August 1964
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CQ

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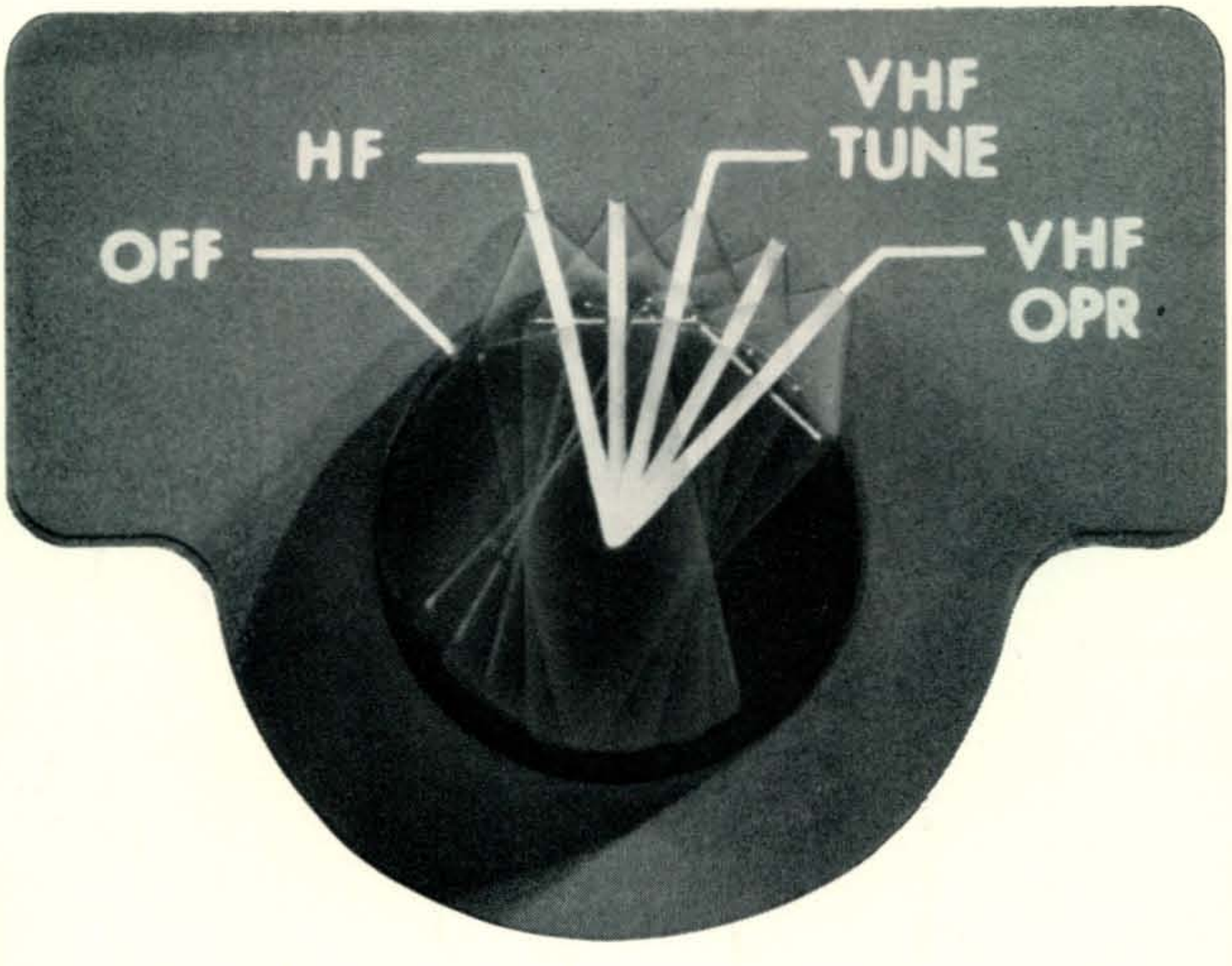
LASERS

The Radio Amateur's Journal



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Flick the switch and you're on VHF. With Collins 62S-1 VHF Converter you can transmit and receive on 6 and 2 or HF without changing cables. Think how great it will be to escape the crowds on the lower bands. The 62S-1 gives you eight full megs of bandwidth. You'll be able to work people you've never been able to reach in the past. You'll be able to get more local QSO's. You'll have the cleanest VHF signal on the air. And you'll have both bands from one self-contained unit. When used with the KWM-2, you don't need an additional power supply. You can use the 62S-1 to cover 49.6 to 54.2 and 143.6 to 148.8 mc (crystals for amateur bands provided). Incidentally, Collins 62S-1 will convert most equipment operating in the 14.0 to 14.2 mc range. Visit your Collins distributor and ask him to demonstrate the 62S-1 VHF Converter. Then ask him about Collins S/Line trade-in value. You'll be pleasantly surprised to find out how little it costs to operate the finest.

COLLINS

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FUNDAMENTAL, PR TYPE Z-2—Frequency Ranges in Kcs.: 3,500 to 4,000 (80-M); 7,000 to 7,425 (40M); 8,000 to 8,-222 (2M); 8,334 to 9,000 (6M) ± 500 Cycles . . . $2.95 Net

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Since 1934, amateurs everywhere have applauded the fine dependability, high output, economical operation, and hair-line accuracy of PR Crystals. These qualities are assured by precision workmanship at every stage in manufacture. The photograph above shows a section of the Finishing Room, where PRs are plated, assembled, soldered, and boxed. Shown are several of the 22 Beckman, Hewlett Packard and C.M.C. Frequency Meters used to check the exact frequency of every PR Crystal. These meters have an accuracy of better than one part in ten million! Put PRs in your rig today. You'll have the finest precision frequency control that money can buy. Your jobber has them for you.

PR Crystals

Since 1934

USE PR AND KNOW WHERE YOU ARE

PETERSEN RADIO COMPANY, INC.
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For further information, check number 1, on page 110

All this performance for only $650.00!

Full amateur band coverage, 80 through 10 meters • Hallicrafters exclusive new R.I.T. (Receiver Incremental Tuning) for ± 2 kc. adjustment of receiver frequency independent of transmitter, and AALC (Amplified Automatic Level Control) • Receiver AF gain and RF gain controls • SSB operation, VOX or PTT . . . CW operation, manual or break-in • 1650 kc. crystal filter . . .

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Frequency coverage: Eight-band capability — full coverage provided for 80, 40, 20, 15 meters; 10M crystals furnished for operation on 28.5 — 29.0 Mc. Other crystals may be added for full 10 meter coverage without adjustment. Available for operation on specified non-amateur frequencies by special order.

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General: Dial cal., 5 kc.; 100 kc. crystal cal.; VFO tunes 500 kc.; 18 tubes plus volt. reg., 10 diodes, one varicap. Rugged, lightweight aluminum construction (only 17½ lb.); size—6½" x 15" x 13".

Transmitter Section: (2) 12DQ6B output tubes. Fixed, 50-ohm Pi network. Power input—150W P.E.P. SSB; 125W CW. Carrier and unwanted sideband suppression 50 db.; distortion prod., 30 db. Audio: 400-2800 c.p.s. @ 3 db.

Receiver Section: Sensitivity less than 1 μv for 20 db. signal-to-noise ratio. Audio output 2W; overall gain, 1 μv for ½ W output. 6.0 — 6.5 1st I.F. (tunes with VFO). 1650 kc. 2nd I.F.

Accessories: P-150AC, AC power supply, $99.50. P-150DC, DC power supply, $109.50. MR-150 mounting rack, $39.95.

New **SR·150** **Fixed/Mobile Transceiver** · ***hallicrafters***

Overseas sales: Export Division, Hallicrafters • Canada: Gould Sales Co., Montreal, P.Q. 5th and Kostner Aves., Chicago 24, Ill.

For further information, check number 2, on page 110

CQ

The Radio Amateur's Journal

Vol. 20, No. 8 August 1964

OFFICES

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

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Departments

406-470 Mc
3.5 db

COLLINEAR VEHICULAR ROOFTOP ANTENNA

Cat. No.
381-509

- 20.0 Mc Bandwith at 460 Mc
- 3.5 db Omnidirectional Gain
- 1.5:1 VSWR
- 75 Watt Rating
- Only 28½" High at 460 Mc
- Spring Temper Stainless Steel Elements and Spring
- Mounts in ⅜" Diameter Hole

Models are available without mounting base to fit all popular antenna bases presently installed on vehicles. Simply remove present ¼ wave whip and replace it with this collinear array...and more than double your mobile system gain.

GAIN 11.5 db IN SYSTEM PERFORMANCE

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8.0 db

COLLINEAR BASE STATION GAIN ANTENNA

Cat. No.
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- 8.0 db Omnidirectional Gain
- 1.5:1 VSWR
- 250 Watt Rating
- 14 ft. Overall length at 460 Mc
- 20.0 Mc Bandwidth at 460 Mc
- 2⅜" dia. Support Pipe
- ⅞" dia. Foam Dielectric Internal Feed Line
- Weight 29 lbs. at 460 Mc

This collinear array consists of six ½ wavelength elements mounted .81 wavelengths apart and fed inphase. Lightning protection is provided by a stainless steel spike at the top of the fiberglass housing connected to the support pipe at the base by a ⅞" conductor.

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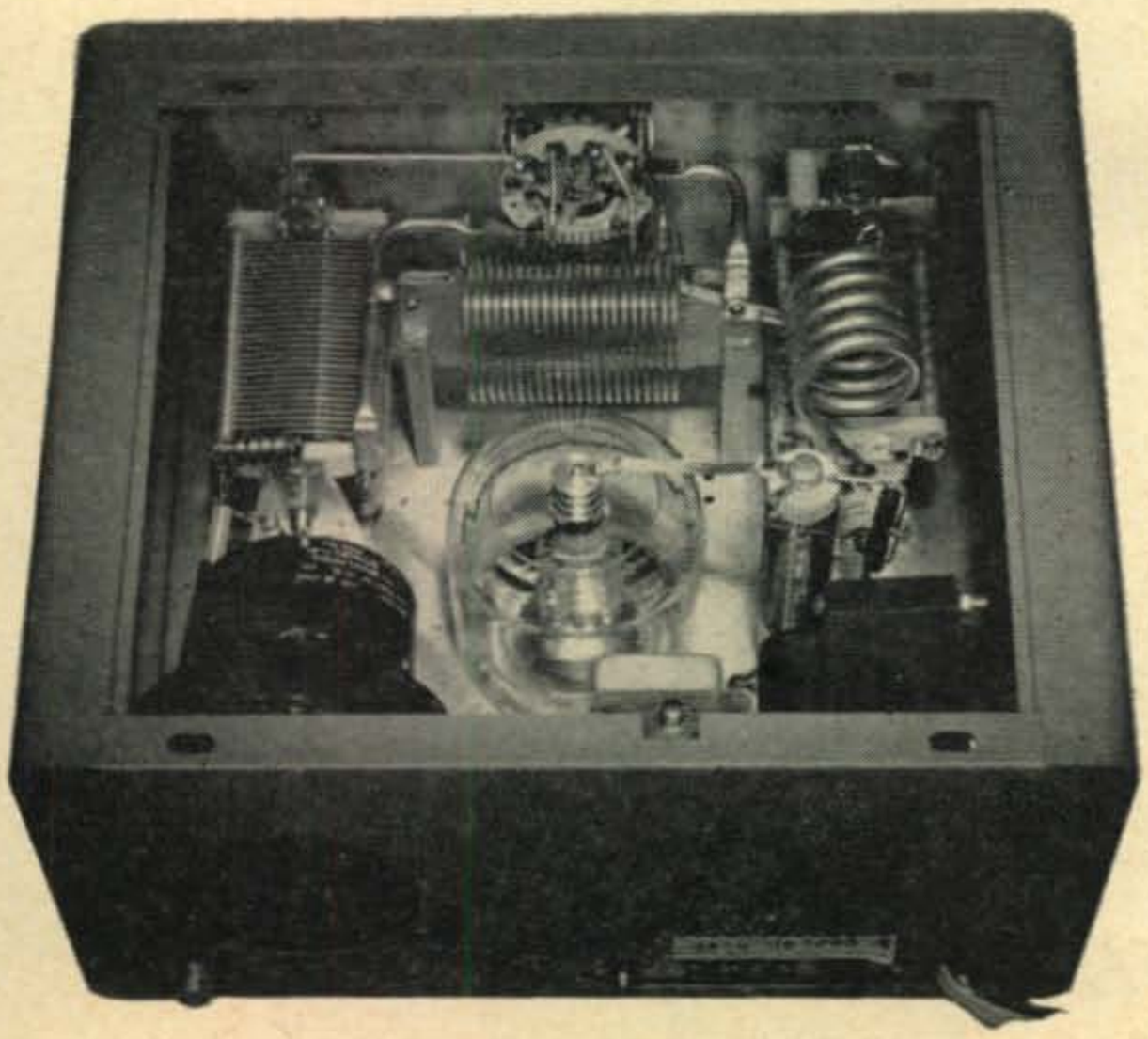
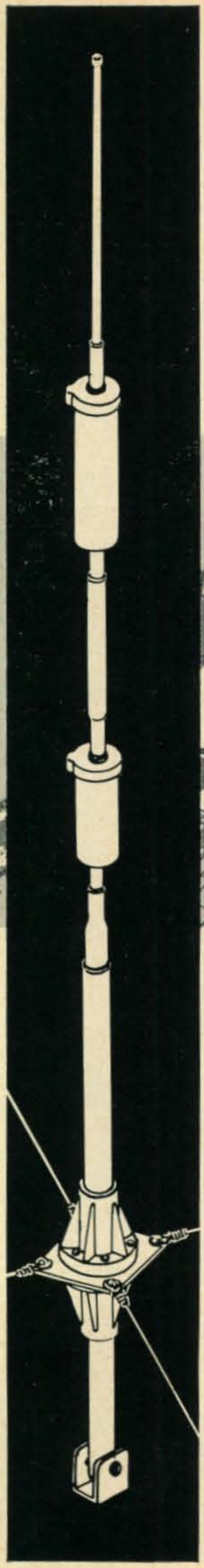
EIMAC

4X250B tetrode chalks up 20,000 hours—and is still going strong!

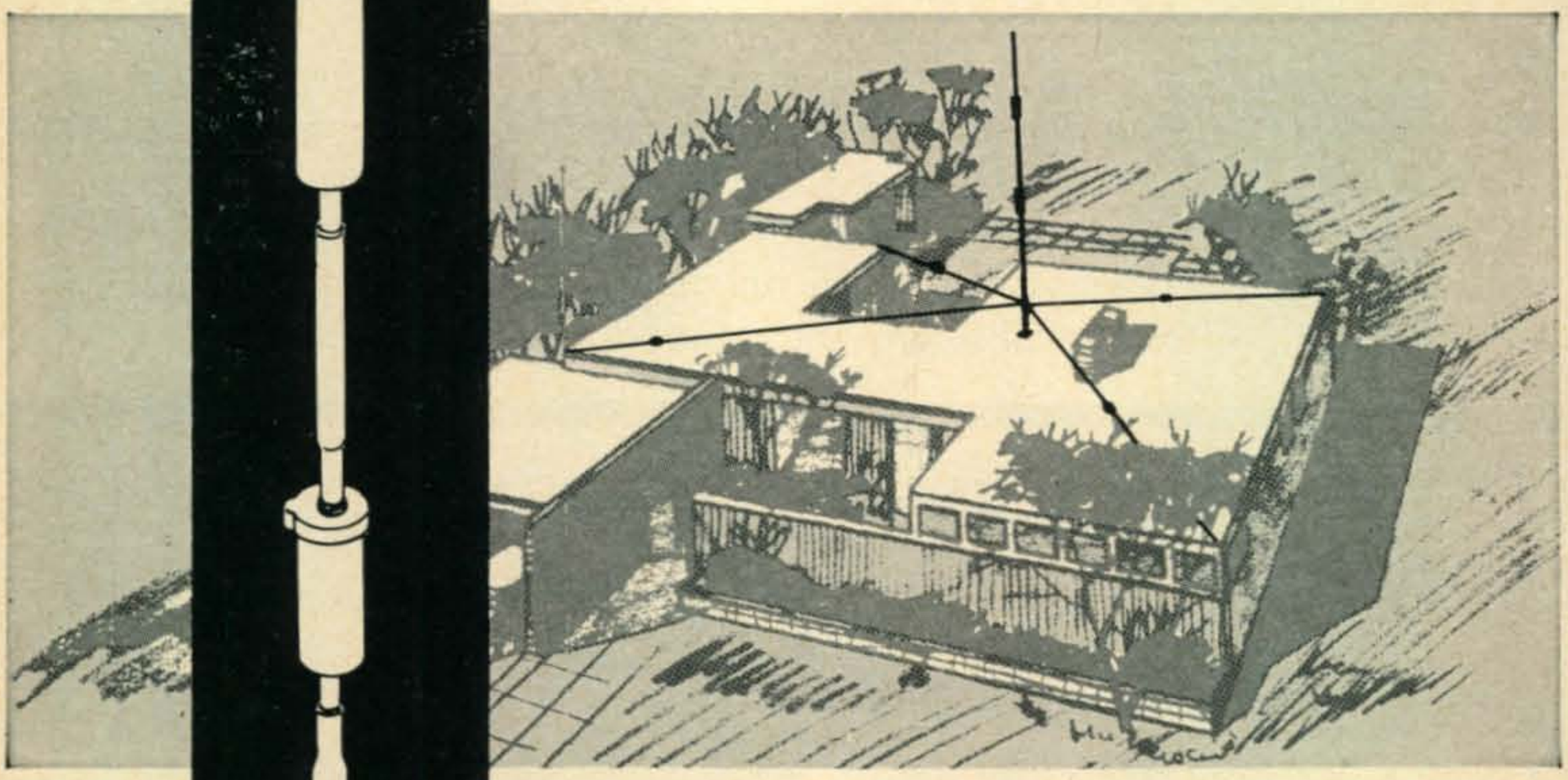
Back in 1960 an original-design Eimac 4X250B tetrode was placed in operation in a UHF communications system belonging to the County of San Mateo, California. 20,000 operating hours later—February, 1964—it was removed by San Mateo Chief Radio Engineer Walter Harrington, W6MX, for test and evaluation. Returned to the Eimac laboratory, this 4X250B tetrode passed acceptance tests with flying colors—within specification in all respects and equivalent in performance to a brand new production tube! This is another example of the way Eimac designs quality tubes for power, dependability, long life. For data on Eimac original-design tetrodes to meet your needs write: Amateur Service Dept., Eitel-McCullough, Inc., San Carlos, Calif.

Eimac®





What's New in Verticals?



Setting the pace in 10, 15, 20 and 40 meters is Mosley's new RV-4 vertical antennas. These outstanding performance giving antennas can now be mounted on any roof as well as on the ground. They operate as a quarter wave vertical antenna on all four bands. The RV-4 features the Mosley slim line Trap-Master traps that have earned user acclaim through daily use in tens of thousands of installations throughout the world. These antennas have automatic band switching for 10 thru 40 meters. The RV-4 antennas are self-supporting and completely factory pre-tuned to maintain low SWR over entire range. The RV-4RK kit for roof mounting includes radial wire mast and hinged mounting. No radials required for ground mounting if a good ground connection can be provided within a few inches of the antenna base. Maximum power rating 750 watts on AM phone, 1000 watts CW and 2000 watts P. E. P. on SSB, input to final amplifier, Uses single 52 ohm coax line. Antenna height 20' 8-5/8" above insulator, with roof mount 25' 2-5/8" Weight of antenna 10 lbs., with roof mount 14½ lbs.

(In request of further information write for literature code # (8)

Mosley Electronics, Inc. 4610 N. Lindbergh Blvd. Bridgeton, Mo. 63044

For further information, check number 6, on page 110

ZERO BIAS

WE'RE not going to bore you this month with more talk of the historic W6DNG-OH1NL moonbounce QSO, (George Jacobs, W3ASK, has more details on page 69), but the achievement *has* steered conversations around the office lately to the old reliable topic of Ham Ingenuity and Building.

It seems that many folks think that amateur radio, as a scientific service, has stagnated, and in support of their beliefs, they bring up the trend toward all-commercial stations, commercial antennas and other accessories. We can't dispute this trend, but we would rather interpret it a bit differently. We feel that the availability of high quality commercial gear has simply *eased* the job of the amateur in the development of communications techniques, instead of eliminating it.

With equipment available in 1950, would this W6DNG-OH1NL have taken place? Perhaps, but the handicap of designing and building receiving equipment with the stability and selectivity needed might well have discouraged even these two hardy investigators.

Could the Monroes, K7ALE and K7ALF have conducted such an intensive survey of 50 mc propagation effects with 1950-style gear? Again, perhaps, but the use of reliable commercial gear relieved them of the unnecessary burden of building and maintaining marginal equipment.

And on the operating end of things, could the communications effectiveness of amateur radio have been so complete without the rugged, compact commercial gear that predominated in the Alaskan earthquake operations? Maybe, but that's a *big* "maybe."

The point is this. Amateur radio has come quite a ways from the days of the first commercial equipment, and we must realize that each new technique development has been made possible by that same equipment. To condemn it is foolish. It just isn't possible to turn back the clock to the days when a good ham built all his equipment, from key to antenna. To encourage this is to negate the progress of 50 years of amateur radio.

But before we alienate all our "back to building" readers, let's just say that we also feel that a modern amateur *should* have the know-how to not only use what equipment he has, but also to add to and refine the equipment when the state of the art requires. An occasional building project has never been known to hurt any ham's interest, and many a new development has come from the shack of an appliance operator. Progress is progress fellow; don't fight it, use it.

CQ's Editorial Aims

It's a good idea, every so often, to try to make clear our reason for being. Back in January 1945, *CQ* began, an offshoot of *Radio* magazine dating back to 1917. At that time, a need was felt for a magazine that did three things: 1—Keep the amateur informed of the happenings within his hobby, both political and operating. 2—Keep the amateur abreast of all technical developments within amateur radio. 3—Educate the newcomer both technically and historically in the nature of amateur radio.

History proves John Potts, *CQ*'s first editor, to be a far-sighted man, for these same needs exist today, and *CQ* is still dedicated to these same three goals. If we stray from them occasionally, forgive us; we're human—and we're amateurs.

Reciprocal Privileges

The following paragraphs are written by Chuck Schauers, W4UZO, our own HAM CLINIC doctor. Having lived, travelled and operated in many areas of the world, Chuck is in a good position to offer advice to all amateurs on how to react to the new Reciprocal Privileges law, and how to make use of it.

"Now that Senate bill S-920 has become Public Law Number 88-313, we might well take pen in hand and thank those Senators and congressmen who made it possible. We might also thank President Johnson for signing the bill into law. Now that reciprocal operations are possible, we amateurs should not take it too much for granted and should remember that in the future there may be other legislation affecting us on which we may need all the help we can obtain. Be courteous and show your appreciation by writing to those who worked so hard to make bill S-920 a reality. While you are at it, remember that no one can rightly accuse the ARRL of inaction in the matter. The ARRL came through, and its President Herbert Hoover Jr. and League counsel Bob Booth spent a lot of time on the bill including appearances before Congressional committees. Thank them too. [*Cont. on page 10*]

3 more instant-heating tetrodes add power design flexibility to the Amperex family of mobile communications tubes

Now, to accommodate the broadest possible range of transistorized vehicular and portable communications design requirements, AMPEREX adds three new Harp Cathode, push-pull tetrodes —the 8408, 8118, and 8348—to its family of instant-heating types. Like their predecessors, the 8042 and 8300, they provide *full talk-power* in well under half a second, are self-neutralizing, feature low cathode inductance, low operating voltage and extreme ruggedness. The entire family of AMPEREX instant-heating tubes is available NOW. One special note: Even within this outstanding family, the type 8408 is truly a "tube among tubes." For by combining rugged, high gain, frame grid construction with harp cathode construction it can provide 6 watts at 500 mc with a warm-up time of less than 0.5 seconds.

How Harp Cathode construction makes the difference

Described simply, the Harp Cathode is a flat rectangle, strung harp-fashion with many superfine wires. Its unique advantages are largely a function of this physical arrangement. Thus, the minute wire size . provides a high surface-to-volume ratio, resulting in instantaneous availability of thermal energy at the emissive surface. The quantity of electrically parallel, directly heated wires assures low cathode inductance. The low filament voltage affords the closest approach to the "unipotential" cathode. Moreover, in actual intermittent operation tests, tubes incorporating the Harp Cathode have given many times longer useful life than tubes with conventional cathodes.

	8348	8408	8118
Frequency—Mc	175	450	450
Drive Power—Watts	1.0	1.5	5
Power Output—Watts	16.0	6.0	21

For detailed data covering all instant heating harp cathode tubes plus descriptions of associated circuitry reducing warm-up times to as low as 80 milliseconds, write: Amperex Electronic Corp., Tube Division, Hicksville, Long Island, New York.

Amperex®

IN CANADA: PHILIPS ELECTRON DEVICES LTD., TORONTO 17, ONT.

For further information, check number 9, on page 110

"Public Law 88-313 does not guarantee that every country permitting amateur radio operations will enter into a bilaterial agreement with the United States, but it does mean that we now have a sound basis for bargaining. The bargaining is of course up to our U.S. State Department.

"Radio amateus possessing U.S. ham licenses living abroad should advise the American Embassy in their areas that they would like to see rapid action taken under the provisions of PL 88-313. Likewise, foreign hams residing in the U.S. should contact their Embassies here.

"A word about operations overseas. If you are an American ham who will be lucky enough to be able to operate in a country that has affected agreement with the U.S. for reciprocal operations remember this: you are a representative of the American way of life and an unofficial ambassador of goodwill.

"Do not jeopardize your operating privileges by phone-patching when it is prohibited, and run no more power than is allowed—remember you are a *guest*. Be courteous and abide by all local regulations governing ham radio operations. Make it possible for those U.S. hams who come *after* you to be welcomed instead of being considered rude and inconsiderate."

Miscellaneous

If you haven't yet looked at the Ham Shop department on page 104, you should. It may prove profitable. Read it carefully and see what we mean.

The 1963 *CQ* World Wide DX Contest tallied participating in one degree or another. This rep- just short of *2,000* entries and over *12,000* hams resents an all-time high for participation in any amateur radio contest in history, bar none! If you don't believe us, ask W1WY . . . he ought to know . . . he counted them! Well done, Frank.

We've received three or four comments in the last few months to the effect that the May and June ZERO BIAS columns were poorly written, inaccurate, and represented poor journalism. In our own defense, we don't claim to be Pulitzer Prize winning writers; as I said, we're amateurs. Inaccurate? Well, we wish our critics could do more than just cry foul . . . maybe do something like *prove* that we're inaccurate.

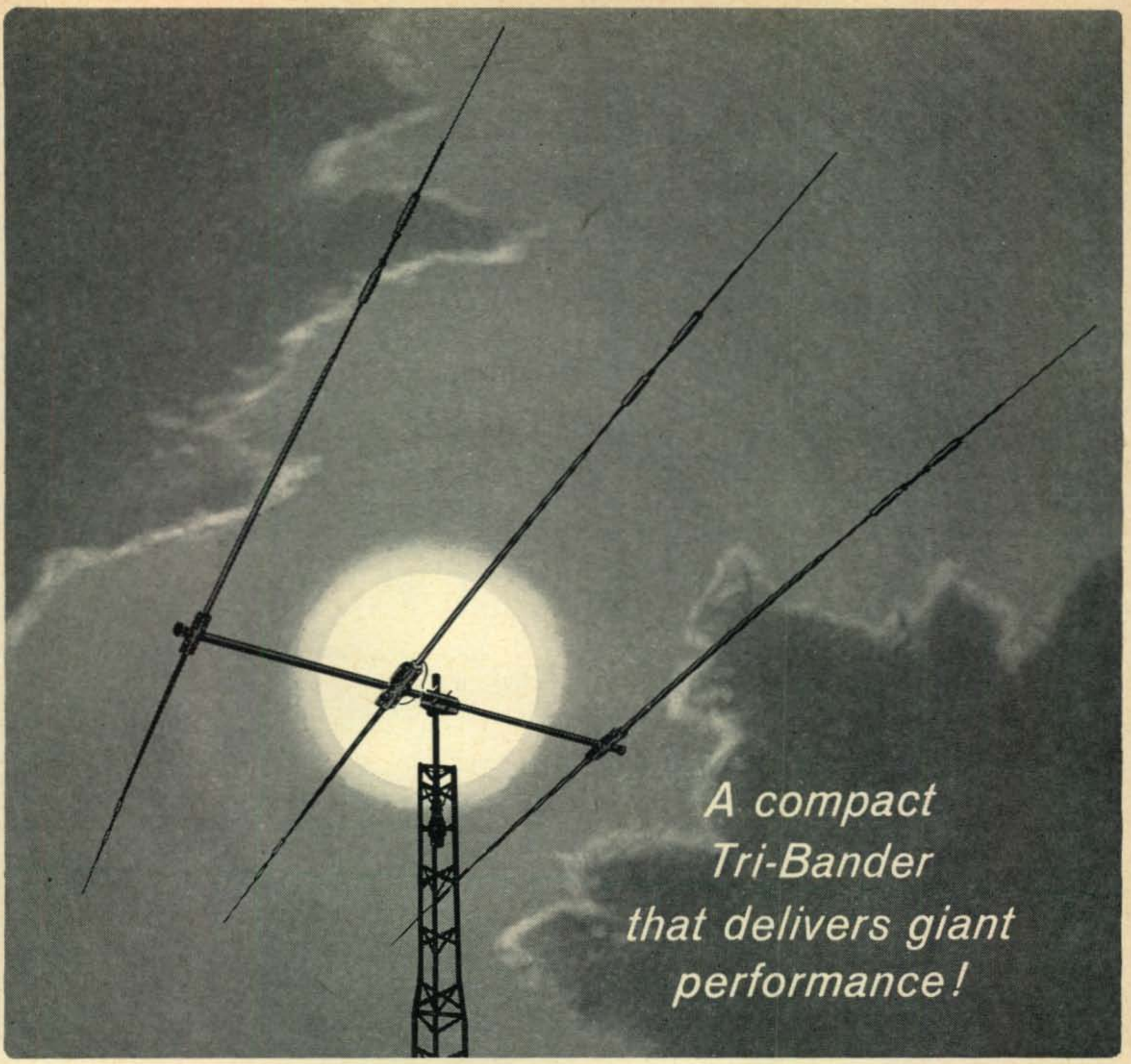
The May and June editorials, unfortunately, did represent poor journalism, possibly unbefitting an amateur radio publication, but it is sometimes necessary to hit hard and low to still a terribly vicious and irresponsibly damaging voice.

In the recent move from New York City to Port Washington, we lost a few things, and acquired a few others. One of the things we acquired was a new Assistant Editor, Al Dorhoffer, K2EEK. Al, incidentally, is one of the "back to building" fellows and one of the "buildingest" hams around.

People have asked why *CQ*'s editorials over the past several years haven't been signed. There isn't much reason for it really; after all, the Editor writes the editorials. But to satisfy those that want to be sure, we'll accommodate.

Dick, K2MGA

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



hy-gain's
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If you're looking for a highly efficient, compact 3-element beam that delivers outstanding performance on 10, 15 and 20 meters...you'll want a Hy-Gain Thunderbird Junior. It installs almost anywhere...as a portable or maintenance-free permanent installation. It has all of the electrical and mechanical features found in the world famous full-sized Hy-Gain Thunderbirds ...exclusive Beta Match...seamless heavy gauge aluminum tubing...heavy gauge die-formed element to boom and mast to boom brackets and hardware that is iridite treated to MIL specs... injection molded cycolac plastic insulators...plus, all new Hy-Q moistureproof traps encased in ageless aluminum housings. Compact low wind load construction allows installation on a light-weight TV tower. Longest element on the 12 ft. boom is 27'6"...turning radius is 15'11". It's easily installed...quickly disassembled for high performance portable applications.

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HY-GAIN ANTENNA PRODUCTS CORP. 8429 N.E. Highway 6 —Lincoln, Nebraska

For further information, check number 11, on page 110

LETTERS TO THE EDITOR

Incentive and the State of the Art

Editor, *CQ:*

. . . I am a graduate student of Microbiology at a large University. I carry a full load of credits, in addition to which I hold a part-time job. My time is as limited as the average amateur. Nonetheless, I *would* make time to study for an advanced ticket.

. . . At the start of my ham career, *CQ* carried articles on gear that could be constructed by a chap of average means, with a fair hope of success. As I glanced at this months construction projects I had a hearty guffaw. "The Unique 75 Meter Transceiver" and the "6BLZ" special" are lauded as projects for the "home constructor". That's a load of baloney. Most engineers wouldn't tackle those projects without a full-time technician and a ton of test gear.

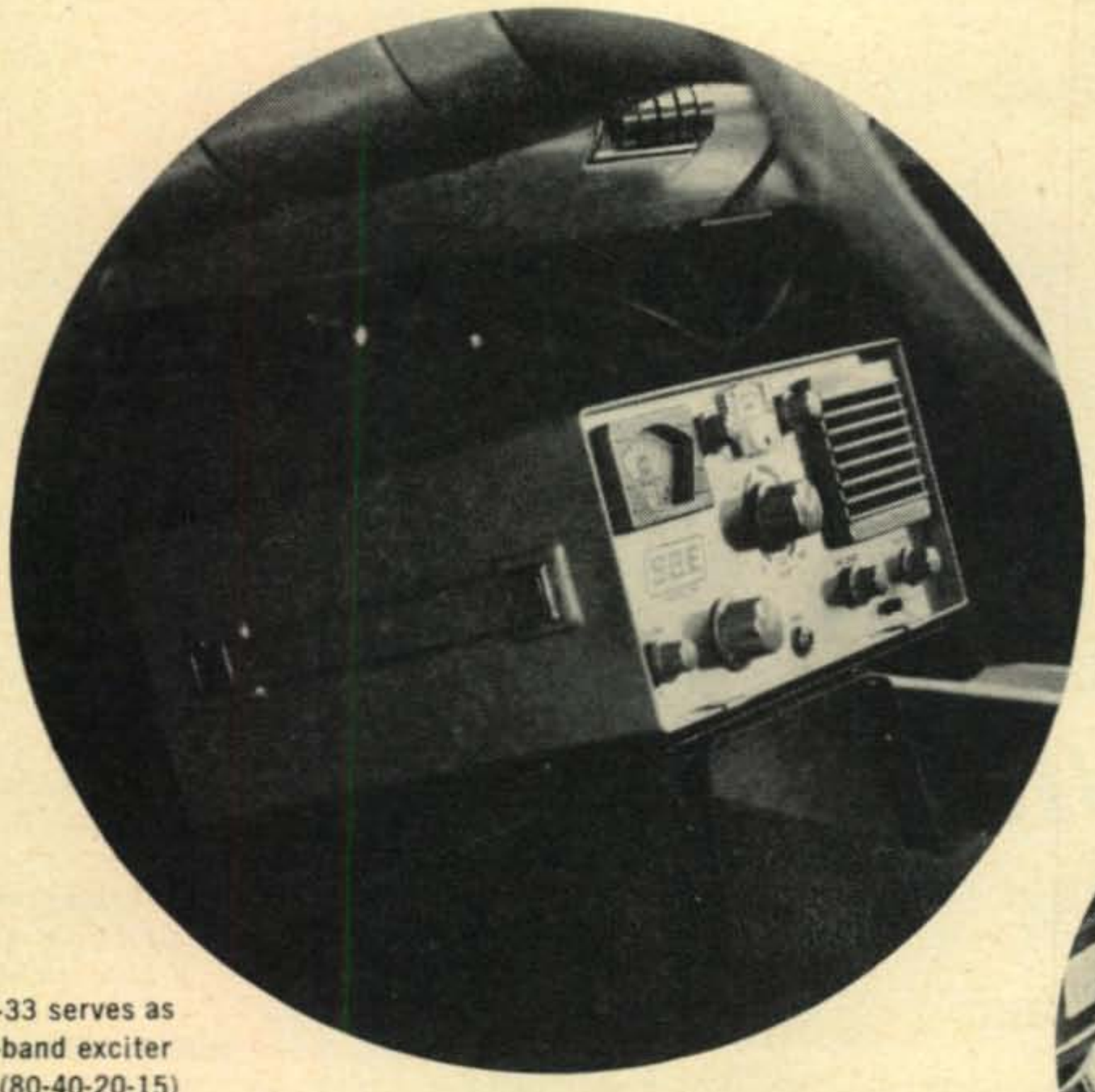
Not being able to construct the gear, is no excuse, however, for not understanding the circuits in use. I always attempt to understand what type of theory is behind a unit's operation.

In days gone by, it was enough to know the difference between amplifier types and modulation circuits. I was able to trouble shoot my old DX-100 with little more than a v.t.v.m. and an assist in getting it off the desk onto a worktable. You don't have to be a college man to see that those days are gone forever. The principle still holds though. In the parlance of an instructor I once had "You can't catch the critter until you can see him." You can't be an efficient operator unless you can see what's going on behind the dull grey crackly finish of that new Super Dooper transceiver staring at you from behind the mike cord.

The present amateur exams are antedated. Who in blazes ever uses key click filters or home brew low pass filters? A few sturdy souls, but the majority of us, without the elaborate shop facilities rely on large manufacturers who can produce these items cheaper and faster. The same is true of formulas for crystal grinding and temperature coefficients. When was the last time you used them? In short it would appear that anyone who squawks about incentive licensing is either lazy (in which case he better take up being a philatelist, which requires no exertion at all) or just a chatterbox who thinks that ham radio is his personal telephone line to the world in which case he doesn't really belong in our ranks at all, he should

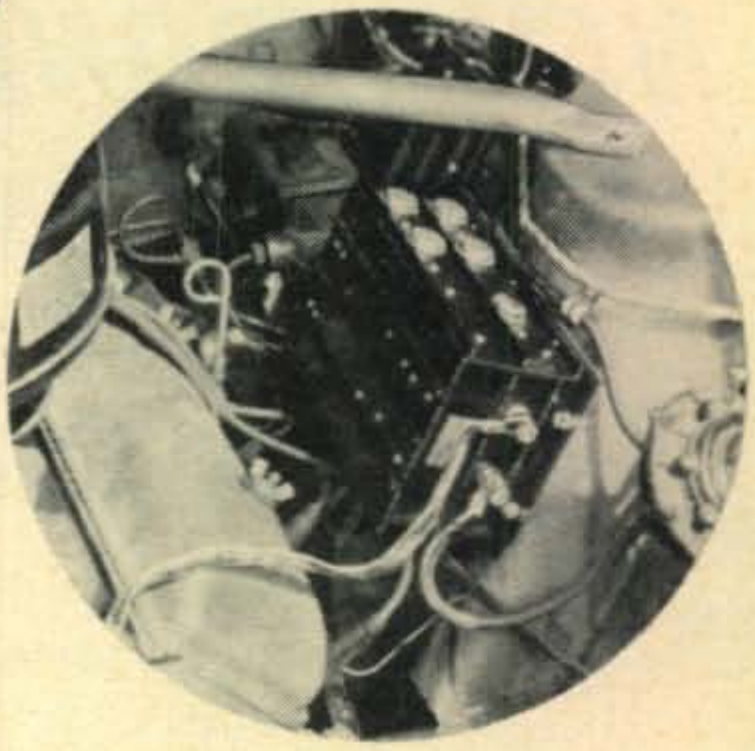
1000 WATTS..WITH WHEELS

The mobile SSB kilowatt . . . once rare indeed, special and costly . . . becomes easy to achieve, and economical too using only standard SBE units. This is **advanced** equipment, sophisticated, in which transistors and diodes replace vacuum tubes in all low-level applications including the outstanding receiver. Current drain is reduced . . . **substantially.** Equipment size is scaled down materially. And these exclusive SBE transistorized designs reduce selling price by eliminating duplicate parts and wiring through the use of bi-lateral circuits that operate both during transmit and receive. Using these big-value items—SB-33 for the exciter and SB1-LA for the linear, a KW (p.e.p. input) fits handily into the family car . . . and space-wise, the family will never know the difference! See below how W6JPM did it.

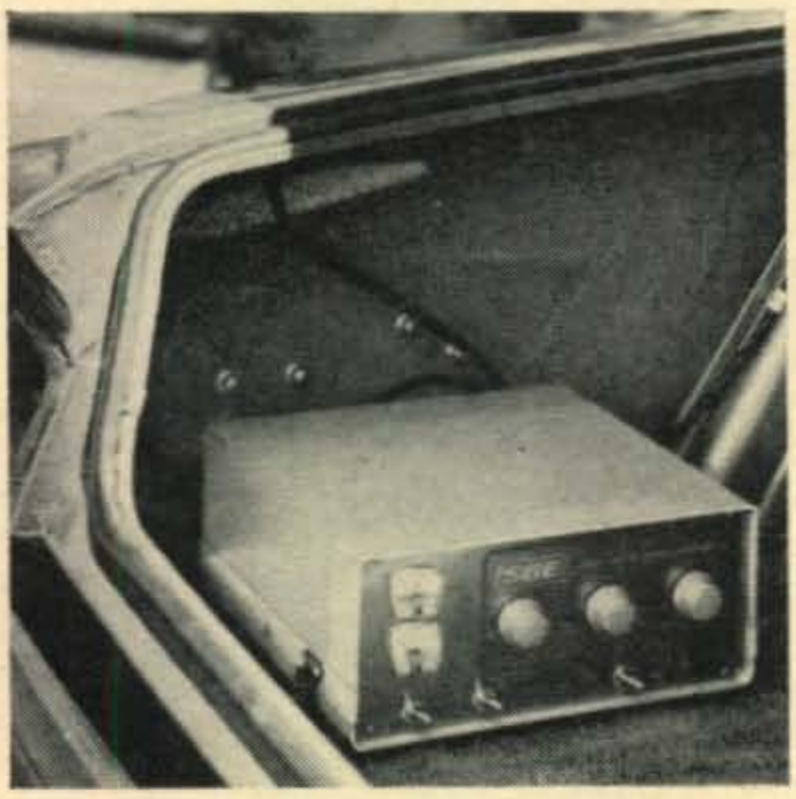


SB-33 serves as 4-band exciter (80-40-20-15) Note how little space it occupies.

Band-spanner "top-sider" antenna with one of the new "gallon" coils, tops off this powerhouse on wheels.



Power supplies, SB2-DCP for SB-33 and SB-3DCP for SB1-LA are tucked into engine compartment.



The SB1-LA 4-band linear occupies modest space in a seldom-used corner of the rear trunk.

SB-33 . . . . . 389.50

SB1-LA 279.50

SBE

SIDEBAND ENGINEERS

317 Roebling Rd., So. San Francisco, Calif.

Please send SBE full-line catalog describing all units used in the mobile KW.

NAME

NUMBER STREET

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RAYTHEON

Export sales:
Raytheon Company, International Sales & Service, Lexington 73, Mass. U.S.A.

For further information, check number 13, on page 110

take up tape correspondence, which eliminates difficulties like QRM and sun spot cycles. The time to raise our standards is upon us, and either we meet the challenge or we drop into obscurity. I think this is the only solution to the problem RM-499 proposes. Its challenge is not political, but ideological in nature. I can honestly see no other solution to our plight. Being very matter of fact about the entire situation, history shows that all those that oppose change are left behind as relics of the good old days.

In closing I would like to say, that I believe that the great majority of amateurs are not fooled or buffaloed by all the hullabaloo that is being tossed at them. If we each approach the issues that confront us in a clear logical fashion, we can't help but do the right thing. A sound technical publication such as *CQ*, *QST*, and even *73* is of great value. Other hobbies have dozens of publications, we have but three. No matter what their political opinions, they represent the only domestic amateur radio publications of national scope. If they stuck to publishing and kept out of politics; if they didn't persist in personal vendettas against one another, our problems would be solved and our standards raised that much faster.

Peter Ludwig, WA2GMG
16-21 212th Street
Bayside 60, New York

On Zero Bias

Editor, *CQ:*

Bravo! Bravo! on your last two ZERO BIAS inclusions in *CQ* [May, June]. I was wondering how much longer *CQ* would "turn the other cheek."

One of the most disappointing attitudes I have noted in this matter, is the League's lack of action to defend themselves against the unfounded allegations cast against them by "Mr. John Hornblower." *CQ*, *Monitor* and *Auto-Call* deserve much credit and admiration for their attempt to squelch ham radio's greatest demagogue.

CQ's proposal to resolve the incentive issue has my full support with exception to the 2 kw power clause. I would rather see all power levels remain at 500 watts (and lower) on all bands below 6 meters. My recommendation would be for 1 kw on 6 and 2 meters and a possible 2 kw maximum on all frequencies above 2 meters. 2 kw is certainly not needed for low freq. "rag chewing." It would seem practical for technological advancement purposes on u.h.f. and microwaves. You may "count me in", as a sponsor of *CQ*'s outlined idea, should it ever become formalized and presented to the FCC as a proposal.

I just read June *73* magazine. Their published letters intended to counter your last month's ZERO BIAS, amuse me. The first letter, as you have no doubt noted, is unsigned. The second letter, written by W4RLS condemns *CQ* for character attack against Wayne Green. Yet, no comment is made in reference to the many character attacks sponsored by Green against other publishers, etc. Isn't it ridiculous? It would appear that the IoAR member who wrote the first letter displayed in June *73*, was none other than ham radio's "Man of the Hour," himself.

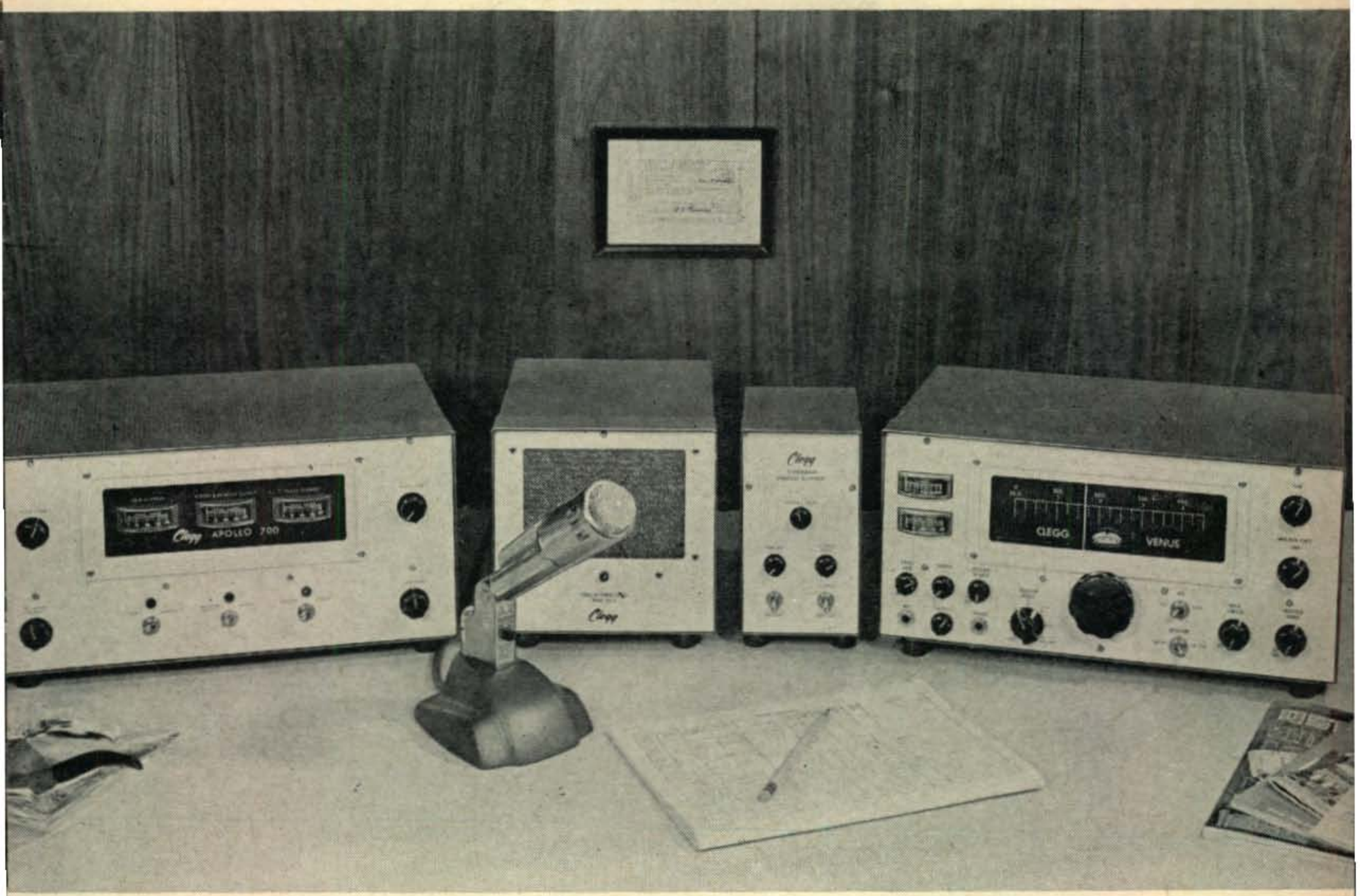
This then boils it down to only one published letter of dissentment in connection with your ZERO BIAS column.

Keep up the good work at *CQ* and let's see more v.h.f. and u.h.f. articles in coming issues. An occasional spread on ham TV would benefit many of the readers.

Milton F. "Doug," De Maw, W8HHS
10598 Peninsula Drive
Traverse City, Michigan

SIX METER SIDEBAND . . . with POWER

Clegg



YOU HAVE HEARD THE VENUS—the cleanest six meter sideband signal on the air—and now a new dimension is added . . . *POWER*. With APOLLO 700, the new Clegg six meter linear with integral power supply, seven hundred—plus watts PEP input makes that VENUS signal a real standout. Top that off with the Clegg SS BOOSTER—the latest Squires-Sanders development in outstanding amateur communications gear—and you have the hottest six meter sideband rig imaginable!

The VENUS, APOLLO, SS BOOSTER and the 416 VENUS AC POWER SUPPLY/SPEAKER are matching units—in performance *and* in styling. These are just a few of the "plus" features that result from years of successful Clegg experience in the design of VHF equipment:

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Keep in touch with your distributor or write for further detail.

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For further information, check number 15, on page 110

Editor, *CQ:*

As a young ham I subscribed to *QST* and *CQ*. I was always, for some reason, under the impression that these two magazines were fighting for top honors and that there was no agreement between the two. Today I received the July copy of *CQ* and starting from the cover in, I came to your editorial (ZERO BIAS). In it you defend ARRL to the fullest and I wish to congratulate you on a great editorial. Keep up the good work!

Gordon Lukesh, K1TCE
P. O. Box 264
Sudbury, Massachusetts

Editor, *CQ:*

Congratulations on your June editorial (ZERO BIAS). Well said!

D. O. Jones, W5QEO/KH6
Honolulu, Hawaii

SWL's Take Note

Editor, *CQ:*

As secretary to the Director of Engineering for a 50,000 watt clear channel station, I see an average of five reception reports per day. About 40% of these are not immediately followed by a QSL card for one or more of the several reasons outlined below. How about an article in your magazine concerning the correct reporting of distant reception? Or would you at least print this letter?

We receive many reports saying "I heard KOA recently, please send me a QSL card." That's often all they say; sometimes they add that they are trying for an award for having logged all fifty states. If I could write to any station and get a QSL that easily, what would such an award mean except that I had written to fifty different radio stations in fifty different states? This kind of letter is followed at KOA by a form letter but not by a QSL—not until we get some information that shows the writer probably did hear us.

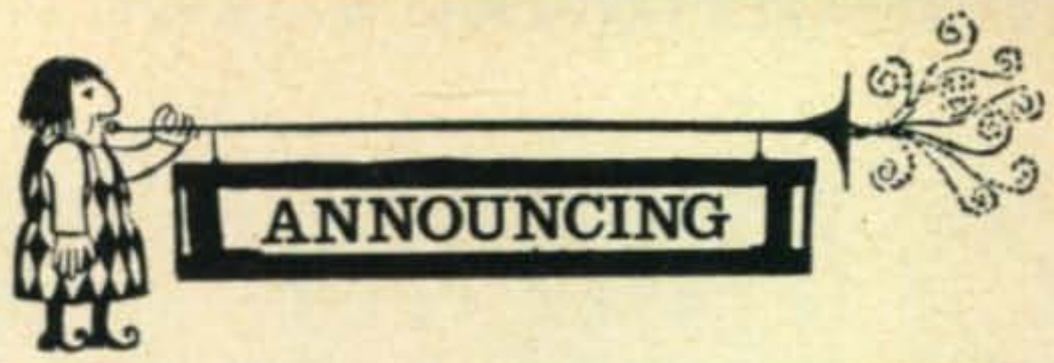
Many reporters do not put their address on the reception report; they assume the return address on the envelope is sufficient. Do they realize that the person who opens that envelope is often not the person who sends the QSL? In our case, one secretary opens the letter, another checks it and makes the log notation, and still another sends the QSL card before forwarding the report to a fourth secretary. Envelopes often get lost or are thrown away, and if there is no address on a reception report, obviously we cannot acknowledge it.

Some reporters say "I heard the news followed by music." Followed when? We may have had thirty minutes of news, followed by thirty minutes of conversation, and then a music show. Usually we reply that "your report is not in exact agreement with our log; could you send us a more complete report?"

Any of the above errors could be easily corrected by a knowledge of how to write a reception report. We at KOA are happy to send QSL's—we like to know who's listening where, but we can hardly reply to an incomplete report. An article in your magazine reaching all of your readers would be a great help not only to the radio stations but to your readers also.

Judy Hunnicutt
c/o KOA TV/Radio
1044 Lincoln Street
Denver 17, Colorado

For further information, check number 17, on page 110



Bowers Mansion, Nevada

The Nevada Amateur Radio Association will sponsor a hamfest in conjunction with the celebration for the Nevada Centennial, August 22nd and 23rd, 1964. The hamfest will be at Bowers Mansion, 20 miles south of Reno on route 395. There will be swimming, transmitter hunts, homebrew and mobile contests, door prizes, C.D. exhibit, and a picnic. For further info contact N.A.R.A., P.O. 2534, Reno, Nevada.

Educational TV

Something of great interest and value to amateurs in the New York City area this fall is the educational TV series "Electronics At Work" due to begin October 5 on WNDT, Channel 13. The course is organized into six units of 15 half-hour lessons each for a total of 90 half-hour sessions. The six units cover: D. C. circuits and Electrostatics, Electromagnetism, Power Supplies and Basic Components, Vacuum Tubes, Audio Communications, and Television. It is free for the viewing, but more value can be drawn from the course is study guides are used in conjunction with the program. Guides are available, at a cost of $1.25 per 15 session unit, from the Wentworth Corp., 615 Meeting Street, West Columbia, South Carolina.

Telecasts will be from 12:30 P.M. to 1:00 P.M. Monday, Wednesday, and Friday and will be repeated evenings.

Although currently showing only in the New York City area, "Electronics At Work" may be made available to other localities if sufficient interest is shown, so spread the word.

CQ U.B.A. Rally—Ardennes

The CQ U.B.A. Rally—Ardennes will be held on the 29th and 30th of August in Belgium. Entry deadline is the 1st of August. Contact E. M. Wagner, G3BID, 5, Ferncroft Ave., Hampstead, London, N.W.3. England for more information.

Decatur, Alabama

The Nroth Alabama Hamfest Association will hold its 11th annual hamfest on August 16th at Florence, Alabama. The association is made up of members from the Muscle Shoals area, Decatur, and Huntsville. Inez Rubley, K4RIL, can supply more information. Contact her care of Muscle Shoals Amateur Radio Club, P.O. Box 306, Florence, Ala.

Chicago, Illinois

The Hamfesters Radio Club will hold its 30th annual picnic and hamfest this year at Santa Fe Park on Aug. 9th, 1964. There will be contests, prizes and many exhibits featured as well as free coffee and doughnuts. For information, contact John Curtis WA9DDY, 9919 S. Washtenaw Ave., Chicago, Ill.

Sault Ste. Marie, Michigan

The annual Michigan Upper Penninsula Hamfest will be sponsored this year by the Twin Sault Radio Club in conjunction with the Kincheloe A.F.B. Radio Club in Sault Ste. Marie, on Aug. 1st and 2nd, at the City Recreation Building. For Sat. a mobile contest and hunt are planned followed on Sunday with the s.s.b. and Upper Penninsula net meetings. Also on Sunday there will be a swap shop and drawings for prizes. Write to Clare Smith K8ZSM, Box 279, Rt. 2, Sault Ste. Marie, for advance registration and information.

Bristol, Tennessee

The 1964 Bristol Amateur Radio Club hamfest will be held on Sat. and Sunday, August 22nd and 23rd, at the American Legion Park in Bristol. Get in touch with Bill Lillard WN4RUT for further details.

Bowling Green, Kentucky

The Kentucky Colonel Amateur Radio Club of Bowling Green is having their second annual hamfest at Beach Bend Park, on Aug. 2, 1964. T. C. Cotrell Jr., 1530 State Street, Bowling Green, Ky. will supply further info.

For further information, check number 19, on page 110

Pittsburgh, Pennsylvania

Sunday, August 2nd, the South Hills Brass Pounders and Modulators Club will hold their 27th annual hamfest, at Spreading Oak Lodge, South Park Pa., 8 miles south of Pittsburgh on route 88. Registration is $2.00 at the door and $1.50 in advance. For pre-registration, and further information, write to Dave Imhoff, W3HND, 2283 Spokane Ave., Pittsburgh, Pennsylvania.

Evansville, Indiana

The TARS Hamfest will be held on Aug. 30th, at ECCO Valley, Hwy. 66, west of Evansville. Registration begins at 9:00 A.M.

50th Anniversary of Canal Zone

Through the courtesy of the Panama Canal Amateur Radio Association, special Golden Anniversary QSLs will be sent confirming QSOs with KZ5 stations during the period from Aug. 8 to Aug. 16 in celebration of the 50th anniversary of Panama Canal Zone on Aug. 15. Also, special commemorative certificates will be presented by the governor of the Canal Zone to stations applying on the basis of 5 or more KZ5 QSO's during the anniversary period. (*Tnx KZ5PR via K1GHT*)

Dover, Delaware

The 1964 Delaware Hamfest will take place in Harrington, Delaware on August 16, 1964. This is a joint activity of the amateur radio clubs in the state. Peter A. Robinson K3OCI, 417 Wyoming Ave., Dover, Delaware, will supply more info.

Dallas, Texas

The Big D Hamboree sponsored by the Dallas Amateur Radio Club, will be held at Vickery Park, August 15, 1964. Talk in on 3915. For more information write to Dave Wheeless, K5DMN, P.O. Box 30532, Dallas, Texas.

Cheyenne, Wyoming

The annual Wyoming State Hamfest will be held this year in Cheyenne, on August 22nd and 23rd. It will be sponsored by the Shy-Wy Radio Club, K7AYF, of Cheyenne. Contact Glen R. Blackburn, K7NQX, P.O. Box 52, Cheyenne, Wyoming, for more details.

Operation Skytop II

In 1963, Operation Skytop operated from sixteen of the highest mountain tops in the Eastern United States. (*CQ*, July 1963, page 48) This year Operation Skytop II will use Mount Mitchell, North Carolina, as a base of operations for mobiling in rare mountain counties. The dates for the expedition are August 8th through the 16th. The base station will operate all bands 160—2 meters. There will be side trips to Grandfathers Mountain, North Carolina and Clingmans Dome, Tennessee. The base call is WA4MIV/4. General operation time for W/K contacts is 1400 GMT to 0500 GMT. Mobile 1 is for rare North Carolina counties and Mobile II is for rare Tennessee counties. The base station frequencies are: *S.S.B.*—3810, 3918, 7225, 7295, 14335, 21387, 21410, and 28645 kc. *C.W.*—3510, 7010, 7074, 14070, and 21070 kc. *Novice C.W.*—3712, 7163, 21110 kc. Also 160, 6 and 2 meters. Special Frequencies—7225 s.s.b.—County Hunters Net. 14331 s.s.b.—YL International s.s.b. nets. 14075 c.w.—CHC Frequency. Mobiles will operate ± 5 kc from above frequencies. For further information contact Arnold Constable WA4MIV, 212 Stonecreek Road, Smyrna, Georgia.

Chicago, Illinois

The Six Meter Club of Chicago will hold their seventh annual picnic on August 2nd, at the picnic grove in Frankfort, Ill. There will be prizes, games, mobile judging contests, swap shop and plenty of refreshments. Drop a line to Eleanor M. Lukas, W9AFA, 3400 W. Columbus Ave., Chicago, Ill., for more information.

Harlowton, Montana

The 32nd WIMU (Wyoming, Idaho, Montana, Utah) Hamfest will be held at Mack's Inn, Idaho, on the 7th through the 9th of August. Pre-registration is $2.50. For further information contact Harry Roylance, W7RZY, P.O. Box 621, Harlowton, Montana.

[*Continued on page 109*]

For further information, check number 20, on page 110

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The totally new Gonset Model 900A *Sidewinder* is the first and only transistorized SSB-AM-CW transceiver (except mixer, driver, final stages in transmitter) to provide complete coverage of the 2 meter amateur band in 4 segments 1 MC wide. Yet it's so compact it fits quickly under the dash of the newest cars! Transistor design makes possible a primary power requirement in the receiver of less than ½ amp! Separate power supply accessories snap-fasten jiffy-quick to back of transceiver, or may be used for remote installation. Here's the trouble-free, solid state transceiver with power to spare for any fixed, portable or mobile application!

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TRANSCEIVER: 9 MC BFO; 15 MC IF; High Frequency Crystal Oscillator; VFO; VFO Regulator; AGC; 9 MC IF • **Dimensions:** 8⅞" W., 4⅞" H., 7 3/16" D. • **Wt.:** 10 lbs.-8 oz. • POWER SUPPLY: **Dimensions:** (AC or DC) 8⅞" W., 4⅞" H., 5 13/16" D. • **Wt.:** 13 lbs.-8 oz.

