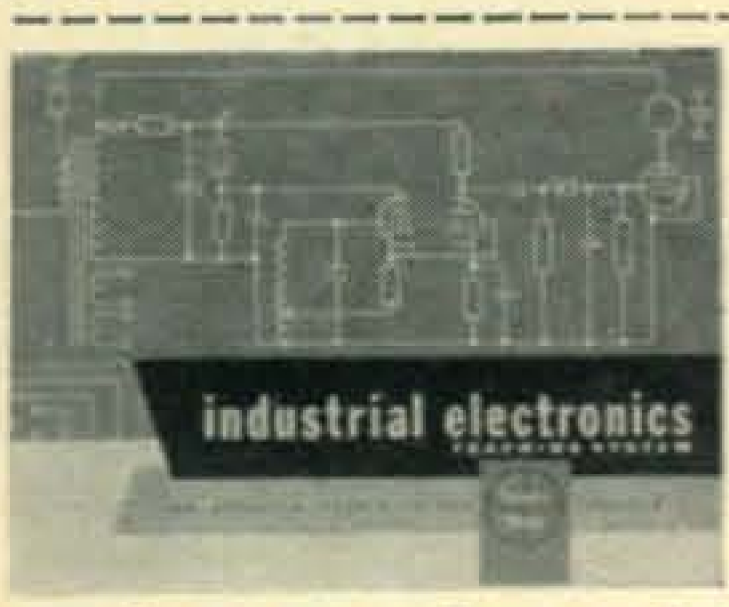


E. F. Johnson

A new type "W" capacitor is announced by Johnson. It requires less than .62 square inches for mounting and with machined plate construction offers values up to 54 mmf at 650 v.d.c. breakdown. For complete details write to E. F. Johnson, Waseca, Minn., or circle 67 on page 110.

Simpson

A 32 page booklet entitled *Simplified Electrical Appliance Servicing* has been published by Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. For complete details on the booklet either write directly or circle 69 on page 110.



Simpson

SIMPSON is now offering an advanced 36 week course intended to prepare students for college study in electronics or employment in industry. The course Electronics 202, comes with instructors' manuals and teacher training aids. For complete information write to: Bulletin 202, Simpson Educational Systems, Division of Metetelic Corp., 853 North Dundee, Elgin, Ill., or circle 68 on page 110.

EDI

Two new types of stud rectifier are now available from EDI. An 800 p.i.v. (1N3649) and a 1000 p.i.v. (1N3650) unit are in stock with both cathode-stud and anode-stud polarity options. For more information write to Gus Bard, Electronic Devices, Inc., 21 Gray Oaks Avenue, Yonkers, N.Y., 10710, or circle 70 on page 110.

1966 CQ W.W. SSB DX Contest Results

BY FRANK ANZALONE,* W1WY

Top Ten
ALL BAND—SINGLE OPERATOR

1M4A	1,031,368		
OD5BZ	620,156	I1BAF	453,096
VK2AHT	541,836	606BW	381,240
ZL1KG	505,830	VK6RU	369,055
DJ6QT	482,346	WA2SFP	328,302
7X2AH	273,182		

Top Six
MULTI-OPERATOR

4U1ITU	950,312	HC1EY	599,322
G8FC	749,324	YV5BWP	591,545
OH2AM	632,366	DJ3GD	534,264

Continental Leaders
SINGLE BAND

28 mc

LU1DAB	80,960
CE6EZ	37,674
WA4WIP	15,616
G3NMH	4,522

21 mc

YV1LA	243,800
YV5BPJ	227,362
MP4TBO	161,738
W2SKE/2	160,680
IT1GAI	157,080
9Q5FV	55,794
KH6IJ	30,080

14 mc

ET3AC	682,086
KX6BQ	533,232
UR2AR	339,633
W3JNN	336,730
4X4FV	258,330
PY1NBF	209,721

7 mc

DJ5BV	35,990
G3NLY	22,601
JA2BTV	7,585
WA4PXP	5,200
PY7APS	2,880
ZL1AGO	1,166

3.8 mc

ON4UN	70,866
DL8UI	26,342
YV5BTS	15,070
W2ZPO	6,396

Returns for the 1966 SSB Contest show a substantial increase over previous contests, over 50% by actual count. The contest is a popular activity but does not seem to bring out the old reliables. Perhaps a little more promotion is in order. Comments also indicate that some modifications are needed in the rules.

The high spot of the contest was Don Miller who once again managed to show up from a new one. Operating from a new country and with a new prefix, how could he miss. Still who could make 1700 contacts in a 36 hour period but Don Miller from the unheard of country, Minerva Reef, and the equally mysterious call 1M4A.

In past years DL3LL has been top dog in the Single Operator category, this year however Harry teamed up with DJ3GD and DL3BN and the trio put DJ3GD in the Top Six.

High scorer for the Multi-operator division however is 4U1ITU, which was manned by I1RB and I1RBJ. The boys missed the million mark only because they had to shut down for a couple of hours due to a severe local storm.

It does not take much of an observation to see that most of the activity was in the 20 meter band. And we are made to believe that this was because of the compulsory non-operating period. Certainly scores turned in by ET3AC and KX6BQ would seem to prove this point. Why spend any time on the lower frequencies when you can make a thousand contacts on 14 mc.

Incidentally, Roy was only using a KWM-2A to a 3 e.l. beam. Martin had a lot more distance to cover from out there in the Pacific and ran a full gallon to a 30S-1 and a 6 e.l. beam.

There was plenty of activity on 21 mc too. Here it was a battle between two countrymen, YV1LA and YV5BPJ. Armando had the better multiplier but Jan overcame this with a much larger contact total.

Even at this early date the 10 meter band began to show some signs of life but it takes our friend LU1DAB to prove it. We don't know Jaycee's secret, certainly it's not the equipment. His lay-out is very modest, a KWM-2 and a TA-33 beam.

The activity on the l.f. bands was mostly confined to the European area with DJ5BV and G3NLY doing an outstanding job on 40 and ON4UN with his usual leading score on 80.

Since this is a prefix contest such calls as 7X2AH, ZF1RD, 9V4VU and 5W1AX had some of the boys scratching their heads. 7X2 is the new prefix for Algeria, Harry Lilienthal, up from 9Q5AB was operating this one. ZF1RB is Cayman Is. down in the Caribbean, K8LSG was down there for a short stay. 9V4VU is Trinidad and 5W1AX is the British Samoas, operated by a group of KS6 boys from across the border.

Most of the logs were in pretty good shape, those that needed a little attention were corrected. However we found it necessary to disqualify SM5BLA for excessive duplication. As we have warned time and time again, it is the responsibility of the contestant to clean up his log before submitting it. Excessive duplication

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of contacts or multipliers will not be tolerated.

Practically all the comments were directed for or against the compulsory "rest period." The score was about 2 to 1 in favor of doing away with the non-operating period. Most of the objection coming from overseas stations.

HP1JC not only wants the rest period eliminated but the contest extended to 48 hours and the prefixes counted on each band. One thing at a time Juan.

There are some advantages in having a time out period, especially for WA1ANR. Quote Pauline, "as a wife and mother it's impossible to lock yourself up for 36 hours."

7X2AH comments, "if you fellows want all band operation, get rid of the non-operating time."

Some kind of a bonus for operating the l.f. bands was suggested by G3NLY, others thought we should figure the multiplier on a prefix per band basis to promote all band operation.

However we feel that the bonus idea would complicate the scoring, and the prefixes per band would result into astronomical scores. We do agree however that the fellows have a legitimate gripe.

How about extending the contest period to 48 hours. This would give two full nights of l.f. operating time and a little extra time to take advantage of the improving conditions on h.f. bands.

We could still retain the 12 hour compulsory non-operating period but make it more flexible, as suggested by W6ITA, and not specify any definite time when it should be taken.

It was also suggested by W3TLN that contacts between North American stations count 2 points, same as in our World Wide DX contest. This never promoted the activity we had hoped for but at least it will equalize the US scores a bit. You will note that almost all the high scores were made by overseas stations.

CE6EZ, second world high on 28 mc. Power was 900 watts to a Heath Warrior and a 2 element Quad. Ralf had to explain to many W/Ks what the contest was all about.

If you fellows have any ideas or suggestions, please let me know at once so that we can incorporate them in the next contest scheduled for April 8th and 9th.

If anyone wishes to donate a Trophy you can also contact me.

Log checking and tabulation of scores was done by Andy Malashuk, W1GYE and yours truly. At the rate the contest is growing we will probably need more help, for the next one.

73 for now, Frank, W1WY

Number groups after call letters denote the following: Band (A-all), final score, numbers of QSOs and prefixes. Certificate winners are listed in bold face.

SINGLE OPERATOR

North America

United States

K1HVV	**A**	**127,756**	**320**	**164**
W1PLJ	"	3,813	50	31
W1HQV	**21**	**109,986**	**315**	**138**
K1CTQ	"	50,397	196	107
WA1APX	"	42,240	218	88
W5NGG/1	"	11,826	87	54
K1ZYM	"	6,952	63	44
W2NSD/1	**14**	**261,414**	**490**	**206**
WA1ANR	"	39,300	165	100
WA2SFP	**A**	**328,302**	**560**	**234**
W2GKZ	"	25,380	105	90
W2NEP	"	5,324	60	44
WB2OLN	"	1,176	49	24
K2GXI	"	686	17	14
W2SKE/2	**21**	**160,680**	**475**	**156**
W2IP	"	1,587	30	23
W2EXH	**14**	**137,445**	**340**	**147**
WB2MFX	"	135,464	330	164
K2DGI	"	28,888	112	92
WB2SQC	"	16,951	100	67
W2ZPO	**3.8**	**6,396**	**60**	**41**
WB2MDH	"	150	20	15
W3TLN	**A**	**210,924**	**422**	**186**
W3AZD	"	210,405	417	195
W3CBF	"	2,705	31	25
KH6FBJ/3	**21**	**112,338**	**290**	**158**
W3JNN	**14**	**336,730**	**567**	**223**
W3TBF/3	"	11,656	90	62
W4RLS	**A**	**26,406**	**140**	**81**
W4DS	"	9,009	68	63
WA4TWQ	"	4,866	72	46
HC5MH/W4	"	2,508	70	33
WA4W1P	**28**	**15,616**	**106**	**61**
K4MAM	"	748	20	17
K4ISV	**21**	**127,254**	**328**	**167**
K4AQQ	"	103,800	280	150
W4DRW	"	35,017	145	97
W4CYC	"	22,274	110	74
W4DRK	"	12,870	80	65
W4EEO	"	799	20	17
W4EEU	**14**	**94,692**	**220**	**156**
WA4LSK	"	24,180	120	93
W4HA	"	12,558	110	69
W4HOS	"	6,370	62	49
W4OMW	"	2,652	40	26
WA4PXP	**7**	**5,200**	**76**	**65**
W5AJY	**A**	**34,556**	**148**	**106**
W5KC	"	15,343	100	67
W5EDX	"	833	17	17
W5EQT/5	**21**	**30,690**	**145**	**93**
WA5GLC	"	13,662	110	66
WA5NVY	"	12,006	80	58
K5DYD	"	10,431	80	61
W6ITA	**A**	**223,278**	**525**	**187**
K6HZP	"	69,734	245	119
K6ERV	"	36,271	160	83
K6CT	**28**	**8,077**	**80**	**41**
W6KPM	**21**	**21,164**	**154**	**74**
W6NJU	"	4,551	55	41
WB6LFR	**14**	**45,425**	**200**	**115**
K6YRA	"	43,456	187	112
W7AYY	**A**	**16,554**	**170**	**62**
W7BTH	"	6,996	53	44
W7ENA	"	320	20	10
W7DLR	**14**	**20,160**	**130**	**84**
W7KOI	"	4,836	65	52
K7QWI	**7**	**1,112**	**25**	**1**
WA8RSL	**A**	**7,701**	**74**	**5**
W8KC	"	1,122	28	1
WA8LNE	"	658	23	1
W8NGO	**21**	**25,333**	**117**	**7**
W8EDU	"	8,379	50	4
K8OVK	**14**	**52,537**	**202**	**10**
K8UDJ	"	26,292	130	8
W9EWC	**A**	**186,295**	**398**	**18**
WA9HJM	"	36,531	155	9
K9ZJV	"	19,760	115	8
K9YHB	**21**	**82,928**	**234**	**14**
K9PPX	"	76,342	220	13
W9UZC	**14**	**50,244**	**183**	**11**
WA9GYZ	"	2,870	39	3
W9JDJ	**7**	**2,346**	**51**	**4**
WAØFWN	**A**	**58,760**	**178**	**13**
KØIQN	"	25,714	140	8
KØIFL	"	15,120	102	6
WØGNX	"	8,151	60	5
WØKDF	"	5,324	50	4
WØBTD	**21**	**34,749**	**135**	**9**
WAØMOB	"	8,700	70	5
WAØHWZ	"	5,371	50	4
WØLBS	**14**	**61,100**	**200**	**13**
WAØKDI	"	23,500	167	9

Alaska

KL7FKP	**14**	**6,321**	**60**	**4**

Antigua

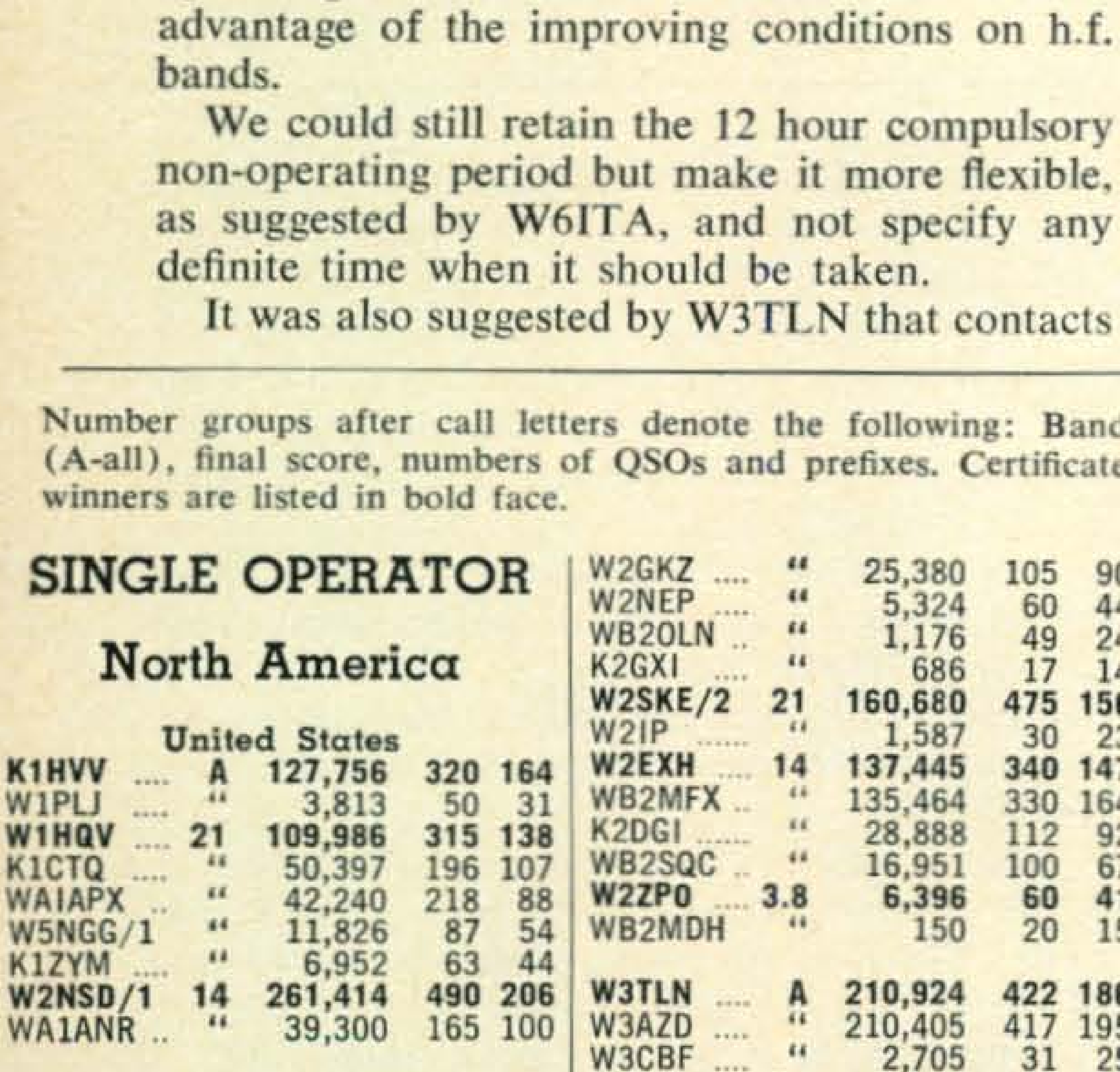
VP2AC	**14**	**9,456**	**161**	**4**

Bermuda

VP9FK	**14**	**155,584**	**683**	**14**

Canada

VO1HI	**A**	**43,498**	**264**	**9**
VO1DZ	**14**	**11,040**	**72**	**6**
VO2AI	**14**	**19,652**	**171**	**6**
VE1TG	**14**	**194,358**	**485**	**17**



K6CT can always be sure of making a good entry on 28 mc, that's George's favorite band with his polarized diversity beam.

CN8AW, one of the few entries from Africa. Tommy spent a limited time on 20 but came up with a nice score, and won himself a certificate.

1NV	"	69,600	250	120
2AFC	14	32,585	142	95
3ES	14	57,702	199	118
4SC	14	15,318	149	74
6BR	14	65,720	289	124
6GN	"	45,686	280	106
6IN	"	16,259	95	71
8AH	A	75,828	269	142
8BB	"	70,668	436	117
8AA	14	247,833	604	201
Canal Zone				
Z5PW	14	145,002	434	169
Cayman Island				
F1RD	14	8,198	156	47
Dominican Rep.				
I8XAL	A	51,415	215	113
Greenland				
X3JV	14	282,557	644	187
Guadeloupe				
G7XX	A	42,336	271	98
Guatemala				
G8IA	28	901	39	17
G8CJ	14	12,400	91	62
G8RH	14	4,004	73	44
Panama				
P1JC	28	8,658	172	37
P3MC	21	5,031	121	39
Puerto Rico				
/4JNY/ KP4	21	46,410	356	91
P4BJM	21	30,515	227	85
P4AST	14	180,442	592	166
P4CQZ	"	9,072	205	54

Africa

Algeria				
X2AH	A	273,182	517	182
Angola				
R6DX	21	50,052	200	86
Egypt				
E1AED/SU	14	143,000	384	125
Ethiopia				
T3AC	14	682,086	977	237
Morocco				
CN8AW	14	89,250	255	119
CN8FS	"	6,960	59	40
Republic of Congo				
9Q5YL	A	84,976	279	113
9Q5FV	21	55,794	202	102
Sierra Leone				
9L1HX	14	143,616	400	132
Somalia				
6O6BW	A	381,240	712	180
South Africa				
ZS5XA	14	27,060	150	66

Asia

Cyprus				
ZC4RM	A	248,329	539	167
Hong Kong				
VS6AJ	A	99,540	315	126
India				
VU2CK	14	28,728	137	84
Iran				
EP2TR	14	124,410	305	145
Israel				
4X4FV	14	258,330	556	158
Japan				
JA8QA	A	3,219	42	29
JA8EL	"	1,348	31	25
JA8AIP	"	1,172	24	16
JA2CWX	21	21,824	125	64
JA2DDN	"	14,204	99	53
JA1NDO	"	5,336	66	29
JA1VZM	"	319	11	11
JA8AA	14	139,113	397	123
JA1RJU	"	13,090	93	55
JA1DFQ	"	5,572	65	34
JA1ITE	"	3,366	40	34
JA1KPA	"	2,380	50	20
JA4AQR	"	198	13	9
JA6GO	"	147	10	7
JA3ADW	"	21	5	3
JA2BTV	7	7,585	76	41
Korea				
HL9US	A	109,952	351	128
HL9KH	14	92,748	281	101
Lebanon				
OD5BZ	A	620,156	1020	197
Malaysia				
9M2LO	A	16,900	117	65
9M6NQ	14	150,801	430	129
Ryukyu Islands				
KR6DJ	A	132,975	392	135
KR6LS	14	63,960	275	104
Syria				
YK1AA	14	11,825	78	55
Trucial Oman				
MP4TBO	21	161,738	412	142
U.S.S.R. Asiatic				
UW9CC	A	249,893	458	203
UA9EU	14	224,280	442	178
UA9HA	"	153,418	351	158
UWØAA	"	15,720	109	56
UAØAI	"	1,800	32	25
UAØKCA	"	936	40	18
UAØGF	"	168	18	8
Armenia				
UG6KAA	14	9,752	76	46
UG6AW	"	7,266	61	42
Georgia				
UF6KPA	14	50,416	190	92
Kazakh				
UL7KBB	14	7,137	65	39
Turkoman				
UH8BO	14	39,804	163	93
Uzbek				
UI8MN	14	5,226	56	39

Europe

Aland Islands				
OHØNI	A	59,280	259	130
OHØNJ	14	23,028	205	76
OHØNF	"	240	16	12
OHØNC	3.7	15,576	167	88
Belgium				
ON5KY	21	76,230	262	105
ON5MG	"	24,120	158	60
ON5AZ	14	53,300	258	100
ON5GA	"	8,928	91	62
ON4UN	3.8	70,866	471	127
Bulgaria				
LZ1DV	3.8	2,982	65	42
Czechoslovakia				
OK1AHV	A	82,305	268	155
OK1VK	"	62,900	256	100
OK3EA	"	51,660	260	126
OK1AHZ	"	27,156	160	93
OK1ADM	"	25,000	125	100
OK1FV	"	20,301	132	67
OK2ABU	"	3,476	58	44
OK1MP	21	13,923	101	51
OK2WCG	14	52,530	263	102
OKZRO	3.8	8,255	130	65
Denmark				
OZ3SK	A	151,690	365	154
OZ1FO	A	20,280	138	65
OZ7DX	"	8,874	95	58
OZ5JK	"	5,590	65	43
OZ3KE	"	2,449	33	31
OZ5GT	14	106,172	517	76
OZ1RH	"	12,238	107	58
OZ1LO	"	1,704	38	24
OZ5EU	3.7	11,232	172	72
England				
G3UML	A	265,374	488	207
G2AJB	"	9,150	100	61
G3MWZ	"	2,520	43	36
G3NMH	28	4,522	52	38
G3PEU	21	48,506	221	79
G5AAB/ W3MD1	14	30,996	152	82
G3VAO	"	26,132	168	94
G3NLY	7	22,601	164	97
Finland				
OH400	A	119,350	409	154
OH2MK	"	39,072	222	111
OH5SM	"	32,457	162	93
OH6VE	"	3,479	73	49
OH2BBR	21	8,175	115	75
OH2XA	"	5,694	60	39
OH2WI	14	123,842	399	158
OH1OE	"	36,660	207	94
OH3UO	"	9,310	129	38
OH1VR	"	2,403	67	27
OH2BEF	"	1,272	30	24
OH3XZ	"	119	7	7
France				
F8PI	A	158,330	422	142
F2YS	"	56,145	239	95
F3KW	"	12,480	104	40
F3KC	21	32,806	254	47
F7FP	14	64,014	283	94
F7GN	"	21,912	160	88
F7FV	"	16,682	153	38
Germany				
DJ6QT	A	482,346	840	211
DJ4IZ	"	57,684	223	114
DJ4TE	"	50,141	206	91
DJ2SK	"	50,048	187	128
DJ3WE	"	43,392	174	128
DJ9ZH	"	41,710	189	86
DJØJGA	"	29,606	184	113
DJ2HI	"	27,720	148	88
DJ3EJ	"	14,904	133	87
DL3RA	"	6,728	80	58
DL9PU	21	60,333	431	67
DL1ED	"	40,375	167	85
DJ1XP	"	25,740	131	78
DJ2YL	"	20,223	109	63
DJ8FF	"	7,958	72	46
DL1KN	14	228,725	526	175
DL7HU	"	127,246	332	149
DJ1SX	"	91,256	308	136
DJ7IK	"	55,195	267	133
DJ6TK	"	37,673	203	101
DL1AM	"	34,884	175	102
DJ9KH	"	14,520	137	66
DJ5BV	7	35,990	206	122
DJ3BW	"	15,826	175	82
DL8UI	3.5	26,342	272	104
DL4NS	A	150,220	444	140
DL4UV	"	55,930	198	119
DL4UL	21	49,020	208	86
DL4AN	14	117,024	346	138
Greece				
SV1BL	A	253,150	679	190
Iceland				
TF3EA	14	92,412	302	153
TF3MF	"	460	24	20

DJ6TK, one of the QRP stations on 14 mc. Dilf had only 100 watts p.e.p. to a ground plane.

Italy
I1BAF ...... A 453,096 899 186
I1AUM .... " 3,713 70 47
I1LCK 14 135,622 402 166
I1EVK ...... " 110,295 373 135
I1KRE ...... " 54,200 267 100
I1LCF ...... " 8,184 83 62
I1LAO 7 11,461 145 73
I1ZSQ 3.8 20,271 218 87

Luxembourg
LX2UW .... A 73,583 271 117

Netherlands
PAØDEC .... A 49,350 190 105
PAØSNG .. " 19,836 144 87
PAØGMU .. 21 13,068 97 54
PAØHBO .. 14 225,885 483 185
PAØHTR .. 3.8 3,266 69 46

Northern Ireland
GI3RTS .... A 38,688 240 93

Norway
LA4LG ...... A 10,168 90 62
LA4DJ 14 22,274 155 86
LA2T .... " 21,488 187 79
LA4AF ...... " 3,914 52 38

Poland
SP3PL ...... A 26,691 136 93
SP8AJK .... " 24,552 204 99
SP8AVB .... " 4,264 82 52
SP9ANH .. 14 13,068 108 66
SP5HS ...... " 12,338 136 62
SP9AHA .. 3.8 1,911 53 39

Portugal
CT1KT .... A 167,860 560 110
CT1PK .... " 166,313 476 161
CT1IK .... " 155,720 509 136
CT1IW .... " 109,839 368 141

Rhodes
SVØWF 21 38,010 224 105

Romania
YO9VI 14 56,592 300 113
YO9AFT .... " 2,074 61 34
YO3JU ...... " 902 24 22

Scotland
GM3JDR .. 14 81,468 349 146

Sicily
IT1GAI 21 157,080 502 136

Spain
EA1GH 14 82,218 261 142

Sweden
SM3RK A 108,277 328 151
SM7AXP " 42,588 206 117
SM5CHH " 20,416 150 88
SM7ASN " 5,977 51 43
SM5BUT 21 64,542 258 93
SM5OV " 44,536 213 76
SM5CQF .... " 41,990 175 95
SM5BPJ .. " 17,050 100 62
SM5MC .... " 14,999 108 53
SM5CEU .... " 12,012 98 43
SM6CNS .. 14 307,242 710 169
SM6AEK .. " 57,245 225 107
SM4CHM .. " 36,359 198 103
SM5GA .... " 20,553 126 93
SM5AZU .. " 10,416 80 62
SM5KV .... " 7,980 86 57
SM5BNX .. " 348 13 12
SM7BEX .. " 228 15 12
SM5CAK .. 7 6,552 121 52

Switzerland
HB9ZY .... A 232,390 517 170
HB9UD .... " 8,673 83 59
HB9TL 14 242,373 550 173
HB9OI .... " 1,736 50 28

Wales
GW3NWV .. 14 13,500 101 60

U.S.S.R.
Estonia
UR2AR 14 339,633 743 189

European
UW3CX .... A 21,060 117 41
UA1DI ...... " 381 17 17
UA1IG 14 82,268 420 131
UA3DB .... " 14,960 115 85
UA4CZ .... " 10,032 121 44
UA1CK 7 4,488 79 51
UA1ABW .. 3.8 72 11 9

Ukraine
UB5UN .... A 265,540 613 220
UB5WF 21 97,911 340 99
UB5WJ 14 89,974 267 143
UT5DZ .... " 48,300 304 115
UB5ARTEK " 45,012 245 121
UB5OD .... " 18,418 182 82
UB5ZJ ...... " 9,126 127 54

White Russia
UC2BF .... A 46,224 259 108

Oceania

Australia
VK2AHT .... A 541,836 1061 173
VK2KM 21 23,797 157 53
VK2APK 14 146,289 366 143
VK2AWW .. " 7,832 61 44
VK3ZR .... A 13,320 86 60
VK3SM 21 8,388 85 36
VK3APJ 14 25,905 160 55
VK4LT ...... A 32,865 168 67
VK5EF ...... A 3,744 50 26
VK5LC 14 10,835 70 55
VK6RU .... A 369,055 821 155
VK7SM .... A 20,450 146 50

Christmas Is.
VK9DR .... A 55,500 198 100

Hawaii
KH6IJ 21 30,080 264 40

Marshall Is.
KX6BQ 14 533,232 1001 184

Minerva Reef
1M4A ...... A 1,031,368 1713 211

New Caledonia
FK8AH .... A 1,380 37 15

New Guinea
VK9GN .... A 170,975 540 115

New Zealand
ZL1KG ...... A 505,830 931 195
ZL1AAS .... " 84,016 328 89
ZL3AB 21 29,068 240 43
ZL1AGO 7 1,166 29 22

Papua
VK9DJ 14 138,050 450 110

South America

Argentina
LU7DGM .. A 103,410 349 90
LU1DAB .. 28 80,960 299 92

Brazil
PY7AKW .. A 59,171 194 107
PY1NBF .. 14 209,721 471 159
PY4OD .... " 201,042 459 153
PY2BGO .. " 12,932 92 53
PY7APS 7 2,880 36 30

Chile
CE6CC ...... A 29,360 135 80
CE6EZ 28 37,674 200 63

Colombia
HK3AAG .. 7 2,640 33 30

Trinidad
9V4VU 21 1,463 27 19

Venezuela
YV1LA 21 243,800 709 115
YV5BPJ .. " 227,362 497 158
YV1QN 14 43,290 189 111
YV7AV .... " 1,848 31 21
YV5BTS .. 3.8 15,070 96 55

MULTI-OPERATOR

North America

WB2FOV 121,693 321 143
(WB2FON, WA2UBC, WB2FOV)
WA4UCE 4,070 53 37
(WA4OSD & WA4CUQ)
WA5HID 79,597 255 137
(WA5HID, HTF, GYX, ILD, JEY)
WA8GUF 76,200 258 127
VE3FHO 170,450 410 175
(VE3FHO & VE3GCO)
VE6GX 76,593 281 121
(VE6AAV, ABP, AJJ, WR)
KL7WAH 115,086 470 129
(K2YFE, K7MQY, W5IDA, WB6HFX)
KL7EDY 44,469 279 81
(KL7EDY & KL7JDO)
KP4AXM 89,278 734 98

Asia

KR6DB 223,890 520 170
(KR6DB, BA, MM, TW, UD)

Europe

OZ7OMR 9,222 102 53
(OZ1RH & OZ5RU)
G8FC 749,324 1212 244
(G2BVN, 3GJQ, 3KZM, 3MNN, 3NAC, 3POX, 5UG, GW3IEQ)
G3RXC 112,868 347
(G3RXC, G3SDD, G3L
OH2AM 632,366 1095
(OH2BC, BH, BS, BQ,
OH3AH 118,378 389
(OH2BBM, OH4NW, OH
OH2TI 68,110 270
(OH1QP, OH3PC, OH
DJ3GD 534,264 990
(DJ3GD, DL3BN, DL
DLØAB 89,024 360
(DJ1XE, 3PV, 7SR, 9
9VQ, DL2OJ, 6
DLØJH 67,945 310
(DL8JL & DL
DM3ML 27,040 148
(Club Stat
DL4WK 268,212 550
(WA5NWT & WA9F
HA5KBB 306,735 779
(HA5DM, 8WH, 5-019, 9-
I1AA 393,414 875
(I1AA & I
I1BER 310,189 703
I1AT 72,125 268
(I1AT, AXD, BEP, CCM, C
LA3P/P 57,960 443
(LA2JK, 5AJ, 5CI, 6XF, 8
LA1K 192,768 520
(LA1EE & LA
SM6AOE 527,175 945
(SM6AOE, 6BJI, 6CAS, 6C
SM7CRW 269,854 643
(SM7CRW & SM7D
SM3CNN 161,624 507
(SM3CNN & SM3
SM5DUL 117,225 430
(SM5ACQ, BJU, BYV, DUL, D
SL3ZV 12,090 140
(SM3DGU, DMU, D
4U1ITU 950,312 1240
(I1RB & I1R

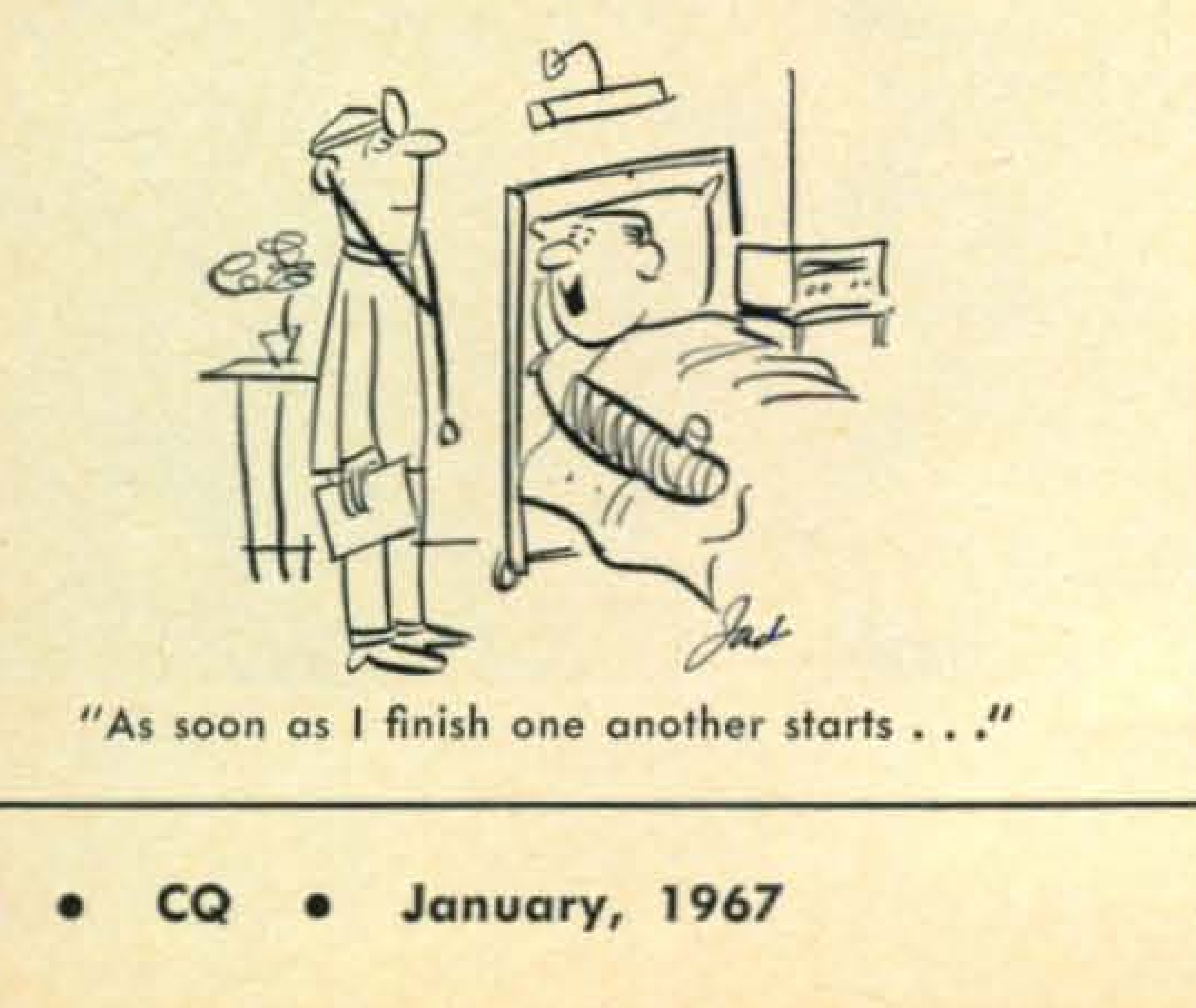
U.S.S.R. Club Stations
UR2KAA 260,586 469
UA1KBW 374,916 795
UA3KBD 65,423 276
UA2KAK 168,141 560
UA2KBD 73,188 386
UQ2KBH 18,834 148
UP2KNP 343,178 774
UB5KKA 58,352 312
UB5KAW 39,349 250

