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The Radio Amateur's Journal

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Offices: 14 Vanderventer Avenue, Port Washington, L. I., N. Y. 11050. Telephone: 516 883-6200.

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ZERO BIAS

A FEW years ago, in 1964, amateur radio in the US enthusiastically greeted the news that the US Congress had passed, and President Johnson had signed into law, PL 88-313, legislation permitting the US State Dept. to enter into negotiations and agreements with foreign governments for the purpose of allowing foreign amateurs to operate while in the US and possessions. In the years since the passage of PL 88-313, the US has negotiated "reciprocal privilege" agreements with 32 foreign governments, and amateurs from both side of the borders have begun to enjoy new freedoms which had previously been denied. But a few flaws seem to exist in the law.

There seems to be no provision in the law covering the special case of political refugees and immigrants to the US, although alien operators *are* permitted to operate after proper application and authorization. There also is no provision for an alien applicant who has been denied an operating permit to find out *why* it has been denied.

Cases which have been brought to light recently involve political refugees from eastern European countries. These refugees have brought with them to the US great enthusiam for the American way of life, enthusiam for amateur radio, and great technological know-how. They have also signed written declarations of their intention to become citizens of the US, and have begun the long and arduous task of becoming naturalized citizens of the US. But a quirk of US law prevents these individuals from holding an amateur license until they are actually citizens, perhaps five years from now.

Are these political refugees a greater risk to US national security then, let us say, another alien here on vacation? Obviously not, so that line of reasoning for the laws is invalid. Then are they any less likely to be ethusiastic and law-abiding amateurs than a native born or naturalized citizen? No, the prime reason for this situation is legal laxity and oversight. No one has cared enough about the existence of the problem to say anything about it except, perhaps, the immigrants involved, and lacking a vote, they lack the tool of "constituent pressure" that a citizen can frequently bring to bear.

The other "different-but-similar" problem involves visiting aliens who are amateurs. They are the individuals who fall under the provisions of the reciprocal privileges law. Under the law, they at least enjoy the privilege of applying for a permit to operate their stations while on US territory, and in most cases the law has worked well. However, as spelled out in Section 97.307 (b), the FCC can, in it's discretion, deny any application for a permit. What the Rules and Regulations *don't* say, but what they also in fact *do* mean, is that *the applicant need not be told by the FCC why his application has been denied*. A simple misunderstanding, an erroneous transfer of information, or personal prejudice on the part of anyone from top to bottom within the US State Department, the FCC, or the alien's own government is sufficient to prevent that alien from receiving a permit to operate. Worse, he need never be told why his permit application was denied, even though he may request the FCC to reconsider it's decision. FCC doesn't have to answer to him.

Unfair? We think so, and we sincerely urge that legislative steps be taken to rectify the situation. How do you feel about the subject?

73, Dick, K2MGA

OUR READERS SAY

Suggestions for "Enlightened DX"

Editor, *CQ:*

Now that the smoke has died down from the *CQ* W.W. DX Contest, I think a few comments are in order regarding pileups and how to minimize them.

The most significant fact that any DX station can realize while operating in the contest is that merely his appearance on the amateur bands will probably cause a pileup. This is a fact of life.

Another fact that most experienced contestants will admit is "at the bottom of every pileup there's a lid" and the lid is the DX station who calmly says, "QRZ contest" and tries to pick out one station while most of the United States screams out their calls.

I will be the first to admit that controlling a million screaming maniacs can be a bit frightening and difficult. (It has been every time I've tried it). But it can be done.

Probably the listing of a few simple commonsense rules might ease the situation:

1. The screaming mob will be only as civilized and disciplined as the DX station demands. If the station applies, consistently and uniformly, fair and effective operating techniques the mob will become docile. But if any of them feel they have been cheated, the whole thing breaks down.

2. The DX station must never allow anyone to call him on his frequency. The weaker his signal the more important this is. Stations will be unable to copy him, and he will thus lose control. The statement "ZZØXX, listening up 3 (or 5 or 10 or 5 to 10, etc.") works wonders.

3. The DX station should, if the going really gets rough, try to break the mob into sub-mobs. This can be done by the call-areas technique: "W2's only, please" or "W4 Able through Mable only, please". But the DX station after giving such a call must never return to a W3 or a WA4Z—.

4. The DX station should give pertinent information (handle, QTH, QSL Manager, etc.) at regular intervals, not to each individual station. This is simply a time saver and allows more stations to be worked.

I think the application of these rules would make a significant difference in contest scores and operator frustration. Two excellent examples of this were the 9GIKG and 5Z4KX operations in the recent contest. Life was made much easier for many operators after these two stations took the enlightened approach. And one has only to remember the highly polished contest performances of PZ1AX for a confirmation of these techniques.

Galen F. Tustison, WB6FGT
Lawndale, California

Advanced Age Novice

Editor, *CQ:*

I heartily endorse Ed Marriner's suggestion in the December issue, to the effect that advanced age Novice licensees might well be granted renewable licenses. I can see no reason for action along these lines being viewed with alarm by anybody. As a matter of fact, taking the pressure off these people, knowing that they could retain what privileges they already had, might be just the right spur to actually accomplishing the increased code speed needed for their General, which they now may not be able to attain due to the fear hanging over them that they won't be able to "make it" in the allotted time.

Of course, there is another side to the story, too. I happen to know an old timer who was a Navy radio operator in W.W. I, who can pass the 13 w.p.m. code test, but who, with his failing eyesight, isolation from help needed, cannot master enough theory to pass the General, but could easily swing the Novice. I am quite certain that if he had a Novice that didn't put unnecessary pressure on him to qualify in a hurry for a higher grade of license, he could learn during his contacts with other hams and eventually get his General, as well as having a lot of fun doing it.

This seems to be the first fresh approach to licensing that I have heard about in a long, long, time.

Clayton C. Gordon, W1HRC
W. Millbury, Mass.

Anti-ARRL

Editor, *CQ:*

It did my heart good to read your closing remarks in your November editorial with reference to the Hartford Gang and everything connected with ARRL *ad nauseum*. I am sure it also had the same effect on countless General class hams who have had their operating curtailed under the new FCC rules.

Now, are you going to let them keep on getting credit and so forth for publishing a new License Manual which will incorporate the study course for Advanced (4-a) and Extra (4-a and 4-b), or do you plan to put out study course for us to follow and thus give all of us a chance to buy it as, I for one, and many others I know, refuse to buy anything they print.

H. Roy Scott, W4UHF
Tampa, Florida

A Real Incentive

Dear Dick:

Congrats to the new Extra in W2-land, and greetings from sunny Florida. Just returned from a hard day at the salt mines and was pleasantly surprised to find the Dec. issue of *CQ* in the mailbox this early. I settled in my favorite chair, relit my stogie, scanned thru the table of contents, and then went to the DX column to see what humor and gossip we were in for this month.

Everything was going fine until I read the letter from G3FKM in a quote from the *RSGB Bulletin.*

Then I became upset, then angry, and then downright disgusted. So I am taking pen in hand and writing my first letter to the editor (something I swore years ago never to do.)