PRICE: TRANSCEIVER: $399.50 Amateur Net; POWER SUPPLY: AC—$67.75 Amateur Net • DC—$79.50 Amateur Net

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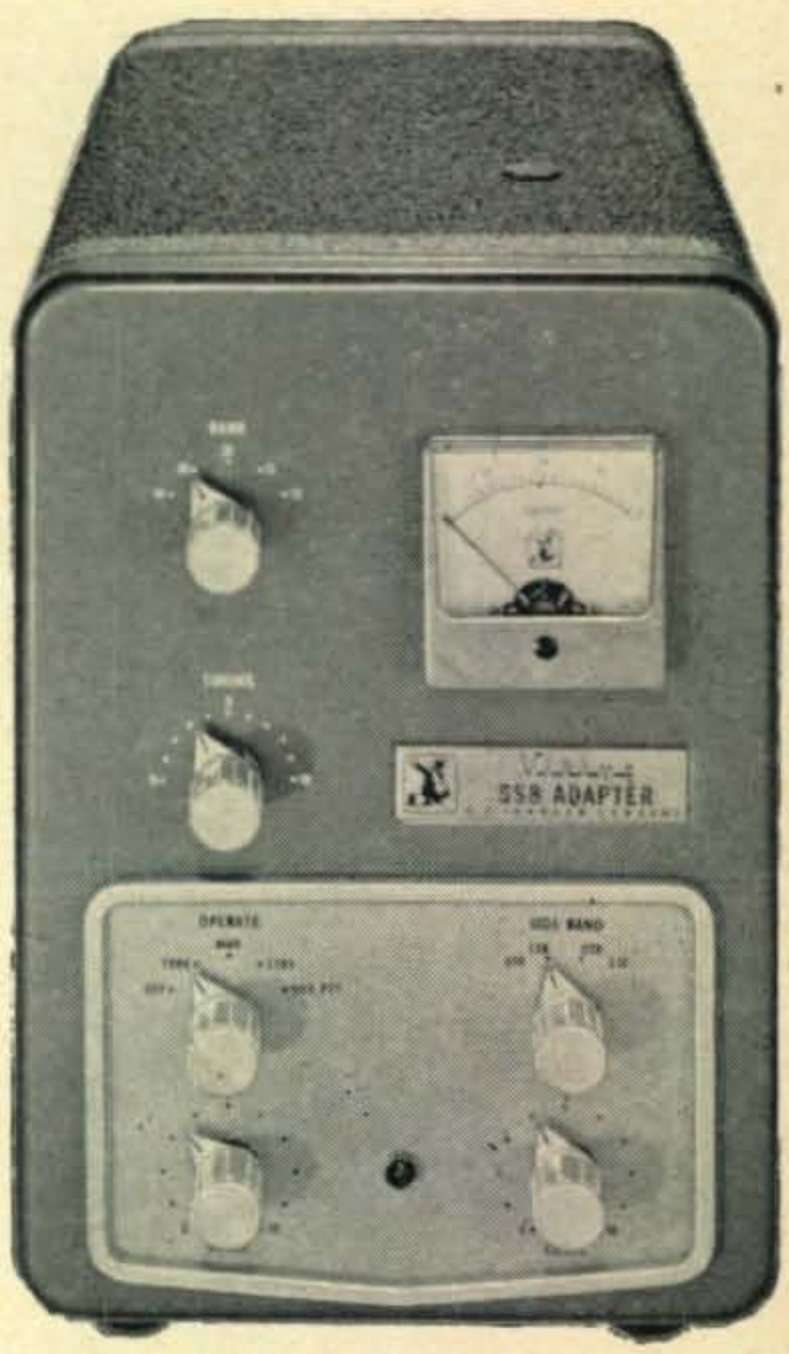

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For further information, check number 23, on page 110

THROUGHOUT the history of radio communication amateur and professional scientists alike have been striving to broaden the spectrum of usable frequencies. In the early days of radio, control of the spectrum was limited to the kilocycle range. Then, gradually, this control extended first to the megacycle region, then to kilomegacycle ranges.

The object of this expansion has not only been to apply communications engineering techniques to as much of the electromagnetic spectrum as possible. It was also intended to reap the rewards of increased bandwidth, since the number of users has been increasing more rapidly than the amount of usable spectrum space.

Over the past generation, electron tubes, klystrons, magnetrons, transistors, and other semiconductor devices have been developed and refined to the point where generation of carrier

LASERS

Part I

BY STANLEY LEINWOLL*

Introduction to the communications mode of the future: Lasers.

waves in the vicinity of 1 millimeter, or a frequency of 300,000 megacycles, was possible. At millimeter wavelengths, however, it became painfully apparent that the practical upper limit of frequencies that could be generated and used by using conventional methods had been reached. The construction of miniature resonant cavities as well as extremely small waveguides made the production of higher frequencies by known techniques an impossibility.

Then, in 1960, a scientist named Theodore Maiman, working for Hughes Aircraft Corp. succeeded in producing a beam of pure red light, at a single frequency. What made Maiman's discovery so remarkable was that the light produced was coherent—it was in phase, and the beam was nearly parallel. Maiman's device, which was called a laser, or optical maser, was different from other conventional generators of light. Light sources such as tungsten lamps, fluorescent bulbs, and even so-called monochromatic sources like sodium vapor lamps, produced a wide band of frequencies which were, in addition, out of phase, of different amplitudes, and of different polarization. Such light is called incoherent.

In radio terms, the laser was comparable to an oscillator or frequency generator, while conventional light sources were the equivalent of noise generators. While it was impossible to modulate the latter, there was a definite possibility of modulating a coherent light beam.

Until the development of this remarkable device, it had not been possible to generate frequencies above about 300 kilomegacycles. Then suddenly, in one step, more potential spectrum space was made available than in all other bands combined. Figure 1 shows the electromagnetic spectrum.

From this figure it can be seen that wavelengths in the visible and infra-red range run from 4000 to 7000 angstrom units, where one angstrom unit is equal to 10^{-8} centimeters (0.00000001 cm.) Since the velocity of light is equal to frequency times wavelength, we can solve for the frequency by substituting the speed of light, 300,000 meters/second. On solving for frequencies in this part of the spectrum we find a range varying from 430 to 750 *million megacycles per second.*

When we consider that at present the total available spectrum is under 200,000 megacycles, the implications stagger the imagination! For example, if only one per cent of the spectrum could be used for amateur communications there would be made available 3 million megacycles of spectrum space. This is fifteen times the total now available in all parts of the spectrum. Assuming about 300,000 amateurs in the world, it would mean enough space to assign every amateur his own personal 10 kc channel!

At the present time laser devices can produce coherent radiation in a portion of the visible spectrum as well as at a number of wavelengths in the infra-red region of the spectrum. The number of frequencies at which optical masers have been producing coherent radiation has been increasing rapidly, however, and there is every reason to believe that the range will continue to increase.

Communications Applications

In the four years since the announcement of the first working laser more than 500 laboratories in this country alone have joined in laser research. Toward the end of last year a television picture was transmitted using a beam of laser light as the carrier. Other laser beams have been used successfully in short range experimental communications systems, and several months ago IBM was awarded a contract by NASA to build

*Radio Frequency and Propagation Manager, Radio Free Europe.

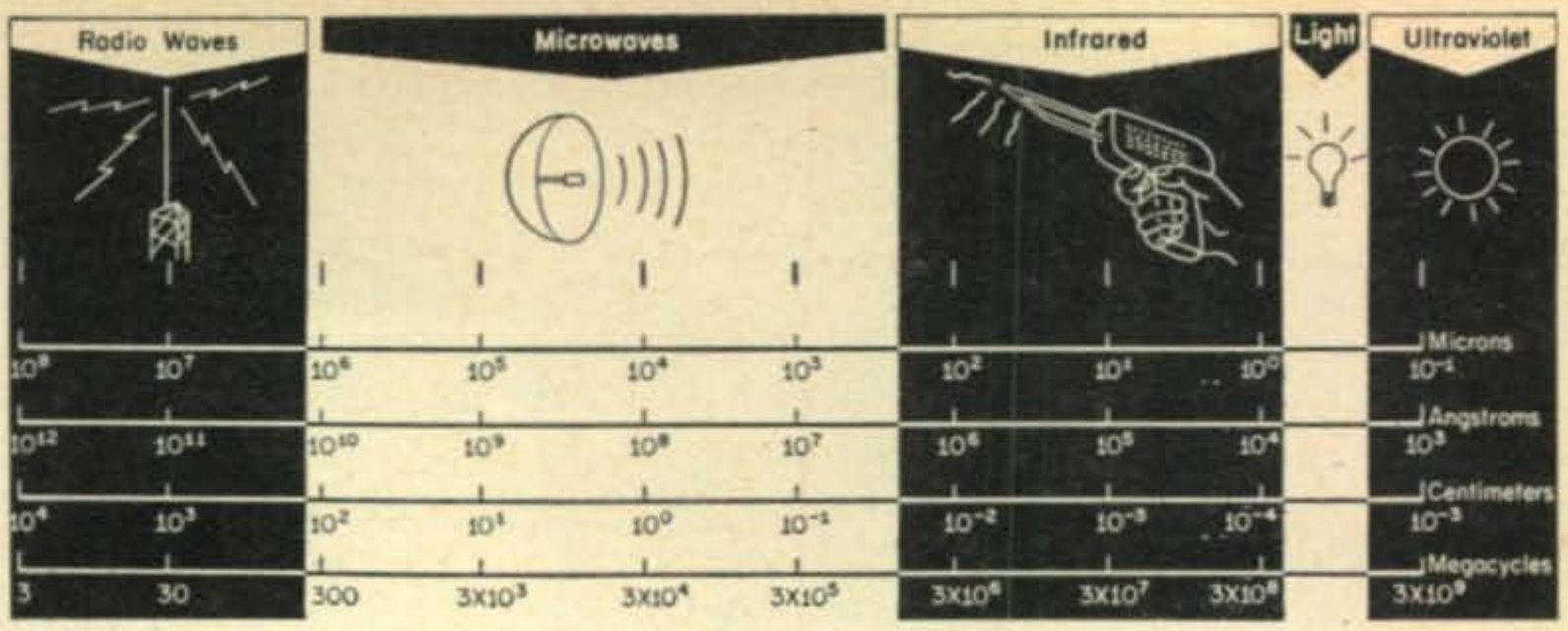

Fig. 1 — The electromagnetic spectrum. The laser produces coherent radiation in the microwave and visible portions of the spectrum.

and test a laser space communications system.

This remarkable device has also seen applications in the fields of medicine, in industry, in science, and by the military establishment. The most revolutionary possibilities, however, are in the field of communications. From this point of view alone the optical maser is one of the most exciting inventions of the century. It has been compared in its potential impact on communications with the vacuum tube and the transistor. It could turn out to be even more important than both!

Many amateurs have been asking for more information about lasers. What are they? How do they work? What do they mean to the amateur community at present and what will they mean in the future? This article will attempt to answer these questions.

Atoms and Energy

The production of laser light involves an entirely new concept in electromagnetic radiation. Whereas electronics had previously limited itself to the control and use of the energy of free electrons that moved about from one atom to another, the laser utilizes energy states *within* atoms themselves to produce electromagnetic waves.

In order to understand how electromagnetic radiation can be generated as well as amplified sub-atomically, it is desirable to describe briefly the modern picture of radiation from within atoms and molecules.

Energy Levels

Every atomic system, whether it is an individual atom, a molecule, a crystal, or some other configuration, has associated with it certain characteristic energy levels.

Ordinarily, the systems are at rest, at their lowest, or ground state energy level. They can, however, absorb energy which raises them to an excited state. It should be mentioned that the excited state is not the natural state of any atomic system, and that it will tend to return to ground level, doing so in the easiest possible manner. Every atomic system can absorb specific, discrete amounts of energy which are unique to that system.

These discrete energy units are most often referred to as *photons*. They can be thought of as minute bundles or packets of energy which exhibit both the characteristics of matter as well as of electromagnetic radiation travelling with the speed of light.

This model of atomic systems is part of a fundamental theory of matter—The Quantum Theory. It has been successful in explaining atomic phenomena which had not been understood previously. According to this theory, the energy level to which an excited atomic system is raised is proportional to the frequency of the photon that is absorbed by the system.

Figures 2A to 2C show what happens when an atom, initially in the ground state, absorbs a photon. The atom, initially at its lowest energy level, fig. 2A, is excited by an incoming photon of the right frequency, fig. 2B. One of the electrons, which orbit the nucleus the way the planets in our solar system orbit the sun, jumps to a higher energy level.

Once the electron has been excited, a number of things can happen to restore it to its original level. The most common way for the atom to return to ground level is for it to emit a photon of the same frequency at which a photon was absorbed, as shown in fig. 2C. This occurs spon-

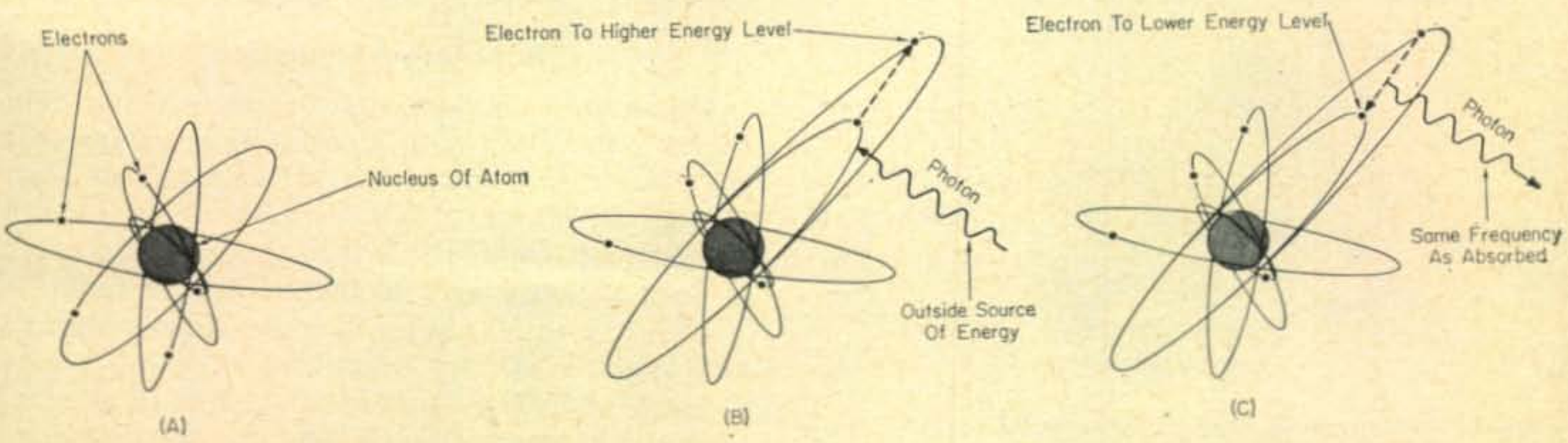

Fig. 2—The series above show how an orbiting electron may be excited by an outside source of energy, the photon. In (B) electrons are in higher energy level by the absorption of the photon. To return to a lower energy level the electron emits a photon of the same frequency as absorbed.

taneously, and can take less than a microsecond from the time the photon was first absorbed. It is also possible for the atom to drop to an intermediate energy level by losing some of its energy in the material by collision. From this intermediate level often referred to as the metastable state it can emit a photon of a lower frequency. This is so because the energy to which an atom is raised is proportional to the frequency of the emitted photon.

In general, the time it takes for spontaneous photon emission to occur depends on the frequency of the incident wave, and therefore on the energy level to which the excited atom has been raised.

At values of frequency which correspond to the portion of the spectrum in the infra-red and visible ranges, spontaneous emission is extremely rapid. As the frequency decreases, excited energy states also decreases, and the time spent in the higher energy level increases.

There is another way for the excited atoms to be returned to ground level states. If, while the atom is in the excited state a photon of the proper frequency strikes the atom, it will emit a photon and return to its normal energy level. This is of fundamental importance, since it leads to a completely revolutionary method of amplifying electromagnetic radiation. A photon of the proper frequency striking an excited atom gives rise to the release of a second photon. This second photon is exactly in phase with the first photon, and travels in the same direction. One photon entered the system and two emerged. Microwave amplification has been accomplished!

In 1958, a historic scientific paper by A. L. Schawlow and C. H. Townes proposed a method of constructing a device that would produce coherent radiation at *optical* wavelengths by using a resonant cavity whose dimensions were millions of times the wavelength of light.

Schawlow and Townes proposed a device made of some fluorescing material with two small mirrors on either side of it facing each other. They theorized that a photon travelling within the mirrored device would interact with other energized atoms to emit other photons. In cases where the photons travelled perpendicular to the plane of the mirrors the wave would strike the mirror and be reflected back into the system, toward the other mirror.

With each succeeding passage of the wave it would grow in intensity until it were strong enough to burst through one of the mirrors as a flash of coherent light. (See fig. 3) In the Schawlow-Townes model it was proposed that one of the mirrors be made semi-transparent to facilitate the maser output. Laboratories throughout the country immediately began intensive research aimed at developing an optical maser.

In July 1960 the first announcement of success was made by T. H. Maiman of the Hughes Aircraft Company, and before the end of the year five materials had been successfully tested in different laboratories. All used the principle of reflecting end mirrors proposed by Townes and Schawlow.

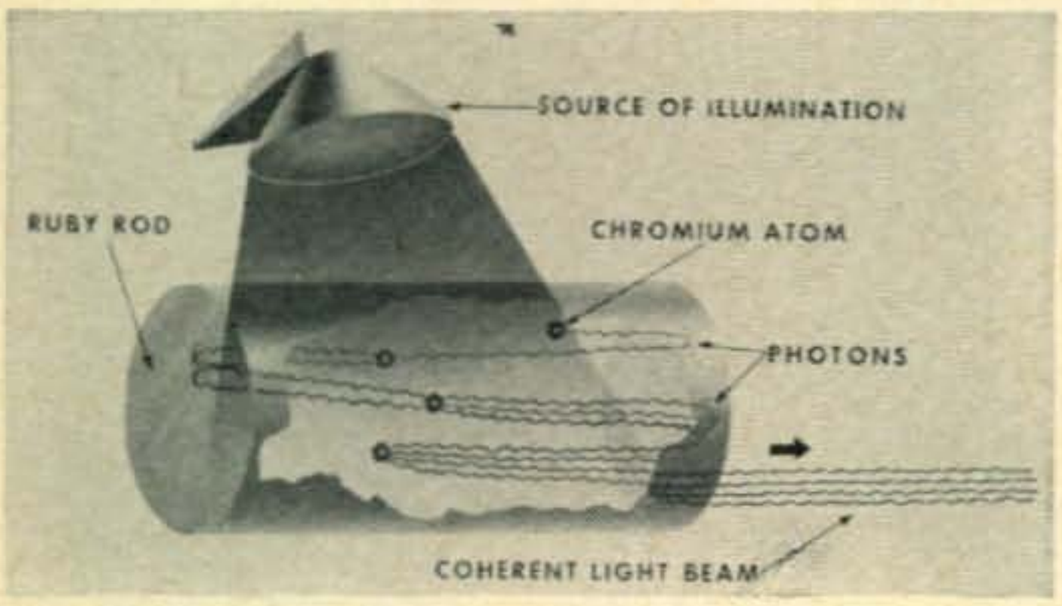

Fig. 3—This drawing illustrates the build up in intensity as the photons travel between the mirrored surfaces until the beam is strong enough to burst through one of the ends as a coherent light beam.

The Ruby Laser

Maiman's laser used a ruby crystal. The amount of chromium in the aluminum oxide determines the color of the ruby. In Maiman's laser the ruby was "doped" with about 0.05 per cent of chromium which gave the crystal a light pink hue.

The pumping source for Maiman's ruby was an electronic flash lamp. Chromium atoms are particularly responsive to light having a wavelength of 5600 angstrom units in the blue-green part of the spectrum. Most flash-lamps are able to supply energy in this range.

Once chromium atoms have been excited to an upper energy level, they require two steps to return to their ground state. This is shown in fig. 4.

There is first an initial drop in energy, as shown. This is a relatively small step and results primarily in heating the crystal lattice. The atom is then at an energy level at which it can remain for several milliseconds, a relatively long time as energy levels go. For this reason, this state, E_1 in the diagram, is called the metastable state. Unless the excited atom is stimulated to do so sooner, it will return to its ground state by emitting a photon at a wavelength of 6943 angstrom units at room temperature. This is in the red region of the electromagnetic spectrum and accounts for the red fluorescent glow of ruby as well as the characteristic color of ruby laser light. This phenomenon is also indicated in the figure.

Population Inversion

When the flash lamp first begins to pump light most of the chromium atoms are in the ground state, E_o. Continued optical pumping raises most of the chromium atoms to their upper energy levels at E_1, from which they immediately begin to drop spontaneously to the metastable state.

From the metastable state the atoms begin to emit photons at random and the ruby rod begins to glow red. The flash lamp continues to fire, feeding chromium atoms into the upper energy level. Then, at a particular point, the picture

[*Continued on page 96*]

RTTY From A to Z

BY DURWARD J. TUCKER*, W5VU

Part I

RTTY, to many amateurs, is a vague if not mysterious mode of communications. Basic information on this amateur radio subject is relatively scarce compared to information on other subjects such as telephony, s.s.b., c.w., etc.

This begins a series of articles on amateur RTTY that will try to cover the subject more thoroughly than has been done before. Furthermore, the author starts at the very beginning.

This is an excellent opportunity for those with no previous RTTY knowledge or experience to become well versed in this fascinating subject. This is also an excellent opportunity for those already in RTTY work to fill in the missing gaps and to broaden their overall knowledge of radio teletype. You will want to follow these articles month by month as they appear.

THE first question that might easily arise in connection with RTTY is, "Why Teletype?" We might counter with; "Why c.w.?" or "Why Voice?" The answer is that RTTY is a mode of radio transmission that is just as interesting, fascinating and as challenging as either radio telephony or c.w. If it's "action" that you want, then RTTY will surely give it to you. There is nothing that quite equals the strange fascination of a teletypewriter as it sets there and types out copy (look—no hands!) like magic. It's like having a second operator at your side. It's efficient—yes, almost a genius. There is little doubt about the truth in the statement, "Once an RTTY'er, always an RTTY'er."

It is nothing short of amazing that RTTY has not replaced more c.w. in the amateur bands than it has, especially in view of the fact that commercial radio telegraph companies abandoned c.w. for RTTY many years ago. It has been apparent to the author for some time that more radio amateurs would take up RTTY work if some of the apparent mystery (for the beginner) that surrounds it could be cleared up. It is the aim of the author to supply all of the basic links of RTTY from A to Z (as the title implies) and to do it in such a manner that it will fit together for the beginner in the most understandable sequence.

What strikes the newcomer to RTTY, is not only the strange and unfamiliar RTTY language, but the equally strange and unfamiliar extra pieces of equipment not found in other than the RTTY'ers shack. It is hoped that this series will not only bridge the gap between c.w. and phone to RTTY for the beginner, but also answer a few unanswered questions for those already in RTTY. If the first part of this article appears oversimplified to the regular RTTY'er, just remember that we all asked some basic questions when we first started out in RTTY work. Too many relatively simple answers to simple questions, so far as RTTY is concerned, are hard to come by when one is just beginning. I can't resist the temptation to make a point on the language problem before covering the subject from A to Z. Here goes: "The space pulse is always on the low side when on f.s.k. and high when on a.f.s.k., but of course, you may invert when you tune in the signal, which is o.k. unless your b.f.o. is already set on the opposite side. Everything clear?"[1]

Teletype Speed

The standard speed of teletype machines used for amateur RTTY is 60 words per minute (if you can type that fast or if you are using a perforated tape), receiving or sending. The operator may be typing at a rate of only 30 or 40 words per minute but each character, as it is typed, races through the teletypewriter at a rate of 60 words per minute. The delay is in the time elapse before the operator strikes another key. One cannot make the machine write faster than 60 words per minute even if the operator can type much faster—say 70 or 80 words per minute. The machine makes mistakes when the typist exceeds 60 w.p.m. This is a lot faster than c.w. unless you are one of those few and far between high speed c.w. operators. Even a poor typist can manage a thirty or forty words per minute typing speed after a little practice.

*6906 Kingsbury Drive, Dallas 31, Texas.

[1]RTTY The Hard Way, No. 9, RTTY Column, *CQ* April 1962, p. 88.

Morse Code

The Morse Code as used for c.w. is binary which simply means that it is formed from two conditions—On or Off. Teletype transmissions work the same way. The c.w. Morse Code is formed from various combinations of dots and dashes with the dash three times as long as the dot. Naturally, there has to be a short space (of same length as the dots) between the dots and dashes in order for each character to be formed such as in the forming of the letter "C". Thus: dash - space - dot - space - dash - space - dot. Likewise, there must be a slightly longer space between groups of characters forming words.

It should be readily apparent, from the above, that the time length of the Morse Code characters vary over a wide range. The letter "E", for instance, has a single dot whereas "zero" with five dashes has the equivalent of 19 dots. In other words, the "zero" character is 19 times longer than the "E" character.

It is also apparent that the time length of the dots and dashes and the subsequent characters they form will vary with the speed of transmission. In other words, all three will be three times as long at 10 words per minute than at 30 words per minute. This discussion of the Morse Code makes it pretty apparent that, although it works well for the human ear, it doesn't appear to be the proper approach for a code to operate a mechanical device such as the teletypewriter. In the first place, a "machine code" must provide some means whereby the receiving machine can be synchronized with the sending machine. This is not only necessary from character to character but *for all elements of each character*. A code whose character lengths vary as much as 19 to 1 certainly does not readily lend itself to adaptibility as a machine code.

Teletype Code

From the very beginning it was apparent that a different approach, other than that of the Morse Code, was necessary in designing an appropriate code for teletypewriter operation. In describing the mechanics of the Morse Code in detail, the stage is now set to show the three principal ways in which the teletype code is different. 1. The teletype code uses dots only (no dashes). 2. The space (same length as the dot) is as much a part of the code as the dot. In other words, the characters are formed altogether from dots and spaces of same time lengths. Furthermore, the length of the dots and spaces do not vary since they are fixed at 22 milliseconds for the standard amateur teletype fixed speed of 60 words per minute. 3. All of the letters, figures and symbols of the teletype code are of the same time length (110 milliseconds plus a 22 millisecond start space and a 31 millisecond stop pulse, making a total of 163 ms (See fig. 1 and 2). Each character has five elements (dots and spaces) plus the 22 ms start space and the 31 ms stop pulse.

Figure 1 shows the pulse sequence of dots and

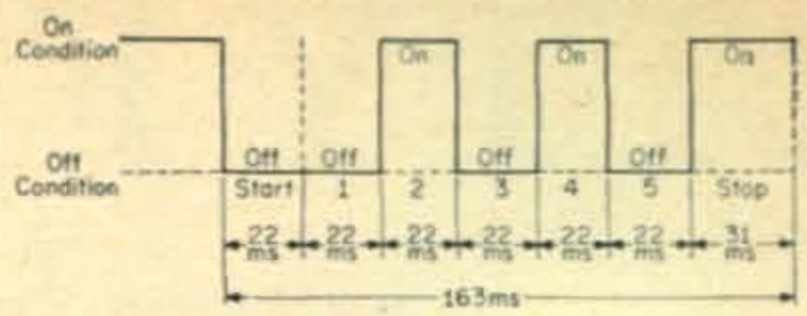

Fig. 1—Pulse sequence of the letter "R" in the Teletype Code is shown above. Each letter, figure, or other character starts with a 22 ms *"Space"* (Off) pulse and ends with a 31 ms *"Mark"* (On) pulse. The arrangement of the On *(Mark)* and Off *(Space)* 22 ms time elements (5 in all) determines the particular character that is formed. All of this is based on the standard amateur RTTY fixed speed of approximately 60 words per minute.

spaces, each 22 ms in length, of the letter "R" in the teletype code. The 22 ms sync or start pulse (Off) is also shown as well as the 31 ms stop pulse (On). The arrangement of the five elements that form the letter "R" is, space-dot-space-dot-space.

One may wonder about the 22 milliseconds start space as well as the 31 millisecond stop pulse since, obviously, this considerably lengthens each character. In fact, almost fifty percent. Actually, the 22 millisecond start space is for synchronizing the sending machine with the receiving machine. The 31 millisecond stop pulse has a two-fold purpose. First, it provides for adequate time, after a character is sent, for the "sending" mechanism of the sending machine as well as the "receiving" mechanism of the receiving machine to properly position themselves for the transmission of the next character. Secondly, the stop pulse also provides a closed circuit for the teletype machine so that it will not "run open" when the machine is in a rest position (when no character is being sent). More on this in later installments.

The teletype code is shown in the last column of fig. 2. Figure 2 also shows a perforated tape of the alphabet, figures and other characters as they might have been punched out by the tape perforator of the Teletype Model 19 tape set. The string of small holes, marked FEED, fits the tape drive sprocket wheel of the machine that originally punched the tape, including these drive holes, as well as the sprocket drive wheel of the various machines that may be used to transmit the tape. It will be noted that, besides the alphabet, numerals, question mark, colon, etc. that there are special characters for word spacing, carriage return, line feed, figures and letters. These last several are for the complete automatic operation of teleprinter in printing received copy. The last column graphically indicates the relation between dots (On) and spaces (Off) in producing the various characters of the five element teletype code as well as the start space (Off) and end or stop pulse (On).

Figure 3, (A), (B), (C), and (D) Tapes shows the two types of tapes in general use by radio amateur RTTY'ers (the two top sets). The tapes are punched from the same blank paper strips and differ only in that the chads are

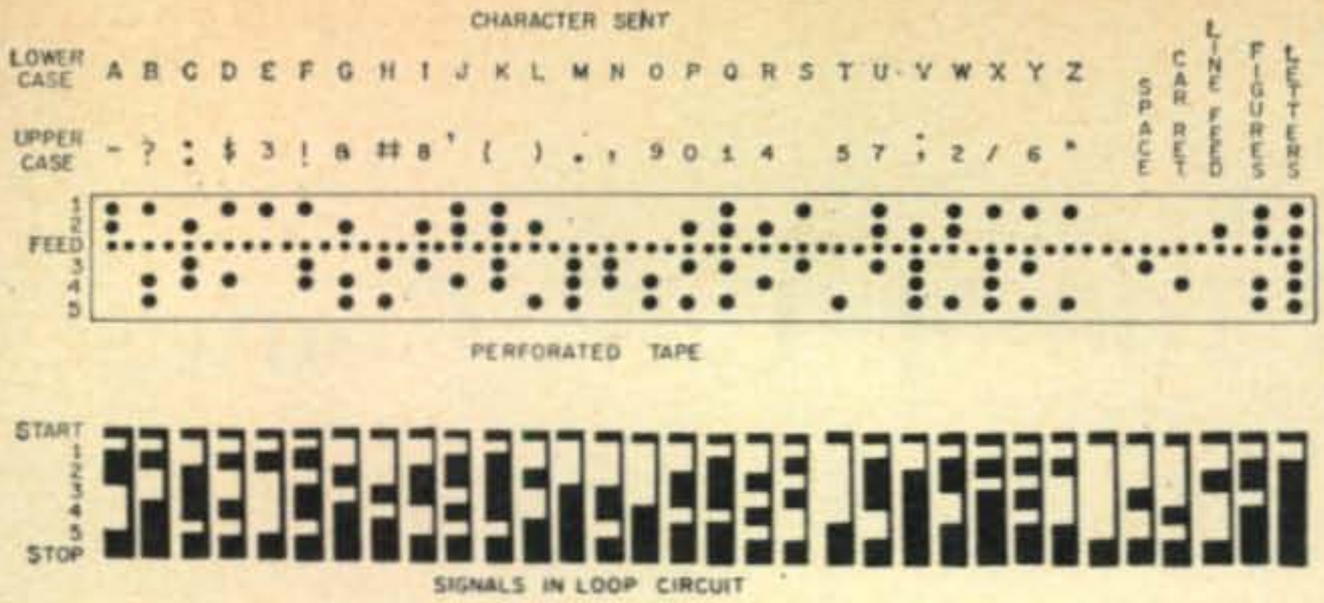

Fig. 2—Teleprinter Code.[3] The perforated tape shows the exact arrangement of dots (indicating On) and spaces (absence of dots) for all characters of the Teletype code. The last column graphically indicates the relation between dots (On) and spaces (Off) in producing the various characters of the five element teletype code.

punched clear of the holes in one type and in the other type the chads remain attached to the edge of the holes by a sliver of paper. About 80% of the hole circumference is punched, leaving the chad attached by the remaining 20%. This last type makes it possible for the message to be typed on the punched tape. This will be covered in greater detail in the next article in which the teletype machines that produce the tapes are covered.

RTTY Speeds

It has been pointed out in fig. 1 that it takes 163 milliseconds or 0.163 seconds to complete one character before the teletypewriter or teleprinter is ready for the next character. Also pointed out was the fact that each code element (the dots) consumed 22 milliseconds or 0.022 seconds. Thus in one second 1/0.022, or 45.45 dots can be transmitted.

The 22 milliseconds dots are called "Bits" and, as stated above, 45.45 Bits per second can be transmitted. The 45.45 code elements transmitted in one second is called a "Baud."[2]

Since the pulse sequence of each letter consumes 163 milliseconds, the maximum number of letters per minute would be equal to, 1 sec/0.163 $\times$ 60 = 368. Thus 368 operations per minute (o.p.m.) are possible.

For RTTY work, a word is considered to average five letters. Since the five letter word must be followed by a space each word is considered to have six operations.

Since we indicated 368 operations per minute are possible and each word averages 6 operations we have 368/6 or 61.33 words per minute. This number of words, 61.33 w.p.m., cannot actually be transmitted since there are other non-printing functions such as Shift, Line Feed and Carriage Return which each take up one operation. The result is a maximum speed of 60 w.p.m.

It might be pointed out, that 60 w.p.m. is by no means the only teletypewriter speed developed or in use today. In fact, there are quite a number, at least eight to my knowledge and perhaps more. The speed varies with the users —Bell system, Western Union, Europe and various military, to mention a few.

One of the reasons that teletype machines are becoming available to amateurs in greater numbers is because of the tendency of commercial users to use the higher speeds such as 75 w.p.m. and 100 w.p.m.

[2]The term "Baud" comes from one of the early developers of the five unit start-stop teletype code, Mr. Baudot.

The speed that is in general use in Europe is that of the Consultative Committee on International Telegraph (C.C.I.T.) which is 66.67 words per minute. Unfortunately, the receiving shaft speed of this code is 461.5 r.p.m. as compared to a receiving shaft speed of 420 r.p.m. for the 61.33 w.p.m. U.S. amateur code (one of the U.S. Bell system speeds) and these codes are not compatible. This creates a problem when an American amateur is using one of the 61.33 w.p.m. U.S. Bell system machines and a European amateur is using a machine using the C.C.I.T. standard. Obviously, the speed of one of the machines must be modified before the two amateurs can communicate with each other.

Machine Speeds

The F.C.C. rules require that a machine transmitting speed of about 60 w.p.m. be used. Machines designed to operate at any appreciably different speeds must be converted to the 60 w.p.m. speed before they can be used on the American radio amateur bands. There are two reasons for this. One is to satisfy the FCC requirement and the other is to be able to talk to the other amateurs. The machines must operate at essentially the same speeds (w.p.m.) in order to communicate one with the other.

[*Continued on page 92*]

[3]Kretzman, B., "An Improved Radioteletype Converter", *CQ*, April 1958, page 44.

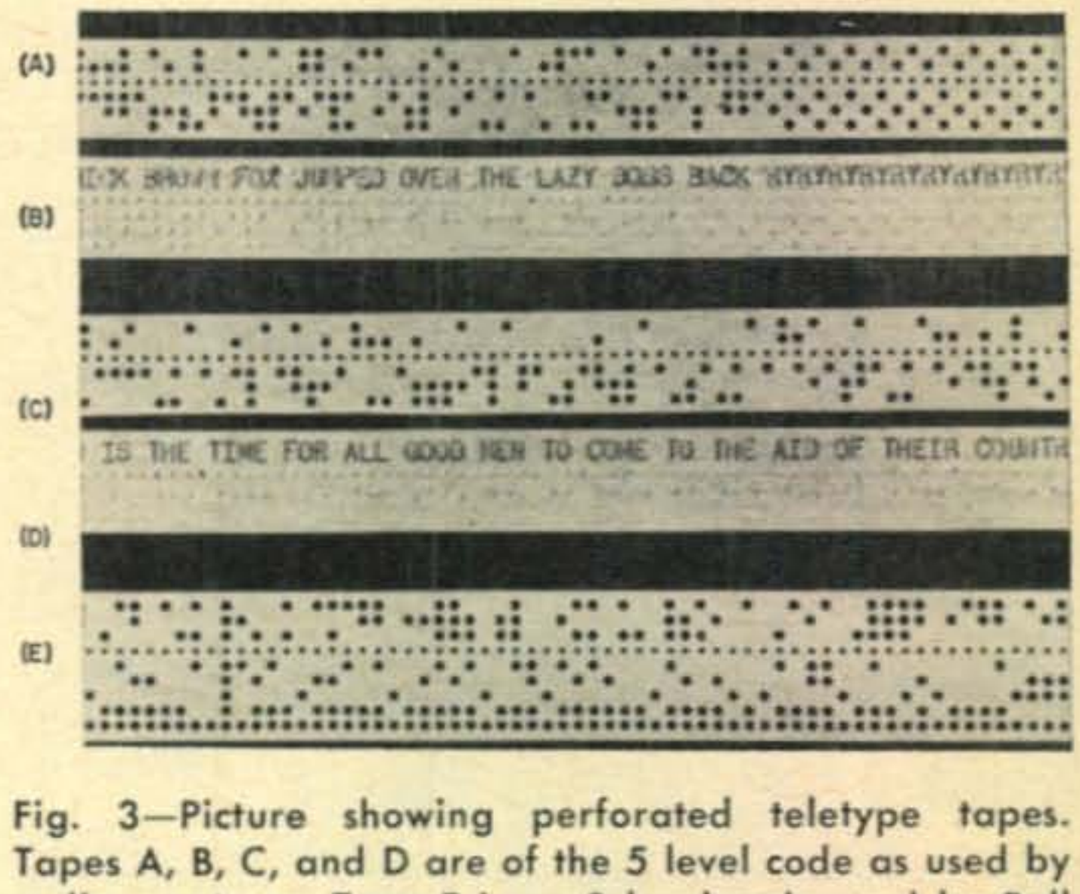

Fig. 3—Picture showing perforated teletype tapes. Tapes A, B, C, and D are of the 5 level code as used by radio amateurs. Tape E is an 8 level code used by Bell Telephone. Tapes A and C were perforated by the tape perforator of a Model 19 "Composite Set" and a Model 14 typing reperforator perforated tapes B and D.

Results of the

5th Annual *CQ* 160 M. C.W. Contest

BY CHARLES M. O'BRIEN*, W2EQS

EVER wonder how we would fare if we had a very low frequency (v.l.f.) band? Think it would be lots of fun? Well, conditions on 160 were such as to make it practically unbelievable that this is our lowest frequency assignment. It acted up in such a way as to make one think he might be tuned to 40 or 80 meters unless he checked his receiver to make sure it was on Top Band.

Conditions here on the East Coast were terrific both nights. And, who ever heard G, GM and DL come through in daylight? Yes, that's right! Signals from over there were audible as early as 2130 Z on Saturday afternoon. Reception of signals, as reported from most areas of the country with but few exceptions, were outstanding. And, the same held true in most instances of the reception of W/VE in foreign countries. When was it that you heard so many DX stations on Top Band? Last year's conditions were the best since the 1955/6 era, but this year's were even better. Ever think it would be possible? We sure did have the very best week-end of the entire season again.

Signals were many times above average on both nights, but those from Europe were best Friday night/Saturday morning. QRN? None at all! Everything just wide open for even the weakest of signals from Europe, South and Central America and the Caribbean. However, signals from the West coast were weak and never did come up to the European strength till Saturday night/Sunday morning when signals from the East were much weaker.

Some want to know how much we want for our crystal ball. Let's just hope, boys, that our ionospheric luck, our being clairvoyant, having that extra sensory perception, or whatever you wish to call it, will be with us again next year.

This marked the first time that all 50 States could work the band and we certainly heard from many who have been missing for long, long years. Every state was represented but South Carolina and Mississippi and all Canadian provinces were on but Prince Edward Island.

A partial view of things to come was had a year ago when, over the contest week-end a total of 1165 stations in 28 countries participated. This merely set the stage for the January 1964 event when a shattering total of 1506 took part from 28 different countries on all continents but Africa. If you didn't know how to compete with and read signals through QRM you were really in dire straits. Yes, the m.u.f. was steadily declining—going lower and lower. How can so many W/K/VE/VO (and some of the DX, too) signals crowd into two small 25 kc segments and still be readable? Oddly enough, and there were a good number of complaints on this, very few of us made use of 1875/1925 kc. For the most part the DX was jammed in between 1825 and 1830 kc. It was just bedlam in those 5 kc.

All previous scoring records were broken and ever so many worked their first foreign DX. New countries contacted were added to dozens and dozens of logs. Look at those scores to see what the boys did. Glance at those 270 QSOs to 9 countries and a multiplier of 53 made by our old friend WØAIH who is an ardent 160 stalwart and W9EWC with 266 and 11 and 54 respectively. Or take a look at K5HRR out Texas way with plenty of QSOs, 12 countries and a 54 multiplier. Let us jump across the pond, too, and there's GM3IGW/A with 269 QSOs in 12 countries and DL1FF with 233 in 13 and DL9KRA with 206 in 13 and G3GRI with 205 in 15. What a long way we've come since the first contest was held 4 years ago when the top total was

[*Continued on page 32*]

*48 Prospect Avenue, Westwood, New Jersey.

WØAIH, the Rev. Paul E. Bittner, at the operating position of his extremely neat layout. Paul is the winner for the State of Minnesota, recorded the highest number of QSOs of any W/K/VE/VO station . . . or in the world for that matter.

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

Connecticut

W1WY	187	45	10	24,300
W1TX	134	38	8	16,264
W1BHQ	111	36	7	11,736
W1ECH	71	25	2	3,550
W1ZL	40	23	7	3,312

Massachusetts

W1BB/1	56	19	10	9,120
W1AQE	101	30	6	7.260
W1PH	61	19	2	2,318

New Hampshire

W1FZ	110	32	6	8,256
W1CTW	55	19	3	2,242

Rhode Island

W1PPN	85	27	5	5,454

New Jersey

W2EQS	227	45	10	28,710
W2FYT	182	41	7	20,828
W2IU	130	36	9	15,048
W2HUG	117	36	8	10,728
K2GAL	105	33	7	8,778
W2KHT	98	30	3	6,360
K2GLQ	100	36	3	5,408
W2CVW	73	18	3	2,916
WA2HNI	58	18	2	2,088
WA2HJF	2	2	1	8
WA2QPX	1	1	1	2

New York

K2DGT	243	50	12	37,100
W2UWD	176	45	9	20,160
W2QOS	177	44	6	16,984
W2PSQ	93	30	5	6,510
WA2HLH	27	8	2	496

Delaware

W3EJU	19	8	2	304

Maryland

W3MSR	200	41	7	20,008
WØGKY/3	80	23	2	3,680
W3BKE	74	23	3	3,588
W3YRN	54	21	2	2,268

Pennsylvania

K3GYC	119	28	2	6,664
W3AZR	83	24	2	3,984
W3AJS	40	19	4	1,824

Alabama

K4HPR	6	3	1	36

Florida

W4WHK	83	30	6	6,420
K4FMA	72	28	6	5,600
K4IXG	65	30	6	4,860

Georgia

K1KSH/4	116	37	7	10,360
K4DKJ	129	33	5	9,834

Kentucky

W4KTA	33	14	2	924

North Carolina

W4WUW	80	25	2	4,000
W4PVT	52	24	4	2,880
WA4FJM	52	20	2	2,080

Tennessee

K4RIN	158	38	6	13,528
W4HIH	48	21	2	2,016

Virginia

W4BVV	246	49	9	30,772
W4KFC	142	37	7	11,988
W4KXV	114	30	4	7,320
W4OWE	116	29	2	6,728

Louisiana

K5TFG	43	24	3	2,448

Oklahoma

K5JVF	85	33	5	6,468
K5OBD	36	19	2	1,458

Texas

K5HRR	188	54	12	25,920
W5HAJ/5	146	43	6	13,932
W5FIX	55	29	6	4,060
WA5IHE	23	17	4	1,190

California

W6VSS	201	45	5	19,890
W6RW	160	42	3	15,120
W6JTB/6	164	39	5	14,196
W6YY	157	37	5	12,802
W6OST	98	26	3	5,304
WA6JPR/6	98	25	4	5,300
K6ZH	77	30	4	5,100
W6GWQ	96	22	3	4,576
W6YC	79	19	3	3,154
W6YKS	77	19	3	3,078
W6NKR	52	20	4	2,560
W6JVA	45	15	3	1,470
WB6GZE	49	13	3	1,378
WA6BXZ	48	13	2	624
WB6AZI	29	7	1	203
WA6YDX	8	2	1	32

Arizona

W7ENA	51	19	2	1,938

Montana

K7CTI	71	22	2	3,124

Nevada

K7ICW	80	23	4	4,048
K7FDB	44	14	2	1,232
W7SHY	34	11	2	748

Oregon

W7WZY	87	23	3	4,186
K7MLO	72	21	4	3,360
K7HDB	44	21	4	2,184
W7MLJ	44	11	3	1,056
W7JRI	41	8	2	656
W7EN	13	9	2	234

Utah

W7ZC	64	15	2	1,920

Washington

W7VGQ	114	27	4	7,020
W7DL	100	28	3	6,048
W7FIM	64	18	2	2,304
K7DEK	49	20	3	2,120
K7JRE	11	5	2	110

Michigan

K8TYS/8	116	36	3	8,640
W8WOJ	66	30	2	3,960
W8GGF	47	20	2	1,880

Ohio

W8HGW	202	52	12	29,744
W8BAR	164	45	7	16,920
K8RRH	176	41	6	15,826
W8LT	121	30	3	7,440
W8VLO	91	34	2	6,188
K8MJG	93	28	2	5,208
K8IQQ	81	26	4	4,628
W8LOF	56	25	2	2,800
K8NMG	51	19	2	1,938
W8YAT	34	16	2	1,088

West Virginia

K8QYG	46	15	2	1,380
W8YBZ	15	11	7	858

Illinois

W9PNE	163	49	9	18,914
K9YYG/9	179	44	4	16,456

Indiana

K9YWO	202	44	3	18,128
K9MMH	140	31	2	8,680
WA9AMZ	93	29	3	5,684
K9GSD	61	24	3	3,120

Wisconsin

W9EWC	266	54	11	35,208

Colorado

WØCDP	159	45	4	15,030
WØDK/Ø	121	34	2	8,228
WØEYE	81	25	2	4,040
WØEXS	60	21	2	2,520

Iowa

WØNFL	106	32	2	6,784

Kansas

WØGDH	194	46	5	18,952
WØVFE	30	16	2	960
KØYGR	18	11	2	396
WØIUB	8	6	1	96

Minnesota

WØAIH	270	53	9	31,588
WØVXO	231	54	8	27,540
WØRHI	110	35	3	7,752
KØPAU	86	37	3	6,660

Missouri

WØUQP	137	42	3	11,844
WØOGC	106	38	3	8,360
WØUXQ	36	20	2	1,440

Nebraska

WØFQB	45	22	2	1,980

North Dakota

WØSDN	151	41	3	12,628
WØCGM	59	29	2	3,422

South Dakota

WØCUC	38	21	2	1,596

Newfoundland

VO1DX	45	14	9	5,292
VO1BD	21	11	7	1,782

Nova Scotia

VE1ZZ	64	15	8	7,560
VE1EK	65	21	6	4,242

Quebec

VE2UQ	229	51	11	31,518
VE2AYY	117	29	5	8,178
VE2ATU	90	28	5	5,936

Ontario

VE3BWY	173	40	9	17,680
VE3EWY	103	31	4	7,626
VE3AGX	65	29	6	4,930
VE3DU	66	26	2	3,432
VE3ABG	43	22	3	2,068
VE3BZB	36	16	2	1,152

Manitoba

VE4RO	129	42	4	11,256
VE4XO	110	37	3	8,436

Saskatchewan

VE5JI	21	15	2	630

British Columbia

VE7EH	85	26	3	4,628
VE7BDQ	61	15	2	1,830
VE7BAT	2	1	1	4

Aland Islands

OHØNI	15	3	3	225

Bahama Islands

VP7NS	44	23	6	9,476

Canal Zone

KZ5FC	9	6	4	390

Channel Islands

GC3PAI/A	25	5	5	625

Colombia

HK4EB	21	19	7	3,363
HK7ZT	4	3	3	51

Czechoslovakia

OK1KPR	139	15	13	8,790
OK1ADM	102	14	11	6,048
OK2KGV	116	13	12	5,915
OK1ZL	106	13	12	5,759
OK1YD	112	11	11	4,444
OK1AEZ	94	10	10	3,800
OK1WT	70	12	12	3,516
OK2QX	82	11	11	3,113
OK1KPX	88	9	9	2,835
OK1KLX	90	7	7	2,142
OK1OO	60	8	8	1,872
OK2BEC	47	9	9	1,737
OK1WR	44	9	9	1,719
OK3QQ	57	8	8	1,464
OK1KOK	56	8	8	1,376
OK1AGV	50	8	8	1,304
OK1AHZ	53	7	7	1,225
OK2KGD	52	7	7	1,211
OK1AJN	54	7	7	1,134
OK1KKD	53	7	7	1,120
OK1BM	53	7	7	1,057
OK1AFC	36	7	7	1,057
OK3CCC	36	8	8	1,056
OK1MG	25	9	8	1,053
OK2LN	50	6	6	978
OK1IQ	41	7	7	910
OK1ZW	34	8	8	904
OK2BCN	44	6	6	816
OK1EV	39	6	6	792
OK2BCA	30	5	5	495
OK2BFJ	30	5	5	390
OK2BCI	9	8	8	360
OK2KJU	18	4	4	276

Eire

EI9J	54	7	7	1,890

England

G3GRL	205	33	15	43,824
G3RBP	178	25	14	20,800
G5ZT	146	23	10	13,618
G3RFS	121	18	11	8,658
G3RSR	218	10	10	6,790
GB3RSS	115	14	12	5,810
G8PG	87	11	11	3,333
G3PEO	93	10	10	3,210
G3MWZ	48	8	8	1,248
G3JVJ	32	6	6	606

Finland

OH3NY	48	7	7	1,659
OH2HK	25	7	7	854

Germany

DL1FF	233	28	13	36,904
DL9KRA	206	23	13	24,863
DL1KB	102	14	13	7,224
DL1JW	79	15	13	5,760
DL7AA	61	15	13	4,650
DL1VW	30	6	6	894
DL1YA	6	4	4	96

Hawaii

KH6EPW	51	14	3	6,916

Honduras

HR3HH	76	31	5	20,365

Jamaica

6YAXG	35	20	6	6,340
6YACZ	29	22	8	5,324

Netherlands

PAØPN	179	18	12	16,902
PAØLOU	10	4	4	176

North Ireland

GI6TK	142	27	12	23,382

Scotland

GM3-IGW/A	269	27	12	39,015

Wales

GW3JI	174	18	12	17,532

West Maylasia

VS1LP	2	2	2	20

Check logs are gratefully acknowledged from: OK2KFK, OK1AIA, OK2DB, OK1KBC, OK1AIR, OK3KAG and OK3KFY.

Top Ten World-Wide

G3GRL	43,824	WØAIH	31,588
GM3IGW/A	39,015	VE2UQ	31,518
K2DGT	37,100	W4BVV	30,772
DL1FF	36,904	W8HGW	29,744
W9EWC	35,208	W2EQS	28,710

116 QSOs and the greatest multiplier was but 31. Let us ask how does the gang make so many QSOs within such an extremely limited amount of frequencies. It takes know-how, buddy, real know-how. Scoring records like these, or anything approaching them, require much more than mere endurance. To be near the top in a competitive encounter such as this calls for constant study of every facet of contest operating skill at your command. All the little secret weapons . . . all the little tricks are put to their acid tests. You waste no effort or motion. Yes, greater scores are yet to come which will make those of 1964 and yesteryear seem like also-rans.

Two of the gang entertained thoughts of working, for the most part, DX only. And, with such superb conditions, they certainly had plenty to select from and call. Of 64 QSOs that VE1ZZ had, 47 were to DX while W1BB rolled up only 56 QSOs but of which 46 were to foreign ports.

DX is DX no matter what band you're on but when you hear the following on 160 it is, for the most part, phenomenal . . . DL/DJ, EI, G, GC, GD, GI, GM, GW, HB, HK, HR, KH6, KL7, KR6, KZ5, OH, OHØ, OK, PAØ, PY, UO5, VP7, VP9, VS1, XE, 6YA. What's the breakdown of participating stations by country? This may be of interest to you:

W/K	904	GW	22	OK	90
VE/VO	40	HB	6	PAØ	5
DJ/DL	17	HK	2	PY	2
G	348	KH6	7	VP7	2
GD	2	KR6	2	XE	3
GI	10	KZ5	2	6YA	2
GM	31	OH	2		

And, one each in all other countries as listed above.

Reportedly there were three different CM/CO stations worked by a very few but latest reports received by us indicate that the use of 160 meters in Cuba is forbidden.

How was activity spread out across the United States and Canada? Let's make another listing of stations participating per district . . .

1st	50	7th	84	VE2	7
2d	82	8th	151	VE3	12
3d	53	9th	108	VE4	3
4th	79	10th	115	VE5	2
5th	30	VO1	2	VE6	1
6th	152	VE1	3	VE7	10

As for weather conditions in various parts of the country and Canada . . . they sure varied. We went from pleasant, warm weather in the south and far west to sleet and ice storms in the midwest and eastern Canada, brisk and clear winter weather in the east, to winds of practically tornado force in Ontario and Quebec where antennas were down and electricity off for hours in some instances.

Power used ran from a measly ½ watt to 200 watts in those areas so fortunate to be able yet to run such QRO. Antennas were as different as anyone could imagine running from the most intricate jobs to plain hunks of wire to a 32 el. beam designed for 220 mc.

We had a record total of 229 logs received from 20 countries. The rarest of all, and one that would be mighty much in demand on any band, is that of VS1LP who had contacts to KR6ML and G3GRL and who heard W6YY. What a shame but the very next day Bob established QSO with Alex, W6ML (ex-W6KIP) after Contest hours.

Boys, please sign your call letters to all logs. We received one very neatly recorded and signed but no indication of the call. Through a process of elimination we finally concluded it was that of a W8 whose call we will leave unmentioned.

For the sake of awards, and in lieu of QSL, *CQ* will honor all listings within the logs received as sufficient proof of contact. And we do not believe we are out of line in stating that ARRL will likewise agree on this point for any of their awards.

A most attractive certificate will be sent shortly to the highest scoring station in each state, Canadian province and foreign country.

Comments

Now tell me fellas, just what would a contest report be without the comments from the gang who participated? This makes for interesting reading matter. So, let's get with it. Here we go. . . .

1st District

W1WY: We had another good one this year. Our special crystal ball is batting 100%. More use should have been made of the 1875-1925 kc portion of the band. W1TX: Foreign participation was excellent. Didn't hear many western stations. Those that did come thru were hard to raise due to their working 8s, 9s and Øs in the

[*Continued on page 86*]

John, G3GRL looks a bit haggard after his contest effort leading to the world-high score.

THE METER MASTER

BY RICHARD C. KELLY*, K5SOD

The Meter Master is a simple device used to determine the characteristics of an unknown meter movement. Most of the parts can probably be found in the average junk box and the small cost will be returned many times over by salvaging those "Tune for Max." and "Eight Dots Full Scale" meters laying around the shack.

In order to make usable items out of unknown meters, two things need to be found out about them. First, we must find out how much current is required for full scale deflection of the unknown meter. This may be read directly from the face of some meters. Second, the internal resistance of the meter must be measured. This second consideration is where the "Meter Master" really earns its salt. The internal resistance of a meter cannot be measured directly with an ohmmeter because such an attempt might damage the "unknown" meter.

In some cases, the full scale range of the unknown meter is all that is needed. For instance; if the full scale current is 25 ma and the meter is to be used in a grid circuit that will be drawing only 10 ma, just put the meter in the circuit and forget the internal resistance. On the other hand, if this same 25 ma meter is to be used in a plate circuit that will be drawing 175 ma, the internal resistance must be known in order to properly shunt the meter.

The haywire set-ups usually resorted to in order to determine unknown meter characteristics are in themselves very risky due to the possibility of shorts and lack of flexibility. To overcome this problem the simple circuit, shown in fig. 1, was built into a Bud Utility cabinet and promptly labeled the "Meter Master."

The circuit combines all the parts necessary to determine the full scale range of an unknown meter. This includes R_1, B_1, binding posts A and B for a calibrated milliammeter and posts C and D for the unknown meter.

Also provided for is the means for determining the internal resistance of the meter by the use of S_1 and R_2.

Using the "Meter Master"

To use the Meter Master is simplicity itself. Assuming that nothing is known about the unknown meter, remove the jumper between Post A and Post B (fig. 1) and set the switch S_1 to SET FULL SCALE. Insert a v.o.m. with the positive lead to post B and the negative lead to post A. Set the v.o.m. scale to the current reading position at 200 ma or more. Always start with a high setting and work down. Now the full scale reading of the unknown meter can be determined. Adjust R_1, the FULL SCALE control to obtain a full scale deflection of the unknown meter, and read the full scale current, I, from the v.o.m. See fig. 2.

If a full scale reading cannot be obtained with the R_1 turned fully clockwise, the unknown meter is beyond the current supplying capabilities of the batteries. This condition is probably due to an internal shunt, and can be overcome as will be

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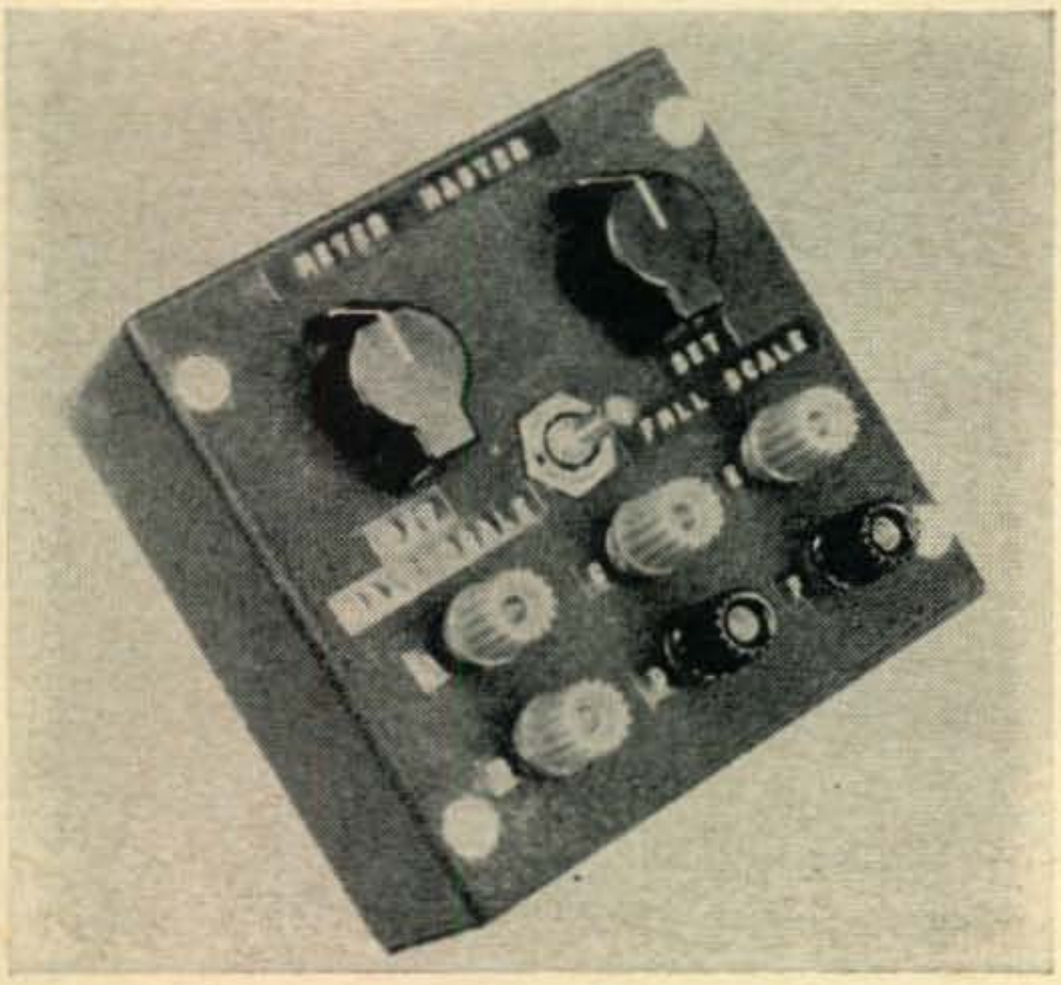


View of the "Meter Master" showing component locations which can vary considerably without affecting the accuracy. The Bud Utility cabinet measures 4"×4"×2".

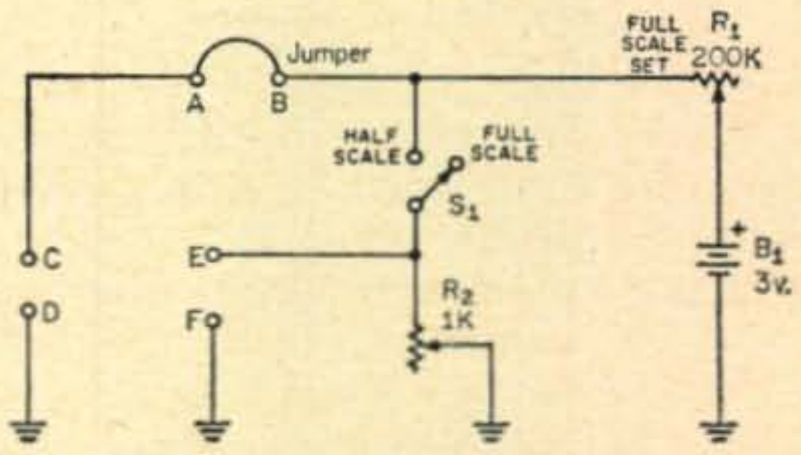


Fig. 1—Circuit of the "Meter Master." Both pots should have a linear taper and their values may vary somewhat if they are drawn from the junk box.