Oceania
5W1AX 462,798 1308
(KS6BO, BQ, BR, BT,
VK9XI 67,872 240
(Club Stati

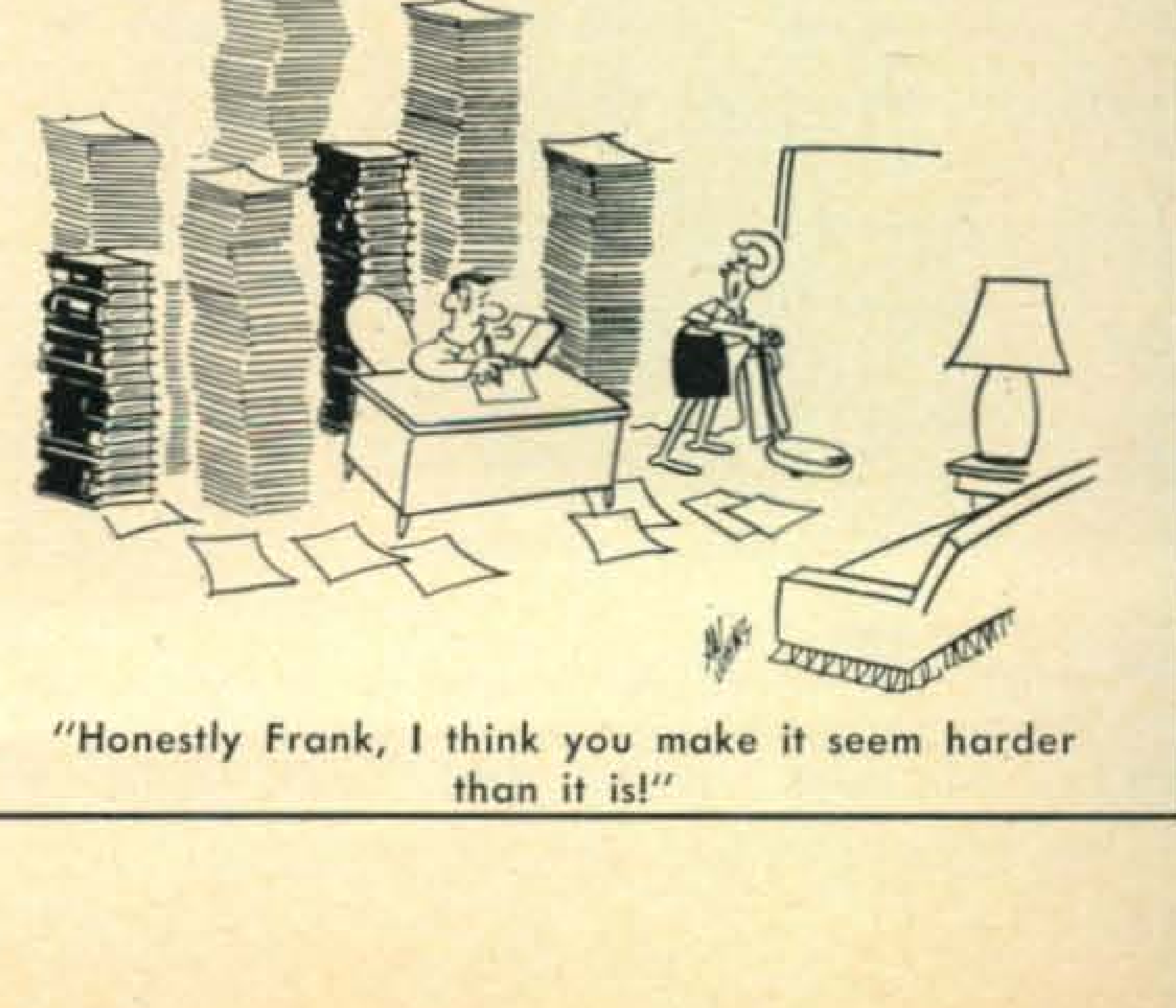
South America
HC1EY 599,322 1153
(HC1EL, 1EY, 1LE, 1TH, K5Z
YV5BWP 591,545 1033
(YV5BQF, BWP, CDK, C

Check Logs: DM2BTO, GB2S LA7JH, OH1TM, OZ6PX, PAØHE PAØWDG PY3BAD, SM4AP SM5BPZ, SM5IC, SM5KG, SM5Z SM7ALA, SM7DML, WB4BY W6FKZ, W6QBY, WB6HGH, W8CH WØLBO, 4X4QL. CT1LU.

At Frank's Expense . . .



"As soon as I finish one another starts . . ."



"Honestly Frank, I think you make it seem harder than it is!"

DO YOU KNOW THE PHILLIPS CODE?

BY HOWARD S. PYLE,* W7OE

ASK that question of a pretty fair proportion of the average ham of today and you'll get the counter query, *"Phillips* code . . what's that?". Most of the ol' timers will recognize that designation immediately but a surprising number of the General Class and practically all Novice licensees will give you a puzzled look and say, "I never heard of it"! And yet *all* hams use it constantly, right down to the veriest beginner!

Phillips code is nothing more or less than a form of "radio shorthand." In your daily use the expressions *GM* (good morning), *abt* (about), *hv* (have), *bn* (been), *cul* (see you later) and hundreds more have all derived from the Phillips code with minor variations to tie it in with strictly ham expressions. Contrary to popular belief however, this short-cut method of conveying intelligence was *not* developed by the ham himself; it was in existence many years before there *was* such a thing as a radio ham!

In 1879, Walter P. Phillips, a working wire telegrapher, conceived the idea of speeding up the transimssion and reception of press matter over existing telegraph lines through use of a 'code' of abbreviations which could be standardized for use by all telegraphers. Transmission at that time was entirely by hand key; the 'Vibroplex' or "bug" as it is more familiarly known, was not invented by Horace G. Martin until many years after the telegraph was placed in practical operation. Reception was by *sight* reading by one skilled in interpreting the dots and dashes as they appeared on a paper tape. Later, as operators became accustomed to the sound of the various characters through the clicking of the relay mechanism which actuated the tape printing device, they discovered that they could interpret directly by sound. As a result, 'sounders' were devised consisting of a pivoted metallic arm moving between upper and lower bars of an 'anvil' so-called. Movement of the pivoted arm was controlled by two electro-magnets which were in turn energized by the impulses representing the dots and dashes of the Morse code as received over the telegraph line.

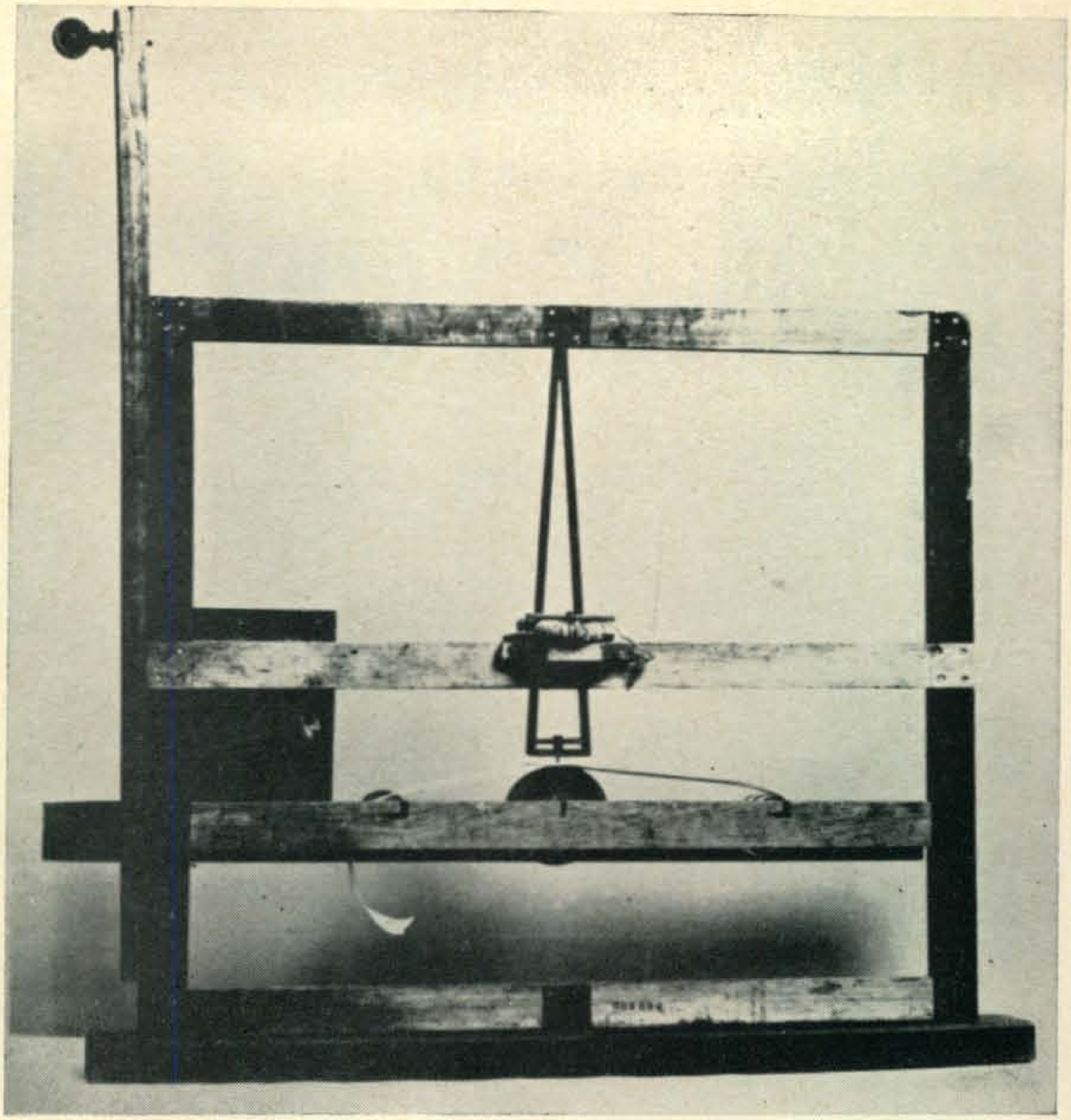
Writing down the dots and dashes as heard found little favor. It was a lengthy process requiring later visual interpretation and was soon abandoned for the more practical method of writing the actual alphabetical characters as received. As speed of transmission increased with practice it was soon found difficult for a receiving operator to keep up with the sender, using a stylus pen as was then done; the typewriter had not at that time received general acceptance. A peculiar style of flowing handwriting soon developed among telegraphers which permitted greater speed in transcribing. Letters were reduced to a minimum number of strokes and often words were linked together. It was an attractive and distinctive penmanship, easily deciphered by anyone; to this day a veteran telegrapher can be immediately recognized by his handwriting!

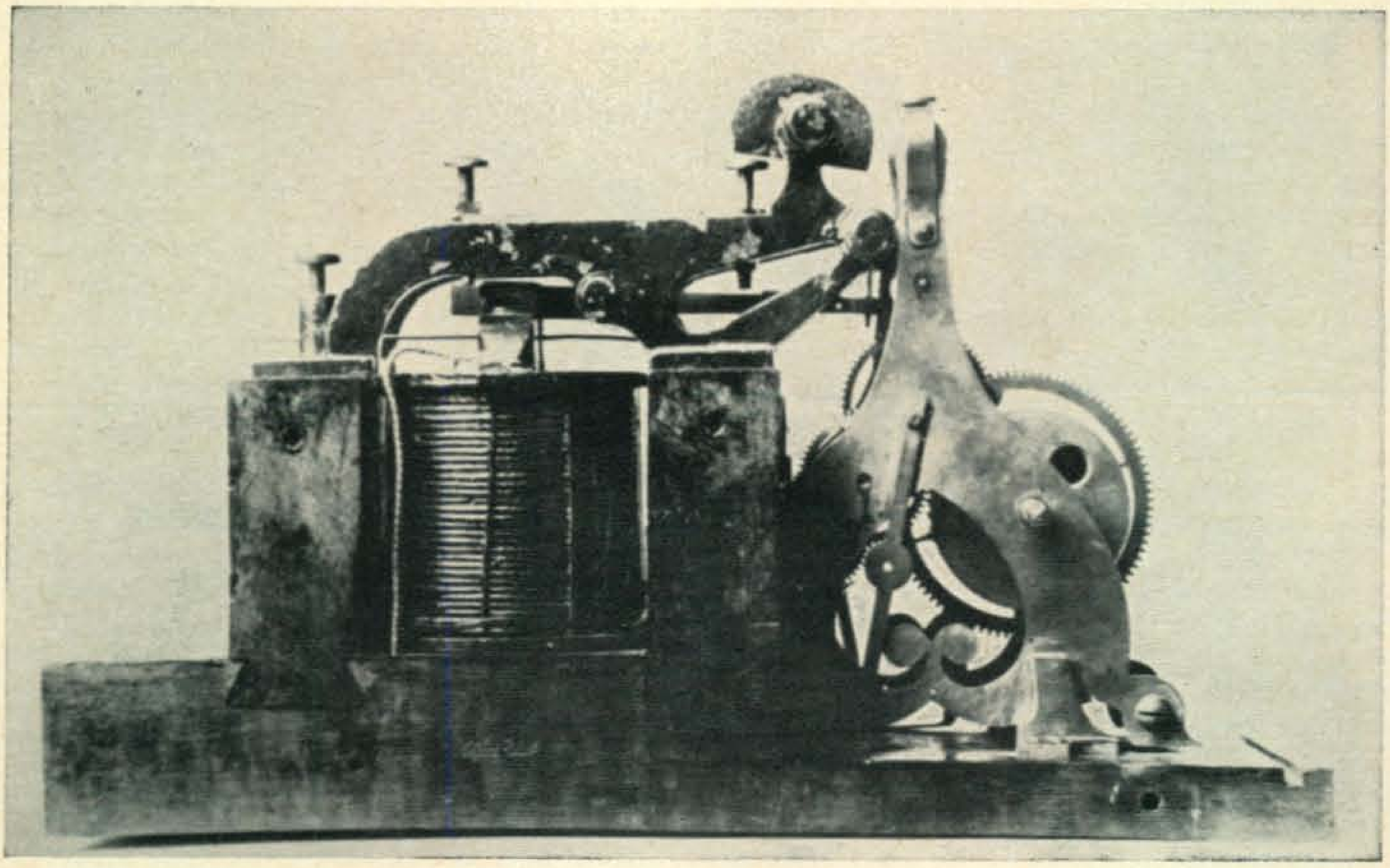
Even this speeding up of the handwriting process soon proved inadequate and was a particularly tiring chore when long press dispatches required transcribing, generally in manifold copies. With the early adoption of the typewriter by telegraph companies and press bureaus however, a greater copying speed was attained but soon it was found that as operators acquired greater typing skill they were capable of copying faster than the transmitting operator could send . . . the shoe was on the other foot! Speed then hit a 'road-block' until Martin came up with his 'bug' which kept the score more even. However manual transmission and reception even so, were limited to about 50 w.p.m. maximum for the average operator . . . what to do to increase this became a leading question in the telegraph field. Walt Phillips found the answer through his development and introduction of the code of abbreviations which immediately became accepted and known as the 'Phillips Code'. After more than 85 years, this short-cut 'code' method is still in wide usage on manually operated telegraph lines although much of the communication is now accomplished by the modern version of the 'printing telegraph' . . . a teletypewriter in one of its various forms. Phillips code is of course unnecessary where the directly printed word either teletyped or reproduced in facsimile, is available. Nonetheless however, thousands of words of

[*Continued on page 100*]

*3434—74th Ave., S.E., Mercer Island, Wash. 98040.

The equipment on this page seems to be part of RTTY A-Z but is actually the first stages of development in modern communication. The photo on the right shows the first telegraph printer-receiver used by Morse in 1837. It was a tape perforator and puller and reception of c.w. was strictly visual. The phillips code wasn't even a dream at that time. (Photo courtesy of Louise Moreau).





The telegraph receiver used by Alfred Vail at the Baltimore end of Morses original telegraph line during the Washington to Baltimore trials of 1844. The Phillips code could have greatly increased the operators receiving speed for this old pioneer. *(Photo courtesy of Louise Moreau)*

The I.C. C.P.O. is built on a 2 × 2 × 4 inch chassis with a miniature p.m. speaker at one end. The IC, housed in a TO-3 can, is on top of the chassis next to the tone control.

THE I.C. C.P.O.

BY E. A. SACK,* W3NRG

Here is a code practice oscillator that makes use of a derated integrated circuit originally intended for military use.

THE potential for application of "space-age" integrated circuits to amateur radio was discussed in a recent *CQ* article[1]. One such application is a code practice oscillator which employs a single I.C. and a minimum of other components to provide a clear, stable tone from a self-contained miniature speaker.

The integrated circuit used in the unit was originally designed as a voltage regulator for military equipment. Because the power requirements for use in the code practice oscillator are well below the design value of the I.C., a special "derated" version has been made available for the ham and experimenter.[2]

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

[1]Sack, E. A., "Integrated Circuits for Amateur Radio," *CQ*, September 1966, p .

[2]Price $3.00 post paid. Write Manager, Customer Service, Westinghouse Molecular Electronics Division, Box 7377, Elkridge, Maryland, 21227.

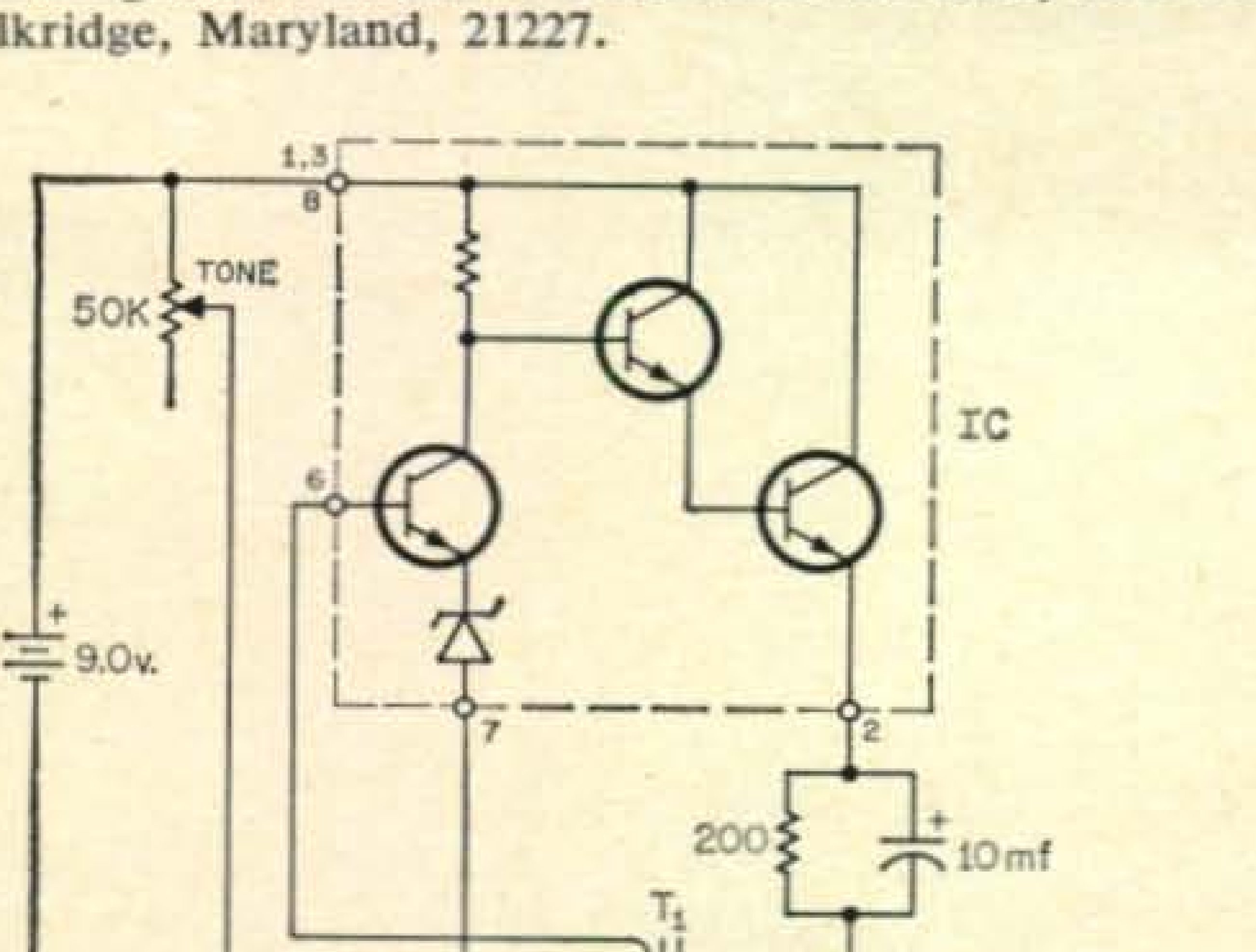


Fig. 1—Circuit of a code oscillator using an I.C. amplifier. The I.C. is a Westinghouse WE110T and T_1 is a 500 ohm to 8 ohm output transformer (Thordarson TR102 or equiv.).

Circuit

Figure 1 shows the circuit of the code practice oscillator. An 8 ohm speaker and a bypassed bias resistor are connected in series with the current output terminal of the integrated circuit. A small transistor audio output transformer feeds back the signal developed across the speaker coil to the base of the input transistor of the I.C. A variable bias voltage is applied through the tone control potentiometer in order to set the emitter to ground potential on the input transistor just above the breakdown "knee" of the zener diode. In operation, the signal fed back from the speaker drives the zener in and out of the conducting region to provide an output signal that is a combination of a relaxation and a feedback oscillation.

A small 9 volt transistor radio battery is sufficient to power the oscillator, which takes less than 40 milliamperes under key down conditions. The key is connected in series with the battery so that there is no drain during standby operation and good battery life is obtained.

Construction

The code practice oscillator may be constructed in a 2 × 2 × 4 inch utility box. The WE-110T is packaged in an eight pin T03 "can" which is mounted on the box with pins extending through a hole in the chassis. A socket is available[3] but it is also possible to solder leads directly to the pins of the I.C. As is true with any semiconductor device, a minimum of heat should be used in the soldering operation.

A miniature speaker is mounted on one end of the box and the key jack is mounted on the

[*Continued on page 102*]

[3]Barnes Development Corporation, 24 N. Lansdowne Avenue, Lansdowne, Pa. Socket Type MS210, approximate price $3.10.

UTILITY TRANSCEIVER POWER SUPPLY

2 | 6 | 10 | 15 | 20 | 40 | 75 | 80

BY JOHN SCHULTZ,* W2EEY/1

This article describes two construction approaches for relatively simple and inexpensive power supplies useful to power many medium level transceivers, either homebuilt or commercial, in the 150 to 400 watt p.e.p. range. A c.w. monitor and speaker are also included in the same housing as the power supply.

BECAUSE most tube-type transceivers use the same design approaches, their power supply requirements can be generalized as follows:

1. B plus of 600 to 800 volts at up to 500 ma peak (transmit mode only).
2. B plus of 250-300 volts at up to 100 ma.
3. C minus of 100 to 130 volts at up to 50 ma (regulated or unregulated).
4. Filament supply of 12 volts at up to 5 amps.

*40 Rossie Street, Mystic, Conn. 06355.

In most cases there is nothing critical about the unregulated transceiver voltages. A 10% variation from recommended values will not noticeably affect performance. It is required in every case, however, that the B plus voltages

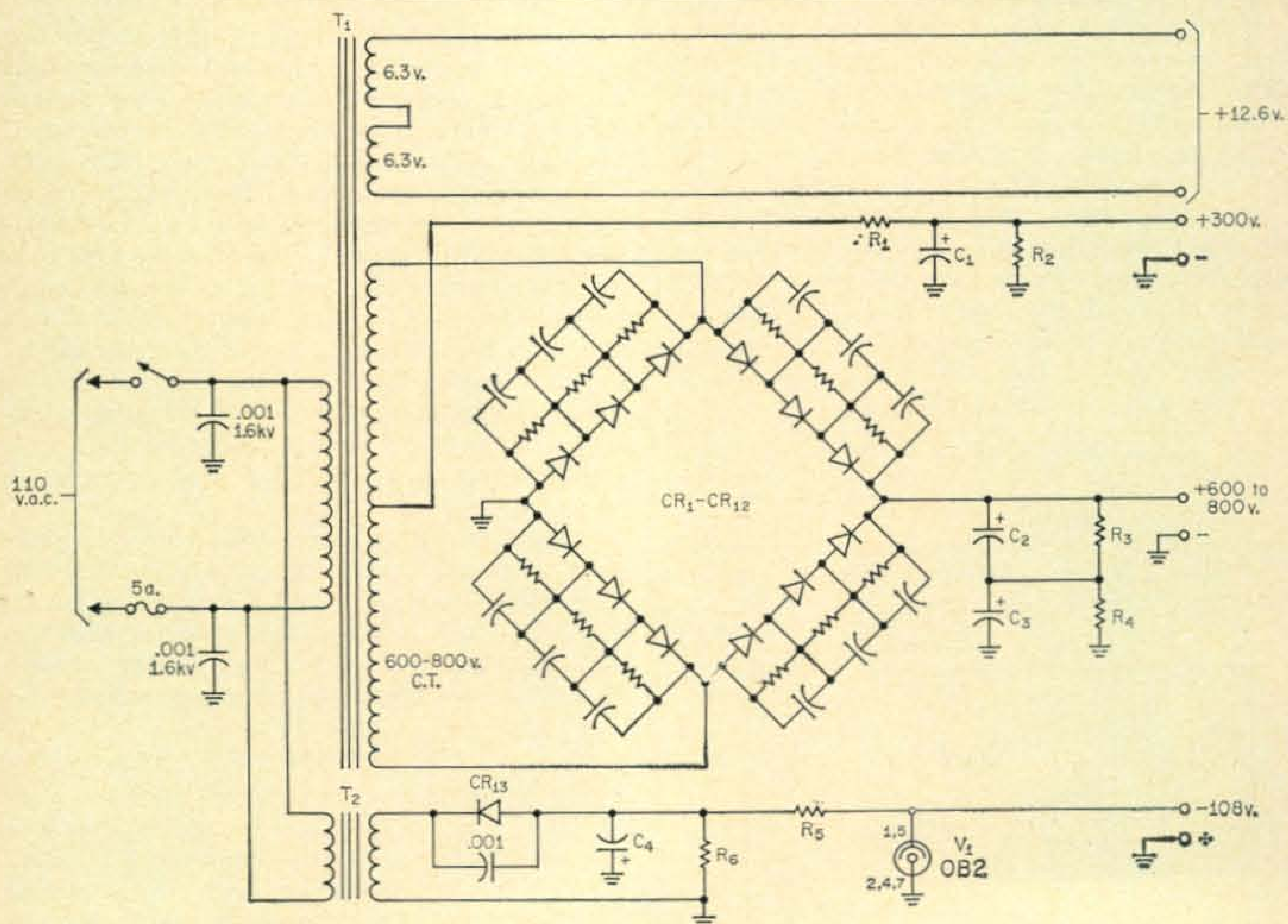


Fig. 1—Circuit of a power supply using a TV replacement or salvaged power transformer. The circuit is useful for operating medium power transceivers. The resistors in parallel with the diodes are each 470K, ½ watt and serve to equalize the p.i.v. The capacitors across the diodes are 0.001 disc ceramics and serve to suppress transient pulses.

C_1, C_2, C_3, C_4—40 mf 450 volt electrolytic.

CR_1 to CR_{12}—750 ma 400 p.i.v. silicon "top hat" diodes.

R_1—See text. Usually 1K, 20 watts is a satisfactory value.

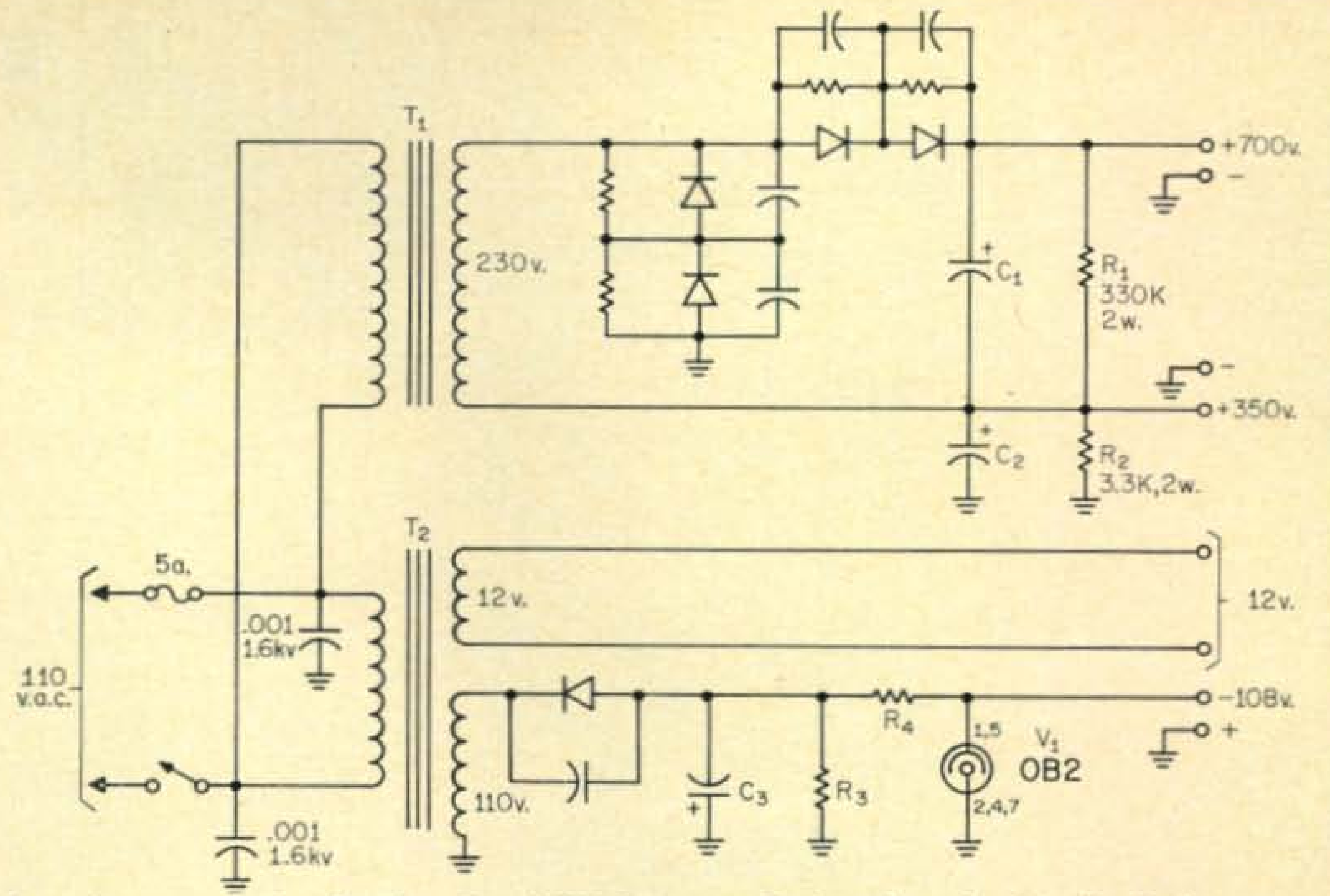
R_2, R_3, R_4, R_6—330K 2 watts.

R_5—3.3K 2 watts. Optional-used in conjunction with V_1 if the transceiver requires a regulated bias source.

T_1—600-800 v.c.t. at 200 ma. Two 6.3 windings at 5 amps. See text.

T_2—117/117 v.a.c. at 40 ma. Isolation transformer.

Fig. 2—Circuit of a full wave voltage doubler type power supply using an isolation type step up transformer and a small amplifier type power transformer. The 470K ½ watt resistors and the 0.001 capacitors across the diodes serve the same purpose as those in fig. 1.



C_1, C_2—100 mf 450v. electrolytic for current loads of over 200 ma.
C_3—40 mf 450 v. electrolytic.
CR_1 to CR_5—750 ma, 400 p.i.v. silicon "top hat" diodes.
R_1, R_2, R_4—330K 2 watt resistors.
R_3—3.3K 2 watts. Optional-used with V_1 if the transceiver requires a regulated bias source.
T_1—117/230 volt isolation type transformer, 100 VA or more. See text.
T_2—117/117 v.a.c. at 40 ma. 12.6 volts at 5 amperes.

have good *dynamic* regulation because of the wide current demand range with s.s.b. modulation. The latter is not difficult to achieve providing transformers and rectifiers with adequate power rating and filter circuits with a large enough output filter capacity are used.

TV Power Transformers

After building several power supplies for various transceivers, I found either one of two approaches worked out most economically. The first approach is to build a power supply around a TV power transformer. These transformers have the desired combination of low *total* secondary voltage (650-800 volts) and high current rating (200-400 ma). Also, one can usually be found with two 6.3 volt filament windings of sufficient current rating so that they can be connected in series for a 12.6 volt filament supply.

A bridge rectifier circuit, as shown in fig. 1, allows obtaining the two B plus voltages. If a transformer with a 800 volt secondary is used, the B plus half voltage taken from the transformer centertap will be too high for most transceivers. A series resistance (R_1 in figure 1) is added to reduce this voltage to the desired value. The only other transformer necessary to complete the supply is a small isolation type (110/110 volts) for the bias supply. Alternatively, a small 6 volt filament transformer could be connected backwards across one of the 6 volt windings on the power transformer to obtain 110 volts.