I have the obvious solution to all the present problems of Ham Radio, U.S. style. The Solution is so simple that I quake at the brilliance of this wonderful idea, and I leap at the chance to "toss this one into the fire" for the brethren to peruse at their leisure.

Problem . . . too many lids on the air signalling from the U.S.

Problem . . . how to thin the ranks rather than to increase them, (with apologies to all manufacturers of store bought gear).

Solution: Create an apprentice program . . . no I don't mean the Novice license. Lets put some teeth into this incentive licensing bit. Lets impose a period of time, say 5 or 10 years apprenticeship, during which no DX operation is allowed. Just think of all the rewards of this scheme . . . no QSL managers needed. QSO's will be longer, leisurely, and pleasant with no breakers; contests a pleasure instead of an ulcer. W/K-stations thinned out to about the post-WWII era.

Think of all the benefits that will accrue . . . with all the newcomers, and those licensed after say 1957 limited to 80 meters day & nights and 40 meters daytime only, (and 160 meters too), with no operation permitted on 20, 15, 10, or 6: they will soon tire of telling each other . . . "the rig here is . . . running a "full" KW . . . into an ole sock . . . and after 5 years or so of this they will probably drop out of the hobby and take up golf or glue sniffing. Meantime, those hardy souls who stick it out and listen to how a nice QSO (ragchew or contest-style) should be conducted (?) will emerge after their term as amateur radio operators, to the ever-lovin' pleasure of Ole Hiram P.

So lets set the period at 10 years and by then I'll be gone and won't have to listen to all the QRM, and please, in the interim, how about keeping off *my* frequency.

George Werner, W4ORT
Jacksonville, Florida

Which Extra in W2-land?—*K2MGA*

Standard Practice

Editor, *CQ:*

I would like to comment on Appendix I of Bryon Kretzman's article "A 5/8 Wave Vertical Antenna for 440" in the March issue. The first sentence starts rights, however, "standard practice" on the amateur f.m. channels is based on commercial practice on the adjacent commercial channels. This calls for 100 kc channel spacing with 50 kc secondary channels on 450 mc. Although the practice he mentions may be standard for Long Island, the above practice is standard for many places, such as Texas, New Mexico, Oklahoma, Virginia, Illinois, and possibly others that I do not know about.

I would like to express my appreciation for the otherwise fine series of articles on amateur f.m. which W2JTP has written.

George Munsch, W5VPQ
San Antonio, Texas

IARC

Dear Mr. Ross:

On reading through the August 1967 edition of *CQ* we found on page 86 a short article concerning our Club activities.

We should like to inform you herewith that only Mr. Gerald C. Gross (HB9IA/W3GG) and John H. Gayer (HB9AEQ) left Geneva and the IARC Hq., whereas Gunter Joraschkewitz (HB9UD) and Heinz Robig (HB9QC) are still with the I.T.U. in Geneva. All four amateurs continue their membership with the Club, and HB9QC and HB9UD only asked to be relieved from their IARC functions.

Dr. M. Joachim, OK1WI
Geneva, Switzerland

Help Wanted

Editor, *CQ:*

I am a boy, aged 13 interested in getting the Novice ticket. Would you please ask some amateurs in the Timonium, Maryland-area if they would give me and another boy help in code and theory. Thanks so much for your help. Also, I read your magazine and enjoy it immensely.

Charles Reville
124 Aylesbury Road
Timonium, Md. 21093

Announcements

Stolen Equipment

Recently stolen from W1RY was the following equipment: HQ-120 and large speaker (both black) numbers and dates beside each tube socket. HQ-140 and defective Collins speaker (both gray), has white indicator marks added to most knobs. KLH-8 (FM) and matching speakers (wood cases). Triplett #630 VOM, Radio Shack small tube tester. Zenith "Long Distance 66" black transistor portable radio. Bausch & Lomb, 20X black Target Spotting Scope. Anyone having information regarding the above, please contact Y1RY, Art C. Bates, P.O. Box L, Hingham, Mass. 02043, or the Police Detective Bureau, Weymouth, Mass.

Fresno, Ca.

The Southern California DX Club announced that the Nineteenth annual joint meeting of the Northern and Southern California DX Clubs will be held on the 27th and 28th of January at the Del Webb Towne House in Fresno, Ca. The convention will begin at 12 noon on Saturday, and will end at 12 noon on Sunday. All interested individuals throughout the country may obtain further information from W6AOA, Frank Cuevas, 14919 Yukon Avenue, Hawthorne, Ca. 90250 or WA6EPQ, Larry Brockman, 30927 Rue Valois, Palos Verdes Penn., Ca. 90274.

A New Ham

The newborn daughter of WØWOX, Larry Meyerson was named, quite inadvertently, Heide Ann Meyerson. Little did they realize there was a new "H.A.M." in the family! Heide, incidentally, is the grand-daughter of Leo Meyerson, WØGFZ of World Radio Labs fame.

Mexico City

President of the League Mexicana Radio Experimenters, Antonio Pita, XE1CCP, is presently discussing arrangements to set up a short-wave station at Convention Hall, Mexico City, for the duration of the 1968 Rotary International Convention (May 12-16). This venture is a joint project of R.O.A.R. which numbers approximately 600 members in 35 countries, and is under the Chairmanship of W9JKC, Byron Sharpe of the Glencoe,

[*continued on page 112*]

19th Annual YL-OM Contest

Time: Phone—Sat. Feb. 24, 1968, 1300 EST (1800 GMT) Sun. Feb. 25, 1968, 1300 EST (1800 GMT)

CW—Sat. March 9, 1968, 1300 EST (1800 GMT) Sun. March 10, 1968, 1300 EST (1800 GMT)

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

Operation: All bands may be used. Crossband operation is not permitted. Net contacts do not count.

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

Exchange: QSO number, RS, or RST report, ARRL section or country. Entries in log should show band worked at time of contact, time, date, transmitter and power. (ARRL section list available for s.a.s.e. to YLRL Vice President.)

Scoring: (a) Phone and CW contacts will be scored as separate contests. Submit separate logs.

(b) One point is earned for each station worked YL to OM, or OM to YL. A station may be contacted no more than once in each contest for credit.

(c) Multiply the number of QSOs by the number of different ARRL sections and/or countries worked.

(d) Contestants running 150 watts input or less at all times may multiply the results of (c) by 1.25 (low power multiplier).

(e) SSB contestants running 300 watts p.e.p. or less at all times may multiply the results of (c) by 1.25 (low power multiplier).

Logs: Copies of all phone and CW logs showing claimed scores, and signed by the operator must be **POSTMARKED** no later than MARCH 21, 1968 and received no later than APRIL 9, 1968 or they will be disqualified. Please file separate logs for each section of the contest. Send copies of logs to:
Claire E. Bardon, W4TVT, Vice President, YLRL, 2238 Morgan Lane, Dunn Loring, Virginia 22027

Awards: 1st place Phone: YL — Cup OM — Cup

1st place CW: YL —Cup OM — Cup

The winner of the Phone cup is also eligible for the CW cup. Certificates will be awarded to high place Phone and and CW winners in each ARRL district and country.

No logs will be returned. Be sure the copy of your log is legible. PLEASE note POSTMARK deadline date: March 21, 1968.

Feenix, Ariz.