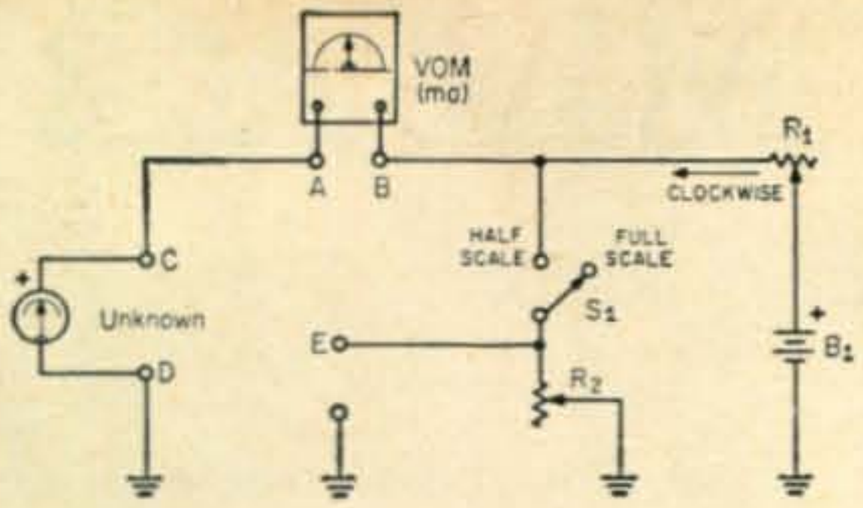


Fig. 2—The "Meter Master" set up to determine the full scale deflection current of the unknown meter.

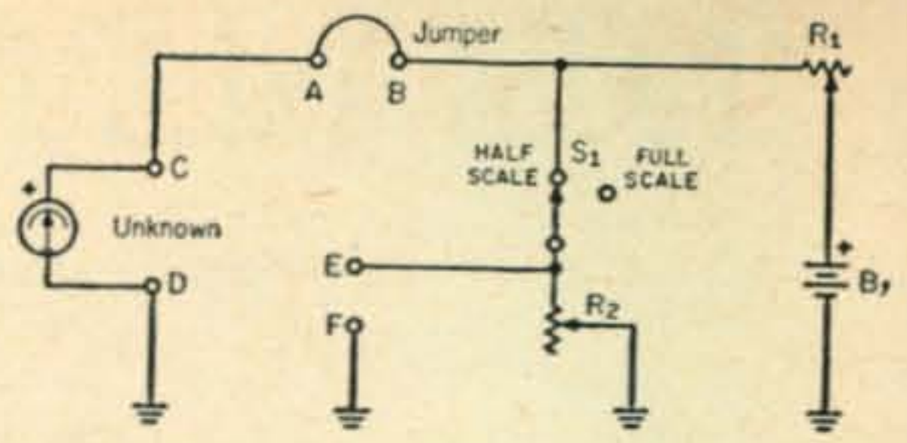


Fig. 3—The set-up for determining the internal resistance of the unknown meter is shown above. Note that S_1 is in the HALF SCALE position.

explained later. If the reading on the v.o.m. is relatively small, set the v.o.m. switch to read less current until a near maximum scale reading is obtained. This will insure greater accuracy.

The current capacity of the unknown meter is is now known, and for this example it will be 25 ma.

Now, on to bigger and better things. Remove the v.o.m. and replace the jumper between post *A* and post *B*, as in fig. 3. The unknown meter will tend to deflect past full scale when the v.o.m. is replaced with the jumper, and it will be necessary to reset to full scale with R_1. With the unknown meter still in place, set the switch, S_1, to HALF SCALE and adjust R_2 for a half scale reading. If a half scale reading cannot be obtained by adjusting R_2, the unknown probably has an internal shunt, and again, this situation will be discussed later. If the meter can be set at half scale, set the switch S_1, back to SET FULL SCALE and measure the unknown meter's internal resistance between Post *E* and Post *F* as shown in fig. 4. For this example 100 ohms will be used.

Shunt Calculations

The unknown meter is now very much known and a value for a shunt can be easily calculated. Let us assume that this 25 ma meter with an internal resistance of 100 ohms is going to be used in a circuit that will draw a maximum of 175 ma. It is desired to raise the 25 ma capacity of the meter to 250 ma and the value for a shunt can be calculated from the formula: $R=R_m/(n-1)$ where R is the resistance of the shunt to be calculated, R_m is the internal resistance of the meter which was just determined to be 100 ohms, and n is the factor by which the original meter scale is to be multiplied (10). In this example, $R=100/(10-1)$ so that $R=11.11$ ohms.

Making a Shunt

Chances are that such an odd value of resistance as 11.11 ohms will not be easy to come by in ready made form. Luckily, any value of resistance can be readily obtained by using resistance wire or even ordinary copper wire. By consulting a wire chart for the resistance per foot, the amount of resistance needed can be measured (with a tape measure or ruler) and wound onto a form. A one inch piece of small diameter poly-rod makes an excellent form.

As an example of how easily these "roll your own" shunt resistors can be manufactured, assume that another meter has been checked out with the Meter Master and that the meter has been found to have the following characteristics:

Full scale deflection—1 ma.

Internal resistance—200 ohms.

Further, assume that this meter will be used in a plate circuit that will draw a maximum of 250 ma. To allow a margin of safety, the meter range will be multiplied by 300 in order to give a new full scale reading of 300 ma. By using the formula, $R=R_m/(n-1)$, the value of the required shunt is found to be 0.668 ohm. The copper wire table (Table I) shows that the smallest wire size that will safely carry a current of 250 ma is #32 wire. The length in feet of #32 copper wire required for a resistance of 0.668 ohm is found by dividing the required resistance (0.668) by the resistance per foot (0.167). This figures out to be exactly 4.0 feet. Four feet may seem to be quite a bit of wire, but this much #32 wire will take up very little room under the chassis when wound around a half-inch or so of small diameter "poly-rod."

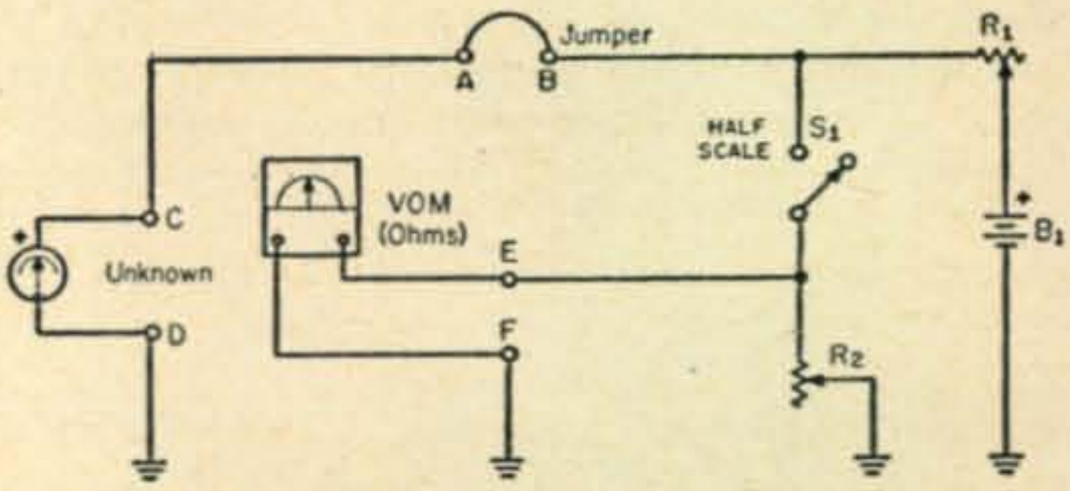


Fig. 4—The equivalent resistance of the unknown meter movement may be read directly from R_2, between posts *E* and *F* with S_1 set in the FULL SCALE position.

Some may question the validity of the high current capacity figures for copper wire as listed in the wire table. Most reference material will give a rating for copper wire of 500 to 700 circular mils per ampere, whereas the author lists capacities that are based on only 250 circular mils per ampere. This discrepancy stems from the fact that most reference materials are giving ratings with regard to transformer windings in which the current would be continuous for long periods of time. When being used for shunt material, however, the wire will be given a periodic rest because of the duty cycle of equipment being used for amateur service.

Multipliers

Figure 5 gives an idealized application for metering in a typical radio frequency amplifier. The resistors R_1, R_2, and R_3 are the shunts. Notice that the resistors R_4 and R_5 are in series with the meter as opposed to the shunt resistors which are in parallel with the meter. These resistors are known as multipliers, and actually convert the meter into a voltage measuring device, as will be covered shortly. The meter to be used in the following discussion will have the following characteristics: (Obtained with the "Meter Master," of course!)

Full scale deflection—200 microamps.

Internal resistance—500 ohms.

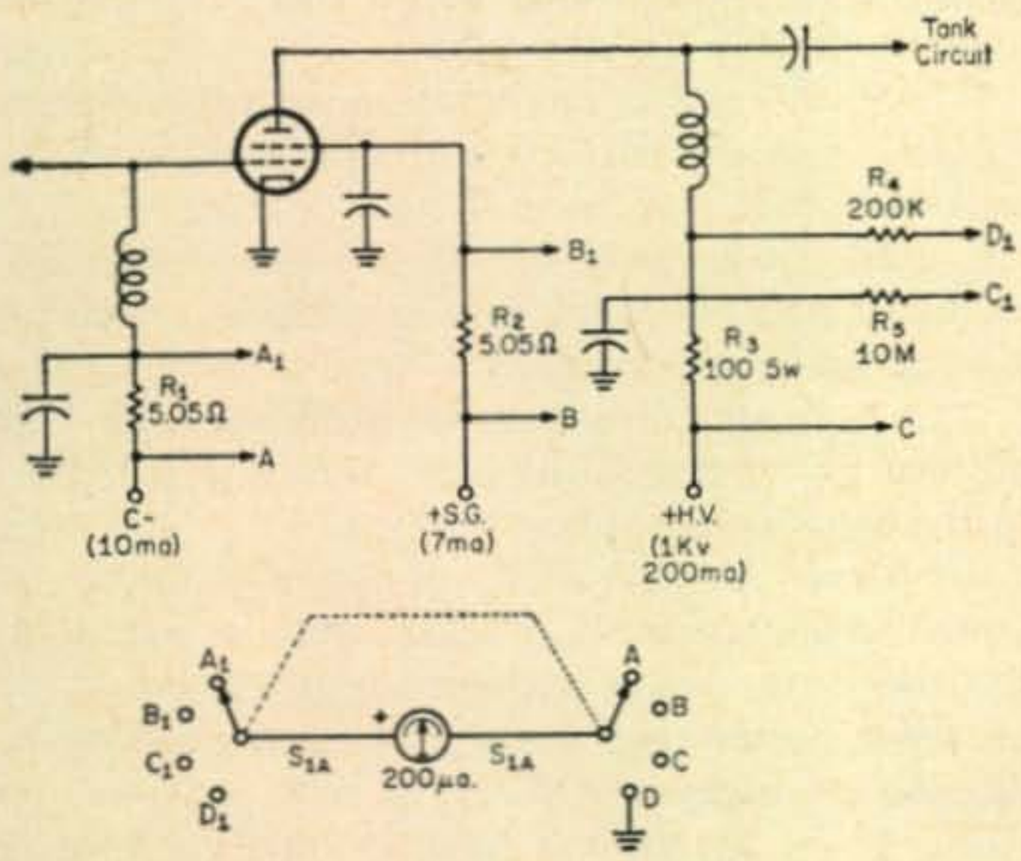


Fig. 5—Above is a typical r.f. stage with all the points being metered. The determination of the shunt and multiplier values are covered in the text. The meter positions are as follows: *A*—Grid Current (0-20 ma), *B*—Screen Grid Current (0-20 ma), *C*—Plate Current (0-400 ma), *D*—Plate Voltage (0-2000 volts).

To see how the values for the shunt and multiplier resistors in fig. 5 were obtained, consider each circuit independently. First, the grid circuit. As indicated in fig. 5, the maximum grid current will be 10 ma. Note that this is fifty times the full scale deflection of the 200 microammeter. A shunt resistor is definitely in order! The calculation of a value for the shunt resistor is now old hat to the observant reader and the resistance needed is: $R=500/(100-1)=5.05$ ohms, as indicated in fig. 5. Observe that the value for n is 100 rather than 50. This gives an adequate safety factor, and the meter will be easier to read with a mid-scale deflection of 10 ma rather than using a full-scale deflection of 10 ma.

The wire chart shows that #38 wire is more than capable of handling the 10 ma grid current. By dividing the required resistance (5.05) by the resistance per foot of #38 wire (0.673), it is found that a length of wire 7.51 feet long will be required. Number 38 wire is pretty small, and seven and a half feet will wind into a mighty compact component. If the prospect of handling this spiderweb-like wire does not suit your fancy, a resistor with a value very close to the required 5.05 ohms can be obtained from a parts supplier. A resistance of 5.1 ohms is available as a standard size, and could be used in this circuit without grossly affecting accuracy.

Second, the screen grid circuit. In actual practice the screen grid current is seldom metered after initial tune-up of a new circuit, but it is shown here for illustration purposes. Since the screen grid will be drawing only 7 ma, a full scale deflection of 20 ma can be used and the value for a shunt will be identical to that for the control grid.

Third, the plate circuit. Referring to fig. 5, it will be noticed that the values of resistance in the plate metering circuit are the everyday variety that are readily obtainable. This is one good argument for using a multiplier-type circuit for metering current. If you would like a quick (?) review of Ohm's Law, try figuring the values for the resistors in the plate metering circuit with only the meter characteristics and the supply voltage and current. Finished? Read on and see how easy it really is.

Table I—Copper Wire Table

Wire Size	Cross Section Area	Ohms per Foot	Current Capacity
28	159.8	0.006	0.600 amp.
30	100.5	0.105	0.420 amp.
32	63.21	0.167	0.250 amp.
34	39.75	0.266	0.155 amp.
36	25.00	0.423	0.100 amp.
38	15.72	0.673	0.060 amp.

Table I—Copper wire gauge *versus* resistance and current carrying capacity based on 250 circular mils/amp. Cross section column is in circular mils.

Multipliers

Perhaps it would be a good idea to briefly explain how a multiplier resistor, such as R_4 and R_5, (fig. 5), converts a current meter into a voltmeter. Actually, voltage, current, and resistance cannot really be measured independently since they are each used to define the others. Recalling Ohm's Law; Voltage=Current × Resistance. So the 200 microammeter being used here is already capable of measuring voltage. But not very much! The exact amount is, according to Ohm's Law, the full scale current (0.0002 amp.) times the internal resistance (500 ohms) which amounts to only 0.1 volt. Figure 6, which is a simplified version of the plate circuit in fig. 5, shows that there will be a difference of potential between point *A* and point *B* of 20 volts when the plate is drawing 200 ma. This is obviously too much voltage for a meter which is capable of measuring only 0.1 volt, so at least 19.9 volts must be "dropped" before the meter can be used. Or, stated in another way, the voltage measuring capabilities of the meter will have to be multiplied by at least 199.

As may have been suspected, the multiplier resistor is going to turn the trick. Luckily there is a formula for calculating such multipliers: $R=1{,}000{,}000 \times E/I$ where R is the value of the multiplier resistor, E is the desired full scale voltage, and I is the full scale reading in micro-amperes. (That's right—it's just Ohm's Law dressed up for working with current expressed in micro-amps.) If a milliameter is to be used, the formula becomes $R=1{,}000 \times E/I$ where I is the current in ma. In this example $R=1{,}000{,}000 \times 40/200=200{,}000$ ohms. This value will give a full scale reading of 40 volts, which happens to be just right for a mid-scale reading of the 20 volts being developed across the shunt resistor.

If the reader is wondering what in the name of Hiram Percy Maxim a mid-scale reading of 20 volts has to do with the plate current, just recall how this 20 volts got there in the first place. Remember that, with the values shown in fig. 5 and fig. 6, it required exactly 200 ma of current flowing through the shunt resistor, R_3, to produce a voltage drop of 20 volts. This voltage in itself is, of course, of little value, but since the meter is now capable of reading a voltage drop of 0 to 40 volts, and since Ohm's Law stated that there is a direct relationship between voltage, current and resistance, the meter also reads plate current of 0 to 400 ma. Clever, don't you think?

The method by which the value of the plate voltage measuring circuit multiplier, R_5, was arrived at is, by now, obvious to the most casual observer. $R=1{,}000{,}000 \times E/200=10{,}000{,}000$ ohms.

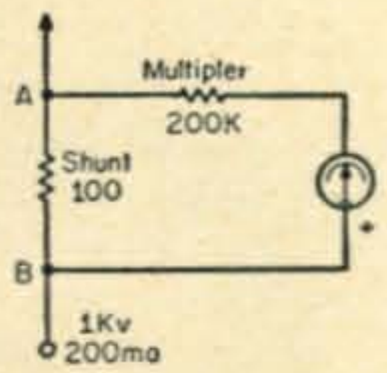


Fig. 6—Simplified version of the plate feed of fig. 5 shows how the multiplier principle is used to check plate current or the voltage drop across the 100 ohm shunt.

There may be some curious souls who are wondering how a value of 100 ohms for the plate shunt resistor, R_3, was come by. The value for this resistor is actually very flexible. In the example presented here, a value of 1, 10 or 100 ohms is desirable because any one of these values will give a good correlation between the voltage developed across the shunt and the 200 micro-ameter being used. For example, if a value of 1 ohm had been used instead of 100 ohms, the drop across the shunt at 200 ma plate current would have been 0.2 volt. In this case, the multiplier resistor would be: $R=1{,}000{,}000 \times 0.4/200=2{,}000$ ohms for a mid-scale reading of 200 ma. With this arrangement, the meter will still read out 0 to 400 ma plate current. Other values can be used for the shunt, of course, but the relationship of R_4/R_3 should always be at least 20/1 or more. A high ratio will insure greater accuracy because the method of figuring multipliers as presented here assumes that all the current flows through the shunt resistor (refer to fig. 6). This assumption is not strictly true. Some of the current flows through the meter and the multiplier resistor, but it is so small as to be of no practical consequence if a proper relationship of R_4/R_3 is maintained.

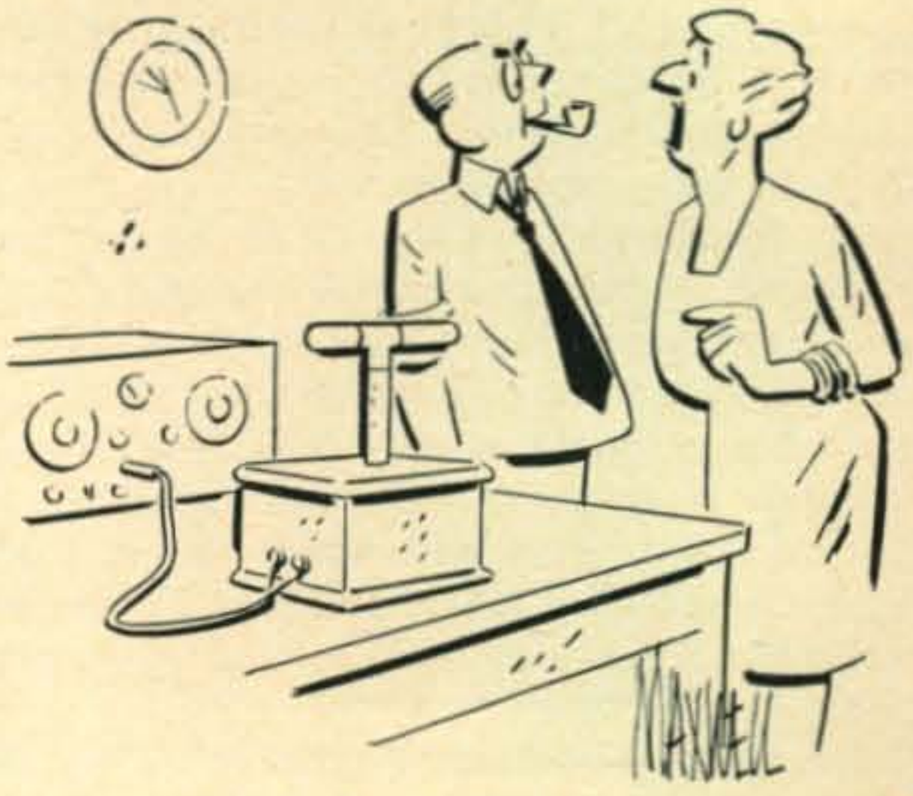
It should now be apparent that with the "Meter Master," Ohm's Law, and a few (formerly) useless junk box meters, many interesting and useful metering applications can be created.

Limitations

The operating range of the "Meter Master" as shown here is approximately as follows. It will measure internal resistance up to about 500 ohms. Since most meters have internal resistances below 500 ohms, this is quite satisfactory. The current measuring ability of the "Meter Master" depends mainly on two factors. First, the range of the v.o.m. used in conjunction with the "Meter Master"; second, the current supplying capabilities of the batteries. In short, the "Meter Master" will work quite well on most meters that are usable in amateur work. It works equally well on moving coil or moving vein type meters.

One note of caution is in order. If the "unknown" meter has an internal shunt, it will foul up the whole operation. If the FULL SCALE control will not set full scale, or if the HALF SCALE control does not set half scale, chances are good that the meter has a built-in shunt. Any moving coil type meter that has a full scale reading of 100 ma or higher is likely to have an internal shunt. If the meter will have to have a shunt in order to be usable anyway, then the internal shunt may as well be removed to make way for a new one. These internal shunts usually consist of a coil of resistance wire connected directly across the terminals just inside the case, so simply open the case and remove it with two deft strokes of the diagonal cutters and—Presto—the meter is ready for a new lease on life. Of course, the meter will have to be "taken from the top" again to determine its full scale reading and internal resistance without the internal shunt.

The "Meter Master" has helped to salvage about $30.00 worth of meters at the author's workbench, so the little device has been almost literally worth its weight in gold. Beside that, it was fun to design and build such a simple and useful piece of equipment. ■



"I was afraid of this. You've become power mad."

One Step Short

BY MARCUS A. FELT*, W2GYQ

Part II

By the end of the 19th century the electrical communication arts had been well established on a scientific basis. In America, the architects of this electrical age had been men of the caliber of Joseph Henry, Samuel Morse, Alexander Bell, and Thomas Edison; and some of these now began to dream of signalling without wires. Of these 19th century inventors only Edison had come close to suspecting the possibility of wireless communications with his investigations of "etheric force" in 1875.

As the 20th century dawned, practical-minded men like Marconi turned dreams into reality by forging the elemental instruments of radio. However, these primitive instruments were totally unsuited for reliable long distance transmission; a feverish search began for sensitive radio detectors. In the early years of the 1900's the stage was set for the appearance of an "electronic magician." The world did not have long to wait.

De Forest

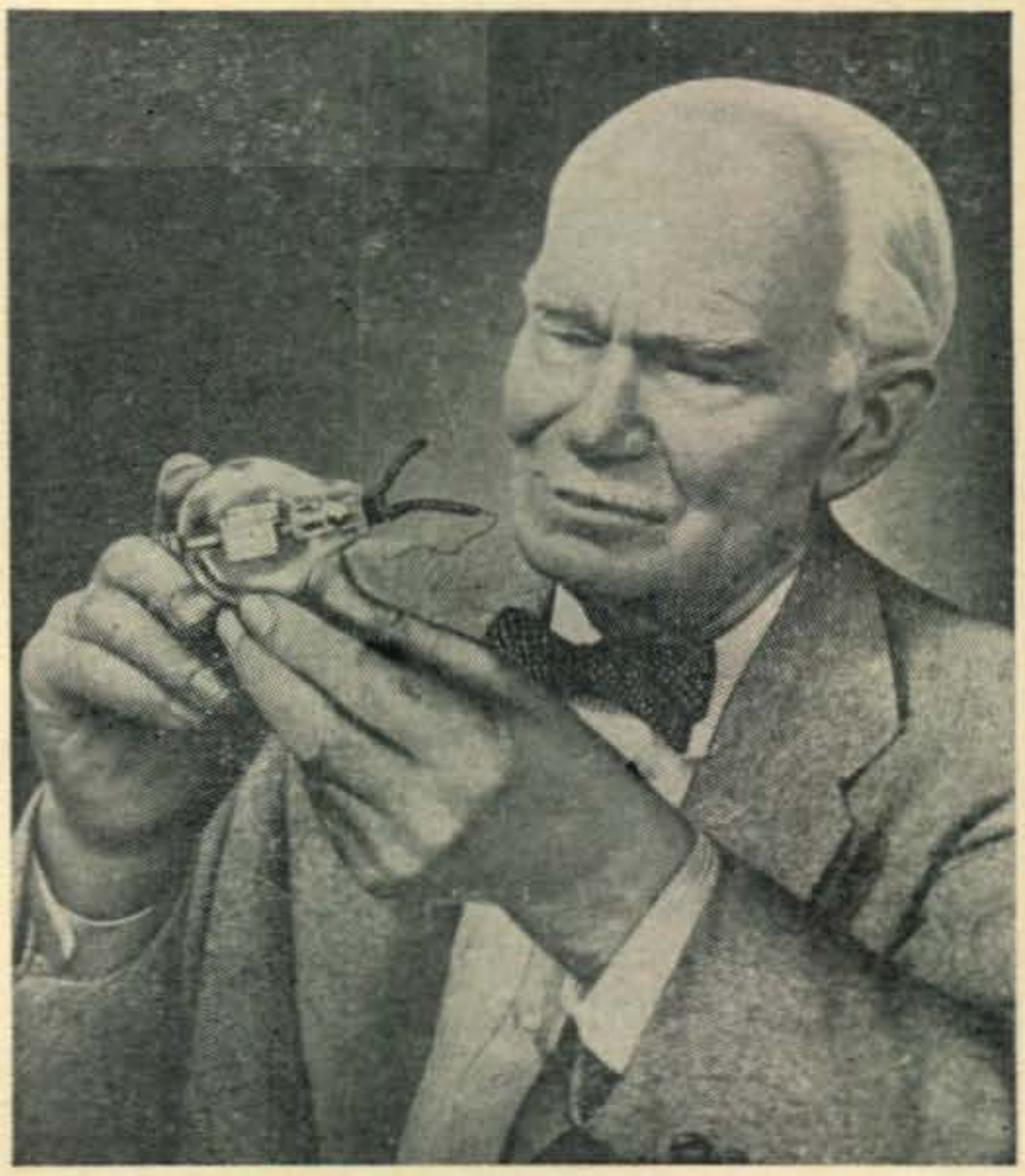
Our third tale concerns an inventor, who in search of a more sensitive radio receiver, traversed a tortuous road that took him from a crude bunsen burner flame detector to the ingenious three electrode radio tube familiarly called the triode, progenitor of all modern electronic tubes. Lee de Forest was an energetic and persistent experimenter whose devotion to radio earned him the appellation in later years of "Father of Radio."

In June 1899 de Forest, despite real poverty and little encouragement in his career, had earned his Ph.D. at Yale University. His thesis 'on reflections of Hertzian waves' indicated his major interest in what was then known as wireless telegraphy.

By the end of 1899 de Forest was striving to improve on the Marconi detector then in use, an unreliable device called a coherer, which used metal filings and had to be decohered (restored to readiness) after each radio wave. He struck out in the direction of electrolytic detection which held promise of self-restoring action. His final detector of this type he termed a "sponder" and for years it was the key element in his receiving system.

Later developments along these lines ended with the introduction in 1906 of the Dunwoodie crystal detector of catswhisker fame. The crystal detector was to survive well into the 1920's but by 1903 de Forest was hard at work following the trail of a totally different radio detector. According to his account he first conceived of a flame detector in which two platinum electrodes under fire would control the local B battery energy by means of the much weaker radio wave energy. De Forest was thinking in terms of a trigger or relay device in which low energy radio waves could control and shape the local energy, a process we call amplification.

De Forest soon passed beyond the unstable flame detector and settled upon the use of incandescent lamps. By 1905 he had developed a two electrode (diode) detector utilizing A battery for filament current and B battery for local current. It differed from the old "Edison effect" lamp only in the sense of utilizing a separate voltage source for the plate circuit. A very slight degree of amplification occurred. Pressing on



Lee de Forest

*50 Prince Lane, Westbury, N.Y.

with his trigger concept, de Forest wrapped a piece of tin foil connected to the antenna circuit around the exterior glass of the diode detector. This was his control electrode. This arrangement was superior to the diode operation and he was encouraged to introduce this second plate within the tube.

He now designed a tube with two internal plates and a filament mounted midway between. Finding this a distinct improvement, he then conceived of placing the control plate between the filament and the conventional plate. However in this configuration he punched a great number of small holes in the control plate. The final step in the evolution of this remarkable device soon followed. De Forest now replaced this perforated control plate with a wire grid and positioned it at minimum distance from the filament.

The first three electrode tube thus emerged as a reality; it contained a filament (cathode), a control grid, and a plate. The genius and persistance of Lee de Forest had given birth to an entirely unique and novel instrument, one that would provide mankind with untold power to seek out and control the secrets of nature. The year was 1906. He called his invention an "audion".

At this point de Forest was not aware of the potential of his "baby". He had searched long and hard for a more sensitive detector of radio waves. His audion tube proved to be somewhat more powerful as a radio detector but not to any remarkable degree. The wireless world by no means beat a path to de Forest's door begging for the audion tubes. In the years from 1906 to 1912 audion tubes simply did not gain acceptance despite efforts by the inventor to commercialize the new device. In the receiver circuits of the day their performance did not justify the expense. The crystal detector came close to matching the capability of the de Forest triode.

In some desperation and eager to realize a financial return on his audion patents, de Forest abandoned his radio development of the audion and initiated serious work with the tube as an amplifier or relay in telephone lines. Long distance telephony in 1912 was seriously handicapped due to fade-out of the weak voice currents over high resistance long wire lines. This had been the immediate and long lasting headache of telephone engineers since the birth of the art.

Michael Pupin, a professor of Electro-Mechanics at Columbia University had made the one singular contribution. His so-called Pupin inductance coils properly positioned in long telephone lines was a partial answer but by no means the final solution.

In July of 1912 de Forest had achieved encouraging success with the cascading of audion amplifier stages; feeding the output of one into the input of the next. However, when introduced into telephone circuits, his amplifier set up a peculiar howl. In order to interest the American Telephone and Telegraph Company, de Forest had to eliminate this howl, or his amplifier would be rendered useless for long distance wire telephony operation. After much experimentation he achieved a useful amplifier and in 1913 sold the wire rights to the audion for a sum of $50,000. De Forest, the "Father of Radio" had removed the howl.

Thereby lies the point of our third tale. This "useless" howl was the one missing ingredient of radio. From this howl phenomenon would emerge every modern instrument vital to the radio development of our times. Today we call it "feedback." It is the basis of all regenerative amplification and oscillation. Properly understood and utilized in appropriate circuits, feedback was to revolutionize the radio art.

Feedback used in a regenerative detector circuit created the long sought answer to highly sensitive radio receivers; feedback in a transmitter type oscillator circuit generated continuous waves of radio frequency making obsolete and ridiculous the crackling spark, the sputtering arc, the sharp pitched whine of high frequency generators; feedback in a receiver type oscillator made possible heterodyne reception of continuous waves and provided the clue to the ingenious superheterodyne circuit. Feedback, a potent genie possessing the magical power of modern radio, lay dormant in de Forest's audion tube awaiting the master's hand.

The tube's creator had passed it by although in later years in ex post facto argument he was to claim and win legal recognition of the feedback principle on the basis of his howling telephone amplifier circuits. Radio engineers knew better; their accolades for the feedback discovery went to a brilliant electrical engineer, Edwin H. Armstrong, who at the age of 22 discovered, understood and patented the feedback principle.

Dr. Lee de Forest had won eternal fame for his invention of the triode tube; honor and glory were rightfully his in recognition of this outstanding achievement, but the true master who called forth the great power of the audion was the young man, E. H. Armstrong.

Pupin

Our final tale concerns the eminent teacher and electrical inventor, Dr. Michael I. Pupin. His long and honorable career touched on most of the important electrical, wireless, and radio developments discovered over a period of 50 years from 1885 to the time of his death in 1935.

Pupin was not a native American, having been born in the peasant village of Idvor, a Serbian community located in what is now the country of Yugoslavia. His humble origin made more remarkable the admirable achievements of his life. His peasant parents were unable to read or write and his native village offered an exceedingly limited amount of formal schooling.

Yet tiny Idvor provided Pupin with several unforgettable experiences instrumental in forming the basis for his most important electrical inventions. During the summers, free of school affairs, he was trained as a herdsman. One of his lessons required that he learn to signal

through the ground. Each boy herdsman, widely separated with his flock, was taught to strike the wooden handle of a long knife plunged deep into the hard earth. Communication took place over amazing distances. Pupin never ceased to speculate on the vibratory phenomenon inherent in this simple communications system.

Another experience, never forgotten, involved the musical operations of the Serbian bagpiper, a prominent figure in every group of herdsmen. Pupin's interest was excited by the adjustments or tuning of the bagpipes which brought forth the differing sounds. These early contacts with sound phenomena were to spark his creative thought patterns throughout his life.

In 1874 Pupin arrived at Castle Garden (southern tip of Manhattan) after a rough steerage passage on the immigrant ship Westphalia. He was fifteen, had five cents to his name, spoke no English, and had no friends or relatives in America; but he did possess courage, brains and a fascination with science. What had brought him to America? He wanted to try his fortune in the land where Franklin had pioneered electrical knowledge.

His progress was rapid. In 1883 he was graduated from Columbia University with honors in science and a determination to pursue the study of Faraday and Maxwell. Pupin doggedly followed his bent; it led him to graduate studies at Cambridge University and Berlin University. He learned from some of the most eminent physicists of the era: von Helmholtz, teacher of Hertz; John Tyndall, colleague of Faraday; Gustav Kirchhoff, formulator of the resistance equations; von Siemens, founder of the famous electrical company. His studies concluded, he was awarded a Ph.D. degree from the University of Berlin under the direction of Helmholtz.

Returning to America in 1889 he accepted a position as an instructor in the new department of Electrical Engineering at Columbia University. It was the beginning of a professional career filled with exciting research, original invention, and stimulating teaching. Many of his students went on to illustrious careers in radio and electronics. Among these can be named Frederick Vreeland, Edwin Armstrong, Mrs. Lee de Forest and Robert Millikan.

Pupin soon was engrossed in the study of alternating currents. At this time Professor Henry Rowland of Johns Hopkins University was engaged in a monumental struggle to justify the transmission of electrical power by the alternating current system. Pushing ahead with alternating current research, Rowland found distortions in the a.c. when that current was magnetizing iron in electrical power apparatus. He considered these distortions to be caused by harmonics of the fundamental frequency.

Pupin seized on this phenomenon so puzzling to Rowland and decided to construct electrical resonators to detect the harmonics; he used parallel combinations of inductance and capacity to measure harmonic frequencies. Out of this research evolved a method of electrical tuning

Michael Pupin

which became fundamental in wireless and radio operation. The former herdsman of Idvor had not forgotten the native bagpiper "tuning" his primitive goatskin instrument.

One of Pupin's greatest inventions was the so-called Pupin telephone coil. It required a tremendous amount of mathematical analysis of electrical motions and called for highly perceptive reasoning to calculate the proper placing of the coils on long distance telephone lines. It was a great achievement. The patent was sold to the American Telephone and Telegraph Company and earned him a good sum of money and worldwide fame.

Many years later Pupin admitted that the physical principle underlying this complex invention was taught to him by Idvor herdsmen. In the outdoor classroom of his youth, Pupin had learned that the firmer the earth between two herdsmen, the louder the signal transmitted by the vibrating knife; in other terms the compressibility of the medium was an important factor in long distance transmission of the vibratory waves. Applying this reasoning to the telephone problem, Pupin solved a long-standing challenge of telephone engineers. The son of Idvor peasants had not forgotten the herdsmen's communication system.

Pupin always considered the earth or ground connection of vital importance in the transmission of intelligence by vibratory phenomena. In later years when the details of Marconi's achievements in wireless telegraphy reached him, he showed little surprise. Marconi's simple yet unique contribution was the concept of grounding both the Hertz sending oscillator antenna and the receiving detector antenna. Thus a loop was formed. The radio currents leaping from antenna to antenna and then returning through the earth

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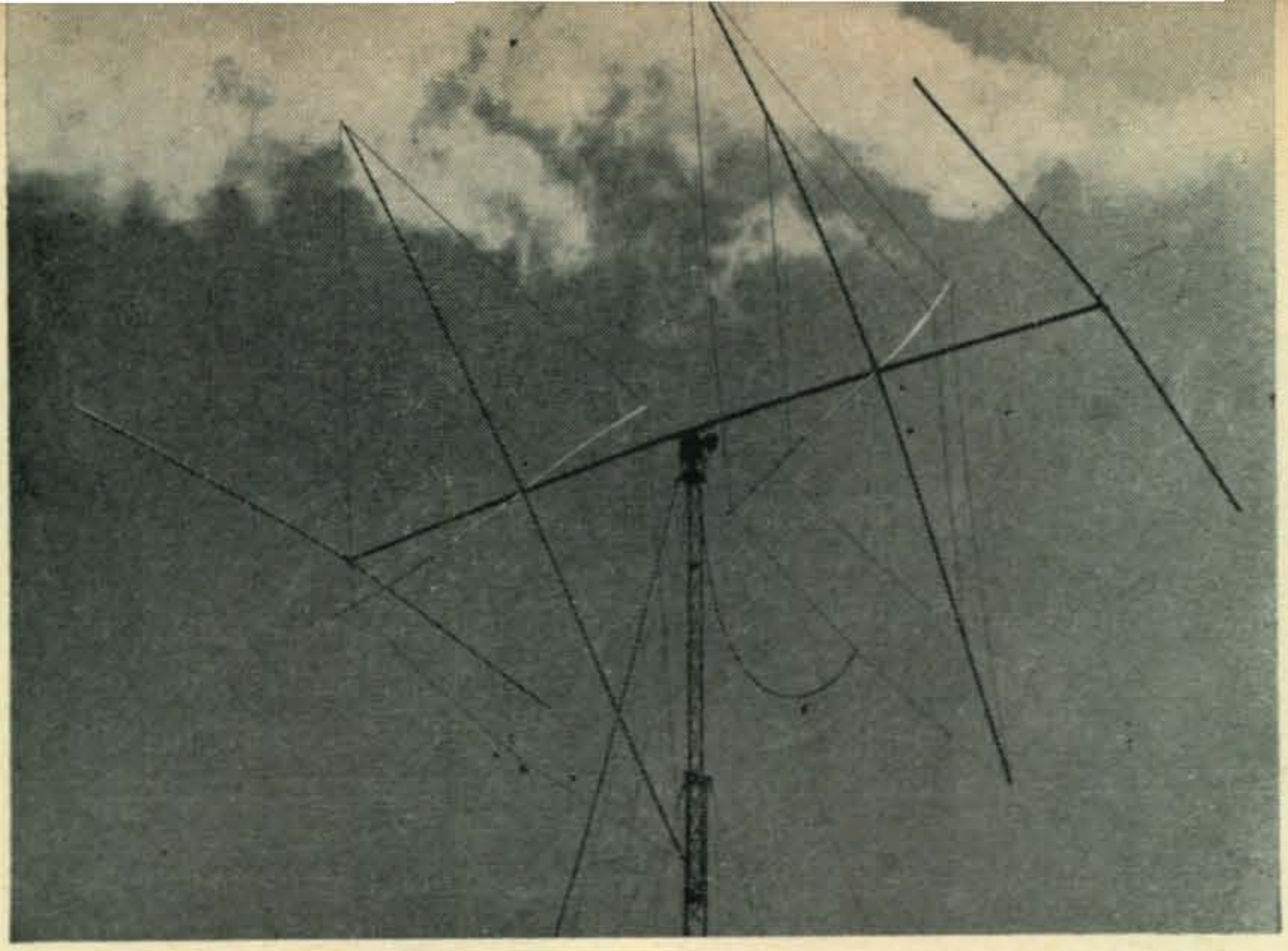

A Cubical Quad Cum Yagi

BY RALPH TURNER*, VK5TR

This 20 meter antenna combines the features of the Quad and Yagi antennas for simple construction and improved performance. The information given is also valid for the conventional two element Quad and can help to improve performance of these antennas.

THE two element cubical quad is in the writers opinion the best all around antenna yet devised. When assessed on a forward gain, angle of radiation, front to back ratio, and low initial cost, as compared to any other type of antenna, for similar performance, it excels.

I have had so much success with the two element quad that, after listening to G3VNA, it was decided to try his approach to quads. G3VNA uses a quad with two conventional elements plus a Yagi type reflector and director. As a result G3VNA puts the best and most consistent signal into VK5 land.

I have talked to many hams all over the world who have built quads and have come to the conclusion that only about 50% of them have been satisfied that their quads are really working at their peak performance. Most think their quad is working but they are not confident enough to say that they *know* that it is working 100%.

The reason for the failure to get a quad working properly is, in my opinion, due to four main points which are as follows:

1. The exceptionally high *Q* of the reflector.
2. The fact that it appears to be impossible to accurately "grid dip" a quad radiator.
3. The disastrous effects that metal spreaders have on the operation of a quad.
4. The interaction between the radiator and reflector elements.

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High Q

The two elements of a Quad could be viewed as the two tuned circuits of a very high *Q* i.f. transformer, where tuning one coil detunes the other. Those readers who have tried to band pass a series of tight coupled i.f. transformers will appreciate that trying to tune these circuits is like a dog chasing its tail.

The *Q* of a quad reflector is so high that it is practically impossible to tune it except by remote means, the proximity of a hand being sufficient to move the resonant frequency many kc. If this effect is clearly understood you are on the way to success with your quad.

Obviously the design of the reflector should be such that any alterations that have to be made to the length of this element can be made without too much pain or strain.

We found that using a loading coil in place of a tuning stub broadened out the characteristics of the reflector and was a whole lot easier to adjust than a stub.

Grid Dipping Quad Radiators

For some reason unknown to the writer, a quad radiator *cannot* be grid dipped in the same manner as a Yagi element. This peculiar effect has resulted in all sorts of varying lengths of radiator elements being published. We suggest that the lengths specified, 17'2" on all sides, be strictly adhered to until final adjustments are made. The

only method of determining the resonant frequency of a quad is by means of an s.w.r. meter. The frequency indicating the lowest s.w.r. is the resonant frequency of the quad.

Metal Spreaders

The writer has not been able to make a quad work efficiently when metal spreaders were used. The reason for this effect is not known.

Interaction Between Elements

The quad is basically two high *L*, low *C* tuned circuits with a high degree of coupling between the elements, and, as with any such circuit, the tuning of one circuit detunes the other. Hence, the advice that the lengths of the radiator must be left alone until the correct length of the reflector is determined by means of adjusting the loading coil.

Design

Well now so much for the why; now for the how. For mechanical balance it is necessary to have four elements on a quad. It is impractical to have three elements, as the quad radiator would be hard up against the tower, or alternatively the weight of the elements on the boom would not be evenly distributed. The Yagi elements were thought to be easier to construct than additional quad elements, but no claim is made for performance as compared to a four element quad.

Boom—As we had a light telescopic mast made of three 15′ sections, a portion of this was used as a boom. The 15′ length of 2″ o.d. was used as the main boom, with the 15′ of 1¾″ o.d. section cut in half and used as extensions to mount the Yagi reflector and director. This procedure allows the spacing between the Yagi and quad elements to be adjusted to some extent.

The ends of the main boom are cut every ¼″ for a length of 2″ and a radiator hose clamp is used to tighten the end of the main boom on to the extension boom. When optimum spacing is selected the two booms should be drilled and locked up with self-tapping screws.

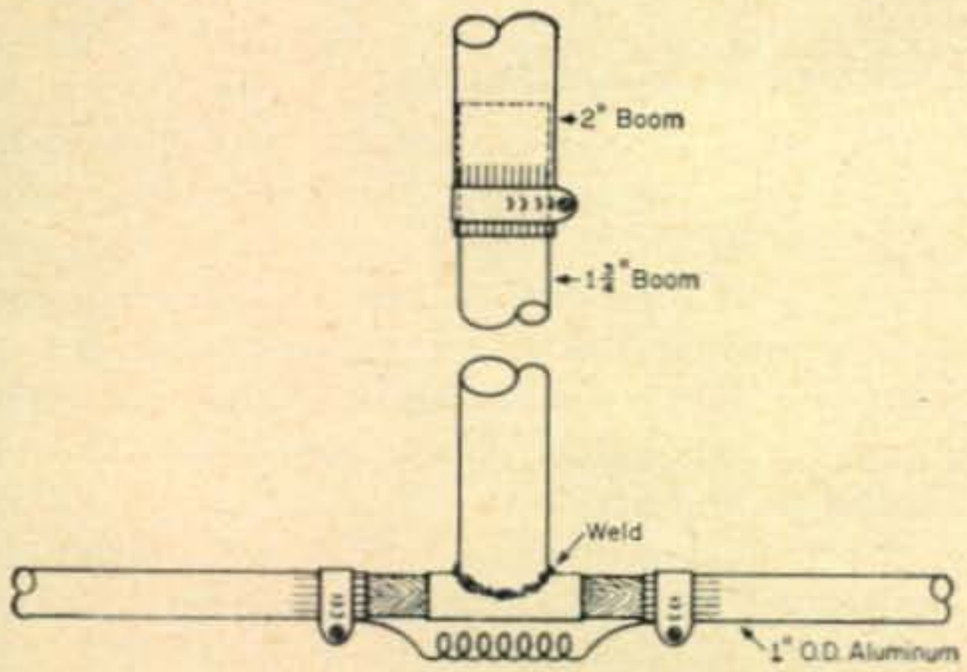

Fig. 1—Method of mounting the Yagi reflector and director to the boom ends is shown above. The details are given in the text.

Yagi Director and Reflector Mountings—In order to mount the directors and reflectors on the extension booms, a 3″ length of 1″ o.d. × 16 gauge steel tube is welded at right angles to the boom. The boom end is filed out to fit and slightly flattened on two sides to meet the diameter of the smaller tube.

A 15″ length of ⅞″ wood dowel, well varnished, is passed through the 3″ length of tube so that six inches projects on each side of the mounting. The Yagi elements slip over the wood dowel to a length of 5″. This is shown in fig. 1.

Yagi Elements—The Yagi elements consist of four 12′ lengths of 1″ o.d. × 16 gauge aluminum tube, two for the reflector and two for the director. This length was chosen at random and has no special significance. The inboard end of each element is cut in four places with a hack saw to a length of 1½″ for clamping purposes. The tube is pushed over the piece of ⅞″ dowel, leaving a space of 1″ between the end of the tube and the steel mount.

The elements are clamped to the wood dowel by means of two 1″ diameter hose clamps. These clamps also serve to mount the loading coils.

Yagi Element Support—In order to prevent the sag in the 1″ aluminum tubing, five 5″ TV type stand-off insulators are mounted along each element as shown in fig. 2. Two ⅛″ diameter holes are drilled approximately ¼″ in from the end of the elements and a #16 wire loop tied through each hole. Two lengths of 100 lb. nylon fishing line are tied to one end, then passed through the stand offs and tied to the other end of the element. If the nylon is tied when the element has an upward curve the entire element should become straight when mounted on the boom.

Fig. 2—The director and reflector would sag without the support shown above. Nylon fish line, 100 lb. weight, is stretched through five 5″ TV stand-off insulators.

Quad Spider—The quad spider is designed to rotate on the boom; this enables the elements to be strung by rotating the spreaders like a windmill and also allows the distance between the quad elements to be varied easily.

The spider mount consists of a 12″ length of 2¼″ 18 gauge steel tube. Four pieces of 1″ i.d. 16 gauge steel tube, 15″ long, are welded to the mount in the form of a square as shown in fig. 3. One end of each of the four pieces of tube are filed to fit perfectly before welding. It is highly desirable to use a jig for setting up, as the tube will move during welding and will not finish up square.

When the spider is welded, four 3/16″ holes should be drilled adjacent to each weld to allow for drain out of any water that seeps into the spider.

Two ⅜″ steel nuts are welded to the spider mount to provide fixing to the boom. These nuts

are easily held in position for welding if the tube is drilled and tapped first and a stud screwed through the nut and the tapped hole.

Spreaders

In the interests of economy and for reasons previously stated the spreaders are half of aluminum tubing and half of wood dowel. Bamboo canes, where available, are ideal but are not readily available in this neck of the woods.

The aluminum spreaders are six feet of 1" o.d. 16 gauge tube. The wood spreaders are six feet of ⅞" wood dowel which should be varnished with three coats before assembly. The aluminum spreader is pushed into the spider for a distance of 4" and held in position by means of two ⅛" × ½" self-tapping screws.

The wooden spreader is pushed into the end of the aluminum spreader for a distance of four inches and is held by means of two ⅛" × ½" self-tapping screws. Drain holes should be drilled in the aluminum spreader adjacent to the end of the wooden dowel on the two bottom spreaders.

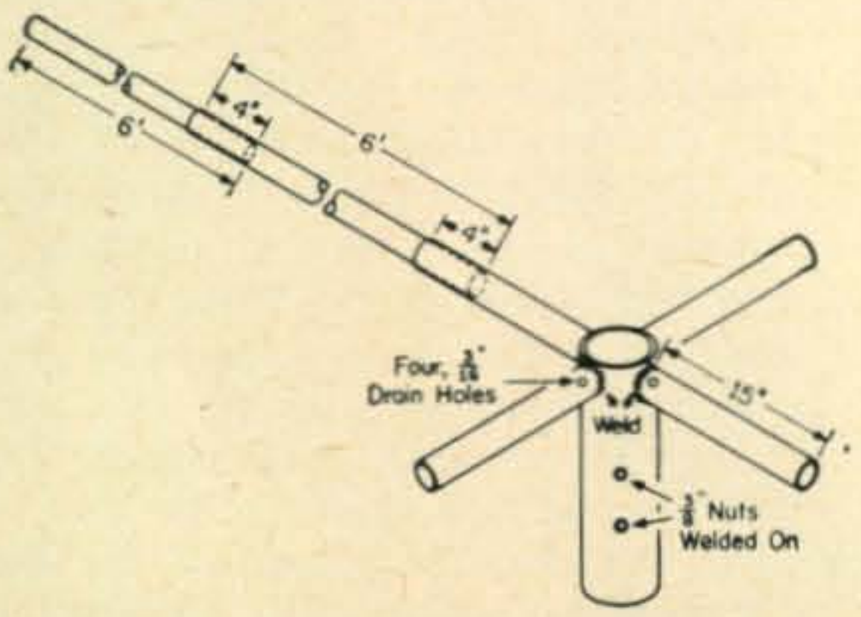

Fig. 3—Details of the spider and spreaders. If bamboo spreaders are used, commercial spiders would be suitable.

Stringing Quad Elements

The quad elements consists of 68'8" of #14 bare copper wire. Other wire of similar size will do but stranded wire is preferred because of its greater flexibility. Two lengths of wire should be run out and pre-stretched and marked at 17'2" with plastic insulation tape. Marking should start from the middle of the 69' to allow for the half lengths of wire from the bottom spreaders to the feed and coil points. When the wire is marked at the center point two points 8'7" each side of the center should be marked. Now remove the center marking and measure the other points.

In selecting the spreaders which are to be at the top of the quad remember that you have to tighten up the ⅜" set screws on the spider after the wire is fastened. These screws are more easily tightened when they are projecting downwards.

Fasten the wire to the top spreader by means of an insulated staple. The staple is not hammered home but allows the wire to pass freely through it. This allows the spreaders to be adjusted so that they are all in line and straight. The spreaders are now rotated like a windmill and the wire is fastened to each spreader.

It is wise to connect the plastic terminal block to the two ends of the wire in order that the bottom side of the wire may be set square. Once the wire has been fixed at all four points the array can be checked for "squareness" and the staples driven home.

Both the quad elements are identical in length of wire and method of fixing. The two quad elements should now be spaced 6' each side of the center of the boom and the set screws locked up. A boom mount is shown in fig. 4. The final position of the elements is shown in fig. 5.

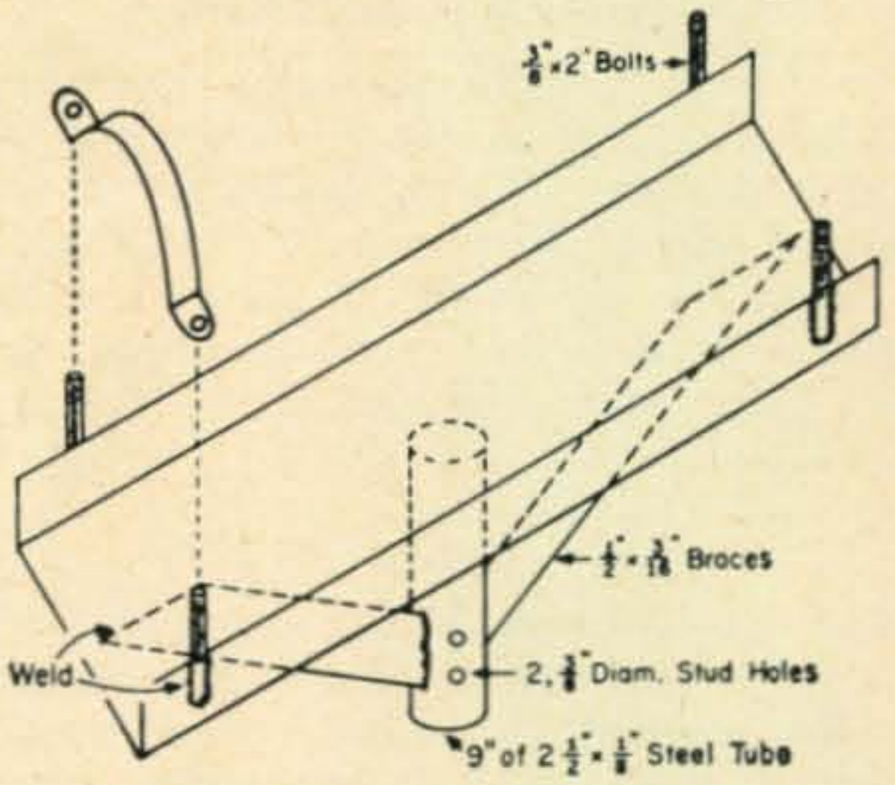

Fig. 4—The boom mount is made of a 2 foot length of 2" × 3/16" channel with four ⅜" × 2" bolts weld as shown. The clamps are 2" × 3/16". The support pipe is braced diagonally by ½" × 3/16" stock.

Square or Diamond

The square type set up is used in preference to to diamond owing to the difficulty experienced with entanglement with guy wires when a diamond shape was used. It has been stated that the diamond set up gives 1 db more gain but our tower and guys did not allow a true comparative test.

Yagi Loading Coils

As the Yagi elements are shorter than the required electrical length, loading coils are necessary. The director coil is 11 turns of #14 copper, wound 1" in diameter over a 2" length. The Yagi reflector coil is 22 turns of #14 wire, wound 1" in diameter over 4". The ends of the coils project for approx 2" and are hammered flat and slipped under the 1" diameter hose clamp.

The Yagi elements should be pretuned to the approx frequency by means of a grid dip meter before fixing to the boom. Remember that in mounting the Yagi elements on the boom the coupling to the other elements will lower the inductance of the loading coil and consequently more turns on the loading coil will be required. We tuned our elements to the desired frequency before mounting on the boom, with the coil wide spaced and then squeezed the coil together to hit the correct frequency when the elements were mounted on the boom.

If a portable grid dip meter is not available a two turn link each end of a two conductor flexible cable can be used to couple the Yagi loading coils to a grid dipper for accurate tuning.

The Yagi reflector and director must be tuned to between 5% and 6% lower and higher respectively in frequency than the desired resonant

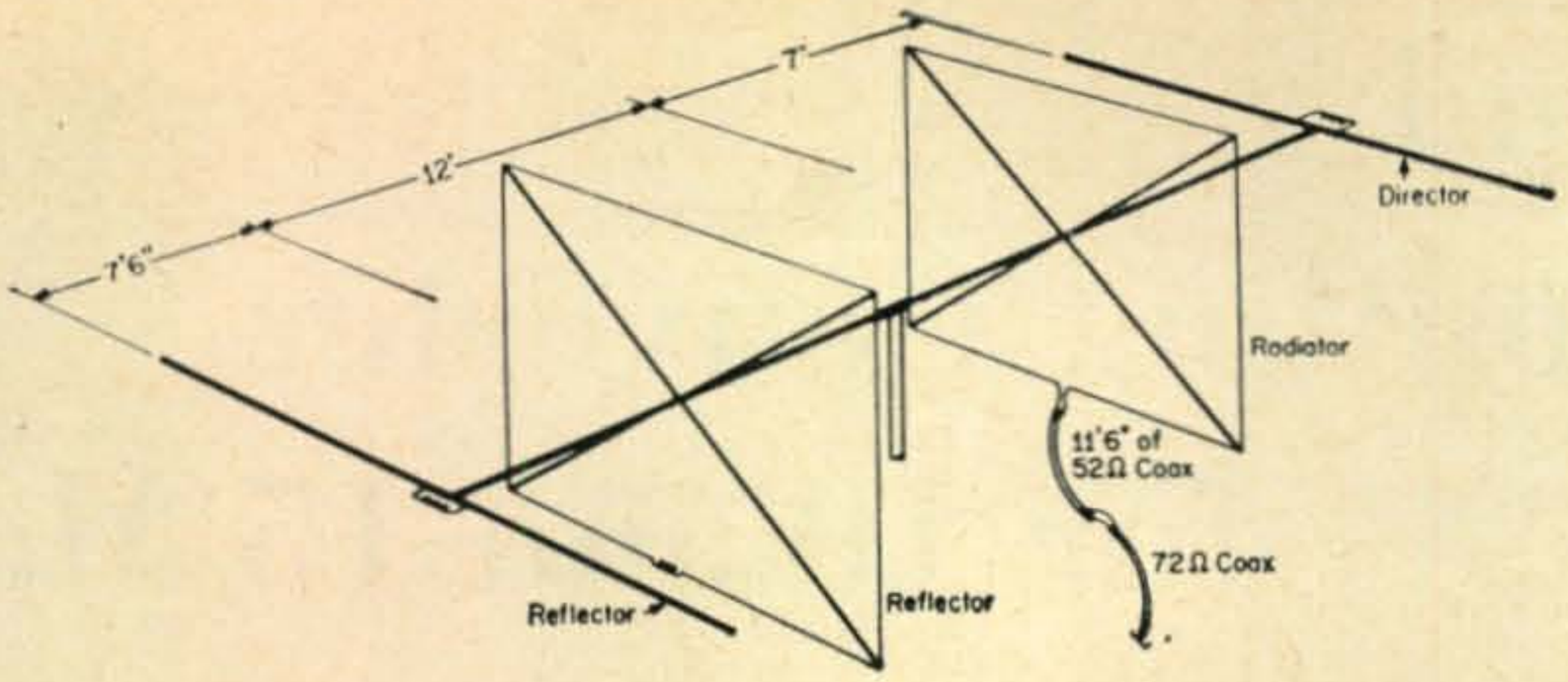

Fig. 5—Overall view and dimensions of the Yagi-quad. The ¼ wave matching stub is described in the text. The quad elements measure 17' 2" on all sides. The coax feed-line is supported by a nylon line, to the boom, to prevent sag.

frequency of the quad radiator. For example, if the desired resonant frequency of the antenna is 14,250 kc the director will be tuned to 13.537 kc and the reflector to 14.962 kc. The antenna will not work 100% unless these elements are correctly tuned *on the boom*.

Quad Radiator Matching

With the dimensions given it was found that the feed impedence of the quad radiator was approx 38 ohms. Our method of feed was to use a 70 ohm coax cable with a quarter wave matching section of 50 ohm coax at the antenna end. The impedance transformation is thus:

$$Z_m = \sqrt{Z_L Z_A}$$

where Z_m = Impedance of required $\lambda/4$ section.
Z_L = Impedance of feed line.
Z_A = Impedance of antenna feed point.

$$Z_m = \sqrt{72.38} \approx 52.5 \text{ ohms}$$

The quarter wave section of 11'6" long and should be well spliced and soldered to the 70 ohm coax and waterproofed with plastic tape.

Terminal Block

A plastic cable connector is used to connect both the feed points on the quad radiator and the coil on the quad reflector. This connector is a handy device and it simplified the replacement of the coax feed as the cable usually breaks, due to flexing by the wind, at the feed point.

Quad Reflector Loading Coil

In order to obtain the correct electrical length of the quad reflector it is considered that a coil is easier to handle and adjust than a stub as it does not flap around in the wind.

The coil is 7½ turns of #14 copper wire 1¼" in diameter, air wound, and is adjusted by means of squeezing the turns together.

Remember the previous warning; the Q of the quad reflector is so high that the proximity of a hand is sufficient to detune it many kc. This element should be roughly tuned for the maximum front to back ratio by turning the antenna back on to a fixed signal. Adjust the coil for minimum received signal. Raise the quad to its full height and check the F/B ratio, it should be in the order of 40 db. It will probably be found that it is necessary to increase the inductance of the coil slightly as the extra height above ground will lower the effective inductance.

A simple method of checking the accuracy of the setting of all coils is to tape a 6" length of ferrite rod and brass rod about 3" apart on the end of a long pole. This enables the coils to be checked at a much greater height than can be done otherwise. Inserting the ferrite rod will increase the inductance and the brass rod will decrease the inductance and thereby indicate which way the coils should be moved. Both the ferrite and the brass rods should be covered with insulating material to prevent shorting the turns of the coils.

Resonant Frequency and S.W.R.

As no way has been found by the writer to grid dip a quad the method of checking the resonant frequency is by means of an S.W.R. meter. With homebrew meters make sure the meter will zero on a 70 ohm dummy load before starting to test the antenna. Our S.W.R. meter zeroed perfectly on low power, 20 watts, but would not zero on full power.

Starting at 14,000 kc take readings of the S.W.R. at 50 kc points up to 14,350 kc and plot the S.W.R. against the frequency. It should be found that the S.W.R. is lowest on 14,250 kc and should be not more than 1 to 1.07 at this frequency. The S.W.R. will rise rapidly each side of the resonant frequency. If the indicated frequency is other than desired, the quad radiator can be shortened by bridging out one corner or lengthened by adding a piece of wire in the bottom section.