The main disadvantage of this approach is the large number of diodes used since each leg of the bridge rectifier should be rated at 1½-2 times the transformer total secondary *peak* voltage (with transient suppression[1]). This cost must be traded off against the very low prices at which husky TV transformers can often be bargain purchased. The large size filter capacitors are used mainly for dynamic regulation and not to keep ripple down.

Voltage Doublers

The second approach to building a power supply and the one I usually found to give a better trade-off regarding cost, compactness and ease of construction is to build a supply around a 110/230 volt isolation transformer. The isolation transformer is used in a voltage doubling circuit, as shown in fig. 2, to supply the B plus voltages and a separate low cost audio amplifier type power transformer is used to provide the bias and filament voltages.

The isolation transformers have high power ratings for their size and two can be easily paralleled for increased current rating. The voltage doubling circuit requires fewer diodes of lower p.i.v. rating than a bridge circuit for the same output voltage. Again, adequate filter capacitor size

[*Continued on page 102*]

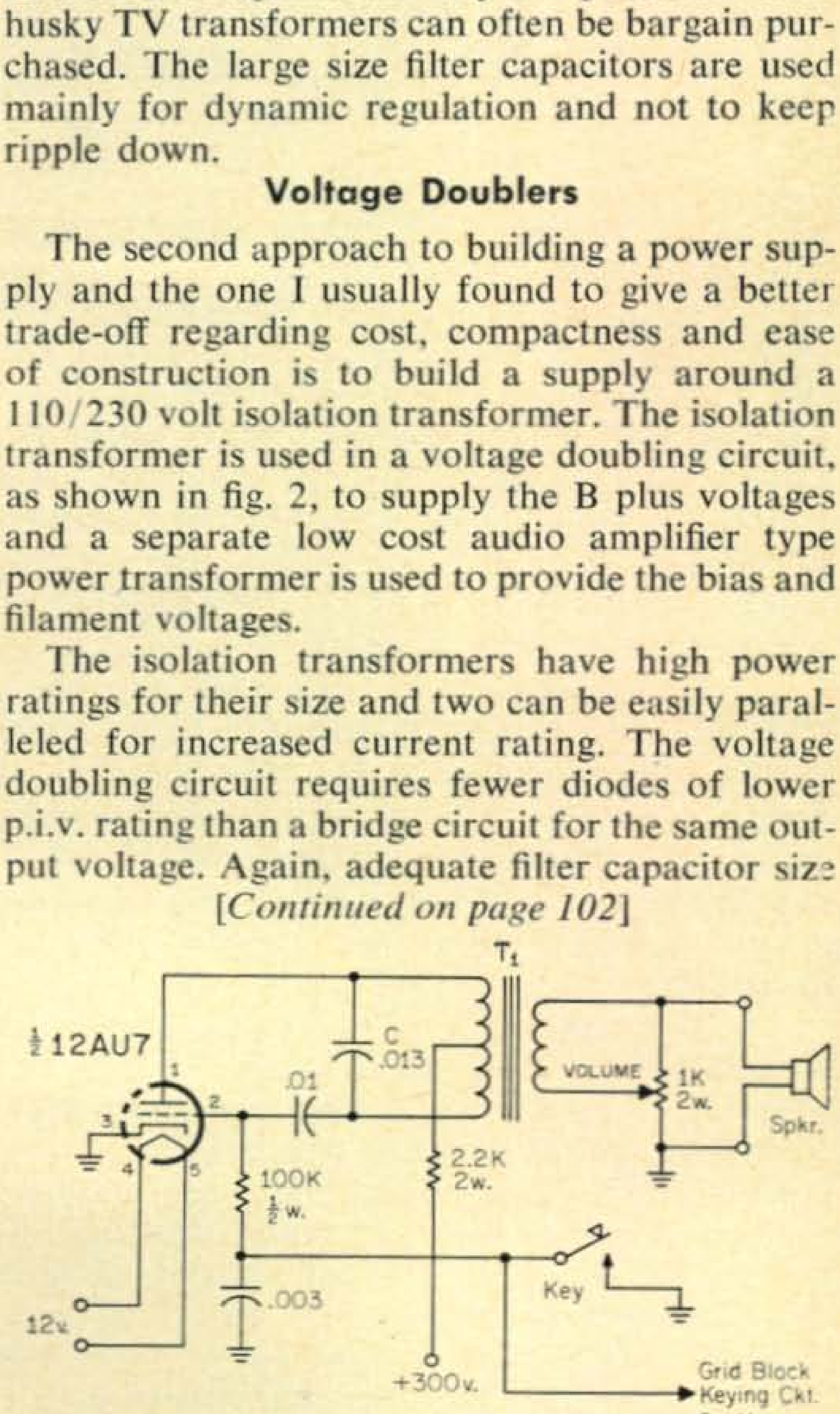
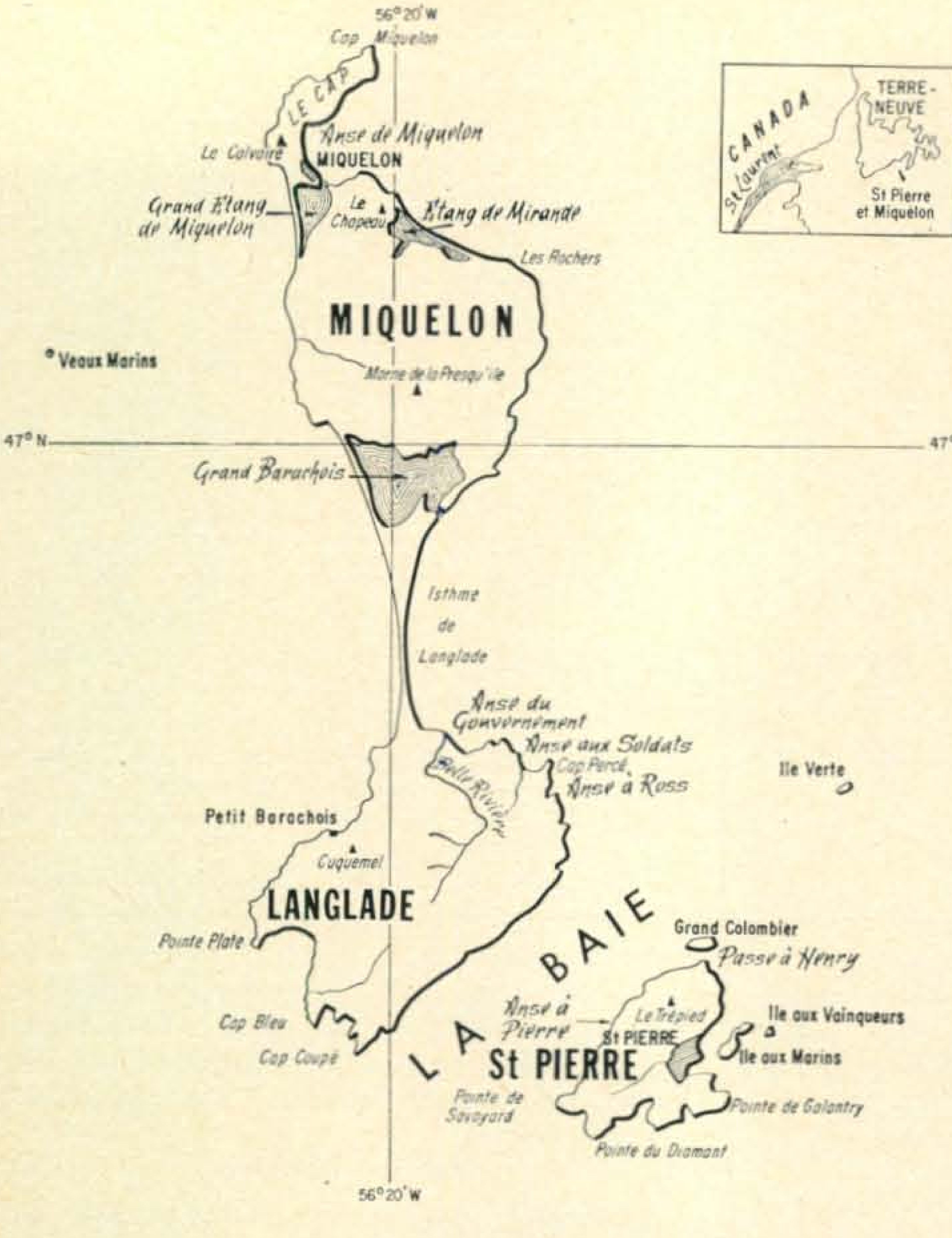


Fig. 3—C.w. monitor for use with grid-block keyed transmitters. Transformer T_1 is a push-pull plate to voice coil output transformer. The value of C may be changed to vary the tone.

[1]Gunther, R. L., "Silicon Diodes and Common Sense," *CQ*, September 1965, p. 53.



FP8AS

BY CHARLES M.

The following is an venerable man on land is situated in the 170 miles northwest south-central

Ever think of going on a DX-pedition? Bet you have. Many of us have dreams. The world over is full of them. Ah, such peaceful bliss day-dreaming is. We're miles and miles and miles away think of something we'd love to be doing. Then, WHAM! Our dreaming is suddenly shattered and back to stark naked reality. What a letdown but how pleasant it was for the little while it lasted.

I'm a DXer and many has been the time when QSO was established with one of those rare little spots on the earth that I'd hope for the day that maybe, somehow, W2EQS could be signing some exotic call. Where to go! Where, oh where? It couldn't be expensive what with raising a young family of four children. And, there's Isabel, my other half.

These thoughts were running through my mind back in 1956. Then came the dawn! St. Pierre et Miquelon . . . only 900 airline miles from New York City. Ah! 'Round and 'round my mind went contacting this one, writing that one, establishing how to get there, what to bring, Customs requirements. Oh, there are a million and one little things and one must plan them well in advance making a full list as he goes along. Well, this was 1956 and my first trip was made there in late summer of 1957. But, this story doesn't revolve around that DX-pedition nor the one made in 1961 but rather the most recent one made in September of 1963 with well travelled and well known Jan Bruinier, DL9KR/FF8CW/6W8CW/FP8BV.

Think it's easy planning for a trip such as this when I live in New Jersey and Jan in Germany thousands of miles away? Many 20 meter schedules were kept.

After months and months of planning the day finally arrived. Jan is a Navigator for Lufthansa so had no difficulty getting transportation over here. I met him at Idlewild Airport Monday, August 26 . . . and back to my home we drove. Now Jan is no stranger here. He has been our guest on a number of occasions and was everyone delighted to see him again!

The following day was spent packing my Rambler station wagon and this in itself is a great chore what with the tremendous amount of paraphernalia that must be taken, the check list to make sure nothing has been overlooked, and then goodbye to the family and we're off.

We left Westwood that Wednesday morning with a brilliant sun and beautiful blue sky over head—two happy fellows finally on their way. Drive we did—right straight through to Sydney, Nova Scotia 1,100 miles away with continuous driving for 29 hours. Tired? Of course! But, we had more important things on our minds than to give sleep even one wee bit of thought.

Disappointments? What DX-pedition doesn't run into some snag? We missed the plane by a mere 1½ hours. This was Thursday. Oh well, there'd be another one tomorrow. Ha! Well, tomorrow came. Weather in Sydney was okay but St. Pierre was fog bound. Ever sit on your hands for 8 hours or more just waiting and hoping? Friday and Saturday . . . same thing. Ugh! Jan, being a navigator knew how to read the charts in what I'd call the navigational room of the Sydney Airport. We "lived" there but nary a break came our way. We got to know every inch of the airport, the men in the control tower

*48 Prospect Avenue, Westwood, New Jersey.

CALLING...

O'BRIEN,* W2EQS/FP8AS

accounting of a trip made by CQ's 160 to St. Pierre et Miquelon. FP8 Gulf of St. Lawrence approximately of Nova Scotia and 16 miles off the coast of Newfoundland.

and navigational room, the pilots, Customs officials, waitresses and whoever else was around.

Sunday we sat again. Such boredom! All this good time going to complete waste when we should be on St. Pierre working the DX gang. But, suddenly, what's that taxiing down one of the runways? Why, it's our DC-3. The fog at St. Pierre had lifted at long last. All equipment was loaded aboard. Soon we'd be on our way. It's only a one hour flight. Then . . . once again we waited and waited and waited. What happened? Came the crushing news that St. Pierre fogged up again. The crew unloaded all our gear.

For four solid days we sat on our you know whats. Bored? Disappointed? Disgusted? Oh!! And, all the time the weather in Sydney was perfect.

We learned, though, that that night the boat, the Miquelon, would be sailing from North Sydney, about 18 miles across the bay. Well, did we ever repack my car in a hurry to get to the harbor facilities, make proper sailing arrangements and get all our gear stored on board.

Consider this, fellows. The plane flight is but one hour—by boat it's 18. But, what if we gambled that flight conditions on the morrow would be okay, didn't take the boat, and then found that FP8 land was still fogged in? We'd still be kicking ourselves. So, we decided to go by boat. Fog or no fog the boat would at least get there. About midnight Greenwich Mean Time she weighed anchor and did Jan and I heave the greatest sigh of relief the world has ever heard!

It was a very peaceful trip. The ocean was ever so calm and the weather beautiful. This was relaxation. Or was it? We wanted to be operating and here we were still on the way. And, what else happened. You guessed it! The fog on St. Pierre lifted and 'round about 1300 GMT Monday didn't the plane swoop down to about 100 feet above us, circle twice, and then was on its way. But, it wasn't the big DC-3. Most of the people who had planned taking that, as we, were also on the boat. This was, by comparison, a small Cessna 310-B. But, the fact remains had we all gambled on the weather for one more day we'd have been on St. Pierre 5 hours earlier. Yes, we'd have been in operation that much sooner and who knows how many extra QSOs we'd have had.

Well, when we docked at 1800 GMT (1500 local time) who was there to greet us but the flight crew and did we all have a good laugh. But, more important, who else was there to welcome us? Good old Gus Roblot, FP8AP. He is a native there. Fellows, I don't know how many of you may have heard or worked him but no finer a gentleman, no finer a friend, no finer an everything could you find. He is a wonderful fellow. As soon as we landed he rushed us thru Customs, got us up to the New Royal Hotel which was to be our headquarters, and then pitched in helping us erect antennas so we could be on the air just as soon as possible.

Our day of arrival was Monday, September 2 and our first QSO was at 2130 GMT. We were in business at long, long last. And, who was there even before breakfast the next day to help us with other antennas? Gus, of course. Now we put up separate dipoles for 15, 20 and 40 meters with a 275 foot long wire 50 feet high for 80 and 160.

What are skip conditions like on St. Pierre? For most of the time you can't even begin to imagine the likes of the W/K QRM. Every one of the 10 districts blast in. They overpower everything. I'm a W. Naturally, I realize there are loads of Ws who still need FP8. But, I wanted to give all parts of the world an equal chance.

Spanish trawlers docking in St. Pierre harbor pose a picturesque setting for the city in the background.

A natural shortcut in one of the rock formations that make up Cape Percé.

A mid-day break on Roncière Wharf.

It was simply amazing when I'd say, "all Ws QRX 5; DX only." Wow! What a pile-up of European signals there were in there! Then there were certain hours when the entire United States was in the skip zone and all that one could hear was foreign DX.

I don't have Jan's log so all I can speak of are my own doings. From FP8AS I had a total of 1167 QSOs to 53 countries during the 11 days of operation. This isn't bad at all when you consider that conditions ranged all the way from rank to good. And, when they were rank they were r-a-n-k!

The second night we were there there was a terrific Aurora Borealis. It was simply beautiful but you know what it did to signals. The next day the bands were dead with the result that Jan and I got to know a little about the Island. We took one gigantic hike around it and enjoyed every single minute of it. The views were breathtaking. He kept saying, "Come on, Charlie, let's climb up the next ridge of hills." Then, when we'd reach them, it would be the next ridge he'd want to get atop. Well, boys, I managed to do it but I'm telling you I sure was huffing and puffing. Who of you will argue the fact that there is a great deal of difference between one who is 28 and the other 46? HI!

Where is St. Pierre? Well, in the very beginning I mentioned that it is 900 miles, as the crow flies, northeast of New York City. St. Pierre et Miquelon are the last relics of the once vast French North American empire. These are her oldest and smallest colony. The total area is but 93 square miles with a population of only 5,000 of which 4,500 live within the capital city of St. Pierre, itself. FP8 land is situated in the Gulf of St Lawrence approximately 170 miles northeast of Nova Scotia and 16 miles off the south-central coast of Newfoundland.

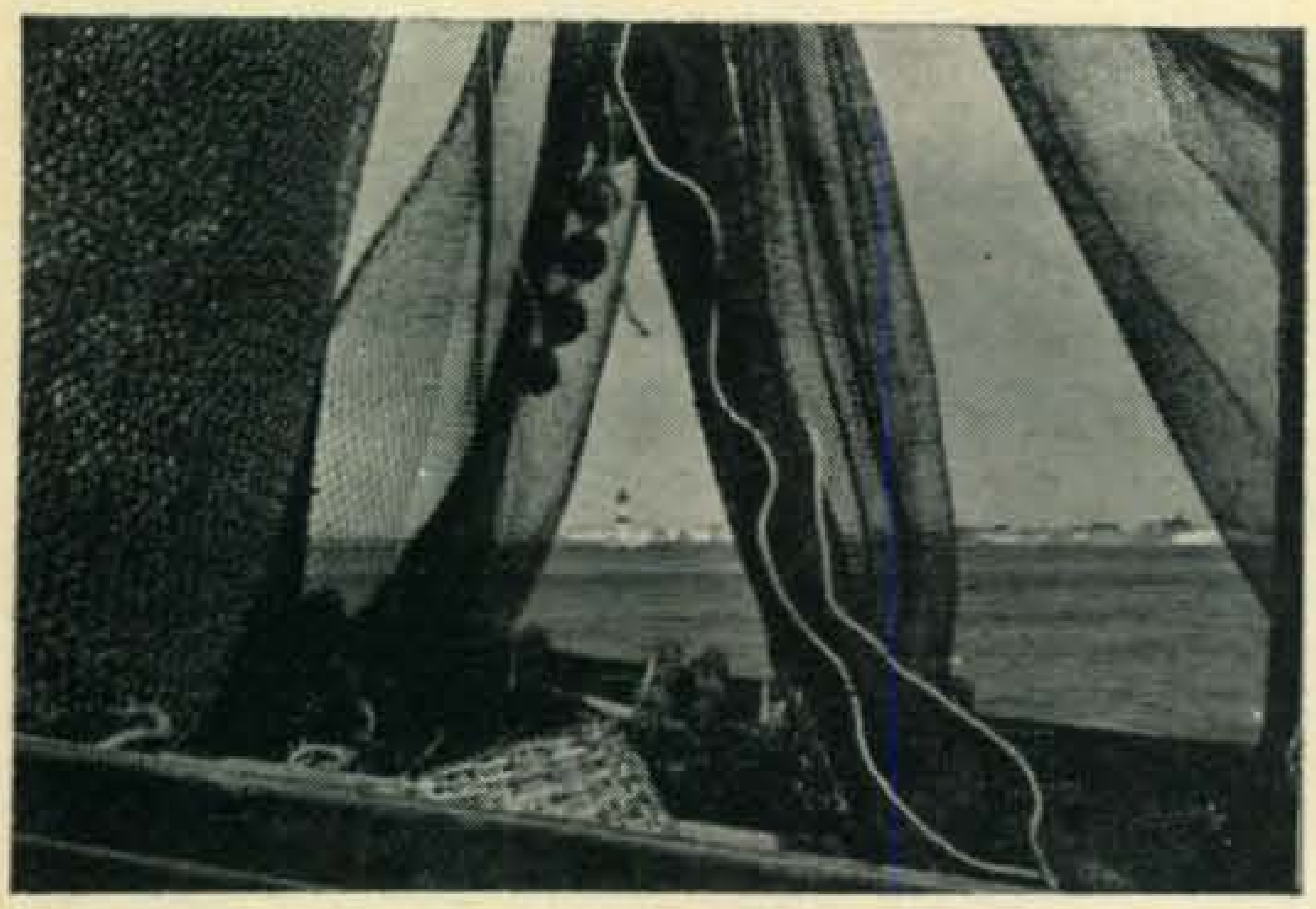
Furthermore, these Islands are located just off the Grand Banks, one of the world's finest fishing areas. And, what thrills fishing is up there. Gus, FP8AP, has his own 32 foot cabin cruiser named "Atta Boy." Jan and I went out with him one day and within 3 hours had 72 mackerel hauled aboard. We were arm weary. Do they use regular rod and reel? No indeed! It's all hand line. You let it out, you troll, and when a strike hits you pull the line in hand over hand. We were to have gone out with Gus on two more occasions but windy and/or foggy (that dammed word again) weather prevented us from doing so.

The grandest evening of the short time we were there was spent at Gus' home with his wife, Renee, and family. Oh, boys, such a delectable French dinner she prepared with all the trimmings. Um-m-m-m! If only you could meet this ever so congenial family.

More of a description about St. Pierre? Okay! Apparently very little is known of these islands as quite a few of the hams asked of us, "what part of Africa or the Indian Ocean are you in?"

The port of St. Pierre is extremely busy 12 months a year. The warm Gulf Stream and the

[*Continued on page 104*]



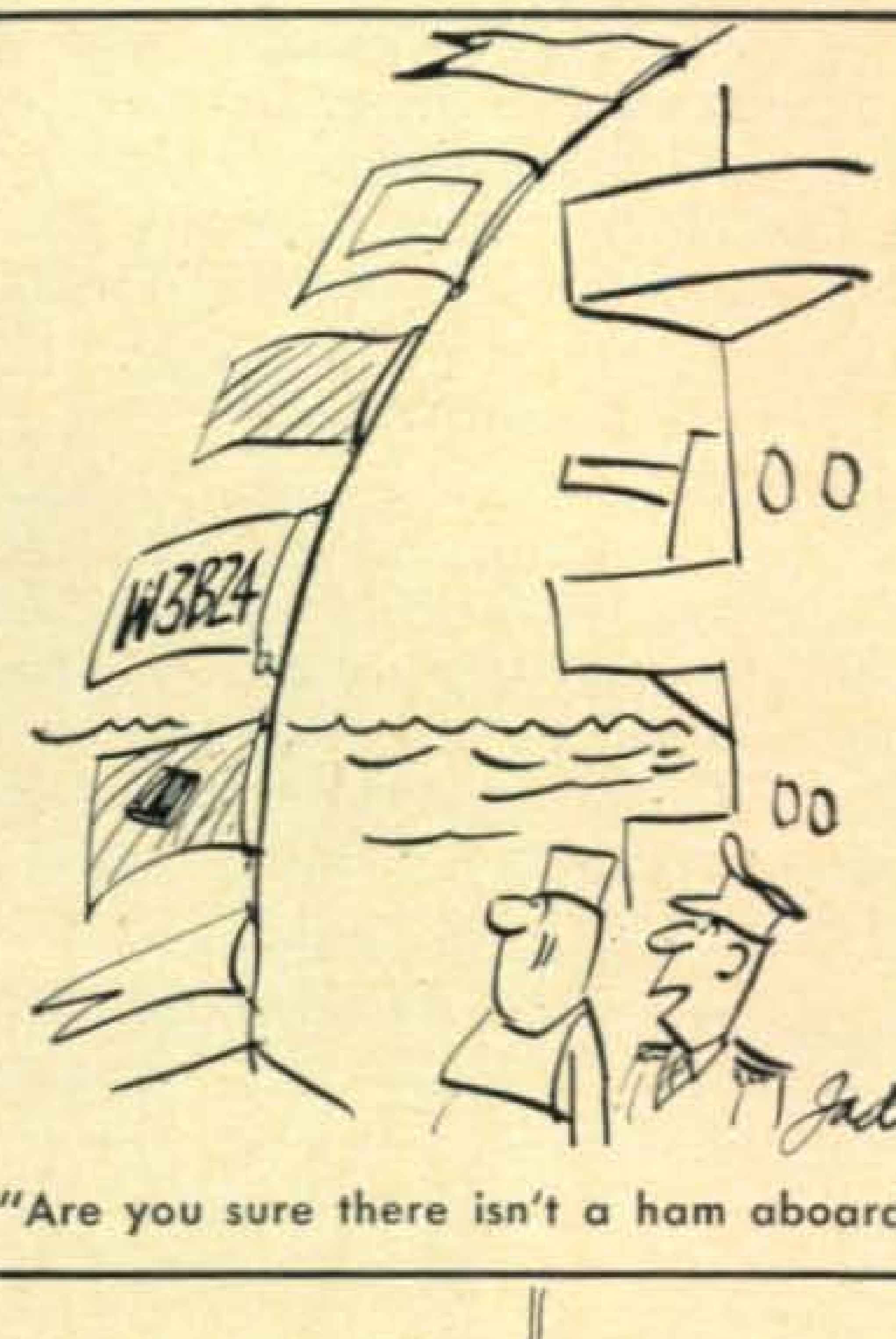
Looking through the nets you can see the lighthouse on "La Pointe aux Cannons".

An aerial view of St. Pierre showing the harbor and the homes of some of its 4500 inhabitants.

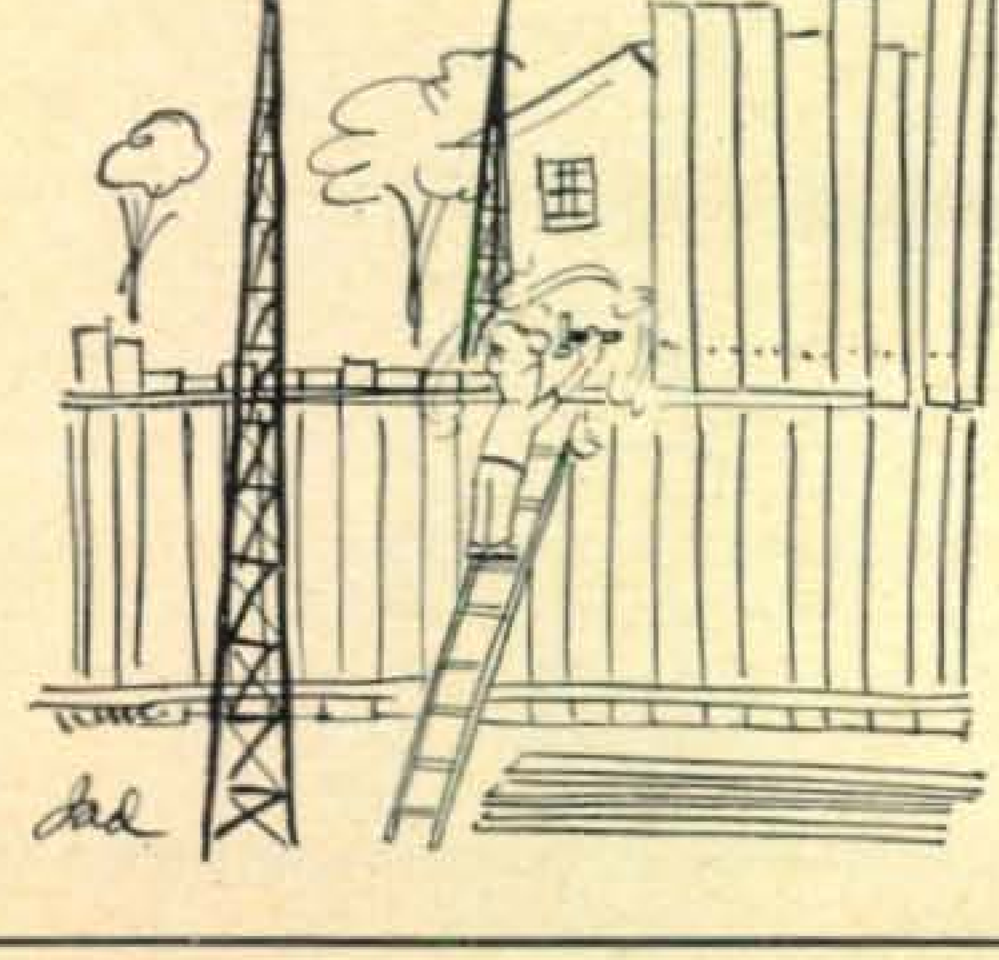
Clever Quips!

"Y'know anything besides W3ZB, calling W3ZB, calling W3ZB, W3ZB, W3ZB . . ."

"Listen, don't try to snow me! You wouldn't know a grid-dip oscillator if one jumped up and bit your hindside!"



"Are you sure there isn't a ham aboard?"



"I'll take that $150 receiver kit in the window, a Bible, and two bottles of aspirins!"

The All-Around Dipole

BY JOHN SCHULTZ, W2EEY/1

Any amateur who uses a dipole elevated at least a half wavelength soon notices its directional characteristics. If one swears by a dipole, he is inclined sometimes to swear at it wanting to work someone located "off the ends." A vertical antenna (dipole, ground plane, etc.) would solve the directional problem, of course, but if frequently happens that one can place a diploe at a reasonably good elevation using available supports but erection of a vertical antenna would be mechancially complicated. The dipole pattern can be distorted by bending it into a V shape to give more omnidirectional response but at the expense of reduced radiation in the main direction.

The problem of a horizontally polarized omnidirectional antenna for v.h.f. usually takes the form of a turnstile antenna (crossed dipoles properly phased) or a formed dipole (ring dipole or halo). Both forms are somewhat impractical at the lower frequencies; the formed dipole because of constructional difficulties due to size and the turnstile because of the four end support points needed plus the phasing line. Oddly enough, I came across a design for a v.h.f. omnidirectional horizontally antenna which is rarely used because other types have better structural forms, but which is easily adapted for h.f. use.

Construction

The dimensions of the antenna are shown in fig. 1. Since I could find no name for the configuration, I simply called it the all-around dipole. Unfortunately, I could also not find any feed-point impedance figures for the antenna and so I performed a few trail-error tests to determine the optimum matching conditions.

*40 Rossie Street, Mystic, Connecticut 06355.

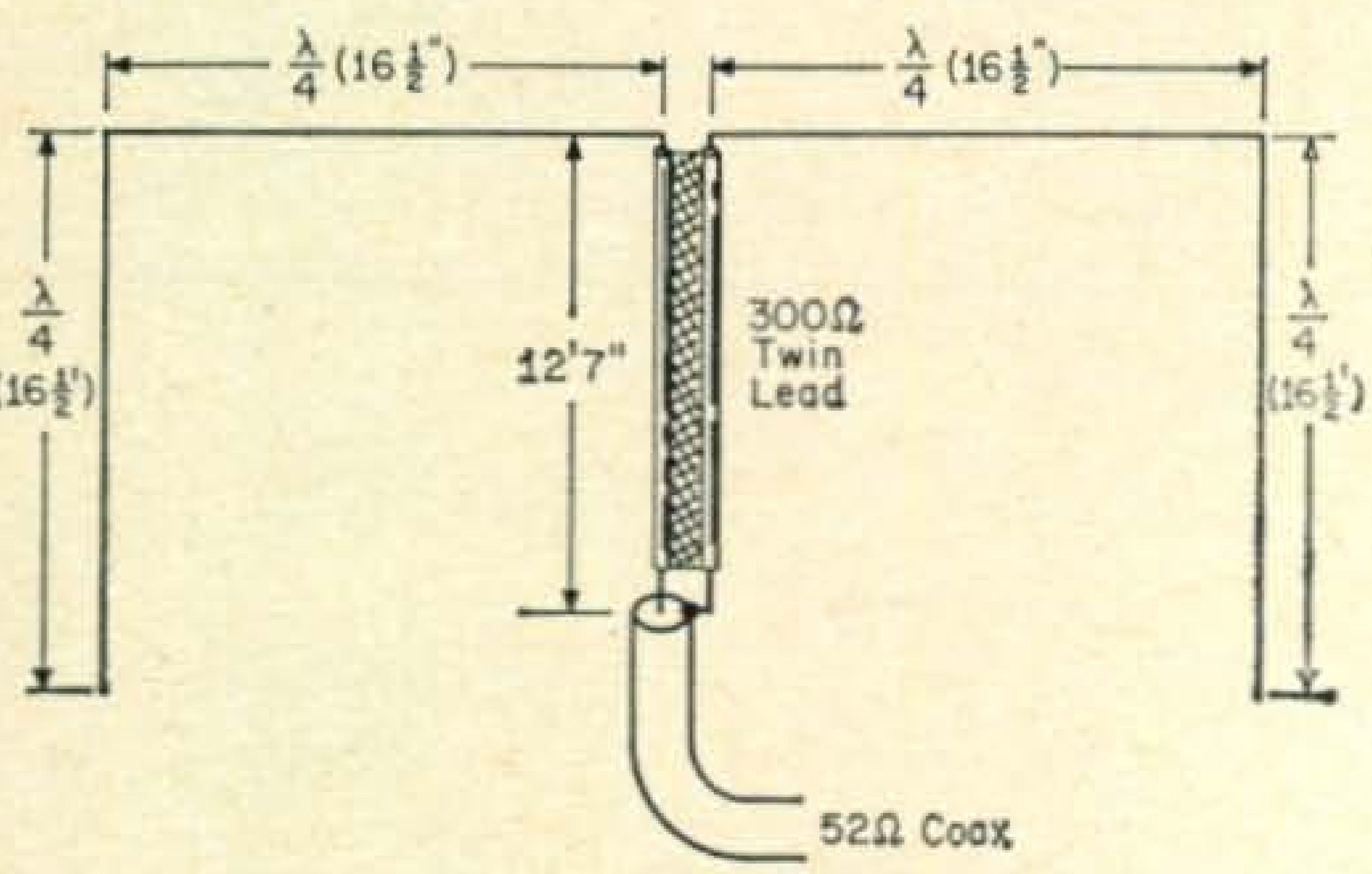


Fig. 1—Basic dimensions of the 20 meter All-Around Dipole. The lengths of the elements are calculated from $L = 468/f_{mc}$. The 300 ohm ribbon matching section should be 0.77 of the quarter wavelength to allow for the velocity factor. A balun with a 1:1 impedance transformation can be used between the coax and 300 ohm line as explained in the text.

According to the wire size (7 × 20) I used to construct a 20 meter version of the antenna, the center impedance, if the end sections were horizontal (making it a double Zepp), would be in the order of 5,000 ohms. Working on this basis I constructed a matching system to suit but found the s.w.r. to be too high. By cut-and-try I finally arrived at the very simple matching system shown also in fig. 1. Apparently folding the ends of the antenna had just lowered the center impedance enough to make a near perfect match using 300 ohm line as a quarter-wave transformer from 52 ohm coax. On the 20 meter model, I measured a maximum s.w.r. of 1.6 to 1 at the band ends with this matching system.

It would be preferable to join the coax to the 300 ohm line with some sort of unbalanced-to-balanced transformer such as a 1:1 balun to avoid pattern distortion from feedline radiation. However, it is not *absolutely* necessary, any more than with an ordinary dipole, but preferable. The radiation pattern, as best as I could determine, looks like fig. 2. The pattern is very similar to a turnstile antenna. The radiation is somewhat less off the ends than broadside but certainly enough to permit working stations that were impossible to work with the ordinary dipole.