Deer Hon. Ed:

Now that Xmas is over, and Hon. Jolly St. Nick has gone back to building toys for next year, Scratchi had about decided to settle down and study up for this insentive licensing bit that are looming on horizon.

Howsumever, fate decided otherwise. Cupple weeks ago a naybor invited me—in fackly he dared me—to jump out of airplane with only parashoot between me and appointment with Hon. St. Peter.

The harder I argewed against it, the more perswaysive he got. Next thing I knew I cupple thousand feet in air, staring out of door of single-engine airplane, with two parashoots surrounding me.

To this day I not recalling all the detales, but are recalling that sumbuddy finely pushing me out of airplane. Wowiee!! Talk about your fast elevator rides! What a thrill!

It only taking me few seconds to reelizing what I'd been missing. I reely got hooked on parashoot jumping in a hurry. There's no thrill on earth like it. Ha! That on acct. can't doing it on earth—doing it in free space. Boy oh boys, Hon. Ed., you should trying it.

Hole next week I jumping like crazy, and I are happier than stray dog lost in Hon. Butcher Shop.

Then I thinking. Why not trying to have QSO while floating down to earth? Thinking are likesame doing, so I building miniature 2-way transistorized unit. It putting out about a watt.

Having amchoor buddy come to airfield with mobile rig next day. I jumping out of plane, waiting until "shoot" are open, then turning on rig and calling him. He coming right back, and we have short QSO until I having to get ready for landing.

I hope FCC excoosing me, but I not riting in log until I am on ground. Anybuddy think

I making log entries in air are crazy. Funny thing though. How I suppose to signing? Am I parashoot mobile?

Not letting that worry me. Next day I calling XE friend of mine on land-line, and making sked for following day. Mexican feller are living in Nogales, Mexico, which right on Arizona-Mexico border, so thinking have fair chance to working him.

So, next day, driving to airfield, raising XE on mobile rig in car, then telling him to stand by. Going up in plane, bailing out, and Hokendoke!! managing to raise him with my powerful one-watter! He say I week, but he reeding me. Of coursely, having some advantage being cupple thousand feet in air.

This reeling getting Scratchi all excited—I now having one state and two countries QSO'ed while working parashoot mobile. So, I thinking—why stop there. Why not go for WAS—or even WAZ?

Let's see now. I needing more powerful xmitter. Can probably designing hundred watt s.s.b. unit so it not too big. Not having to transmit or reseeving too long at one time, so can using small battery and just using it for one jump before recharging it—or buying new one.

An antenna is more of a problem. I could use long trailing wire if having some way to tooning it. Or, maybe could rigging up beem in some way and pack it inside parashoot, ho when it opening up, beem are all in place. That may take a little work.

I'll working on it, Hon. Ed., and letting you know when I figyouring out how to do it.

There's another grate thing about working parashoot mobile—it's bound to help the QRM sityouayshun. I mean, how long a QSB can you have with the ground rushing up at you? Geronimo!!

Respectfully yours,
Hashafisti Scratchi

HIGH GAIN BACKFIRE ANTENNAS

BY DEAN HOFER, *W5PSG

IN THE past few weeks there has been considerable interest stimulated in ham activities in the u.h.f. bands. The years 1964, 65, 66 will long be remembered by u.h.f. enthusiasts because such previously difficult things as moonbounce are now a rather common occurrence within ham circles. The obstacles to long distance u.h.f. communications are rapidly being overcome by improved u.h.f. techniques including converters and antennas. The costly converters of yesterday can be equalled or surpassed by relatively inexpensive transistorized units.

This trend toward increased u.h.f. interest has created the need for antennas which yield very high gain and have excellent side lobe and front to back characteristics. It is the purpose of this article to give the general background and describe such a high gain antenna for the 144, 220, 432, and 1296 mc bands. The antenna however, can be scaled to any desired frequency.

* 1425 Nantucket Drive, Richardson, Texas 75080.

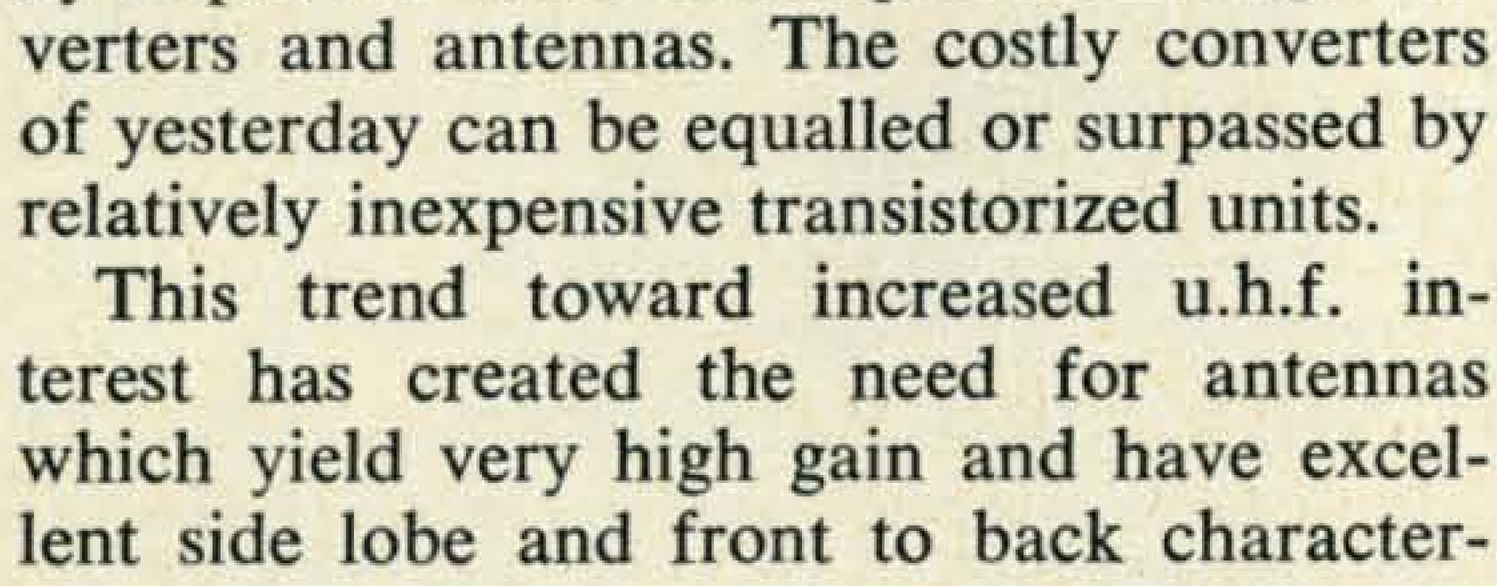


Fig. 1—The simple backfire array shown above consists of a Yagi antenna terminated into a plane reflector.

Backfire Antenna

The backfire antenna is no longer anything new and its operation has been described as far back as the January 1960 *Proceedings of the IRE*.[1] Since this 1960 correspondence in *IRE* a considerable amount of work has been done on the backfire array, including actual working models built by hams for the v.h.f. bands.[2,3] After discussing a few backfire principles, I shall comment on some of the more recent developments in backfire antennas.