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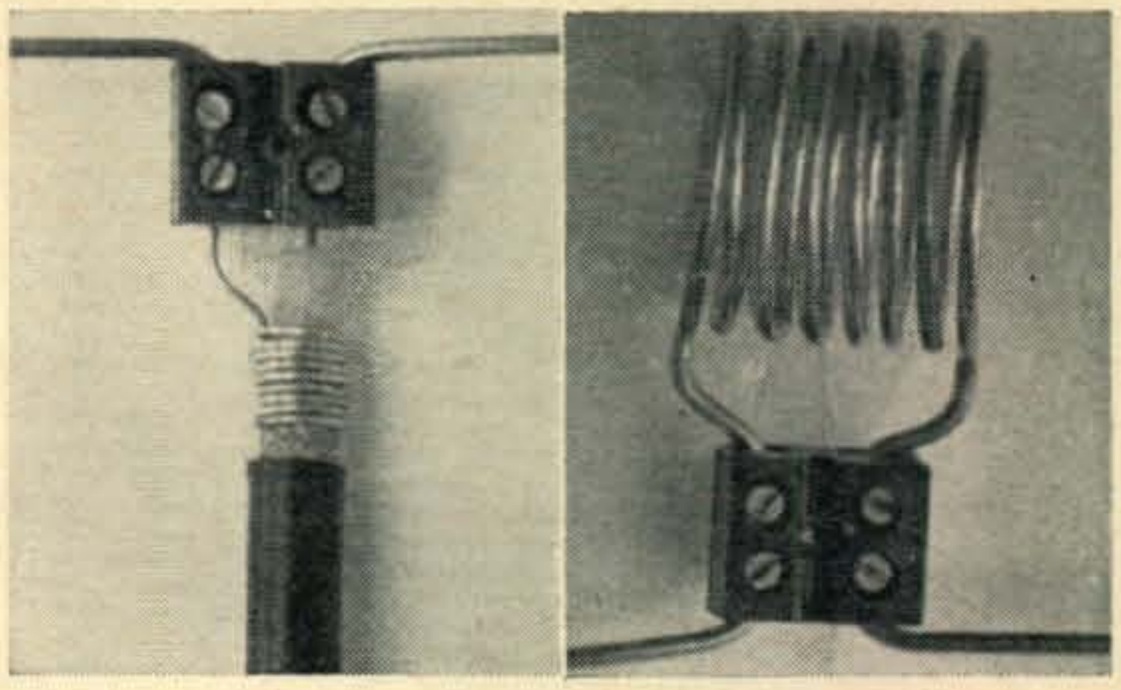


Photographs illustrating the use of plastic terminal blocks for connecting to the quad reflector and driven element.

A Sideband Transmitting Converter for 10 and 15 M.

A Companion Piece For 80-40 M S.S.B. Exciters.

DURWARD J. TUCKER*, W5VU

Two previous CQ articles[1,2] described the design and construction of an s.s.b. generator, v.f.o., mixer, r.f. amplifiers, vox and the power supply of an exciter covering 40 and 80 meters. This article covers a crystal oscillator, mixer and r.f. amplifiers necessary to cover 15 and 20 meters. Economy and simplicity of design, without compromise of performance, was adhered to as in the original articles.

TREMENDOUS interest was shown in the original article on single sideband generator design and construction covering the speech amplifier, audio band-pass filter, audio phase-shift network, 1600 kc r.f. crystal oscillator, r.f. phasing network and 1N34 balanced modulators.[1] The same interest is being given to the second article on the complete exciter covering 80 and 40.[2]

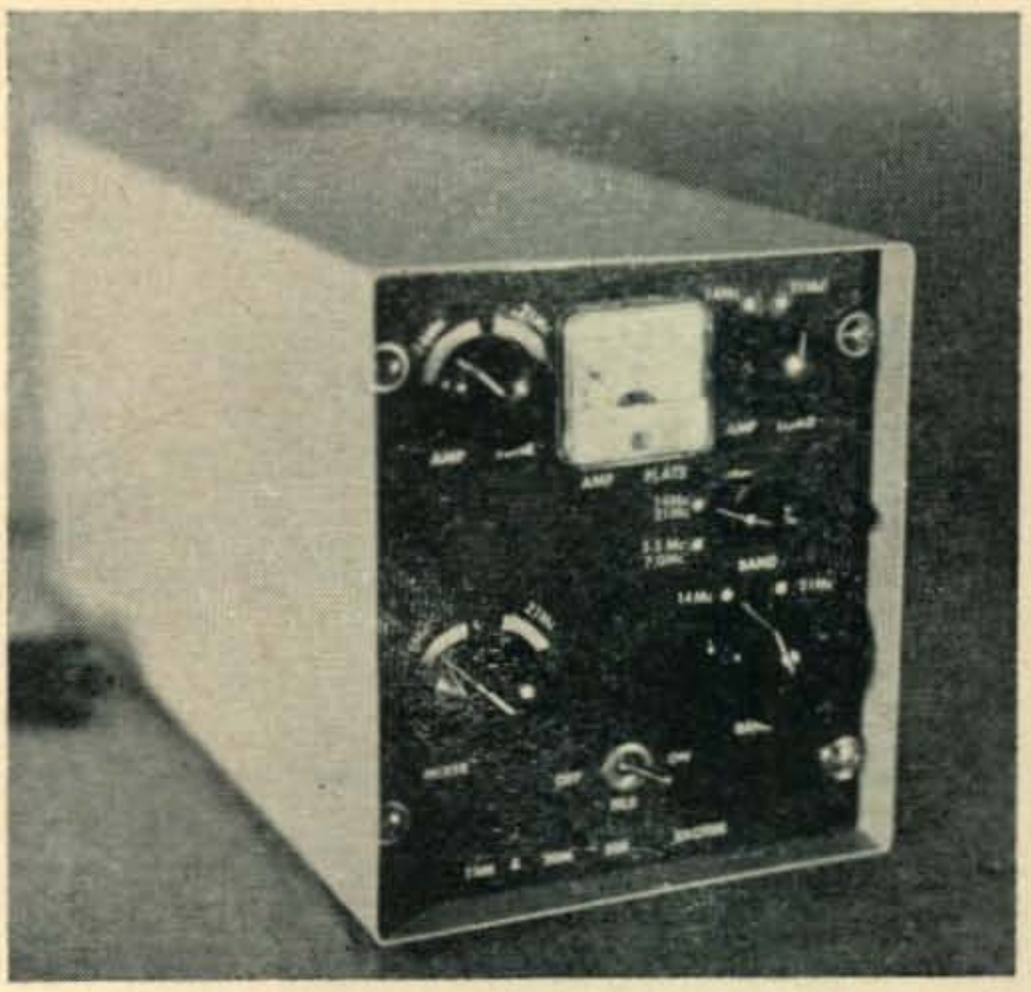
Figure 1 shows a block diagram of the 15 and 20 meter exciter unit (no. 5) covered by this article as well as units 1, 2, 3, and 4 previously covered.

Mixer

Little deliberation was required in selecting the 7360 beam-deflection tube as a balanced-mixer since this tube was designed for s.s.b. transmitter and receiver use. Typical operating conditions given by the manufacturer list oscillator suppression, third order distortion, and fourth order distortion each at approximately —40 db. The 7360 has two deflecting-electrodes to which the single sideband signal is fed.

In the 40 and 80 meter exciter the 1600 kc. s.s.b. signal from the generator was mixed with a v.f.o. which had a frequency range from 5.1 mc to 5.7 mc. In this instance the 40 and 80 meter exciter should be properly tuned for the 80 meter band (3.5 to 4 mc) and its output fed into the deflector electrodes of the 7360 mixer tube at a peak voltage of from 2 to 8 volts. This voltage should be kept as low as possible in order to keep distortion at a minimum. The 6AB4 crystal oscillator signal should be fed into the control grid of the 7360 tube at a peak voltage of from 5 to 10 volts.

The 6AB4 crystal oscillator uses a 10,350 kc crystal to reach the 14 megacycle band and a 17,450 kc crystal to reach the 21 megacycle band. The crystal oscillator frequency of 10,350 kc



Front view of the 10 and 15 meter s.s.b. transmitting converter showing the control placement. The knob to the left of the plate meter is AMP. TUNE, to the right, AMP. LOAD. The two large knobs on the bottom row are, left, MIXER TUNE and right, AMP. BANDSWITCH. The control above the BANDSWITCH serves to bypass the converter for 3.5 and 7 mc operation. The toggle switch controls the filament voltage.

*6906 Kingsbury Drive, Dallas, Texas.

[1] Tucker, D. J. & Copeland, J. L., "Single Sideband Generator Design," *CQ*, August, 1960, p. 26.

[2] Tucker, D. J. & Copeland, J. L., "A Single Sideband Exciter," *CQ*, February, 1962, p. 54.

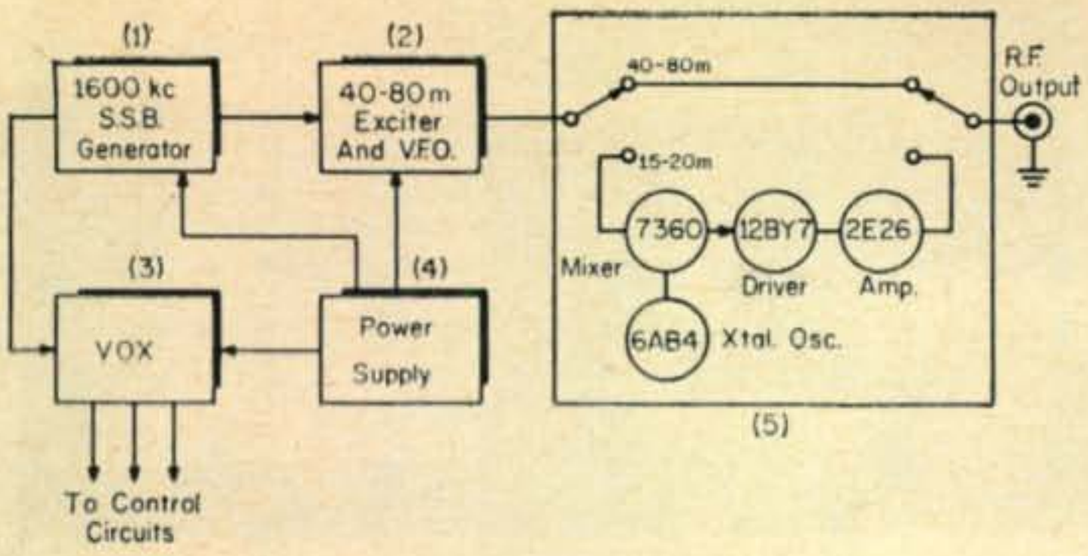


Fig. 1—Block diagram of the complete s.s.b. exciter that covers 80, 40, 20 and 15 meters. Only unit (5) is described in this article; the others have been covered in previous issues of CQ.

plus the 40-80 meter exciter frequency of 3,650 kc properly mixed in the 7360 mixer tube gives an s.s.b. output frequency of 14,000 kc which is the low end of the 20 meter band. Tuning the v.f.o. of the exciter so that its output frequency increases from 3,650 kc to 4,000 kc gives complete coverage of the 20 meter band from 14,000 kc to 14,350 kc. Appropriate calibration of the v.f.o. dial (on the 40-80 meter exciter) may be readily accomplished by logging the proper points alongside the calibration on the dial for the 3,650-4,000 kc portion of the 80 meter dial calibration. The 14,000 kc point is adjacent to the 3,650 kc point and the 14,350 kc point is adjacent to the 4,000 kc point. Intermediate points between 14,000 kc and 14,350 kc are similarly logged.

The crystal oscillator frequency of 17,450 kc plus the 40-80 meter exciter frequency of 3,550 kc properly mixed in the 7360 mixer tube gives an s.s.b. output frequency of 21,000 kc, the low end of the 15 meter band. Tuning the v.f.o. of the exciter so that its output frequency varies from 3,550 kc to 4,000 kc gives complete coverage of the 15 meter band from 21,000 kc to 21,450 kc. Calibration of the v.f.o. dial for this band is accomplished in the same way as outlined for the 20 meter band.

Crystal Oscillator

It has already been pointed out that the crystal oscillator is only required to supply a voltage of 5 to 10 volts peak to the control grid of the

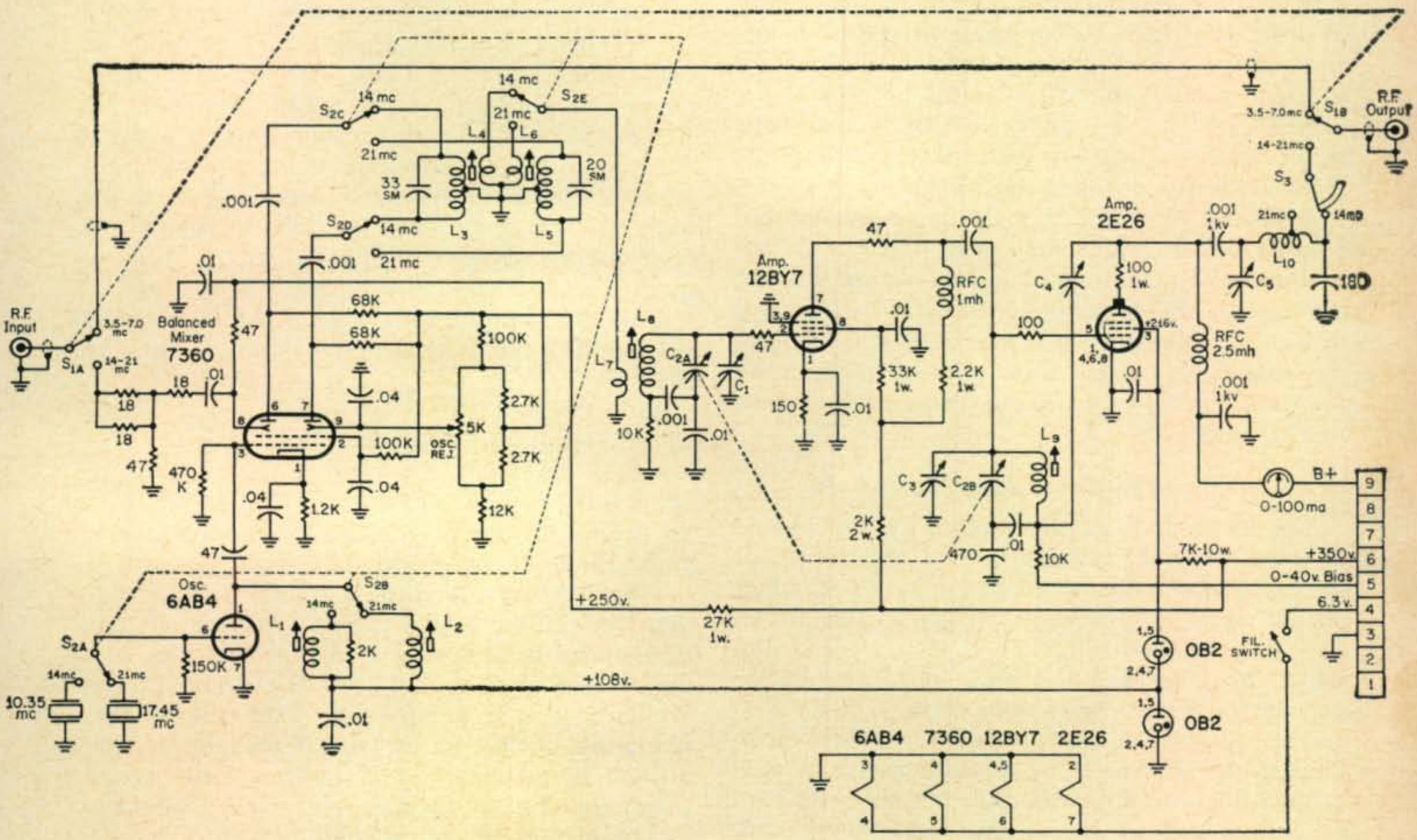
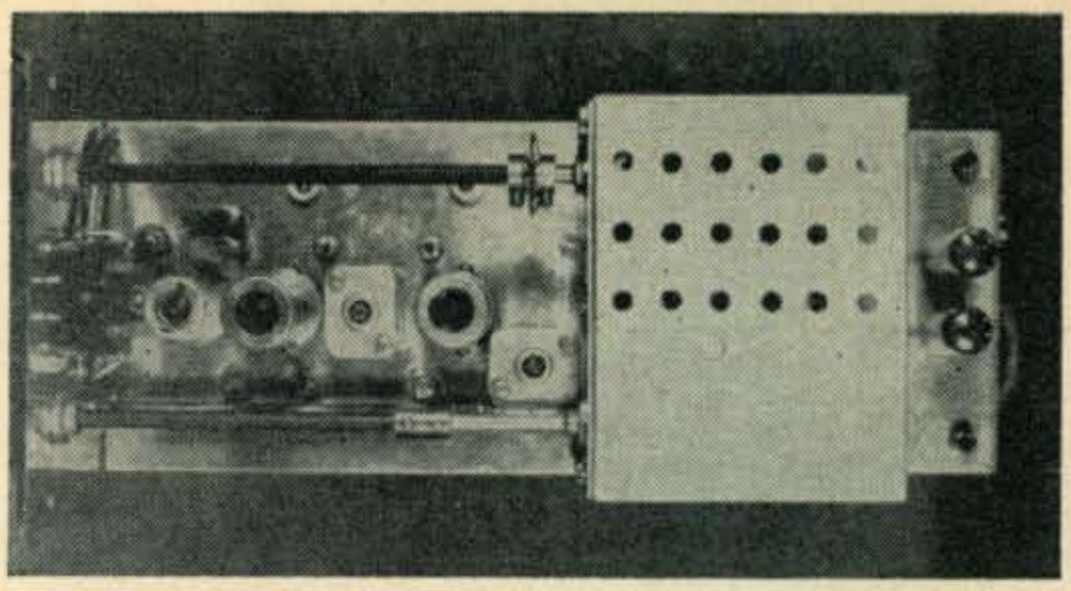


Fig. 2—Circuit diagram of the s.s.b. transmitting converter for 10 and 15 meters. All resistors are ½ watt unless otherwise noted; all capacitors greater than one are in mmf and those smaller than one are in mfd unless otherwise noted.

C_1, C_3—1-8 mmf, Erie 532A.
C_{2A}, C_{2B}—50-50 mmf. Hammarlund HFD-50.
C_4—1-7.5 mmf, Centralab 829-7.
C_5—3.2-36 mmf, Hammarlund HF-35.
L_1—28t. #30 Formvar wire on 7/16"d. slug tuned ceramic form.
L_2—15t. #30 Formvar wire on a 7/16"d. slug tuned ceramic form.
L_3—20t. #28 Formvar bifilar wound on ½" d. National XR-50 form.
L_4—3t. #28 Formvar wire wound on cold end of L_3.
L_5—8t. #24 Formvar wire bifilar wound of ½" d. National XR-50 form.
L_6—3t. #24 Formvar wire wound on cold end of L_5.
L_7—3t. #30 on the cold end of L_8.
L_8—10t. #30 Formvar wire on ½" d. ceramic form.
L_9—8t. #30 Formvar wire on ½" d. ceramic form.
L_{10}—15t, tapped at 9t., B&W #3016 (32 t.p.i., 1" di.) or equiv.
S_1—2 pole 2 pos., Mallory 32225 or equiv.
S_2—6 pole, 2 pos., Centralab PA2000 series or equiv.
S_3—1 pole 2 pos., shorting switch, Centralab 1460 or equiv.

7360 mixer tube, and this is not difficult. In doing this the plate voltage and subsequent plate current of the oscillator tube should be kept low. Since it is desirable to have a regulated screen voltage for the 2E26 output tube, it is not difficult to go one step further and provide for a regulated plate voltage for the crystal oscillator tube. The selection of a tube to use for the crystal oscillator becomes almost a matter of personal choice as a number of tubes are readily available that will meet the above requirements. I selected the 6AB4 in this instance, as it meets the requirements very nicely.



Top view of the s.s.b. transmitting converter for 10 and 15 meters showing the general layout. On the left we have the 6C4 crystal oscillator followed by the 7360 mixer and 12BY7 amplifier. The 2E26 is in the enclosure with the output pi-network. The two 0B2 regulators are on the rear lip.

R.F. Amplifier

Circuit losses are higher and gain is harder to come by at 14 mc and 21 mc than at 4 and 7 mc. It was decided, therefore, to use a 12BY7A tube in the intermediate amplifier stage rather than the 6BA6 used in the 40-80 meter exciter.

The 12BY7A is a high gain tube and care should be used in the placement of its associated circuitry and parts. The grid and plate circuit coils (L_7, L_8 and L_9) are enclosed in shielded cans and are mounted on the top of the chassis in order to further isolate the grid and plate circuits of the 12BY7A tube. It might be necessary to place a small shield across the bottom of the tube socket (as was done with the 6BA6 stage in the other exciter) or even neutralize the tube if oscillation is encountered in this stage.

It should be noted that the input and output circuits of this stage are gang tuned and that both the 15 and 20 meter bands are tuned without the use of band switching coils. Small 1-7.5 mmf trimmer capacitors were placed across each of the two tuning capacitors in order to simplify the problem of tracking in gang tuning these two circuits.

2E26 Final Amplifier

The 2E26 final amplifier stage for the 15 and 20 meter exciter follows closely the design of the 2E26 final amplifier stage for the 40-80 meter exciter. The one main exception in the circuit design is that neutralization is incorporated into the 15-20 meter unit and it was not found necessary in the 40-80 meter unit.

The inductance of L_{10} and taps used is influenced by individual load requirements as well as the selection of the plate tuning and fixed load capacitors across the output end of the inductance. A B&W #3016 one inch diameter air-wound coil was used. Ten to fifteen turns will be required depending upon individual circumstances. The tap point for 21 mc should be determined experimentally

Construction

The author has never been one to give minute constructional details unless they deal with a specific problem or pitfall. The average ham is going to be governed, to a great extent, by what he has on hand with which to build or construct the unit.

Listed here are a few facts and details that should hold more than a passing interest to any one who builds the unit.

It is desirable to switch bands, say from 80 meters to 20 meters and back again with a minimum amount of adjusting or readjusting. This can be done without reducing the output of the 80 meter signal to bare minimum proportions in order not to overdrive the 7360 mixer tube. A power reducing pad was placed in the coaxial r.f. line at switch S_{1A} for this reason. Switch S_{1A} and S_{1B} along with the power reducing pad were put in the 2E26 compartment in order to isolate the high level r.f. input away from the relatively low level circuits of the other tubes where its presence might bring on undue problems.

The 7360 output coils, L_3 and L_5 were bifilar wound in order to present a balanced output to the 7360 mixer tube.

It is desirable that the output signal of the crystal oscillator, the mixer and the 12BY7A amplifier be fairly constant at the grid of the 2E26 for the 15 and 20 meter bands. In addition, the signal should be reasonably equal over the entire range of each band. The 14 mc signal will, in all probability, tend to be greater in amplitude than the 21 mc signal. The 14 mc signal may be reduced by inserting a resistor in series with the 14 mc plate coil, L_1, of the 6AB4 crystal oscillator tube at the base end of the coil. Further reduction of the 14 mc signal may be accomplished by placing a swamping resistor across inductance L_1. Uniform output on each band can be obtained by placing swamping resistors across L_1 and L_2 and by adjusting the resonant point of each coil toward one end of the band as conditions dictate. Further flatening of the response of each band may be had by repeating this process for coils L_3 and L_5.

Alignment

Considerable details were given on alignment in the article on the 40-80 meter exciter.[2] It is not considered that the alignment procedure for the 15-20 meter exciter is sufficiently different from that of the 40-80 meter exciter to go into details on this in this article.

[*Continued on page 89*]

DX-ing from G-Land

BY L. H. THOMAS*, G6QB

Although we all speak the same language and often, the same amateur-idiom, there are great differences in the operating conditions here and those in G-land. G6QB, the DX Editor of Short Wave Magazine, attempts to clear up some possible misunderstandings.

In the whole of the United Kingdom, which takes in six prefixes, we have no more than about 10,000 licensed amateurs, of whom probably only 5,000 are regularly active. Comparing this with conditions in the U.S.A., you might think this puts the U.K. in the "ham's paradise" class. But you would be wrong, since many other circumstances come into account, chief among them being the proximity of so many different European countries. But let us first talk about the British amateurs themselves.

Before the war there were only about 2,000 of us. Back in 1923, when G6QB (or rather "6QB") took the air for the first time, there were probably only 600 or 700 stations actually on the bands then available. Many U.S. stations seem curious about our call-sign set-up, so let me first explain this.

The real Old Timers (prior to World War I) had calls consisting only of three letters. I believe this was the custom all over the world. The first British calls as we now know them used the figure 2 and two letters, starting in sequence from 2AA in 1919 or thereabouts. When the 2's were exhausted, the authorities for some reason skipped to the figure 5, and then, when the 5 sequence ran out, to 6. Up to some time well in the 1930's, there were no British calls except 2's, 5's and 6's —all with two letters only. During the early 1920's no prefixes were in use anywhere, and the state of affairs in Europe was that any call beginning with Ø was a Netherlands station; 1's came from Italy, 4's from Belgium, 7's from Denmark, 8's from France and 9's from Switzerland. Other queer combinations such as SMZZ hailed from Sweden, and EAR62 and the like from Spain. But you will note how many of the prefix numerals have stuck, with ON4's, HB9's, PAØ's practically traditional.

Around 1924 the era of worldwide DX opened up, and with such fantastic stations as Australians and New Zealanders actually being heard in Europe it was obviously necessary to invent some prefixes. This was done, and we had the U.S.A. stations signing "U", Canadians "C", Australians "A" and so on. There was some overlapping and much confusion. The next step was the use of Continental prefixes, under which U's and C's became NU's and NC's, Australians OA's, Brazilians SB's, and the like. We ourselves signed "EG". And then came order once more, and by 1928-29 the beginning of the present series of prefixes was in being, although no one would ever have predicted that more than 100 countries would emerge!

But this is digressing. The main point is that by 1930 we had G2's, G5's and G6's, all with two letters. Anyone you hear holding such a call is pretty surely an Old Timer. In the mid-1930's the first G8's appeared, followed by G3's and finally, just before the war, G4's—still all with two letters. Many three-letter calls beginning with G2 had been issued, but these fellows had licenses for dummy loads only. They were known as "Artificial Aerial" licenses; no radiation was permitted, and the allocation of a call-sign was obviously just a matter of being able to identify anyone who strayed and coupled the thing up to an antenna. (Many did!)

The Post-War Scene

Then, on September 1, 1939, came the big shut-down. All licences were cancelled, most of the gear was impounded (and, incidentally, very nicely stored and returned in perfect condition after more than six years). And, with the issue of licences again in January 1946, our G.P.O. astounded us by starting on a three-letter G3 series for all new licensees. The G3's now outnumber the rest of us by a vast majority, but in 1946 they were oddities. G2's with three letters also began to appear—these were the old dummy-aerial fellows who had now qualified for a full license.

The vast renaissance of amateur radio in 1946 and the following years was of course largely due to the number of young men who had trained in some form of communication while in the Services. Those with certain qualifications did not have to pass a technical test; others did not have to pass the Morse test; and in certain cases both tests were waived. The G3's poured out and the stations came on the air in apparently limitless numbers, compared with the select few of the pre-war years.

All this explains, of course, why you can work six G's in the same town and find that they all have different types of call-sign—we have no

*186 Winchelsea Road, Hastings, Sussex, England.

"districts" over here, but we *can* give you some 36 different prefixes for WPX, when you start looking for GC6's, GM5's, GD8's and the like.

QRM

Before the war we used to think we knew what QRM meant. Certain European countries with fairly lax regulations had been notable for the raw a.c. notes emanating from them, and what we should now designate as T6 was considered quite a pleasant noise if it came from certain of these primitives. (After all, the famous Leon Deloy, 8AB, made the first contact between France and the U.S.A. with a 25-cycle a.c. power supply . . . you could count the dots in each of his dashes!)

But as the post-war boom rode on, and the bands really filled up, a new menace was let loose—the v.f.o. Netting had been a rarity before the war. You got a crystal as near the band-edge as possible and called CQ, then listened slowly up the band for a possible reply. After the war netting was universally adopted, which would have been a good thing if everyone had known how to build a stable v.f.o. But our friends, the primitives, simply slapped some sort of an oscillator together, slammed on some sort of a power supply, and let rip. Hence we had notes that were basically about T5 or T6 all over the place, but they didn't even stay in one place; they crept, they chirped, they clicked—and many of them are still doing just that.

When you call a G station and he doesn't come back, just try to imagine some of the QRM that may have been masking you. You probably wouldn't hear it over there, for these gentlemen with the horrible signals seem to have mastered the problem of cutting out their low-angle radiation and developing maximum efficiency in the short-skip region! And the same applies to their reception, since a G will often call a W, or other DX, only to be answered by a clutter of these horrid noises, the perpetrators of which can obviously only hear moderately local signals. DX is a closed book to them, and they form a sort of all-pervading curtain of raucous noise through which the DX work has to take place, with both ends pretending that the noise isn't really there.

This is one of our main problems in G-land. Whereas in short-skip conditions in the States you may have lots of trouble from lots of signals in a distant call area, they are at least clean signals (or so we, over here, fondly imagine them to be!) But a skip of 600-900 miles puts us within range of LA, SM, OZ, OH, UA, SP, LZ, YO, YU, I, EA, DL, DM, OE, and so on. Some of these countries are truly notable for clean signals, especially the Scandinavians. And this has always been so, right from the early days. LA's, OZ's, SM's and OH's, take a bow! Right at the other end of the scale are . . . well, you probably know, so we won't mention them.

The Power Situation

Here in G-land our power limit is an *input* of 150 watts to the final stage, and this is rigorously enforced. (In general, it is strictly adhered to without the need for any enforcement—but there are exceptions here, as everywhere else.) Many of the Europeans have no such limit and can run up to 500 watts and more. But the worst of all are the countries that obviously have little or no supervision—no equivalent of the FCC or our GPO—and what some of their stations use is anybody's guess.

So we are under a little disadvantage with this 150-watt limit. However, much better a 150 watt station with an efficient antenna system than a kilowatt and a mismatch, and the limit has at least made us very antenna-conscious. Listening to the great welter of signals from the States, when the DX bands are open, we naturally find the usual outstanding signals, but it is surprising how often they do not turn out to be the kilowatt boys. Many a time it happens that one of the very strongest on the band will come back and describe his rig as "150 watts to 3-el. beam" or even, in certain conditions, to a dipole or a ground-plane. Conversely, a station from which the signals are no better than most of the others, and sometimes even weaker, will often confess to the use of a kilowatt. We spend a lot of time wondering where some of those surplus watts are going to.

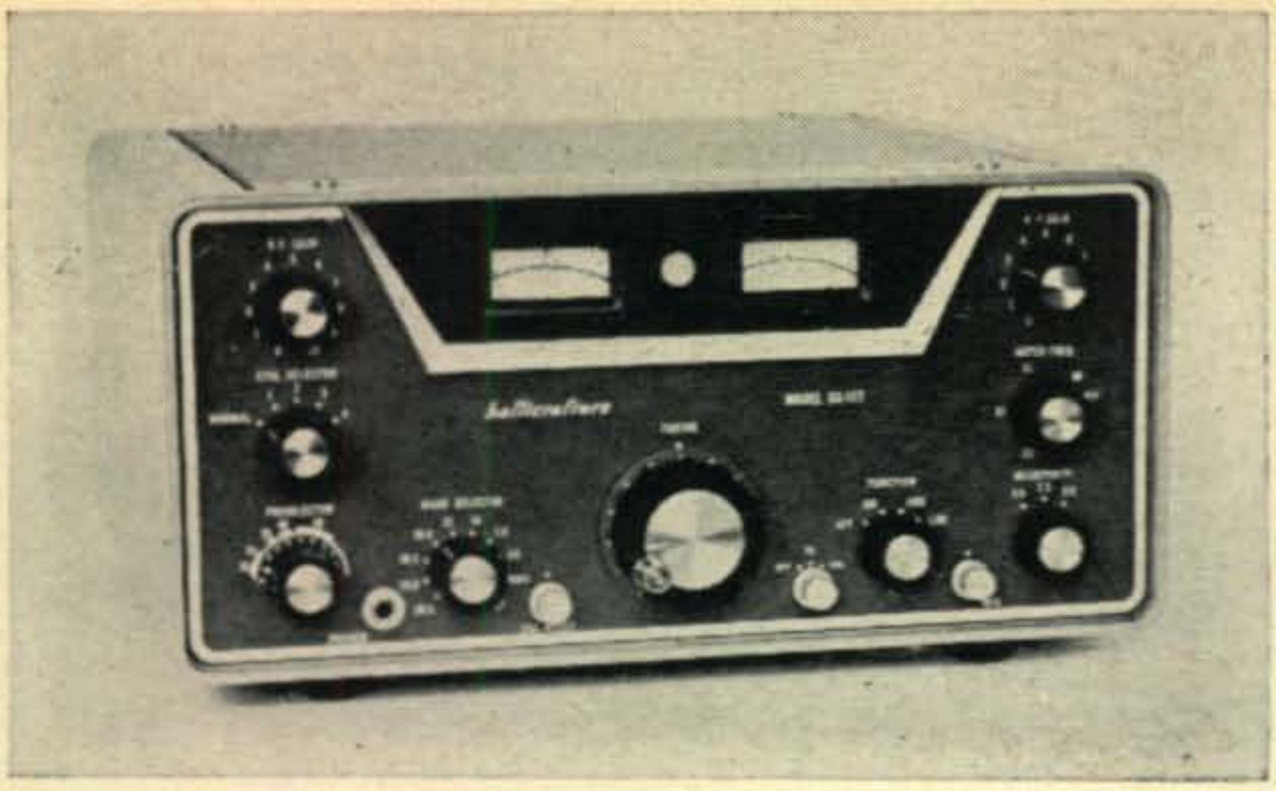
With a worldwide limit of 150 watts, we are convinced that no one would be worse off, and a great number would be better off—if only because they were forced to re-think their antenna situation. Certainly the worldwide QRM level would be reduced, though possibly not by much, having regard to some of those splendid 150-watt signals referred to.

Antennas

In general, the average G has far less space around his house than many of the W stations Admittedly there are probably far more of you fellows in apartment blocks than there are of us in similar circumstances; but some of the monster beams that we hear of, and see in your illustrations, are just not possible over here. There are also some nasty sets of town-planning regulations which prohibit the use of even a 30-foot pole in some cases. Properly fabricated towers are a rarity; poles or masts higher than 50 feet are almost as scarce; and the vast majority of Quads or Yagi beams are no more than thirty feet high. Also a surprisingly large number of hams over here use simple dipoles or possibly long wires. In many cases where the neighbors would not tolerate a steel lattice tower in one's backyard, they will not raise an objection to two slender poles and a long wire actually crossing their property.

Of course, stations located in the open country here have the same opportunities as in the U.S.A. It just happens that the vast majority of ham stations are situated in tightly-populated areas, and this probably holds good all over the world. (But there are undoubtedly more highly-sited rotary beams in the city of Los Angeles than in

[*Continued on page 90*]



The new SX-117 receiver (left). Starting at the top left, working down and to the right are the following controls: R.F. GAIN, XTAL SELECTOR (for auxiliary ranges), PRESELECTOR, phone jack, BAND SELECTOR, CALIBRATE RESET, TUNING, ANL and CAL ON-OFF, FUNCTION selector, B.F.O. TUNE, SELECTIVITY, NOTCH FREQUENCY, and A.F. GAIN. The dial window for the calibrated scale is on the left with the S-meter on the right at the top. The dots on the tuning knob skirt represent frequency increments of approximately 1 kc.

CQ Reviews:

The Hallicrafters SX-117 Receiver and HT-44 Transmitter

THE Hallicrafters SX-117 Receiver and HT-44 Transmitter are medium-priced high-quality companion units which may be operated individually with independent frequency control or which may be used together in a transceive combination with the transmitter's frequency controlled by the receiver. Full coverage of all the amateur bands from 3.5 through 30 mc is provided for s.s.b., a.m. and c.w. operation. Accurately calibrated general-frequency coverage from 3 to 28 mc is also available with the receiver on an optional basis.

The SX-117 receiver has a self-contained solid-state a.c. power supply, while the HT-44 transmitter is operated from the Model PS-150-120 60-cycle a.c. power supply which also houses a loudspeaker. Only the addition of a microphone, key and antenna is needed for a complete 200-watt station setup.

SX-117 Receiver

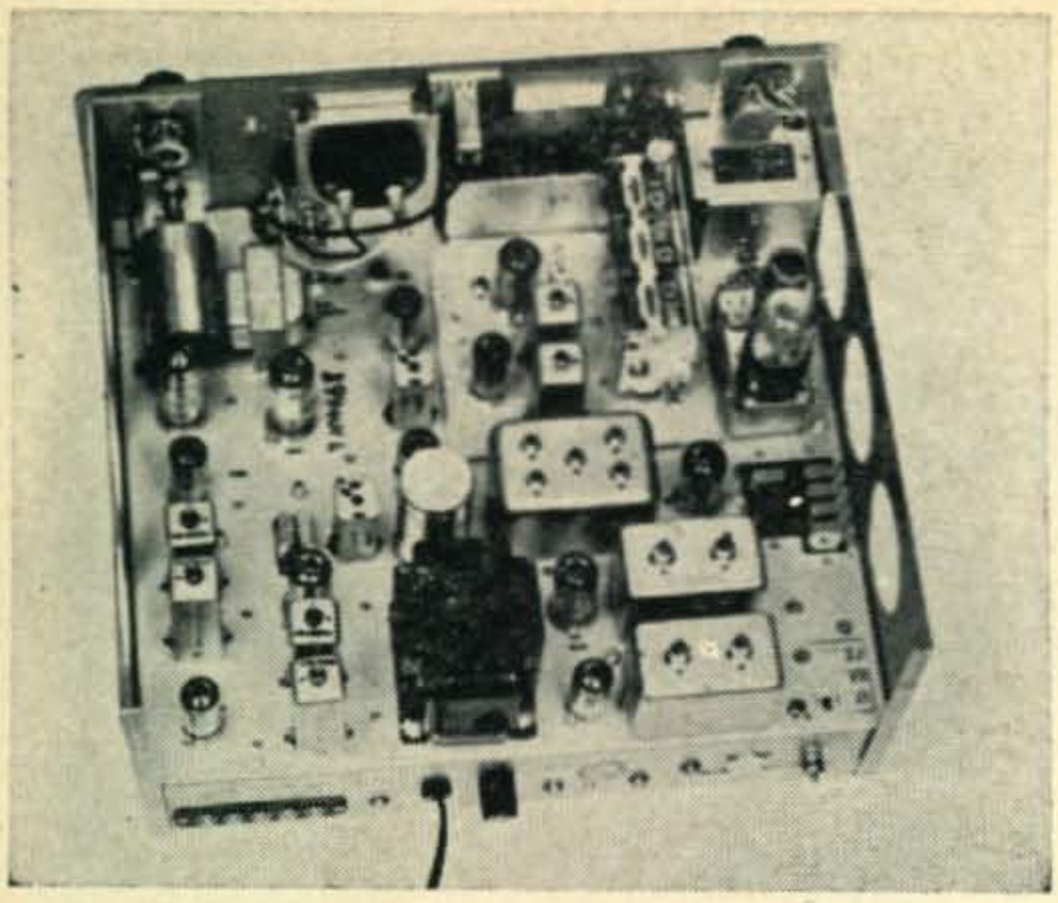
The SX-117 basically is a ham-band-only receiver; however, a WWV-range (10 mc) is included along with four separate auxiliary heterodyning crystal positions for coverage on any one of four selected 500 kc band segments, other than the amateur bands, to provide any additionally desired frequency ranges between 3 and 28 mc. Facilities are also provided for fixed-channel reception using the v.f.o. as a crystal-locked oscillator. A separate outboard unit, the Model HA-10 LF/MF Tuner, also is available for extending the frequency range down to 85 kc.

The SX-117 includes many features found in its big brother, the SX-115.[1] It is a triple-conversion superhetrodyne with a transmitter-type v.f.o. and crystal-controlled first and third conversion oscillators. A high order of mechanical and electrical stability assures drift-free operation. The tuning rate is the same for all bands. These are arranged in 500 kc segments and the tuning mechanism, using a combination of pinch and gear drive, provides backlash-free operation.

Selectivity is variable in three steps to furnish a 500 cycle, 2.5 kc or a 5 kc bandwidth at 6 db down. A variable T-Notch filter is included to eliminate interfering hetrodynes or beat notes.

[1] *CQ* Reviews: The Hallicrafters SX-115 Receiver, *CQ*, March, 1964, page 48.

The HT-44 transmitter (right) matches the SX-117 receiver. Starting at the top left, working down and across to the right, the controls are: VFO SELECTOR, MIC GAIN, OPERATION switch, MIC connector, FUNCTION switch, CALIBRATE RESET, TUNING, CALIBRATE LEVEL, BAND selector, VOX DELAY DRIVER TUNING, R.F LEVEL and FINAL TUNING.



Top view of the SX-117 receiver. The ganged v.f.o. and variable i.f. tuning capacitor is just to the right of center. The auxiliary-crystal sockets are at upper right with a plug-in type of crystal calibrator set between these and the five heterodyning crystals seen toward the foreground. The b.f.o. coil is in the round horizontal can at the upper left.

A product detector is provided for s.s.b. and c.w. Either upper or lower sideband may be selected. Conventional double-sideband a.m. reception may be obtained with a separate envelope detector. An effective s.s.b./c.w. i.f. noise limiter also is included.[2] The b.f.o. is tunable from the front panel.

A built-in 100 kc crystal calibrator provides accurate frequency markers against which the receiver tuning dial may be precisely indexed by means of a calibration control which adjusts the v.f.o. frequency instead of mechanically shifting the fiducial hairline off center.

Amplified a.v.c. with a fast attack has a slow-release time for s.s.b./c.w. and a fast release for a.m.

Calibration

The main tuning dial is calibrated in 5 kc increments spaced about ⅛" apart. Two scales appear on the dial, namely: 0-500 kc (black) and 500-1000 kc (red). If the band used starts at an even megacycle, the frequency is read on the black scale. For a band starting at a 0.5 mc point, the red scale is used. The skirt on the vernier-tuning knob is divided into 15 segments spaced 7/16" apart. Each division represents a frequency increment of *approximately* 1 kc.

Other Specifications

Other specifications are:
Stability: Better than 300 cycles after warmup.
I.F. Signal Rejection: More than 50 db.
In-band Tweets: Equivalent to less than 0.5 μv signal (in the amateur bands).
A.F. Output Power: ¾ watt at less than 10% distortion.
A.V.C. Figure of Merit: More than 80 db.
Antenna Input Impedance: 50 to 70 ohms unbalanced.
A.F. Output Impedance: 3.2 and 500 ohms. Headphone output for 50 to 2000 ohm phones.

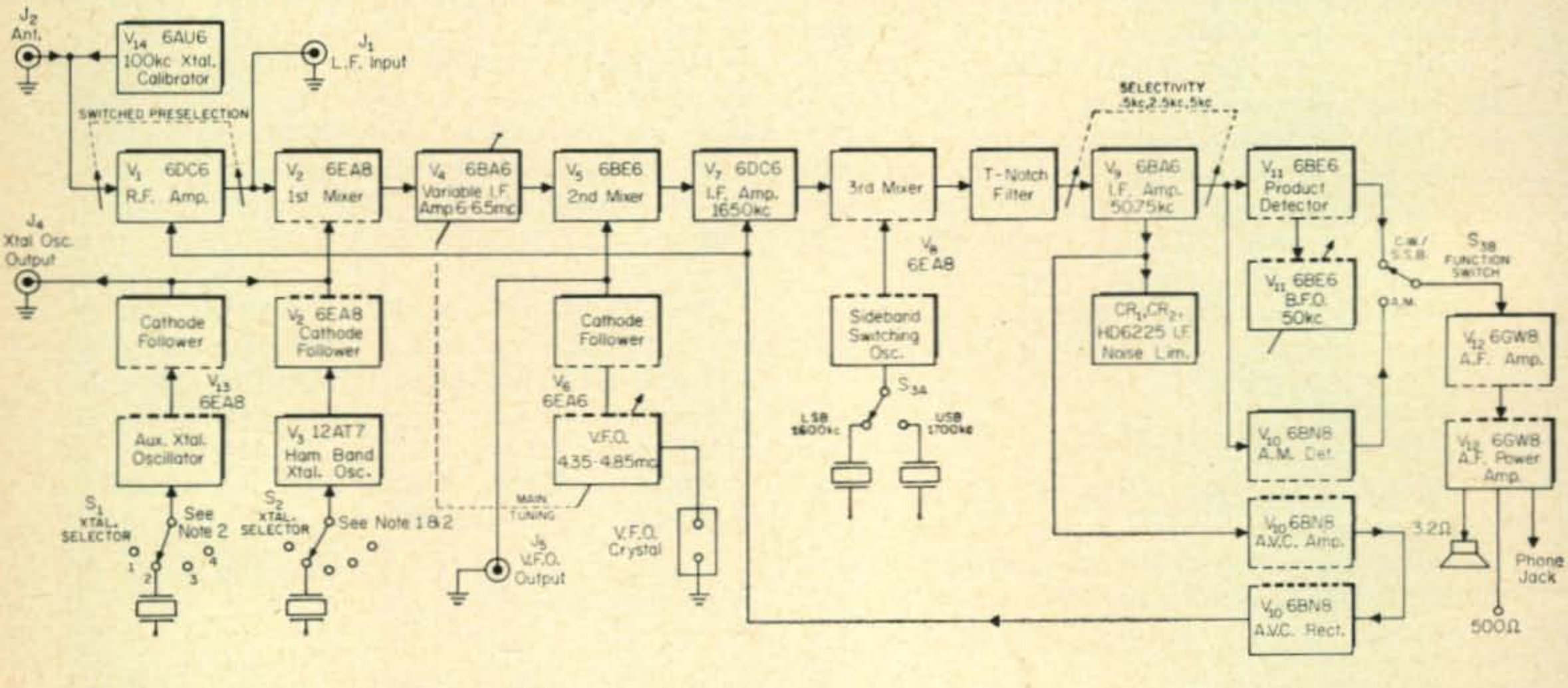


Fig. 1—Block diagram of the SX-117 lineup. R.f. amplifier, V_1, feeds the input signal to the first mixer, V_2, where it is combined with appropriate heterodyning frequencies for the amateur bands, form crystal oscillator V_3, to produce i.f. signals in the 6.5 to 6.0 mc range. These are amplified by the variable i.f. amplifier, V_4, and in turn are mixed in V_5 with the v.f.o. which operates from 4.35 to 4.85 mc to produce a fixed i.f. of 1650 kc. This is amplified by V_7 and is passed on to mixer V_8 where heterodyning with the lower-sideband crystal of 1600 kc, or the upper-sideband crystal of 1700 kc, produces the last i.f. of 50.75 kc. Before going on to the variable-selectivity i.f. amplifier, V_9, the signal passes through a variable T-notch filter which provides a minimum of 50 db rejection at any one selected frequency in the i.f. range. For s.s.b. and c.w. the 50.75 kc signal is demodulated by the product detector and the b.f.o., V_{11}, and the resulting audio is produced through V_{12}. For a.m. the signal is demodulated by the envelope detector, V_{10}, and passes on to the a.f. system. Amplified a.v.c. is obtained from V_{10}. The a.v.c. time constant is automatically changed when the function switch is set for the various modes of operation. CR_1 and CR_2 comprise a solid state s.s.b./c.w. i.f. noise limiter. It also can be used with a.m. The block diagram of the HT-44 is shown in fig. 2.

Power Consumption: 70 watts from a 117 v. 60 c.p.s. a.c. source.

With the exception of the headphone output, which is a standard phone jack on the panel, the output circuits appear on a terminal strip on the rear apron along with auxiliary remote standby-control terminals. The antenna connector is a phono-type jack, as are those for the v.f.o. and crystal oscillator outputs which are needed for transceiver operation when the HT-44 transmitter is used in conjunction with the SX-117. An additional phono-type jack is used for the low-frequency input from the outboard HA-10 unit. A fuse and chassis-ground terminal are also located at the rear.

Performance

Performance of the SX-117 was found to be up to specifications and in some cases better. Measurements indicated the following:

Sensitivity on a.m. for the 10-meter band was a little less than 1 μv for a 10 db signal-to-noise ratio (slightly better on the other bands). For c.w. and a.m. it was 0.5 μv or less for the same noise ratio.

The sideband suppression was —30 db at 1 kc (2.5 kc selectivity position).

I.f. Signal rejection (6-6.5 mc) was 50 db with the 40-meter band in use, better than 70 db on all other bands. The only in-band tweets found on any of the amateur bands appeared at 14,135 and 28,900 kc (in the only 10-meter segment checked) and were equivalent to a signal level of less than 0.25 μv.

The receiver gain varied over a spread of 11 db, depending on the band in use. Likewise, signal inputs of from 130 to 500 μv were required to produce an S-9 meter reading. Below S-9 the incremental readings were higher than the actual signal-level changes.

In respect to the a.v.c., action is very smooth. The a.f. output level increased an average of 9 db for an input-level rise of 66 db (5 μv to 10,000 μv) and 15 db for an 80 db increase (1 μv to 10,000 μv).

Mechanical and electrical stability, calibration and frequency readout were well within specifications. Line voltage changes of $\pm 10\%$ produced less than a 50 c.p.s. frequency shift even though voltage regulation is not employed.

General Coverage Use

Use of the auxiliary crystal positions for reception on ranges outside of the amateur bands was not checked. In this regard, however, it should be noted that operation at 1600 kc, 1650 kc, 1700 kc and in the range from 5.5 to 7 mc is not recommended due to the possibility of interference from the various oscillator frequencies which fall at these points or due to other conflicts related to the variable i.f. system. The instruction manual contains a chart with the needed tuning and auxiliary-crystal information for all the possible ranges between 3 and 30 mc. Data for segments between 85 kc and 3 mc, using the HA-10 outboard tuner, is also given.

HT-44 Transmitter

The HT-44 Transmitter is a 200 watt-input unit with selectable upper or lower s.s.b., conventional d.s.b. a.m. and break-in c.w., completely covering all the amateur bands from 3.5 through 30 mc. Power output is rated at 100 to 130 watts on c.w. and s.s.b. (p.e.p.) and 25 to 35 watts carrier for a.m.

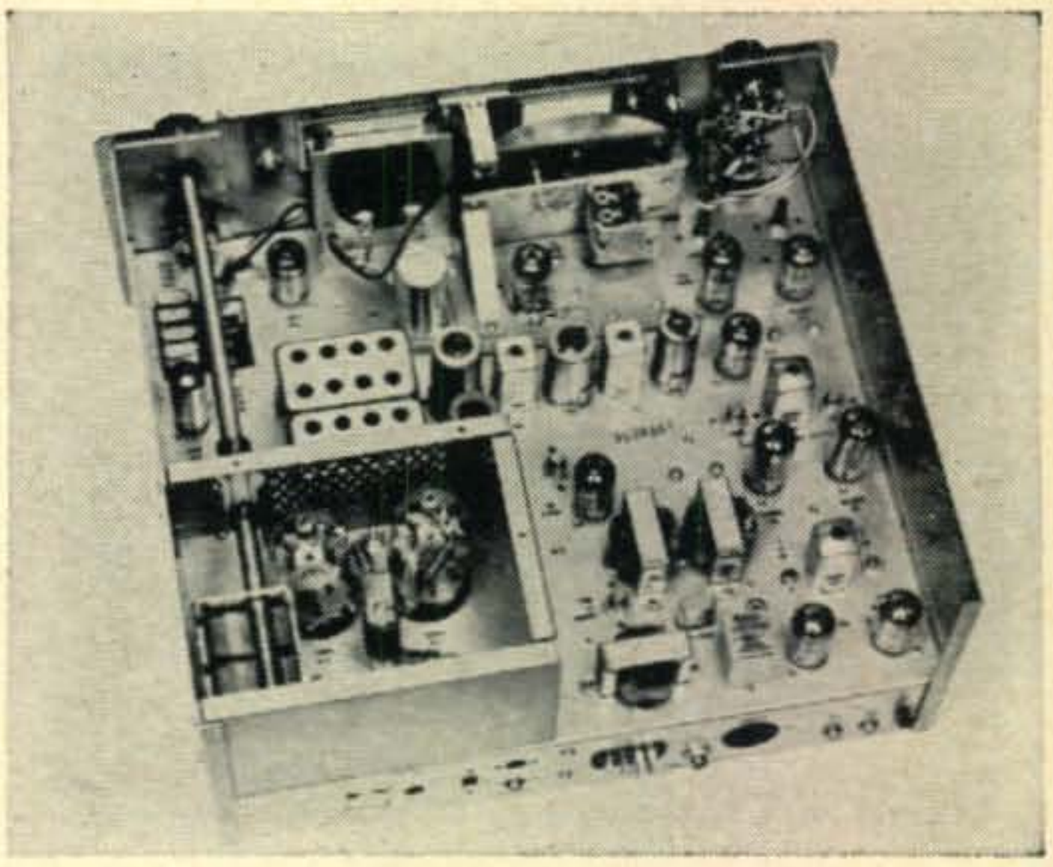
As in the SX-117 receiver, each tuning range covers a 500 kc amateur-band segment controlled by a stable v.f.o. with a similar dial and calibration-control arrangement having an equal degree of frequency stability, readability and calibration accuracy.

S.S.B. Generation

The phasing method of s.s.b. generation is employed along with special audio filtering, providing excellent speech quality with a minimum of 30 db unwanted-sideband suppression over the speech range and with 3rd and 5th order distortion products down in excess of 30 db. Carrier suppression is rated at 50 db and output from unwanted beats at —55 db below maximum output.

Amplified Automatic Level Control (a.a.l.c.) is employed which is fast-acting and which minimizes flat-topping and splatter which might otherwise result from excessive a.f. gain. Up to 12 db of compression is obtainable to ensure maximum talk-power with a clean signal.

Manual (mox), full voice control (vox), push-to-talk (p.t.t.) or c.w. break-in operation may be used. The vox level and anti-trip controls are internal adjustments, readily accessible, while the vox delay for phone and c.w. breakin is controlled by a conveniently located knob on the panel.



Top view of the HT-44 transmitter. The carrier generator and a.f. stages are in the foreground at the right. The v.o.x. section is at the upper right. The v.f.o. is near the dial at the upper center. The line of tubes and i.f. transformers running crosswise makes up the r.f. string with the driver coils in the cans with the holes on top. Heterodyning crystals are at upper left. The final amplifier compartment is in the foreground.

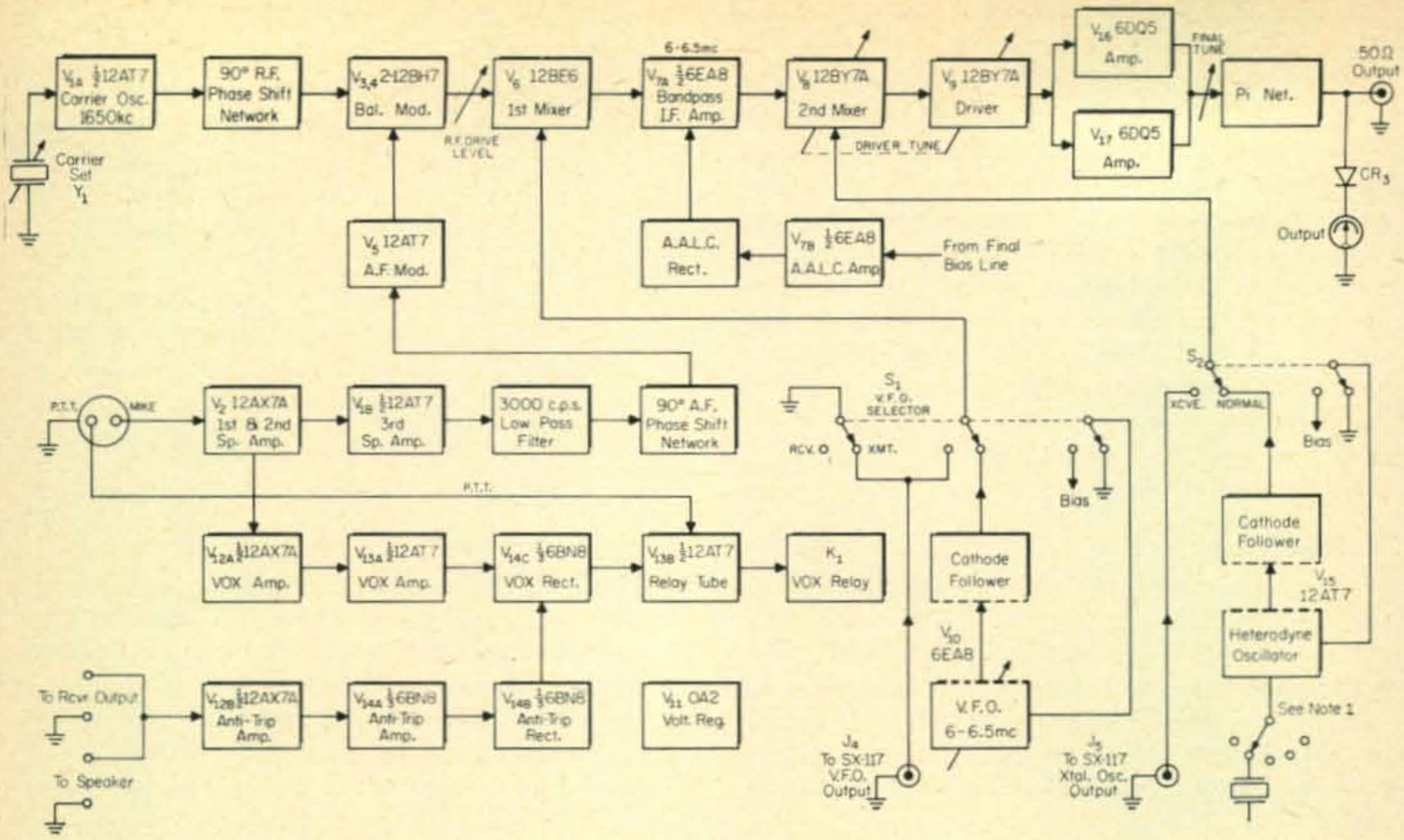


Fig. 2—Block diagram of the HT-44 transmitter. Although its phasing type of sideband generator basically is a conventional arrangement, it does have some features not always found elsewhere.

The a.f. section has plenty of gain for the microphone signal, due to the use of *three* stages of speech amplification in V_2 and V_{1B}. A low-pass a.f. filter is used after the speech amplifier to eliminate audio components above 3000 c.p.s. and thereby improve the dynamic unwanted-sideband suppression at the higher audio frequencies. It also minimizes the possibility of distortion products at this point. The 90-degree a.f. phase-shift network and the a.f. modulator are conventional, while the balanced modulator is well stabilized with the use of four triodes in V_3 and V_4.

The carrier frequency is generated at 1650 kc by the crystal-controlled oscillator V_{1A}. The crystal frequency may be "rubbered" for precise frequency alignment when transceiver operation is employed in conjunction with the SX-117. This eliminates the need for a 50.75 kc stage to lock in with the receiver frequencies. The r.f. phase-shift network is the L/C type.

The output of the balanced modulator is mixed in V_6 with the 4.35 to 4.85 mc signals of the v.f.o., V_{10}, to produce an i.f. of 6 to 6.5 mc for which V_{7A} is a bandpass amplifier. Mixing of the i.f. with appropriate heterodyning frequencies (from crystal oscillator V_{15}) in V_8 produces the amateur-band frequencies for the driver, V_9, and the final amplifier which consists of paralleled 6DQ5's, V_{16} and V_{17}. The final tank employs a pi network having a fixed output impedance for matching into a 50 ohm load.

A.m. operation is produced by the customary method of disabling one of the audio modulators and unbalancing the carrier; however, a departure in this respect is that the arrangement automatically fixes the carrier level at the balanced modulator (when the function switch is at A.M.) to the proper point for 100% modulation, while an R.F.-LEVEL panel control is used to adjust the total a.m. drive from the output of the balanced modulator to the proper operating power level for the final amplifier.

Transceive Operation

A special feature of the HT-44 is that it can be operated as a "slave" to the SX-117 receiver for transceive-type of service. With the proper cables (Hallicrafter CA-44) installed between the two units, either transceive or independent frequency control may be instantaneously chosen by means of a v.f.o.-selector on the panel. When independent operation is conducted, a calibrating, or spotting, position with a level control is available on the panel in order that the transmitter frequency may be heard in the receiver for precisely setting the frequency to that of another signal.

Transceiver operation requires that coaxial cables of a specific type and length be used for interconnecting the oscillator feeds from the SX-117 to the HT-44. Also, the b.f.o. control on the SX-117 must be set so that zero beat (easily checked using the crystal calibrator) is maintained when the fuction switch is shifted from USB to LSB. Following this, the carrier generator frequency (1650 kc in the HT-44) must be correctly set so that exact frequency correlation between the receiver and the transmitter is obtained. This adjustment is made while listening to a beat note on the receiver obtained from the transmitter. Once this has been done, no readjustment is required unless it is later found that the receiver and transmitter frequencies do not coincide.

No difficulties were experienced with transceiver work after these steps were concluded. The ability to instaneously switch to transceive or independent operation provides a convenient and smooth degree of flexibility.

Tune Up

Tuneup is conducted using the c.w. position

and applying a small amount of r.f. drive by means of the drive-level control and then resonating the driver and final amplifier circuits for peak outputs as indicated by the relative output-power meter on the panel.

For c.w., the drive level is than advanced to just below the point of output saturation. For a.m. it is adjusted to one half the meter reading found for c.w. With s.s.b., the drive-level control is disabled by the function switch and the mic gain is advanced to the point where voice peaks kick the meter up to about half-scale.

The fact that low drive is available for tuneup eliminates the need for a quick tuneup time to minimize the possibility of damage to the final amplifier tubes.

Connectors

A panel-mounted receptacle accepts an Amphenol 80-MC2M two-terminal connector for a high impedance microphone and its associated push-to-talk switch. The mic-gain control is located on the panel.

A rear chassis-mounted eleven-pin accessory-control socket accepts an Amphenol 86-PM11 plug (supplied with the unit) for connecting anti-trip circuits to the receiver and for connections to accessory contacts on the v.o.x. relay which provide two s.p.d.t. functions and one s.p.d.t. function with the pole (arm) grounded. A terminal on the socket also provides for receiver muting. Another terminal is available for connecting an external manual-operations switch, such as a foot control or a c.w. key; however, a separate key jack is also located at the rear.

Phono-type jacks are used for the antenna and and the SX-117 v.f.o. and crystal oscillator outputs. A cutout is punched in the chassis to allow the installation of an SO-239 connector for the antenna, if preferred. Cutouts also are provided for an additional receiver-antenna phono jack and an internal antenna-changeover relay.

Performance

The maximum output power (c.w. and s.s.b.-p.e.p.) measured between 120 and 100 watts, with the lower readings experienced on the higher frequency bands. Carrier for a.m. was a little over 25 watts.