Hints

The only construction points to remember are to keep feedline at right angles to the antenna for at least a quarter wavelength and to keep the vertical quarter wavelength ends aligned both horizontally and vertically. The latter is especially important to secure good radiation in the direction in line with the antenna (the reason for constructing the antenna in the first place). In actual construction, the end wires should be tied to the ground by means of an insulated line such as thin plastic clothes line. ■

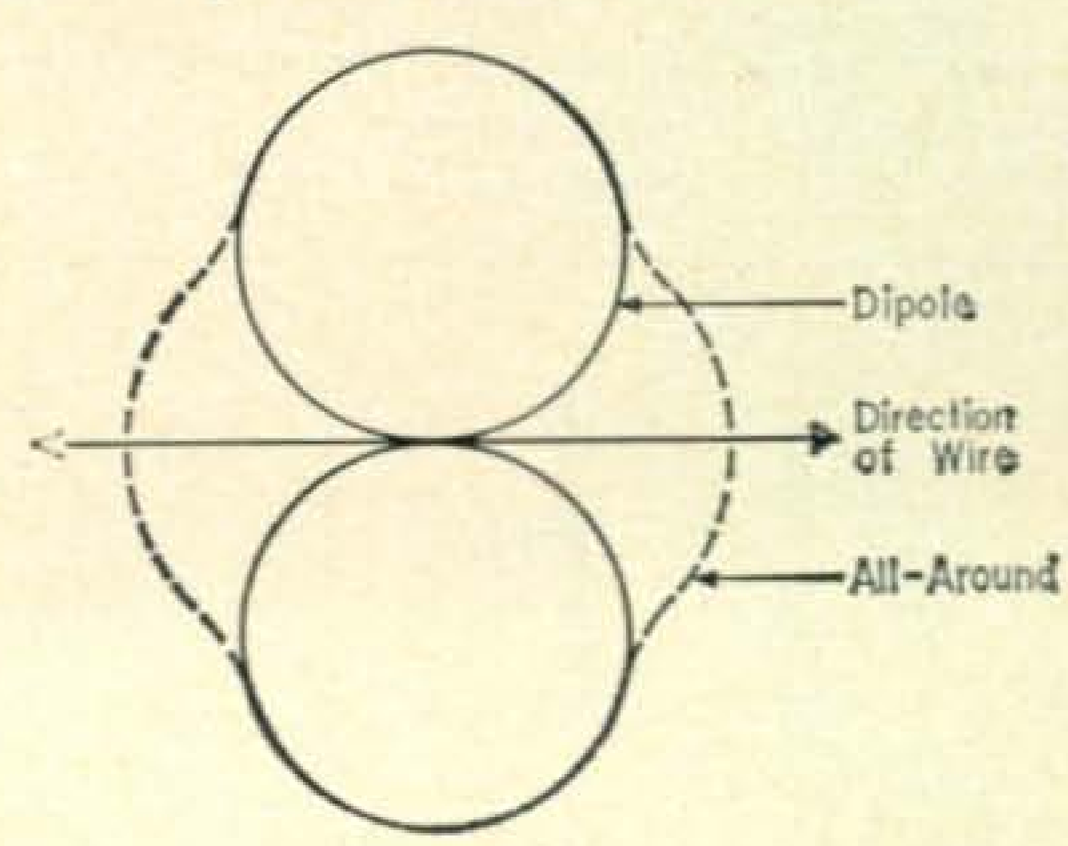
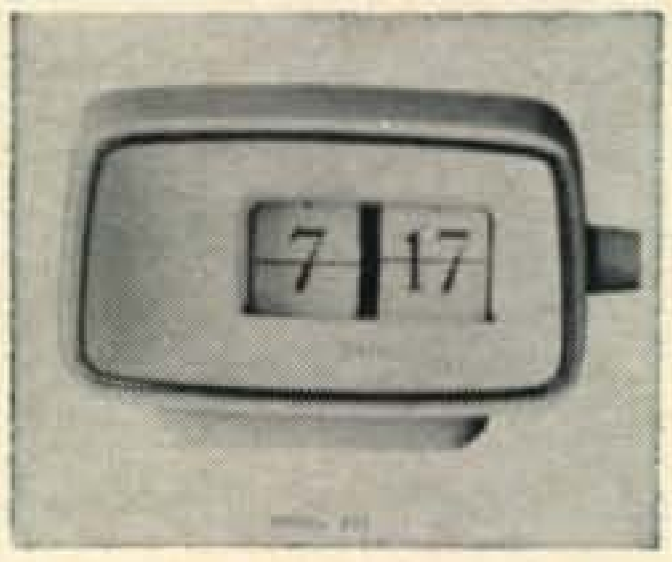


Fig. 2—Comparison of the difference in horizontal radiation pattern of a conventional dipole (dotted line) and the All-Around dipole (solid line). Radiation from the ends, almost nonexistent in the dipole is about 6 db down from the broadside radiation. The flap top portion of the antenna should be λ/2 high for best results.

NEW AMATEUR PRODUCTS



Caslon

The Caslon digital clock has no hands, but uses easy to read rotatable numbered cards to indicate the time. They are driven by a synchronous motor and nylon gears. There are two models, the 101 (above) and 201 (below) for either a 12 or 24 hour per day cycle. The retail price is $24.95. For further information either write to Ropat Co., 5557 Centinella Blvd., Los Angeles 66, Calif., or circle 64 on page 110.

Salch

Herbert Salch & Co., makers of the Tunaverter, which converts any car or home radio to tune the ham bands from 160 through 2 with individual tunable converters, now introduces a new model. The model 1828 tunes 118-128 mc, which includes the aircraft, tower, unicom and other air traffic frequencies. The transistorized unit is self-powered by a 9 v battery and is priced at $29.95. For further details write to Herbert Salch Co., Woodsboro, Texas, 78393 or circle 72 on page 110.

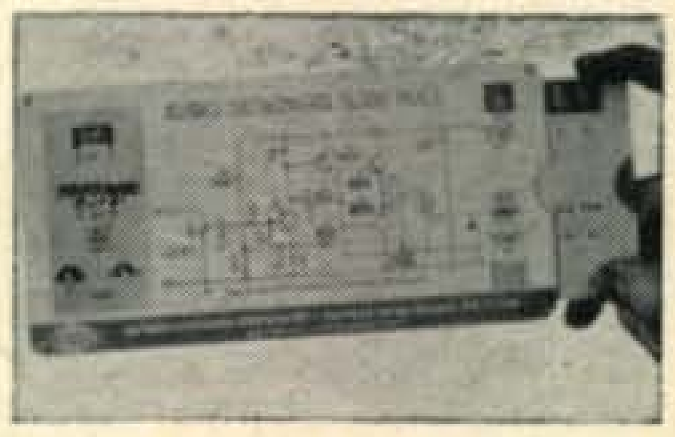
Times Wire

A unique kit complete with 50 feet of ½ inch Alumifoam® coaxial cable, two Timatch® type "N" connectors and full instructions has been announced by Times Wire. Alumifoam is reported to have greater power handling capability than RG-8/A as well as two-thirds less feeder attenuation for greater efficiency. For complete specs and prices write to Times Wire Cable Co., 358 Hall Ave., Wallingford, Conn., or circle 73 on page 110.

Sylvania

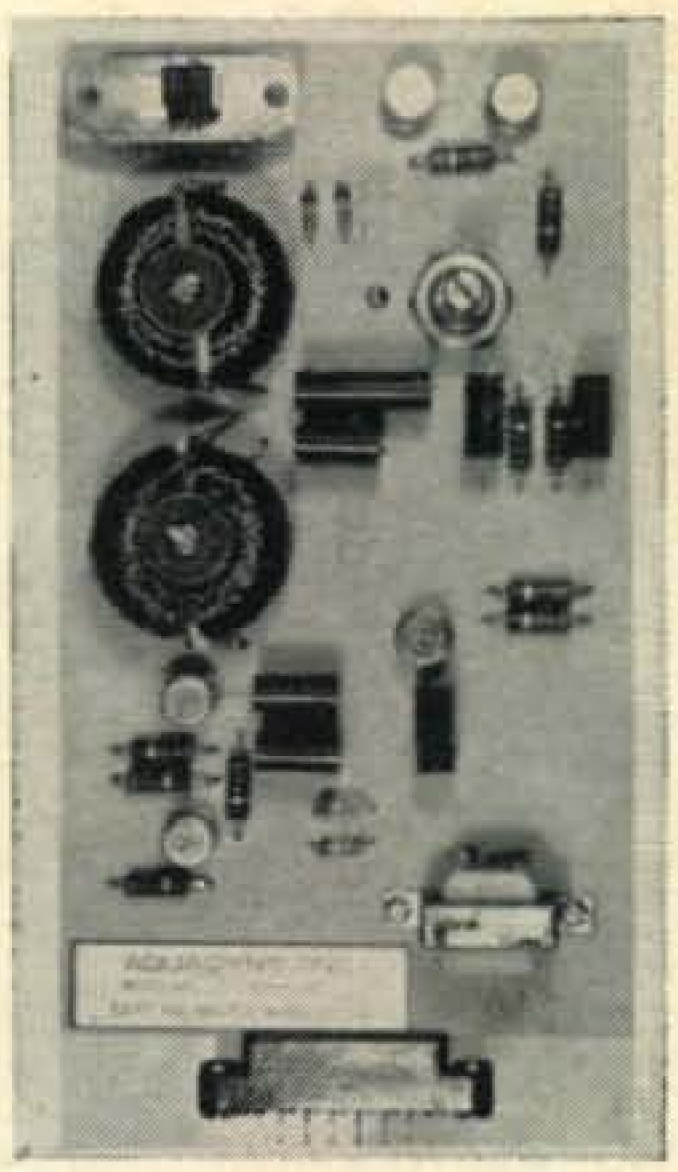
Availability of a new 120 volt pilot light set has been announced by Sylvania Electric Products. One red and one green lamp are included in the blister package. The 3 watt units were developed for computer use and are now available for consumer use. For more information write to Sylvania Lighting Products Division, Sylvania Electric Products, Inc., 730 Third Ave., N.Y., N.Y. 10017, or circle 74 on page 110.

Amperex



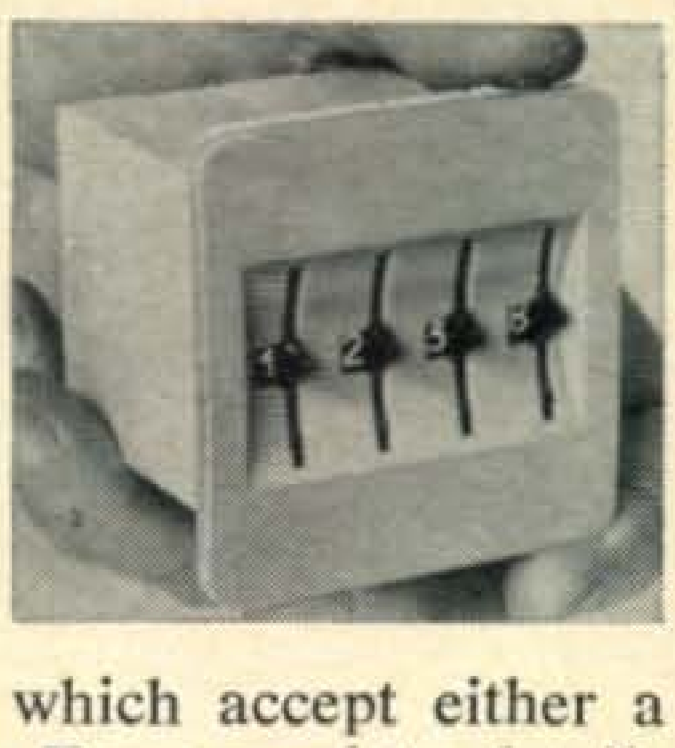
Amperex has introduced a slide rule for the design of audio circuits. Using a basic circuit and with the manipulation of the slide, seven different audio amplifiers are presented with all part values to fit most applications. It is priced at 50¢. For more information write to Amperex, Semiconductor Div., Hicksville, L.I., N.Y. 11802, or circle 75 on page 110.

Aquadyne



A new RTTY receiving converter kit is being offered by Aquadyne. The KTY-1 uses 5 transistors and 4 diodes to provide the signal to drive the selector magnet. The converter operates on 850 cycle shift and features a reverse-normal switch and balance control. The KTY-1 operates from 12 v.d.c. and is priced at $24.95 postpaid. Complete specs can be had by writing Aquadyne, Box 175, E. Falmouth, Mass., 02536, or circling 76 on page 110.

Amperex



Amperex announces a line of thumbwheel switches designed for use in any single-pole, double-pole or 4-pole switch application. They are available in decimal form or as coding and decoding types, which accept either a binary or decimal input. For complete details either write direct or circle 77 on page 110.

WIRELESS BEFORE 1900

BY ED MARRINER,* W6BLZ

Sit back in your favorite chair and relax while you read the following account of wireless operating before 1900. Click off the transceiver and keep in mind that all this happened not too long ago.

THE radio amateur of today owes a great debt of gratitude to Guglielmo Marconi, who was probably the first radio amateur operator. "G.M." as he was called by his close friends, liked to be considered an amateur as this example indicates. During the early 1930's, Marconi was invited to a Fresno, California ham club meeting to give talk. As he walked around shaking hands, a young fellow said to him, "Sir, it is great to shake the hand of such an important man." Marconi replied, "Forget it son, I am nothing but an amateur myself." In a way this was true; Marconi had little formal education, but it did not impede his progress in the development of wireless equipment. It did annoy many British scientists and the public when he came to England to exhibit his wireless equipment as was shown in letters to many English journals.

Guglielmo Marconi was born on April 25, 1874 at Marzabotta near Bologna, Italy, a son of wealthy parents. In his early years he was tutored on the parental estate, and at the age of 14 attended the Institute Cavellero at Florence and later went to the Leghorn Technical Institute. It was at Leghorn where he met an old blind man who taught him the telegraphic code. At Leghorn too, he became acquainted with Professor August Righi of the University of Bologna, who also influenced his life.

During the summer of 1894, when Marconi was 20 years old, he went to Biellese in the Italian Alps for a vacation. During this period of relaxation, he read an account of the death of Heinrich Hertz, and of his Hertzian wave experiments, where a signal was transmitted across a room. Marconi was intrigued; his alert mind coordinated the experiment with Righi's spark gap, and the blind man's code teaching. Why not combine all of them into a communication system? Marconi rushed to Potecchio to discuss the idea with his brother. They went right to work on the idea and developed two resonating wave emitters tuned to the same frequency by careful determination of the size and height of aerial plates. By the spring of 1895, they were able to send and receive a signal three quarters of a mile. Using a redesigned Branly coherer detector, with 95% nickel and 5% silver and a narrowed down slit, all put in a vacuum, the receiving sensitivity was increased. With this device, and by adding a ground system, they were able to transmit over a hill to a distance of 1400 meters.

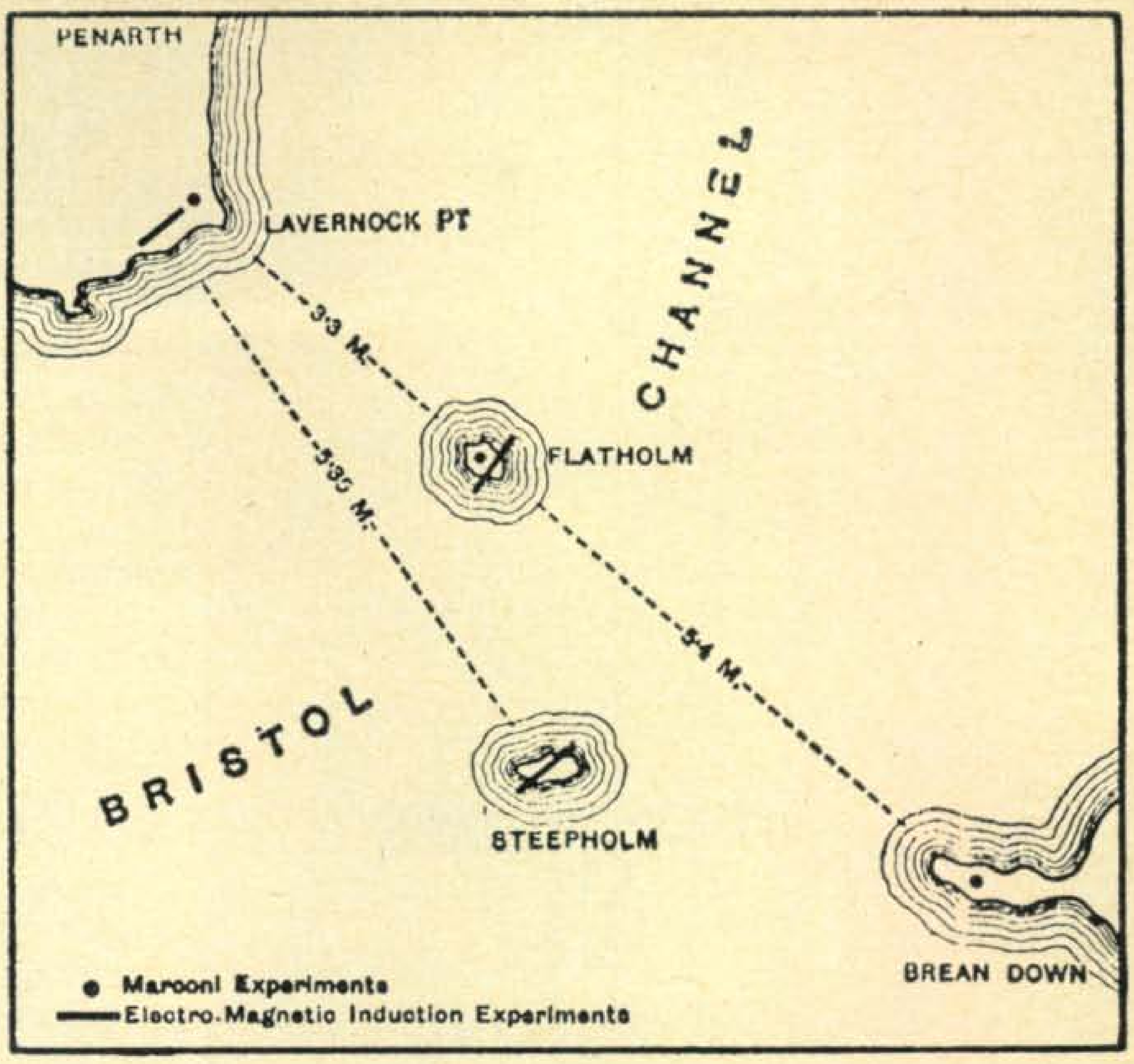
Marconi was a serious youth and wanted to show the world his findings. He first approached the Italian government but they were uninterested.

By Dec. 1895, Marconi had his wireless telegraph working quite well, and his mother, recog-

Guglielmo Marconi

*528 Colima Street, La Jolla, California.

Map of the channel area where Marconi's experiments were carried on.



nizing the importance of the device, urged him to take it to England. Thus on a day in February 1896, when he was only 22 years old, he departed for England. Arriving with his instruments, which were mistaken for bombs or infernal machines, they were broken up before passing through the British Custom authorities, and rendered temporarily useless for demonstration.

In March, a family friend, Mr. Campbell Swinton, presented a letter to Sir William Preece, who was then director of the Posts and Telegraphs, introducing young Marconi. The letter read as follows:

"Dear Mr. Preece,
I am taking the liberty of sending you with this note a young Italian of the name Marconi, who has come over to this country with the idea of getting taken up a new system of telegraphy without wires, at which he has been working. It appears to be based upon the use of Hertzian waves and Sir Oliver Lodges coherer but from what he tells me, he appears to have got considerably beyond what I believe other people have done in this line."

Mr. Preece at this time was 60 years old, and a wonderful understanding man. He later said that he was fascinated with young Marconi, who essentially had an English face, and one in conversations and habits would certainly not be taken for a foreigner.

Mr. Preece immediately asked for an official demonstration and assigned Mr. George Steven Kemp of the English Postal and Telegraph Department to help Marconi with the arrangements. Mr. Kemp was a good choice; he was enthusiastic and had many ingenious ideas. He became a life long friend and helper for Marconi.

First English Tests

The first tests were conducted on July 27, 1896 from the Post Office building. A message was sent 100 yards. Soon there were many sarcastic letters sent to English journals by jealous public observers who resented a foreign novice outdoing the great British scientists who had been working on other communication systems. Many of the letters were both humorous, and some showed fear; but all enhanced the history of wireless and many have been hidden away in British journals. Despite the sarcasm, Mr. Preece obtained funds to test Marconi's system on Salisbury Plains, where the distance was increased from a mile to 6 miles and then to 9 miles by the use of shorter waves and copper reflectors.

The remainder of the year was spent improving the equipment and giving lectures. In 1897, the equipment was moved to the Bristol Channel at Lavernock Point, and a receiving station at Flathorn, where Mr. Preece had previously been conducting magnetic communication experiments in sending messages to the Island, three and one half miles away.

The Island to shore experiments appeared rather dubious to many public critics as was shown by a letter to the editor of the London Standard, dated April 30, 1897, by a skeptic who worried about the radiation effects.

"Sir: I lately took part in a discussion of Mr. Marconi's recent invention, which is the subject of an article from the pen of Mr. H. J. W. Dorn, which appeared in the, "Strand Magazine" for March last. I happened to mention that Mr. Marconi thought he could, with a sufficiently powerful instrument, transmit an electric wave right across London, from Kensington to the General Post Office, and I questioned whether this could be done without possible injury to those who might happen to be directly in line between his transmitter and receiver. I was, however, civilly informed that I was what I sign myself, and that such person would not even be aware of the passage of the electric wave, much less be injured by it. Will any of your scientific readers give me an opinion on this question? At present I do not feel quite sure that an electric wave in the eye may not at any moment be my fate unless Mr. Marconi quickly invents some mode of controlling his waves, and confining them within certain limits, instead of allowing them to roam about London at their own sweet will. He tells us they go through anything and everything. I am, Sir, your obedient servant.

Ignoramus."

The editor could not contain himself and answered the letter promptly as follows:

"It is impossible not to feel sympathy for anyone likely to suffer from an electric wave in the eye; possibly it might make the retinal rods and cones act as "coherers," with incoherent consequences to the sufferer. Perhaps Mr. Preece, in his forthcoming lecture at the Royal Institute will make the matter clear to people of the same way of thinking as, "Ignoramus."

Success on Flatholm

On May 11th, 1897, Marconi tried to contact Flatholm Island with no results. Again on May 12th nothing was heard as he tried a zinc cylinder

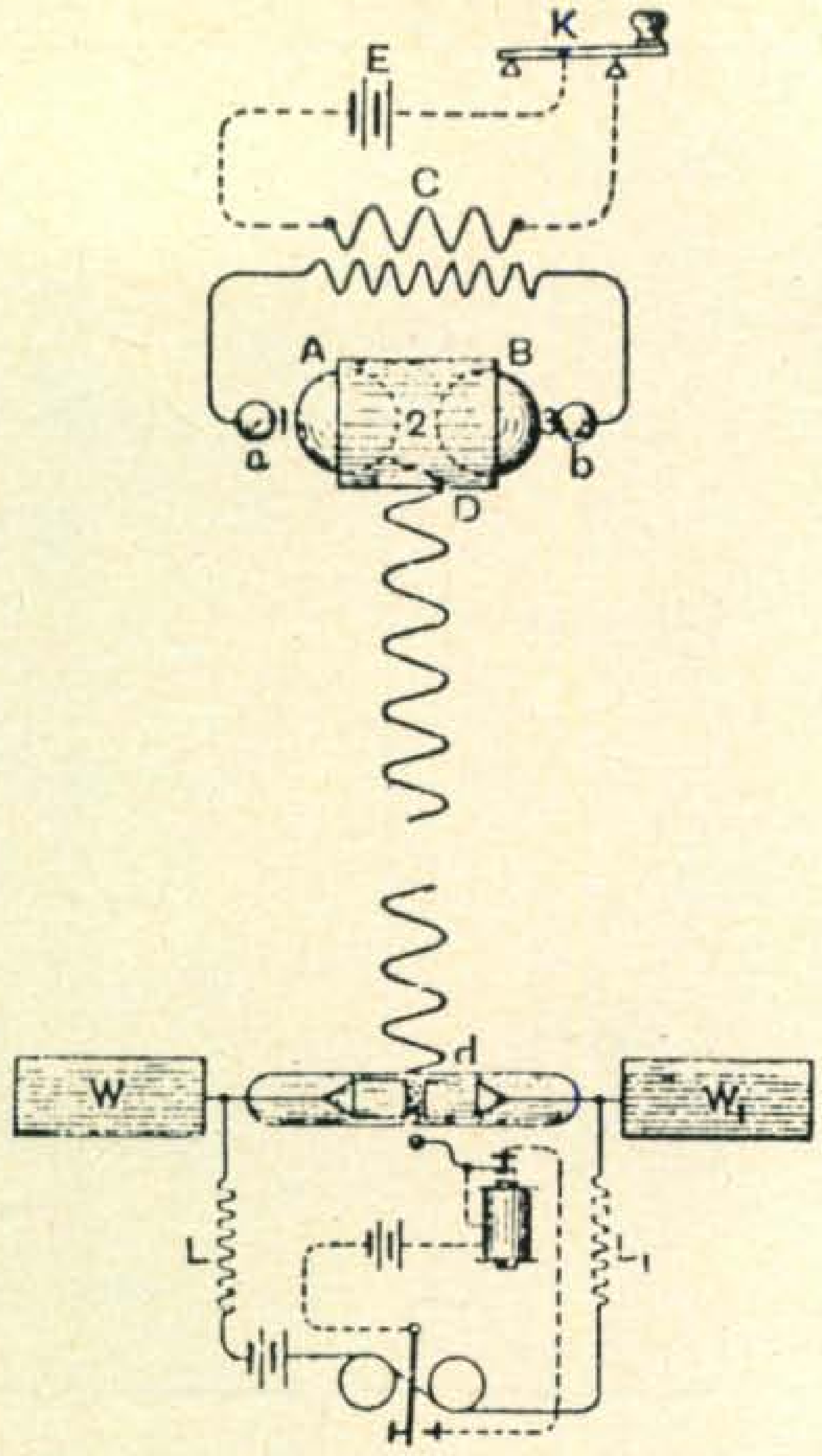


Fig. 1—Diagram of the Marconi transmitting and receiving apparatus used in the very early experiments.

aerial, 6 feet long and 3 feet wide on a 90 foot mast with 60 feet connected to the sea. Could the skeptics be right? Things were not going too well. But on May 13 he moved the coherer detector down to the foot of a cliff and thereby increased the antenna length to 150 feet. The transmitter was moved to Brean Down nine miles away and further out in the channel. The equipment now worked! The test was witnessed by Professor Adolphus Slaby a 23 year old German scientist, who was in later years to become one of Marconi's competitors.

The tests were finished, and Mr. Preece gave a lecture before the Royal Institution, June 4; 1897, just a year after Marconi had arrived in England. He said:

"Science has conferred one great benefit on mankind. It has supplied us with a new sense. We can now see the invisible, hear the inaudible, and feel the intangible. We know that the universe is filled with a homogeneous continuous elastic medium which transmits heat, light, electricity and other forms of energy from one point of space to another without loss."

A profound statement by a man with a vision of the future.

Marconi's Apparatus

A form of Prof. Righi's Hertz radiator as constructed by Marconi is shown in fig. 1. The spark gap was two balls made of brass, 4 inches in diameter (*A* and *B*) fixed in an oil tight case of insulating material. A battery (*E*), was thrown in and out of the circuit by the Morse key (*K*). Whenever the key is depressed sparks pass between the gap. Since the system *A* and *B* contain capacity and electric inertia, oscillations are set up in it of extreme rapidity. The line of propagation is (*Dd*.)

The receiver consisted of a small glass tube four centimeters long, into which two silver pole-pieces were tightly fitted, separated from each other by about half a millimeter. The thin space was filled by a mixture of fine nickel and silver filings, mixed with a trace of mercury. The tube was exhausted to a vacuum of 4 mm, and sealed. It formed part of a circuit containing a local cell and a sensitive telegraph relay.

In its normal condition the metallic powder is virtually an insulator; the particles lie in disorder. When an electric wave falls on them they are polarised, and subjected to pressure, or they "cohere," and current passes. The resistance falls to about five ohms and becomes a conductor closing the relay. After each pulse the detector has to be thumped by the clapper to jar the particles back into disorder, limiting the code speed.

Birth of Marconi W.T. Ltd.

After the Flatholm tests, Marconi was invited to give a talk before the Royal Society on June 16, 1897 and demonstrate his equipment, along with Dr. Oliver Lodge, and Mr. Preece's equipment. Now convinced he was making headway with the experiments, Marconi went back to Italy in July for tests with the Italian government.

The transmitter was installed on the Gulf of Spezia, and on July 16th transmitted 8 miles to a receiver installed on the warship San Martino. Later with a 90 foot mast and 111 foot antenna the distance was increased to 11½ miles. Marconi's fame now spread fast and he rushed back to England where Mr. Preece had laid the groundwork for a company called Wireless Telegraph and Signal Ltd. The company later became the Marconi Wireless Telegraph Co. Ltd. After a period of 18 months after first landing in England, he now had a company worth 100,000 pounds, in which he received one half of the capital stock and 15,000 pounds cash. He was now only 23 years old. The editor of *The Electrician,* had this to say in the July 30th, 1897 issue:

"We record today the registration, with a capital of 100,000 pounds, in handy one pound shares, of the Wireless Telegraph and Signal Company Ltd, which, perhaps, it is needless to say, proposes "to acquire from Signor Guglielmo Marconi certain letters of patent." From the ever-flowing stream of paragraphs and articles with which the daily papers have been flooded since Signor Marconi's arrival in this country, we inferred that his discoveries would before long form the basis of a commercial undertaking.

"There is, of course, absolutely nothing reprehensible in this, since science is in these days nothing if not a mode of money making. At the same time, when the latest product of Maxwell's fundamental equations, and Hertz's fundamental experiments becomes the raison d'etre *of a joint stock company to which the British public may conceivably be asked to subscribe, Signor Marconi's labours must be examined in a commercial spirit; that is to say, we must ask exactly what he has accomplished, exactly what is the industrial utility of the work done, and exactly what is that may be validly covered by a patent.*

"Now the general principles underlying Signor Marconi's apparatus are well known, so that there can scarcely be anything in the nature of a master patent. And much the same may be said of all the component parts of his radiator—which is admittedly Righ's—and of his receiver which is of the Branly-Lodge pattern.

Of course a novel combination of 'old instrumentalities' may be as commercially valuable as a master patent, if not more so, provided the particular combination protected is so far superior to all other possible ones, that, practically speaking, it holds the field. In our opinion, Signor Marconi could only defend with any reasonable chance of success a patent of this later kind. Hence, intending investors in a Company owning the Marconi patents would do well to make sure that expert opinion supports the contention that the particular devices proposed to be employed far transcend all others in range, reliability and ease of manipulation. If that be the case, which, for ought we know, may well be so, there still remains the question of what commercial use is going to be made of wireless telegraphy. So long as it remains in its present stage of development its sphere of usefulness must obviously be an exceedingly limited one. Of course, it may develop into something very different, *in which event, provided valid patents are taken out and shrewd business men are at the helm, the original shareholders may revel in gold without going to the far-distant Klondyke. But then these off-chances are more to the taste of speculators, with whom we have nothing to do, than of investors."*

Commercial Traffic

The editor probably pricked up his ears when shortly after his editorial, Marconi transmitted 34 miles on Salisbury Plain. Right after this the equipment was moved to Alum Bay on the Isle of Wight, and the spark increased to a 10 inch gap, with a 120 foot antenna. A second station was set up at Bournemouth 14 miles away and later moved to Poole. Marconi was alert to selling his system as he now intended to make commercial use of wireless by reporting ship movements and giving demonstrations. However, he did not make any money until June 3, 1898. when Lord Kelven gave him his first paid message, and one shilling thereafter for every message sent from Alum Bay to Bournemouth, where today a granite memorial remains to mark the spot where the station stood.

The first commercial traffic interested Lloyd's of London who wanted to pass ship information between Ballycastle in Northern Ireland, to a lighthouse on Rathlin Isl, a distance of 7 miles.