There are several types of backfire arrays in existence. Perhaps the simplest is a yagi terminated into a plane reflector as shown in fig. 1.

Here we have an ordinary yagi with reflector, driven element, and three directors. The signal is fed to driven element *DE* and a slow wave propagates down the array and is radiated through virtual aperature VA_1. It continues to travel to the right until it reaches plane reflector *M*. Here it is reflected back and will traverse the yagi a second time. The wave is now radiated from virtual aperature VA_2, and hence we have a backfire array. This antenna acts as a yagi of double length because the wave must

[1] Erenspeck, H. W., "The Backfire Antenna, A New Type of Directional Line Source," *Proceedings of the IRE*, January, 1960, p. 109-110.

[2] Technical Topics, "The Backfire Antenna," *QST*, February 1961, page 50.

[3] Technical Topics, "The Backfire Antenna," *QST*, October 1961, page 50.

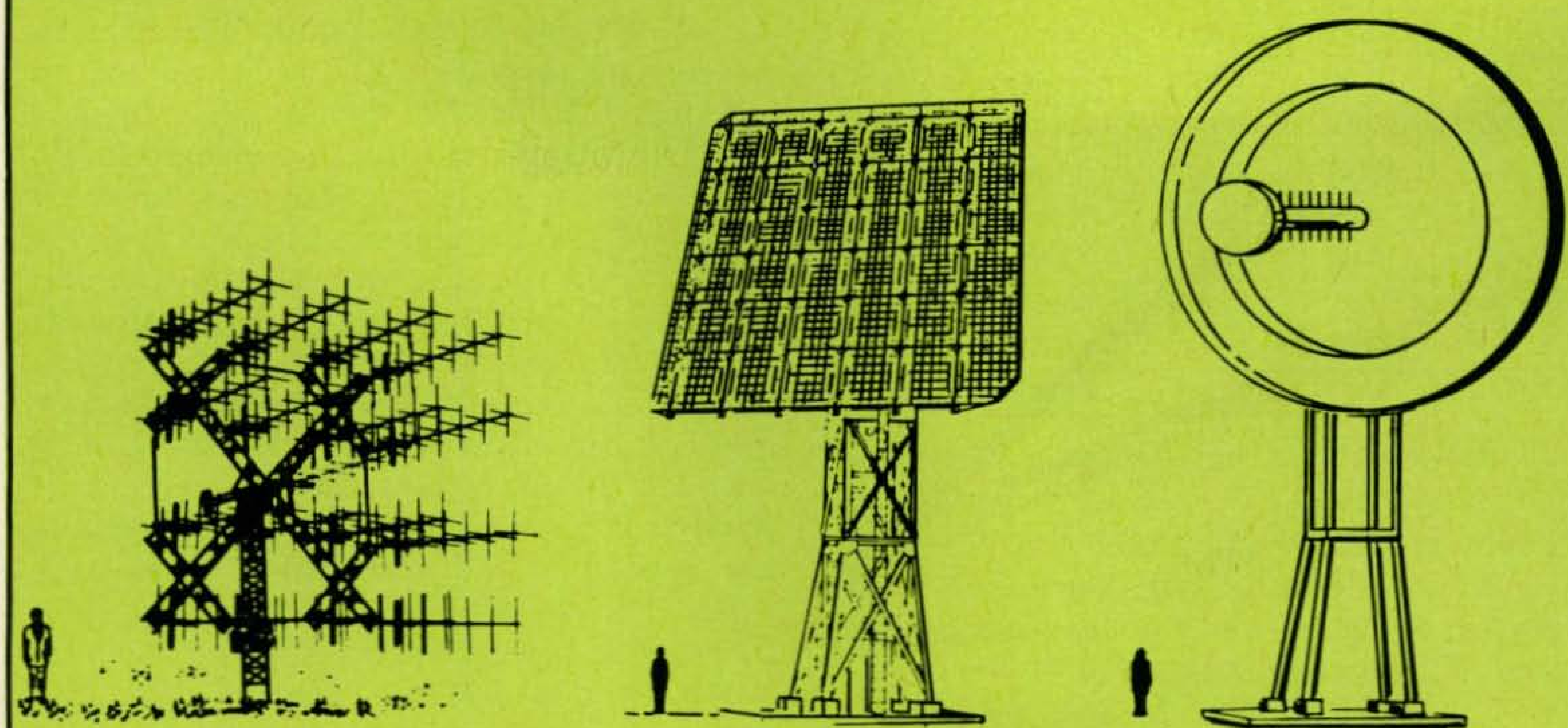


Fig. 2 (A)—Array of sixteen 2 λ Yagis built by NASA. It provides 22.4 db gain over an isotropic source. (B)—Thirty-six cavity backed slots produce a gain of 21.2 db over an isotropic source. (C)—A 4 λ backfire antenna produces a 23.5 db gain over an isotropic source.

traverse the structure twice. The reflector M is plane and should be large enough to intercept the bulk of the wave being propagated through virtual aperture VA_1. Placing the plane reflector M in front of the yagi requires retuning the yagi elements.

The initial backfire antenna was described by Ehrenspeck as listed above. Based on these principles, ham band backfire antennas were built and reported upon in