Unwanted sideband suppression is specified as 50 db or more at 1 kc and a minimum of 30 db from 500 to 2500 c.p.s. Envelope patterns seen on a 5" oscilloscope indicated the best suppression at any point to be a little over 40 db; however, close to 40 db was maintained over the whole audio range from 500 to 2200 c.p.s., dropping to near 35 db at 300 and 2500 c.p.s. In effect this is better, especially since good suppression is maintained down to the lower audio frequencies, making simultaneous upper and lower sideband QSO's on the same frequency more practical. Besides this, the sideband suppression remained the same when sidebands were switched. Anyone who has attempted the precise alignment of a phasing exciter no doubt has experienced the difficulty of obtaining a reasonably uniform high degree of sideband suppression at *all* frequencies in the speech range while at the same time maintaining such performance when sidebands are switched.

Another interesting observation was that the carrier remained balanced out at all audio-input signal levels, a situation which is not always experienced, regardless of the method of s.s.b. generation, as stable carrier suppression mainly is a function of the balanced modulator.

The speech quality of the HT-44 sounds most pleasant and rounded out which is made possible by the use of the phasing system whereby it is feasible to transmit lower audio frequencies (without inferior sideband suppression) than can de done with many filter-type systems. The result is a more natural sounding speech quality without harshness.

V.o.x. and c.w. keying performed excellently. The a.a.l.c provides a consistently good signal punch. No evidence of flat-topping was observed, even when an excessive amount of a.a.l.c. was used.

Although ruggedly constructed, the SX-117 and HT-44 are relatively light in weight, that of the former being 18½ lbs., and that of the latter 16¼ lbs. Each unit is enclosed in a gray wrap-around type of cabinet which is perforated for good ventilation. The top and bottom plates are easily removable, each requiring only a quarter turn of four mounting screws. This assures ready access to all parts above and below the chassis without necessitating removal of the unit from the cabinet. Dimensions are: 7¾" h. × 15" w. × 14¾" d. The panels are finished in a combination of black, silver and gray with Hallicrafter's neat and functional styling.

The manufacturer has done a fine job in providing quality units having a high degree of flexibility and covering a wide scope of operations while still keeping the price down to a medium level. While some of the features are optional at additional cost, it should be recognized that this approach must be taken to eliminate the need for a higher investment in additions which may not actually be required.

The SX-117 receiver is priced at $379.95 and the HT-44 at $395.00. Each unit is supplied with crystals for the 3.5, 7, 14 and 21 mc amateur bands and for the 28.5 to 29.0 mc segment of 10-meter band. Crystals are available for other 10-meter band segments and for the auxiliary ranges of the receiver (type CR-18U for up to 20 mc, type CR-23U above 20 mc).

The PS-150-120 60-cycle a.c. power supply for the HT-44 is $99.50. The CA-44 cable assembly for transceive operation is $4.95. The HA-10 LF/MF tuner costs $24.95. The manufacturer is the Hallicrafters Co., 5th and Kostner Aves., Chicago 24, Ill.—*W2AEF*

The finished mike stand is made from a surplus gun control assembly mounted on a discarded lamp base. The total cost was one dollar.

BY RONALD LUMACHI*, WB2CQM

A SURPLUS MIKE STAND

This inexpensive push to talk project not only satisfies a functional need, but also supplies the imaginative amateur something to "shoot back" with.

PUSH-TO-TALK operation, in most instances, has been welcomed to ham radio since the operator is relieved of switching manually with rapid fire s.s.b. QSO's. In my kilowatt application, the push-to-talk mike stand feature was desirable. However, this refinement proved expensive when various commercial units were examined.

Since cost was a prime factor, and funds were in short supply, a home brew stand was decided upon. A glance at a surplus parts catalog[1] produced a gun control assembly originally designed to fit comfortably in the hand of an airplane pilot. The unit cost was $1.00 and when receipt proved ideal for the project.

In addition to a large trigger switch there are additional switches conveniently placed. All switch pins are terminated at the bottom of the gun control unit and some probing with a continuity tester netted the matched trigger pins. These two terminations were placed in series with the push-to-talk control of a PL-068 mike plug (tip and ground) and activated with the trigger mechanism. Trigger tension was adjustable for comfortable operation via a small spring loaded pressure control.

The microphone was secured to a small swivel head salvaged from a bullet-shaped living room lamp, however, a short length of flexible metal mike support might be easily substituted. The support was forced into the area formally occupied by the control's thumb switch and glued liberally with Duco cement. The hole was made somewhat larger by reaming some of the hard rubber material.

The wooden base was removed from an old living room lamp and drilled to the approximate size of the control's threaded base and secured by screwing down into position. Base substitutes can be easily improvised to fit the threaded end of the control. Three additional switches (momentary types) are also found on the control and their uses are limited only by the imagination of the builder.

The completed unit's appearance commands respect and proves comfortable in the palm of the hand. The trigger mechanism is light to the touch and prolonged periods of transmission have not been fatiguing. Truly, an adequate reward for a small energy and cash outlay. ■

*73 Bay 26th Street, Brooklyn 14, N. Y. C.

[1] Fair Radio Sales, 2133 Elida Road, Lima, Ohio.

GOOD DESIGN PRACTICE

BY SUMNER WEISMAN*, W1VIV

For some reason, homebrew gear seldom has the smoothness of appearance and operation nor the reliability of commercial gear. A little care in design, however, and a lot of patience can usually rectify this situation.

If there is one thing that is absolutely unique about this hobby of ours, it must be the fact that we are the only consumers of commercially manufactured electronic equipment who absolutely demand good design practices. If any manufacturer attempted to sell us equipment in which poor design became evident, it would immediately be all over the amateur bands for everyone to hear. Therefore, just about all manufacturers of amateur equipment honestly attempt to incorporate as much good design practice as possible, as they could not stay in business very long any other way. Also, they have found that many good features cost very little extra to include, but greatly enhance the equipment.

Even with the great choice of commercial gear on the market today, many of us still prefer to build our own. In many cases it is a matter of finance, and in others merely a desire for individuality and rank nonconformity. This is as it should be, of course.

Many amateurs, however, when designing and building their own equipment, have only the vaguest ideas of what good design practice means. Often, the finished product leaves much to be desired both electrically and mechanically. While the average constructor is not expected to be a design engineer, there are many asy and inexpensive ways to give a piece of gear the look and operation of commercial equipment.

The U.S. Naval Electronics Laboratory has put out a booklet called *Suggestions for Designers of Electronic Equipment*. While written mainly with military equipment in mind, many of the suggestions are directly applicable to ham gear, and are certainly worth reviewing.

Common Design Faults

TECHNICAL FAULTS

1. Operation of parts above ratings. This is probably the most common error committed by hams. It is much less expensive to put in adequately rated components in the first place.
2. Inadequate electrical design. Examples: low sensitivity, regeneration, poor selectivity, hum, spurious responses.
3. Inadequate power line filter.
4. Excessive radiation producing interference.
5. Inaccessibility of parts for maintenance.
6. Relays open under vibration. A quite common fault in mobile rigs.
7. Electrical instabilities caused by mechanical parts of insufficient rigidity.
8. Inadequate protection of wires and cables passing through metal partitions, or where hinged chassis are used.
9. Calibration (or scale) marks lacking on controls.
10. Cable harnesses not adequately supported to prevent fatigue failures at rigid termination points.
11. Parts not secured, allowing damage during shock and vibration. For example: terminal boards or other assemblies cantilever mounted, and massive parts secured with screws of insufficient strength, or by wire leads only. You wouldn't hang a power transformer by its leads alone, so why do it to a heavy electrolytic?
12. Inadequate ventilation. Many a mobileer has scratched his head when the transistors in his power converter went out even though they were adequately heat sinked.
13. Poor selection and location of controls. This is another very common fault. Many hams greatly underestimate the importance of operator comfort.
14. Gears secured with set screws instead of pins.
15. Inadequate clamping and cooling of electron tubes.
16. Failure to use lock washers where required, or use of incorrect types. Such things as beam antennas, and all mobile and portable equipment should use lock washers. How many of us do?

EQUIPMENT FAULTS

1. Visual indicators mounted so that operators cannot adequately see scales, pointers, numbers.
2. Fineness of scale graduation, design of numerals and pointers, and scale progression poorly presented for accurate reading.
3. Controls work contrary to operator expectation. Naturalness of movement direction is derived from previous experience as well as certain handedness factors. For example, how would you like to rotate your a.f. gain control clockwise and

*9 Springhill Rd., Framingham, Mass.

have the volume decrease?

4: Maintenance is complicated by stacking assemblies and parts so that many must be removed to repair or replace one or a few.

5. Handles seldom provided; chassis or units too heavy to move without undue strain.

6. Calibration adjustment controls—especially screwdriver adjustments—are too sensitive.

Design Suggestions

ELECTRICAL

1. Choose top quality, standard electronic parts.
2. Reduce stress on parts to improve reliability.
3. Minimize use of parts known to have high failure rates such as connectors and relays.
4. Fuse or otherwise protect both sides of the power line and provide spare fuses in a convenient location.
5. Design equipment so that interference and undesired radiation are minimized. The FCC is quite strict about this, and with excellent reason.
6. Do not series-connect pilot lights. Not only is it harder to find the defective one, but a higher voltage than expected is lurking across the open light.
7. Where possible, avoid use of friction or pressure contacts. Where used they should be designed to prevent erratic operation under service conditions.

MECHANICAL

1. Secure all electron tubes, large fuses, and other plug-in items by easily released, positive-holding clamps. Large electron tubes require support for the envelope. A clamp only at the base is seldom successful.
2. Avoid the use of cantilever mounting for parts.
3. Wire lead-connected electronic parts which are large in comparison with a standard 2-watt composition resistor (having a diameter greater than 0.4 inches) should be secured to the chassis or parts board to prevent lead breakage.
4. In mounting parts by wire leads, the clearance between the soldered connection and the body of the part should not be less than ¼ inch and should not exceed ½ inch in length.
5. Do not use rivets for mounting parts which may be subject to replacement or for maintaining electrical continuity.
6. Self-tapping screws should not ordinarily be used.
7. All setscrews should have one type of head.
8. Do not use flathead screws on thin panels.
9. Internal wiring should be combined into a cable and held by lacing or other suitable means. This cabling should be clamped to the chassis at frequent intervals to prevent conductor breakage.
10. Protect wires and cables running through holes in metal partitions from mechanical damage by use of grommets or other suitable means.
11. Stranded copper wire that has been soldered to a terminal should be secured so that vibration does not cause the conductor to flex near the area where the individual strands have been soldered together.
12. Do not join leads without a support at their junction. How many of us are guilty of this?
13. Secure glass windows to panels with clips, snap rings, or other positive means. Do *not* use cement alone.
14. Avoid threading aluminum alloy into aluminum alloy parts.
15. Do not use dissimilar metals in contact where corrosion can be expected.

'HANDLES SELDOM PROVIDED'

16. Do *not* use acid or corrosive soldering fluxes. Rosin is the only noncorrosive flux.

THERMAL

1. Limit heat dissipation in equipment by choice of efficient parts (semiconductor devices instead of electron tubes) and circuits (class B or C operation instead of Class A).
2. Use parts which have maximum thermal operating range and minimum temperature sensitivity.
3. Keep parts cool by effective thermal design. Locate parts for best heat dissipation and isolate sensitive parts from heat sources.
4. Use conductive heat transfer to lower surface temperature of high power-density devices such as tubes, power handling resistors, transformers, and small motors.
5. Choose the equipment cooling method according to the unit: When less than 0.25 watt per square inch, natural cooling should be used. (Free conduction, convection, radiation.) For more than 0.25 watts per square inch, but less than 2 watts per square inch, forced air cooling should be used. When over 2 watts per square inch, indirect liquid cooling should be used with metallic conduction paths from heat sources to the liquid coolant.
6. Arrange hot parts to form a bank of minimum height. If vertical stacking is necessary, the parts should be staggered.
7. Place temperature-sensitive parts below (or isolated from) heat sources.

FORCED AIR COOLING

1. Design equipment so that forced air is in a direction to aid natural convection.
2. Direct cool, clean air on hot spots.
3. Cool hot parts with parallel air flow. Do not use "second-hand" air for cooling if at all possible. If "second-hand" or series flow air must be used, the sequence of air passage over cooled parts must be carefully planned so that sensitive parts or parts with low maximum permissable operating temperatures are cooled first and so that in every case the coolant has sufficient thermal capacity to maintain required part temperatures.
4. Air flow in equipment should be measured and mapped with smoke. Insure that power tubes have required air flow.
5. Isolate intake port from exhaust.
6. Choose a blower of adequate capacity and

cool the blower motor.

7. Provide protection against equipment damage in case of blower failure. One simple method for amateur equipment is a microswitch controlling plate voltage attached to an aluminum vane in the air flow path. Of course, a thermal relay can also be used.

PART CONSIDERATIONS

1. Where maximum tube life is desired, limit maximum envelope temperature of soft-glass tubes to 100° C.

2. Utilize thermally effective tube shields. Shields should have inner surfaces blackened, should provide metallic contact with at least 50 percent of the envelope surface area in the plate region, and should have low resistance in any joint between the shield and the mounting surface. Hams have been using such shields with great success for several years. While a bit more expensive, they greatly lengthen tube life.

3. Semiconductor devices are particularly temperature sensitive, and thermal designs for them are critical. Extreme care should be taken, by measurement, if in doubt, to never exceed recommended maximum junction temperatures under any condition.

4. All power handling semiconductors should be mounted on metallic conduction members or sinks. Where electrical insulation is required, it must not produce unsound thermal designs.

MAINTENANCE

1. In mounting parts, keep ease of maintenance in mind. Provide access to both sides of chassis. Leave sufficient hand room to remove and replace part.

2. Use care in mounting miniature parts. Their smallness often influences the designer to mount them in ways which makes maintenance difficult.

3. Place fixed guide marks on equipment if presetting of controls is required for a standard maintenance operation.

4. All chassis should be completely removable from the enclosure without extensive disassembly.

5. Design equipment to permit thorough visual inspection of all parts so that obvious failures, such as open tube heaters, burned resistors, leaking capacitors, and broken wires and terminals can be located quickly.

6. Connectors mounted on the rear of the front panel and on the chassis rear apron must be available for test and service.

7. Make overload protective devices (fuses, circuit breakers, etc.) available from the front panel if possible.

'OBVIOUS FAILURES'

8. Localize circuit parts and subsystems to the maximum extent consistent with good electrical and mechanical design.

9. Whenever possible eliminate need for maintenance adjustments by use of stable parts and tolerant circuit designs. Never use adjustable parts where part values need not change during the life of the equipment.

10. When soldering wires (including part leads) to terminals, do *not* wrap wires around terminals more than is necessary to retain part during the soldering operation. Under no circumstances should this wrap exceed 90 degrees. This is in direct oppotion to what was formally taught. Just a few years ago a strong mechanical connection was considered necessary before soldering, but modern solder is much stronger than it used to be. How many small components have you ruined while trying to unwrap and unsolder them at the same time?

11. Leave a lead extension of about 1/16 inch beyond the terminal, and do not mount more than three wires on one terminal. This extension is to grasp with long-nose pliers when unsoldering, and is often called a "courtesy lead."

12. Use captive fasteners where there is danger of parts being dropped into assemblies.

13. Use quick opening fasteners for equipments which must be serviced frequently; however, do not use ¼ turn fasteners for structural applications such as panel fasteners which secure a chassis in the enclosure.

14. Minimize the need for special tools.

15. Mount terminal strips or connectors to be accessible from the front of the equipment when opened.

16. Lamp holders should be of the lock type and permit lamp replacement from the front.

17. Provide 10 percent spare terminals (at least 2) on terminal strips and connectors. There are always additions and changes to be made.

SAFETY

1. Provisions should be made to prevent contact with voltages in excess of 70 volts r.m.s. Do not locate adjustment screws or other commonly worked-on parts near unprotected high voltages or hot parts.

2. Provide voltage dividers with test points for measurement of voltages in excess of 1000 volts.

3. Provide guards or safety covers for potentials in excess of 350 volts r.m.s. on contacts, terminals, and similar devices.

4. Ground all external metal parts, control shafts, and bushings. Antenna or transmission line terminals should be at ground potential except with regard to the energy to be radiated.

5. Provide rotating antenna assemblies with local power safety switch at the antenna. Very few amateurs incorporate this simple devce. It might be wise to remember that the shock of coming in contact with even low voltages could cause a nasty fall from a tower or roof.

VISUAL DISPLAY

1. Visual indicators should be mounted as nearly perpendicular to the line of sight as possible.

2. Numerals and letters should be simple in design. Avoid extra flourishes.

3. Scale graduation should not be finer than necessary within the accuracy of the instrument itself.

4. Instrument pointers should be designed to reduce parallax. They should not overlap numerals or indices.

5. Utilize similar numbering and scale pro-

gressions for dials on the same panel.

6. Use scale breakdowns of units, fives, or tens when possible. Avoid irregular scale breakdowns.

7. For multi-revolution dials, orient the zero position at 12 o'clock.

8. Controls should be marked to indicate direction of operation.

9. For dials which have a finite scale, provide a definite scale break between the end of the scale and the zero position.

10. Utilize maximum contrast between the color of dial or scale markings and the background of the dial.

11. Select counter types in which the numbers "snap" into place.

12. An upward movement of a counter should indicate a numerical increase.

13. Avoid fractions or decimals on dial scales when possible.

14. Select counters which read from left to right.

15. Warning indicators should be located as close as possible to parts of the equipment to which they apply.

16. Critical warning lights should be isolated from other lights to be most effective.

17. Provide even illumination of all parts of a dial including the pointer.

18. In dial scale design, the fixed scale with moving pointer is preferred over the fixed-index/moving scale design.

19. When multiple scales are involved on one dial or instrument, provide positive identification of the scale in use.

20. The opening for open-window dial display should permit viewing at least two numbers.

CONTROLS

1. Often-used controls should be placed somewhere between elbow and shoulder height.

2. Controls and indicators that are used only occasionally should be mounted behind access doors. Adjustment should be by means of knobs.

3. Controls and indicators that are infrequently required should be available only when the equipment is open for maintenance. Such controls should be screwdriver adjusted.

4. Control movement should be in the "expected" direction; that is, increases should be caused by movement to the right or upward.

5. Adjustment-type knobs should be no more than 2 inches in diameter and should be used for very light torques.

6. Round knobs should be used for controls requiring smooth continuous movement. Bar or pointer type knobs should be used for detent-type switching.

7. Control actions should be positive without being sticky or stiff.

8. Keep number of operator controls and indicators to a minimum.

PANEL LAYOUT

1. Panel layout should be as functionally simple as possible.

2. Provide clear, legible labels. Use standard abbreviations. Provide illumination where necessary and be consistent in placing labels either above or below controls or meters.

3. Avoid glossy surfaces or highly polished metals.

4. Do not place cable entrances on front panels.

If some of the above seems overly strict, just compare it with military equipment. Some is designed to operate between –54° to +65° C; to withstand 95 percent relative humidity; to operate in winds of 75 knots, and with an ice load of 4.5 lb. per square foot. Some of our equipment, in comparison, has trouble operating correctly for any length of time at room temperature on the ham shack desk!

The writer hopes it is now obvious that the use of good design practice has many benefits. Home designed equipment, or even equipment built from somebody else's design, can look better, run cooler, and have less breakdowns. As modern amateur equipment becomes more and more complex, we should all try to modernize our design practices and keep the quality of our equipment as high as possible. ■

Dow Corning Silastic RTV 732

A number of radio amateurs have found Silastic RTV 732 very useful for solving problems regarding water-proofing and corrosion-proofing antenna installations, such as may be needed at joints, cable connectors, nuts and bolts, feedthrough points, etc. RTV 732 is a self-adhering silicone-rubber material which can be applied for use as a grommet, sealant, protective coating or an adhesive on metal, glass, ceramics, plastics or silicone rubber. It is a white-colored viscuous substance supplied in a squeeze tube furnished with an applicator spout. It is ready to use, no mixing is required, and it cures on exposure to moisture in air. Silastic RTV 732 is a product of Dow Corning Corp., Midland, Mich.

DX DX DX DX DX

URBAN LE JEUNE, JR.*, W2DEC

The following certificates were issued between the period from May 6th, 1964 to and including June 5th, 1964:

CW-PHONE WAZ

1985	W8KIT	P. H. Darwactor
1986	WA6GFY	Lockheed Employees Amateur Radio Club
1987	OE3HY	Karl Hluchy
1988	W4RLS	J. Foy Guin
1989	WA6OHJ	Kyle Bryant
1990	WA6HRS	Hillar L. Raamat
1991	W1YYM	Ellen White
1992	JA1BTM	Jun. J. Yokohawa
1993	W9QLD	Hi Hewson
1994	WØFRX	Fred K. Thompson
1995	W6REH	J. G. Davis
1996	W4HUE	George A. Mack
1997	HB9AAF	Fritz Muhlheim
1998	VK3TL	Ken Matchett
1999	K3NMY	J. E. McCarley
2000	W8EVZ	Jim Resler
2001	WA4CXR	Lawrence L. Williams

ALL-PHONE WAZ

244	I1RB	Pier Paolo Bavassano
245	JA1BWA	Toshio Takashasi
246	F2MO	Michel Dort
247	DL1KB	Hans Pazem
248	GI3JIM	A. J. Rourke
249	W2TVR	Fred Spinning
250	F8SK	Roger Dort
251	VE7PU	Dick McQuillan

TWO-WAY SSB WAZ

231	W2MES	Joseph V. Hellmann
232	I1RB	Pier Paolo Bavassano
233	W2PTM	Robert R. Welch
234	DL1VR	Herbert Alfke
235	W2TVR	Fred Spinning
236	DL9OV	Kurt Zaar
237	VE7PU	Dick McQuillan
238	W9SFR	Steve Hritsko
239	F8SK	Roger Dort
240	W3YZI	J. Hurwitz

CW WPX

546	JA5FQ	S. Syono
547	G8JR	Peter Haskins
548	W6IPH	Fred W. Fiedler
549	VK3JF	John F. Heine
550	W3FDH	Robert G. Adams, Jr.
551	K2QIL	John Kane
552	W1AIO	Thomas W. Penney
553	OE8KI	Ing. Hans Krejci
554	K4YFQ	Austin Regal
555	W7AIB	Herman F. Helgesen
556	K4AUL	David H. Bloch
557	SP9PT	Wojciech Ktosok
558	SP8HR	Zbigniew M. Rybka

PHONE WPX

109	UQ2AN	Bruno Geiza

SSB WPX

176	ZB1A	Howard G. Cunningham
177	OA4PD	Vitaly France
178	DJ2QZ	Ernst Kuehn
179	SM5UF	Harry Engstram
180	WA2VOH	Charles Boller
181	LA5HE	Raenar Otterstad
182	OK1MP	Miles Prostecky

MIXED WPX

92	VE3BKL	Homer T. Houser
93	W8GMK	John Marhefka
94	PY4AYO	Waldir Ferreira Drummond
95	W4ZYS	Meryl C. Burns
96	W5LEF	Willie E. Petty
97	SP8HR	Zbigniew M. Pybka

100 TWO-WAY SSB

457	VK3TL	Ken Matchett

Changing Times

To keep up with the exploding ham population in Mongolia, JT1KAA has become the QSL Manager. There are presently over 20 hams in Mongolia, however, most confine their activities to 40 and 80 meters. How long did it take you to get a card from Zone 23?

New Country

Tansan Federation (Tanganyika and Zanzibar) has been formed. Should be a new country a la 6O1/6O2. (I5/VQ6) Active stations have been VQ1GDW and 5H3JR.

From Netherlands DX Press

"We wish to express our congratulations to the ARRL on behalf of their 50th anniversary, May 17th, from the Dutch DX gang.

"However, we were not able to copy W1AW's message from the League President W6ZH because the W/K boys completely covered up their own club stations' frequency on 14,280."

How about a little more consideration fellows!

Here and There

AP West Pakistan: AP2MI has been active on 14263 kc s.s.b. usually around 1430 GMT. *(Tnx WGDXC)*

CEØA Easter Island: CEØAC has recently been active on 14100 s.s.b. He also operates c.w. around this same frequency. The preferred time is between 0000 and 0230 GMT. *(Tnx LIDXA)*

CR4 Cape Verde Island: CR4AD is active on s.s.b. between 14107 and 14120. Best time seems

*Box 35, Hazlet, New Jersey 07730.

Maintaining a firm grip on his newly won Hallicrafters SR-150 Transceiver, Urb LeJeune, W2DEC, your DX Editor, poses with John Hern, VS9AAA (left), who flew in from Aden to attend the recent Single Sideband Amateur Radio Association Dinner and Hamfest. The firm grip was in answer to John's joking attempt to convince Urb he needed it more! John pulled Urb's number out of the hat, so don't let anyone tell you that DXers don't stick together. *(Tnx K2MGE)*

to be between 1900 and 2000 GMT. He is easily scared away by QRM and usually lasts for only 4 or 5 contacts before going QRT. *(Tnx NEDXA)*

FB8ZZ Amsterdam Island: FB8ZZ has been active on s.s.b. using a transceiver which was sent to him by HB9TL. The rig will eventually go to FB8XX and FB8WW. The rig tunes 14100 to 14270 with provisions for three crystals. They are 14108, 14113 and 14125. HB9TL will handle QSLs for all s.s.b. contacts. *(Tnx HB9TL)*

FK8 New Caledonia: There has been quite a bit of c.w. activity from FK8AB and FK8BI recently. Both operate around 14050 beginning at 0230 GMT. FK8AU has also been active on s.s.b. *(Tnx NEDXA)*

FY7 French Guinea: Gaby, FY7YF, active daily on 14105 kc s.s.b. between 1100 and 1200 GMT. *(Tnx WGDXC)*

HL Korea: The following letter is from Aug, HL9TS/K2UVU. "I'm really having a ball being DX instead of chasing it from W/K land. When conditions warrant back to the states, I just call CQ once and all hell breaks loose, both on c.w. and s.s.b. I'm starting to get a little more time to myself and will be operating as much as possible.

"My KWM-2 and quad are holding up fine and seem to be putting a good signal into the states through the mountains surrounding the QTH. Conditions have been pretty decent to the US from 1100-1400 GMT for east coast and 0100-0300 GMT for the rest of the US. I've talked to a lot of old buddies and it really feels good to communicate all the way back to home.

"Just finished a go with VK9TG and VK9JK on New Guinea and had a long c.w. chat with Rao, VU2RM. CR9AH was giving me some QRM, hi." (Sounds as though you're working real hard Aug.)

KB6 Canton Island: KB6EPN is presently the only station active from Canton Island. He usually operates around 14270 s.s.b. beginning at 0200 GMT. He is especially on the lookout for east coast stations. *(Tnx NEDXA)*

KJ6 Johnston Island: KJ6CC is currently active on s.s.b. around 14340. *(Tnx VERON)*

KL7 Alaska (Shemya Is.): "At the present time, I (WA6BTK) am the only operator at KL7EFN. I operate on 20 s.s.b. most of the time and prefer 14270 when it is clear. About the only time KL7EFN is on the air is when I have a day off. Generally, I am on from 2200 GMT to 0700 GMT.

"I have an Eldico exciter driving a Viking Kw at the full legal limit. The receiver is a Hammarlund HQ-160 and the antenna is a sloping V and a double extended doublet for 20. There are some spare receivers and transmitters in the shack.

"Conditions out here for the states are from about 0000 GMT to 0200 GMT and from 0400 GMT to 0700 GMT. South America is in at about 0200 to 0400 GMT and Oceania is in from 0800 GMT to about 1100 GMT. Europe and the Far East is in from 1600 GMT to 2000 GMT.

"I will be happy to make any skeds provided they are for 20 meters.

"Some other stations on Shemya Island are KL7FBI (club station also); WA6OTB/KL7; and KØRAX/KL7. KL7FBI stays on 20 s.s.b. most of the time, too. WA6OTB stays on 40 s.s.b. and KØRAX is on 20 c.w. and 40 c.w." Thanks to Stu, WA6BTK, for the above.

KM6 Midway Island: Tex, WØPI/KM6, has been

The good looking (?) chap is none other than Aug, K2UVU, at the operating position of HL9TS. Aug is having himself a ball. See his letter in the text. His quad is called the local helicopter trap.

WAZ and WPX

The WAZ and WPX certificates are awarded by the *CQ* DX department. WAZ is issued for proof of contact with the 40 Zones of the world as shown on the official WAZ Zone Map. WAZ is issued in three classes, *i.e.* Any mode, all phone and all s.s.b. For complete rules, see the January, 1962 *CQ*, page 50.

WPX is issued in four classes, *i.e.*, all c.w., all phone, all s.s.b. and Mixed. The number of prefixes required are: C.w.-300; Phone-300; s.s.b.-200; Mixed-400. For complete rules, see January, 1962 *CQ*, page 52. WAZ applications, Zone Maps and WPX applications may be obtained from the DX Editor at the address shown at the head of this column. Please send a self-addressed, stamped envelope or a self-addressed envelope and an IRC. All applications should be sent directly to the DX Editor.

active between 0900 and 1030 GMT. He likes 14250 kc. *(Tnx VERON)*

KR8 Okinawa: Of interest to prefix hunters is the availability of KR8BI on 14030 around 1230 GMT. This chap is an Okinawan National. Although quite a few KR8s have been licensed, most confine their activities to 40 and 80 meters. *(Tnx NEDXA)*

KS6 American Samoa: K7VAS/KS6 is looking for east coast contacts every Wednesday and Thursday evening starting at 0230 GMT around 14338. *(Tnx NEDXA)*

LU South Shetland Islands: LU8ZC has been somewhat active on 14100 kc c.w. and a.m. phone around 0000 GMT. *(Tnx LIDXA)*

MP4Q Qatar: MP4QBF is active starting at 1700 GMT. He listens on his own frequency of 14255 kc or up 5 kc. He is the only s.s.b. station in Qatar. *(Tnx LIDXA)*

OD5 Lebanon: OD5AX is reported active between 1800 and 2000 GMT, usually 14290/95 kc s.s.b. *(Tnx WGDXC)*

SU Egypt: VE6AMX is active daily on 14130 kc. He listens for c.w. on his frequency and also s.s.b. between 14250 and 14255. The best time is between 2100 and 2200 GMT. He is looking for North Dakota, South Dakota and Idaho to complete his WAS. *(Tnx WGDXC)*

SVØ Rhodes: SVØWF is presently active and keeps a weekly sked with Larry, W2PCJ, at 1300 GMT on 14280 s.s.b. on Sundays. SVØWF will stand by for breakers after his QSO with Larry. *(Tnx NEDXA)*

TJ8 Cameroons: TJ8AG and TJ8YL are active on 21 mc a.m. around 1830 GMT. *(Tnx WGDXC)*

TR8 Gabon: TR8AD is presently the only active station from Gabon. He is active on weekends on 21 mc a.m. usually between 2000 and 2100 GMT. He tunes the American phone band for French speaking stations. (Parlez-vous Francaise?) *(Tnx NEDXA)*

VK Lord Howe Island: A group of Australian hams will be operating on 20 and 40 meters from Lord Howe Island from August 18th to Sept. 1st, 1964. It will be mostly phone. The operators are VK2AAK and XYL Mona, VK2AXS; Reg VK2AI; and Phil VK2TX. Lord Howe Island is about 400 miles from the east coast of Australia and is reached by flying boat. It is a lovely place for a holiday as the climate is very mild. The families are going along too. *(Tnx VK2AAK)*

This neat station belongs to Chris, ZS6BCT. Chris works 15, 20, and 40 c.w. and s.s.b. and is usually on daily between 1900 and 2100 GMT. He is 21 and works for an insurance company in Johannesburg. *(Tnx WA9DSO)*

VK4 Willis Island: John, VK4JQ, has gone QRT and left Willis Island. I don't know if his replacement is a ham. *(Tnx WGDXC)*

VK9 New Guinea: The following is from Sandy, VK9GC, via the NCDXC bulletin: "I've been on the air only a few months from this QTH and haven't been very active due to pressure of work.

"I work on a coastal radio station and due to a shortage of staff have been kept busy.

"You certainly live in a big town compared to New Guinea standards. Rabaul is the biggest town in the Islands and has a population of 2500 Caucasian, 2000 Chinese, 1500 half caste and many thousands of natives.

"New Guinea is rather primitive. In some parts of the interior, cannibalism still goes on and still about one quarter of the entire area is out of bounds for visitors for their own safety. The language is pidgin, which is a mixture of German, English and local words.

"I am married, have a daughter of 4 years and we have a house boy to do the work. He is supplied with a nice house and gets 3 pounds per week which is good money to him.

"In regard to the weather, it's hot here all of the time with no difference between summer and winter. The temperature is about 85-95°F during the day and 70 at night. Fortunately we get plenty of rain which keeps everything nice and green. We have no TV of course but have one picture theatre and a local radio station, all very modern, HI.

"Gear here is 100 watts to two 6146's in parallel and the RX is a HQ-129X to a 300 foot long wire.

"I will be at this QTH for at least another two years and probably more as I like the climate and the quiet, easy going life very much. No parking problems here, HI."

VK9 New Guinea: Norm, VK9NT, has been on daily starting at 1200 GMT. He now has a quad and is usually active between 14105 and 14125 kc. *(Tnx WGDXC)*

VK9 Norfolk Island: VK9RH is a new station on Norfolk Island. He is active on 14150 kc a.m. around 2230 GMT. *(Tnx LIDXA)*

VR4 British Solomon Islands: VR4CM, operated by Arnold and Mary, will be active on s.s.b. around 14320 GMT whenever possible. *(Tnx NEDXA es* KP4 DXer*)*

VR5 Tonga Island: VR5AD active on 14020 kc at 0000 GMT. *(Tnx WGDXC)*

VS1 Singapore: All VS1's should be signing 9M1 about the time you read this.

VU2 Nicobar Islands, VU5BJ: VS1LV accompanied by VS1LX, VS1LU, VS1MC plus loggers

California DX'ers W6WX, W6SAI (standing) and K6OHJ (seated left) greet world traveller W4BPD. Gus will be mighty loud on his next trip if he uses the Eimac 4CX35000A that he is clutching to his bosom. *(Tnx W6SAI)*

and cooks for a ten-day period at this spot soon. Rig will be a KWM-2 with dipole and vertical antennas. Around-the-clock operation is planned. Frequencies: C.w.-14007, 14012, 14017, 14022, 14025, 14050, listening not less than 5 kc up or down. S.s.b.-14112, 14117, 14122, 14175, 14250. Will announce listening frequencies. QSL via K8VDV.

YI Iraq: For what it's worth, YI3D has been somewhat active on 14021 kc with a drifting T8 note. Says to QSL via YU3DO. *(Tnx WGDXC)*

ZB2 Gibraltar: Pete, ZB2AE, is occasionally active on 14040 kc around 2200 GMT. Only ZB2A and ZB2AE are active at present. *(Tnx WGDXC)*

ZL Kermadec Island: ZL1ABZ is occasionally active on 14130 kc s.s.b. around 1130 GMT. *(Tnx LIDXA)*

ZS2MI Marion Island: ZS2MI has been somewhat active on s.s.b. between 1100 and 1200 GMT. He prefers 14310 kc. He is temperamental and QRTs when the pileup gets too large. *(Tnx NEDXA)*

4W1 Yemen: 4W1D will try to make a visit to YK in August on his way home to Switzerland. *(Tnx NCDXC)*

7Z1 Saudi Arabia: 7Z1 is the new prefix for Saudi Arabia and 7Z1AA has been active on 14105 s.s.b. around 1700 GMT. 7Z2 and 7Z3 will be used for other areas of Saudi Arabia. *(Tnx NEDXA)*

9U5 Burundi: Both 9U5DL and 9U5DH may be found on 21,240 kc a.m. phone. *(Tnx VERON)*

9X5 Rwanda: 9X5MH has been active on 14 mc s.s.b. as well as c.w. 9X5MW prefers 21 mc c.w. but may be found on 14 mc from time to time. *(Tnx VERON)*

QTH's and QSL Managers

DL4CQ	via K8NTE
EA8DO	Box 215, Tenerife, Canary Islands
EA9EA	Miguel Munoz, Aragon 20, Melilla, Spanish Morocco
ET3FF	Box 2014, Addis Ababa, Ethiopia
ET3JF	Box 1141, Asmara, Ethiopia or via DJ3GI
ET3RR	Dick Syriac, U. S. Navcommsta APO 843, N. Y., N. Y.
FB8WW	(s.s.b. only) via HB9TL
FB8XX	(s.s.b. only) via HB9TL
FB8ZZ	(s.s.b. only) via HB9TL
FG7XP	Daniel Esnard, Box 110, Pointre-A-Pitre, Guadeloupe
FG7XT/FS7	via K5AWR
FH7XV	via W2CTN
FO8AA	Box 374, Tahiti, French Oceania
HL9TO	Wally MacDowell, Co. B 11th Engr. Bn (C) (A) APO 358, San Francisco, Calif.
HM5BF	POB 4, North Pusan, South Korea
HR1SO	Sven Olson, Box 176, Tegucigalpa, DC, Honduras
K7VAX/KS6	Box 458, Pago Pago, American Samoa
KB6EPN	Clive Preece, c/o Postmaster USPO, Canton Is.
KG6SB	Trust Territory, Saipan, Mariannas Is.
KJ6CC	Douglas Aircraft Radio Club, Box 130, APO 105, San Francisco, Calif.
KS6BA	P. O. Box 307, Pago-Pago, American Samoa
LU1ZC	via LU9DFB
ex-M1M, now K3KMO	3504 De Pauw Place, College Park, Md.
OA4KY	Box 2965, Lima, Peru
OH2BH/OHØ	via W2CTN
OY8KR	Box 10, Torshavn, Faeroes Is.
ex-PJ2AE	via W1HTE
PJ5SB	via KØKZO
SVØWF	(Rhodes) via W2PCJ
SVØWR	via WA2DVU
TF2WIN	Dave Whitney, 932 AC & W Sq., FPO 568, N. Y., N. Y.
TJ8AC	B. P. 26, Garoua, Cameroun
VK9DR	Don via W2GHK or VK6RU
VK9GC	Box 55, Rabaul, Territory of New Guinea
VP8HJ	via SM5BLA
VP8HO	via K6GMA
VR4CM	via K5HWV
VS5MH	W/VE via WA2WUV all other Box 777,
VS5TA	Singapore
VS6AZ	via K6GMA
VS9MG	W/VE via WA2WUV, others via VS1LX
VU2BJ	via K8VDV
WØPI/KM6	Navy 3080, Box 26, c/o FPO, San Francisco, Calif.
YS1JJG	Box 1210, San Salvador, El Salvador
ZC5AM	W/VE via WA2WUV, others Box 777,
ZC5AT	Singapore
5A1TG	Box 1651, APO 231, N. Y., N. Y.
5A2TJ	Joe Teaster, Box 139, APO 231, N. Y., N. Y.
7Z1AA	via HB9AET
7Z3AA	via MP4BDM
3A2CP	via RSGB
7X2VX	via W4UWC
6W8CU	Pierre Goriot, Box 791, Dakar, Senegal
7X2DU	via REF
9U5BB	Andre Berckmans, B. P. 14 Usumbura, Burundi
9U5DL	Box 92, Usumbra, Burundi
9L1JC	J. Clark, HQ. RSLMF, Freetown, Sierra Leone
9L1JR	J. Richardson, Box 53, Freetown, Sierra Leone
9L1KW	K. Waerzer, FCSC, Freetown, Sierra Leone
9L1NH	(9L1 QSL Bureau) Nick Henwood, Technical Institute, Freetown, Sierra Leone
9L1TL	T. Lloyd, Forah Bay, Freetown, Sierra Leone

73, Urb, W2DEC

PROPAGATION

GEORGE JACOBS*, W3ASK

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for August

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **4, 11, 23-24, 31**	A	A-B	B-C	C
Normal: **2-3, 5, 7-10, 12-16, 20-22, 25-27, 29-30**	A-B	B-C	C-D	D-E
Below Normal: **1, 6, 17, 19, 28**	C	C-D	D	E
Disturbed: **18**	D	D-E	E	E

How To Use These Charts

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

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

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

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

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

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

6—The Eastern USA chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9 and ø areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid through Sept. 30, 1964, and are prepared from basic propagation data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

TWENTY meters is expected to continue to be the best band for DX propagation conditions during August. The band is forecast to open for DX shortly after sunrise, and to remain open until several hours after sunset. Good openings are predicted to almost all areas of the world, and signal levels are expected to be exceptionally strong during the late afternoon and evening hours.

Although mainly confined to southern or tropical areas, some fairly good 15 meter DX openings are forecast during daylight hours. A few 10 meter openings to these areas may also be possible during the month around noontime and during the afternoon hours.

Excellent short-skip conditions are expected to continue during August on 10, 15 and 20 meters as a result of sporadic-*E* propagation.

Despite seasonally higher static levels 40 meters is expected to open to many areas of the world from shortly before sunset, and remain open through the hours of darkness and the sunrise period. To most areas of the world, 40 meters is expected to be the best band for DX propagation during the late evening and early morning hours.

Some fairly good 80 meter DX openings are expected during the hours of darkness and the sunrise period. Signal levels may, however, be weak and the band noticeably noisy.

Few 160 meter DX openings are expected during August, but some may occur during the hours of darkness and the sunrise period.

This month's *CQ* Propagation Charts contain a detailed forecast to DX areas of the world for use during August and September, 1964. Instructions for the correct use of these Charts appear directly below the "Last Minute Forecast" at the beginning of this column. For a more detailed forecast of short-skip conditions expected during August, over distances ranging between approximately 50 and 2400 miles, see the *CQ* Short-Skip Propagation Charts which appeared in last month's column.

VHF Ionospheric Openings

The *Perseids*, a month long meteor shower which began late in July, is expected to reach maximum intensity during mid-August. Ioniza-

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

tion produced at an altitude of approximately 60 miles by the unusually large number of meteors entering the earth's atmosphere during the shower period should make possible meteor-scatter type openings on both 6 and 2 meters, especially during the middle of the month.

Sporadic-*E* ionization is expected to continue to occur fairly frequently during August, resulting in a number of 6 meter openings between distances of approximately 900 and 1400 miles. Some openings of this same type may also occur on 2 meters at distances ranging between 1100 and 1400 miles. V.h.f. short-skip openings as a result of sporadic-*E* ionization most often occur between 9 A.M. and 1 P.M., and between 5 P.M. and 9 P.M. local standard time.

During periods of ionospheric disturbances v.h.f. openings may occur as a result of auroral-scatter. Check the "Last Minute Forecast" appearing at the beginning of this column for days that are expected to be "below normal" or "disturbed" during August. Auroral-scatter v.h.f. openings are very likely to occur on these days.

Sunspot Cycle

The Swiss Solar Observatory reports a monthly mean sunspot number of 9 for May, 1964. This results in a 12-month running smoothed sunspot number of 23 centered on November, 1963. A smoothed sunspot number of 14 is predicted for August, 1964 as the sunspot cycle continues to decline slowly towards a minimum value.

Next month's column will feature a special discussion on 160 meter DX propagation conditions.

73, George, W3ASK

CQ DX Propagation Charts

AUGUST & SEPTEMBER, 1964

Time Zone: EST (24-hour Time)

Eastern USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe	09-12 (1) 12-14 (2) 14-15 (1)	06-08 (2) 08-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-20 (1)	18-19 (1) 19-20 (2) 20-23 (3) 23-01 (2) 01-05 (1)	19-21 (1) 21-00 (2) 00-01 (1) 21-00 (1)†
Northern Europe & European USSR	09-13 (1)	06-11 (1) 11-13 (2) 13-17 (1)	20-02 (1)	21-00 (1)
Southern Europe & North, West & Central Africa	09-12 (1) 12-16 (2) 16-17 (1)	05-07 (2) 07-12 (1) 12-14 (2) 14-17 (4) 17-19 (2) 19-22 (1)	18-20 (1) 20-00 (2) 00-03 (1)	19-21 (1) 21-23 (2) 23-01 (1) 20-00 (1)†
Eastern Mediterranean & East Africa	10-12 (1) 12-14 (2) 14-15 (1)	05-14 (1) 14-16 (2) 16-20 (1)	19-23 (1)	*Nil*
South Africa	07-10 (1) 10-13 (2) 13-15 (1)	06-14 (1) 14-17 (2) 17-19 (1) 00-02 (1)	18-19 (1) 19-21 (2) 21-23 (1)	19-21 (1)
Central Asia	*Nil*	06-09 (1) 18-21 (1)	18-21 (1)	*Nil*
Southeast Asia	*Nil*	07-10 (1) 17-21 (1)	*Nil*	*Nil*
Far East	16-19 (1)	05-07 (1) 07-09 (2) 09-10 (1) 15-17 (1) 17-19 (2) 19-21 (1)	05-08 (1)	*Nil*
Pacific Islands & New Zealand	13-17 (1) 17-19 (2) 19-21 (1)	18-20 (1) 20-23 (2) 23-07 (1) 07-09 (2) 09-12 (1)	23-02 (1) 02-05 (3) 05-07 (2) 07-08 (1)	03-07 (1) 04-06 (1)†
Australasia	16-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 17-21 (1) 21-23 (2) 23-01 (1)	02-04 (1) 04-06 (2) 06-08 (1)	04-06 (1) 04-06 (1)†

Eastern USA To:

Northern & Central South America	11-13 (1)* 13-16 (3)* 16-18 (1)* 07-11 (1) 11-13 (2) 13-15 (4) 15-17 (3) 17-19 (1) 19-21 (1)	06-08 (3) 08-10 (2) 10-12 (1) 12-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-22 (2) 22-06 (1)	18-20 (1) 20-22 (2) 22-03 (3) 03-05 (2) 05-07 (1)	20-22 (1) 22-03 (2) 03-06 (1) 01-04 (1)†
Southern Brazil Argentina, Chile & Uruguay	11-14 (1)* 14-15 (2)* 15-16 (1)* 07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (4) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-23 (1)	20-22 (1) 22-03 (2) 03-07 (1)	22-06 (1) 02-05(1)†
McMurdo Sound, Antarctica	13-16 (1) 16-17 (2) 17-19 (1)	14-16 (1) 16-18 (2) 18-20 (3) 20-22 (2) 22-00 (1) 07-09 (1)	00-05 (1)	*Nil*

Time Zones: CST & MST (24-hour time)

Central USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe	10-13 (1)	05-06 (1) 06-07 (2) 07-14 (1) 14-16 (3) 16-19 (1)	20-22 (1) 22-00 (2) 00-03 (1)	21-00 (1) 21-23 (1)†
Northern Europe & Eastern USSR	09-12 (1)	06-10 (1) 10-12 (2) 12-16 (1)	20-01 (1)	21-00 (1)
Southern Europe & North, West & Central Africa	10-11 (1) 11-14 (2) 14-16 (1)	05-07 (2) 07-12 (1) 12-13 (2) 13-15 (3) 15-17 (2) 17-20 (1)	18-20 (1) 20-23 (2) 23-01 (1)	19-20 (1) 20-22 (2) 22-00 (1) 20-23 (1)†
Eastern Mediterranean & East Africa	08-13 (1)	06-12 (1) 12-15 (2) 15-19 (1)	19-22 (1)	20-22 (1)
South Africa	07-09 (1) 09-12 (2) 12-14 (1)	06-13 (1) 13-17 (2) 17-19 (1) 00-02 (1)	18-19 (1) 19-21 (2) 21-22 (1)	19-21 (1)
Central Asia	17-20 (1)	06-07 (1) 07-09 (2) 09-10 (1) 18-21 (1)	19-21 (1) 05-07 (1)	*Nil*

*Predicted 10 meter openings, all others in column are 15 meter openings.

†Predicted 160 meter openings, all others in column are 80 meter openings.

[*Continued on page 88*]

CONTEST CALENDAR

FRANK ANZALONE*, W1WY

Calendar of Events

August	1-2	Illinois QSO Party
August	8-9	WAEDC C.W.
August	15-16	WAEDC Phone
August	22-23	*CQ* Summer VHF
August	29-30	All Asia DX C.W.
August	29-30	QRP QJO Party
August	29-31	West Virginia QSO Party
†September	5-6	Peruano Phone
September	19-20	S A C C.W.
September	26-27	S A C Phone
September	26-27	MARC VE/W
October	3-4	Oceania DX Phone
October	10-11	Oceania DX C.W.
October	10-11	VU2/4S7 DX Phone
October	10-11	ARRL CD C.W.
October	17-18	ARRL CD Phone
October	17-18	VU2/4S7 DX C.W.
October	21-22	YL/AP C.W.
October	24-25	*CQ* WW DX Phone
Oct. 31—Nov. 1		RSGB 7 mc DX Phone
Oct. 31—Nov. 1		New Hampshire QSO Party
November	4-5	YL/AP Phone
November	7-8	OPEN DATE
November	14-15	ARRL SS Phone
November	21-22	ARRL SS C.W.
November	21-22	RSGB 7 mc DX C.W.
November	28-29	*CQ* WW DX C.W.
†December	5-6	OK DX C.W.

†Events that have not been officially announced.

Illinois QSO Party

Starts: 1600 GMT Saturday, August 1.
Ends: 2200 GMT Sunday, August 2.

This is the second annual QSO Party sponsored by the Illinois Chapter #17 of the Certificate Hunters' Club.

Complete rules and operating frequencies appeared in last month's CALENDAR.

The mailing deadline for your logs is September 15th and they go to: Illinois QSO Party, c/o Cliff Corne, K9EAB, 711 West McClure Avenue, Peoria, Illinois, 61604.

DARC WAE

C.W.—August 8-9 **Phone**—August 15-16
Starts 0000 GMT Saturday, Ends 2400 GMT Sunday in each instance.

Rules for the 10th annual WAE DX Contest appeared in last month's CALENDAR. Also the latest WAE country list which is necessary to determine your multiplier. The QTC feature of the contest is a radical departure from all other contests, therefore it is strongly recommended that you study the rules thoroughly. If possible use the official DARC log forms.

The mailing deadline is September 30th and your logs go to: Dr. H. G. Todt, DL7EN, Chlodwigstr. 5, 1 Berlin 42, Germany.

CQ Summer VHF

Starts: 1:00 P.M. Local Time, Saturday, August 22.
Ends: 1:00 P.M. Local Time, Sunday, August 23.

See page 34 of the July issue for the details.

All Asia DX

Starts: 1000 GMT Saturday, August 29.
Ends: 1600 GMT Sunday, August 30.

This is the 5th annual All Asia DX Contest sponsored by the JARL. It's the Asians working the non-Asians on c.w. only in this one. Use all bands, 1.8 thru 28 mc.

Classification: Operation is limited to single operator only, on all bands and each individual band.

Serial Numbers: For OM stations, five figures, RST report plus your age. For YL stations, five figures, RST reort plus 00, (zero, zero).

Points and Multiplier: For non-Asians, one point per contact and a multiplier of one for each Asian country worked on each band. For Asians, one point per contact and a multiplier for each non-Asian country worked on each band. The DXCC and WAE country lists will be used.

Scoring: Score for each single band is the total contact points multiplied by the total number of countries worked. The all band score is the total contact points from all bands multiplied by sum of the countries from all bands.

Awards: Certificates will be awarded to the top scorer in each band in each country and to the three highest scorers on all bands in each country. (In past years I have made the suggestion that awards in the USA and Canada should be made on the basis of call districts but it hasn't made much of an impression with the JARL boys.) There are additional awards to the highest scoring all band stations in each continent.

*14 Sherwood Road, Stamford Conn. 06905.

Arrival deadline for your logs is November 30th and they go to: The JARL Contest Committee, P.O. Box 377, Tokyo Central, Japan.

West Virginia QSO Party

Starts: 2300 GMT Saturday, August 29.
Ends: 0500 GMT Sunday, August 31.

The annual West Virginia QSO Party is jointly sponsored by the Kanawha Radio Club and the Mountaineer Amateur Radio Club. This party offers an opportunity to gain credits toward the Worked West Virginia Award and the All Counties Award.

Bands: Use all bands, c.w. and phone. The same station can be worked for QSO credit on each band and each mode. For example, a c.w. and a phone contact on the same band with the same station is good for 2 points.

Points: Each completed contact counts 1 point. Stations outside the state will try to work as many West Virginia stations as possible. However West Virginia stations are not permitted to work stations in their own state for point credit.

Multiplier: West Virginia stations multiply their total QSO points by the number of ARRL sections and countries worked. All others, total QSO points by the number of West Virginia counties worked.

Exchange: West Virginia stations: QSO number, RS/RST and county. All others: QSO number, RS/RST and ARRL section or country.

Frequencies: Suggested operating frequencies: 3570, 3890, 3903, 7050, 7205, 14050, 14300, 21050, 21350, 21410, 28050, 28800 and 52250 kc.

Awards: Certificates will be awarded to the highest scoring station, both phone and c.w., in West Virginia and in each ARRL section and each participating country. Multi-operator stations are not eligible.

Logs: Logs must show; date and time in GMT, station worked, QSO number sent and received, band, mode and county, ARRL section or country worked.

Filing: Logs must be postmarked no later than October 1st and go to: Contest Chairman, Ross Kirk, K8YBU, 901 Sixth Avenue, St. Albans, West Virginia.

Peruano

Starts: 0001 EST Saturday, September 5
Ends: 2400 EST Sunday, September 6

Also, no official announcement has been received from the Radio Club Peruano. Last year this was a phone contest only. Logs went to RCP Att: G. Chirinos, OA4PX, P.O. Box 538, Lima, Peru. Rules were covered in the September 1963 issue.

S A C

C.W.—Sept. 19-20 **Phone**—Sept. 26-27
Starts: 1500 GMT Sat. Ends: 1800 GMT Sun.

This is the sixth Scandinavian Activity Contest and this year is sponsored by the SSA (Sweden).

1964 CQ World Wide DX Contest

Phone

Starts: 0000 GMT Saturday, October 24
7:00 P.M. EST Friday, October 23.
4:00 P.M. PST Friday, October 23
Ends: 2400 GMT Sunday, October 25.
7:00 P.M. EST Sunday, October 25.
4:00 P.M. PST Sunday, October 25.

C.W.

Starts: 0000 GMT Saturday, November 28.
7:00 P.M. EST Friday, November 27.
4:00 P.M. PST Friday, November 27.
Ends: 2400 GMT Sunday, November 29.
7:00 P.M. EST Sunday, November 29.
4:00 P.M. PST Sunday, November 29.

It's the world working the Scandinavians and for contest purposes the following prefixes will be considered country multipliers: LA, LA/p, OH, OHØ, OX, OY, OZ and SM/SL (a total of 8 on each band).

1. Use all bands, 3.5 thru 28 mc.
2. Two classifications, single and multi-operator.
3. The usual five and six digit serial numbers, RS/RST report plus a progressive three figure contact number starting with 001.
4. Each contact is worth one (1) point.
5. A multiplier of one (1) for each country prefix worked on each band, a maximum of 8 per band. (LA/p will count as only one country even though there are 3 countries under that prefix.)
6. The final score, total QSO points multiplied by the sum of the country prefixes from all bands. (No single band classification.)
7. Certificates will be awarded to the two highest scoring stations, phone and c.w., in each country and each W/K call area. Additional awards may be made, depending on the returns.

Logs should show, in this order: Date/time in GMT, station worked, number sent and received, band used, note each new prefix as it is worked. A separate sheet for each band is not necessary, however a summary sheet showing the scoring for each band is requested.

The summary sheet should also include other essential information regarding equipment used and comments. Don't forget the usual signed declaration that all rules have been observed. And your name and full address in BLOCK LETTERS.

Mailing deadline is October 15th. This year your logs go to: SSA, Contest Manager, Karl Friden, SM7ID, Box 2005, Kristianstad 2, Sweden.

MARC VE/W

Starts: 1800 EST Saturday, September 26.
Ends: 2400 EST Sunday, September 27.

This is one of the more popular local contests that stirs up a lot of activity, while the supply of VE's holds up. Its the Canadians work-

[*Continued on page 88*]

SPACE COMMUNICATIONS

GEORGE JACOBS*, W3ASK

APRIL 12, 1964 will go down in amateur radio history as the date on which the first trans-Atlantic two-way 2 meter QSO took place, via moonbounce.

On this date, using the moon as a passive reflector, Bill Conkel, W6DNG of Long Beach, California established *two-way* c.w. communication with Lenna Suominen, OH1NL, of Nakkila, Finland, on the 2 meter band.

Not only was this an historic achievement for amateur radio space communications, since the moon is a natural satellite of the earth, but it also established a number of new records. This was the first fully 2-way 2 meter earth-moon-earth communication over any distance, since previous moonbounce experiments on this band consisted of receiving echos from ones own transmission, or one way communication between stations. Until this successful QSO between W6DNG and OH1NL, however, the vital factor of a complete exchange of information was lacking.[1]

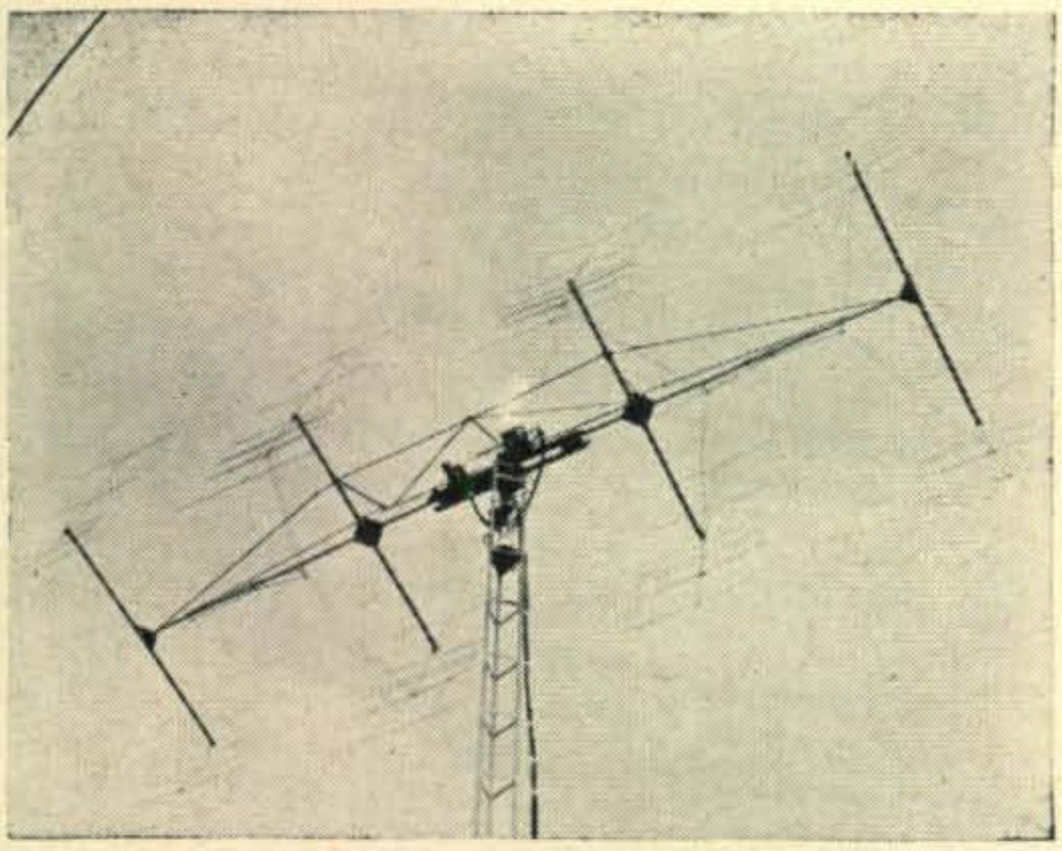
The history making moonbounce between W6DNG and OH1NL also establishes a new DX record for 2 meters. The distance between both stations is put unofficially at 5,300 miles! It was also the first trans-Atlantic 2-way QSO to take place above the 50 mc band.

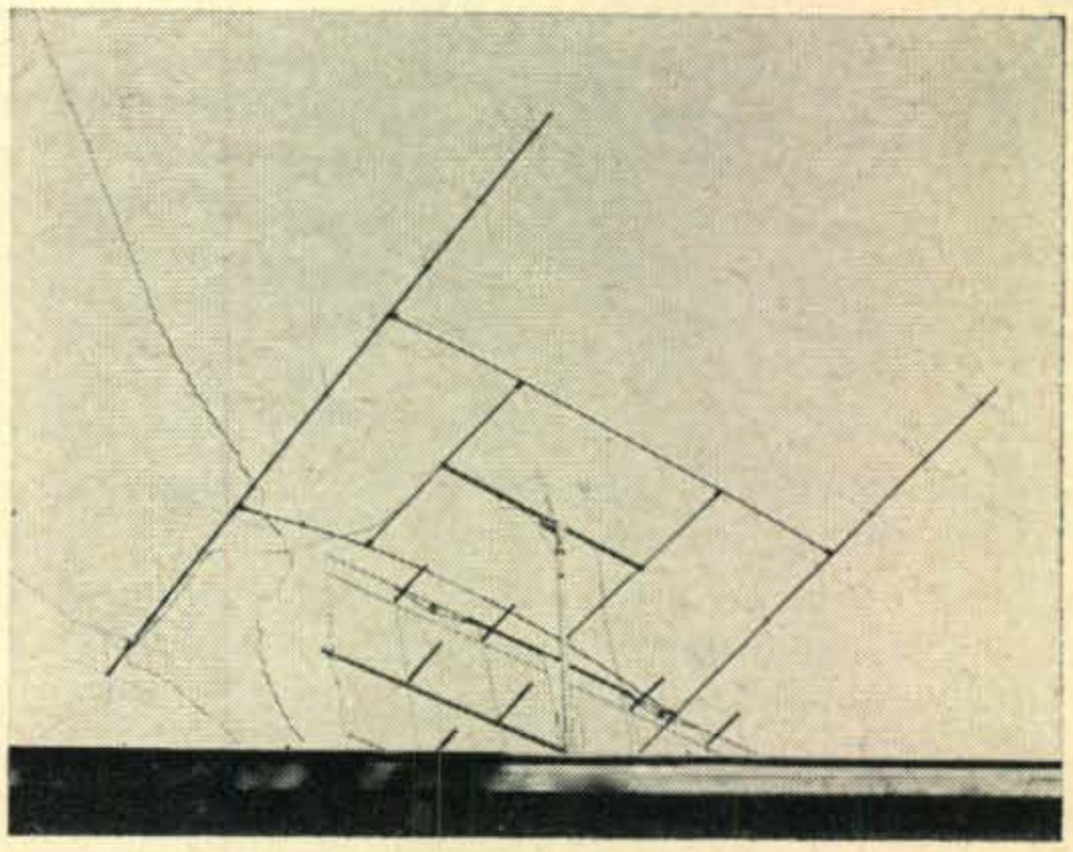
This QSO did not come about by chance. Bill, W6DNG, has been experimenting with v.h.f. and earth-moon-earth transmissions for over ten years. Four years ago Bill met Lenna Suominen, OH1NL, through correspondence. Len shared Bill's interest in moonbounce experiments, and they agreed to conduct test transmissions on 2 meters between California and Finland. The first one-way signal was received during the winter of 1961, and this was repeated again on several occasions over the past two years, first Bill would receive signals from Len, and ther at other times Len would receive Bill's signals This was the pattern until April 12, 1964, when patience and devotion paid off and two-way communication between both stations was established.