It is quite evident Marconi was energetic and kept on the move. While preparing for the tests at Alum Bay, he was bouncing back and forth to London giving demonstrations as this news item indicates:

The Electrician, May 13, 1898—*"A demonstration of the Marconi system of wireless telegraphy took place recently at the offices of the Wireless Telegraph and Signal Co. Ltd. in Mark Lane. The proceedings naturally evoked a great deal of interest, and amongst those present were; The President of the Board of Trade, the Right Hon. Charles Ritchie, Sir Courtenay Boyle, Lord John Hay, Admiral of the Fleet, Lord Kelvin, and Lord Charles Beresford. Signor Marconi was at the transmitting end, and Lord Charles Beresford read the messages printed on Morse tape in another room in the building, all of which were easily deciphered. The company is arranging for further demonstrations of its system, and among other places will shortly give a display on Wimbleton Common."*

The Goodwin lightship incident brought the advantages of wireless to the attention of the Board of Trade which sent a delegation to Dover as noted in this news item dated April 7, 1899:

Trinity House and Wireless Telegraphy—*"The Deputy-Master of Trinity House, with a committee of Elder Bretheren, accompanied by Lord Rayleigh, the scientific advisers, and Captain the Hon. F. C. P. Vereker, of the Board of Trade visited Dover, during the past week, with the object of making an official inspection of the wireless telegraph system as experimentally in operation between the South Foreland lighthouse to the East Goodwin lightship. "*

Things were happening; the Dover Corporation submitted a petition:

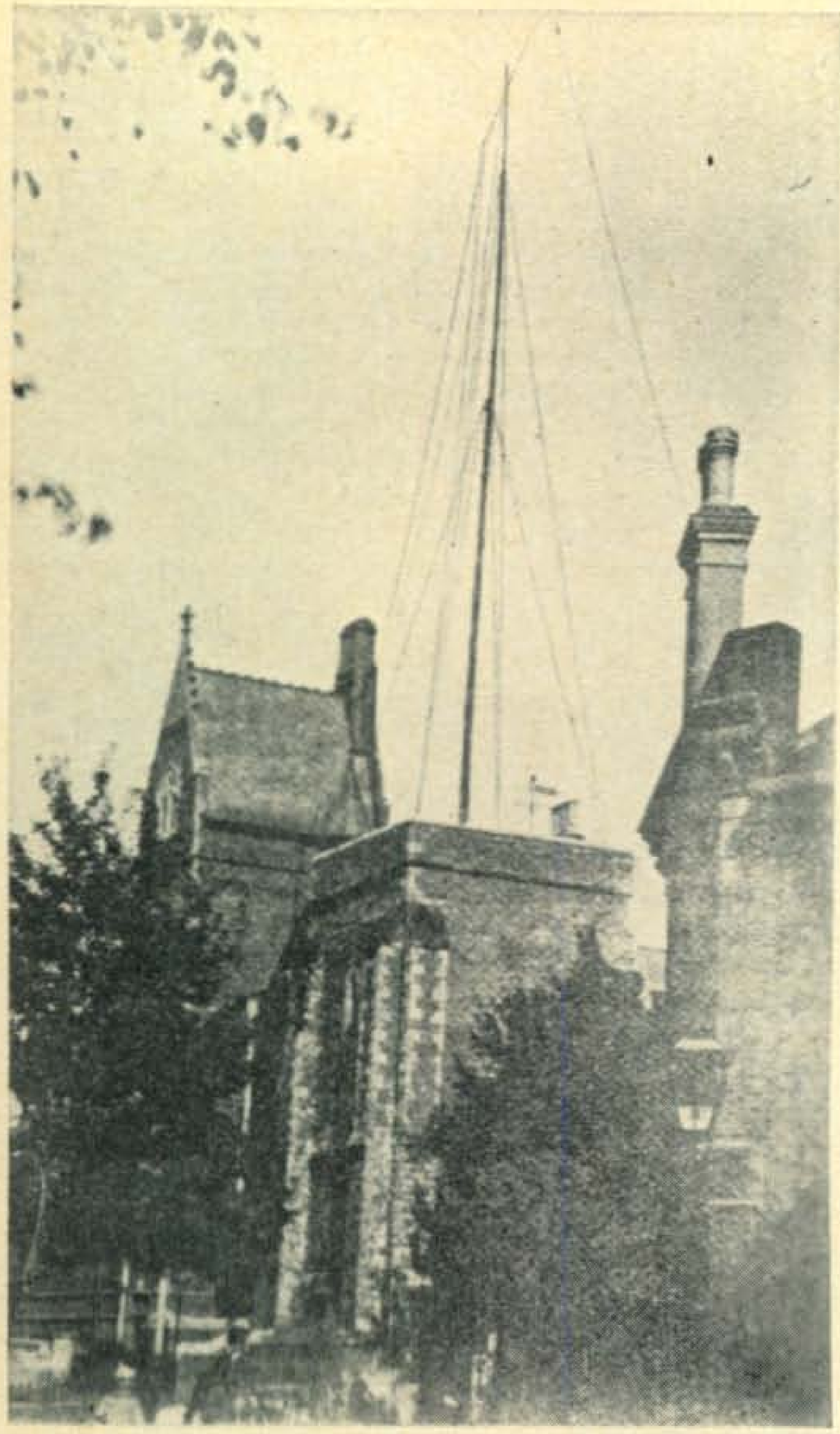
"That all lightships shall be connected with shore by means of the system of wireless telegraphy. The Trinity House states that experiments are still being conducted, and that the Corporation's suggestion will be considered in due course. On Saturday last the first practical application of wireless telegraphy on the occasion of a shipwreck was made between the East Goodwin light vessel and the South Foreland lighthouse. A vessel, the 'Elbe,' went ashore south of the Goodwin Sands, and the South Goodwin light vessel fired signals, a thick fog prevailing at the time. The signals being heard at the East Goodwin lightship, communication through the wireless telegraph apparatus at that lightship was made with the lighthouse, from whence telegraphic messages were sent on to Kingsdown and Ramsgate for lifeboats to put out."

On July 20th, 1898 we find Marconi on the yacht Flying Huntress, sending racing information to Kingsdown, Ireland. He handled 700 messages. His equipment was now portable and could be moved quickly to take advantage of any publicity situation. He set up on the Isl of Wight, where the Prince of Wales was laid up with a bad knee, and forwarded information to the Royal residence at Osborne House seven miles away.

In December, on Christmas Eve, 1898, the first rescue by wireless took place, when the Goodwin Sands lighthouse cables were lost by smashing waves. The accident was reported by wireless showing the advantage of aerial communication over cables. The same month, the *Standard's* Vienna correspondent announced that Marconi's system of wireless was being used at Pola to a distance of six to eight miles, and that the equipment was being improved upon by a young student named Bela Schefer, for the Austrian Navy.

The British Navy now alert to the possibilities of wireless, equipped vessels with Marconi gear in 1899. The first three ships were the H.M.S. Alexandria and two cruisers, the Juno and Europe, which exchanged messages over 74

Instrument room at the South Foreland lighthouse showing Mr. Bullock, Marconi's assistant, at the operating position.



Trinity house.

miles. A contract was let in 1900 to outfit 26 warships and six coastal stations, which Adm. Wilson V.C. used in maneuvres in 1901. The Juno was dispatched to New Zealand with the first shipboard set.

Marconi, in the meantime, was working fast with his installations. On Mar. 3, 1899, his station reported a steamer stuck on the Goodwin Shoals. The East Goodwin light sent a message for help to the Wimereux, France station. Later the steamer R.F. Mathews collided with the East Goodwin lightship, but this message was picked up by an amateur at Dover, which indicates others were listening, besides Marconi, as early as 1899.

Despite the cross channel communication activity, the press apparently just heard about the station location as is mentioned on Mar. 24, 1899:

"We hear that the French station for the cross-channel wireless telegraph trials will not be at Boulogne itself but at Wimereaux, a village two miles to the West of Boulogne, the English station being at South Foreland. The distance between the two stations will thus be 30 miles."

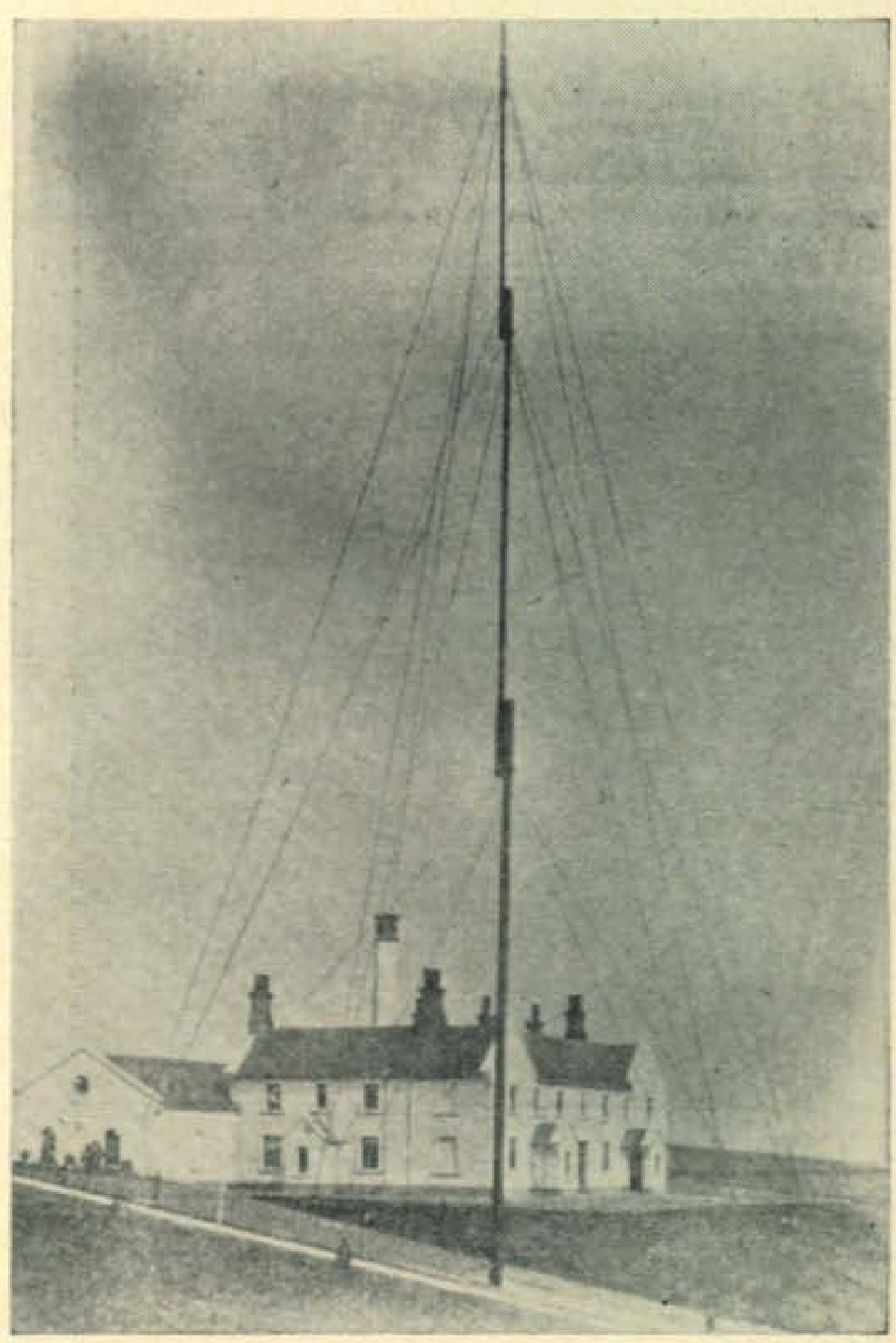
Scientific Help

Scientists now were beginning to help Marconi. Prof. J. A. Fleming, who later was to help Marconi design the Poldu high power station, visited the Marconi network and wrote the following article for the Electrician, and Times, April 7, 1899 issue:

"During the last few days I have been permitted to make a close examination of the apparatus and methods being employed by Signor Marconi in his remarkable telegraphic experiments between South Foreland and Boulogne, and at the South Foreland lighthouse have been allowed by the inventor to make experiments and transmit messages from the station there established both to France and to the lightship on the Goodwin Sands, which is equipped for sending and receiving ether wave signals. Throughout the period of my visit messages, signals, congratulations and jokes were freely exchanged between the operators sitting on either side of the Channel, and automatically printed down in telegraphic code signals on the ordinary paper slip at the rate of 12 to 18 words a minute. Not once was there the slightest difficulty or delay in obtaining an instant reply to a signal sent. No familiarity with the subject removes the feeling of vague wonder with which one sees a telegraphic instrument merely connected with a length of 150 feet of copper wire run up the side of a flagstaff begin to draw its message out of space and print down in dot and dash on the paper tape the intelligence ferried across 30 miles of water by the mysterious ether.

"The public have already been placed in possession by The Times *and other agencies of a general description of the apparatus employed by Signor Marconi, and there is no need, therefore, to enter into technical details. Within the last few days also various scientific men have been invited to give the public the guidance of their opinions on the novelty and utility of these demonstrations.* These criticisms have for the most part not been of a very helpful nature. *The general public are not much concerned with questions of priority or with the claims or suggestions of rival experimentalists, but they are interested in ascertaining the serious possibilities of that which has been actually achieved.* Signor Marconi has never hesitated to acknowledge that he has built upon the foundations laid by others, *but a vast gulf separate laboratory experiments, however ingenious, from practical large scale, demonstrations conducted wtih all that*

[*continued on page 92*]



Mast and aerial at the South Foreland station.

International Mission Radio Association

BY TOM AQUINAS COX, O.F.M. CAPUCHIN W2CBX*

"W2MZV, W2MZV . . . This is YN4CF calling, YN4 Charlie Fox, Bluefields, Nicaragua calling W2MZV."

"YN4CF here is W2MZV. What's new down there in the Mission Father Dell. . . . ?"

All of us who work any DX have run across a QSO like this from time to time. A person working in a foreign land is keeping in touch with a friend or relative back home via the magic of amateur radio. We hear Peace Corp workers, missionaries of all faiths, and service men. If we can work through the pile-up, we feel honored to have a QSO with these people—to give them some news from home, or perhaps pass some traffic, to help out in any way possible.

This is what IMRA (International Mission Radio Association) is all about. Its purpose is to provide a voluntary, non-commercial communication service for those working in foreign countries. IMRA is dedicated to the service of those people serving their fellow men in foreign countries.

The association is also dedicated to the continuation and extension of our unique ability as hams to enhance international good will. The importance of recognizing all amateur radio operators throughout the world as persons, unique, interesting, and not just rare or not-so-rare DX call signs is stressed. IMRA means international good will through amateur radio..

The FCC states that one of the purposes for the existence of Amateur Radio is to advance skills in both the communication and technical phases of the radio art. IMRA subscribes to this purpose.

To accomplish radio communication, we need two things, people and equipment. The first is the more important. People use or abuse equipment, and people respect or abuse their fellowmen. IMRA is dedicated to fostering the art of communication by stressing the importance of people in communication. Mr. Jean Shepherd, K2ORS, guest speaker at the ARRL Hudson Division Convention last October passed a very praise-worthy comment in his talk. He said that even that very faint, the almost inaudible da-dit-da-dit-. . . he is a PERSON, Persons are very wonderful creatures. Communications takes people. IMRA is dedicated to trying to stress more the importance of persons, and thereby to enhance even more that great fraternity that is part of amateur radio.

*Mary Immaculate Friary, Garrison, New York.

Where did IMRA come from?

Originally the association was formed under another name over four years ago by a group of clergy-hams at St. Anthony Friary, Hudson, New Hampshire. It was formed to bring together hams interested in providing communications for a limited number of missionaries in foreign lands. After four years of growth, the association decided it could help and serve more people by broadening its scope and appealing to the entire amateur radio fraternity. Today IMRA is dedicated first and foremost to the proposition of international friendship on a person-to-person basis with no restrictions as to race, color, or creed.

Since our humble beginning in New Hampshire, we have grown in membership and enthusiasm. A monthly newsletter is sent to all members. This newsletter, printed in Grailville, Ohio, keeps everyone up to date on the activities of the association. In addition, a few regional IMRA nets have been established in different areas. Four Conventions have been held, the most recent was held in Loveland, Ohio. Our next convention will be held in Ashville, North Carolina.

Shown at the 4th annual IMRA convention in Grailville, Ohio, last July are: (standing l. to r.) Rev. Daniel Linehan, S.J., W1HWK, Marie Sutter, WA8LEI, Bob Waters, W1PRI, Sister Mary Concordia, R.S.M., WA8KEK (sitting l. to r.) Rev. Gilbert Leduc, K1EMQ, Most Rev. Vincent S. Waters, Rev. David Reddy, O.F.M., K2BUI.

Where is IMRA going?

We are looking forward to the day when we will have an efficient net in operation on one or more of the low bands. It is our hope to make it possible for anyone overseas to make contact with as many areas in his own home country as possible. To have this hope fulfilled, IMRA needs a large membership, members who can give time to provide this communications service.

Besides providing a communications system, IMRA wants to provide equipment for those engaged in serving overseas, when and where possible. We all know, I am sure, that there is a real need in this area. In many places of this modern world, it takes a letter five or six weeks to reach its destination a few miles away. A letter destined for home might even take longer. For example, a missionary or Peace Corp worker, if he has knowledge of amateur radio and has equipment, could contact different outposts or home in five or six minutes instead of five or six weeks—and he would get an immediate reply! To a person serving in a jungle or remote rural area, amateur radio could be not only a morale builder, but the only method available for communicating quickly in an emergency with the outside world. Who cannot sympathize with the doctor who travels through the mountains spending a week getting from one station to the next? With the aid of amateur radio he would know where his services are most needed. Maybe, because of his communication ability, he would be able to save a human life. In some areas the educational ability of amateur radio is now being proven. Amateur radio can and is being used as a valuable weapon against revolutionary propaganda.

To facilitate their efforts and lessen the burden of their tasks, these teachers, instructors, doctors, missionaries, need our help. They need our help to get equipment.

If it sounds like we are begging, you are hearing us very well. There is no sense of shame in begging for these people who have dedicated time in their life, or their whole life, to the betterment of humanity in lands strange to them. Our work will not be easy, but any help we can provide will make life a little easier for them.

This is not, however, an appeal for home brew equipment or old boat anchors. If the equipment lying around the shack is useless to us, it is even more useless to those overseas. If we give equipment, obviously, it must be good equipment.

In a nut shell, the aims of IMRA are:

1. To provide a communications service for all people in any overseas service.

2. To foster international good will through the magic of amateur radio and through thoughtful DX operating procedures.

3. To provide the needier people working in foreign lands with equipment when and where possible.

To us involved in amateur radio, communicating is second nature. IMRA stresses that it should be conducted in such a manner that we spread good will throughout the world. Our actions, thoughts, words, operating practice, etc., are all open for all to hear. When we are working DX literally hundreds may be listening to us. We hams have a unique way to get even closer to and more intimate with a native of another country than even a tourist can. There is a great need here. How many stateside stations with good operating procedures must a DX station work to offset the image the few thoughtless DX-chasers create.

IMRA feels that it has found another way, not conflicting with existing organizations and nets, to make amateur radio serve people. IMRA is open to any and all radio operators throughout the world who want to put more purpose in amateur radio and into communications.

IMRA was present at the ARRL Hudson Division Convention in Tarrytown, New York, last October. There we made many friends, received comments and encouragement. Now we are appealing to you. We want and need your help. We want you to be a vital part in IMRA.

For further information, please write to:

Grail Radio Club, Grailville, Loveland, Ohio 45140

Radio Club, St. Anthony Friary, Hudson, New Hampshire 03051

Radio Club Mary Immaculate Friary, Garrison, New York 10524

Mr. Murrill Burton, 1008 Mendenhall St., Thomasville, N.C. 27360

Rev. Daniel Linehan. S.J., Weston Observatory, Weston, Mass. 02193

Rev. Leonard Bose, 106 North Rangstorff Ave., Mountain View, Calif. 94041

Rev. Peter Bechman, O.S.B., St. Benedict Abbey, Atchison, Kan. 66002

Mt. St. Paul Amateur Radio Club, 500 Prospect Ave., Waukesha, Wisc. 53186

Rev. David Reddy, O.F.M., 601 McKinley Parkway, Buffalo, New York 14220

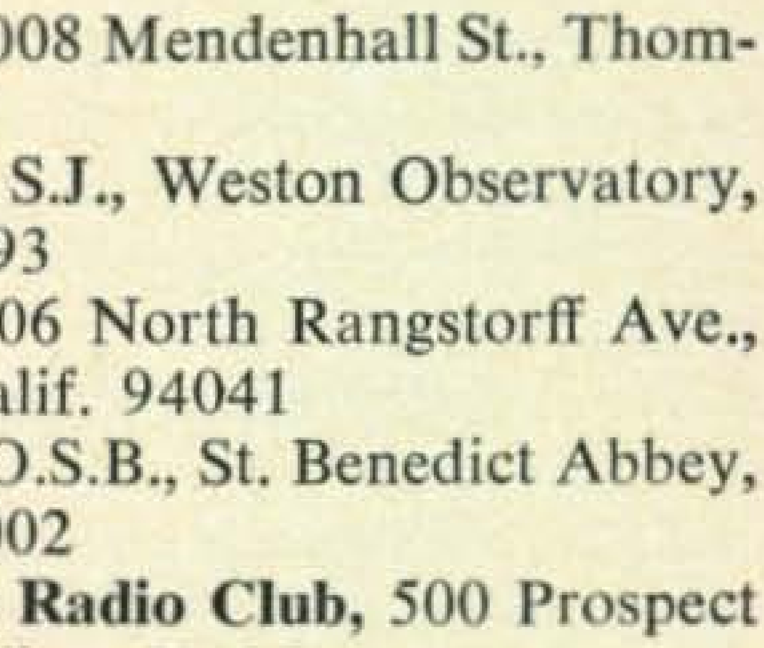
Maryknoll College Radio Club, Glen Wllyn, Illinois 60137

V. Mayree Tallman, 428 South West 28th Road, Miami, Florida 33129

Mr. Roy Alciatore, 5700 Canal Blvd., New Orleans, La. ■

New Amateur Product

Amperex



AMPEREX announces the latest edition of their *Condensed Electron Tube Catalog*. The 27 page catalog lists descriptions and basic specs on their full line of tubes. For a copy write to Amperex Electronic Corp., Advertising Dept., Hicksville, L.I., N.Y., 11802, or circle 71 on page 110.

Mayor Chuck Hall of Miami, Fla. presenting a certificate of appreciation to Andy Clark, W4IYT, for his work with the Dade County Civil Defense. Andy is the Editor of *Florida Skip* and Chairman of the Red Cross Communications Committee. He has been licensed since 1939 and active in community service most of that time.

K2UVG/MM claims amateur radio's biggest ground radial. The radial is the U.S.S. Saratoga, 4.1 acres of steel aircraft carrier. At the mike is Vergal Briggs, WB4EDQ, with Chuck Spitzner, K4VOM, Hank Petruskewic, WA2YJZ, and Tom Moyer looking on. Hank Kahrs, holder of K2UVG is not pictured. After all someone has to look after the ship. (U.S. Navy Photo)

PEOPLE AND PLACES

Jorge Janer Mestres, EA3GI, of Barcelona, Spain is shown operating the Space Needle Amateur Radio Club station in Seattle, Washington. Jorge is touring America at the invitation of the U.S. State Dept's Bureau of Educational and Cultural Affairs in connection with his work in commercial radio and TV in Spain. While here he addressed the club on the background and activities of Spanish amateurs.

Miss Maureen Kelly, TV actress, accepts a message from Fred A. Tadini, vice president of the N.Y.C. Chapter of APICS. APICS or the American Production and Inventory Council Society had a convention in Philadelphia last Sept. and amateur radio message handling facilities were provided to cover most of the world. Messages to service personnel were relayed through MARS. Miss Kelly can be seen in Hallmark's Hall of Fame production of "Anastasia" on TV this month.

Planning a trip to San Marino? Then Mike, I1ZJG is the man to see. He is the one who made those past DX trips there possible. He is usually on 14325 every night around 6 P.M. N.Y. time.

DX

BY URB LE JEUNE,* W2DEC

Here and There

Country Name Changes—British Guiana, VP3 is now Guyana—Basutoland (ZS8) is now Lesotho—Bechuanaland (ZS9) is now Botswana.

AP Pakistan—All AP stations are now QRT.

CEØ Easter Island—WB2JVD/CEØA: Marc has been active on both 15 and 20. He has a sked with his QSL manager, K5GOT, about 2200 on 15. He usually starts operating at 2100, 21350-370. He also has a sked on 14300 at 0200, after which he will work the breakers. I might warn you that he is not a contest style operator and prefers to rag chew. *(Tnx LIDXA).*

FH8 Comoros—Andre, FH8CD, remains active on the low end of 14 mc s.s.b. Also on 28.6 mc s.s.b. *(Tnx VERON).*

FW8 Wallis—FW8RC on 14245 kc weekends. *(Tnx VERON).*

KW6 Wake—Now active from Wake are KW6DS on 14 mc c.w. and KW6EO and KW6EJ on the high end of 14 mc s.s.b. *(Tnx VERON).*

PJ5B Bonaire — Kirk, KØGZN and Virginia, KØGZO, will operate as PJ5BC and PJ5BD for three weeks starting about January 20th. Operation will be on 10-15-20 meters. QSL to home QTH.

SVØ Crete—Bill, SVØWL, passes along the following for his activities: I plan to be on Crete for about two years and will operate s.s.b., RTTY and some c.w. Equipment is 32S-1, 75S-1, ground plane. Have 40′ tower beam and linear, but not on yet. Mostly 20 and 15, but check 10 often.

TA Turkey—The following stations are operating legally and are rather active. Most operations 14 mc c.w. with exception of TA1AV on 21 mc c.w. TAEAV, Istanbul, name Avni; TA1DS, Istanbul; TA2YC, Istanbul, name Hadi; TA2AC, Ankara; TA2FM, Ankara, name Zazil; TA2BK, Ankara. QSL as per QTH section. *(Tnx DX-MB).*

TJ Cameroun: Herman, HK1QQ, is now signing TJ1QQ. He will be in Cameroun for two years. Herman will also visit some of the rarer African spots as time permits. *(Tnx VERON).*

TR8 Gabon—TR8AD on 14225/21190 kc a.m. TR8AG 14 mc c.w. *(Tnx VERON).* Also TR8AG is now on s.s.b. and has been active almost daily on 14140, at 2000 and 2100 GMT. For skeds talk to Eva, PY2PE. She can be found around 14215-240 just about every evening. *(Tnx LIDXA).*

TU2 Ivory Coast—TU2BK has been quite active on 14043 at about 2130 GMT. QSL via Box 54, Port Bouet, Ivory Coast. *(Tnx LIDXA).*

*Box 35, Hazlet, New Jersey 07730.

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

CW-PHONE WAZ			
2250	OH1VA	2252	JA1OIO
2251	WA2LMW	2253	WA6CAL
ALL-PHONE WAZ			
344	W1MMV	346	W2CES
345	DJØKQ		
TWO-WAY SSB WAZ			
425	DJØKQ	427	OA4OS
426	SM6CMK	428	SMØATN
CW WPX			
748	YU1SJ	751	OK1JD
749	I1LGR	752	W3CBY
750	OK3JV		
PHONE WPX			
135	W4LEF		
SSB WPX			
254	PY3BAD		
MIXED WPX			
127	OK1BY		

TY Dahomey—TY2BC 14 mc c.w. and s.s.b. weekends. *(Tnx VERON).*

VP5 Turks & Caicos Is.—Ralph, VP5AB, passes along the following: "QSL information for the hams left on VP5, Grand Turk and Caicos Islands is as follows: VP5BP, via W2CTN; VP5RS, via K7UXN; VP5RB, via W1EQ; VP5NK, Norm Karlburg, RCA/Grand Turk, c/o GMRD, POB 4187, Patrick AFB, Fla. 32925.

"VP5AR has already left for Mahe Island and should be active soon. I am not very active and in my year here I have only filled a little more than 70 pages of log and hope to be leaving soon.

"I also wish that you would clear up to some of the newcomers the meaning of KN and that DX are people and not commercial outfits to give them a new country for awards. I try to do my part to help when time permits, but I do like to be able to enjoy a QSO and my hobby in the way that I choose.

"Also a bit of information many don't seem to know is that VP5 is only one country, even though most lists are not up to date. VP5 is only Turks and Caicos Islands and most activity will come out of the Missile tracking station here on Grand Turk Island. Cayman Island is now ZF1 and Jamaica is now 6Y5 and not VP5 as they used to be and still are listed on older country lists.

VK9 Christmas Island — VK9DR and VK9XI are back again. VK9XI was worked with excellent signals on 14110 listening 14240 at about 1600 GMT. *(Tnx LIDXA).*

VK9 Nauru—Bill, VK3AHO, reports via the LIDXA that VK9DF is a new station on Nauru. He is on 14160 kc s.s.b. around 1200 GMT.

VS5 Brunei—Mike, VS5MH, is active on Monday, Wednesday and Friday. He has a sked with his QSL manager, W1DGJ, at 1230 GMT after which he will take on all. His frequencies are 14195/205. *(Tnx NEDXC).*

VS9O Oman & Muscat — W6OAQ, Herman

Scholtens, 58 Hallsens Lane, Ben Lomond, Calif. 95005 offers to help with any overdue VS9OSC QSLs. Send Herman a SAE & 3 IRCs or mint British stamps. VS9OC has been quite active on 14195 at about 2200 GMT listening 14200 up. *(Tnx DXpress).*

XT Upper Volta–XT1AC, 14 mc c.w. and s.s.b. almost daily.

XV5 Vietnam–WA9FUX/XV5 is newly licensed in Saigon. Dick prefers 21 mc c.w.

XW8 Laos–XW8BS will be active for 18 months. He likes 14220/225 kc from 1200 GMT. *(Tnx DX Club of Puerto Rico).*

3C/3B Canada–In order to publicize Canada's Centennial Year (1967), Canadian amateurs may, if they wish, use special prefixes 3C and 3B to replace their normal VE & VO, respectively, during the 1967 calendar year only. Thus VE1AA would be 3C1AA and VO2AA would be 3B2AA, etc. No prior authority or license amendment is required.

5U7 Niger Republic–5U7AK on 14230 kc s.s.b. frequently. *(Tnx VERON).*

8F4 Indonesia–Bob, 9V1LP is presently signing WØGTA/8F4 from Sumatra. He will be on almost daily at 1400 GMT on 14140 s.s.b., listening about 14225. He also operates 15 meters as well as c.w. on all bands. In checking with the FCC in Washington, W2CES reports that he has the necessary papers filed and it is okay for US stations to work him. *(Tnx LIDXA).*

QTHS and QSL Managers

CN8FC	W. T. Broder, Box 40, FPO, N. Y. 09544.
CT2YA	via Yasme.
DJØAA	via G2DHV.
EL2D	Richard G. Miller, Box 98, Monrovia, Liberia.
FL8HM	via W7WLL.
GC8HT	via W6UNP.
HI8IBC	Box 951, Santo Domingo, Dominican Republic.
HZ1RR	Box 20, Riyadh, Saudi Arabia.
IØRB/4U	via W2GHK.
KZ5GN	via W7VRO.
MP4DAN	via DJ4AB.
MP4TBO	via VE1AKZ.
OK1APN	via WA4BAO.
ON8IR	via G2DHV.
OX5AR	CMR. Box 2102, APO, N. Y., 09023.
SVØWL	(Crete) via W3CJK.
TA1AV	via SMØKV.
TA1DS	via SMØKV.
TA2YC	via DJ2PJ.
TA2AC	via K4AMC.
TA2FM	via DJ2PJ.
TA2BK	via DJ2PJ.
TG9EP	via DL7FT.
TJ1QQ	via W4DQS.
TR8AG	Guy Vallier, Boite Postal 157, Liberville, Rep. of Gabon.
VK9AG	via W2CTN.
VKØMI	G. Johnson, 3 Inglis St., Newton, Hobart, Tasmania, Australia.
ex VP5AR	via WA8GUA.
VP5BP	via W2CTN.
VP5RS	via K7UNX.
VP5RB	via W1EQ.
VP5NK	Nork Karlburg, RCA/Grand Turk, c/o GMRD, POB 4187, Patrick AFB, Fla. 32925.
VP6PJ	via WB2UKP.
VP7EA	via WA4NXC.
VQ9AA	via W4ECI.
VQ9BC/D	Box 191, Mahe, Seychelles.
VQ9TC/D	Box 191, Mahe, Seychelles.
VS5MH	via W1DGJ.
VS9HRV	Sgt. Ray Vasper, 210 Signal Squadron, Aden, BFPO 69, London, England.
W6FHM/DU1	via W6FHM.
WOGTA/8F4	via W2CTN.
YS1RK	via W6FUF.
ZD8ARP	via BBC, Ascension Island.
5U7AC	via W9RKP.
7Q7PH	via W1MRQ.
7Q7PS	via W1MRQ.
9J2MM	via W4NJF.

Propagation

BY GEORGE JACOBS,* W3ASK

Typical winter h.f. propagation conditions are expected to continue through January and February. Maximum usable frequencies are expected to remain high during the daylight hours, dropping to seasonally low values during the hours of darkness. Atmospheric noise levels (static) are expected to be at their lowest values of the year in the northern hemisphere, and signal levels are predicted to be exceptionally strong during many band openings.

Although good 10 meter DX openings are forecast to many areas of the world, 15 meters is expected to be the best band for DX propagation conditions during the daylight hours. Excellent openings to almost all areas of the world are forecast from shortly after sunrise, through sundown. Good openings to most areas of the world are also forecast for 20 meters from dawn through the evening hours, with conditions peaking shortly after sunrise, and during the late afternoon hours.

Fairly good DX propagation conditions are forecast for 40 meters, beginning in the late afternoon hours, and continuing through the hours of darkness until shortly after sunrise. Eighty meter openings to some areas of the world are also forecast for the nighttime period. Some 160 meter DX openings may also be possible during the hours of darkness and the sunrise period, especially when static levels are low.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use in the continental United States for distances between approximately 50 and 2300 miles. Special prediction charts centered on the states of Hawaii and Alaska are also included. The Charts are valid through February 28. See last month's column for DX Propagation Charts for January.

Sunspot Cycle

The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot number of 55 for October, 1966. This results in a smoothed sunspot number of 36 centered on April, 1966. This month's *CQ* propagation forecasts are based upon a predicted smoothed sunspot number of 62, as the solar cycle continues to rise at a somewhat faster pace than previously.

V.h.f. Ionospheric Openings

Some meteor-scatter type v.h.f. openings may take place during the first week of January, when the *Quadrantids* meteor shower is expected to occur. The Quadrantids is generally a moderately active shower period.

January is expected to be a month of relatively little sporadic-E or auroral activity. Some v.h.f. openings due to these phenomena are likely to occur, however, when h.f. propagation conditions are below normal or disturbed. Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are expected to be disturbed or below normal during the month.

1966 In Review

The present sunspot cycle, the 20th to be re-

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for January

Days	(4)	(3)	(2)	(1)
	Forecast Rating & Quality			
Above Normal: **1, 3, 6, 14, 29, 31**	A	A-B	B-C	C
Normal: **2, 4-5, 7, 9-10, 12-13, 15-17, 19, 21, 24-25, 27-28, 30**	A-B	B-C	C-D	D-E
Below Normal: **8, 11, 18, 20, 23, 26**	C	C-D	D	E
Disturbed: **22**	D	D-E	E	E

HOW TO USE THESE CHARTS

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

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

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

On the "Short-Skip" Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

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

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 300 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

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

6—These Propagation Charts are valid through Feb. 28, 1967. These Charts are prepared from basic propagation, data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

corded since observations began at the Zurich Observatory two hundred years ago, increased at a somewhat faster rate during 1966.

The present cycle began during October, 1964 with a smoothed sunspot number of 9.6 (see Fig. 1). By January, 1966, the cycle had risen to 27, and by the end of 1966 its estimated level was 60.

While the sunspot numbers observed during 1966 were in the low to moderate range, the ionosphere behaved as if solar activity was considerably higher. There is yet no scientific explanation for this deviation. DX propagation conditions were, therefore, somewhat better than would have been expected for this range of sunspot activity.

During 1966 the 10 meter band opened for world-wide DX during the daylight hours of the fall and winter months; 15 meters remained open for world-wide DX throughout the daylight and early evening hours of each month of the year, and 20 meters remained open for DX around-the-clock during the late spring and summer months, and from dawn through at least the early evening hours during the other months. During the hours of darkness good DX conditions existed on 40 and 80 meters, and some 160 meter DX openings also took place during the hours of darkness and at sunrise.

All-in-all, good propagation conditions existed on all the amateur h.f. bands, 160 through 10 meters, during 1966, and were the best observed since the last period of moderately high solar activity which took place during 1961.

Outlook 1967

The solar cycle is expected to continue to increase during 1967, but at a somewhat faster pace. The new year should begin with a smoothed sunspot number of approximately 64, and end with a number of approximately 100. This is a moderately high level of solar activity.

The present sunspot cycle appears to be following closely the behavior of an average cycle. If it continues along its present course, it should reach peak intensity during the fall of 1968, with a smoothed sunspot number of approximately 105 (see Fig. 1). In fact, Professor M. Waldmeier, director of the Zurich Observatory has announced that he expects the present cycle to reach a peak by mid-1968, with a smoothed sunspot number of 110. Other scientists, however, predict a more intense maximum. A comprehensive report on sunspot cycle 20 is in preparation, and is expected to appear in *CQ* later this year.

The moderately high level of solar activity expected for 1967, should result in a further improvement in propagation conditions on the 10, 15 and 20 meter bands.