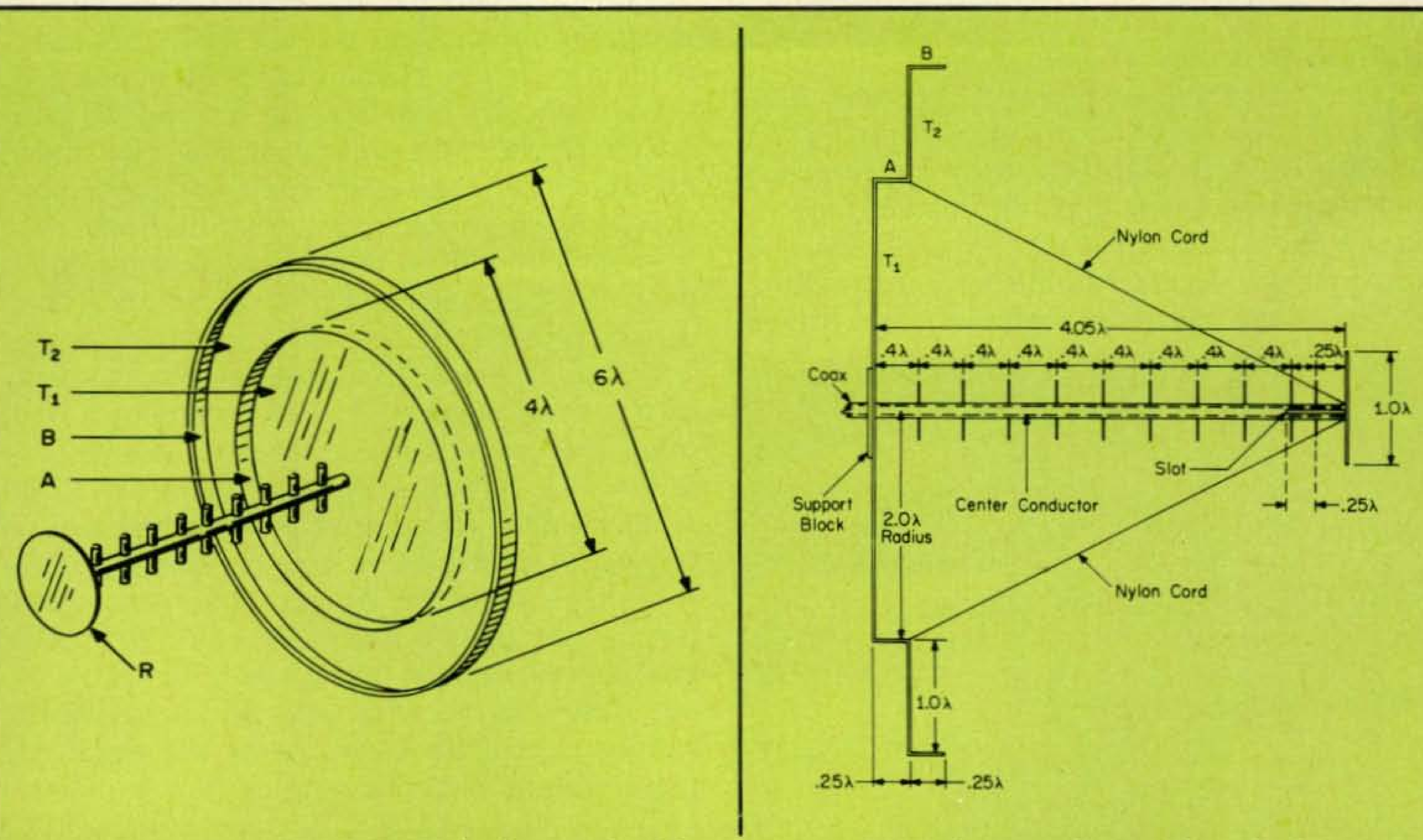


Fig. 3 (A)—Isometric view of a high gain backfire antenna. (B)—Side view showing lengths for construction. The details for the slot, driven element and center conductor are shown in fig. 6(B), the shortened version of this antenna. Reflector R is 1/16" thick.

PART	144mc	220mc	432mc	1296mc
B	20.5"	13.42"	6.83"	2.28"
d	20.5"	13.42"	6.83"	2.28"
T_1 DIAM.	328.0"	214.69"	109.32"	36.44"
T_2 DIAM.	492.0"	322.04"	163.99"	54.67"
DE to D_1	16.40"	10.73"	5.46"	1.82"
DE to R	16.40"	10.73"	5.46"	1.82"
D_N to D_{N+1}	32.8"	21.47"	10.93"	3.64"
L	328.0"	214.69"	109.32"	36.44"
λ"	82.0"	53.67"	27.33"	9.11"

Chart I—High gain backfire array dimensions.

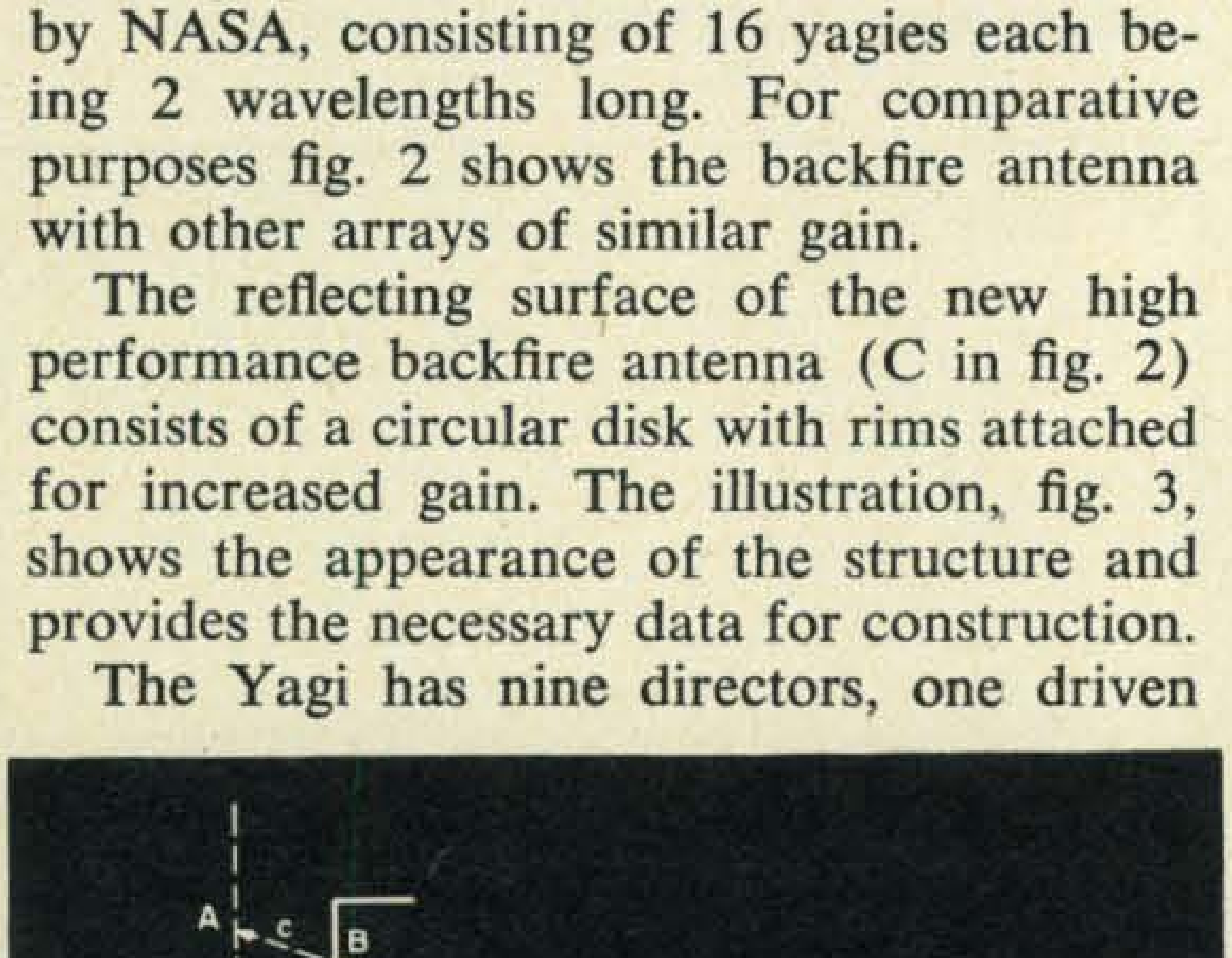
February, 1961, and October, 1961, *QST*. Here it was pointed out that a gain of 4.5 db was obtained over a one wavelength long yagi with front to back up to 19 db.

High Gain Backfire Antenna

.Recent work has resulted in greatly improved pattern control. This is a result of the improved backfire antenna as found in the March, 1965, *Proceedings of IEEE,* by Dr. Ehrenspeck. Working models have been built which yield gains greater than 8 db over an equal length yagi, with side lobes 22 db down and front to back near 30 db down from maximum signal lobe. An array yielding gain of this order has been built by NASA, consisting of 16 yagies each being 2 wavelengths long. For comparative purposes fig. 2 shows the backfire antenna with other arrays of similar gain.