While it takes far more than ordinary equipment to establish 2 meter communications by moonbounce, W6DNG and OH1NL have proven that radio amateurs can do it. Both stations run the maximum legal limit c.w. power, and both use receiving equipment reflecting the ultimate in amateur design techniques for extreme selectivity and low signal, low-noise reception. The

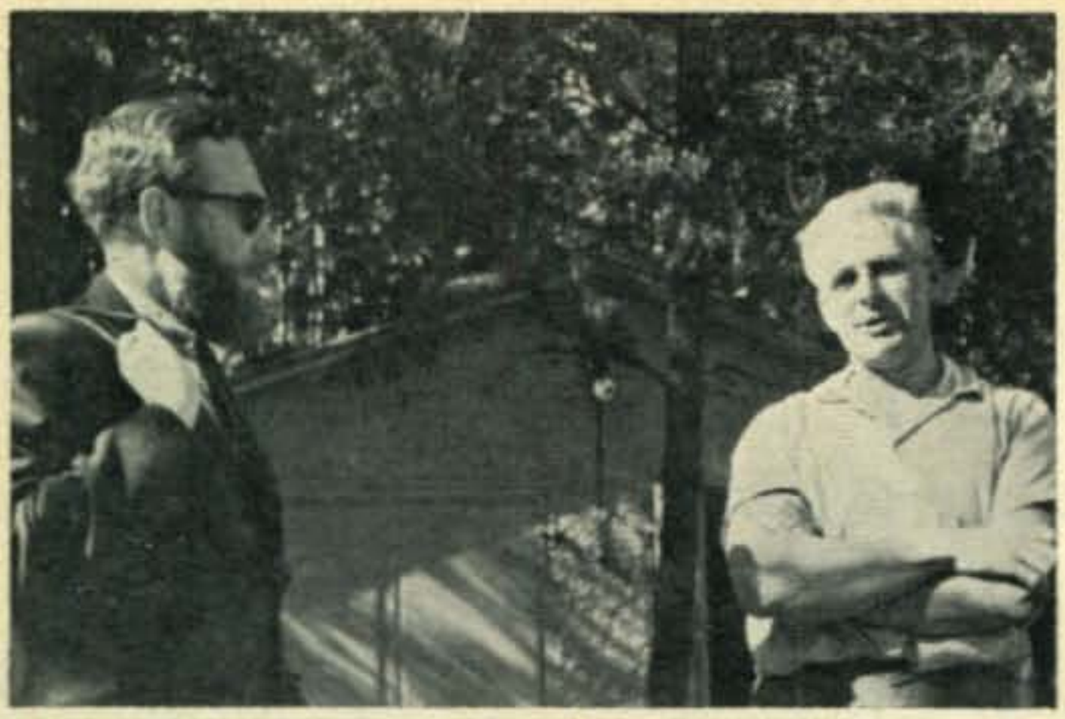
*11307 Clara Street, Silver Spring, Md. 20902.

[1]Two-way moonbounce communication was established on 1296 mc between W6HB and W1BU/W1FZJ on July 21, 1960. The U.S. Navy operates a moonbounce circuit between Washington, D.C. and Honolulu, Hawaii in the 435 to 445 mc range. For more details on earth-moon circuitry, see Space Communications, pp. 86-88, *CQ*, October, 1960.





Antennas used for W6DNG-OH1NL California-Finland 2 meter moonbounce QSO. At right, W6DNG's array of eight 7-element Yagis of graduated element spacing, stacked four wide and two high, used for both transmitting and receiving. At left, OH1NL's array of 2 rows of 13 sets of crossed dipoles, or a total of 52 elements, used for transmitting, and an array of 6 × 12 dipoles series coupled, used for receiving.



Bill Conkel, W6DNG, of Long Beach, California shown operating the rig with which he established the first two-way 2 meter moonbounce QSO with OH1NL. Running a full kilowatt of c.w. power, the rig uses a pair of EIMAC 4X250B's in the final.

Lenna Suominen (right), OH1NL of Nakkila, Finland shown at his QTH with OH2XZ shortly before establishing the new 2-meter DX record to California via an earth-moon-earth relay.

antenna systems used at both stations, while different in some respects, have gains in excess of 20 db, and can be rotated vertically and horizontally so that the moon can be tracked accurately at all times (see photos).

Hearty congratulations go to W6DNG and OH1NL for proving that the pioneering spirit in amateur radio is very much alive, and for showing the way to what in time will no doubt be a path over which many others will follow in establishing space communications by means of reflection or relay from manmade satellites as well as from the moon.

A telephone check with Bill Orr at presstime indicates that all is going well, but slowly, with OSCAR III. Some difficulties are still developing as the electronic equipment of what will soon be amateur radio's first active communication satellite undergoes final environmental tests. Bill expressed confidence, however, that all the problems are minor ones and that they are being solved almost as fast as they develop. According to Bill, it still looks as if an early fall launching may be possible. More late news on OSCAR III in next month's column.

73, George, W3ASK

Unclaimed Awards

IT'S a little hard to explain why, but hams seem be about the "movingest" people in the world! Among our authors alone, we record about 90 changes of address each year, and many's the time an article runs with an author's address on it only to be changed before the magazine is off the press.

An even more puzzling thing is the way a fellow will work like the dickens for one of *CQ*'s awards or contests only to leave no forwarding address when the wanderlust again strikes him. Uncovered in *CQ*'s big move to new quarters were the following unclaimed awards: eleven certificates from various *CQ* World Wide DX Contests over the past four years, WPX certificates, and trophies from our W. W. DX Contest. That's a lot of nice wallpaper and dust collectors!

We need help in locating the present or past holders of the following calls (mailing addresses or other info. will be appreciated): OHØNE, 5A2TC, OQ5LL, KG6AIA, HC1IE, MP4BDC, 5A2TS, DL5HI, SP8HU, 9Q5AAA, VE3BQL/SU, G3AWZ, ZS7P.

Some of the above of course are American servicemen who operated from foreign QTH'S during their enlistments and who have probably moved on to other posts by now.

By the way, anybody interested in reading a "What Ever Happened to . . ." department? Contributions and ideas welcomed. —*Ed.*

VHF REPORT

BY BOB BROWN*, K2ZSQ

A Moonbounce Weekend For KP4BPZ

TESTS made during the ARRL June V.H.F. QSO Party afforded unparalleled opportunities for moonbounce communications on 144 and 432 mc. And several well-known v.h.f. enthusiasts made the most of them. On June 13 and 14 Gordon Pettinghill, KP4BPZ, was transmitting into the world's largest parabolic reflector, the 1000-foot steerable installation at Arecibo, Puerto Rico. Special permission was obtained for its use on this weekend and many moonbounce enthusiasts were alerted some weeks before. The message to these enthusiasts read as follows:

"From 1842 to 2130 GMT June 13, KP4BPZ will transmit on 432.000 mc. On June 14, from 1938 to 2224 GMT, he will be on 144.001 mc. C.w. will be used, and he will listen from 10 kc above his frequency upwards for calls."

Minimum requirements, by the way, for cooperating stations in such an endeavor are 100 watts transmitter output, antenna gain of at least 10 db, with accurate aiming at the moon, a receiver noise figure of 3 db, and receiver selectivity of 100 cycles. Matter of fact, KP4BPZ specifically requested that stations with lesser capability avoid transmitting on or near the moonbounce frequencies during the test period.

Although complete information is still sketchy at this writing, we have confirmed that at least 19 amateurs worked KP4BPZ. On Saturday W1FZJ at Medfield, Massachusetts, worked KP4BPZ on 432 mc with signals riding 18-20 db above the noise at the New England end. Also we have it that several W2's, W4's and W9's were QSO'd by this extraordinary station in the Caribbean. Contact with W1FZJ was on a.m., both stations using inputs of approximately 150 watts. Last minute note: also worked W1BU, W9GAB, G3LTF and HB9RG on 432 mc c.w.

On Sunday, June 14th, Gordon switched per his memo to 144.001 mc and was clearly heard by Carl Scheidler, W2AZL, of Homdel, New Jersey. Carl was using an 11 element Yagi, yet signals from KP4BPZ were copyable over the noise level even on the deepest of fades. Carl's receiver, by the way, was set at 3 kc bandwidth, about average by today's v.h.f. standards. Stations worked on 2 meters included: W1BU, K2LMB, W3LUL/3, W3TIK/3, W3TMZ/3, W4FJP (?), W4HJZ, WB6GZY, WØIC, G2HCJ, DJ3EN, DJ8PL, and DL3YBA!

*77 Bar Beach Road, Port Washington, L.I., N.Y. 11050.

These seemingly magnanimous achievements probably come to most readers as quite a shock, at least by comparison to what most of us are doing. Yet moonbounce is a mighty force to be reckoned with and what we are seeing today is only the beginning. More discussion and details on this effort will appear in September *CQ*'s UHF ROUNDUP column, ably digested and presented by our own Mr. Katz. Till then we suggest you draw your own conclusions. Moonbounce, anyone?

Heard Rhodesia Lately?

A small automatically-keyed transmitter has recently been installed on a prominent hill some 5000 feet above mean sea level (and approximately 1000 feet above the surrounding country) at a site 25 miles north of Salisbury in Southern Rhodesia. The transmitter, which is running continuously 24 hours a day, is unattended, but frequently monitored in Salisbury for correct operation. The frequency used is 50.046 mc and F1 keying (FSK) is used to give an upward shift of approximately 200 cycles per second on "mark." The signal sent in Morse characters is "QRA de ZE1AZC" and this is repeated continuously, with a 36-second break of carrier every 6 minutes to allow receiving stations to check no-signal conditions and to adjust automatic recording instruments. R.f. power to the antenna is of the order of 40 watts—the antenna being a quarter-wave ground plane.

The six meter Rhodesian transmitter is of unique design, in that the final r.f. section is built into the antenna itself and the entire rig is a.c. line operated but will automatically change over in a few seconds to a gasoline driven generator in the event of a power failure.

It is intended to keep this equipment in operation through the International Years of the Quiet Sun (IQSY), and reports of reception in Cyprus, The Republic of South Africa and from various centers of Southern Rhodesia have already been received. It is entirely conceivable that northern European v.h.f. stations and even American amateurs will be able to catch smatterings of signals from ZE1AZC. And, as many 50 mc addicts remember who operated during the last effective sunspot cycle, S8-9 contacts with Southern Rhodesia were made throughout the United States.

Ivan Wood, ZE3JJ, c/o E.S.C., P.O. Box 377, Salisbury, Southern Rhodesia, is the chap to whom all reception reports should be directed. Needless to say, any and all reports will be

greatly appreciated and certainly acknowledged. Ivan, by the way, has been issued a special experimental license for this exotic beacon operation (See October '62 *CQ* for the story of ZE3-JJ's endeavors).

Masterminds of this project are Fred Anderson, ZS1LA, of Worchester, South Africa, who constructed the equipment and made it available, and Ray Cracknell, ZE2JV, of Salisbury, who has done much experimental work of v.h.f. propagation (particularly transequatorial), and who is collating the results obtained.

Abolish A.M. on Six?

An interesting proposal has been laid before the men in Washington by E. J. Mick, W3ZWR, of Philadelphia, a prominent and enthusiastic proponent of v.h.f. f.m. operation. Mr. Mick's "Proposed Channelizing Plan for the 5.711 Meter FM Band" includes, among other things, deleting operation on all modes other than f.m. above 52.5 mc. How's that for a starter?

Basically, the plan boils down to this: W3ZWR wants to establish seven 36 kc channels, every 36 kc from 52.524 to and including 52.740 mc. This permits all f.m. operators to use even-kilocycle rocks. (For example: 2.918 mc $\times$ 18 = 52.524 mc for transmitter oscillator).

Mr. Mick adds, "The fourth channel we're setting aside as the National Net, rather than the unofficial 52.525 mc frequency." Regarding this much-used channel he says: "You'll note that it requires an odd-ball 2.9180566$\frac{2}{3}$ + kc transmitter crystals."

One feature of this plan will certainly appeal to the boys who want to get the most for their surplus money. Since all commercial 2-way gear used in ham f.m. will cover any channels in any 140 kc segment, an f.m. enthusiast merely aligns his rig and receiver for highest chosen frequency in the 265 kc f.m. band. Both rig and receiver are then set up to cover any four consecutive channels just by changing both transmitter and receiver crystals as desired. Simple?

We would be very interested to hear from v.h.f. f.m. operators across the country regarding W3ZWR's proposal. Personally, I feel that the plan's strong points could well be adopted without FCC intervention. How about you?

Another Crack at Slide Mountain

Not long ago your loyal columnist attempted the impossible: To scale Slide Mountain, New York state's highest pinnacle, for operation in the Spring *CQ* V.H.F. Contest. The peak is located in the Catskills, elevation 4208 feet. A few years ago K2OIQ/2 managed to reach the top with a Gonset Communicator and compiled the highest six meter score on record in a similar contest: 11 million points. Well maybe it was possible then, but it shore ain't now!

The group of us (WB2CUD, WB2DCA, K2ZSQ, K3EAV and K3SFW) left the day before (a Friday) from Plainfield, New Jersey at approximately 9 P.M. We reached what we had believed to be the base of Slide Mt. at 1:30 A.M. EDST Saturday. For those who should contemplate this misadventure, by the way, be forewarned: it is a 7 mile climb to the top. And there is no road. She must be attacked on foot, through the woods, across streams, up creek beds and through winding foot trails (some of which lead no where in particular). Well we didn't know this and had the experience of a lifetime. The sign said "2.8 miles to Slide Mt." This we were prepared for. What the informative little placard *didn't* say, however, was that that 2.8 mile hike took you to the base of the hill. From there you go up another 5.2 miles!

Anyway we started the climb at 2 A.M. and were still heading up at 8 when the sun was up. Each of us had gear: one G-50, one Tecraft 2 meter transmitter, one 1.5 kilowatt generator, one Drake 2B receiver, one Redline converter, one 24 foot 11 element six meter beam, etc.

Well, we pushed ourselves to the brink of human endurance and we still weren't to the top. Sleep? Impossible. We had already passed the timberline and could count sheep only in a wet bed of snow, should one be so inclined in the first place. At this sad point we had all gone without rest for 26 hours and had "had it." And yet we had another two loads of equipment to lug up to the camp if we ever made it the first time. That's right: A total of 42 miles. Enough said?

I must confess that I was one of the first to call it quits. K3EAV and K3SFW quickly joined me, however, and this miserable bedraggled trio trudged down the mountain in a seemingly never-ending search for rest. Eventually—it seemed like three days—we reached the bottom and crawled into K3EAV's small VW for a couple of hours sleep. It wasn't long thereafter before we were joined by WB2's CUD and DCA who had actually made it to the summit before they arrived at the inevitable conclusions we had earlier.

To make a long story short(er), the May contest got along just fine without help from K2ZSQ/2 or Slide Mountain. The family doctor says my left leg will still remain an integral part of yours truly and WB2DCA reports that his beloved G-50 miraculously still works. We figure we came out fine, considering. . . .

Learned advice to future would-be mountain-climbers out to break K2OIQ's record: Don't.

It's This Month

Lest we forget, August 22 and 23rd is the big weekend for the v.h.f. contest crowd. It marks the *CQ* Summer V.H.F. Contest, one you will not likely forget for quite a while if you intend to participate. All the rules can be found on page 34 in the July issue, but a complete set of rules and log forms can be had for a self-addressed stamped envelope to: *CQ* V.H.F. Contest Committee, 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050. See you in the contest!

[*Continued on page* 98]

HAM CLINIC

CHARLES J. SCHAUERS*, W4VZO

ALTHOUGH HAM CLINIC's main role is assisting hams with their ham radio technical problems, we receive many letters asking us for advice and assistance on such subjects as transistorized auto ignition systems; high fidelity equipment; model airplane radio control; amateur telemetering gear; CB radio servicing, high-school science fair projects of all kinds; using surplus equipment for other than ham radio work; electronic school recommendations and many others.

In every case we try to be as helpful as possible, especially if the writer is a ham. On the other hand, there are *some* letters we do *not* answer because we do not wish to take away business from consulting engineers who mush charge for their services in order to live.

For weekend service, direct your letters to me at 4 Lutzelmatt Str. Luzern, Switzerland while I am in Europe. Be sure to enclose two postal international reply coupons obtainable at any postoffice) or a quarter for airmail return postage. This is a small price to pay for the information you seek. If you are in no hurry for a reply send your letters to *CQ* Headquarters.

Vacation

From the 18th of August to the 18th of September we hope to be back in the USA for a needed vacation. We shall visit both coasts. If you wish to get in touch with us drop *CQ* a card or telephone them, they can tell you where we shall be at any given time. Urgent letters *only* will be answered during the period.

Observation

Progress has been so rapid in radio-electronics that new bits of information are unearthed every day. This accumulation of data poses a gigantic *retrieval problem*. The answer to the data collection and dissemination problem is of course the use of computers. By using computers much duplication of research effort will be obviated. But the effort must be centralized. That is, we should have a "national facts agency" as advocated by that great scientific prophet, Hugo Gernsback, editor-in-chief of *Radio-Electronics* magazine. For a small fee any bit of scientific or engineering information could be obtained.

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

We at HAM CLINIC started out with one filing cabinet for ham information, now we have four! We also have an increased library and a few more instruments in our private lab. Yet it is difficult for us to keep up with the changes.

Observed: thanks to the ham publications like *CQ, QST, RSGB Bulletin, 4U1ITU Calling* and others, the average ham can, if he is diligent, stay up with the latest advances in amateur radio communications. However, no one person or no one magazine can hope to have *all* the answers to every ham's technical problems. We at HAM CLINIC do our best but as we have said before, we simply do not know it all, nor can we answer every question that we receive. We do not yet own a computer, but we believe that there is one in our future.

Questions

Automatic Off-set Frequency Control–"Can you supply me with the necessary information to enable me to tune my receiver (in my homebuilt transceiver) but yet keep my transmitter on contact frequency? Frequency excursions need not be great but the device should enable me to tune above or below zero beat."

Thanks to John Savage, W4JYW, Lake Worth, Florida, see fig. 1. His method to provide automatic off-set frequency control of an oscillator to provide fixed operation on transmit and vari-

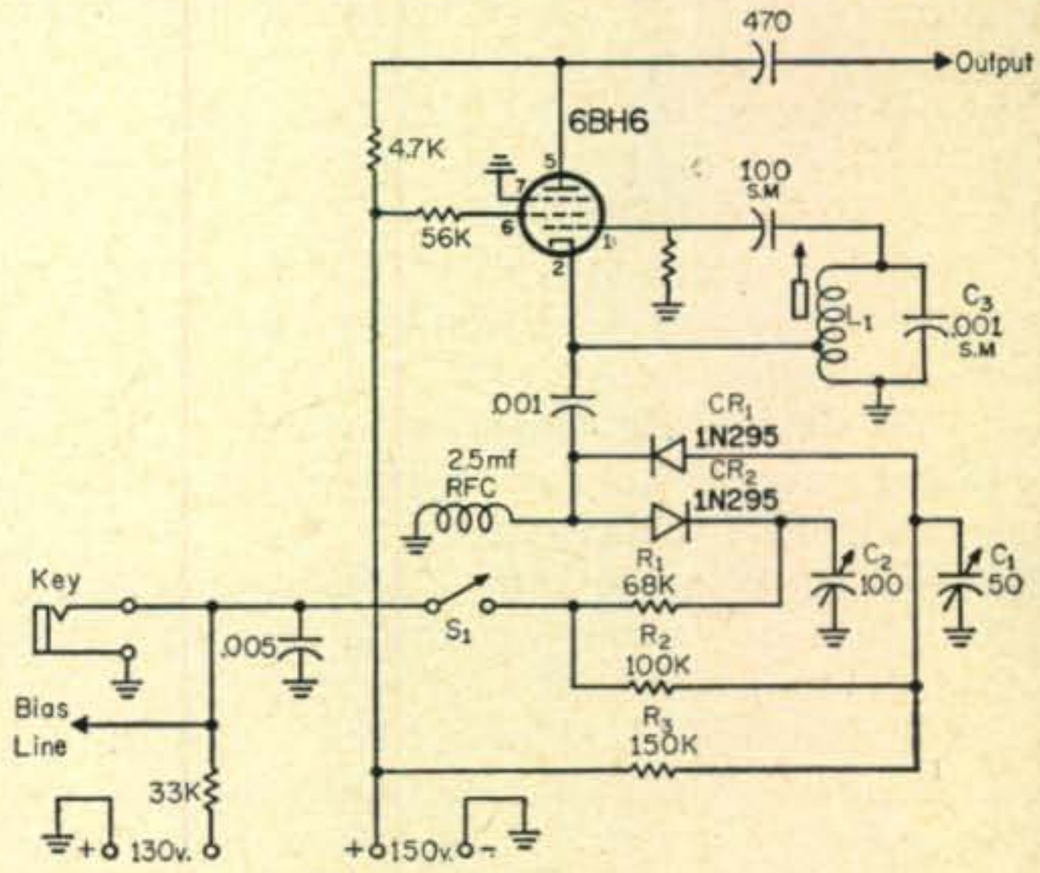


Fig. 1—An automatic off-set frequency control for s.s.b. transceivers. L_1 is wound on an XR-50 from and grid-dipped with C_3, to the v.f.o. frequency. Use the chart in fig. 2. Tap 4t. from cold end.

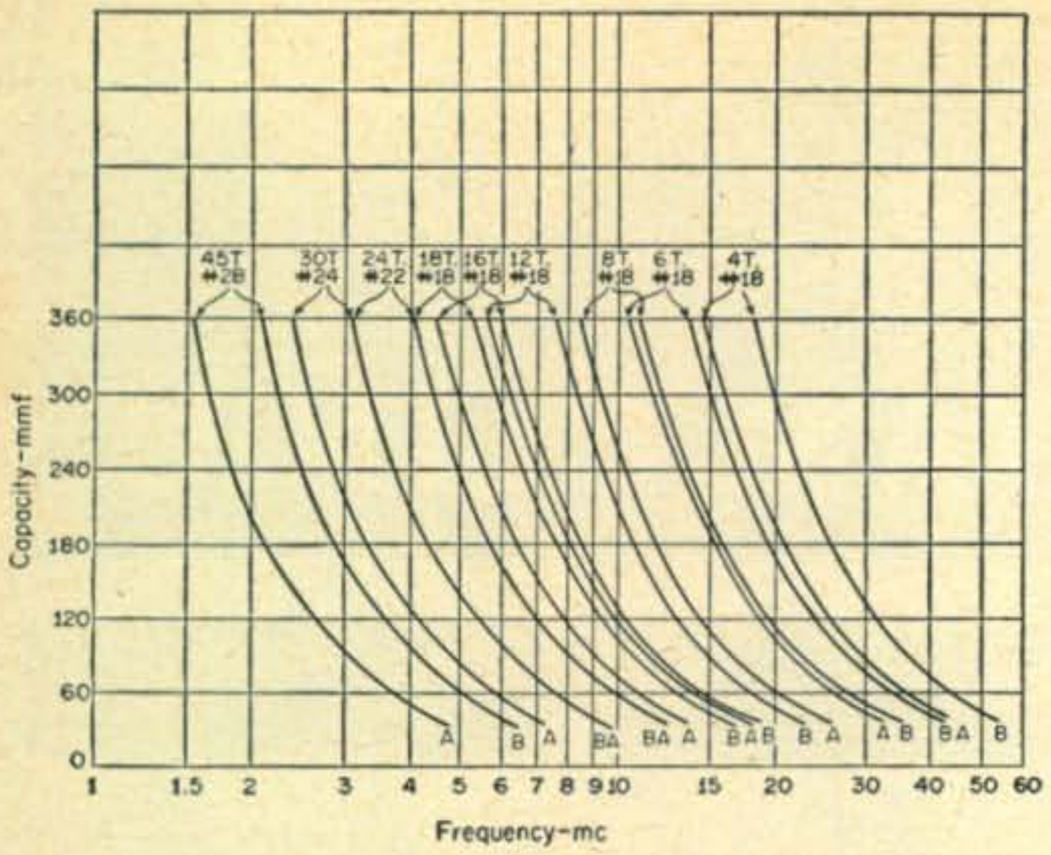


Fig. 2—Chart showing resonant frequency vs. capacity for various coils wound on National XR-50 coil forms. Curves marked A are for maximum inductance (core in); those marked B are for minimum inductance (core out).

able operation on receive was tried and it worked very well. Instead of the 6SK7 used by John, I used a 6BH6 (a sharp cut-off pentode) which worked very well. No relays are used.

Switching is accomplished by diodes CR_1 and CR_2 to select one or the other of two condensers to become part of the frequency selective circuit formed by L_1 and C_3. Condenser C_2 should have twice the capacity of C_1 and be adjustable from the front panel. This permits tuning above or below the nominal center frequency as determined by C_1.

With S_1 open, positive voltage is applied to CR_1 via R_3 causing it to conduct and connect C_1 to the tuned circuit. Closing the key causes the following biased stages to turn on, but does not cause any change in oscillator frequency. With S_1 closed, negative voltage through R_2 cancels the positive voltage formerly applied to CR_1 and applies a negative voltage through R_1 and CR_2 causing conduction of this diode and non-conduction of CR_1. In this state, C_2 functions as the adjustable frequency control. Closing the key will now ground the bias line causing the removal of negative voltage to CR_2 and application of a positive voltage by voltage divider action of R_2 and R_3 to CR_1 which brings the oscillator back to the nominal center frequency automatically.

Values of capacity given result in approximately 5 kilocycle deviation above and below an average frequency of 1695 kc. Keying is clean with no observable chirp or instability.

Thank you John for sharing your very fine idea with HAM CLINIC readers.

XR-50 Coil Winding Info.—"I have some XR-50 (National) coil forms on which I have no winding data. Can you help me?"

Yes. See fig. 2. This is the chart usually packed with XR-50 forms. Knowing full well that many hams have the forms but not the chart it is reproduced herewith. If you use the chart with any other coil form (same size) make sure that the core is the correct material. National's forms are low loss and great for ham equipment.

Standard Prefixes—"Can you tell me what tera, giga, nano, femto and atto mean?"

Yes. These "standard" numerical prefixes are: tera—10^{12}; giga—10^{9}; nano—10^{-9}; femto—10^{-15}; and atto—10^{-18}. Incidentally, the term kilocycle, megacycle and cycle become kilohertz, megahertz and hertz respectively in international usage. You will see these abbreviated in magazines now (not only European ones), as Kh, Mh and h.

ALC for the HT-37—"I would like to add an automatic load control (a.l.c.) to my HT-37. Can you help me?"

Joel W. Avery of Valley Station, Ky. shares his idea with the owners of the HT-37 which works very well. It is shown in fig. 3.

Joel calls his scheme "automatic power control." His circuit is adjustable to any power level on any band and requires drilling no additional holes. It can be installed in about 20 minutes. Here is the way Joel recommends that you go about the job: "First remove the HT-37 from its cabinet. Then remove the shield from the final tank. Construct the voltage doubler on a terminal strip and attach it to the front of the shield. Connect the doubler between R_{20} and R_{21}. Then mount the pot through the available hole in the rear apron and connect the output of the doubler to one end of the pot. From the center leg of the pot connect the 2.5 mh choke, the other end of this going to the driver stage control grid, *i.e.*, pin #2 of the 12BY7. Replace the shield and the case.

"To adjust the circuit, begin operation with maximum resistance of the pot all the way in. Load the transmitter normally, then set the pot to the level of output desired (any point below maximum). The transmitter will now peak to this level and will *not* flat-top."

Thank you Joel for the excellent idea. I am sure many of our HT-37 owner readers will appreciate your help. Hallicrafters please note.

Register with Manufacturers—"I bought a second-hand set sometime ago and had trouble with it. I wrote the manufacturer and received no reply. What does a guy do to get information from a manufacturer on a second-hand set?"

If you have purchased a late piece of ham equipment second-hand, do advise the customer relations department or the service department of the manufacturer who made the equipment. Ask to be placed on their mailing list for modifications (of your set) which come out from time to time.

When you receive the modification bulletins and make the modifications, hold on to them so that you can show whoever buys your set that it is up-to-date.

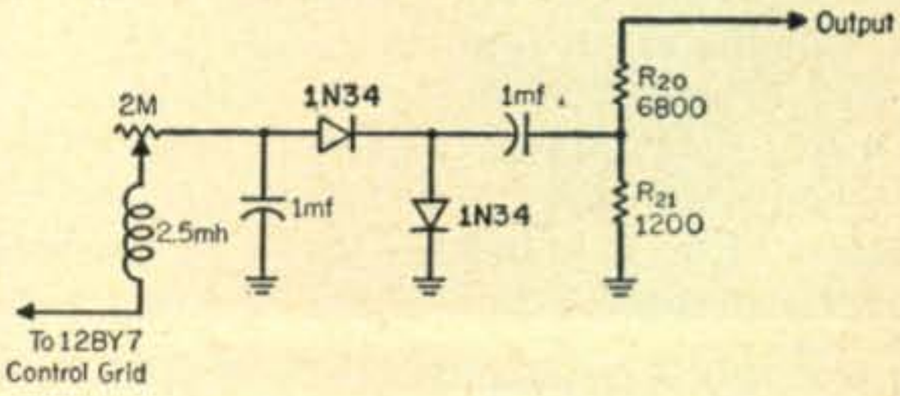


Fig. 3—Automatic load control circuit for the HT-37.

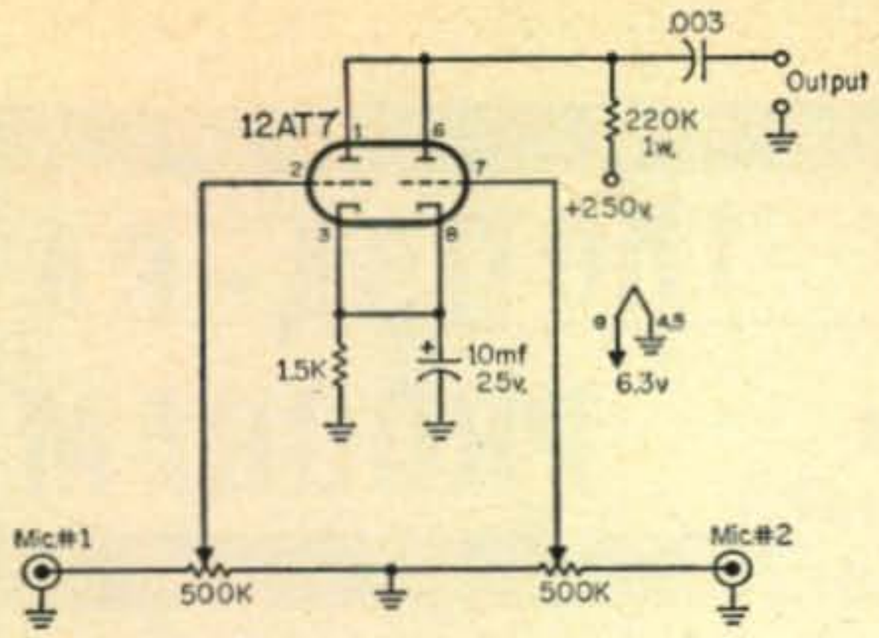


Fig. 4—A simple microphone mixer.

In writing to manufacturers, always give the serial number of your set and the name of the company or person you bought it from. The manufacturer can then change his mailing list accordingly.

Help the manufacturer to help you! Register your set.

Simple A.F. Mixer—"I would like to be able to feed either one of two mikes or both simultaneously into my transmitter and would like for you to suggest a mixer. Can you do this for me please?"

Sure. See fig. 4. The pots are adjusted for individual or double mike gain. Instead of the 12AT7, transistors could be used, but it is assumed that you are using a tube type speech amplifier.

Putting the 32V on 160 Meters—"Did anything appear in *CQ* on putting the 32V on 160 meters?"

No, but see the April 1954 issue of *QST* for the info.

AN/ARC-1 As 2 M Transceiver—"In what issue of *CQ* did information appear on converting the AN/ARC-1 for ac operation on the 2 meter band?"

CQ for May 1960.

Black Widow Transmitter Receiver—"I obtained a ?-hand Black Widow transmitter-receiver but without an instruction book or diagram. Any info on this set in past issues of *CQ?* What happened to the company who made the BW?"

An article on the BW appeared in the January 1958 *CQ*. I do not know what happened to the company. According to statistics, about 4000 firms failed in the USA during the first 3 months of 1964, among these were a number of radio-electronic companies. They come and they go! Suggest you advertise in *CQ* for the info you need.

Selenium Blowouts—"I built a selenium rectifier power supply. I used series resistors connected to each rectifier but about every month or so one rectifier blows out. What causes this and what can I do?"

First decrease the size of the series resistors. Next, parallel *each* rectifier with a .01 mf ceramic capacitor. Voltage transients are no doubt doing the dirty work. The parallel capacitors will help to increase the life of each rectifier.

An Appeal for Assistance — Have you ever stopped to think how fortunate you are, living in America and being able to buy all the magazines and books you need? Have you ever stopped to think about those who are trying to better the lot of their young people in nations where ham radio is considered a luxury? Well, if you have not, you should. The foreign aid dollars that *we* (yes, I pay US taxes too!) send to developing nations are not used to increase a country's ham population. So we hams must help fellow hams in other countries much worse off than we are. This appeal is directed to European hams too.

Remember, when we help foreign hams we are helping maintain the status quo of ham radio internationally, and without international cooperation we can lose some of our ham frequency spectrum space.

I would like to suggest that you send your unneeded technical books and magazines to Dr. E. T. Cho Ph.D., President of the Tongkuk Electronic Engineering College, 22-27 Tongza Dong, Seoul, Korea. Dr. Cho studied in the US at Purdue and in Indiana and was once the Chief Signal Officer of the Republic of Korea Army as a Major General. He was also once in the Ministry of Communications and is considered as one of Korea's outstanding educators. Let us help the students and hams of Korea. Send Dr. Cho some of those books and magazines laying around your shack. If you do, you'll be contributing to international goodwill and the status of amateur radio.

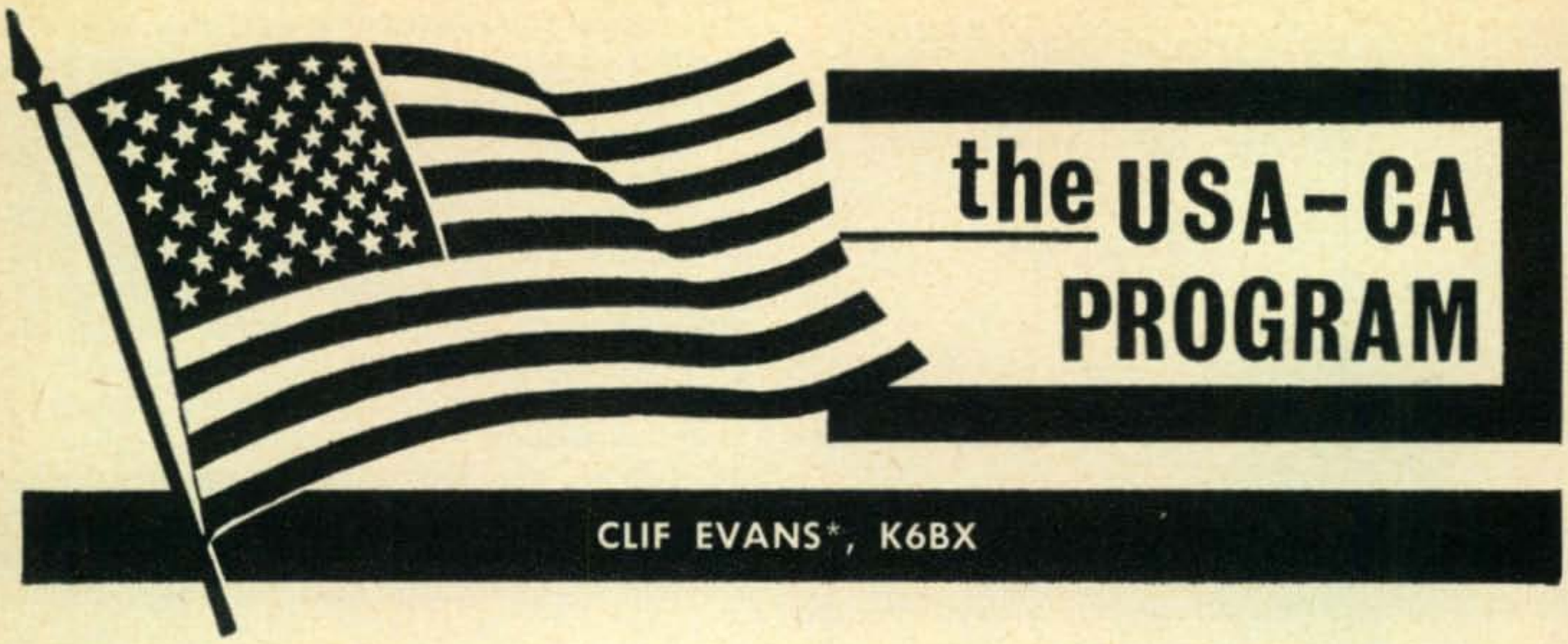
Later on, I will have other destinations for your donations. If you have equipment to give, all the better. Note to our African friends: would you like for us to help you help yourselves—without one string attached? If so, write to me. This offer is a permanent one.

Thirty

Some of you who have written directly to me and received a reply have told me how happy you were to receive the beautiful stamps of Switzerland I use on my correspondence. I always try to use the latest issues of Swiss stamps on my letters or cards to you. So when you write directly you receive a rapid answer plus some beautiful stamps.

As you no doubt remember, Elfriede and I work on correspondence in the evenings and on week-ends. We enjoy receiving your letters and helping hams the world over. We feel that we are not only helping ham radio but are, in our own little way helping the cause of freedom and international understanding. We feel as so many other hams do that amateur radio is a force for peace. Through people-to-people contacts we learn more about each other and appreciate each other's problems more—the end result is friendship. You too can enhance the public service aspects of ham radio by helping needy foreign hams or hams-to-be. Can we count on you too?

72, 73 and 75 Chuck



CLIF EVANS*, K6BX

TWENTY-TWO County Hunters came in for USA-CA credits during May. Eleven of the twenty-two were for original USA-CA-500 Award certificate and remainder were for higher level endorsement gold seals as shown in below Honor Roll.

USA-CA HONOR ROLL

500					
K5SGJ	374	VE3-9301	382	K8VSL	42
	375	W2EAF	383	W8NXN	43
W8JAQ	376	VE3-7554	384	1500	
W5FPN	377	KØEJW	385	WA9AJF	9
W3AIZ	378	1000		K8VSL	10
CT1PK	379	K5SGJ	38	KØHUU	11
W7GAQ/6	380	K3LXN	39	2000	
WØGWT	381	K2PFC	40	W5EHY	4
		VE3-9301	41	WØMCX	5

Of the above we are pleased to note two s.w.l.ers bagged USA-CA-500. Fred J. Woodley, VE3-9301, went on to become first s.w.l. to reach the 1000 county level which proves point that most hams will give s.w.l.s the courtesy of a QSL. Indications are that more and more DX s.w.l.s are becoming interested in the USA-CA Program. We might remind U.S. hams that in most other nations before a person can become a ham, he or she must serve apprenticeship as a s.w.l., and unlike in the U.S. s.w.l.s of most other nations are considered and treated as fraternal brothers. So Mote It Be.

To again point up a fact that 7 mc now dominates as the County Hunter's band, KØEJW made all his 500 county confirmed contacts on 7 mc s.s.b. with most contacts in and around the County Hunter's Net on 7220 kc. The CHC/FHC Service Net opening 1800 GMT daily on 14,340 (plus or minus 2 kc) is becoming favorite county check-in frequency for 14 mc s.s.b. mobile operations. One does not have to be a member of either net to check in and join the activities.

We Get Letters

Olof Lundberg, SM6CKV: "Clif, the USA-CA Program I read about in *CQ* sounds very exciting. Please send me a copy of the rules you state are available upon request. I worked 1300 W/K stations during the ARRL c.w. DX contest. It is early yet, but of first 51 QSL cards received, 29 do not name county information. I cannot understand this and it will be interesting to see what overall percentage of U.S. hams give DX stations the courtesy of naming counties. In any event, the USA-CA Program has by beam pointed toward your U.S.A."

Chuck Muller, HK3VV: "Clif, we are really pleased to apply for the beautiful USA-CA Award. It was fun. I sweated, fretted and oftentimes got shook up trying to work some of those elusive 'rare' ones. Was great fun even with few sad moments when a guy who promised a QSL never delivered, or what you thought to be Alpine County turned out to be L.A. Working 500 counties from a DX location is not easy, believe me, but it does stimulate high interest and makes the award highly prized. I do want to register a complaint against QSLing habits of too many stateside hams. Here at HK3VV, 871 counties were worked before getting the required 500 confirmations. Seems U.S. hams just don't QSL like they used to. We feel strongly that the final courtesy of a QSO is a QSL and we make them out during the QSO before the fellows have time to forget the di-di-di-dah di-di-di-dah of my call. We don't expect QSLs direct and it gives us

The Prairie State Mother-Daughter Award sponsored by the Montgomery County (Illinois) AREC, Inc., for contacting four Mother-Daughter ham teams representing at least three states (8 contacts). Teams do not have to reside in same state. Send GCR (certified) list and $1 or 10 IRC to Custodian, Golde Hoover, K9AXS, 401 East Wood Street, Hillsboro, Illinois. Award is co-signed by Golde's daughter, Carole, K9AMD, now married to Bill Allen, K9AKF. All three are CHCers.

*United States of America Counties Award Custodian, Box 385, Bonita, California 92002.

The Coplay Boy Scout Troop #52 Award; U.S. stations work troop club station K3WQW plus two members of the Troop; DX stations work club station plus one member. Send log data list and $1 or 10 IRC to Troop #52, c/o P. I. Somssich, K3VWH, 1120 Hokendauqua Street, Coplay, Penna. K3VWH, the Scoutmaster, is ex-HA8S and HA8Z.

great joy to receive them via bureaus . . . slow boat (by burro here). A most appreciated QSL just received was one for a contact back in 1961. The fellow penned, 'heard you tell another station how much you appreciated cards from rare U.S. counties. Got to thinking, checked . . . sure enough, I failed to QSL. My apologies being so late, and be assured, from here on out, those asking for QSLs will get them.' Again Clif, I wish to express my sincere thanks to all you folks at *CQ* who had the imagination to dream up this award which is sweeping the world with high interest."

Dan Onley, K4ZRA, Custodian of the Kentucky Bluegrass County Award sponsored by the Owensboro ARC, Owensboro, Ky., wrote Cliff Corne, K9EAB, of iron lung fame, the following: "My sincere congratulations to you on becoming the first winner of the Bluegrass All Counties Award of Kentucky. Through the kindness of State Senator Casper Gardner and of Governor Ned Breathitt, your achievement has qualified you to be commissioned as a full-fledged "Kentucky Colonel!" . . . they feel that such interest in the Bluegrass State certainly merits the state's world-famous mark of distinction." Here, again, as we keep reiterating, realistically 'engineered' awards programs provide outstanding PR vehicle upon which unlimited good publicity may be generated enhancing amateur radio's stature and place in our society. In this instance the Louisville Courier-Journal newspaper has carried a feature story in Sunday supplement.

Letter from QCWAer, QRPer Elmer Kleppin, W9DBO, brings out the question continually cropping up about the absurdity of some county awards rules which require mobiles or those on field-day operations to stop, make out and mail QSL cards at some Post Office within such county or else those sponsors refuse to accept written statements on such cards that a QSO took place in county named. A few have misunderstood that contacts within such states also required this absurd requirement for USA-CA awards purposes. Let me repeat: the USA-CA Award has no such ridiculous features. For USA-CA, a valid QSL card wherever mailed is considered valid proof a contact was made. This writer is requesting all sponsors of county awards to drop any postmark requirements; failing their cooperation we will then seek new sponsors of state county awards.

Here is the new Idaho Counties Award. See text for rules. One will have to see the award to appreciate all the humorous wildlife, hunting, fishing and camping scenes pictured in silver mass array as background on the certificate. We understand that Idaho is one of the few states left where each year more deer are bagged than hunters are shot. USA-CA welcomes Idaho into the County Hunter's Program.

You have heard of ham widows, golf widows, poker widows, etc. . . . well, heres a humorous awards protest by the 'widows' of self indulging Firemen. See text for details.

Sue Pierce, K5SBN, writes, "Clif, when you folks dreamed up the USA-CA, you had to be inspired. No other awards program has generated such world-wide interest, more fun, more frustrations and sheer excitement than this one. DXCC seems pale now. We have chuckled at your statement, 'There are no ridiculous awards; only ridiculous sponsors'. Now Clif, that's close to home . . . looking through your *Directory* for county awards with ridiculous requirements, and talking to DX friends, it appears to us that the California County Award is a generator of considerable ill-will. Three features; that of requiring all 58 counties (many uninhabited), requirement that QSLs must be postmarked within counties even without Post Offices, and the requirement that QSLs be sent to sponsor rather than acceptance of GCR, all add up making this award one of least interest to the great majority of county hunters. If it were not that the USA-

CA included California separately from these restrictive requirements, fewer beams would be turned toward California. Can't you shake some one up out there and get a progressive California County Awards program with classes (seals) and which recognizes DXer handicaps?" K6BX note: Yes Sue, a new California Counties Award as you describe is in the mill and soon to be announced. We might inject here that awards are supposed to be instruments generating good will. Also, a sponsor does not and cannot ascribe good PR or 'value' to an award; to contrary, 'value' of any award is valid only to extent such award requirements are acceptable to and supported by the masses of hunters. On this score, it is a stupid PR blunder by any sponsor to assume that because his award is most difficult to achieve, that it has PR 'value'. Very 'difficult' awards usually have ridiculous features rejected by a majority of hunters. We might also point out that the sponsor of an award which literally 'dies' once won, lacks understanding of awards PR. Well 'engineered' awards programs, and interest in them, never 'dies'.

Pictured here is the Mammoth Cave ARC award for contacting six members after August 1962. Send log data and 25¢ to club, Glasgow, Kentucky. The certificate pictures the entrance to the Mammoth Cave, one of the world's wonders. The Mammoth Cave was discovered in 1733 by a bear hunter named Houchins. The cave gave evidence of earlier residence by prehistoric Indians. Here again is example how awards can be used to promote knowledge of America's 'treasures.'

County Hunting Tips

Suggest those interested in contacting Dakota County, Minn., drop Stan Rutherford, WØEUG, letter with s.a.s.e. For contact with semi-rare Iowa County, Wisconsin over week-ends, any band, might try setting up schedule with Arnold Bachmann, K9DCJ, Rte 1, Blue Mounds, Wisc.

We still are receiving many notifications of planned mobile trips into 'rare' counties but with such short notice such cannot be accommodated in this column which requires 60 days advance notice. It is suggested those with short notice mobiling plans attempt to check into the County Hunters' Net around 7220 kc.

W8IBX and WN8MEZ plan to operate from several 'rare' Ohio counties over weekends during August using 7036, 7176 & 14072. S.a.s.e. to them for details.

Drop George Maxey, W6BIL, an s.a.s.e. if

Here is the Worked Ottawa Mobile Award (W.O.M.), recently revived, sponsored by the Ottawa Valley Mobile RC, Inc. for working five members while they are mobile. Send QSLs and s.a.s.e. to Jack Barlow, VE3CEB,191A Clare St., Ottawa, Ontario, Canada. Might we remind U.S. Amateurs that U.S. postage stamps are no good to a Canadian; use Canadian stamp on s.a.s.e. or send appropriate number of IRC. Members of OVMRC include VE3BEB, BJO, BST, CDC, CEB, CGP, DQM, GX, AGU, CGD and CIW.

interested in contacts with several 'rare' Northern California counties. George's job requires him to mobile through that area. George also reports his inability and non-acceptance of ridiculous awards requirements which would require him to drive to some Post Office within each county to mail QSL cards. As George relates, some of these counties are uninhabited and others would entail considerable expense to drive to a distant Post Office each time a mobile contact is made in any specific 'rare' county. To meet these California County awards requirements, George had been making out cards on return home and then mailing them to the Postmaster in each county with embarrassing request that the cards be re-mailed to satisfy sponsor requirement. George reports he will continue to dish out these 'rare' county contacts but has lost 'stomach' in any further attempts to satisfy postmark requirements.

For many 'rare' Nevada and Arizona counties, listen for W6DIX/7 checking in almost daily on CHC/FHC Service Net, 14,340 or thereabouts as QRM dictates. Mobilers and county hunters

Fresh off the press is the new Illinois Counties Certificate sponsored by the Peoria Area ARC. Basic certificate for working 52 of the 102 Illinois counties. No date restrictions. No band or mode endorsements. Seals for contacting 72, 92 and 102 counties. Send GCR alphabetical list showing full log data. CHC general rules prevail. Fee is $1 or 10 IRC. For subsequent seals send s.a.s.e. An outline map of Illinois showing counties sent for s.a.s.e. Custodian: Clif Corne, K9EAB, 711 West McClure Ave., Peoria, Illinois 61604.

and others are invited to check in to this net daily commencing 1800 GMT.

Idaho Joins USA-CA Program

The Magic Valley Radio Amateurs, Box 1176, Twin Falls, Idaho 83301, announces sponsorship of an Idaho Counties Award. Requirements: Idaho stations contact 12 Idaho counties; Continental U.S. and VE stations contact 8; all others contact 4. Send QSLs, list and 50¢ or 5 IRC.

The name Magic Valley, according to map on MVRA letterhead and my Atlas, seems to center about thirty miles either side Twin Falls, one of nature's most scenic areas of the U.S. See picture of the Idaho Counties Award.

Red Wagon Widows 'Protest'

Here is an unusual award . . . Red Wagon Widow for contacting three members of the "Widows" working each on both A1 and A3 modes on any band (again, total 6 QSOs; each of 3 members worked on both c.w. and phone). To be a member of the Widows, one must be the XYL of a fire-fighting fireman either paid or volunteer. See picture of certificate. QSOs with the Widows when they are in contact with each other do not count. The award 'commemorates' as stated on certificate, "The above widows being radio hams and having stoically survived their OM's stag conventions, all-night conflagrations, scheduled false alarms and other excuses designed to justify his recurring absences from home, are proud to present this certificate." To get the award send list and $1 to the Asst. (fire) Chief, WA2UAB, Mabel C. Fitz Simmons, 68 E. Main St., Morrisville, New York.

Here is a case of both 'objectivity' and humor . . . there is room for much more humor in amateur ranks than now evident .

5 x 9 Award Announced

The West Virginia CHC Chapter #35 announces sponsorship of the 5 x 9 Award with following requirements: Work 5 West Virginia stations plus 9 stations each located in a different call-area within Zone 5. Zone 5 consists of VO1, VE1, VE2, FP8, VP9, W1, W2, W3 and Fla., Ga., S.C., and Va. in W4, and naturally West Virginia in W8. All contacts after January 1, 1964. No endorsements. Send GCR list, $1 or 10 IRC to Custodian, C. R. Nelson, 4620 Kanawha Ave. S.W., South Charleston, West Virginia 25309.

The W. Va. CHC Chapter was formed March 10, 1964 with Charter members W8PQQ, UMR, YBZ, K8BHG, BIT, MNG, MQB, TBR, TNE and YBU. It is significant their chapter number 35 coincides with historical fact that West Virginia was the 35th state to join the Union and just last year celebrated its Centennial. Chapter #35 meets each 2nd Thursday each month on 3910 kc at 2330 GMT for those desiring contacts with W. Va. CHCers while they are conducting chapter business.

QSL Manager Good Will

The Bossier High School ARC, W5ZBC, POB 5223, Bossier City, La., has launched a program seeking to become QSL Manager for one or two hams in each of the countries of Central and South America. The club seeks those with heavy QSLing requirements. Purpose is, in addition to promoting international good will, that of economic accommodation to all. C.A. and S.A. hams interested in this offer should contact the club direct for details.

We related in previous column wherein CHC Headquarters Box 385, Bonita, Calif., maintains a large list of U.S. amateurs willing to be QSL managers for DXers seeking such service.

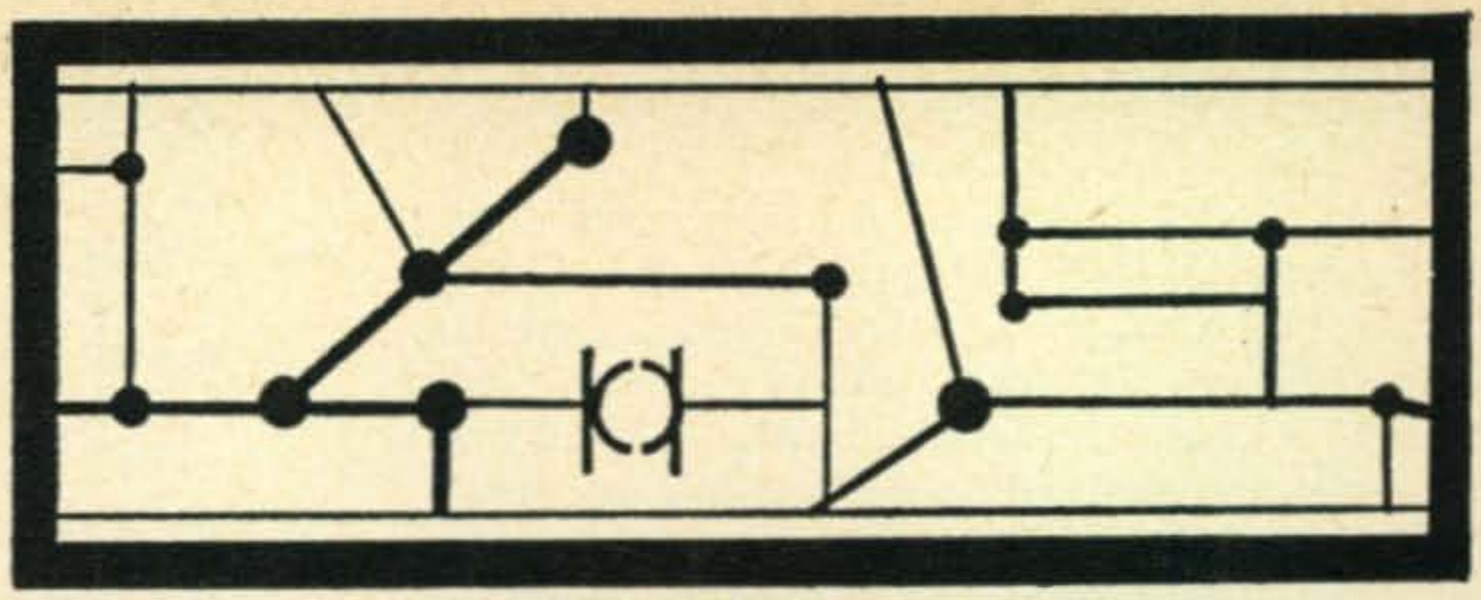
What's Cooking Department

Each day it becomes obvious from mail received that new folks have become interested in the USA-CA Program and its endless chain of exciting applications. It appears almost mandatory that in each column we re-state the USA-CA Program and Rules are available by sending s.a.s.e. to K6BX and that the 108-page USA-CA state/county *Record Book* showing and listing all 3078 U.S. counties is available direct from *CQ* for $1.25. For literature on these and other awards matters, make request direct to K6BX with s.a.s.e.

It is a major purpose of the USA-CA column to help others obtain greatest possible amateur radio publicity at a PR level which enhances amateur radio stature with deserved recognition of public services. We can't promise publication of any matter; however, we are always seeking high-interest items . . . keep us informed . . . so we may inform others. Clif, K6BX

This rare shot shows most of the Directors of the Asociación de Radio Aficionados de la República Mexicana (ARARM) all at XE2OA's shack. From front to rear, and left to right: XE2DM, XE2OA, XE2PAG, XE2WW, XE2YL, XE2CZ and XE2YH. The ARARM Convention took place in Guadalajara on May 14-17. *(Tnx XE1BT).*

NOVICE



WALTER G. BURDINE*, W8ZCV

MANY of you will be going to the local hamfests and field-day set-ups this summer and enjoying yourselves with the gang. You might even meet W8ZCV there. I get to many of the gatherings within a 350 mile circle of Dayton, Ohio. I may come with friends, Volkswagen or plane, but I will always have my share of the fun and the same luck at winning the nice prizes given away. (They just don't seem to know that I'm there when they hand out the prizes.)

I have been to a few meetings this summer and invariably have been asked to stand up and expose my ignorance to the assembled multitude. I recently attended a meeting and while standing up, was asked how I stood on the Incentive Licensing Proposal. Now, I had not intended to become entangled with those for or against this action, but I will answer if asked. My answer is, "I am for anything that will improve the status of amateur radio and the amateur." Even if I have to study some to improve my position, I'm for anything that will improve my status in amateur circles. If I'm too lazy to exert the small amount of effort, I'll just send back my two licenses and take up a hobby that doesn't require me to think or act in any strenuous way. Maybe I'll just join the Girl Watchers Society of America. At my age I'll only watch so it won't take any effort except to turn my head.

The thing that struck me as being the most fantastic was the fact that of about 25 people talking about the proposal, not a single person seemed to have any idea of taking any exam to improve their amateur standing. It seems that we have become a nation of people that wants everything given to us rather than have the privilege of earning it. I really had never thought of an amateur in that way before, it was a shocking thought.

Just what is amateur radio coming to, anyway? Have we become a bunch of button-pushers that only have a license because it is a status symbol? Has it become too easy for us to buy a kilowatt rig, get someone with enough know-how to set it up and put us on the air, that we may operate at our heart's content. I'm just wondering. Not me, I'll always be a ham even when you have to use a b.f.o. to copy my phone signals when I'm on phone because my tired old voice is so high pitched it sounds like c.w. If anybody else can do it, I can.

I'm sure you will disagree with me, but just remember, I didn't voice my opinion until you asked for it. I have a right to say it just the same as you have. By the way, I do have an Advanced license, but I don't use the privileges granted by that license, it's *my* status symbol. Oops, I've just fallen from my soap-box.

Something To Read

I've just read a very interesting article in *The Saturday Evening Post* for May 30. The article is "Race Against Blindness," by Max Gunther, on page 36. It is a story of the eye bank network as set up by a group of hams to help provide emergency communications for the eye banks across the nation. They operate twice daily at 7:00 CST morning and evening on 3970 kc morning and 3963 in the evening. Ted Hunter, WØNTI is usually NCS as he is centrally located. The story ends with a very nice tribute to hams every where: "If there is one thing at which hams are expert, it is communication." Try to read the article, you'll like it. A salute to Max Gunther.

Getting Started (continued)

In this day of science and scientific survival it behooves each of us to interest as many potential scientists of the future to study and scientific research as possible. Almost every device that we use has had an electronics specialist's hand in its development. Automation was developed by using electronic science to do the job formerly done by human hands. We must now have those same hands to repair our electronic counterparts. We must still be smart enough to operate and repair them. We have not been replaced, just helped.

We need many scientists for survival in the atomic age. I know of no better or more interesting training ground for the budding scientist to cut his teeth on than the field of amateur radio. He should get as much mathematics as he can absorb to help him in future projects. He

*R.F.D. 3, Waynesville, Ohio 45068.

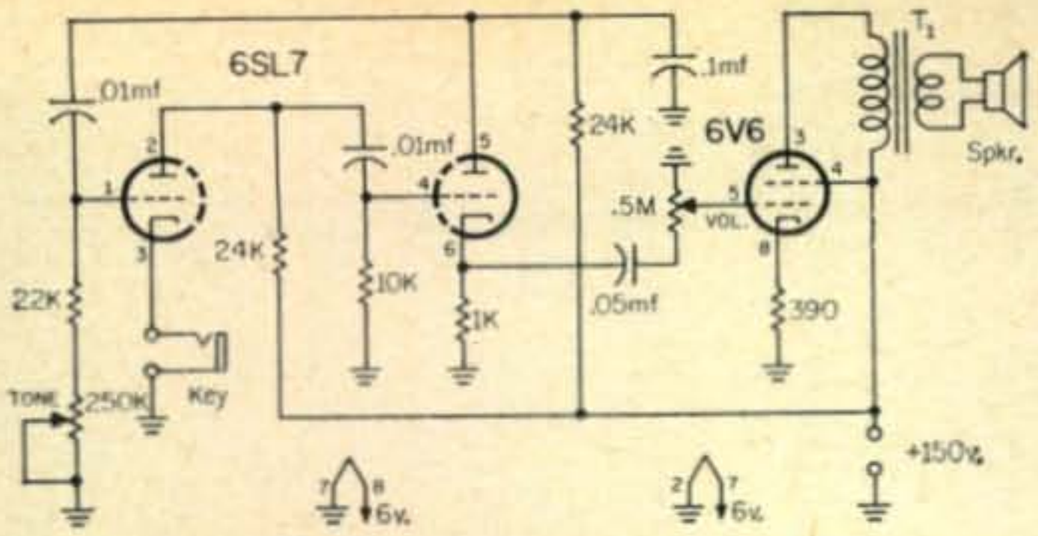


Fig. 1—Tube type code oscillator using inexpensive parts. The 6SL7 may be replaced by a 6SN7, 12AU7 or any other dual triode while the 6V6 may be replaced by a 50L6, 12A6, 6AQ5, etc. with appropriate changes in pin connections and filament voltage. Transformer T_1 is any 50L6-type output transformer.

must study English composition so that he might be able to express himself fluently. Get all the education that you can obtain, it will help you in the future.

Did you ever wonder what motivates a person to become a ham? The natural curiosity of things unknown motivates many of us to attempt new projects with the hope of improving our position in the world. The scientific approach to the desire to improve our human relations with peoples of the world is another reason for becoming a ham. The interest in constructional items in the electronics field causes many to eventually join the ranks of amateur radio operators. Many of us use the knowledge gained by becoming hams to obtain jobs in the electronic or allied fields. The ham has proven that he is adaptable, he can advance in many directions with the knowledge gained in the amateur bands.