Ten meters should continue to open to most areas of the world during the daylight hours of the fall, winter and early spring months. During the summer months, short-skip is expected to take over on this band, except for some fairly good DX openings to southern or tropical

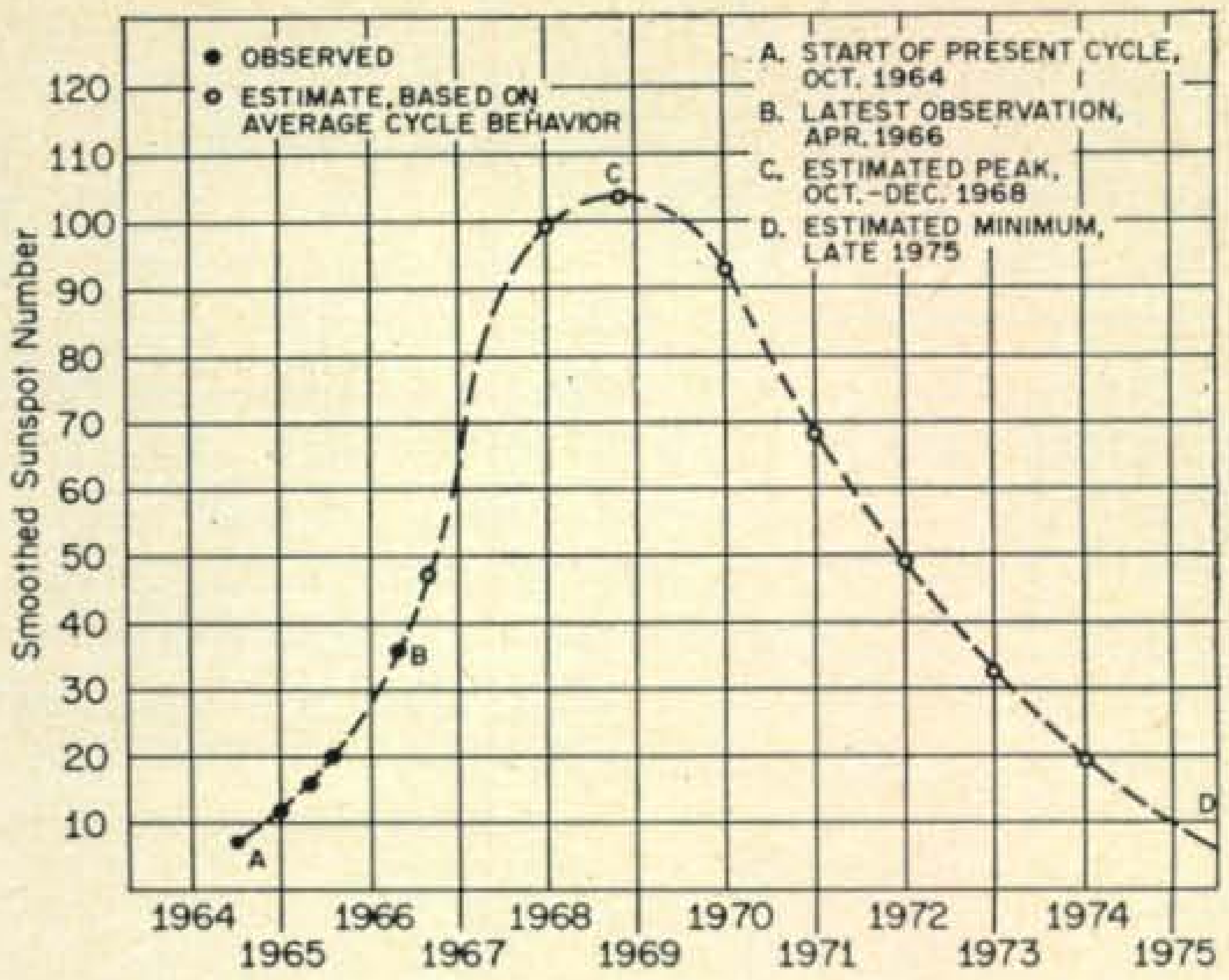


Fig. 1—The progress of the present sunspot cycle from 1964-66 and the prediction for 1967-75.

regions. Exceptionally strong signal levels are expected on many 10 meter openings during 1967, and the band should open more frequently and to more areas of the world than during 1966.

Continued improvement is also expected for 15 meters. Excellent DX conditions are expected from shortly after sunrise through the early evening hours during every month of the new year. East-west openings will peak during the fall, winter and spring months, but should be possible during the summer months as well. North-south openings should be possible at almost all times when the band is open.

Twenty meters will continue to be a year-round DX band from sunrise through the evening hours. During the late spring and summer months, however, it is also expected to be the best band for DX propagation conditions during the hours of darkness.

DX propagation conditions decrease slightly on 40 meters as solar activity increases. Good DX conditions are expected during 1967, however, from shortly before sunset, through the hours of darkness, until shortly after sunrise. The band is expected to open to most areas of the world during this period, especially during the fall, winter and early spring months, when it is likely to be the best band for DX propagation during the nighttime hours.

A decrease in propagation conditions as a result of increased solar activity may be more marked on 80 and 160 meters during the new year. Somewhat fewer DX openings are forecast for these bands, although some fairly good ones may take place on 80 meters during the hours of darkness, especially during the late fall, winter and early spring months. Some DX openings may also be possible on 160 meters during the hours of darkness and the sunrise period, but conditions are expected to be somewhat poorer than during 1966.

The surprise of the new year may be the 6 meter band. Solar activity may reach a level by next fall which will permit long-distance F-layer propagation to take place on this band for short periods of time. Some openings to tropical or southern areas from the USA (for example, to

South America, Africa and Australasia, etc.), may be possible during the noon period as a result of regular F-layer propagation, and again during the early evening hours as a result of trans-equatorial F-layer scatter which takes place during periods of high solar activity.

In summary, improved propagation conditions are expected during 1967 on the 10, 15 and 20 meter bands, with a slight decrease in conditions on 40 meters and a somewhat more marked decrease on 80 and 160 meters. Some DX openings may be possible on 6 meters during the fall and winter months.

73, George, W3ASK

CQ Short-Skip Propagation Chart

JANUARY & FEBRUARY, 1967

AT PATH MID-POINT

(24-HOUR TIME SYSTEM)

Band (Meters)	*50-250 Miles*	*250-750 Miles*	*750-1300 Miles*	*1300-2300 Miles*
10	*Nil*	*Nil*	07-09 (0-1) 09-15 (0-2) 15-17 (0-1)	07-09 (1) 09-11 (2) 11-15 (2-3) 15-17 (1-2) 17-19 (0-1)
15	*Nil*	08-16 (0-2)	07-08 (0-1) 08-09 (2) 09-11 (2-3) 11-16 (2-4) 16-18 (0-2) 18-20 (0-1)	07-08 (1-2) 08-09 (2) 09-11 (3) 11-16 (4) 16-18 (2-3) 18-20 (1)
20	11-15 (0-1)	08-09 (0-2) 09-11 (0-3) 11-15 (1-4) 15-17 (0-2) 17-00 (0-1)	08-09 (2-3) 09-11 (3-4) 11-15 (4) 15-17 (2-4) 17-18 (1-4) 18-21 (1-2) 21-00 (1) 00-08 (0-1)	08-09 (3-4) 09-10 (4) 10-14 (4-3) 14-18 (4) 18-21 (2-3) 21-00 (1-2) 00-07 (1) 07-08 (1-2)
40	07-08 (0-1) 08-09 (1-3) 09-10 (2-4) 10-16 (4) 16-17 (3-4) 17-19 (1-3) 19-20 (1-2) 20-00 (0-1)	02-07 (0-1) 07-08 (1-2) 08-09 (3) 09-11 (4-3) 11-15 (4-2) 15-17 (4) 17-19 (3-4) 19-20 (2-3) 20-21 (1-2) 21-00 (1-2) 00-02 (0-2)	07-08 (2) 08-11 (3-1) 11-15 (2-1) 15-17 (4-2) 17-19 (4) 19-20 (3-4) 20-23 (2-4) 23-02 (2-3) 02-04 (1-3) 04-07 (1-2)	07-08 (2-1) 08-15 (1-0) 15-17 (2) 17-19 (4-3) 19-23 (4) 23-02 (3-4) 02-04 (3) 04-07 (2)
80	07-08 (2-3) 08-09 (3-4) 09-20 (4) 20-22 (3-4) 22-03 (2-3) 03-07 (1-2)	07-08 (3) 08-09 (4-2) 09-16 (4-1) 16-18 (4-2) 18-22 (4) 22-03 (3-4) 03-07 (2-3)	07-08 (3-1) 08-09 (2-0) 09-16 (1-0) 16-18 (2-1) 18-20 (4-3) 20-03 (4) 03-05 (3) 05-07 (3-2)	07-08 (1) 08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-02 (4) 02-03 (4-3) 03-05 (3-2) 05-07 (2-1)
160	09-17 (1-0) 17-19 (3-2) 19-05 (4) 05-07 (3-2) 07-09 (2-1)	17-19 (2-1) 19-21 (4-2) 21-04 (4) 04-05 (4-3) 05-07 (2-1) 07-09 (1-0)	17-18 (1-0) 18-19 (1) 19-21 (2-1) 21-04 (4-3) 04-05 (3-2) 05-06 (1) 06-08 (1-0)	18-20 (1-0) 20-21 (1) 21-01 (3-2) 01-03 (3) 03-04 (3-2) 04-05 (2-1) 05-07 (1-0)

‡Predicted 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.

*GMT or Z time is 5 hours *ahead* of EST; 6 hours *ahead* of CST; 7 hours *ahead* of MST; 8 hours *ahead* of PST, and 9 hours *ahead* of Alaskan Standard Time in the time zone between Skagway and 141 degrees west longitude, etc.

†Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST, and 10 hours *behind* GMT.

ALASKA

*Openings Given In GMT**

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	18-20 (1) 20-22 (2) 22-23 (1)	17-19 (1) 19-20 (2) 20-22 (3) 22-23 (2) 23-01 (1)	11-16 (1) 16-18 (2) 18-21 (1) 21-22 (2) 22-00 (3) 00-01 (2) 01-03 (1)	04-13 (1) 07-12 (1)‡
Central USA	18-20 (1) 20-23 (2) 23-01 (1)	16-19 (1) 19-21 (2) 21-00 (3) 00-01 (2) 01-03 (1)	11-17 (1) 17-19 (2) 19-21 (1) 21-23 (2) 23-01 (3) 01-02 (2) 02-04 (1)	03-14 (1) 07-12 (1)‡
Western USA	18-21 (1) 21-00 (2) 00-02 (1)	17-19 (1) 19-21 (2) 21-00 (3) 00-02 (2) 02-04 (1)	11-17 (1) 17-20 (2) 20-21 (3) 21-00 (4) 00-01 (3) 01-03 (2) 03-05 (1)	04-05 (1) 05-12 (2) 12-15 (1) 15-16 (2) 16-17 (1) 05-12 (1)‡ 12-15 (2)‡ 15-17 (1)‡

HAWAII

Openings Given In Hawaiian Standard Time†

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	07-08 (1) 08-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	06-07 (1) 07-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	12-15 (2) 15-17 (3) 17-20 (2) 20-02 (1) 02-04 (2) 04-12 (1)	17-19 (1) 19-21 (2) 21-00 (3) 00-03 (2) 03-04 (1) 19-21 (1)‡ 21-01 (2)‡ 01-03 (1)‡
Central USA	07-08 (1) 08-10 (2) 10-14 (3) 14-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	13-14 (3) 14-17 (4) 17-19 (3) 19-21 (2) 21-04 (1) 04-06 (2) 06-08 (3) 08-13 (2)	17-19 (1) 19-20 (2) 20-03 (3) 03-04 (2) 04-06 (1) 19-21 (1)‡ 21-03 (2)‡ 03-05 (1)‡
Western USA	06-08 (1) 08-10 (2) 10-14 (3) 14-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-15 (4) 15-16 (3) 16-18 (2) 18-19 (1)	06-07 (2) 07-10 (4) 10-14 (3) 14-16 (4) 16-18 (3) 18-22 (2) 22-06 (1)	16-18 (1) 18-19 (2) 19-22 (4) 22-02 (3) 02-04 (2) 04-09 (1) 19-20 (1)‡ 20-22 (2)‡ 22-04 (3)‡ 04-05 (2)‡ 05-07 (1)‡

"That may be weak, the kids used the antenna to make a tent."

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Dec. 21 - March 20		Canary Islands Contest
January	7-9	Virginia QSO Party
January	7-9	Arkansas QSO Party
January	8-9	Saskatchewan QSO Party
January	**28-29**	**CQ WW 160 DX**
January	28-29	Arizona QSO Party
January	28-29	Louisiana QSO Party
February	4-5	ARRL DX Phone
February	10-12	QCWA QSO Party
February	12-13	Bermuda Contest
February	18-19	ARRL DX C.W.
February	25-26	YL/OM Phone Contest
February	25-26	Vermont QSO Party
February	26-27	Bermuda Contest
March	4-5	ARRL DX Phone
March	11-12	YL/OM C.W. Contest
March	11-12	RSGB BERU
March	18-19	ARRL DX C.W.
April	**8-9**	**CQ WW SSB DX**

Canary Islands Contest

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

Look for EA8 stations during this period. Your QSO exchange *must* include the previous day's min./max. local temperature. Five QSOs (10 for EU stations) will earn you the "Tenerife Eterna Primavera Award."

See last month's CALENDAR for additional details. Your cards go to: Tenerife Eterna Primavera Award, P. O. Box 215, Tenerife, Canary Islands.

Virginia QSO Party

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

Besides contest awards you can also earn credits for the Old Dominion and USA-CA awards.

Complete details in last month's CALENDAR. Your logs go to: Roanoke Valley ARC, Box 2002, Roanoke, Virginia 24018.

Arkansas QSO Party

Starts: 2200 GMT Saturday, January 7
Ends: 0400 GMT Monday, January 9

This is the 2nd QSO Party sponsored by the North Arkansas Amateur Radio Society.

There are no time or power restrictions and the same station may be worked once on each band and on each mode for QSO credit.

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

Scoring: Arkansas stations: 1 point per contact multiplied by number of states, provinces and foreign countries worked. Out-of-state: 5 points for each Ark. contact multiplied by number of Ark. counties worked. (Max. of 75).

Frequencies: c.w.—3525, 7025, 14025, 21025, 28025. a.m.—3825, 7225, 14225, 21225, 28560. s.s.b.—3975, 7275, 14325, 21425, 28650. Novice —3735, 7175, 21110.

Awards: Certificates to the highest scoring station in each state, Canadian province and foreign country. (Min. of 100 points.)

Mailing deadline is January 30th and your logs go to: North Arkansas ARS, c/o Don Anderson, WA5GVG, 508 North Robinson, Harrison, Arkansas 72601.

Saskatchewan QSO Party

Starts: 0001 GMT Sunday, January 8
Ends: 0001 GMT Monday, January 9

The Regina Amateur Radio Association has organized this activity to celebrate Canada's Centennial.

Phone and c.w. are separate contests and one contact per band permitted with same station.

Exchange: QSO number, report and QTH. for VE5/3C5 stations. QSO number, report and state, or province for all others. (3C5 is a special prefix that can be used by VE stations during the Centennial.)

Scoring: Saskatchewan stations score 1 point for each outside contact, multiplied by states and provinces worked. Outside stations score 3 points for each VE5/3C5 contact, multiplied by different Saskatchewan QTHs worked.

Frequencies: c.w.—3560, 7050, 14075, 21050, 28050. Phone—3850, 7250, 14250, 21300, 28550.

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

Mailing deadline is January 31st. Logs go to: Regina Amateur Radio Assoc., 2117 McPherson Avenue, Regina, Saskatchewan, Canada.

Louisiana QSO Party

Starts: 1800 GMT Saturday, January 28
Ends: 2200 GMT Sunday, January 29

This is the second annual QSO Party sponsored by the Lafayette Amateur Radio Club.

The same station may be worked and counted for QSO points on each band and mode.

Exchange: QSO number, report and QTH. Parish for Louisiana stations; state, province or country for all others.

Scoring: Louisiana: 1 point per contact including other La. stations, multiplied by states, Canadian provinces and countries worked. Others: 1 point per QSO, multiplied by number of Louisiana parishes worked. (Max. of 64).

*14 Sherwood Road, Stamford, Conn. 06905.

Frequencies: 3600, 3910, 7100, 7230, 14100, 14300, 21100, 21400, 28100, 28700.

Awards: Certificates to top scorers in each state, Canadian call area and country. 1st, 2nd, and 3rd place winners in Louisiana will also receive certificates. (A min. score of 50 needed to win.)

Mailing deadline is February 28th. Logs go to: Lafayette ARC, 612 Harding St. Lafayette, Louisiana 70501.

CQ WW 160 DX

Starts: 0000 GMT Saturday, January 28
7 P.M. EST Friday, January 27
Ends: 1200 GMT Sunday, January 29
7 A.M. EST Sunday, January 29

Note the change in the starting and ending times, two hours earlier than previous years. Rules remain the same and were covered in last month's CALENDAR.

It is recommended that you study the FCC regulations for 160. A copy of the regulations and contest log sheets are available upon request. Include a s.a.s.e. of course.

Mailing deadline for logs is February 28th. *CQ* 160 Contest, 14 Vanderventer Ave., Port Washington, L. I., N. Y. 11050.

Arizona QSO Party

Starts: 2100 GMT Saturday, January 28
Ends: 2100 GMT Sunday, January 29

The newly formed Saguaro High School Amateur Radio Society announces its sponsorship of the 1st Arizona QSO Party. Rules are as follows:

Eligibility: All W/VE Amateurs are invited to participate. Only single transmitter-single operator on single transmitter-multi-operator stations will be considered for awards.

Scoring: Arizona: All Arizona stations count 1 (one) point per QSO multiplied by the number of states and provinces worked and by number of counties. Out of state: All out of state stations count 5 (five) points per contact with all Arizona stations ONLY, multiplied by the number of Arizona counties worked.

Exchange: Arizona stations call "CQ QSO Party, this is Arizona, W7XYZ" etc. on phone and "CQ test de Ariz W7XYZ" etc. on c.w. Send contest number, signal report, and county. Out of state call "CQ Arizona" on phone and "CQ Ariz de W7XYZ" etc. on c.w. Send contest no., signal report, state or province and county.

Bonus: An extra 100 points will be given to each station if substantial proof of ARRL membership can be provided. This score will be added on at contest Headquarters.

Awards: A certificate will go to the top 2 (two) scorers from each state or province and to the top 4 (four) from Arizona.

Logs: Logs must show date & time (GMT) plus all information required in item 4. Totals must be made on last log sheet for credit.

Frequencies: c.w.: 7025, 7075, 7160, 7180, 3750, 3665, 14010, 14005, 21105, 21110, 28010, 28100. a.m.: 3880, 7285, 14220, 2300, 28500. s.s.b.: 3900, 3995, 7225, 7245, 14275, 14325, 21350, 21400, 28600, 29000.

Address: Reports must be sent to WA7CNP c/o The Saguaro High School Amateur Radio Society, 6250 N. 82nd St., Scottsdale, Arizona, 85251.

QCWA QSO Party

Starts: 2200 GMT Friday, February 10
5 P.M. EST Friday, February 10
Ends: 2200 GMT Sunday, February 12
5 P.M. EST Sunday, February 12

This year's Party is sponsored by the Delaware Valley Chapter.

There is no point scoring involved, this is primarily a party to renew old acquaintances and see how many members you can contact.

Non-members are welcome to participate, but only members are eligible for the QCWA certificate and the traveling Plaque donated by Headquarters.

Three members are tied with two wins each, W4FNQ, W6ZPX and W8BNK. A victory this year for any one of this trio will mean perminant possession of the Plaque. (Unless someone upsets their applecart.) It should be an interesting competition.

A list of operating freqencies and other information will appear in next month's CALENDAR.

ARRL DX

Phone: February 4-5 and March 4-5
C.W.: February 18-19 and March 18-19
Starts: 0001 GMT Saturday, **Ends:** 2400 GMT
Sunday in each instance.

This one is probably the granddaddy of them all, having been in action for the past 33 years.

The modifications made this year were long overdue and a step in the right direction. The elimination of the quota of contacts per country should increase activity in both directions. And the special Plague award to each continental leader will certainly increase foreign participation.

One more improvement I can suggest, cut the contest period down to one week-end for each section. Give some of the other activities a break.

See the current *QST* for rules in details, write ARRL for free contest forms.

YL/OM Contest

Phone: February 25-26. **C.W.:** March 11-12
Starts: 1800 GMT Saturday. **Ends:** 1800 GMT
Sunday in each instance.

Complete rules will be found on page 8 of this issue.

Editor's Notes

Conditions for the Phone week-end of our World Wide DX Contest were terrific, and we are going to see scores that are unbelievable. Just an indication of things to come with the 10 meter band opening up. At this writing we have not received enough logs to publish a list of claimed

[*Continued on page 96*]

You say your taxes were raised?

You missed three payments on your Jaguar XK-E?

You had to turn in your Playboy Club Key?

Your salary was cut?

You say the F.C.C. has expressed interest in your four different calls?

You say food is so expensive it's cheaper to eat money?

You say you invited your boss to dinner and during the soup course the finance company repossessed your furniture?

You say your XYL backed the family car out of the garage after you backed it in the night before, and now you can't get to the Newsstand to get your monthly copy of CQ?

HOLD IT!!

While we are in no position to alter the tax structure, give you a raise, or sway the F.C.C., we *can* save you a pile of cash on CQ! So drop that anchor, pick up a pen and dash off a CQ subscription right away!

1 yr.	**I PAY ONLY $ 5.00**	a savings of $ 4.00
2 yrs.	**I PAY ONLY $ 9.00**	a savings of $ 9.00
3 yrs.	**I PAY ONLY $13.00**	a savings of $14.00

And now with all this newfound money at your disposal, you can begin to really live again!

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

THE January "Story of The Month" is about Irene, WA9EZP, but first the data on awards issued. "Otts", K8CIR received #3 ALL 3079 Counties Special Plaque. Robert, K9WSL received a USA-CA-2000 award and endorsements of All 7mc s.s.b. for his USA-CA-1000 and USA-CA-1500 awards. USA-CA-1000 awards for mixed operations went to David, W4SKI; Fred, W6UBP; Dave, WAØJKT and Andy, VE2-8679. A USA-CA-500 award endorsed All 14 mc went to the club station LA1H and one endorsed All A-1 went to Henry, VE2HR. USA-CA-500 awards for mixed operation went to Marion, K1SLJ; David, W1III; Helene, W1YWT; Sanford, K6QCF and Richard, KØYIP.

USA-CA HONOR ROLL

ALL 3079		1000		500	
K8CIR	3	WAØJKT	105	KØYIP	594
2000		VE2-8679	106	K6QCF	595
K9WSL	31	W6UBP	107	W1YWT	596
		W4SKI	108	VE2HR	597
				LA1H	598
				K1SLJ	599
				W1III	600

SPECIAL USA-CA HONOR ROLL
Top Twenty-Five County Hunters

K9EAB	3079	K4VOF	3001	W9CMC	2501
WØMCX	3079	K5SGK	2970	WØGYM	2500
K8CIR	3079	K8KOM	2803	W8UPH	2414
W2QHH	3069	K8IWI	2780	K3LXN	2331
W9ICF	3050	W5EHY	2779	K8VSL	2180
WØJWD	3039	VE3-9301	2679	K8EUX	2154
WA9AJF	3012	WØKZZ	2632	W5NXF	2080
K5SGJ	3005	WØVFE	2527	WA5AEB	2062
				W2JWK	2050

Irene Kennedy, WA9EZP
Holder Of USA-CA-500 Award #560
All A-1 7 mc

Irene has become a very busy YL, for she has undertaken the task of introducing Novices to the joys of award hunting. Irene has always been especially interested in working with Novices and this is another facet of this interest, and 7 mc c.w. is her favorite band where you can find her practically any hour of the day or night.

During a recent move to Indiana, she found time to carefully check her thousands of QSL cards and thus acquire USA-CA-500 Award #560 endorsed All 7 mc A-1, and obtain her CHC membership, which bring her award totals to over 100.

It was that special spot in her heart for Novices that gave her the idea of incorporating her two "hobbies." This led to the formation of the CHC Int. Novice Chapter #11. Through the efforts of Irene and this group, Novices can now more fully enjoy the satisfaction and achievement that award hunting gives. Many new awards are being sponsored for contacts with Novice stations.

WA9EZP is a member of the YL clubs, L.A.R.K. and H.A.W.K. She is vice-president of the Fort Wayne A.R.C. and is also an A1-Op, of which she is very proud. Her OM, Howard, WA9FBK is a member of the Flying Hams Club and the one who keeps all of the gear running, for it gets a lot of use at their shack.

In the three year period since she received her General license, she has accomplished a lot. Irene s.w.l.'ed for almost 6 years before a friend suggested she get a license of her own. Not knowing a thing about the technical side of radio and not being able to tell the dits from the dahs, it was a little while before the WN9 call was received. That had expired one week before she had possession of her General Class license and Irene recalls that it seemed like the longest week of her life.

So if you want to have a ragchew with a bubbling YL who can make the sun shine for you on the gloomiest days, just tune around for that very distinctive fist of WA9EZP. (Many thanks to Ardell, WA9MIR for all this information, additional information on the awards can be obtained from Ardell's OM, WA9EPH, Dave Vanderweel, 1110 Birch Dr., Mt. Prospect, Ill. 60056).

Letters

"Trot," W3BRX, writes: "I will begin study at Uni. of Delaware for PHD in psychology Feb. '67. Will have all-band 500 watt mobile rig fired up by then (c.w. only) so hope to make Delaware counties available to "hunters."

George, W1DPJ, writes: "During this past summer I have been operating 14 & 7 mc c.w. from my cottage on Sebec Lake in rare Piscataquis county.

Have been on during many QSO Parties and didn't always give out the county. Anyone working me as /1, that needs Piscataquis county, QSL to my home QTH, ok in any book."

Awards

New Custodian for "The Garden State Award," Joseph A. Stauhs, WA2BNF, 105 Carpenter

Irene Kennedy, WA9EZP

*103 Whitman St., Rochelle Park, N.J. 07662.

Street, Belleville, N. J. This award was described and pictured in *CQ*, January 1965. Basic award for confirmation of 10 N. J. counties, write "Joe" for full details.

The Pennsylvania Chapter of The National Awards Hunters Club is pleased to announce the following awards:

Publicity Award: Issued for contacting amateurs in cities, the names of which start with each letter in "PA. CHAPTER, NAHC." The cities are *P*hiladelphia, *A*llentown, *C*hester, *H*arrisburg, *A*ltoona, *P*ittsburgh, *T*amaqua, *E*rie, *R*eading, *N*ew Castle, *A*liquippa, *H*azleton, and *C*lairton. Send GCR list and $1.00 to W3LXN.

Zones 3-4-5 Award: Issued for contacting one amateur in each call area comprising Zone 3, 4 and 5 as follows: Zone 3: VE7, W6 and W7. Zone 4: VE3, VE4, VE5, VE6, W4 (Ky., Tenn.), W5, W9 and WØ. Zone 5: FP8, VE1, VE2, VP9, VO1, W1, W2, W3 and W4 (Alabama, Florida, Georgia, North Carolina, South Carolina and Virginia). The basic award plus the appropriate seal will be awarded when the initial application meets the basic requirements. Seals will be awarded when the applicant qualifies for the remaining Zones. Send GCR list and $1.00 for initial award to W3LXN. Seals are offered free of charge.

Principal Cities & Towns Award: Issued for contacting amateurs in the principal cities and towns in the Commonwealth of Pennsylvania, as follows:

1. Fifty (50) contacts for basic award and seal.
2. One hundred (100) contacts for second seal.
3. Two hundred (200) contacts for third seal.
4. Three hundred (300) contacts for fourth seal.
5. Seven hundred thirty seven (737) for fifth seal.

The first station to qualify for the fifth seal will be presented a trophy in addition to the fifth seal. It is recommended the "Index to the Pennsylvania Official Highway Map" be used as a guide and check-off list. Send an alphabetically arranged list with GCR certification and $1.00 for basic award and first seal. Additional seals are awarded without charge. Send to W3LXN.

Young Ladies Award: Issued to amateurs who contact five (5) YL or XYL members of the Pennsylvania Chapter. Additional seal for extra at no charge. YL members are: WA1ANE, WA2CMG, K3JJN, WA4BMC, WA4FJN, K4TBG and WAØHWV. Send GCR list and 50 cents to W3LXH, Paul O. Mitch, R.D.#2, Milton, Pa. 17847.

CCAF Award

The Pennsylvania awards are as follows: Zones 3-4-5 Award, Publicity Award, Principal Cities and Towns Award, and the Young Ladies Award.

Copper Coin Award of Falun: The CCAF is issued by the Falun Radio Club of Sweden, and consists of a hand-made, engraved miniature in copper of a 1-daler-piece from the time of Carolus Rex (Charles XII) 1715 (size 57x63x3 mm. or 2¼" x 2½" x ⅛", weight 100 gammes or 3.5 ounces).

The award can be won by all licensed amateurs in the world (club stations included) who have been in two-way contact with amateurs within the Falun area (Lat. 60°36′ 30″ N, Long. 15° 38′ E. in SM4 district), and thereby gathered at least 10 points according to the following table. Only one contact per station and band after January 1st, 1966 will be counted. For stations situated closer than 50 kilometers from Falun. 20 points are required.

Band	3.5	7	14	21	28
Zones 14, 15, 16 and 20	1	1	1	1	1
All other zones	5	3	2	2	2

All contacts have to be made on the same mode, i.e. c.w., a.m., s.s.b., RTTY etc. . . . A minimum report of 338 on c.w. and 33 on Phone must be recorded in both directions.

Applications with an attached record of contacts claimed and a check of $5.00 (Sw. cr. 25:00) should be sent to: Falun Radio Club, P. O. Box 12, Falun 1, Sweden. Before an application can be approved, all amateur stations in Falun with whom the claimant has been in contact with, must have received the applicant's QSL card. The award will be forwarded by registered mail.

Notes

I still have a waiting list of overseas friends in need of your used POD 26, I'll be happy to mail their address/addresses to you. A HAPPY AND PROSPEROUS NEW YEAR TO YOU ALL. How was your year? 73, Ed., W2GT.

HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV

IN the early years of ham radio one could not open a radio magazine without seeing ads for loudspeakers—today the only ads one sees on loudspeakers are in the magazines that cater to hi-fi enthusiasts.

One of the most neglected components of a ham station is the loudspeaker. As long as sound issues forth from this transducer most hams are happy—or so it seems. For 9 years HAM CLINIC has only received a few questions on the subject of loudspeakers, but there is more to speaker technology than just connecting one up to a receiver.

Most speakers in use today by hams were not designed specifically for voice or c.w. communications. Unlike the hi-fi speaker, the "ham" or communications type speaker can be of nearly any size and shape without regard to *the* best frequency response.

Speakers found in most hamshacks today are of the dynamic, permanent magnet (PM) moving cone type. These require no extra power for operation as did the electromagnetic speaker of yester-year.

Some PM speakers have adjustable voice coils, others have these without adjusting spiders. When the speaker cones warp in the latter, there is little one can do except to replace the entire cone and voice coil assembly.

Adjustable voice coils are usually centered around the armature (part of the magnet assembly) by a spider fastened to the center of the armature with a single screw.

To adjust a voice coil (called centering the cone), the screw holding the spider is first unloosened and shims are inserted between the voice coil and the armature. The cone is flexed a few times by hand then the spider holding screw is tightened. Calling or business cards can be used as shims.

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

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

Most speakers have an impedance of 3.2, 4, or 8 ohms. Special speakers used in transistor circuitry may have impedances as high as 48 ohms. Impedance matching is important, otherwise the power delivered to the speaker will be affected and there no doubt will be intolerable distortion if the mismatch is great enough.

What most hams want from their speakers is good clear voice quality. If they use a speaker for c.w. work (and some hams do—including me) then they want one which will sound good without unwanted resonances.

Selecting a speaker for ham radio operations should not be difficult, but a speaker which may please me, may not please you, so the selection is a personal thing—aside from technical considerations.

Actually, a speaker having a low af frequency cut-off of 200 c.p.s. (or Hz if you prefer) and a high frequency cut-off of 4000 c.p.s. is ideal for good crisp voice reception, but a speaker that cuts off at 6000 c.p.s. will usually sound "better" to the *average* ham ear.

How speakers are mounted and cased is important. A speaker should *never* be mounted on the receiver cabinet proper for this can lead to microphonics. (I'll get some backlash on this but it is true!)

Metal cabinets (if used) should be sturdy and of welded construction—wooden cabinets are better—at least at voice and c.w. freqencies. But a box does not a cabinet make!

For years now, manufacturers have been "sticking" speakers in cabinets—usually metal ones—well, this is fine for those who are *easily* satisfied, but *metal* mounted speakers leave much to be desired as far as *good* sound is concerned. Unless the metal cabinet is "doctored."

To cut down or eliminate undesirable resonances in speaker cabinets (wood or metal), one can use either glass wool (glued to the walls of the cabinet) or compress bandage (first aid) material. It is annoying when a speaker will suddenly "squack" when a signal of a certain pitch is received.

Make sure that you pick the speaker that has a "reserve" power rating. This means that if your set puts out 2 watts, you should use a 4 watt speaker. You'll never need 2 watts for comfortable listening, but the *dynamic* capability (that you hear so much about) does seem to make for better sound at the lower sound levels. The hi-fi enthusiast has an amplifier of 50 watts capability which he *never* uses—why? The same reason for the higher power speaker rating.

When you mount your speaker in your station, mount it so that *both* your ears catch the sound (unless you are deaf in one ear).

Do not do as one ham did: he tried and tried to find out why his set sound distorted—he checked tubes, voltages, components, etc. to no avail. So then he bawled out the manufacturer for selling him a "lemon." After writing to me in detail, I wrote back and told him to remove his speaker from the cabinet and examine it. He did. Here is his reply: "Dear Chuck: My face is red, my blood pressure is '250 over 143'—my kid poked a pencil into the loudspeaker cone until it looked like the cheese you eat over there (Switzerland). Excuse me for bothering you, but with 7 junior ops running around, what can I do?" Now *you*, dear HAM CLINIC reader, know what I told him to do!

Don't be smug about speaker selection. Those s.s.b. stations will sound a lot better if you take your time selecting your speaker. If you are saddled with a speaker mounted in your power supply, well, this is a convenient place to mount it (for the manufacturer) but I suggest you can do better by removing it and mounting it on the wall. Good listening.

Questions

a.c. Line Regulation—"I live in a coal mining area where the line voltage drops to around 95 volts when the mine and tipple are working. When the mine load is off the voltage soars to as much as 135 volts. You can imagine the trouble I have! I think I have bought more tubes for my ham gear, TV etc. than any other ham in the U. S. Transistorized equipment here (a.c. powered) is out of the question. My ham rig uses about 500 watts. What can you suggest? I am desperate."