The reflecting surface of the new high performance backfire antenna (C in fig. 2) consists of a circular disk with rims attached for increased gain. The illustration, fig. 3, shows the appearance of the structure and provides the necessary data for construction.

The Yagi has nine directors, one driven



element, *DE,* and a circular plane reflector, *R,* of 0.5 wavelength radius spaced 0.20 wavelength from *DE.* The radius of the inner plane T_1 is 2.0 wavelengths. T_2 is a plane reflector ring of 1 wavelength width and 3 wavelength radius. The plane in which T_1 and T_2 lie are separated by a distance *A* as shown in the side view sketch. The rim *A* is about 0.25 wavelength and surrounds T_1, whose depth is *d* (the distance between T_1 and T_2). *B* is a rim surrounding T_2, whose width is also about 0.25 wavelength. Spacing between the feed point and first director is fixed at 0.20 wavelength. All other directors are spaced at 0.4 wavelength from each other. The overall length, *L,* measured from T_1 to *R* is 4 wavelengths. Chart I includes calculated dimensions for the 144, 220, 432, and 1296 mc bands. This antenna is somewhat impractical at 144 mc because of phvsical size.

The maximum gain for the backfire antenna is closely related to its length and phase velocity. It has been shown that the phase velocity of the wave traveling along a yagi can be used as the design criterion for maximum gain. This stems from work done by Ehrenspeck and Poehler.[4] For each length of yagi there is an optimum gain and phase velocity. Adjustment of phase velocity will be discussed later.

The radiation pattern of the backfire array is the vector sum of the field E_1, radiated from the driven element and E_2 (reflected wave from T_1 and T_2). If E_1 and E_2 are out of phase, the resultant field will be their difference. If, however, they are in phase, they will reinforce each other and the resultant field will be their sum. It is the purpose of T_2, as seen in fig. 4, to maintain this proper phase relationship.

Consider point *P* at the driven element as the signal source. A wave traveling from point *P* to point *C* must travel a distance (a) before it is reflected. Another wave traveling from point *P* to point *A* must travel a distance (b+c) which is greater than (a) before it is reflected. Hence the two waves leaving the same point at the same time will not be reflected at the same time. This is not desirable because one of these waves cannot contribute as much as the other to the resultant backfire pattern. As a matter

[4] Ehrenspeck & Poehler, "A New Method for Obtaining Maximum Gain From Yagi Antennas," *IRE Transactions on Antennas and Propagation,* October, 1959, p. 379-386.

of fact, the wave arriving out of phase will *subtract* from the total field strength. If, however, we add plane reflector ring T_2 and properly space it from T_1, the in phase relation may be restored with the resultant gain of more than 2 db over that of T_1 alone. The waves are now reflected at points *C* and *B* at the same instant in time. Therefore T_2 serves a very useful purpose. In a sense one can think of points *B* and *C* as points lying on a parabolic reflector. The radiation pattern of the antenna described in this article has a half power beam width of 11.5° in the *H* plane. Beam widths in other planes were nearly the same and hence yielded a gain of about 23.5 db over an isotropic source. A typical pattern is shown in fig. 5.

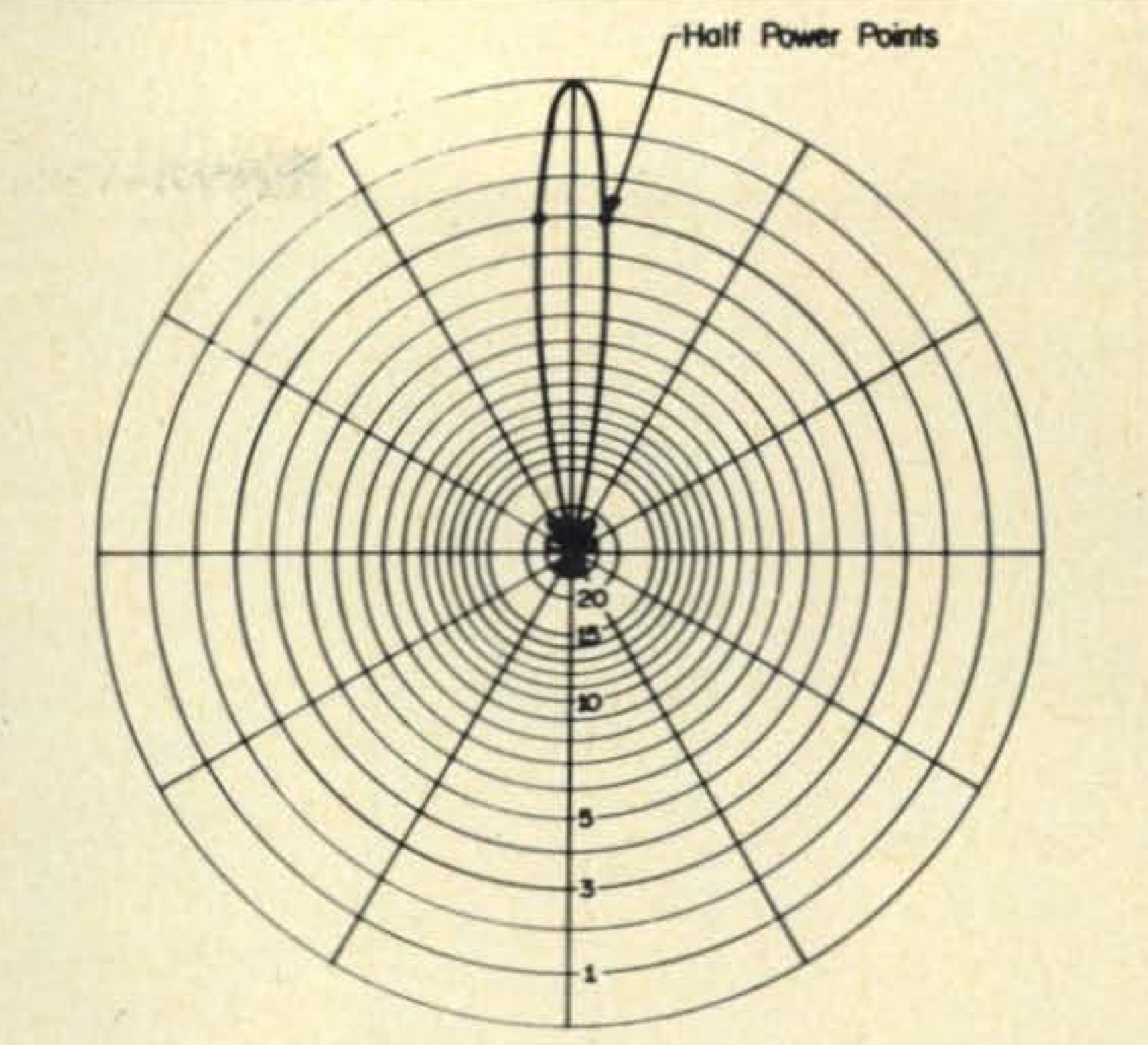


Fig. 5—H plane pattern of the 4 λ backfire antenna. The beam width at the half power points is 11½ degrees.