The amateur, when learning c.w., has mastered a common linguistic bond with peoples of other lands. Code is an international language and used for communications, will help to foster international goodwill and understanding.

Some want a license just so that he can talk on the radio to anyone with a license. Whatever the reason, you sure can have more pleasure with a ham license than any other way that I know of and do it more easily.

As I said in the last column there are necessities to setting up and operating an amateur radio station. Number one is the license itself. That will probably be our biggest problem. Other necessities will be the receiver, transmitter, antenna, in some places the necessary power for operating the complete station and of course the operator himself. The station and the antenna set-up have been covered in *CQ* and other publications. The license can be obtained by no one but your own efforts and abilities. I would say that 99 percent of the people could get a license if they really tried.

The necessary license can be obtained by taking a test proving your ability to copy International code at speeds of 5, 13 or 20 words depending upon the class of license desired. The other part of the examination deals with your technical ability. You must know enough to operate your station efficiently and you must prove to the Federal Communications Commission that you can do the job. When you are able to do this, your license will be issued and you are on your way.

At present, five classes of licenses are issued to the amateur operator upon passing the required tests:

The **Novice** license is good for 1 year and can not be renewed. It requires a minimum of technical knowledge and the ability to copy code at five words per minute. All equipment must be crystal controlled and operated at 75 watts or less power. Phone is permitted on 145 to 147 mc. C.w. is authorized on the following bands: 3700 to 3750 kc, 7150 to 7200 kc, and 21,100 to 21,250 kc.

The **Technician** license requires a code test of five words per minute and an extensive technical test, the same as required for the Conditional and the General class licenses. The Technician is authorized *all* amateur privileges above 50 mc *except* the 144 to 145 mc and 147 to 148 mc portions of the two meter band.

The **General** and **Conditional** classes of license requires a code speed of 13 words per minute and the same technical examination as the Technician class license. The General and Conditional class licensee is authorized all amateur privileges.

The **Advanced Class** license is reserved for previous holders of the old class A license and has all amateur privileges except those reserved for the Extra Class licensee.

The **Amateur Extra** Class license requires a code test of 20 words per minute and advanced theory and practice examinations. They are authorized all amateur privileges and such additional privileges as may be granted to holders of this class license.

Learning the code seems to be the main deterrent to getting the amateur license but this need not be a painful task if approached with the right attitude. A small number of aspirants have some difficulty learning the necessary technical data to pass the test. Obtaining the necessary knowledge to pass the test need not keep you from enjoying the thrills that come to the amateur radio operator.

The technical portion of the examination can be learned by carefully studying any of the books mentioned in last month's article. A few evenings spent in serious efforts to understand the mysteries of radio will be very rewarding. Enough theory can be learned to pass the amateur radio license test and gain an insight into the mysteries of radio. I guess My friend Jack Landers, K3IJ, sums it all up in part of an article he recently published when he wrote "Every man's life can be glorified by using well what ever he has. Business is like a wheelbarrow, for it moves only when you push it. At all times you get out of life exactly what you put into it. Above all, give your hobbies all you have."

There is no magic way that you can learn the

code. It takes a certain amount of regular practice and determination to learn to copy and send code correctly. You will need a code oscillator and a key for sending to really learn it well. A receiver that will tune the short waves, (one equipped with a beat frequency oscillator or b.f.o. will aid your learning the code in a minimum of time. Make up your mind that you can learn the code, practice often, at least 20 minutes per day, keep your mind on the code while practicing and you will soon be able to copy from the radio. Then it really becomes interesting.

Code oscillators can be bought in kit form and built. Many of the catalogs list either complete units or modules for generating the necessary low frequency audio oscillations for producing code characters. I have spent a good many hours building code oscillators for folks or looking up diagrams for them to build their own, and I will show some of the diagrams here for your use. If you have tubes and power supplies in your junk box, use them. Otherwise I think it is best to build a transitorized oscillator. They may be used anywhere as they have their own power supply and do not need to be connected to the a.c. mains. The units shown here can be built in a small cabinet and the speaker can be either self contained or an existing speaker can be used to reduce the initial cost. The small transistorized phase shift oscillator can be fed into any existing audio amplifier. I use the same audio amplifier for many purposes.

The small transistor code oscillator shown in fig. 2 can be built for a very small sum and can be used for group practice. The tube models can also feed an audio amplifier for group practice. Use what you have and if you don't have, watch your catalogs carefully for the bargains. You can get all of the parts from a defunct television or radio set; that really is your cheapest way out. Use your handbooks and use your head. Good luck, see you on the air.

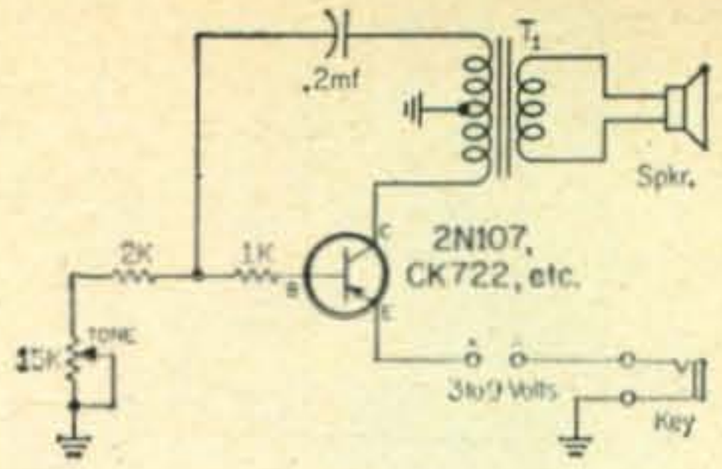


Fig. 2—A simple transistorized code oscillator suitable for driving a small loudspeaker. Any inexpensive PNP transistor may be used. Transformer T_1 is a Lafayette TR-109 transistor output transformer.

Letters From Our Readers

I really enjoy your letters and get many good ideas for the column from them. Here are a few for you to share.

"Dear Walt: I have read your column with interest since way before I received my license. In my belief you've done a very good job of it. Like many others, I like to read about those who build their own rigs from new parts or surplus. These people make the Novice column worth while.

"My rig is a Knight-kit T-60 transmitter feeding a 40 meter dipole 20 feet high. The receiver is a Knight "Star-Roamer." With this rig I have contacted 19 states, I need the 7s and Øs most of all. I will be glad to sked anyone needing Mississippi for WAS or just for a good ragchew.

"I would like to mention WN5FTZ and WN5FHT. These two are the cause of my being a ham. If you don't want to be a ham stay away from them, I visited them and I am very thankful that I did.

"You asked us what we wanted in the column. I would like to see something on longwires and dipole antennas.

"I doubt that my letter will be published, but I tried. 73. Dean, WN5HJU, RFD #2, Armory, Mississippi."

Over the Atlantic flies this note with another idea. It comes from Bjarne Lundholm, SM3-DDC, Odensalagatan 62, Ostersund, Sweden:

"Dear Walt: Even here in Sweden we read your column with much interest. I think *CQ* is a really fine magazine for those interested in ham radio.

"Walt, I would like to exchange tape-recorded 'letters' with someone in the United States. I am 17, studying and interested in almost everything, hi. My recorder has a tape speed of 1⅞" per second and has the two channel system. I can also record and playback other speeds and the 4 channel system.

"Well, I hope you'll find someone interested in that (it might even be a pretty girl, hi). So until next time I thank you very much in advance. 73 es gud luck: Bjarne."

Thank you, Bjarne for the kind words and keep on reading *CQ*. Write and let me know if you receive many letters on tape. Do you QSO any of our Novices? I am always interested in your letters. Look for me on 15 and 20 meters either phone or c.w.

Help Wanted

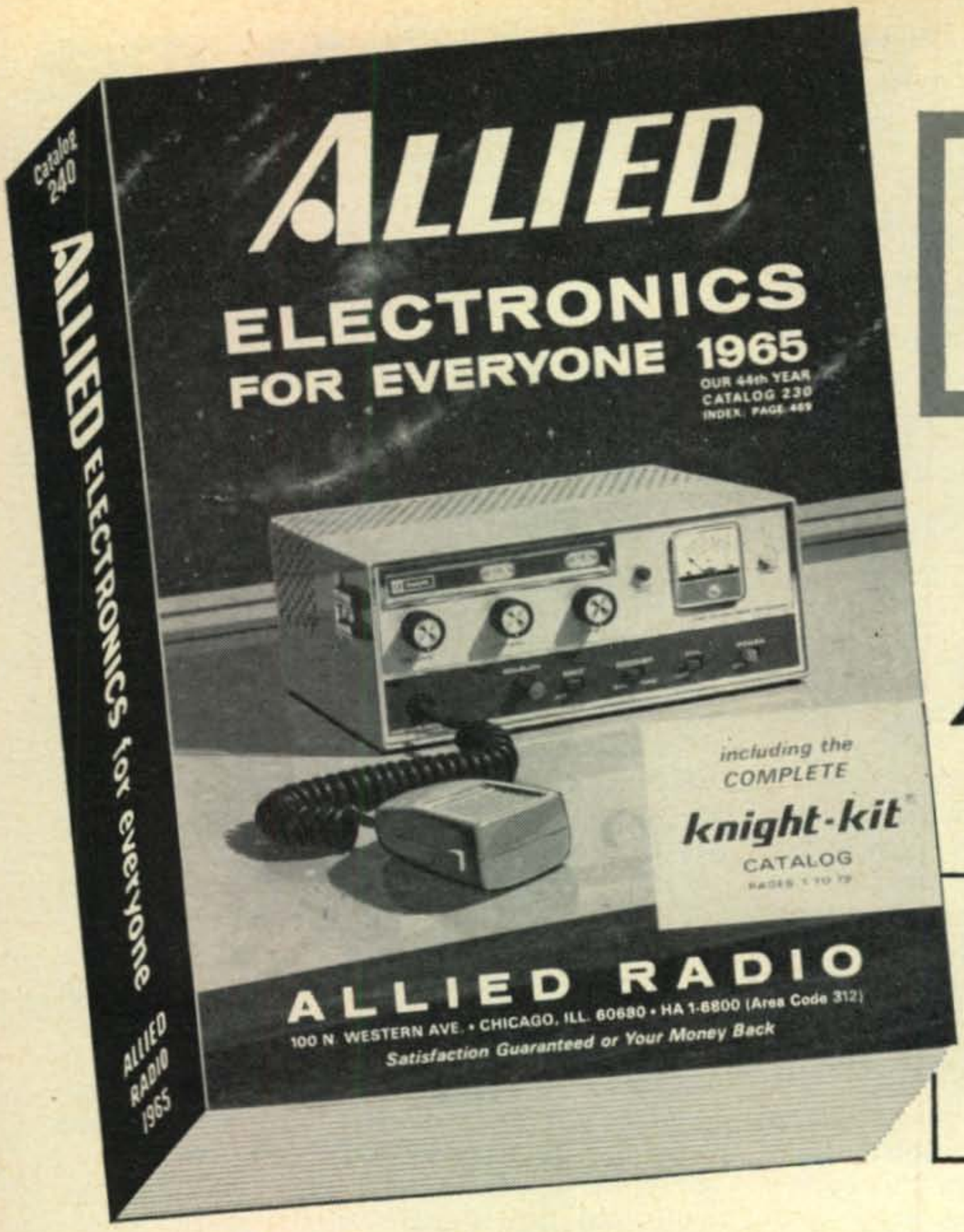
Don Carter, 2890 Sandy Creek Highway, Adrian, Michigan, phone 265-7828 needs help with the code and theory. By helping others you also help yourself. I've had this result quite often myself and you never know in what direction your return will come from or how you will receive that return.

At two hamfests lately I have had an amateur come up and identify himself and tell me how he was helped by having his name in this space. It is a good feeling to know that in your small way you have helped and I want to thank those that helped those two and the many others. Thanks again.

That's about all for this month. Keep your letters and pictures coming to me. Use the correct address: Walter G. Burdine, W8ZCV, Waynesville, Ohio 45068. Do not send mail for me to New York, it causes double work and takes longer to get here.

I'll see you at some of the hamfests around the five state area.

73. Walt. W8ZCV



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UHF ROUNDUP

BY ALLEN KATZ*, K2UYH

I GUESS everyone has heard of the new two meter record set by W6DNG and OH1NL. You don't have to be too much of a crystal ball gazer to recognize the significance this contact could have to future u.h.f. operation. I say "could have," however, because of the atmosphere which has grown up about the word moonbounce. Many amateurs associate gigantic parabolic reflectors and anything but amateur equipment with this feat. But as K2ZSQ pointed out in last month's VHF column, W6DNG used a rather modest array compared to some of the monsterous antennas which have warmed the surface of the moon. His transmitter was of the standard kilowatt variety, and his 416B preamp is a not too unusual 144 mc front end.

I am sure Bill made use of a few unusual techniques, though I doubt whether these are the true secrets behind his success. One would do better to look to his character; that of stick-to-it-ness, not accepting what the experts say as gospel—in the true tradition of amateur radio. Our hat's off to Bill Conkel, W6DNG.

A System

It is a known fact that many stations have the necessary db's to accomplish moonbounce on two meters, except for one item; they don't point their beams at the moon, and they don't keep them pointed there . . . they don't have a system.

From all the data of past moonbounce tests (there is quite a bit by now), it appears that an effect exists similar to the "openings" found with other forms of propagation. This phenomena is probably connected with the Farday rotation.[1] The relationship, however, is not simple. It is not even known for certain whether the polarization is randomly rotated or hovers about a fixed point. We are hoping that Bill and Len will be able to supply the answer to this question and others. But it can be said from what we know already, that a system planned for moonbounce is a necessity.

Support

During the past year and a half or so, we have been trying to give you a column in which you would be interested. The extent of our success has in a large measure been up to you. Your letters and suggestions form the framework about which this column is built. I am sorry that I have not been able to be more active on the u.h.f. bands than I have, but I have had the responsibility of completing my education and earning a living. My operating time, if anything, is decreased by my efforts on the column, but I will be on 220, 432, and 1296 mc regularly now. This is not enough to supply an accurate picture of u.h.f. activities, though, and your support is needed. Remember, if you don't see it in the column, it's because you didn't write in about it.

To those of you who have written so many letters in the past, a million thanks. Keep up the good work and I will try to get the news and information disseminated faithfully.

Letters

Grid, W4GJO on Varactors: "It was a pleasure to read your column on power varactor multipliers. Your first two paragraphs on the subject stated the case beautifully. But, why, oh why did you have to follow this with your warning regarding linear operation?" *(That's what we found Grid.)*

"The facts are that these devices are surprisingly linear when properly adjusted, and a well-modulated 2 meter signal at the right level fed in will come out an equally well modulated 432 mc signal." *(Maybe ours wasn't properly adjusted, but I know some other fellows whose triplers were not adjusted properly either.)* "Observed linearity is as good or better than many tube type straight through linear amplifiers. They are even linear enough to do a good job on d.s.b., and it appears that they will work on s.s.b. with carrier reductions of up to 15-18 db. Full s.s.b. is not satisfactory, however, because of the lack of reference carrier or sideband to stabilize the rapid capacitance changes in the varactor." *(Some of the locals are sure going to be surprised.)*

"Lou, WA4BYR, has developed some very interesting input and output circuits for these devices, which makes adjustment extremely simple, and with greater output than the more conventional configurations heretofore described

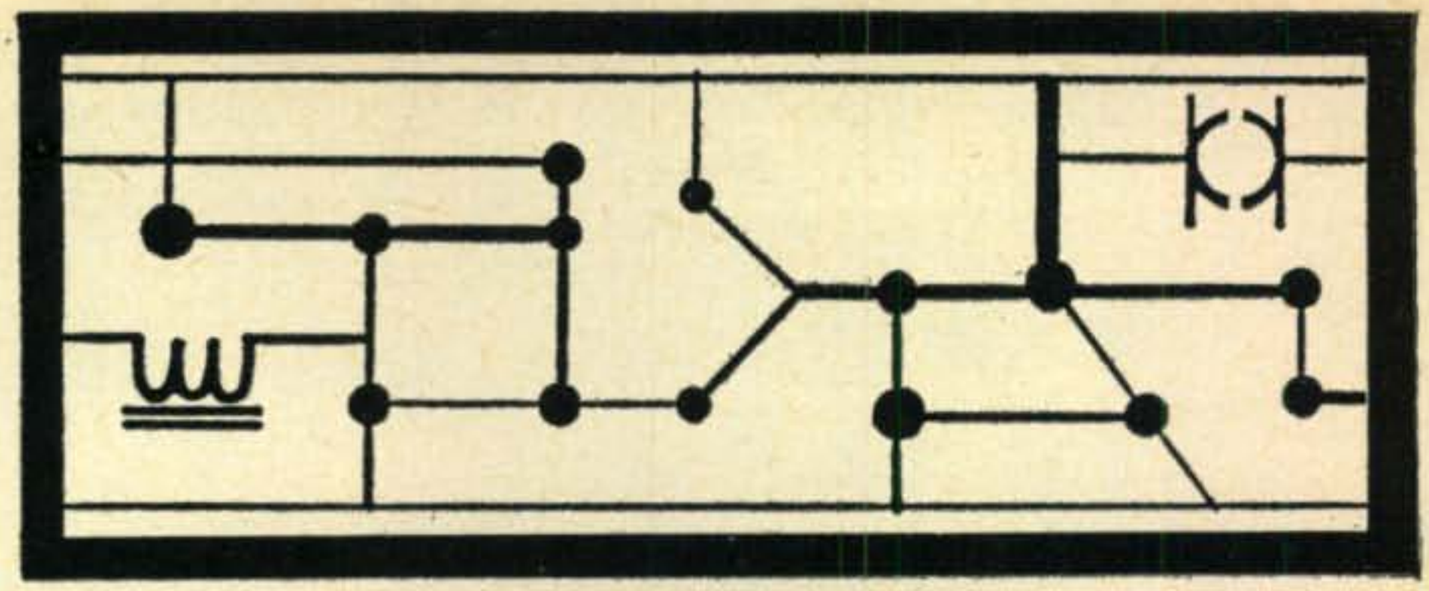
[*Continued on page 111*]

Larry, W8RLT received at W8JLQ about 50 miles away during a local band opening.

*48 Cumberland Avenue, Verona, New Jersey

[1] The effect by which the polarization of a radio wave is rotated as it passes through the ionosphere.

RTTY



BYRON H. KRETZMAN*, W2JTP

RTTY Operating Frequencies

Nets centered on frequencies given; operation usually ± 10 kc on h.f.

80 meters	3620 kc
40 meters	7040 kc
20 meters	14,090 kc
15 meters	21,090 kc
6 meters	52.60 mc
2 meters	146.70 mc

LAST month, in the interest of improving the quality of radioteletype signals on the air, we gave some details on the adjustment of the keyboard contact mechanism; and, incidentally, suggested that quite an improvement could be obtained by using a *properly adjusted* polar relay to key the f.s.k. unit, rather than keying directly from the keyboard contacts.

It is the undesirable practice of some RTTYers to play with the range finder on the machine to attempt to compensate for the other fellow's biased signals. As we said, the range finder, like the polar relay, should be left alone once it has been set. It is apparent that many RTTYers just do not understand the purpose of the range finder, so let's lay down the books on TU filter theory and see just what this device is supposed to do for us.

Orientation

First of all, let us look at a typical Teletype character. Figure 1(A) shows the pulse construction for the letter *R* if correctly transmitted. As you know, the system rests on *mark*. The start pulse, always a *space,* is 22 milliseconds long. Each of the successive selecting pulses, either *mark* or *space* depending upon the particular character, is also 22 ms long. The stop pulse, always a *mark,* is 31 ms long. Since this is a "start-stop" system of transmission, the stop pulse was made longer than the others to give the machine a little more time to reset itself for the next character.

Figure 1(B) shows the letter *R* as received, with the 20% selecting interval shown solid black. In order to reduce errors to the minimum,

*431 Woodbury Road, Huntington, N. Y. 11743

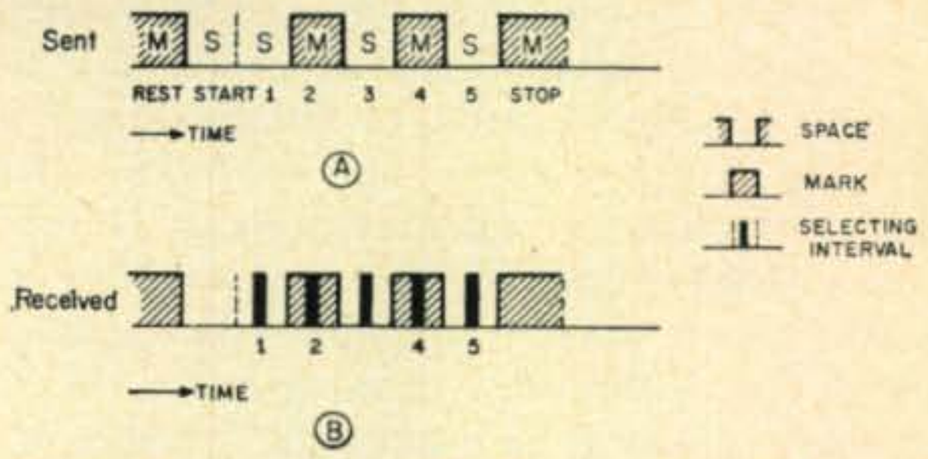


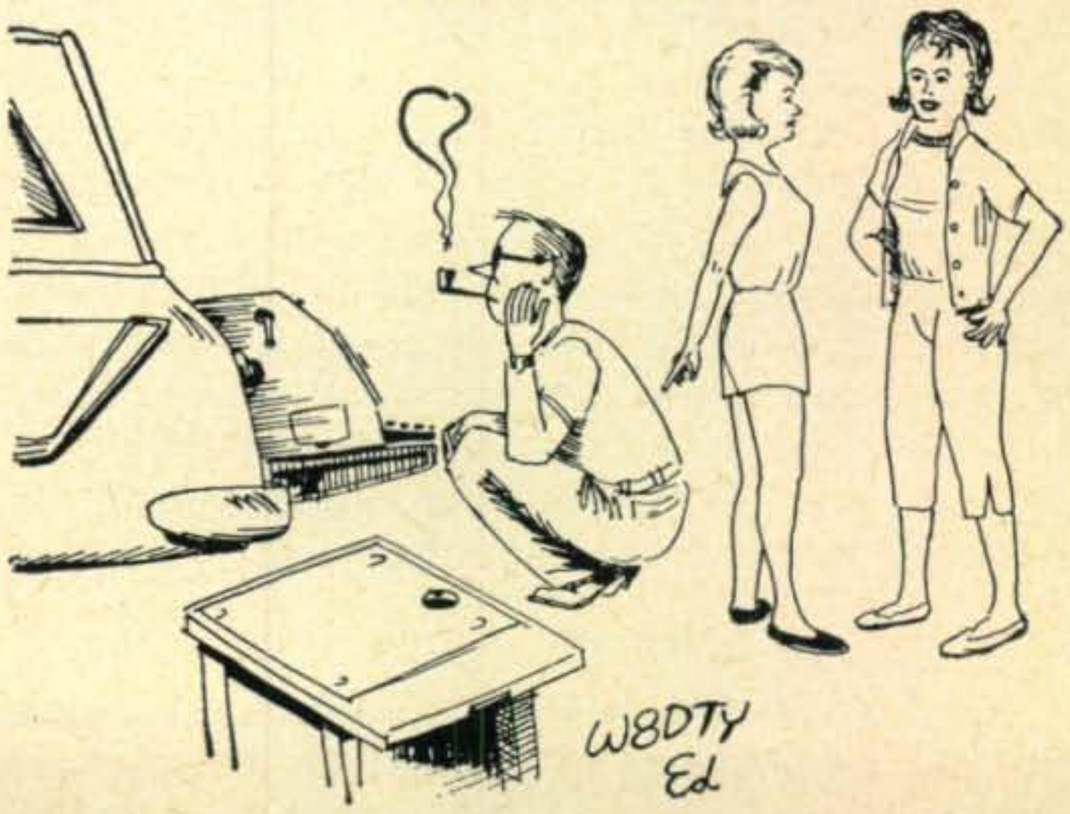
Fig. 1(A)—Transmission and (B) reception of letter "R."

a specific means is provided to put that selecting interval right in the middle of each pulse. (As you can easily imagine, it is the transitions that get moved around in random time relationship on an h.f. radio path.) The means provided to achieve this is called *orientation,* and the range finder on the receiving selecting mechanism permits the mechanical movement of the selecting interval with respect to time. All the selecting elements are shifted, with respect to the beginning of a start segment, by moving the latch assembly through an arc corresponding to the length of a unit, or 22 ms. The range finder scale is calibrated in percent of a unit, up to 120 to take care of those speed differences that cause each unit to be *more* than 22 ms long.

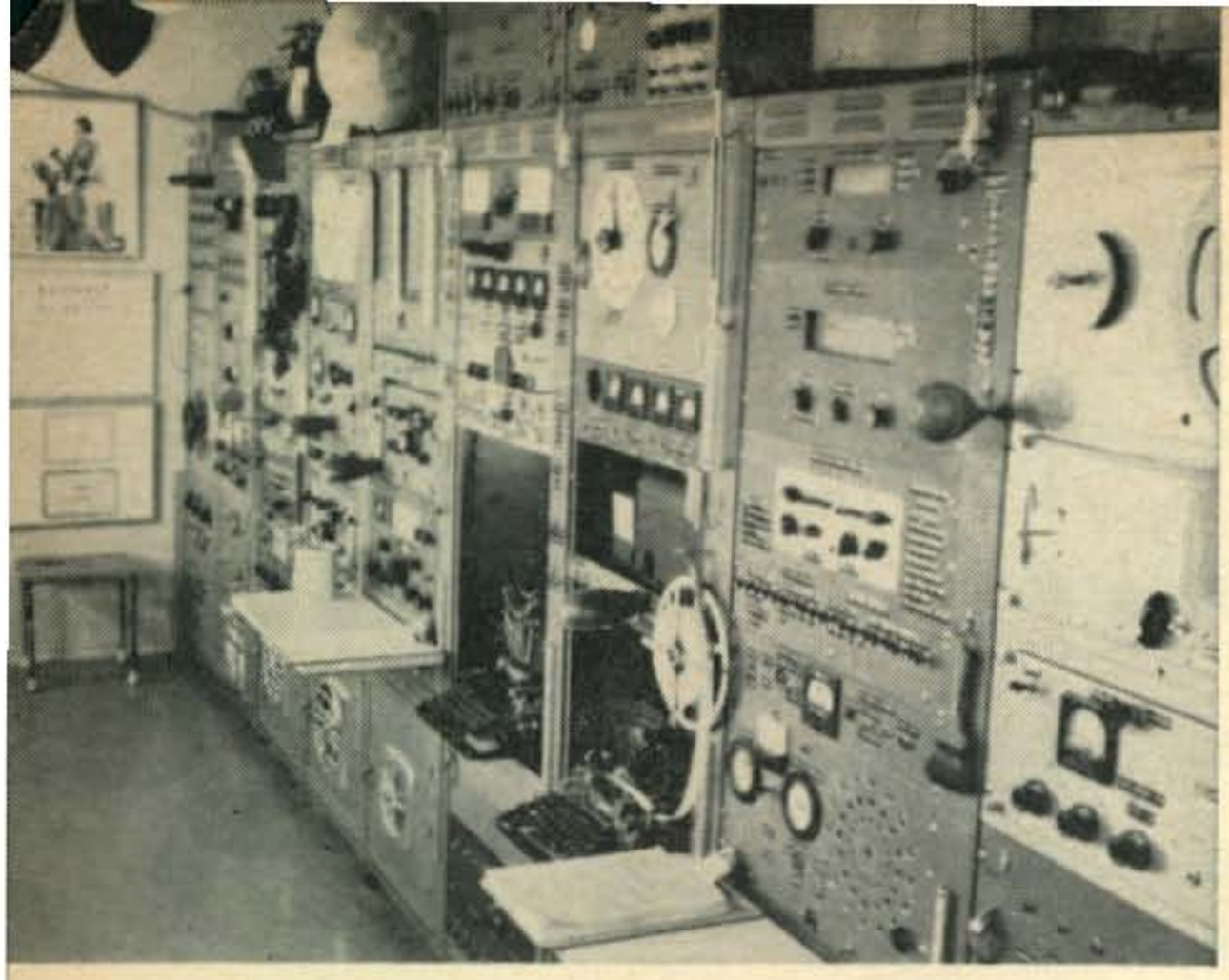
Setting the Range Finder

In any system involving a number of variables, it is desirable to reduce the number to the mini-

RTTY The Hard Way...No. 34



"Dads trying to figure out how he can go mobile . . ."



WB6DBD at Santa Barbara, California, operated by Albert H. Steinbrecher, ex-W7LVR. The "rig" consists of 9 rack cabinets. Machines include a Model 15 page printer and Model 14 tape equipment. The TU is an Electrocom FSC-250. Receivers include a 75S-1 and a 75A-1. Transmitters include several exciters and a kw final using a pair of 4-250's in Class C.

mum. In other words, if you are trying to receive a garbled RTTY signal, you could play with your receiver, the TU, and/or the machine itself, to try and improve copy. The most logical approach is to first set up the receiver by tuning in the signal properly. That eliminates one variable. Then, if the machine has been correctly oriented, the only variable left is the TU, the proper place to compensate for the other fellow's bias.

How do you correctly orient a machine? Very simple, if you can borrow a tape transmitter (TD) and hook it into your local d.c. receiving loop. The continuous-loop test tape usually used is punched for, "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG'S BACK 1234567890", followed by a line of RY's. Start up the TD and move the range finder to the lowest value before errors appear. (This should be about 10.) At the other end of the scale, about 90 should be reached before errors again appear. The operating margin would then be 10 to 90, or an 80-point range. To correctly set the range finder, add the low end reading to the high end reading, then divide by 2. For example, 10 plus 90 is 100, divided by 2 then is 50, the correct setting. Once set, the range should hold indefinitely. Depending upon the amount of operating you do on RTTY, the range should be checked in this manner every few months; for peace of mind if nothing else.

On the Boards

In the June RTTY Column we announced that we had obtained a supply of printed circuit boards, and connectors, for the W2JAV transistorized narrow shift TU as initially described in the September '63 issue of *CQ*, and again in the June '64 issue where we gave a large, detailed, parts placement layout for this TU. The boards are available for $2.50, each, postpaid; undrilled, but with connector included. Send money order or check, made out to me, to the Huntington QTH at the head of this column. *Do not send cash*. By the way, we cannot export.

On the Bauds

W1ILV of Middlebury, Conn., works both 20 and 80. K1EQC of Naugatuck, Conn., and W1MVH of Hamden, Conn., both are on 80.

W1QP works 80 from East Harwich and W1FGL from Falmouth, Mass. K2SBD in Albertson, Long Island, and of the "Mike Farad" traffic net is looking for that on 80. W2QLI of Corning, N.Y., WA2OQV of East Orange, N.J., K2YXB of Poughkeepsie, N.Y., W2BVE of Maywood, N.J., and WA2ZVL of Lockport, N.Y., are all on 80 meters.

W3UQX of Allentown, Pa., uses narrow shift on 80. K3SNQ of Lansdale, Pa., runs tape on 80 with an FRXD and 100 watts. W3PQZ is trying to drum up 2-meter RTTY activity in the Cumberland, Maryland, area. W3NKL of Wallingford, Pa., is on 80 meters. W4VFR is /4 from Albany, Georgia.

W6SEW, working in North Scotland and trying to get the locals on RTTY, is looking for a 50 cycle 1500 r.p.m. motor for a Model 15, and gear sets: Pinion-7 teeth, Drive-25 teeth; and, Pinion-9 teeth, Drive-30 teeth. The latter set, with the 1500 r.p.m. motor, will permit operation on 50 baud, the European amateur RTTY standard. (The U.S. standard is 45.45 baud.) If you have any of these, write John L. Porep, c/o Lenkurt Electic, U.S. Naval Radio Station, Navy 524, c/o FPO, New York, N.Y. 09564. W6VPC, 1067 Mandana Blvd., Oakland, Calif. 94610, has 88 mhy and 44 mhy toroids, 5 of one kind in a can, for $1.50 per can, postpaid.

K7DNK of Klamath Falls, Oregon, has a Type 152 Model 2 TU and is looking for conversion dope to 850 cycle shift. *(FB on narrow shift on 7140 kc, Smitty!)* W7FCH of Bellingham, Wash., now has a 14 typing reperforator. K7IMN of Seattle, Wash., has a TT-63/A regenerative repeater. (*RTTY*, April '64) K7VSB of Pullman, Wash., is looking for gear. *(Contact W7WWG, Doug.)*

W8DLT of Detroit, Mich., has retired after 36 years with Michigan Bell. Michigan RTTYers who want to register for equipment through the RTTY Society of Michigan, contact Grant Bunting K8LXJ, 4152 Cumberland, Berkley, Mich. The Michigan group nets on 3630 kc Sunday afternoons at 4 P.M. (local time) WN8KDS of Shaker Heights, Ohio, is looking for gear. W8CWL of Solon, Ohio, has a Model 26, a 14 typing reperf., and two 14 TD's. W8GMH of Cleveland, and K8EJI of Dayton, Ohio, are on 80 as is W8QMI of Midland, Michigan.

W9UE of Chicago is anxious to buy Kleinschmidt TT-76 or TT-76A tape units. K9UIM is looking for a CV-89. K9DOF of Elkhart, Indiana, has a new Drake 2-B receiver. W9CTX

[*Continued on page 100*]

YL

LOUISA B. SANDO*, W5RZJ

IN the *P*ublic *I*nterest, *C*onvenience *O*r *N*ecessity—PICON. This award, highest honor that can be bestowed on an amateur in the Rocky Mtn. Division, was presented on May 19 at an Albuquerque Chamber of Commerce luncheon to Irene Henderson, K5WZA, in recognition of her years of public service work. Irene is only the second to receive this award in N.M.—W5ZHN having received a similar one for 1961. It is a handsome plaque of wood in the shape of a shield with gold insets engraved thus: "PICON plaque 1963, Rocky Mountain Division, New Mexico Section—Irene Henderson, K5WZA."

Irene's public service work extends in many directions. She has worked in Civil Defense since 1956, before she became an amateur—in fact, it was observing the ham rigs in operation at CD Hq. that inspired her to get a license. With the help of W5ZHN and W5WRS she got her Novice in Oct. '59, Conditional in '60, and she earned her General in '61. Now assigned to the CD message center, Irene has helped during Albuquerque flash floods. She also is a member of AREC. Active in the Red Cross for many years, Irene also does a weekly stint at the Veterans Hospital teaching leather work as part of the patients' therapy. She also has helped several of the patients to pass the amateur operators exam. She has been active in teaching the visually handicapped and has given individual instruction to those who had difficulty in following the weekly courses at the Training Center, reproducing greatly enlarged heavy-lined schematic diagrams for those who had partial sight.

The most recent of Irene's service activities is participation in the Eye Bank Net. This has required twice daily check-ins providing information as to the need for, or availability of, eyes donated to the Lions Club Eye Bank, which in Albuquerque is located at the Lovelace Clinic. On April 26 Irene handled traffic that resulted in the first eyes being shipped from the N.M. Eye Bank to Colorado Springs for a corneal transplant.

Irene is reluctant to speak of her service work—she feels these are things all of us should be doing, particularly providing service through our amateur stations. She is a "doer," or as she ex-

[*Continued on page* 100]

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

K6UTO, Betty Kuegeman, one of the many hams working throughout the Alaskan earthquake emergency, handled over 600 messages. Betty's OM is K6AYI, she has held General since '56, is a member of San Diego and L.A. YLRCs, enjoys ceramics, leather work and photography. *(Photo courtesy W6QGX.)*

Irene Henderson, K5WZA, holds the PICON plaque for 1963 which was awarded to her in recognition of her years of public service work.

160 Meter Test [*from page 32*]

top segment. Found operation more difficult with only 50 watts in competition with 100 and 500 watt stations. W1BHQ: This is the first contest that I have entered since I've been a ham. I've been on 160 for a little over a year now and in that time have worked 18 countries and 38 States. Have been on air since 1930. I sure enjoyed this Contest and would like to see it more than once a year. W1BB. I dabbled in DX mostly because I didn't feel I should beat myself out trying to win again. [You managed to do it just the same—*ed.*] It was a grand show. Don't know how you fellows plan such superb DX weather. However, there didn't seem to be as much country activity as there "should" have been.

2d District

W2FYT: Best contest yet. Good condx! Only planned for 150 QSOs but with band so active had to stick for a few more. You know . . . like a dope addict. W2IU: As you can tell from the long breaks between QSOs at times, I didn't stick with it very well. [Sez u!—*ed.*] W2HUG: DX condx were excellent. Worked 4 new countries and 2 new States. The new QRP regulations didn't prove much of a hindrance. Maybe the good DX condx compensated. K2GAL: A respectable showing indeed considering all. W2KHT: Regret poor showing. Rig blew! WA2HNI: This was my first 160 meter operation and I wish I could have been on more but my old man, W2HUG, was also in Contest—hi! WA2HJF: Ran ½ watt. If there had been one thousand stations on 160 in my area I'd have had one thousand stations on 160 points. The contest caught me unprepared and I had to use my "high" power rig. I'll be ready next year. Better polish up the trophy, boys. K2DGT: Condx seemed unusually good with low noise levels. Openings to western Eu. were excellent. On the other hand, tho, condx to the west weren't as good as one would expect. Activity was good but for the fascination offered by 160 meter operation there were too few on. [???—*ed.*]

3d District

W3EJU: Sure wished I could have worked a Delaware station—hi! [W3EJU is in that rare State of Delaware —*ed.*] W3MSR: This is the first time I've taken this contest seriously and enjoyed it more than ever. Sure did enjoy first QSOs with Eu. on 160. WØGKY/3: Heard lots of DX but you can't work 'em without an antenna. Mine has to be the unobtrusive type! First time on 160 since 7 Dec. 1941. See you next year and hope you make it two week-ends. Power 20 watts. W3AZR: I was on 160 only a little over a week so this contest was a real nice way to start off. One little complaint. I tried operating the upper segment 1875/1900 kc but found this part of the band just about totally ignored. Can't understand why. With all the crowding on the lower portion I should have thought that more of the gang would have been working in the new segment. Overall, it was a great contest. Enjoyed it more than any other I've ever entered.

4th District

K4HPR: This is a real QRP rig. Ran 1 watt input to a 40 meter longwire. I did manage to work a few stations and heard many more. Sure was plenty of activity. W4WHK: Never, in any contest on any band, have I seen such courteous operating habits. It was a distinct

The Antioch DX Society, W6JTB operated from Butte Mountain, California. Left to right are the operators: WA6IJG, WA6IJH, WA6GJW, and K6PJY

K8TYS and K8CGM operated K8TYS/8 from St. Clair, Michigan.

pleasure. Finally figured out where all the DX was. Having been on 160 less than a month I found that knowledge of the band would have helped my test score. Oh well, there's always next year. Hope *CQ* keeps this Test going. [We sure do intend to, Dave—*ed.*] K4FMA: QRM very heavy down here. Northern stations were having a field day working stations that were inaudible here. Was lucky enough to work 2 new countries—HK and PY. Missed KZ5FC. No local stations on 160 regularly down here. The only local QRM I had was from VP7NS and VP7NY, 180 miles distant. K1KSH/4: This has been beyond any doubt one of the most enjoyable contests I've ever been in since being an amateur. Thanks again for giving we 160 meter bugs a real bang-up affair this year, in past years and, I hope, for years to come.

5th District

K5TFG: Although I didn't work the entire contest I really enjoyed it. Sure lucked out as the mid-semester holidays at college came the week of the contest. So, I had plenty of time. K5HRR: Very happy about DX and States worked but somewhat disappointed in number of QSOs. My 5 European contacts have to go down as one of the biggest thrills in 9 years of hamming. Bring on '65! W5HAI/5: QTH was a cabin at Mill Creek, near Lake Texoma, Grayson County, Texas. A great time was had by all and we can hardly wait till next year. Other operators were K5LIW and K5DMM. WA5IHE: Too bad I wasn't back at KL7JDO for this affair. Of all calls to draw after my return to the States for a strictly c.w. man. There just wasn't any justice for me this time.

6th District

W6VSS: This was my first time out for this event and enjoyed it immensely. KH6EPW had a terrific signal from the Islands—proof that 160 is sometimes better than we think it is. Extremely disappointing to me was HK4EB who at times was S9 but not once did I hear him work a signal at 2 mc. Received a s.w.l. QSL from G land. Looking forward to participating again next year. W6RW: First 160 meter contest. Will have to get something to quiet down that Loran. W6YY: Sorry we didn't do better but a million excuses with but one guarantee . . . we'll do a good deal better next year! We learned that G3GRL was calling us the first night but we didn't hear him . . . sob! On the second night we called VS1LP several times blind. He heard us okay but we didn't hear him—sob again!

7th District

K7ICW: Having recently sold my Valiant it was necessary to get a suitable replacement if I were to get into the contest. A promised transmitter was withdrawn 3 days before contest time. Another one was borrowed but it wouldn't give grid drive on 160. So my father-in-law, W7HJ, loaned me his Viking II as a back-up standby. Next, the receiver problem. My 75A-3 and 51J-3 proved too broad and susceptible to overload on strong QRM. So another one was promised. It also was withdrawn at the last minute. Then I borrowed a 500 c.p.s. filter from a friend for my 75A-3, etc., etc. [And some of you fellows thought you had troubles?—*ed.*].

K7MLO: Once more a bang up contest. Condx here in Oregon were very good. Worked 40% more stations than last year including HR3HH—a real thrill. Lower power limits seemed to make very little difference. Thanks once again. Will be on next year. W7EN: It was a great contest. Boy what QRM! Think it was the busiest 25 kc I've seen in many a day.

8th District

K8TYS/8: Had all kinds of trouble with the weather. The winds had gusts up to 70 m.p.h. which caused our ¼ wave balloon supported antenna to part. We sure had some scurrying around to do then to get back into operation. Looking forward to next year's contest already. W8WOJ: I thought the contest was great. Only wish I could have spent more time on the air. Condx were quite good with the band remaining open a large share of the time. For the first time I heard Gs on 160. See you again in '65. K8RRH: Thunderstorm and strong winds blew away hopes for exotic antennas. Off to slow start but condx excellent later. FB contest: K8IQQ: Wasn't going to enter contest but it turned out I had lots of fun and just wish I had been on longer. Heard my first Eu. DX and worked a G. What a thrill!

9th District

W9PNE: DX condx were wild with Europeans coming in from sunset time to 0800 GMT. Far longer than ever before. However, it was one-way skip for me. Spent the best part of 4 hours per night calling Eu.'s but worked only one. Very frustrating. Sure was highly competitive this year. Stations sure were crowded in the 2 active segments. Contest is really lots of fun. WA9AMZ: This was the first time that I have really gone "all out" to get set for a contest. Heard G3PQA as well as DL1FF and several other weak Gs between 06 and 07 GMT. We also think we heard a weak PAØ. K9GSD: Real fine contest. Sure wish had gotten started when test commenced and not at 0600 Z. Worked first DX in 6YACZ. FB test.

10th District

WØCDP: A very fine contest. Missed it last year due to moving to the big city. 160 is a lot easier to work out in the sticks—these broadcast band harmonics knock out a lot of useful kcs. [You can say that again—*ed.*] WØDK/Ø: Again operated from the site of KDEY using their 185′ towers for xmtg and rcvg. WØNFL: Tnx to *CQ* for fb contest. First time I really entered. Hope to be back next year with better receiver and antenna. WØVFE: First contest on 160 for me. Got antenna up half an hour before and only 20 feet off ground. Sure had a great time. Took me ten years before I got on 160 but I'll be a regular from now on. WØAIH: I can't forget some of the outstanding W6 signals and the European opening Sunday morning. The mid-west certainly had the joy of being able to operate both lower and upper segments but this is only a small comfort when I recall the east coast working Europe like I work them on 14 mc! Does any W1 or W2 want to exchange QTHs? My ears certainly had a ringing sensation Sunday morning . . . most peculiar.

Canada

VO1DX: Condx here were excellent and regret now didn't stay up all night. Activity was at the highest level yet. Added 5 new countries to my total. The 550 foot longwire put up last year really paid off. Received many S7/S8 reports from across the pond. VE2UQ: It's a great scramble and much fun. It was interesting to work G3GRL at 2143 Z. Condx much better the first night but at all times were fairly good but not up to 1963 on the Eu. path. VE2ATU: Generally I found condx to be good and heard lots of DX but due to local condx I wasn't able to get out too well. Noise level very high most of time and I had great difficulty with freezing rain on my antenna feeders and insulators. Suppose this is one of the penalties one must pay for living so far north. VE3BWY: I am wondering if the QSO with OK1ADM was the first VE/OK on 160? [Dunno, Ham. Better check VE1ZZ—*ed.*] We moved into a better location in a high part of Toronto where reception is excellent. VE3AGX: Condx poor here. Just after Contest started it rained for 6 hours. Noise level very high due to 3 rows of high line hydro towers each carrying about 400,000 volts just ¼ mile away. On Saturday and Sunday got the tail end of hurricane with gale winds up to 65 m.p.h.

K5TFG, Dick Baxter was the lone Louisiana entry giving a new state to 43 happy Top Band men in 3 countries.

DX DX DX DX DX DX DX

KL7AUV: I am not submitting any log because mine added up to a great big ZERO. Spent 4 hours calling and listening Friday and Saturday nights with nary a QSO. The main reason I made no score is that none of the boys were listening on any but their own frequency and all of them were between 1800-1825 and 1975-2000. I didn't hear a single signal between 1875 and 1925. My 50 watts would be covered up at the low or high end but probably not in the middle segments. Back in 1937-40 I worked some good DX at night on 160 and, in spite of Loran, good DX is still possible using the proper technique. [What an absolute shame Jack had no luck at all. How many of us are kicking ourselves in the knowledge now that such a rare country and state was a-rarin' to go with QSOs?—*ed.*].

DL7AA: A very nice contest. Next year hope to have more time for participation. KH6EPW: Located on beach 50′ from the surf on the windward side of Oahu. HR3HH: I feel that the contest this year was a success again as far as participation goes. We heard many stations. However, I don't believe the condx were as good as in the past. Europeans were heard both evenings but for a very short duration. I had one come back to me but was unable to copy. DL1FF has the outstanding signal not only in the contest but all season long. Don't know how many times I've called him. On the other hand I receive s.w.l. cards saying that many Europeans are calling me almost every time I operate—hi! 6YACZ: Regret I cannot find my copy of the rules so don't know if this is acceptable as an entry as unable to compute total score. [your log was fine, Dev, as was Peter's, 6YAXG—*ed.*] PAØLOU: Unfortunately I didn't have much time available for participation this year. Hope next year is better. GI6TK: Sorry I could operate for only a few hours as I had a touch of flu and felt real shakey. Where was all the DX such as EP, EL, CT1, etc.? I got a great thrill when K5HRR came back to me. Think this contest should get a bit more publicity. Let's have a test in the middle of the week for a try-out and see who the keen boys are. In my opinion, though, this contest is tops.

VS1LP: Here is my log for the 1964 160 contest. As you can see, there are only two "live" entries in the log but all the same they were big ones for me as they represent my first and second DX contacts on 160 after weeks of frustrating unanswered calls. In addition, each one represents a "first ever" contact between Singapore and the country concerned on 160. The day after the contest at 1440 Z I worked W6ML which makes a total of three different continents worked on 160 within less than 24 hours. It was a very memorable and exciting week-end and I thoroughly enjoyed the contest. Propagation condx were superb . . . really the best ever and I heard literally dozens of Europeans on from 2200 to 2345 Z. Heard literally dozens of Europeans and W6YY. Here's to a bigger, better and *longer* 160 contest in 1965!

OK1ADM: Very good condx during this test. HK4EB (569) and VP7 were heard. Plenty of W/VE peaked at 579-589. I am looking forward to next year's Top Band Test. OK1ZW: I heard W/K and VE/VO but I am sorry no QSO. The condx bad and very QRM/QRN. ■

Contest Calendar [*from page 66*]

ing the USA and North American possessions.

Rules are the same as in previous years and will be covered in detail in next month's CALENDAR.

Oceania DX

Phone—October 3-4 **C.W.**—October 10-11
Starts: 1000 GMT Sat. Ends: 1000 GMT Sun.

This is the old VK/ZL contest with an expanded format that has proved popular the past few years. Its the world working VK/ZL and Oceania. Unfortunately this year they will again be bucking the stateside clatter of the ARRL CD party during the c.w. week-end.

Rules are the same as last year and will also appear in next month's CALENDAR.

VU2/4S7 DX

Phone—Oct. 10-11 **C.W.**—Oct. 17-18
Starts: 0600 GMT Sat. Ends: 0600 GMT Sun.

This is a new one jointly sponsored by the Radio Societies of India and Ceylon. The object of the contest will be for DX stations to work as many VU2 and 4S7 stations as possible during the contest week-end. By plan or by coincidence the operating mode is opposite to other activities on those week-ends so no operating difficulties are anticipated for their first contest venture.

Rules in details will be covered in next month's CALENDAR.

CQ World Wide DX Contest

There will be no changes in the rules which are now well established and known the world over. However a brief run-down for the uninitiated operators in far away places might be in order.

1. All bands may be used, 1.8 thru 28 mc.
2. Competition is in three divisions: (a) Single operator, (b) Multi-operator, single transmitter, (c) Multi-operator, multi transmitter.
3. Single operators have the option of operating on all bands or on a single band only. Multi-operator stations however are judged on all band operation.
4. Serial numbers, RS/RST report plus your zone.
5. QSO point value: (a) 3 points between stations in different continents. (b) 1 point between stations in the same continent, but in different countries. (c) Contact between stations in the same country are permitted for zone and/or country multiplier but have *no* QSO point value. (d) *Exception:* Contacts between stations in the

[*Continued on page 87*]

Prop. [*from page 64*]

Time Zone: PST (24-hour time)

WESTERN USA TO:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe	10-12 (1)	06-11 (1) 11-13 (2) 13-17 (1) 22-00 (1)	19-01 (1)	21-00 (1)
Northern Europe & European USSR	09-12 (1)	07-10 (1) 20-23 (1)	19-00 (1)	*Nil*
Southern Europe & North, West & Central Africa	11-14 (1)	06-08 (1) 08-11 (2) 11-13 (1) 13-16 (2) 16-19 (1)	18-19 (1) 19-21 (2) 21-22 (1)	19-22 (1)
Eastern Mediterranean & East Africa	08-11 (1)	06-12 (1) 19-21 (1)	*Nil*	*Nil*
South Africa	10-13 (1)	05-13 (1) 13-16 (2) 16-18 (1) 21-23 (1)	18-19 (1) 19-20 (2) 20-21 (1)	19-21 (1)
Central Asia	17-19 (1)	06-07 (1) 07-09 (2) 09-10 (1) 16-17 (1) 17-18 (2) 18-21 (1)	05-07 (1)	*Nil*
Southeast Asia	16-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 19-00 (1)	03-07 (1)	03-06 (1)
Far East	14-17 (1) 17-19 (1) 19-20 (1)	06-07 (1) 07-09 (2) 09-19 (1) 19-21 (2) 21-23 (1)	00-02 (1) 02-06 (2) 06-08 (1)	03-07 (1) 04-06 (1)†
Southeast Asia	17-20 (1)	06-07 (1) 07-09 (2) 09-12 (1) 20-00 (1)	05-07 (1)	*Nil*
Far East	14-16(1) 16-18 (2) 18-20 (1)	05-06 (1) 06-08 (2) 08-13 (1) 20-22 (1)	05-08 (1)	*Nil*
Pacific Islands & New Zealand	12-14 (1) 14-18 (2) 18-21 (1)	17-19 (1) 19-21 (2) 21-23 (3) 23-02 (2) 02-07 (1) 07-09 (3) 09-11 (2) 11-13 (1)	23-01 (1) 01-06 (3) 06-07 (2) 07-08 (1)	01-03 (1) 03-06 (2) 06-07 (1) 03-06 (1)†
Australasia	14-16 (1) 16-19 (2) 19-21 (1)	18-20 (1) 20-00 (2) 00-07 (1) 07-09 (3) 09-10 (2) 10-11 (1)	03-04 (1) 04-06 (2) 06-08 (1)	04-05 (1) 05-06 (2) 06-07 (1) 04-07 (1)†
Northern & Central South America	11-13 (1)* 13-16 (3)* 16-17 (1)* 07-10 (1) 10-12 (2) 12-15 (3) 15-17 (4) 17-19 (2) 19-21 (1)	00-06 (1) 06-08 (3) 08-10 (2) 10-12 (1) 12-15 (2) 15-19 (4) 19-22 (3) 22-00 (2)	19-21 (1) 21-22 (2) 22-01 (3) 01-03 (2) 03-06 (1)	21-23 (1) 23-02 (2) 02-05 (1) 23-05 (1)†
Southern Brazil Argentina, Chile & Uruguay	11-13 (1)* 13-15 (2)* 15-16 (1) 07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-17 (4) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-18 (3) 18-20 (2) 20-22 (1)	20-22 (1) 22-02 (2) 02-06 (1)	23-05 (1) 23-04 (1)†
McMurdo Sound, Antarctica	12-16 (1) 16-17 (2) 17-19 (1)	14-16 (1) 16-18 (2) 18-20 (3) 20-22 (2) 22-00 (1) 07-10 (1)	23-06 (1)	*Nil*

Pacific Islands & New Zealand	12-14 (1) 14-18 (2) 18-20 (1)	07-08 (1) 08-10 (2) 10-18 (1) 18-20 (2) 20-22 (4) 22-00 (2) 00-02 (1)	21-22 (1) 22-05 (3) 05-07 (2) 07-08 (1)	22-01 (1) 01-04 (2) 04-06 (1) 02-06 (1)†
Australasia	12-16 (1) 16-20 (2) 20-22 (1)	17-19 (1) 19-20 (2) 20-22 (3) 22-00 (2) 00-07 (1) 07-09 (2) 09-13 (1)	01-02 (1) 02-03 (2) 03-05 (3) 05-07 (2) 07-08 (1)	02-03 (1) 03-05 (2) 05-06 (1) 03-05 (1)†
Northern & Central South America	11-12 (1)* 12-14 (2)* 14-16 (1)* 07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-20 (1)	09-10 (2) 10-13 (1) 13-15 (2) 15-18 (4) 18-20 (3) 20-22 (2) 22-06 (1) 06-09 (3)	17-20 (1) 20-00 (3) 00-02 (2) 02-06 (1)	19-21 (1) 21-01 (2) 01-04 (1) 00-03 (1)†
Southern Brazil Argentina, Chile & Uruguay	12-13 (1)* 13-14 (2)* 14-15 (1)* 07-08 (1) 08-10 (2) 10-12 (1) 12-13 (2) 13-15 (3) 15-17 (2) 17-19 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-21 (1)	19-21 (1) 21-02 (2) 02-06 (1)	21-04 (1) 00-03 (1)†
McMurdo Sound, Antarctica	11-16 (1) 16-18 (2) 18-20 (1)	07-09 (1) 16-18 (1) 18-20 (2) 20-22 (3) 22-23 (2) 23-00 (1)	00-07 (1)	*Nil*

One Step Short [*from page 39*]

connection. To Pupin it was a verification of his Idvor signalling days; and thereby lies the point of our final tale. We can best illustrate by quoting directly from Pupin's autobiography: "Every now and then we are told that wireless signals might be sent someday to the planet Mars. The judgment of a former herdsman of Idvor considers these suggestions unscientific for the simple reason that we cannot get a ground on the planet Mars and, therefore, cannot take it into close partnership with our Hertzian oscillators. Without that partnership there is no prospect of covering long distances."

In 1930-31, Karl Jansky, a Bell Telephone engineer, was investigating the noise impulses often heard on long distance telephone calls. Buried in the noise was a constant hissing signal. After diligent research Jansky was convinced that the hiss originated with radio waves emanating from outer space. An American radio amateur, Grote Reber, became interested in the extra-terrestrial emissions. Using modest equipment he built the first radio-telescope. The radio frequency radiations were in fact coming from the Milky Way. The ground concept of Pupin had vanished into space.

Today we accept as commonplace the radio transmission of signals from deep space probes in the vicinity of our planets. We use the moon as a target to relay radio waves back to earth. We look ahead to a network of radio communication from planetary space ships to Earth. We feel no sense of miracle in this; we say it is science. To Pupin, this was outside of reality. Perhaps, if he could have listened to the imaginary voice of radio, it might have whispered: "The difficult I do immediately, the impossible takes a little longer." ■

15 & 20M. S.S.B. Adapter [*from page 46*]

It was pointed out, in the discussion of the mixer, that the 7360 mixer tube attenuates the fourth harmonic about —40 db. An input s.s.b. signal of 3,650 kc to the 7360 tube mixes with the crystal oscillator frequency of 10,350 to produce a 14,000 kc signal. The fourth harmonic of 3,650 is 14,600 kc which does not fall within the 20 meter band. This signal should be reduced an additional —20 to 25 db by the two tuned circuits of the 12BY7A amplifier stage. This unwanted signal should be further reduced in the 2E26 final stage.

An input s.s.b. signal frequency of 3550 kc to the 7360 mixes with the crystal oscillator frequency of 17,450 to produce an s.s.b. output frequency of 21,000 kc. The 6th harmonic of 3550 is 21,300. This unwanted signal should be attenuated about 60 db if care has been used to keep the Q of the mixer and 12BY7A amplifier coils (L_5, L_8 and L_9) as high as possible. This harmonic will sweep across and out of the 21 mc band as the exciter is tuned to the high end. This harmonic should not give any trouble but it should be checked as a matter of routine.

The 5th harmonic of a 4 mc input s.s.b. signal almost reaches the 21 mc band. The 5th harmonic of a 4 mc is 20 mc which is still outside of the band and well away from the frequency of 21,450 kc to which the exciter is tuned. Attenuation of this unwanted signal should be at least 70 db or better and certainly should give no trouble.

Power Supply

This unit obtains its power from the power supply, (unit no. 4 in fig. 1) that furnishes power for the 40-80 meter exciter. This heterodyne unit is provided with a flexible power cord and a male plug that plugs into a female auxiliary power plug on the rear of the 40-80 meter exciter.

Operation—More Power

Operation of this unit is similar to the operation of the 40-80 meter exciter described in an earlier article. That previous article should be referred to for typical operating conditions, a.m. and c.w. operation as well as s.s.b. operation.

It is possible to transform the unit from the exciter class to the transmitter class; the power may be approximately doubled by doubling the plate voltage to the 2E26. A further increase in power may be obtained by replacing the 2E26 with a 6146 which fits the 2E26 socket. If this is done the bias voltage must be changed accordingly. If still additional power is desired it can best be obtained by increasing the plate voltage of the 6146 to 800 volts and again adjusting the 6146 bias voltage and possibly the screen voltage accordingly. Finally, two 6146's may be used in parallel if that much power is desired, particularly if one has no thought of adding a linear amplifier in the near future. ■

DXing from G Land [*from page 43*]

the whole of Europe—and probably ten times as many!)

Vee-beams and rhombics are as rare as ZD5's —we live on a small island and there isn't the room! Even on 160 meters there are large numbers of hams struggling along with 67 foot wires

The Bands Available

Nominally, we are allowed to use the same bands as you are, from One-Sixty down to Ten . . . but the conditions are very different. On 160 meters we have the full use of 1800-2000 kc, but on a shared basis; and our co-partners in this are Loran, other navigational beacons, ship-to-shore telephony (high-powered coastal stations every 7 kc throughout the band) and *trawlers,* hereinafter known as Fish-Fone. The latter are probably the worst encumbrance, because they are liable to pop up anywhere, and invariably run to about 600 per cent modulation. (If we hear an extraordinary mixture of whistling and scratching noises on about 1950 kc, the chances are that it is a trawler on 1900 or 2000 kc!) Stations living on or near the coast are naturally the worst sufferers.

One other thing, of course—on 160 meters we are limited strictly to *ten watts input.* With this, however, the few stations with really efficient antennas can reach across to Stew of W1BB and his many collaborators, when the conditions are really good. More normal working covers the whole of the British Isles with good signals, both phone and c.w.; and we can often work the OK's, HB9's and the like. Good DX for us is the occasional ZB1 or even OHØ who shows up. G6CJ and G6GM scooped the pool a few years back by working ZL, but that was a matter of very careful preparation and skeds at precisely the right time, and could not be repeated by the average ham. Owners of outstandingly good G signals, heard over on your side on 160 meters, are most certainly those lucky enough to have antennas at least a half-wave long and strung up reasonably high . . . *and* an unusually good QTH in which to plant them.

Eighty meters is another "shared" band for us, various services using it for short-haul work. Our band is only 3500-3800 kc, and this is now rapidly filling up with high-powered RTTY, in addition to all the strange chirpy things which we put down to mobiles in the services. But, once again, those with the right antenna can work all the DX on Eighty, both on s.s.b. (around 3795) and c.w. (3500-3550). The s.s.b. gang, in particular, have recently been making their lists of DX worked look like 20 meter lists.

On Forty we are even more handicapped, the band now being only 7000-7100 kc. And in the middle of that there are liable to be broadcast stations in those countries who are not signatories to the international agreements. Further, where there are pirate broadcasters there is also jamming. So only the brave spirits attempt real DX on Forty, and they need first-class receivers as well as good antennas. However, working the U.S.A. has been pretty easy during the winter and spring, either from 2200 GMT onwards or around 0700-0900 GMT.

Twenty, Fifteen and Ten have no particular problems on this side. The conditions under which we use the bands are almost identical with yours. One snag which possibly hits us harder over here is the proximity of Russia, the owner of most of the jammers, which have a delightful habit of parking, in an "idling" condition, in either the 20 or 15 meter bands for long periods.

Time-Tables

Because of our geographical position relative to the U.S.A., our times for DX working would probably strike most W operators as curious, and sometimes inconvenient. A typical day on Twenty (when conditions are good) might look like this: 0600-0830, West Coast U.S.A. and possibly some Pacific DX; 0700-0930, VK and ZL; 0930-1130, mostly Europe!; 1130, first East Coast W's breaking through, peaking around 1230 and fading out again; 1300-1500, not much, but possibly Middle East and Africa; 1500-1700, U.S.A. West Coast comes in and goes out again; 1700-2000, South Africa and sometimes South America, with preponderance of East Coast W's carrying right on until 2300; 2000-midnight, W's and Central/South America; midnight-0600 (in summer only), mostly W's.