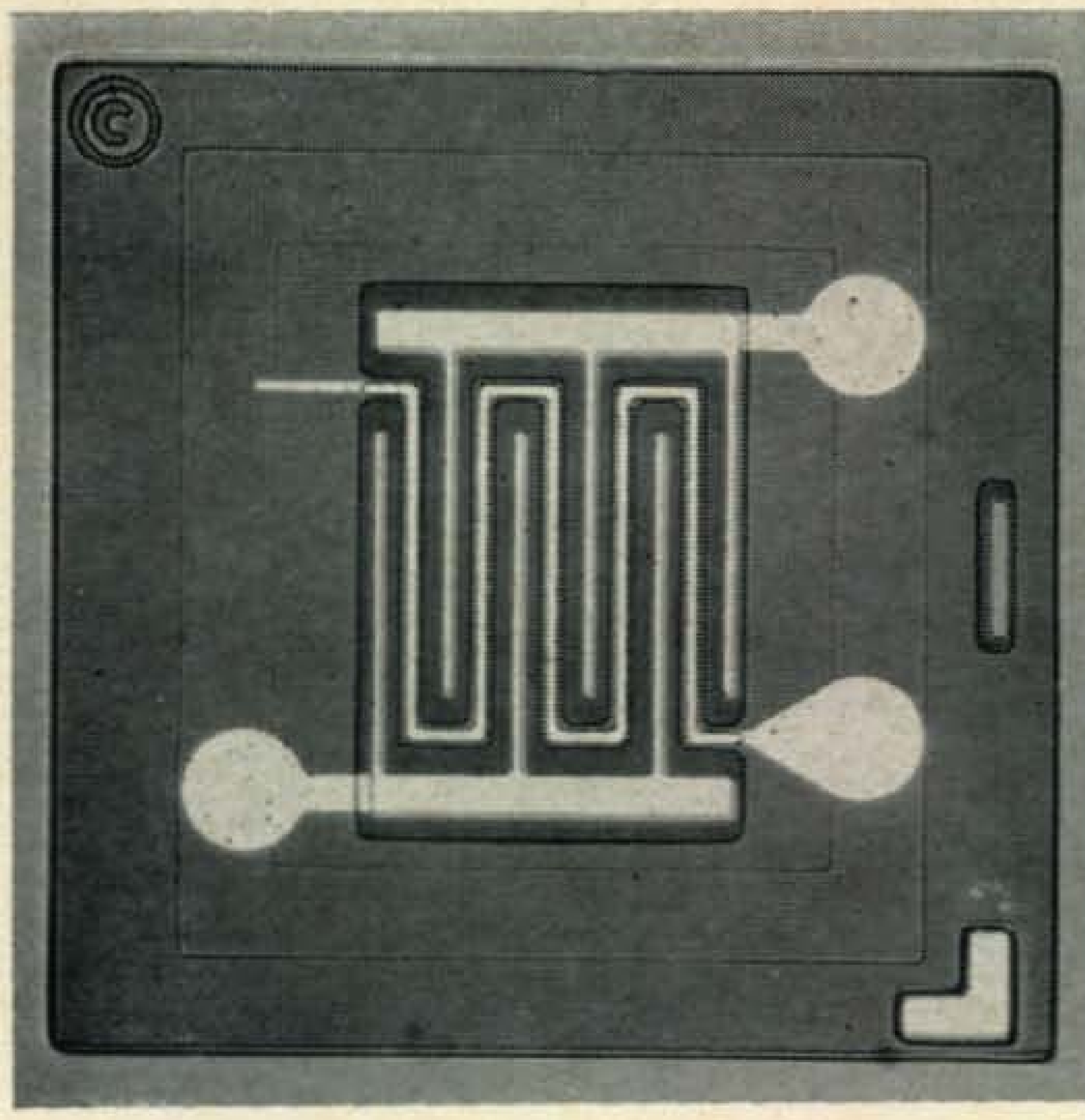
I would suggest that you obtain a *Sola* constant voltage transformer model 23-13-060 (Allied Radio stock number 62Z517), price $30.00. This transformer will give you a *constant* 118 volts output for voltage inputs ranging from 95 to 130 volts at 60VA. This is better than a manually adjusted (tapped) regulator transformer.

FET r.f. Amplifier—"I have been reading a number of articles in various magazines on field effect transistors and understand them. To me the FET seems to be the ideal approach to the front-end problem for my transistorized receiver. I find that it is more effective than some tube r.f. amplifiers. Can you recommend an FET to me that has a noise figure of less than 6db at 144 mc?"

Yes, I think so. The *Fairchild* FT57 has the following characteristics: it is silicon. A maximum noise figure of 4.5 dbs at 100 mc is claimed, but the typical is 2.7; a maximum reverse capacity of 0.8 mmf at 100 mc (typically 0.6 mmf); a minimum neutralized power gain of 15 db at 100 mc (typically 20db). Drain current at zero gate voltage is 9 to 26 ma, typically, 16 ma. It is available in the TO-72 package. A word about this FET: it is Fairchild's patented Planar II epitaxial processed unit. I have used it with success in a receiver I have been experimenting with. (The *CQ* editor has seen the proto-type). It is ideal for 144 mc ham use in converters. An interesting photograph of its configuration is shown on these pages.

NCX-3 Chirp—"On c.w. I have been receiving reports that my NCX-3 chirps. What is the cause and cure?"

Some do. This is due to an r.f. voltage being fed back to the voltage regulator tube. V_{18}. It can be entirely eliminated by doing the following: remove the red wire from pin 1 of V_{18} and



An enlarged view of the Fairchild FT57 field effect transistor (FET) that can be used at 144 mc with low noise.

reconnect it to pin 6. Add a 2.5 mh r.f. choke between pins 1 and 6. Add a .01 mf discap from pin 6 to ground. Solder all connections. Simple!

HRO-500 Rough Audio—"I am an owner (and a proud one) of the National HR-500 receiver; however I experience a little bit of rough audio —a.c. hum. What can I do?"

I take it that you are an early HRO-500 owner. A potential ground loop exists in a number of early HRO-500's which may cause excessive hum or "rough" audio. This loop may be eliminated by making the following wiring modifications to the HRO-500 power supply: locate the green wire coming from the power transformer which is connected to the ground lug of the filter capacitor (C_{135}). Disconnect this wire from the capacitor ground lug. Put a ground lug under the power supply terminal board bracket adjacent to the capactitor (C_{135}) ground terminal. Connect the green power supply transformer wire to this ground lug.

Next, locate the audio terminal board. Figure 49 (in the book). This is the chassis, bottom view, audio TB. Remove 2 coaxial audio cables (grounds) which are attached to terminal #5 and solder to a ground lug which should be placed under one of the 8/32 screws which hold the audio driver transformer to the chassis. These cable shields are long enough to reach this new ground lug, without additional wire. This completes the modifications.

f.m.'ing of SB-33 (SF-1 Series)—"I recently bought a second hand SB-33 transceiver in excellent condition and I am a very happy owner, but I have received a few reports from discerning hams that my set f.m.'s. Can you help me please?"

Sure. See fig. 1. The location of the parts and ground points shown are essential to prevent the ground loops. The triangular shield plate may be removed to perform the changes but be certain it is properly replaced and secured.

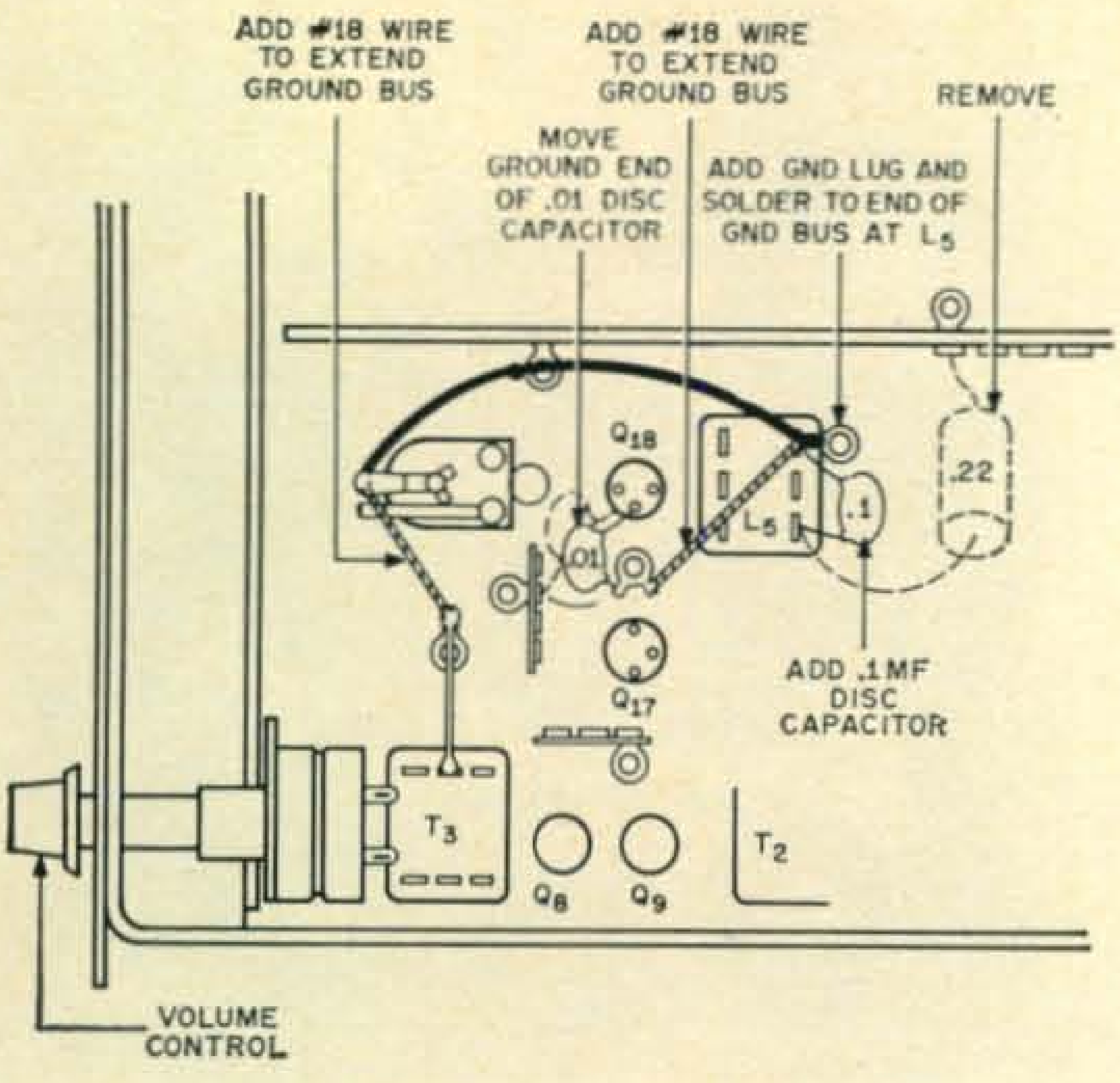


Fig. 1—The modification of the SB-33 to prevent fm'ing.

Novice Problem—"I'm 19 years old and got interested in ham radio at highschool. Now you know that 19 year olds don't have a lot of money. I approached my dad and told him that I wanted to take up electronic engineering in college and he was quite happy. I then suggested to him that I wanted a loan from him for ham equipment and he turned me down flat. He said, 'look, I am not rich. I make $7500 a year. I have saved for your education but not your hobby. I explained to him that the hobby of ham radio was educational and fitted in with my education, but he refused to listen. All I need is about $300 to go on the air when I get my General class license; I have not made one contact yet for I have no equipment. What can I do?"

Well son, let me tell you. I think your dad is a considerate guy and you should listen to him. If you want ham gear why not consider an "out of school" job? It takes patience and a lot of saving to get extra money but it can be done. Why depend upon dad all the time? He's taking care of the main thing—your education. I have had *this* question many times before. Why is it that *dad* has to do it all? Thomas Edison's dad didn't help him a bit. Get with it! Make your own hobby way!

Building vs Buying—"Building is for the birds. Why should I knock myself out putting together a ham transmitter when I can buy a better already built one? Sure I can learn more by puttering around with a soldering iron, but brother, this does not make me a better communicator. Some of us have it and some of us don't—so why argue?"

Ham radio is more than pushing switches my friend. It is the satisfaction of putting together a set that works (and you know how it works). I don't advocate buying "appliances"—but if you're one of the "chosen" few and you've got cash—that is your business. But I *agree* with those who have written to me and suggested that the new ham should get some experience building his own. But if someone gives me (or a new ham) $500 and tells us to spend it, I'm sure we can. I for one will not buy parts if I don't have a station—I'll buy equipment . . . already made.

CB and the Ham "Technician"—"A friend of mine who is a CB'er came to me with a poor working (sic) set. I fixed it so that it would operate okeh. Later he got a citation. He was furious. He came to me and said that I was the cause of it. All I did was to replace a shorted by-pass capacitor in the receiver section of his transceiver. Am I liable?"

No. But what did he get the citation for? Hams are NOT allowed to work on CB sets where their work will affect modulation, frequency etc. This is a job for a Commercial Second Class or higher licensee, radio telephone operator (licensed by the FCC).

BC-610 TVI—"After I got my General class license I was talked into buying a used BC-610 surplus transmitter. I put it on the air and now the neighbors are all 'after me.' How do I de-TVI this set? I only use it on 80 meters."

See *QST* for May 1951. This old set is still around, but why *anyone* would want to use a.m. instead of s.s.b., I don't know. S.s.b. is here to stay and most of it is TVI'*less*. Why buck the trend? A.m. for ham voice communications is a dead dodo!

Thirty

For 9 years now, HAM CLINIC has tried to help fellow hams—in many ways it has succeeded. Of course we have been unable to answer many questions, but we have tried. No one can blame us for *not* trying. Perhaps we will never be in the "ham hall of fame" but we have answered thousands of letters and used most of our spare time for amateur radio . . . helping fellow hams with their problems.

So as the new year begins, we wish you all a happy, peaceful, and prosperous New Year.

73 and 75, Chuck and Elfriede

New Amateur Product

Heath

A new improved single band s.s.b. transceiver kit line has been added by Heath. These are updated versions of the HW-12, 22, 32 and have an A following the number. New features are: front panel selection of upper or lower s.s.b., improved audio and a.v.c. response, mike and gain control, front panel bias adjustment, a.l.c. input, and a full 200 watts p.e.p. input. There are three versions, the HW-12A (75) $99.95, the HW-22A (40) $104.95, and the HW-32A (20) $104.95. Two power supplies are also offered, the HP-13 mobile supply, $59.95 and the HP-23 fixed supply $39.95. For complete details either write to Heath, Benton Harbor, Mich., or circle 78 on page 110.

SURPLUS sidelights

BY GORDON ELIOT WHITE*

In recent months there have been a number of articles in the amateur magazines on facsimile communications, including the discussions of reception from the Tiros and other weather satellites, and the overall description of Fax which Bill Tyrell, W2YKG and I did in the September, 1966 *CQ*[1]. For the same reasons which operate in the radio teleprinter (RTTY) field, surplus is the logical source of fax equipment—recorders, transmitters, converters and keyers. I have had a number of requests for data on the surplus facsimile gear, and will attempt to round up the field this month.

The most common surplus fax machine (transceiver) is the military AN/TXC-1, in its various models. It is an old item, built in the period just after World War II by the Times Facsimile Corp. Times Facsimile has now been bought by Litton Industries, and renamed Westrex, with offices at 540 West 58th Street, New York.

The TXC-1 is large, measuring 35 inches long, 22 inches wide and 18 inches high. It weighs 85 pounds, plus a 30 pound power supply, PP 86/TCX, which is 10" × 12" × 8" itself. As with so much older gear, the bulk indicates solid construction and good quality design.

This unit can both receive or transmit, via photographic or electric stylus method, at 30 or 60 r.p.m. It is thus one of the most flexible surplus fax machines, although it has been outmoded in military service by its size and by higher drum speeds. The stylus method, incidentally, is probably the best type of recording for experimental work, since you get a recording directly, without a lot of messy developing in photographic chemicals, and since you can see the copy at once you can correct your receiving adjustments as the photo comes in.

The manual for the TXC-1 is NavShips 90168 or 90168A, or Army TM 11-489 or 11-2258.

The TXC-1 includes an 1800 c.p.s. fork unit, very closely controlled for synchronism of the drum speed at 60 r.p.m. A multivibrator can provide 900 c.p.s. alternating current to the phonic wheel motor for operation at 30 r.p.m., and a motor jack is provided into which other frequency power may be introduced to give other drum speeds. This is a useful provision for experimentation, since, in theory, 3,600 c.p.s. could be used to give a drum speed of 120 r.p.m. or 7,200 c.p.s. 240 r.p.m. (These speeds exceed the range suggested in the manual, but probably could be achieved with some work on the motor amplifier to prevent attenuation of the higher frequencies) I mention higher speeds, as the Navy is now using 120 r.p.m. for its weather charts on the high frequency bands and the Air Force is about to shift from 60 r.p.m. to 120. The 240 r.p.m. speed is used for transmission from the Tiros weather satellite.

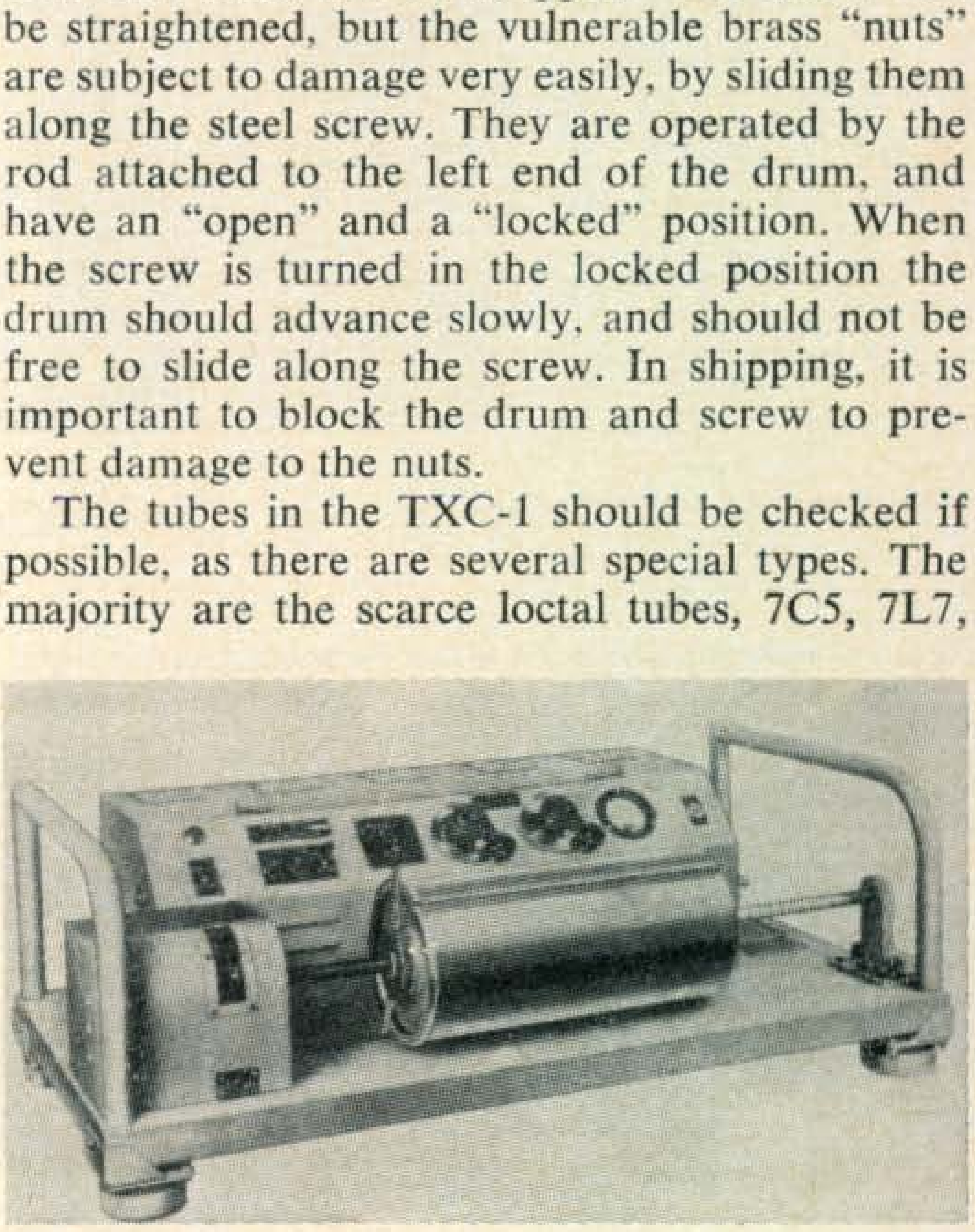
It is possible to receive 240, 180, 120 r.p.m., or any other multiple of 60 r.p.m. on a 60 speed drum, but you will get four pictures, for instance, when receiving 240 r.p.m. on a 60 r.p.m. machine, each picture consisting of a quarter of the lines sent. The redundancy in fax provides a fair reproduction, even with "loss" of three-fourths of the information! See fig. 1, which is a satellite photo of Greenland received on a TXC-1 machine by W1GNS.

I have seen dozens of TXC machines in surplus channels, usually without the PP-86 power supply. It is possible to use the TXC-1 as a receive-only unit without the power unit by building up a 450 volt d.c. supply, but the PP-86 contains important parts of the transmitter lamp driving circuit, so it should be obtained if at all possible.

Since the machine is a mechanical device, in buying one it is important to check vital parts for wear or damage before laying out about $65, which seems to be the price range on these units. The motor should run on 115 volts, 60 cycle a.c., in its unsynchronized mode, an easy test if the power unit is available. If stylus operation is desired, the stylus should be checked—it is behind the drum on the panel below the db meter.

But most important, the lead screw and its half-nuts must not be stripped. The screw can be straightened, but the vulnerable brass "nuts" are subject to damage very easily, by sliding them along the steel screw. They are operated by the rod attached to the left end of the drum, and have an "open" and a "locked" position. When the screw is turned in the locked position the drum should advance slowly, and should not be free to slide along the screw. In shipping, it is important to block the drum and screw to prevent damage to the nuts.

The tubes in the TXC-1 should be checked if possible, as there are several special types. The majority are the scarce loctal tubes, 7C5, 7L7,

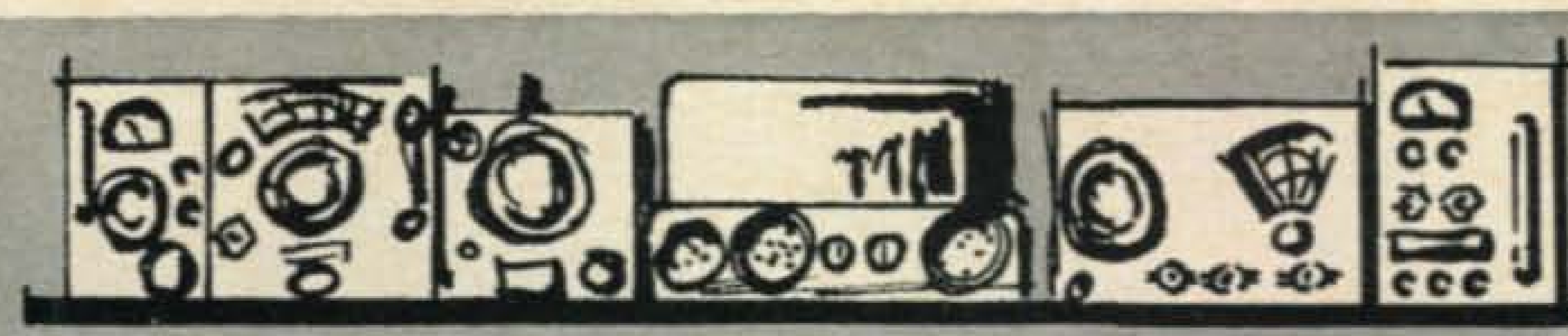


AN/TXC-1 military facsimile transceiver, useful for 30 or 60 r.p.m. reception.

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

[1]"Amateur Reception of Weather Satellite Picture Transmissions," K2RNF, *QST*, November 1965, p. 11. "Copying Weather Pictures via Amateur Facsimile," J. B. Tuke, *CQ*, Aug. 1966, p. 25. "Facsimile Communications for Amateurs," by G. E. White and W. T. Tyrell, *CQ*, Sept. 1966, p. 44.

SURPLUS CORNER



For further information, check number 20, on page 110

For further information, check number 21, on page 110

Fig. 1—Weather satellite photo fo Greenland by the ATP satellite, copied by Normanr Riquier, W1GNS, on the AN/TXC-1 recorder. Despite the fact that the 60 r.p.m. TXC receives only one fourth of the transmitted lines, the picture is still recognizable. This was copied on electrosensitive paper.

etc. There are three 1635 octal-base tubes in the amplifier for the motor. These are power dual triodes, somewhat similar to 6N7's, but they cannot be replaced by the 6N7 without doing damage to the voltage regulator circuit in the set, including melting of the 7C5 plate. . . . The crater lamp for the photographic recording section is a Sylvania R-1130 tube which lists at $23. There is also a #5652 phototube in the transmitting section which is hard to find. The exciter lamp in the transmitter should be a General Electric #1605, but a standard auto headlamp bulb for 6 volts can be used such as Tungsol #1129, or its equal in other makes. This duplicates the electrical characteristics pretty well, but the filament is too wide for best resolution. It does however protect the circuit which would be damaged if operated without the bulb load.

The 884 thyratron can be replaced by a 6Q5. The 5Z3 power rectifier may be a problem if it goes bad.

Paper for the direct (stylus) recording mode can be obtained from Jim Cooper, W2BVE, 834 Palmer Ave., Maywood, N.J. at $1 plus postage for a roll larger than a roll of page paper for a Teletype machine. This paper has a faint graph printed over it, but it is fine for testing a fax machine. Paper may also be bought at $21.50 for a 250 sheet package from Communication Papers Inc., box 1106, Scranton, Pennsylvania 18501.

The TXC-1 can be tested by feeding into its "receiver" jacks an audio tone in the vicinity of 1800 c.p.s., which should give a gray or black line. Any regular audio pulse such as that from WWV can be used for a trial run, without a converter, to see if a pattern is received.

For proper reception an amplitude-modulated tone is required, either direct from the receiver, or as is usual on the h.f. bands, via a converter. As in RTTY work, the usual mode is frequency shift of 800 cycles, with audio swinging from 1500 to 2300 c.p.s. The receiver b.f.o. is of course used to derive the tones from the received carrier shift.

The most common surplus converter is the Times Facsimile CV-172/U, or the commercial version, RGD. There are both plain and -A models of the CV-172, the -A being identical with the commercial RGD, and the difference chiefly in the provision of outputs to either of two recorders in the -A model.

The CV-172 contains a limiter, amplifier, and a tuned circuit which attenuates a 2300 c.p.s. signal between 10 and 20 db more than a 1500 c.p.s. tone, and thus it converts the incoming audio frequency shift to an amplitude-modulated signal. In this unit it passes the shifting audio as well, but the recorder "reads" only the amplitude variations. Tuned circuits in the converter feed an "eye" tube for tuning purposes only. This would be a rather easy circuit to duplicate at home, much easier than an RTTY converter.

The CV-172/U book is NavShips 91394. At one time Westrex could provide copies of the RGD book. None of the tubes used in the converter are at all hard to find. A slightly revised version of the unit was given Navy number CV-1066/UX. The Army manual for the CV-172 is TM 11-5101. The CV-172 has been available from Tallen Co., 300 7th Street, Brooklyn, N.Y.

The TXC-1 itself has been available at Anker Electronics, Box 26, Wilkes Barre, Pennsylvania, 18702, and from Alva Radio, 3101 Pico Blvd., Santa Monica, California. Harry Gartsman, W6ATC at Alva would swap Fax gear for UPX-5 or APA-89 units.

The FX-1 is a transceiver much similar to the TXC-1, except that it operates at the odd speed of 90 r.p.m. The PE-140 or PE-150 power supply is similar to the PP-86 used with the TXC-1. This is the chief unit in the RC-120 fax set. The book is TM 11-489, or TM 11-375B.

The CNP, or TT-29/FX is a 100 r.p.m. fax set, built by the old Acme Newspictures Co. Acme built the FOA, also a 100 r.p.m. machine, for which the book is NavShips 95004 or 95005. The FOC is the third Acme-built Navy machine, also 100 r.p.m. All three Acme units are set up for photographic reproduction only. One of the most flexible Fax machines is the Acme FNP-IS, which may be available from the press services from time to time. It provides many speeds, including 60 and 120 r.p.m., and photographic reception only.

The current late-model military fax receiver is the RD-92, and the RD-92A. This is a Westrex machine, designed for either table top or 19 inch rack mounting. The RD-92 provides 60 r.p.m. speed, and is set up for stylus recording only. Some RD-92-A units have either 90 or 120 r.p.m. speeds, but are otherwise identical to the earlier set. The NavShips book is 91401. The RD-92 is much more modern than the TXC set, more compact, but is of course receive-only. The RD-92A is also designated RO-172/UX in some cases, which is always a 120 r.p.m. set.

Other late Navy gear includes the AN/GXH recorder, which is primarily a data receiver, and the AN/UXH-2, a fax set operating at 60, 90 or 120 r.p.m., stylus type recording. The AN/GXC sets are special units, operating at odd speeds, but might be capable of conversion to standard specs.

The CV-2C/TX is a transmitting-receiving converter-keyer for Fax, adjustable to various speeds and shifts. The manual is TM 11-489 or 11-2252A. The KY-44/FX is a transmitting-only keyer for Fax, which converts the input from the fax machine to frequency shift for the h.f. transmitter. Books are NavShips 91441, 91877, and 91627.

The MD-168/UX is a recent transmitting converter for Fax, its book is NavShips 91629.

There are other, commercial Fax sets, built by Muirhead, Alden, Westrex, Xerox, and other companies, but most are in the same price range as a #28 ASR Teletype machine, several thousand dollars, making surplus the logical source to start amateur work.

As I mentioned, the military services use 60 and 120 r.p.m. transmission now, and will be all 120 r.p.m. in a year or two. Much weather data is sent now on 60 r.p.m., and most press photo transmissions are at 60 revolutions. The National Aeronautics and Space Administration is using 240 r.p.m. for satellite work. Other speeds are used in Europe and for specialized services. The most critical item in Fax is the drum speed, which must be accurate at within a few parts in a million for successful transmission and reception.

U.S. Weather fax transmissions by the Navy's network are listed in Hydrographic Office publication 118 A and B, which also lists RATT (Teletype) and X CW transmissions.

NSS, the Navy's Washington station, transmits 120 r.p.m. Fax on 3357 kc, 8081 kc, and 20,015 kc throughout the day. The Air Force's KWAF station in Washington transmits at 60 r.p.m. on 6912.5, 4793.5, 10,185, 12,201, 19,955 and 14,672 kc also throughout the day with weather charts.

Tiros data can be obtained from the U.S. Weather Bureau in Suitland, Maryland, or from NASA.

A good manual on FAX reception is NavPers 10857, which is old, but good if you can find it.

I have been asked for data on the AN/TRC-7 set by many amateurs and the following table was provided by W4KJQ:

Crystal Data for AN/TRC-7
(Taken from TM 11-617)

The i.f. for the AN/TRC-7 is 12 mc.
The formula for the receiver crystals is:

$$\text{Crystal Freq (kc)} = \frac{1000\ (\text{carrier freq} - 12)}{\text{harmonic}}$$

For the transmitter, the crystal frequency is 1/18th of the carrier output of the receiver, the harmonic used is as follows:

carrier:	
100-107.99 mc	11th harmonic
108-115.99 mc	12th harmonic
116-123.99 mc	13th harmonic
124-131.99 mc	14th harmonic
132-139.99 mc	15th harmonic
140-147.99 mc	16th harmonic
148-155.99 mc	17th harmonic

I have heard from Telemethods International, Box 18161, Cleveland, Ohio, that they are offering very clean test gear for RTTY, specifically

[*Continued on page 96*]

regularity and freedom from failure which is the absolute condition of their public utility.

"*I cannot help thinking that* the time has arrived for a little more generous appreciation by his scientific contemporaries *of the fact that Marconi has by minute attention to detail, and by the important addition of the long vertical air wave, translated one method of space telegraphy out of the region of uncertain delicate laboratory experiments and placed it on the same footing as regards certainty of action and ease of manipulation, so far as present results show, as any of the other methods of electric communication employing a continuous wire between the two places.* This is no small achievement. *The apparatus, moreover, is ridiculously simple and not costly. With the exception of the flagstaff and 150 ft of vertical wire at each end, he can place on a small kitchen table the appliances, costing not more than 100 pounds in all for communicating across 30 or even 100 miles of channel. With the same simple means he has placed a lightship on the Goodwins in instant communications, day and night with the South Foreland lighthouse. A touch of a key on board the lightship suffices to ring an electric bell in the room at South Foreland, 12 miles away, with the same ease and certainty with which one can summon the servant to one's bedroom at a hotel. An attendant now sleeps hard by the instruments at South Foreland. If at any moment he is awakened by the bell rung from the lightship he is able to ring up in return the Ramsgate lifeboat, and, if need be, direct it to the spot where its services are required, within a few seconds of the arrival of the call for help. In the presence of the enormous practical importance of this feat alone, and of the certainty with which communication can now be established between ship and shore without costly cable or wire, the scientific criticisms which have been launched by other inventors against Signor Marconi's methods have failed altogether in their appreciation of the practical significance of the results he has brought out.*

"The public, however, are not in the least interested in learning the exact need of merit to be apportioned to various investigators in the upbuilding of this result. They do, however, want to know whether the new method of communication across the Channel established by the expenditure of a few hundred pounds will take the place to any considerable extent of submarine cables which have cost many thousands of pounds to lay and equip. They do also desire to learn what reasons, if any, will prevent every lighthouse and lightship round our coasts from being forthwith furnished with the necessary apparatus for placing it in instantaneous and secure connection with the mainland. They also hope to hear that the methods can be applied to enable ships to be able in addition to communicate instantly in case of need with shore stations. To understand how far these things can be done and to appreciate the necessary or present limitation of the method, it is requisite to explain that each vertical wire or rod connected to a Marconi receiving or sending apparatus has a certain "sphere of influence." Signor Marconi has proved by experiment up to certain limits that the distance to which effective signalling extends varies as the square of the height of the rod. A wire 20 feet high carries the effective signal one mile, 40 feet high four miles, 80 feet, 16 miles, and so on. Up to the present time he has not yet discovered any method of shielding any particular rod so as to render it responsive only to signals coming from one station and not from all others within its sphere of influence. [Note: This was accomplished shortly after this by using Lodge's patent on coil and capacitor tuning.] *In spite, however, of what has been said, there is no inherent impossibility in attaining this desired result. At present all signals sent from the South Foreland to France affect the receiver on board the Goodwin lightship. But this offers no difficulty. In an ordinary electric bell system in a hotel the servant recognises the room from which the signal comes by means of a simple apparatus called an indicator, and a very similar arrangement can be applied to distinguish the origin of an ether wave signal when several instruments are at work in a common region. Subsequent inventions, as also perhaps the promulgation of some necessary Board of Trade regulations for the use of the ether,* [we have them now!] *will prevent official ether wave receivers from being disturbed by vagrant electric waves sent out by unauthorised person in their neighborhood. The practical upshot, however, of the matter is that at present if more than two stations are not established within certain regions these stations can communicate with each other freely and regularly by means of ether wave signals sent out and received by long vertical rods or wires. No state of the atmosphere, and neither darkness nor storm, interrupts, so far as yet found, the freedom of communication.*

"Up to the present time none of the other systems of wireless telegraphy employing electric or magnetic agencies have been able to accomplish the same results over equal distance. Without denying that much remains yet to be attained, or that the same may not be affected in other ways, it is impossible for anyone to witness the South Foreland and Boulogne experiments without coming to the conclusion that neither caption criticism nor official lethargy should stand in the way of additional opportunities being afforded for further extension of practical experiments. Wireless telegraphy will not take the place of telegraphy with wires. Each has a special field of operations of its own, but the public have the right to ask that the fullest advantage shall be taken of that particular service which ether wave telegraphy can now render in promoting the greater safety of those at sea, and that, in view of our enormous maritime interests, this country shall not permit itself to be outraced by others in the peaceful contest to apply the outcome of scienific investigations and discoveries in every possible direction to the service of those who are obliged to face the perils of the sea. If scientific research has forged a fresh weapon with which in turn to fight Nature "red in tooth and claw," all other questions fade into significance in comparison with the inquiry how we can take the utmost advantage of this addition to our resources."