Medium Gain Backfire Antenna

The backfire antennas discussed thus far will yield high gain, which makes them useful for moonbounce applications. The physical size of this antenna at the lower frequency bands such as 144 mc is quite large. For this reason we shall consider the short backfire antenna. This is an especially interesting and useful antenna because it yields a remarkably high gain for its physical size. The short backfire antenna has been depicted by H. W. Ehrenspeck in the August, 1965, *Proceedings of IEEE.*

A side view sketch of the backfire array is found in fig. 6.

The antenna consists of two circular plane reflectors, *M* and *R*, spaced 0.5 wavelength apart. *M* is a circular disk 2.0 wavelength in diameter. The antenna is fed by the dipole *DE* placed between *M* and *R*. The width, *r*, of the rim around reflector *M* is about 0.25 wavelength. Reflectors *M* and *R* may be made of solid sheet metal or a fine mesh screen to minimize wind loading. This antenna has the unique advantage of being insensitive to feed polarization. Thus it may be linear in any direction, crossed or circular. A typical pattern is shown in fig. 7.

The gain of this short backfire antenna has been measured to be more than 13 db over a dipole. All side lobes are down 20 db or more from the maximum lobe and the front to back ratio is more than 25 db. Fig. 8 shows the comparative size between a short backfire antenna and a long yagi of similar gain.

A yagi antenna needs 15 or more elements with an overall length of at least 4.0 wavelengths to yield a gain of 15 db over an isotropic source. Yagis with optimized gain have quite high side lobes. In order to obtain patterns comparable to the short backfire antenna, the number of reflectors and the overall length of the yagi would need to be significantly increased. The two arrays shown in fig. 8 both yield patterns of nearly

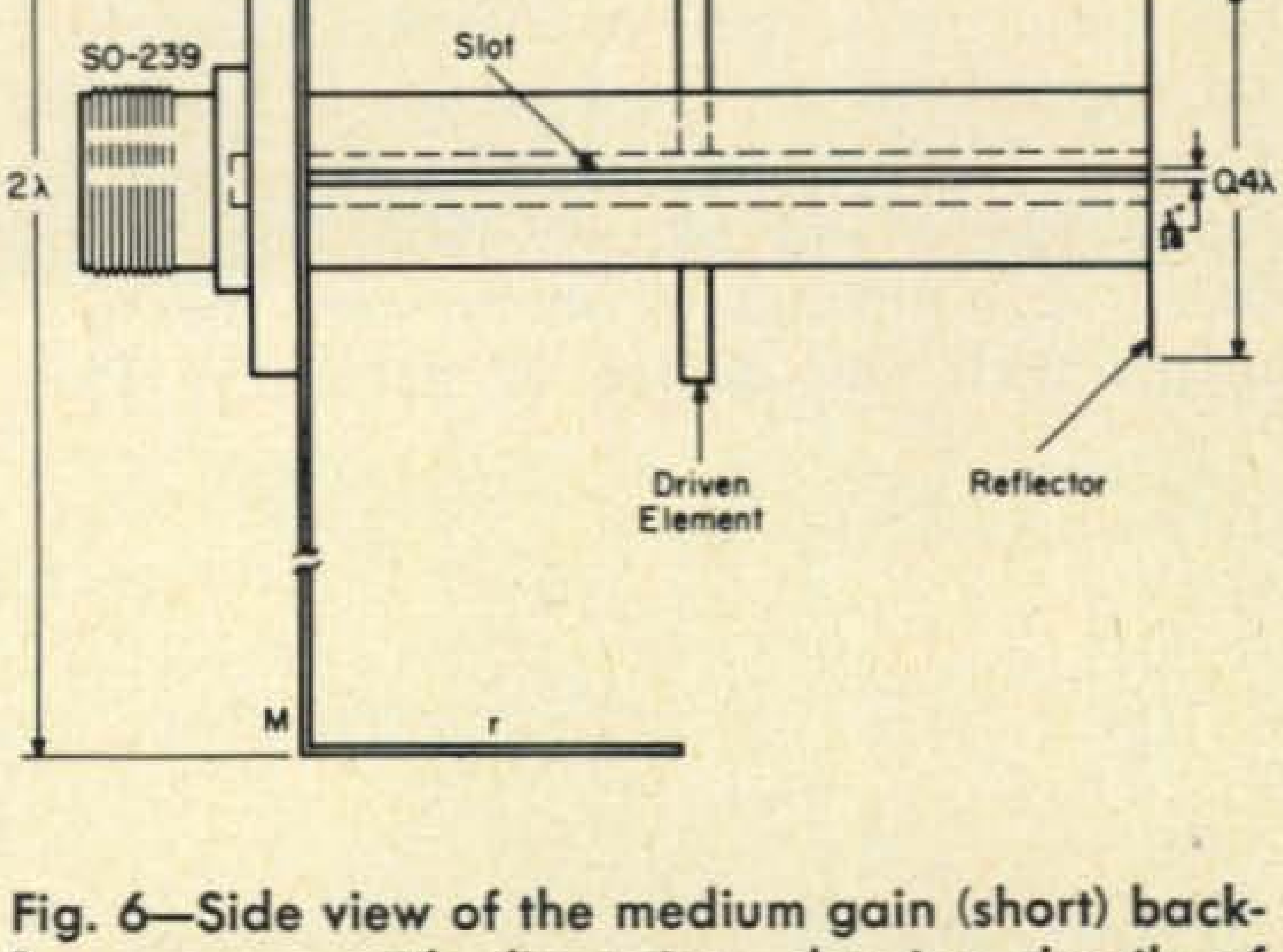


Fig. 6—Side view of the medium gain (short) backfire antenna with dimensions showing details of the balun and driven element. The width of the slot is approximately 1/16" wide. If it is made too wide, it will act as a two wire transmission line. The driven element has one side connected to the wall of the boom. The second side of the driven element is connected to the wall of the wall of the boom *and* the center conductor.