The Far East and the Pacific are elusive, sometimes coming over the long path in the early mornings, sometimes *via* short path in the middle or late afternoon. And, of course, the time of year makes a great difference. In lean sunspot years Oceania often becomes quite a rarity during the summer, and starts appearing again (usually 0700-0900) in about October.

On Fifteen things are rather different; the W's never appear until 1400 or thereabouts, and during the morning there may be some good Far East and even Pacific DX on the band. If the North Atlantic path is not open during the afternoons, we are liable to find the odd VS1, 9M2, VS6 and the like instead. Sometimes, VK and ZL (mostly the latter) are excellent in the mornings—not very early, but at their best around 0900. Rare Pacific DX may also show up on the odd lucky date. W's, in the summer, are there from 1400 until fade-out, which may be quite late; in the winter they last only for three hours or so. On the odd day, the West Coast may hold its own with the East, or even predominate, but just as often no W6's or 7's are there at all. Sometimes, when the path is best in a southwesterly direction, one would think that no W's except the fifth district were on the air at all. Other times the 4's have it. But it is more usual for the band to be full of W1, 2, 3, 8 and 9 with a smattering of the other districts.

TVI Trouble

TVI is a fairly acute problem in Great Britain, since the BBC stations operate in Band I, on frequencies from 41.5 mc to 66.75 mc. Also, we do not have stations in every town, but they are regionally grouped. So lots of amateurs may find

themselves in a fringe area, where the TV signals from the nearest station are pretty weak; but they still have the full responsibility for non-interference. Working on 14 mc in a district relying on Channel I, for instance (41.5 mc sound, 45 mc vision) can mean a long and desperate hunt for the third harmonic, and keeps a fair proportion of amateurs off the air altogether during the main hours of TV entertainment, if the location is as much as 75 miles from the TV station, which it may well be.

Gear Available

Naturally, with such a small ham population, we have nothing like the choice of equipment that you have. There are quite a few firms turning out excellent transmitters and receivers (at prices that would astonish you in the States), but only in small quantities. The Government surplus market is flourishing, and the London junk-shops are hard to get into at week-ends, when one would put our ham population at a much higher figure than 10,000! Even the RCA AR-88D, that wonderful receiver that pervaded Europe in such quantities during the war without ever becoming well-known in the States, is still available in brand-new condition at prices between 150 and 200 dollars—probably one of the best buys of all time (it would assuredly cost more than five times that figure to build now).

American equipment is freely available over here, but the prices (including import duty) put it beyond the range of most of us. Not only are the prices high even by your standards, but the average income-level over here is probably between one-half and one-third of the figure in the U.S.A. For example, a Viking Invader is priced at £285 (say 855 dollars), a Hammarlund HQ-170 at £184 (562 dollars) and a Drake 2B at £138 (414 dollars). British-built equipment is much cheaper but does not always fill the requirements so well—not that it is inferior in quality, but there is not the breadth of choice.

Home-brew flourishes—probably in a somewhat higher proportion than in the States. A surprising number of stations boast *complete* home-brew (transmitter, receiver and all auxiliary equipment); many more stop short of building the receiver (not surprising with second-hand AR-88D's at 100 dollars or so!) but can say that everything else in the station is amateur-built.

This has been a pretty sketchy picture of life and conditions in G-land, but we G's seem to have one thing in common—we always enjoy working you fellows in the States . . . and because there are such a darn great number of you there is seldom any shortage of QSO's! Furthermore, when real DX conditions are pretty bad, it's safe to say that we can find one band or another on which it's possible to get a QSO with W-land at some time during the day. If it isn't, then you can really write a note about bad conditions in the log. We sincerely hope that the enjoyment is mutual, and look forward to many more thousands of QSO's across the pond. ■

Cubical Quad [*from page 43*]

Differing ground, mast, guys and proximity to other buildings can all cause changes in the resonant frequency of the system.

Checking the front to back ratio on transmission should be carried out with a station at least 1,000 miles away as local checks are very apt to be erroneous due to radiation from other antennas and buildings. One local ham 7 miles away measured our F/B ratio 12 db; two others, one in Hawaii and the other in California both said the F/B ratio was in excess of 40 db.

Painting

The spider and booms should be galvanized, but if such treatment is not possible all steel should be treated with a rust inhibitor and painted with two coats of zinc base primer and two coats of silver finish. Careful preparation of all steel work prior to painting will be well repaid by the long rust free life of the work.

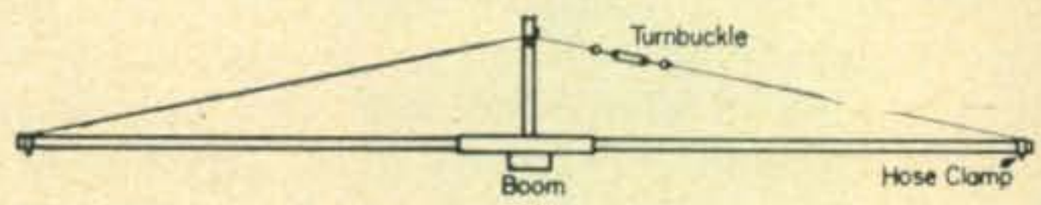


Fig. 6—To prevent boom sag a 2′ length of ½″ steel tubing was weld to the side of the boom mount. A 3″ ¼″ diameter is welded to the top of the rod as a hook to support the ⅛″ stranded steel cable. The tension is adjusted with the turnbuckle.

Bracing

Due to the light material used in the "boom" a 3/16" stranded steel cable brace was fitted as shown in fig. The cable can be fastened at each end of the boom with hose clamps. A 2′ long vertical post was fastened to the center of the boom or mast. A light turnbuckle provides for adjusting the tension of the cable. Nylon fishing line of 100 lb. weight is used to brace the quad spreaders. The line is fastened to the ends of the boom and tied to each spreader at about 9′ above the spider. This bracing really stiffens the spreaders. ■

RTTY A-Z [*from page 29*]

Up to this point in referring to the speed of teletype machines, the author has talked in terms of words per minute such as you would speak of automobile travel in miles per hour. Like the car, a teletype machine has a motor and gears which have a bearing on the speed. In the case of the teletype machine it is powered by a synchronous electric motor of fixed r.p.m. and the speed of the teletype machines main shaft (called the receiving shaft) controlling the printing mechanism is determined by the fixed gears connecting the motor to this shaft. Naturally, the C.C.I.T. speed of 66.67 w.p.m. requires a considerably higher receiving shaft speed than does the American Bell system speed of 61.33 w.p.m.

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The speed of the receiving shafts of the two machines must be essentially the same and the code speeds in bauds should also be the same for two machines to be compatible. For instance, the U.S. Western Union 65 w.p.m. machines and the U.S. Bell 61.33 w.p.m. machines are compatible since each have a receiving shaft speed of 420 r.p.m. and the code speed of each is 45.45 bauds. The difference in speed is due to the fact that the stop pulse of the Western Union code is 22 ms as compared to 31 ms for the Bell System machine code.

Machines that operate at 60 w.p.m. or at speeds that can be readily converted to 60 w.p.m. are not as easy to come by in foreign lands since, invariably, the commercial users in such lands use speeds other than the U.S. Bell system where most of our machines come from. It must be realized, in discussing the various transmitting speeds, that average speeds or average w.p.m. are meant since we are dealing with machines or mechanical devices.

Code Nomenclature

The five unit code is often referred to as five channel and as five level with all three meaning the same thing. The units themselves are often referred to as "bits" and the bits per second is the baud speed as already covered. It is 45.45 bauds for a speed of 61.33 w.p.m. (rounded off to 60 w.p.m.). It will be noted that in speaking of the aforediscussed code as a five unit or five level code, we are referring to the five levels of "intelligence changing portions" of the total of seven transmitted portions that make up each character. The "start" of every character is always a *space* and the end of every character is always an On pulse, so it is only the five equal length time segments (22 ms for the amateur 60 w.p.m. Code) inbetween that change in forming the characters. Therefore, the reference to it as a five unit code.

Nevertheless, the code is sometimes referred to by its entire character make up. In this case they take the entire character length which is 163 ms and divide this by the time length of each of the 5 middle units (22 ms) to determine the code units. Thus $163/22 = 7.42$ units. For the U.S. Western Union code with a character length of 154 ms we would have $154/22 = 7.5$ units. For the 100 w.p.m. U.S. Code with a character length of 100 ms we would have $100/13.47 = 7.42$ units.

Frankly, the author prefers to think of all of these codes simply as 5 level codes. There is a good reason for this. There are codes of other levels such as an eight level code in which there are now eight character forming time segments that may be either space or pulse in forming the characters instead of 5 character forming time segments as in the aforediscussed 5 unit codes. Eight level codes and others have varied applications in advanced telephone system services,

data processing, computers and the like. An eight level code is shown in fig. 3 (E) as a basis of comparison with the four samples of the five level code also shown in fig. 3. As radio amateur RTTY'ers, we are only interested in the 5 level codes herein discussed and particularly the 60 w.p.m. one since it coincides with the FCC requirement and the machines available for our use.

Part II, next month, will take up the subject of the Teletypewriter machines with a generous assortment of pictures of the more common types in use by American radio amateurs. Internal views of the machines will also be given, showing their mechanical construction.

[*To be continued*]

LASERS [*form page 26*]

suddenly changes. It is the point at which the population of excited chromium atoms has been inverted and there are more chromium atoms at level E_1 than there are at E_0. At this point, photons begin to interact with chromium atoms at level 1 to a significant extent. This results in stimulated emission of other identical photons and a cascade begins. Photons travelling parallel to the long axis of the crystal, which is several centimeters long and about ½ centimeter in diameter, will continue in the same direction until they strike the end of the crystal, where they are reflected back into the crystal.

Photons travelling in any direction other than this will pass out of the ruby. In the meantime, photons moving back and forth inside the crystal will continue to build until the intensity of the radiation is great enough, at which time some of it bursts through the end of that face that is slightly transparent, in a coherent pulse of light. This is shown in fig. 3.

Coherence

Because a photon emitted by stimulation of another photon is in phase with the first, because the frequency of both is the same, and because both travel in the same direction, the beam emitted has space, time, and directional coherence. Coherence can be shown by repeating an experiment used in the early nineteenth century by Thomas Young to illustrate that light consisted of electromagnetic waves.

In this famous experiment light passes through a flat surface in which two small parallel slits have been cut. If light from one slit reaches a point on a screen behind it in phase with light from the second slit there will be a brightening on the screen. If the light is not in phase, one source will cancel the other and there will be a dark area on the screen.

By placing two parallel slits directly against the surface of the ruby from which the light emerges, an interference pattern will appear. It has been found that this interference pattern is in very close agreement with what has been theoretically calculated assuming a plane wave that is perfectly coherent emerging from the two slits.

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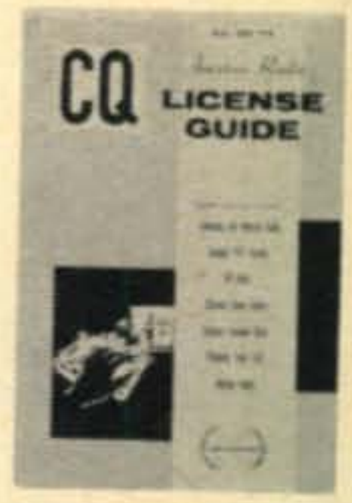

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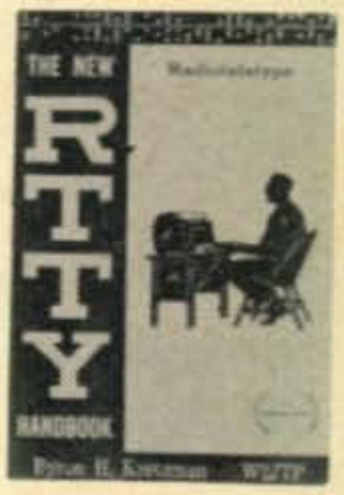

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Xenon flash tubes are most frequently used to pump ruby lasers. These emit intense pulses of light which last about one half to two milliseconds. Laser output at room temperature is of somewhat shorter duration than this, running from about one to two milliseconds.

Because of heating effects, it is not possible to operate a ruby laser continuously at room temperature without damaging the crystal. In 1962 Bell Laboratories announced the development of a ruby laser that would operate continuously. This was made possible by using a new method of pumping, and by operating the laser at liquid nitrogen temperatures (about 200° below 0° C).

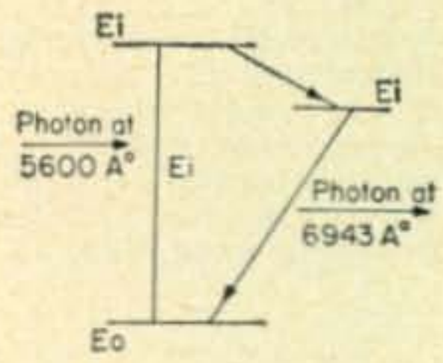

Fig. 4—Energy level diagram for chromium. A photon at 5600 Angstrom rises the level from E_o to E_1. The photons give up some energy to the crystal lattice by dropping to E_1, a metastable state where they remain several milliseconds. Decay to E_o, the ground level, from E_1, results in the emission of a photon in the red portion of the spectrum either spontaneously or by interaction with another photon.

Other Laser Materials

Since Maiman's first ruby laser in 1960, other materials have been used successfully to obtain laser action. Among these have been calcium fluoride, calcium tungstate, and even glass, as host materials. In addition to chromium, dopants used have included neodymium, dysprosium, and uranium.

The only solid-state laser to operate continuously at room temperatures was announced several years ago by Bell Laboratories. It is a calcium tungstate-neodymium doped crystal. Output power is very low.

Ruby is still the most widely used material, and most laboratories currently doing solid state optically pumped laser research use the ruby crystal.

[*To be continued*]

VHF [*from page 70*]

That Trophy's Still Unclaimed

Just got a note from Abe Cutler, WA2ONB, who reminds us that the East Coast VHF SSB Association is still offering a trophy for the first ham to work 48 states on six meter s.s.b. The present sporadic-*E* season has re-awakened considerable interest among the sideband operators, warns Abe, but further advises that no award like this has ever been made and "we think it would be an honor to the ham that can win it." We heartily agree.

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Drop a line to WA2ONB (or any member of the group) for a list of the 267 sidebanders in the New York to Washington, D.C., area and more award information.

Thirty

Our column's a bit smaller this month for a good reason. The XYL and I are in the process of moving to Port Washington, L.I., about four blocks from the new *CQ* headquarters. So it is more packing and unpacking, tearing down antennas and putting up new ones, etc. But never fear, we should be settled shortly. In the meantime, we are trying to compile the results of the *CQ* Spring V.H.F. Contest in time for the next issue. Sorry, we are not letting the cat out of the bag. You'll just have to wait to find out who won. In the interim, let's see what *you* can do in the August affair!

73, Bob, K2ZSQ

RTTY [*from page 84*]

of Danville, Ill., is on 80. W9WKC of Hoopeston, Ill., is giving away an AN/FGC-1. (It *must* be picked up!)

Comments

Several times in the past we have suggested that local, cross-town, QSO's be made on 2-meters, instead of on the h.f. bands, so that these frequencies might be made a bit clearer for more distant traffic. We have also suggested that the inexpensive commercial surplus f.m. ex-taxi and police car sets, now in good supply, be used for this purpose. They are ideal because their receivers as well as their transmitters are fixed (crystal controlled) on one frequency, and because their squelch circuits make monitoring painless. (Speakers are quiet until a carrier comes on.)

Where can these f.m. sets be found? Well, for a starter, try FM Surplus Sales, 1100 Tremont Street, Boston, Mass. 02120; and Northwest Electronics, Box 7, Chesterton, Indiana. We don't know of any sources on the West Coast, unfortunately.

73, Byron, W2JTP

YL [*from page 85*]

presses it, a "fighter," for what she feels should be done. At times, against tremendous odds, such as ill health, that fighting spirit has kept her on top. A Hungarian by birth, she moved to Belgium in 1935, where in WW II she many times barely escaped with her life in the bombings. During the German occupation she worked with the Belgian Underground, hiding people in her apartment, plus gun parts and ammunition parachuted in, until finally she herself had to go underground during the last 10 months of the war to keep out of the hands of the German Gestapo.

K5WZA is very active on c.w., holds 30 w.p.m. CPC, and also operates single sideband. She particularly enjoys the "XG" Radio Club c.w. net (she is NCS) comprised of former citizens of

England. Irene's OM (who is not a ham) was born in England and they lived in London (also in Pakistan) before coming to the U.S. in 1952. OM Henry is an architect, and artist and they share other interests such as music and reading (Irene reads in French and German) and are planning an architect's and ham operator's "dream house" to be built in the Sandia Mtns. east of Albuquerque. Irene has been taking courses in English and looks forward to one day writing of some of her experiences. With her determined spirit we know she will succeed. We salute you, Irene, as an outstanding amateur operator, and a most charming person!

The Eye Bank Net, of which K5WZA is a member, is in need of volunteers. Currently there are only two stations in Albuquerque on the net, Irene and Dr. Fred Low, K5LXM, a retired eye doctor. W5ZHN, Carl Frantz, is chairman of communications for the Eye Bank Net in New Mexico. Stations are needed throughout the state. The net meets on 7.205 kc every day except Sunday at 7:00 A.M. MST (1400 GMT) and again at 6:00 P.M. MST (0100 GMT) on 3.963 kc Mon. through Fri. Usually it takes only a few minutes to clear with the net; only when instructions must be transmitted for shipment of eye corneas does it take longer. Anyone willing to serve in the net should contact W5ZHN at 1100 Wade Circle, N.E., Albuquerque.

The national Eye Bank Net was started by WØGET, Dr. A. E. Braley, with assistance of Ted Hunter, WØNTI, on Dec. 20, 1962, to serve in connection with the Eye Banks established by Lions Clubs throughout the country. The Lions Clubs accept donations from people who express a desire to will their eyes to the bank. In order to be useful for corneal transplants, the corneas must be transplanted within 48 hours after the death of the original owner. In some cases of eye disease a transplant must be made within 24 hours or a person will lose the sight of his eyes. In cases of accident, usually a transplant must be made within 12 hours. Hence the great need of speed in reporting when eye corneas are needed and where they are available. The corneas are flown from one city to another in special refrigerated containers.

This national Eye Bank Net is performing a great public service. Check with your local Lions Club and see if you can help.

Among other YL stations in the Eye Bank Network are WA4IDV, Jo Ann; WØOMM, Donna; WØMRJ, May; K5LUZ, Mildred; K4LES, Connie; WA9GWZ, Bev.

Floridora YLs

During the FLORIDORA business meeting held at the Orlando Hamfest these officers were elected for '64-'65: Pres., K4RHL, Ellie; V.P., K4UIZ, Ev; secy, WA4NRO, Gale; treas., W4VSG, Sue. Certificate custodian is K4RNS, Marge, and P/C is WA4FJF, Ellen.

Congratulations to W4BWR, Ruth, for receiving the plaque awarded to her as being the most outstanding YL in Florida! 33, W5RZJ

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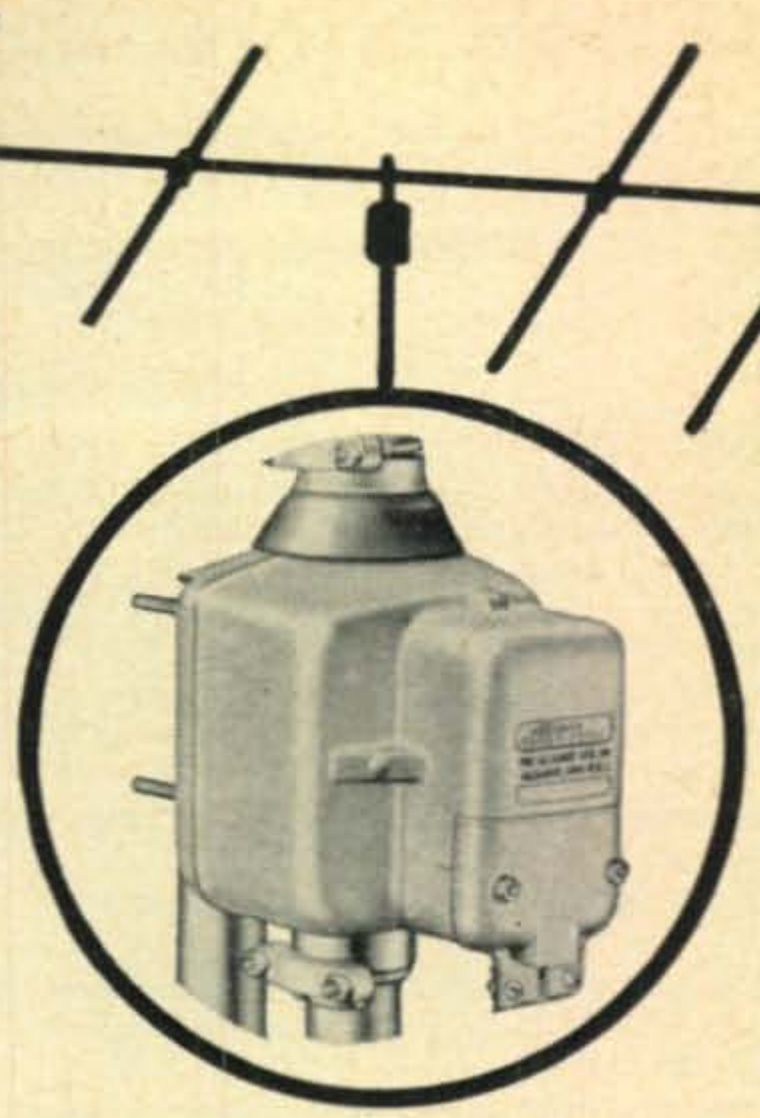

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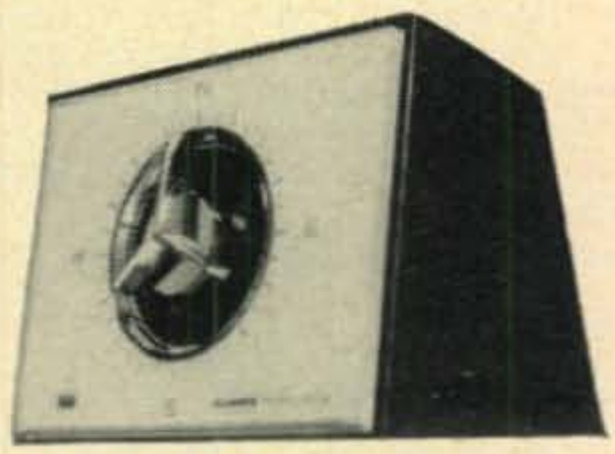

Model C-225

For further information, check number 44, on page 110

LAFAYETTE RADIO ELECTRONICS

THE CHOICE OF VALUE-CONSCIOUS AMATEURS THE WORLD OVER

LAFAYETTE "PRECON" AMATEUR PRESELECTOR CONVERTER

49.50

Imported

MODEL HE-73

- **Crystal Controlled**
- **For 80-40-20-15-10 Meter Bands**
- **As a Converter—Converts Receiver to Dual Conversion Operation**
- **Improves Selectivity**
- **Widens Band Spread**

A great 2-in-1 combination. Tuned interstage circuits and 2 stages of RF amplification assures higher signal-to-noise ratio, improved I.F., image rejection. Easy to install.

PROFESSIONAL-QUALITY 14-TUBE COMMUNICATIONS RECEIVER MODEL HE-80

129.50

Imported

- **Dual Conversion on 6 Meters**
- **5-Bands: 550KC-54MC**
- **Product Detector Circuit for Improved SSB Reception**
- **Separate BFO and Q-Multiplier Circuits (can be used simultaneously)**
- **Crystal Calibrator**
- **Efficient Superheterodyne Circuit**
- **Effective Automatic Noise Limiter**
- **Voltage Regulated Power Supply**

Features outstanding sensitivity, Q-Multiplier selectivity and electrical bandspread, makes a handsome addition to your ham shack. Calibration crystal is sold optionally.

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Bronx, N. Y. — Boston, Mass.
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Send for Big New 422 page 1964 Catalog

LAFAYETTE RADIO ELECTRONICS
Dept. CH-4 BF P.O. Box 10
SYOSSET L. I., N. Y. 11791

☐ Please send me new 1964 Catalog 640
☐ Ship Stock No. ..... $..... enclosed.

NAME .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

For further information, check number 45, on page 110

Ham Shop

Rates for the Ham Shop of 5¢ per word for advertising which in our opinion, is non-commercial in nature. A charge of 25¢ per word is made to all commercial advertisers or organizations. Since we do not bill for Ham Shop advertising, full remittance **must** accompany all orders.

Closing date is the 15th of the 2nd month preceding date of publication. Your copy should be typewritten, double spaced on one side of the page only.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein. We reserve the right to reject advertising which we feel is not of an amateur radio nature.

QSL's . . . $1.90 . . . Dime . . . Filmcrafters . . . Martins Ferry, Ohio.

CREATE a QSL with a "Sampler Instruction Kit" 25¢. Samco, Box 203-C, Wynantskill, N.Y. 12198.

QSL Samples, dime. Print Shop, Corwith, Iowa.

CB QSL CARDS. 3 colors gloss. Samples dime, C&S Printing, Box 284, Dunellen, N.J.

QSL's 100/$1.00 200/$1.85. Postpaid. Use own rubber stamp. We sell. Sample and catalog 10¢. Directory of Certificates and Awards $2.50. K6BX, Box 385, Bonita, Calif.

TOP PRICES paid for AN/GRC-3 thru 9, GRC-26, 27 to GRC you name it. AN/URM, UPM, USM, SG-1, 2, 12, 13, any and all mil test sets. GR, HP, Meas. Corp, Boonton, ARC, Tektronix, all commercial sets, AN/ARC-27, 33, 34, 44, 52, 58, 65, etc. R-390, 389, 388, SP-600, BC-610, T-368, We pay shipping. Call, Write, Visit our store. Tech. Systems Corp. 42 W. 15th St., New York 11, N.Y. Call Ed. Charol, CH 2-1949.

TOROIDS uncased 88 mh 60¢ each or 5/$2.50. Fasold, WA6VVR, Box 34, Dixon, California.

ATTENTION HAMS! We buy, sell ham gear. Repair and alignment facilities available. Hold Advanced and First phone. Used gear always reconditioned. Money back guarantee. KitKraft Company, P.O. Box 406—Canal St. Station, New York N.Y. 10013.

COMMUNICATIONS teletype, unusual surplus bargains. Free flyer, MDC, 923 W. Schiller, Phila. 40, Pa.

ANTENNA tuning unit, brand new $3.00 postpaid (cost Navy $85.00). MDC, 923 W. Schiller, Phila., 40, Pa.

REMOTE CONTROL unit, 9 tubes, AN/ARW-26, brand new, complete, $5.00 postpaid (cost Navy $125.00) MDC, 923 W. Schiller, Phila., 40, Pa.

FOR SALE Complete instructions including 28 page booklet and 22" × 36" schematic for converting the ART-13 transmitter to a.m. and s.s.b. Satisfaction guaranteed. $2.50. Sam Appleton, 501 No. Maxwell St., Tulia, Texas.

STOP! Don't buy, sell or swap until you see the latest interesting offers in "Equipment Exchange"! 12 big issues $1 sample copy free. Write: Brand, Sycamore, Ill.

WANTED: Commercial, military, all types, ARC, ARN, ARM, GRC, PRC, URR, URM, TS, 618S-T, 51R, 51X, APN, others . . . Ritco, P.O. Box 156, Annandale, Va.

CRYSTALS free bargain list. Nat Stinnette W4AYV, Umatilla, Fla. 32784.

ATTENTION RTTY'ers. Typewriter ribbon re-inking device—$3.00 postpaid! WØAJL—Walter E. Nettles, 201 So. Eudora St., Denver, Colorado, 80222.

SAVE Discount Catalog 10¢ Mladenka Sales, Rt. 1, Box 84, Flatonia, Texas.

FREE Electronics parts catalog. Bargains. Save. Power transistor 2N155, $1.00. Western Components, Box 2581, El Cajon, California.

ARE YOU LOOKING for New Ham or CB gear? We have closed one of our stores and have many specials in over-stocked new equipment which might be just what you have been looking for at a price which is exceptionally low. Please inquire specifically your interest and we will quote a surprising stock reduction price. Graham Radio, Dept. BB, Reading, Mass.

HAM EQUIPMENT Buy, Sell, Trade. Free details on HEED directory . . . WA2NHH, 1225 Hillside Pl., North Bergen, N.J.

WANTED Commercial, Military, Alltypes, ARC, ARN, ARM, GRC, PRC, URR, URM, TX, 618S-T, 17L, 51R, 51X, APN, others . . . Ritco, P.O. Box 155, Annandale Va.

6 METER TVI? Tiny high-pass filters for the worst TVI cases. install in less than a minute on any TV. Stops everything under 52mc. 100% effective or money back. $1.95. Communications Specialties 210 SanLorenzo, Pomona, California.

ATTENTION VHF CONTEST OPERATORS. The Mountain Top VHF RC, a world-wide contest club is open for membership. We need chapter presidents, in all 50 states. Small and large stations invited. Send for information and applications. Mountain Top VHF RC, 1424 Clinton Ave., So. Plainfield, New Jersey 07080

FOR SALE: 75A-4 #2453, filters, $450; HT-32 $300; HT-33 final, 2 new spare 4CX300's $250; Drake 2B, Q-Mult-Spkr new $225; Ranger $130. Any item or combo, no ship, meet halfway. W1AGS, Weston, Conn.

SX-100 HALLICRAFTERS receiver, perfect, $150. E. Long, 301 Jackson, Joplin, Missouri 64801.

WANTED: AN/GRC-3 thru 10, -19, -26, etc., RT-66, -67, -68, -70; R108, R109, R125, T-125, etc. Also receivers: 51J-, SP-600-, R-388, -389, -390, etc., and ARC-27, -34, -55, -6. Test Equipment—Military: TS-, -UPM, -URM, -USM; and commercial: H.P., G.R., Tektronix, etc. we pay freight. Amber Industrial Corp., P.O. Box 2129, Newark 14, New Jersey. Sell confidently. Our

ACCESSORY EQUIPMENT. Many specialties. Free Details. Halco., Box 283, Saxonville, Mass.

PRINTED CIRCUIT BOARDS Hams, Experimenters. Many different projects. Catalog 10¢. P/M Electronics, Box 6288 Seattle, Washington 98188.

CRYSTAL CLEAR bargains in xtals. Free list. Nat Stinnette, W4AYV, Umatilla, Fla. 32784.

HAMS Convert any television to sensitive, big-screen oscilloscope. Simple changes. No electronics experience necessary. Illustrated plans, $2.00. Relcoa, Box 10563, Houston, Texas.

WASHINGTON Amateur Radio News. Free copy. Foundation for Amateur Radio, 2509 32nd St., S.E., Washington, D.C. 20020.

WRITE for free lists of finest reconditioned amateur equipment. Guaranteed. On approval. Time payments. Buy the best for less. Henry Radio Company, Butler, Missouri.

FOR SALE: Johnson Viking "6N2" transmitter $90. Johnson "6N2" vfo $25. Ameco Nuvistor 6 meter converter and power supply $30. Will not ship. Write Frank, A.R.S. WA2UDD, 3-54 30th St., Fairlawn, N. J. or call 201 SW-70482.

TOROIDS 88 mh 50¢; SBE-33 mobile power supply, like new $30. K5BQA, 11040 Creekmere, Dallas, Texas 75218.

4-250A 800 watt 7 mc class C final. Fully shielded with all power supplies in 6' enclosed rack. Easily converted to all band. $100. Dave Allen W1WAI, 9 Upland Rd., Burlington, Mass.

NEED March 1959 issue of Radio-TV News. $1.00 ppd. Mark, R #1, Milos, Missouri.

GONSET Super 12 converter, excellent condition, $30. ATR Inverter 60 watts, 110 volts output, 6/12 volt input), $25. Mike Swink, KØVVR/7, 1210 Kearney, Idaho Falls, Idaho.

WANTED: Early round DeForest Audion with candelebra screw base also "H" transmitting tube, Boonton Q-meter, Radio News, callbooks, catalogs before 1926. W9EWK, 610 Monroe Ave., River Forest, Illinois. 60305.

SELL: Knight T-60 xmtr, R-100 rcvr, Lafayette KT-320 rcvr. Best offer. Donald Mays, Rt 4, Box 378, Madison Heights, Va.

COLLINS 32S-1, 75S-3, 516F-2 with cables and manuals. $995. Ayres, 325 Washington Ave., Jermyn, Pa.

DRAKE 1A $135; HE-45 and halo, $65; 80/40/20 m ssb/cw homebrew 160 watts, internal vfo, $60; 50m. ARC-5, $10; BC-453, $7; National 2 inch monitor scope, $15; R101B, $20; 4CX300A's, 35TG's, 4-125A's, 4-250A, 813's; 40 ft. triangular tower available August, $28. R. Bain, W8WNZ, 525 High Street, Wadsworth, Ohio, Tel. 336-0345.

SWAN SW-240 xcvr with matching SW-117 ac ps only $265. Both purchased new in January, this year, with receipts to prove it. Used very little, perfect electrical condition; not one scratch, mar, or other defect. In original cartons. Write Scharpf, 101 S. Illinois Ave., Atlantic City, N.J.

SX-101 MKIII Hallicrafters receiver & speaker for sale at $195. Like new. EICO 720 Transmitter for $59. FOB R. Treadwell, 86 Mossman Road, Sudbury, Mass.

NATIONAL NCX-3 ssb transceiver. Late model. Serial #55-8466 with NCX-A-AC power supply. Excellent condition $350. FOB Boston. K1VUX, Joseph Rand, 49 Old Morton St., Mattapan, Mass. 02126. Tel: 617-298-0196.

CENTRAL ELECTRONICS 200V The transmitter with everything, excellent condition $525. W8BPX, 7300 E. Aracoma, Cincinnati 37, 513-351-2612.

SALE Heath DX-60, Heath HR-10 rcvr with 100 kc crystal calibrator, new, used once. Also Heath VF-1, very clean. All with manuals. $125. K4FHG, 2001 Thomas Ave., Anniston, Ala. 36201.

TRI-EX HZR-71 for sale. Complete with rotating and raising mechanism, and height indicators. Original cost $2350. Sacrifice $900. W6YMD. Bill Guimont, 1980 Meadow View, Thousand Oaks, Cal.

SELLING OUT: Excellent DX-100, Modified for SB-10, Hammarlund, HQ-140-XA with built in crystal calibrator and speaker, Harvey Wells T-90 xmitter and Elmac PMR-7 receiver and ac and dc power supply for both. Contact Harold Sanders, K4QWJ, 1407 Mercer Street, Wilson, No. Car.

DRAKE TR-3 Serial 1326 with ac and dc supplies complete for $625. Vox just modified by Drake to TR-3A configuration. Also Hunter Bandit 2000A Serial 439 with Hunter bias modification $475. Both units mint condition used less than six months. K4ZJF, Milt de Reyna, 4030 Hallmark Drive, Pensacola, Fla.

FOR SALE Hallicrafters SX-111 with manual $150; Johnson Adventure with manual $35 or submit your price, both in A-1 condition. W6ERV, Larry Steels, 2711 Marengo Street, Los Angeles, Cal.

FOR SALE: Late model Heath Mohawk receiver with xtal calibrator, perfect condition $200; Collins 32V-3 transmitter, late model with new extra 4D32 tube, $250. FOB K8SNO, Ben W. Perks, 275 West Home Rd., Springfield, Ohio, Tel: 513-322-8613.

SELLING OUT GSB-100 $225, HQ-170C $200, both for $400; Heath VHF-1 $135, HB 10-6-2 rcvr $50, both $160. Other items, write for list. FOB. Bob, 626 26 Street, Cairo, Ill.

COLLINS 75A-4 receiver. Perfect. $500. Cash. 2.1 kc filter. Tom Murphy, 7319 Raton Street, Houston, Texas, 77055, phone OV 2-3032.

HIGH SCHOOL, college students . . . learn commercial radio announcing! 2,000 home-town radio stations need part-time disc jockeys, announcers, assistant play-by-play sports announcers! For books, magazines, write: Disk Jockey, Box 620-CQ, Pierre, South Dakota, 57501.

COLLINS S-Line 32S-1, 75S-2 noise blanker, c.w. filter. Make offer. W5HXW, 1234 Glen Cove, Richardson, Texas.

FOR SALE: G-50 $175 and Model 14 kbd $85. First check takes it. J. Ortiz, KP4GN.

SELL OR TRADE late model HQ-180C with speaker $275, DX-35 $35. Want HQ-110, Johnson Ranger I, Johnson Match Box, 275 watt model. Paul Sturpe, 1207 39th N.W. Canton, Ohio. Phone 492-3392.

SELL vhf ARC-5 transmitter with tech. manual, test unit and connectors $15. ARC-5, 3.5-4.0 mc with regulated power supply $15. BC-221, blank book, excellent condx $20. 1500 volt, 0.5 amps, primary 115 vac 60 cps $20. K1PSS, 121 Marble St., Athol, Mass.

GONSET GSB-100 $225, LA-400C linear $125, both excellent. Will deliver within 100 miles. W8CUT, 1776 Valnut, Coshocton, Ohio.

SELL OR TRADE: SP-600 JX-28 receiver, HQ-129X with Heath Q-Mult. Excellent condition. KE-93 Mobile rcvr with ac supply, S-meter, 12 vdc (as is). Prop pitch motor with 115 vac selsyns and indicator (unmodified). FL-8 audio filters, 115 vac selsyns. Tubes. Parts (sase) for list. Interested in good side-band exciter, Johnson 500, f/w Valient II or what have you. W5BBV, 3808 Gingerbread Rd., Alexandria, La.

SWL Ham in 1965. Need xmtr, rcvr, useable junk, can't afford to pay, even shipping. Would appreciate. James Hince, Box 325, Cayuga, Texas.

75S-1 $225 cash, 4CX1000A linear final with power supply, $200 cash. Leo Severe, RR2 Box 5, Wilmington, Illinois.

WANTED: KWM-2 & accessories ac & dc. Also want Millen Transmatch 92200 or 1 kw Match Box 250-30-3. Have a new Invader 200 to trade. F. E. Coble, 251 Collier Ave., Nashville, Tenn.

TECHNICAL MANUALS for military surplus electronics. Stamp for list. W3IHD, 4905 Roanne Drive, Washington, D.C. 20021.

FOR SALE Mint SX-101A w/spinner knob $270 and HT-32 $325. Steal both for $550. WA9HRN, 590 Crooked Lane, Battington, Ill.

FOR SALE: Heath O-12 scope $55; Heath PC-1 trans. power converter 12 vdc input/120 vac output $20; Heath GW-21 transceivers $75 pr; Morrow mobile rec 5BRF/FTR $100; Elmac Vibrator Supply 12/6 vdc in, 600 and 300 vdc out $25; Hal Skurnick, K2QYY, 180 East 163 St., Bronx 51, N.Y.

HT-37, new April 1963, used little, superb condition, $325 will ship prepaid and insured 500 miles in original carton. K5DMO, W. F. Koepp, 9750 Parkford Dr., Dallas, Texas. 75238.

HUNDRED QSL's: $1.00. Samples, dime. Meininger, Jessup, Iowa.

FOR SALE OR TRADE NRI TV course $15. CIRE Radio math course $5. Pickett slide rule $10. Sony transistor television, Knight transistor radio $4. RCA geiger counter $25. Send for complete list. Witmer, FAA, King Salmon, Alaska.

NEW! Unusual QSL's. Free samples. Johnny, P.O. Box 3554, Austin 4, Texas.

NO MORE COMMERCIALS! Uninterrupted music while you work. Background music adapter for car/home fm. $34.95 wired plus shipping, tax. Mail order only. Myers Enterprises, 14931 Roscoe, Panorama City, California.

COLLINS 32S-1 xmtr $380. 516F-2 ps $80.00. KWM-1, 516F-1 $375. All like new. WA9KBL. 815-323-2486.

QUALITY! Quantity! Terms! Trials! Trades! Over 1000 used units on hand. Big discounts applicable on most models. Write for free "Blue Book" listings. Leo, WøGFO, Box 919, Council Bluffs, Iowa.

KLEINSCHMIDT TT-76 or 6A tape equipment wanted immediately. Cash deal. W9UE, 6140 N. Hartling Ave., Chicago, Ill. 60645.

SELL All perfect condition Heath QF-1 $5; Mosley TA-31-Sr. $10; Hallicrafters S-102 2 meter receiver $10. M. Zakin, 67-48 181 st., Flushing, N. Y. 11365. OL 8-0837.

PEORIA HAMFEST September 20, Exposition Gardens, Peoria Area Amateur Radio Club. Registration $1.00 until Sept. 11. Write: Ferrel Lytle, W9DHE, 419 Stonegate Rd., Peoria, Illinois.

COLLINS 75A-2A for sale. The 75A-2A is the same as the 75A-3. Price $325. Dan Weatherman, K9ZGQ, Waveland, Indiana. Phone 317 435-2598.

ELIMINATE MOBILE vibrator noise. Transistorized vibrator substitute plugs directly into vibrator socket. Reduces battery drain. Same size as vibrator. 6 or 12 volts. Not a kit. Comes completely wired ready to use. For *negative ground* only. State make and model of transceiver. $11.95 ppd.—$5.00 deposit on all COD orders. Tel-Trol Systems 2180 Bronx Park East., Bronx, New York, 10462.

Did You Know

. . . that it costs only 5¢ a word to insert an ad in *CQ's* Ham Shop? That's right; only 5¢ a word will buy you an ad that will be seen by more active amateurs than *anywhere* else! So, why wait to sell that extra piece of gear or those spare parts? Simply send your typewritten copy along with your remittance (5¢ per word, minimum $1.00) to: Ham Shop, c/o *CQ*. The Radio Amateurs Journal, 14 Vanderventer Avenue, Port Washington, New York 11050. You will find that your ad has more than paid for itself.

12 DB GAIN forward. 100 db front to back ratio. Our rhombic antenna is superior to any other antenna on the market. We challenge you to find an antenna on the market with as much forward gain. We do not guarantee good performace, just the best. Specifications: 2000 watts p.e.p. 600 ohms impedance, swr 1.3 to 1, low Q, easy to match. Complete with high tensil strength copper wire, insulators, and termination resistor. This is the same antenna used by telephone companies for overseas communication. Sold on a fifteen day money back guarantee. Exact frequency must be specified. Order now! 20 Meters $44.95, 15 Meters $37.95, 10 Meters $39.95. The Hilliard Laboratories, Box 2614, Macon, Georgia.

ANNOUNCING! The 30th Annual Hamfester Radio Club Hamfest and Picnic, Sunday, August 9, 1964 at Sante Fe Park, 91st and Wolf Road, Willow Springs, Illinois, near Chicago. For complete information and maps write John Chass, K9LOK, 5434 South Bishop Street, Chicago, Illinois, 60609.

COMMUNICATOR III Gonset six meter with six good crystals. Excellent. $150. Sixer with three good crystals $35. Heathkit reflected power meter $10. Robert Hutcheson, 705 Harding Pl., Nashville, Tennessee.

MAKE REASONABLE OFFER. Heath Apache, Mohawk and AK5 speaker, expertly wired. Send SASE for goodie list. KØWMV, Joseph Bau, 638 40th St., S.E., Cedar Rapids, Iowa, 52403.

SELL: Link 120 watt fm Base Station. Fine for six meters $60; KWM-2, MM-1 Bandscanner, $1050. Excellent condition never mobile. FOB Dallas. W5EEY, Melton Goodwin, 11421 Fernald Ave., Dallas, Texas, 75218.

IF W1WAI and K7BIX will send a post card to the CQ offices we will send a free copy of the VHF Handbook by return mail.

WANTED 1945 issues of CQ magazine for CQ collection. Issues must be complete, including covers. Contact the CQ editorial offices concerning price and condition.

SWAN 12v mobile power supply $65. also Heathkit HW-12 sideband 75 meter transceiver $90, both excellent condition. Joseph Dubovy, 2890 Rouen Ave., Winter Park, Fla.

ORIGINAL TOOTS (CQ May, page 47) plus hour-counting meter and extras $35. or better offer. Like new BC-221AJ frequency meter with audio modulation, calibration and instruction books $65. Viking Ranger, factory wired, excellent, $135. Vibroplex $12. Latching overload relay $4. GE 150-volt ac meter $3. CQ's September, December, 1952; February, 1955. QST's July, August, 1928, March, May 1929; January, February, 1935; August, 1937; July, August, October, November 1941; October, 1952. Everything best offer. COD. Felstead, KH6CU, (2043) 1777 Ala Moana, Honolulu, Hawaii.

FOR SALE: Collins 32S-1 and 75S-1. Factory modifications. Less power supply. $600. No scratches, perfect condition. Hal Franks, K7BIX, 841 E. 6th Ave., Helena, Montana, 59601.

SELL Pair new 4X150 $40., pair new 4CX250B $62., Versteeg, 945 Martinique, Merritt Island, Florida.

Contest Calendar [*from page 88*]

North American continent *only* will count 2 points.

6. Your multiplier is determined by the number of zones and countries worked on each band.

7. The final score is determined as follows: (a) Single Band, Zones plus countries multiplied by the QSO points. (b) All Band, the sum of the zones and countries from each band multiplied by the total QSO points from all bands.

8. Certificates will be awarded to the top scorer on all bands and each individual band in each country and each call letter district in W/K, VE and VK.

That briefly covers the rules, but they will be published in detail in the September issue.

Official log forms and summary sheets are available from *C.Q.* Include a large self-addressed envelope with your request and don't forget to include sufficient postage. IRC's are acceptable.

Note our new address: CQ, 14 Vanderventer Ave., Port Washington, L.I., N.Y.

Editors Note

Some activities have been omitted from the "Calendar of Events" because we have not been notified in time. We need material for the CALENDAR but not that badly that we have to beg for it; their loss is greater than ours. Three months before the date of the activity is the very minimum of time the material must be in my hands.

There will be a delay in the mailing of the certificates this year, due of course to the moving of *CQ* to new quarters. So please bear with us, you *will* get your "wall paper."

Hope you are all having a pleasant summer.

73 for now, Frank, W1WY

YOUR mailing strip is IMPORTANT

X-62J2243Rc MAR 63

RONALD BUCHTER-WA2ZIM
75-40 BELL BLVD
BAYSIDE 64 L I N Y

Whenever you write to CQ concerning your subscription, change of address, or renewal, cut your mailing strip from the wrapper of your latest copy and attach it to your letter.

This will help us to find your stencil in our files which is the first step in faster, more accurate service to our readers.

CQ MAGAZINE
14 Vanderventer Avenue
Port Washington, L. I., N. Y. 11050

READER SERVICE

CQ Magazine, Dept. RS

14 Vanderventer Ave. Void after
Port Washington, L.I., N.Y. 11050 Aug. 24, 1964

Please send me more information on your ads in the Aug. 1964 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	A
11	12	13	14	15	16	17	18	19	20	B
21	22	23	24	25	26	27	28	29	30	C
31	32	33	34	35	36	37	38	39	40	
41	42	43	44	45	46	47	48	49	50	D
51	52	53	54	55	56	57	58	59	60	E
61	62	63	64	65	66	67	68	69	70	
71	72	73	74	75	76	77	78	79	80	

Total Inquiries ☐

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advertisers index

in various ham journals." *(You know CQ is always interested in u.h.f. construction articles. Why not tell Lou to give it a try?)* "Lou has made a miniature tripler small enough to be housed inside the final amplifier compartment. He is driving it with a 6360 in linear service with only 250 volts on the plate, and he can drive his 4X250B to full output easily! Believe me, the vacuum tube is dead in these applications." *(It looks like you have done a lot of research on varactors. We certainly aren't perfect and appreciate your comments. Keep them coming!)*

Vic, W5HPT reports: "Activity has been rather slow up to the past weekend, when the band opened up on 144 and 432 mc (May 3). I can't say how good it may have been on 220, since I still haven't got much in the way of gear other than the TRC-8." *(Hurry up, your missing a good bet not being on 220.)* "Conditions were good to Baton Rouge, La., W5UKQ; to Opalossis, La., W5KTR; to the deep south, W5ONS, Victoria, Texas; and to the west W5LID, Odessia, Texas from here in Bedford, Texas. A great number of stations were also copyable from Houston and San Antonio.

"Projects in the wind include a new antenna-converter switching arrangement, so I can switch any converter to either receiver or both; a new regulated supply for the screen of the 144 mc rig; and further improvements in the TV set up." *(Fine business on the projects, keep up the good work.)*

Ben, W9VOL: Ben reports contacting the following list of stations on 220 mc during the month of April: W9MCG, Chicago; K9JIJ, Chicago, WA9FCF, Cedarlake, Ind.; K9DNG, Salk Village. Ben's gear include 125 watt high efficiency transmitter, W.E. Planar 6280 low noise receiver, and 10 over 10 array.

Dick, WA4FIJ on 432 in Florida: "Just a brief report of 432 mc activity in West Florida for a change." *(We heard from Grid on the southern end of the path last month.)* "Made contact with W4GJO in Sarasota (275 miles) on 22 April at 0435Z. Also worked WA4BYI in Englewood (302 miles) at 0442Z. Signals were 569 and 579 respectively. The rig here is a 4X150 at 50 watts input, 60 degree corner reflector fed with a folded dipole. The receiver is a 6CW4 preamp, APR-44 tuning head, and an NC-300." *(Glad to see someone is putting West Florida on the u.h.f. map.)*

Fred, WA8DOM on U.H.F. Century Club: "I think it would be an excellent idea to update the Century Club award." *(We think so too, now all we have to do is convince the editor.)*

"I don't know how many contacts for the award—in this area 10 would be next to impossible." *(Aw come on, use your imagination a little and don't give up. With your enthusiasm, I am sure that the 1220 mc band will be populated in no time.)*

"I will have an APX-6 on the air before the end of the summer, and have been trying to get others on the band without luck. Considering the low initial investment, easy conversion, etc., I don't see why more contest minded people don't get those additional multipliers."

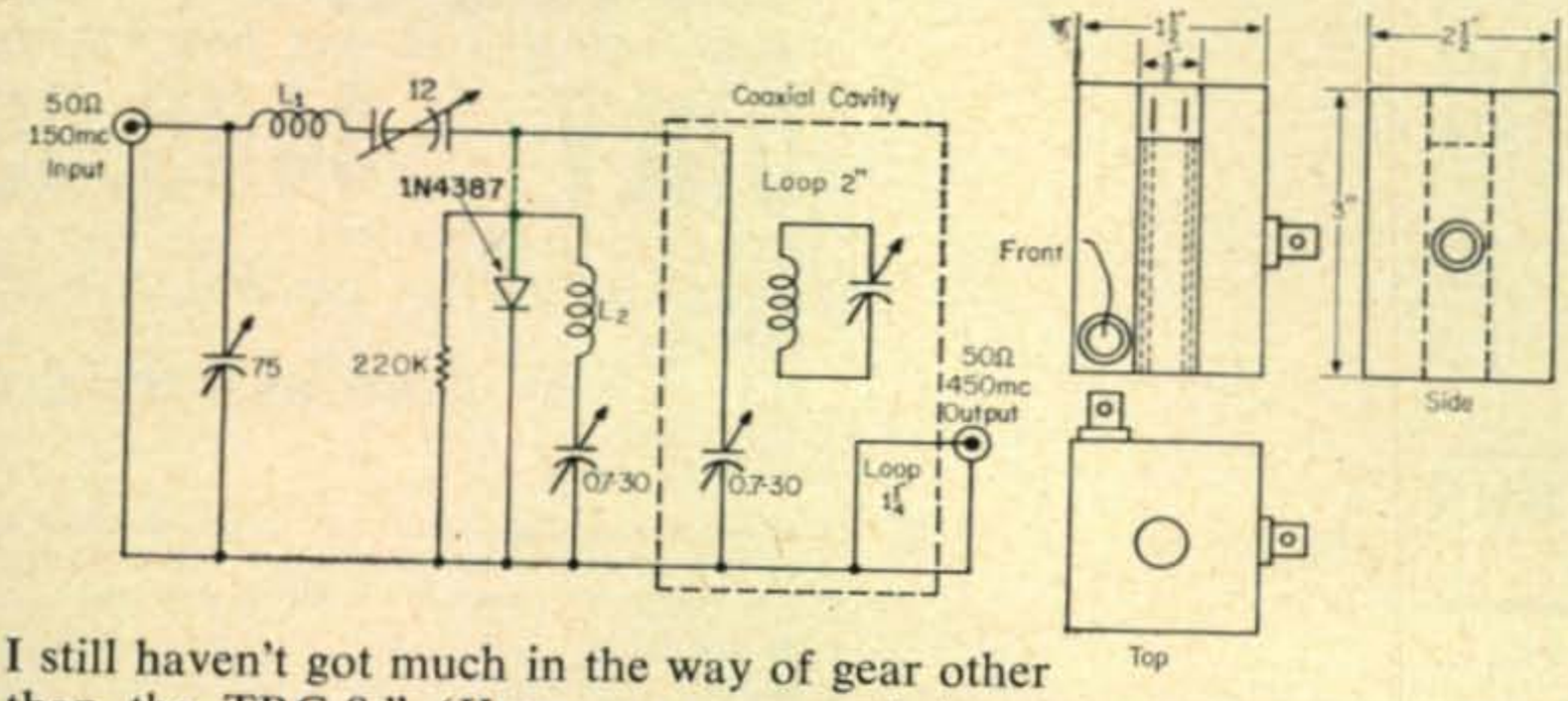

Fig. 1—150 mc to 450 mc varactor tripler circuit. In the coaxial cavity, the 2" long input loop is of #14 wire spaced .095" from the center conductor, while the 1¼" long output loop is of #20 wire spaced .045" from the center conductor. Brass tubing ½" diameter is used for the center conductor which is dielectrically loaded with Rexolite and piston tuned with a threaded shaft.

Notes

Al, K7VQI dropped off a note to say that ham TV is still progressing in Arizona with K7HID the latest to join the group with a flying stop scanner working closed circuit, and a transmitter under construction. John, WA8DXW in Marshall, Michigan still going strong on ATV and looking for other interested amateurs. Don, WA2VOI is interested in microwave operation and is putting a reflex klystron on 3 kmc from Salamanca, New York, Gary, K6VOQ has expressed an interest in weak signal detection, and would appreciate correspondence. I guess he has received several pages from us by now. That's it for this month, BCNU in another 30.

73, Allen, K2UYH

"George wants a ham shack in the worst way, but we haven't been able to afford it yet."

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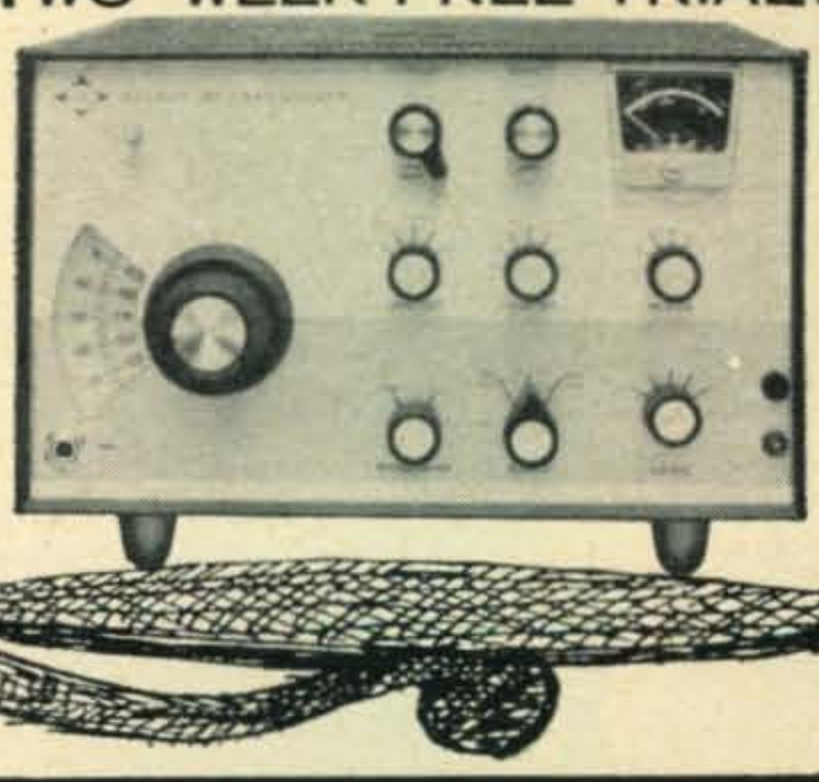

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For further information, check number 58, on page 110

rockcrusher

National's new 2000 watt linear amplifier is desk-top dynamite. Every component in the NCL-2000 is rated for operation at a "DC" kilowatt. If you want to check power output you'll need a bigger wattmeter than those now available on the amateur market. On any band the '2000 will pin a meter that only reads 1000 watts full scale.

Addition of the NCL-2000 to your desk-top station allows you to run at the maximum power allowed by law. It's no half-way linear with TV components and a "Christmas tree" string of receiving tubes straining to deliver a doubtfully efficient 500 watts (average) input. The two 8122 ceramic tetrode output tubes were designed specifically for SSB, and provide 800 watts of plate dissipation to assure conservative operation — and at a replacement cost of only $31.50 each.

Not only does the NCL-2000 deliver the power, but it does it cleanly. Third and fifth order distortion products are down 30 to 45 db, hum and noise down a minimum of 40 db. Operate in areas of high humidity? Don't worry about power supply or plate circuit breakdown. The '2000 is rated for full output at 90% ambient humidity. Properly safety conscious? You would have to work to get by the lid interlock that positively breaks all power to the plate relay, or the automatic shorting bar that discharges B+ directly to ground (throwing out the overload relay) in case of the remote possibility of interlock or bleeder failure. In addition, the equipment itself is protected through a one minute time delay relay and a plate overload relay.

Very simply, no other amplifier on the market at any price gives you even half of these features: ■ 2000 watt PEP input on SSB, 1000 watt input on CW, RTTY, or AM ■ Equal power output on all bands 80 through 10 meters ■ Completely self-contained desk-top package with built-in power supply ■ Exclusive grid-controlled AB_2 operation for high efficiency and linearity ■ May be driven to full output with any exciter delivering 20 watts to 200 watts PEP ■ Passive grid with internal 50 ohm exciter dummy load and relative exciter output indication for simplest tuneup ■ All necessary relays built in for transceiver or transmitter-receiver operation ■ Instantaneous switchover to exciter-only operation when desired ■ ALC output ■ Separate precision plate and multimeters ■ Most complete safety and overload protection, including 1 minute time delay relay, overload relay, lid interlock and automatic shorting bar ■ National's exclusive One-Year Guarantee.

Your National dealer has the NCL-2000 in stock right now . . . at only $585, better buy one in self defense.

or further information, check number 7, on page 110

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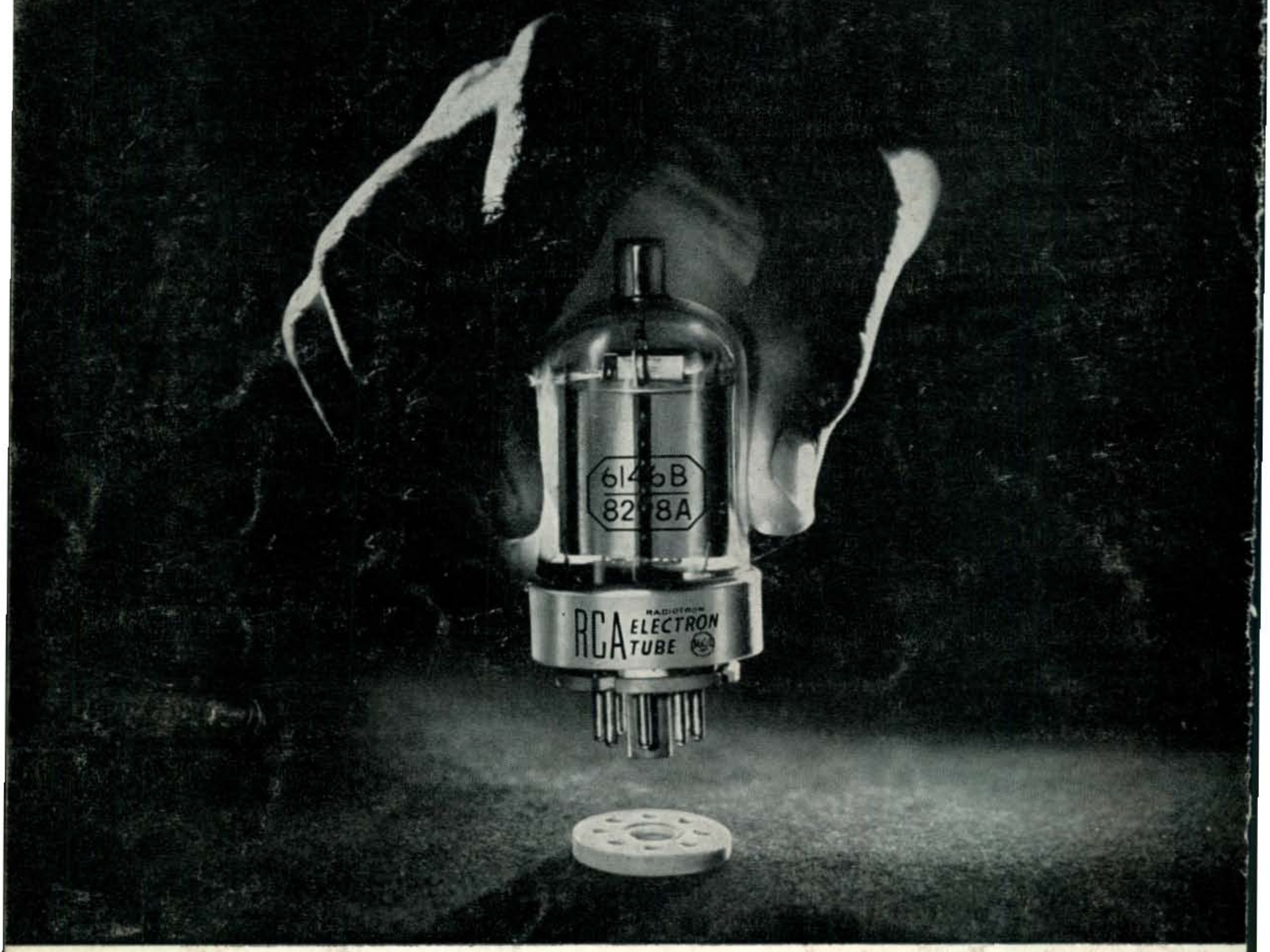

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Class C AM	600	23	8
Class C CW	750	35	12

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