In appreciation for the item, Marconi sent Prof. J. A. Fleming a telegram on April 7, 1899: "Glad to send you greetings conveyed by electric waves through the ether, from Boulogne to South Foreland, 28 miles, and thence by postal telegraph-Marconi."

It is noted that the Editor of the *Times* heartily endorsed the Professor's view, that time had arrived for more appreciation of Marconi by his contemporaries.

Suggested Controls

Signalling continued at South Foreland across the channel to Wimereux, amidst hail, snow and thunder storms. Visitors came from all over the world to witness. A deputation from Brazil wanted a network on the Amazon River. The U.S. War Dept. wanted experiments at Ft. Meyer, Va., and a syndicate wanted to acquire the W.T. Co. for sole rights of establishing communications between England and America. Everyone was excited.

There was talk about controlling wireless and issuing licenses by the G.P.O. to keep interference down. Others wanted no government restrictions. Theory and arguments were projected on how wireless worked, and of its future. The public demanded descriptions of the stations. April of 1899 was an exciting month for Marconi, and he did write a full technical description of the station on South Foreland for the *Electrician Magazine*. He said:

"The instrument room at the lighthouse is on the ground floor, and was formerly used as the kitchen. The apparatus was two sets of coherers, and induction coil, transmitting and receiving apparatus upon a small table. The battery power is largely in excess of the requirements, to avoid the necessity of frequent replacement, for the transport to this isolated spot has to be considered. The

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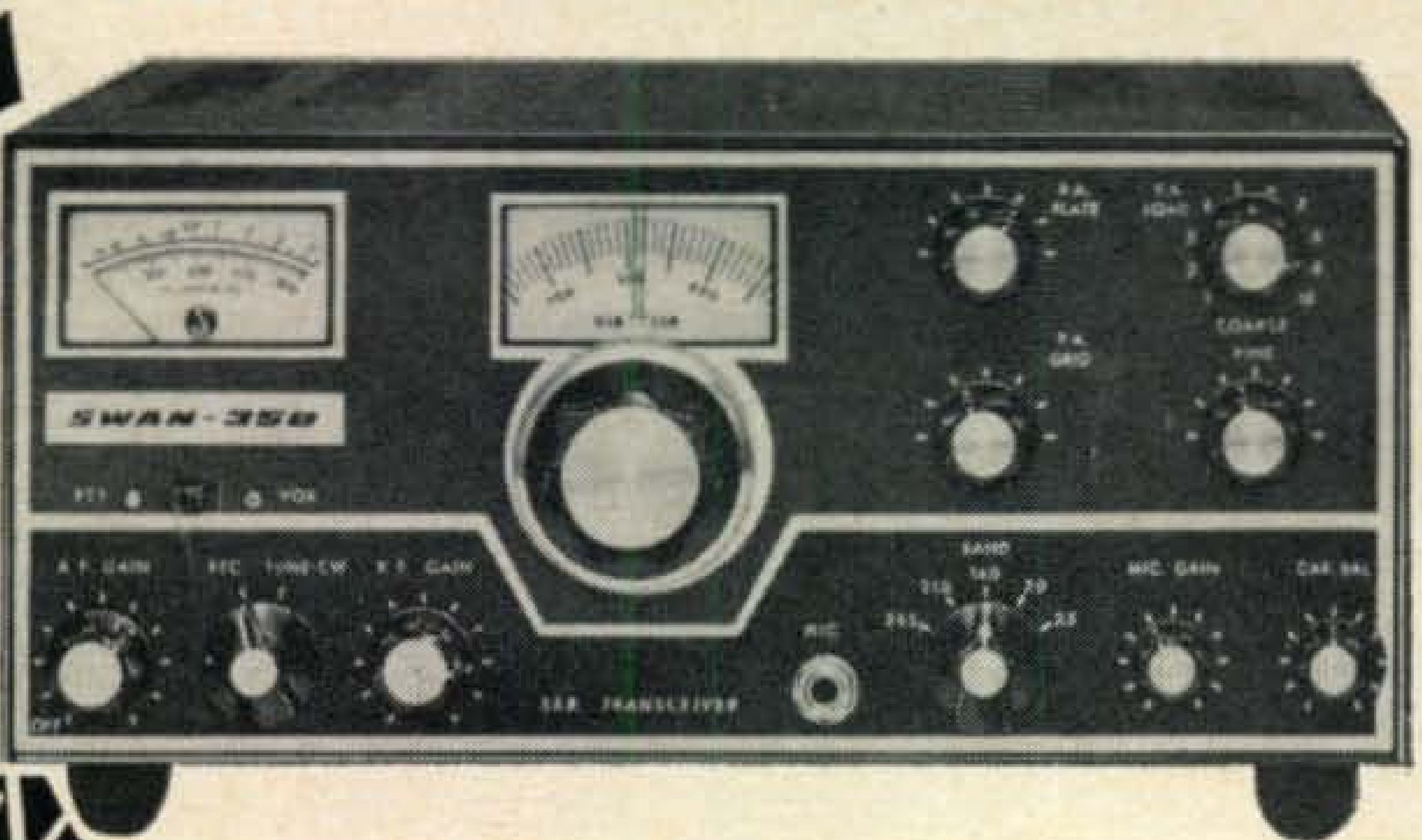

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transmitter and receiver is of new design, and automatically connects up the receiving instruments when not in use for transmitting. The length of spark in the coil is, ¾ inch. The signals received, both from the lightship and Wimereux, are very clear Morse dots and dashes, and, in addition to the Morse inker a loud bell circuit is available, which enables the attendant to read the signals without the aid of the printed record. When the bell circuit is on, this printed record is somewhat less perfect. It may be added that Mr. Marconi has found that no message can be received by the present apparatus when the shunts are taken out. A speed of 14 to 15 words per minute is obtained at the lighthouse by expert operators, and higher speeds by very expert operators. It is said that some of the French operators have reached 20 words per minute. The mast on South Foreland is 150 high, in three lengths. The cross piece was fixed for experimenting with a double wire, but not used in ordinary working. The equipment is in no way disturbed by the lighthouse arc lamp or electrical machinery which has been running for about 27 years."

The Souh Foreland wireless station was situated at a remote spot on the higher cliffs between Dover and St. Margaret's Bay, at a point where for mlies around the intruding stranger could be observed by the occupants of the South Foreland lighthouse. It might be assumed that the object of the W.T. Co. was to keep the experiments being made in wireless safe from the prying eyes of the inquisitive. But this was far from being the case. Having gained the summit of the cliff the presentation of a card gained the visitor ready access to the miniature station (if it can be styled by such a dignified term). Here Mr. Bullock and another assistant keep watch and ward over the simple apparatus employed in the manipulation of telegraphic messages between the South Foreland light and the Goodwin on one hand, and between the South Foreland light and the French station at Wimereux. All was strikingly simple.

The South Foreland lighthouse is classic ground to the electrical profession. It was here that John Tyndall made his famous investigations into relative merits of electricity, coal gas and oil as illuminants, and where Hopkinson and Adams tested their alternators.

Throughout April 1899, Marconi was constantly trying new devices, and made measurements on a moving vessel, the S.S. Ibis, in the channel. Antenna tests were made with reflectors. He also decided there is no advantage gained by erecting the antenna on top of a cliff instead of setting up on the beach. Real progress is only made in shorter stages and he had no thought of contacting Paris or even the United States at this time. The maximum distance was 70 miles, and he warned the public to be on guard against premature statements through unauthorized channels.

Signal Selection

On the last of April, Marconi announced that within the past few days he had made what may turn out to be an important advance by regulating his transmission so that signals from other stations do not interfere with each other. Here is the announcement in the *Electrician*, dated April 28, 1899.

"A development of more than usual interest, and one that should be of supreme importance, is announced this week in connection with Marconi telegraphy; namely, that cross-signalling has been eliminated. *Undoubtedly the interference liable to arise from wireless stations, other than a given pair seeking communication, has hitherto been one of the most serious of obstacles.*

Naval Experiments

By July, 1899, England led the world in signalling. Marconi was devoting his time to the British Navy and was stationed daily on the "Juno", mainly because the vessel was commanded by Captain Jackson, who for a long time had been devoted to the subject of wireless telegraphy. The newspapers said:

"A great deal of secrecy is observed on the 'Juno'. Mr. Marconi is being kept under lock and key so far as the Press is concerned. It is the quaint tradition of the Navy that no publicity be given regarding even the most innocent experiments, the equipment having been moved into the Captain's cabin to secure more privacy."

Information on the Naval tests were not revealed until Aug. 18, when the commanding officers of the "Alexandria," "Europa," and "Juno" gave the result of the general experiments. *A new distance record of 74 miles had been set!*

It is interesting to note from a news item on Aug. 11, 1899, that the Marconi system was being installed in the Hawaiian Islands for communication between the Islands.

American Yacht Races

On Sept. 15th, the New York Herald completed arrangements with Marconi to erect a set of equipment on a steamer, which would follow the races between Mr. Lipton's yacht, the "Shamrock" and the American boat "Columbia," and report the race results. Mr. Marconi left for America to supervise the installation, but before he left, made the announcement that the French government had bought the Wimereux station, and his system was being installed in Trinidad. Also, a station with 200 foot high masts was being installed at Harwich, Eng. to communicate with channel steamers. Two stations could now operate on the ether without interfering with each other.

During the yacht races Marconi handled 1200 messages. The U.S. Navy asked for a test on the U.S.S. New York and U.S. Massachusetts and between the Fire Island light, a distance of 12 miles. Back in England typical messages were being flashed back and forth to the lightships: "Message: What kind of night is it on Goodwins? Are you all right? Do you want the lifeboat sent? Reply at once. Sig. Town Hall, Dover." "Reply: Fresh breeze here, well, wind west, number five breeze, no we don't want the lifeboat. Sig. Asby, lamplighter."

High Power

A news item on Sept. 29, 1899 read as follows:
"Flash, it appears beyond question that signals transmitted to Dover from Wimereux were detected at Chelmsford, the intervening distance being 90 miles."
This was a new record and Marconi was rushing back to England to suggest to the company directors he needed 25,000 watts for Prof. J. A. Fleming and R. N. Vyvyan to construct a large transmitter. The greatest power being used at the time

was 250 watts. *Marconi was going to try span the Atlantic!* The money was not granted, however, until July 1900. The transmitter was not tested until Jan. 1901 after many problems from the masts coming down. Marconi was jubilant; the first contact was with Crookhave, Ireland 225 miles away.

An interesting observation was made of the Poldhu site by Mr. E. Malkin, who in his younger day was in the British Navy. Needing some seamen to help with the antennas he was sent ashore with the working party:

"After getting ashore at a nearby cove we went in search of what remained of the Marconi station after the gale of Sept., 1901, which had wrecked the original installation. This had consisted of twenty masts, each of which were joined together in four lengths, reaching 200 feet in height. All that remained of the antenna system after the disastrous gale, were ten masts of four by three inch timber, bound together in three lengths to a height of about 180 feet. Our boat's crew was far more interested in their original purpose. The ten masts were set up in an arc of a circle, with a Triatic stay on top, from which hung the antenna wires, converging at the bottom into a fan shape. The station itself, which we were not permitted to approach, was powered by an oil engine, judging by the exhaust smell."

The rest is history. Marconi left for Newfoundland, Nov. 25, 1901, on the S.S. Sardinian; he was ready to send across the Atlantic ocean. All this in a six year period from his beginning experiments. It was a lifetime.

On Dec. 9th the station in Newfoundland was listening for Poldhu on 960 meters. The signal was heard shortly after noon, Dec. 12th, 1901. G.M. was now 27 years old. The world was told of the test by a press release on Dec. 15,, 1901, that the first message by wireless had crossed the ocean. ■

Contest Calendar [*from page 80*]

scores, but will have one in the next issue.

If the c.w. week-end is equally good, and it could very well be if George's forecast is on the nose, this will indeed be a successful year.

A couple of coming events have not come thru with an announcement so I am unable to give you anything on the REF contest and a couple of state parties. Information in this column is also circulated to overseas publications so they actually are missing out on quite a bit of publicity.

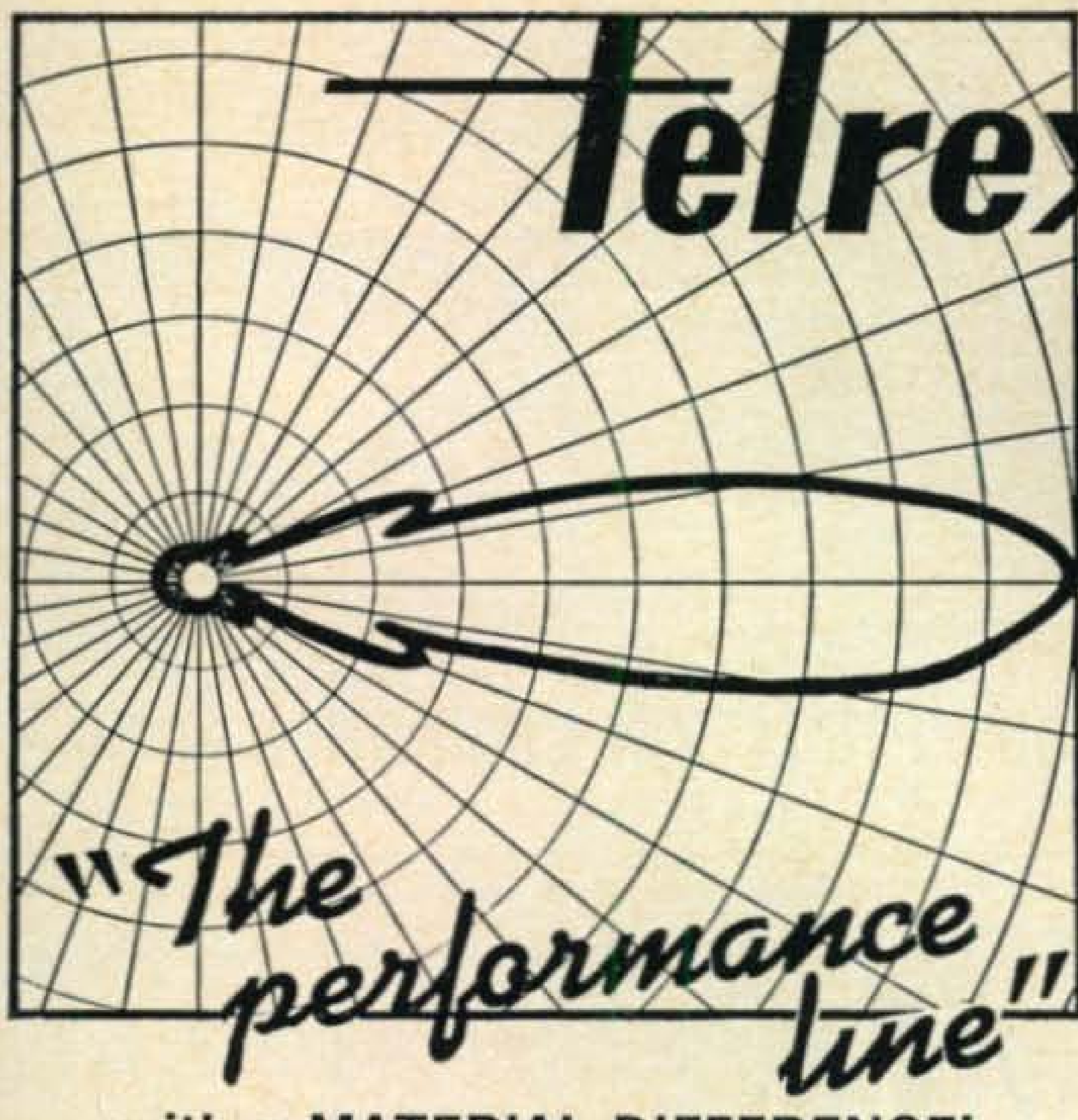
If you haven't already mailed in your contest log, time is running out on you. And we always welcome a good photo of your station, especially one taken in connection with the contest.

73 for now, Frank W1WY

Surplus [*from page 91*]

the TS-2/TG test generator and the OCT-2 Frequency shift monitor calibrator. Telemethods carries a large line of #28 and older teleprinter gear and test sets. Anything you need in that line, ask them about it.

The amateur with an interest in RTTY might be interested in looking at the *RTTY Bulletin*, a monthly publication run for many years by Merrill Swan, W6AEE. RTTY is now being taken over by Dusty Dunn, W8CQ, at box 837, Royal Oak, Michigan. Subscriptions are $3 a year. ■



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For further information, check number 30, on page 110

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Letters [*from page 6*]

I have to produce a 64 page catalogue annually and think I can appreciate the work that must go into *CQ* all the time.

I think you do a great job and am certainly very proud to be an occasional contributor on the cartoon side.

J. Worthington, G3COI
Wolverhampton, England

Feels good to know someone appreciates the job you're doing each month. Of course, *CQ* is hardly unique in its production problems, but it doesn't make the problems any less knotty. —*K2MGA*

Noise Generators [*from page 32*]

The generator output is then activated to produce twice the original noise output (3 db increase on the db scale of a v.o.m. or v.t.v.m.). Noise factor is then equal to 20 *IR* where *I* is the diode plate current and *R* the diode load resistance (equal to receiver input impedance). Note that for $R = 50$, Noise factor simply equals *I* (in ma). Noise factor may be expressed in db by referring to a db power graph.

The accuracy of this method is probably 10-20%. It is certainly sufficient to tell whether a preselector, converter, etc., can meet its basic design objectives and to compare different circuits, components, etc. The most important caution to observe when making measurements on a receiver is to be sure all stages are operating in a linear range (including audio stages if output is measured at that point). A.v.c. and limiting circuits, for instance, must be turned off.

Other Uses of Noise Generators

Another handy use for a noise generator is to make attenuation measurements; for instance, to see whether an old piece of coax cable still has low attenuation. The generator is connected to one end of the coax and the other end to a receiver tuned to the desired operating frequency. The generator output is noted on the receiver and then the generator connected directly to the receiver, without changing any control settings. The difference in db reading on the receiver "S" meter gives the approximate attenuation of the cable.

Another extremely interesting use of such a generator is for antenna tuning experiments. The generator is connected through an s.w.r. directional coupler to the antenna or antenna coupler to be adjusted. A receiver, tuned to the desired adjustment frequency, is connected to the reflected voltage output of the directional coupler. The antenna circuit is then adjusted for minimum receiver output which, of course, is equivalent to minimum s.w.r. This method certainly saves final tubes during adjustments as well as reducing unnecessary QRM on the bands.

The approximate shape and characteristics, such as cutoff frequency, for low-pass and band-pass filters can be approximately determined by connecting the filter between the generator and a receiver. The receiver is tuned through its frequency range and a graph made of the receiver output level. ■

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No ads from commercial enterprises, please. This service is designed to aid the cash-tight **amateur** only!

The publisher reserves the right to refuse any ad he feels is unfairly deceptive or unsuitable for an amateur magazine. He also reserves the right to withdraw this offer without notice.

For further information, check number 5, on page 110

Phillips Code [*from page 55*]

Phillips make-up pass daily over numerous manual telegraph circuits. The code has been revised from time to time by various telegraphic experts as the need arose but is basically still that of Walter Phillips.

Adaptation to radio usage came into being with the first commercial use of wireless communication. Many of the pioneer ship and shore station wireless operators were initially recruited from the ranks of wire telegraphers and they took their knowledge of Phillips with them. The early day ham was quick to adopt this short-cut method and, in the intervening years has slightly modified some groups to make them more adaptable to his operations. For example, the abbreviation *abt* used universally by the ham to indicate 'about', appears in Phillips as merely *ab* . . . Phillips uses *abt* to mean 'about the'. *Tx* as used by hams to signify 'transmitter', appears in Phillips as 'this is'. *Rx*, the ham expression for 'receiver' is interpreted as 'recommend' in Phillips! There are of course, many abbreviations of more complicated nature such as *saik* meaning 'shot and instantly killed', *scotus* for 'Supreme Court of the United States', *ufp* designating 'under false pretenses' and many others. While these are frequently used in press dispatches, they hardly appear as part of ham conversation!

For those hams who are interested in broadening their knowledge of this very convenient radio short-hand, a copy of the Phillips code is a 'must" for their shack. To the best of our knowledge there is but one source for the complete list. The Vibroplex Co., 833 Broadway, New York 3, N. Y. publishes the complete book known as *The Phillips Code—TCR Edition* and which contains as well a world time chart, Q signal list and the Japanese, Arabic, Turkish, Greek and Russian radio telegraph codes in addition to both the American and International Morse. You'll find this little volume at $2.85 postpaid to be a very valuable aid in increasing your radio operating speed and proficiency. BCNU!

Space Signals [*from page 29*]

from the ground. Telemetry signals usually consist of two or more musical tones transmitted at the same time, or in the case of the Russian Cosmos satellites, of a series of dots and dashes of different length.

Inclination and period data are included in the following table as a further aid in identifying satellites from which signals can be received. Inclination is the angle that the satellite's orbit makes with the equator. If a directional antenna is being used to receive satellite signals, the inclination data can be used for determining the direction from which the satellite's signal should be heard first. The satellite's period is the time it takes, in minutes, for the satellite to complete an orbit. By timing reception on successive orbits, it is often possible to identify the satellite by its known period. ■

For further information, check number 49, on page 110

For further information, check number 31, on page 110

For further information, check number 32, on page 110

For further information, check number 33, on page 110

The I.C. C.P.O. *[from page 57]*

other. The 50K tone control is on top, next to the I.C. All other components, battery, transformer and emitter bias network are mounted inside of the chassis.

Results

A clear, stable tone is obtained from the unit with volume suitable for individual use, or practice in small groups. Tone can be varied to suit personal preference by adjustment of the control. Keying is clean and will follow any speed the operator cares to employ. ■

Power Supply *[from page 59]*

is very important for good dynamic regulation. Each unit should be at least 100 mf for total current loads up to 200 ma and 200 mf each for loads up to 500 ma.

The rating of the TV transformer or isolation transformer can be determined by taking either ⅓ of the peak power input of the transceiver or ½ of the c.w. input, whichever is greater. Isolation transformers are usually rated directly in watts (or VA) and for a TV transformer can be taken as half the total secondary voltage times the secondary current rating. I have used this method with a number of transformers and always found the power rating so determined to be adequate for normal operation.

C.W. Monitor

Figure 3 shows a c.w. monitor which is conveniently built into the same housing as the power supply and speaker if a transceiver lacks this feature. An example of the construction of a power supply is the one shown in the photographs. It was initially used with a HW-32 and later with a Swan 350. The transformer used is a 150 watt isolation type in the circuit of fig. 2. Most of the components are mounted on the small aluminum plate which is fastened to the isolation transformer bolts. One filter capacitor is mounted with an insulated ring. The c.w. monitor tube mounting is clearly makeshift; enough space for it should have been provided on the aluminum plate (as well as a vr tube when required). The speaker is mounted on a small piece of ¼″ plywood which in turn is placed over the louvered side of the cabinet case. The headphone jack is wired in series with the speaker.

The cabinet shown is a power system transformer box. However, utility cabinets, with a few ventilation holes drilled, also make good, inexpensive housings. A good power cable to use is Belden 8449 nine conductor rotator/control cable, using the two larger conductors for the filament supply. ■

For further information, check number 34, on page 110

FP8AS Calling *[from page 62]*

cold Labrador Current meet not too far away which is the basic cause of so much fog. However, the temperatures don't reach the extremes with the result that during the summer it rarely exceeds 80 degrees F. and 14 degrees F. in the winter although on the very rare occasion it might possibly reach 0 degrees F. The port is completely ice free. There are a multitude of fishing boats and freighters utilizing both engines and/or sails. Many Spanish Basque fishermen are here, also, and speak only the Basque language. A knowledge of French is of tremendous aid but if you don't speak or understand it you can get by as a goodly number of the local population understand English. The people are extremely hospitable and friendly.

Up until 1958 the only way one could get to St. Pierre from the United States or Canada was by boat. But, these boats had no set schedule. Since these French islands are not self-sustaining they must depend on imports and that is the position these two boats, the Miquelon and the Langlade, play in the economy. Passengers had been secondary. When the holds were full—whether it be coal, foodstuffs, cattle, etc.—they sailed. If there were passengers waiting all well and good. If not, all well and good, too. Needless to say that under such conditions there wasn't much of a tourist trade to St. Pierre et Miquelon.

However, in 1958, two enterprising men from North Sydney, N. S. took the gamble on chartering a DC-3 and a Cessna 310-B for daily flights from Sydney to St. Pierre and return. Their names? Camille and Sam Goora. And, did this "gamble" pay off. Furthermore, what it did for the economy of these Islands is beyond words. The number of tourists has skyrocketed. Flights are maintained throughout the 12 months of the year. In order to reap some of the benefits from this tourist boom the boats above mentioned commenced a regular schedule. in 1963 leaving Sydney every Wednesday and St. Pierre every Monday. And, for the 1964 tourist season the French Government plans to put into service a new, modern 1,000 ton vessel.

The St. Pierre coast is rugged but beautiful. The cliffs rise 400 to 600 feet right straight up out of the sea. But, the town of St. Pierre, itself, can be seen spreading out over a gently sloping hillside in the shadow of the rugged hills. Yes, rugged but beautiful; rocky and, perhaps, barren. For the most part there is only scrub growth on the island of St. Pierre but it is all so different from anything I've ever experienced before. As yet I have not visited Miquelon or Langlade which, from all I've heard, are beautiful with full grown forests, lakes, fresh water streams. Maybe the next time I visit these isles I'll have the opportunity to give a more detailed description of the entire 93 mile archipelago.

Reasonable? Oh, my goodness! Jan and I had three rooms; we also had three TREMENDOUS meals a day with wine (actually, by far, more food—meat—than we could possibly eat) yet for all this the charges for the 11 days at the New Royal Hotel under the ownership of M. and Mme. William Miller came to but $62.15 or $5.65 per day.

Our idyllic St. Pierre DX-fest lasted September 2 to 13 (Friday, the 13th). And, we experienced no trouble whatsoever in leaving the Island by plane. The morning of our departure dawned clear and beautiful. Our little Cessna 310-B was there awaitin' us and off we took. This was the first time I saw these islands from the air and it was a sight I'll long remember.

Enjoyable? Ah yes! Where else from this area can one go these days for a vacation to a "new" country, enjoying life and your favorite hobby to the hilt? I hope it won't be too long before I have the opportunity to go back.

Should any of you readers envisage a trip to this "far off land" may I be 100% emphatic about this one point. DO NOT apply to the French government in Paris for permission to be licensed to operate FP8. Direct all your inquiries to M. Gus Roblot, FP8AP, St. Pierre et Miquelon Islands, via Sydney, Nova Scotia, Canada—or to me.

In closing please let me pay tribute to Gus Roblot in this fashion. He is of such help to everyone and so friendly I'm sure St. Peter (St. Pierre) will have a special seat reserved on his right for him and all hams will get a most friendly greeting as they pass through those Pearly Gates.

For further information, check number 13, on page 110

ANNOUNCIN

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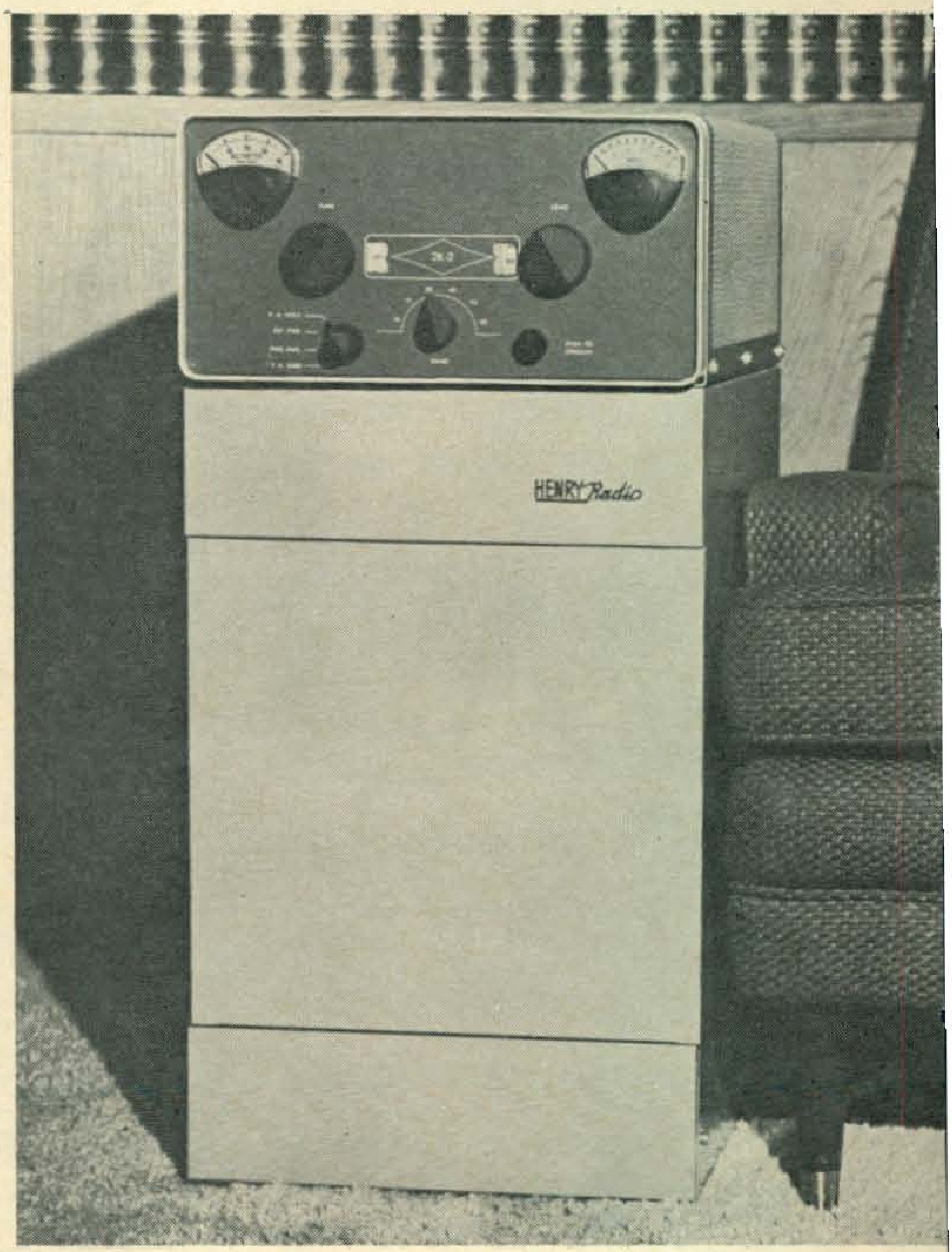

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Ham Shop

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WANTED: Gonset Super Six converter, reasonable. Raymond Fisher, Box 234, Charleroi, Penna. 15022.

SELL: HT 37, $200.00, excellent condition; WAØLGU; Box 158; Hector, Minn.

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AUTHORS MODEL HETROCITER described in March '63 CQ, $45.— W6BLZ, 528 Colima, La Jolla, California 92037.

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WANTED—interested in homemade equipment, Novice-General. Radio Amateur, 338 Sierra, Moorpark, California.

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FOR SALE—75A-4 receiver, serial no. 5721, two filters, 3-6 kc. Excellent condition with separate rack mtg. brackets. $450.00. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

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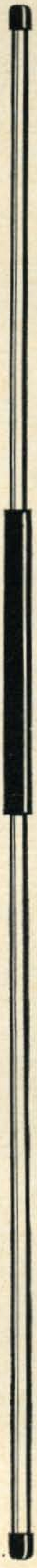

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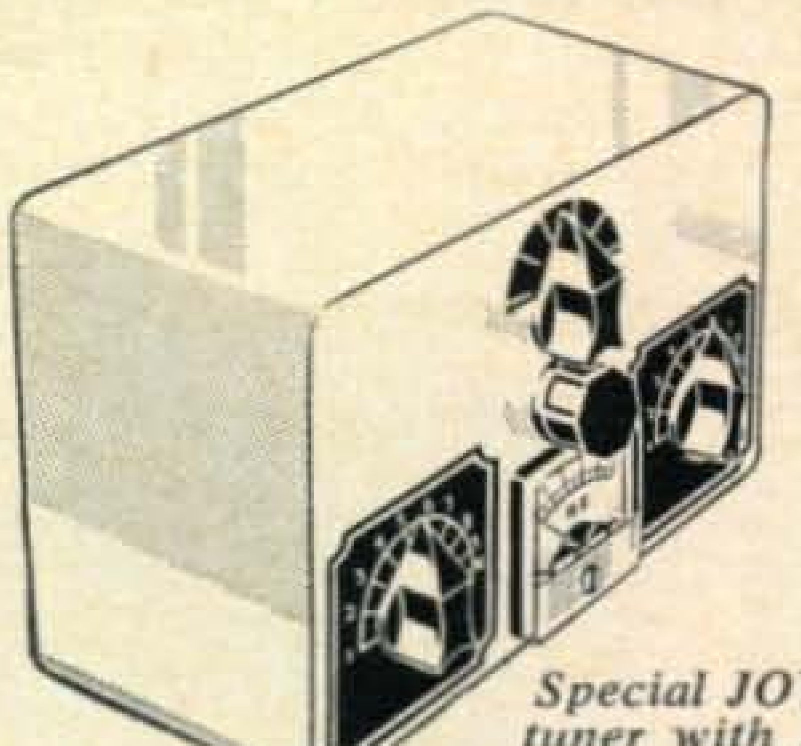

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