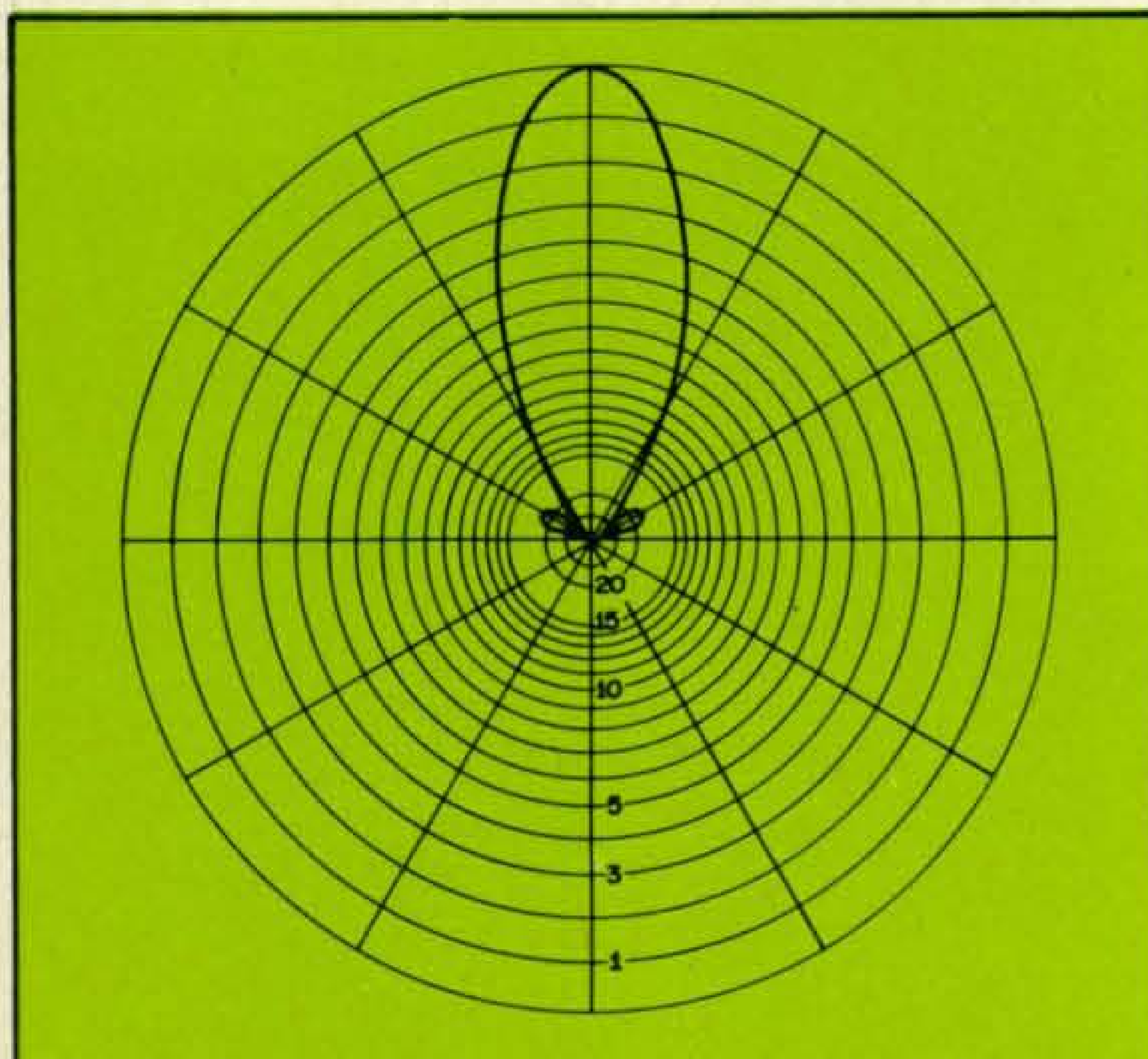


Fig. 7—Polar pattern of the short backfire antenna for the E plane. The H plane pattern is very similar.

the same quality. The short backfire array, however, has less than 1/10 the axial length of the yagi. Chart II shows basic dimensions for the short backfire array of fig. 6 for 144, 220, 432, and 1296 mc.

Tips For Construction

The reader is urged not to plunge into this project head first with a sudden burst of enthusiasm without first considering that he will need to spend much time and patience in construction, tuning, and matching of the backfire antenna. Like most other methods of improving antenna performance, backfire gain is no Santa Claus proposition. Before the project is started one should know how he expects to measure antenna gain and v.s.w.r. Without a properly designed antenna range and pattern recording equipment, it is difficult to obtain gain measurements with any degree of accuracy. This, however, does not mean that it is impossible for the ham to get the backfire antenna to work. It would be well for anyone deciding to build the backfire antenna to read as many reference articles as possible,[5] including the one in *QST,* "Practical Operating Hints for 1215 MC."[6] In this article is described a field strength indicating device consisting of a small dipole, diode and meter. Obviously, this will not read db gain, but is very useful in indicating relative field strength with respect to some reference level. Hence, in tuning the antenna one can tell when the field strength is getting better and when it goes through a maximum value.

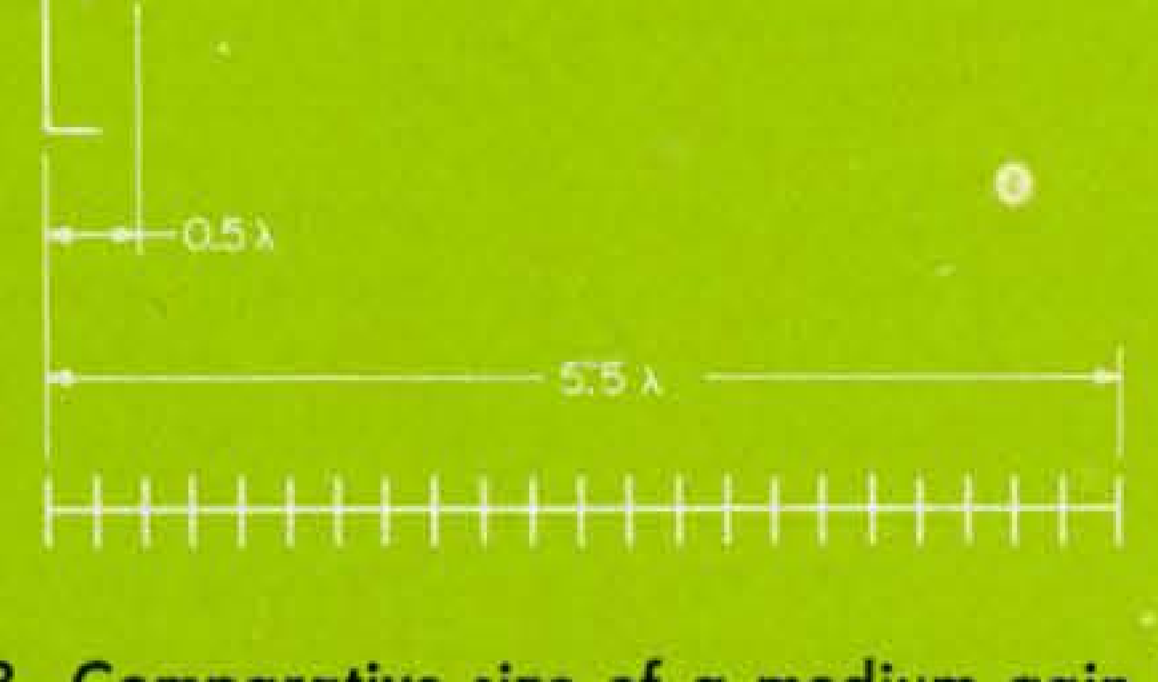


Fig. 8—Comparative size of a medium gain backfire antenna and a Yagi antenna of equal performance.

Adjustments

As mentioned earlier, the gain of a yagi, or in our case, a backfire, can be maximized by proper adjustment of the velocity of the wave traveling along the yagi. An almost infinite number of combinations of director spacing, diameter and height will give the same phase velocity. The method of obtaining this optimum phase velocity is not important. There is a very practical approach to this problem. (Ehrenspeck & Poehler mentioned earlier.) Here it is suggested that all but one of these variable parameters be fixed. The one remaining variable can then be adjusted for optimum gain (field strength). Perhaps the simplest adjustment is that of element lengths by means of telescoping tubing. Fortunately, v.h.f. antennas are very small. Most hobby stores stock telescoping brass tubing in various sizes, which works very well for tuning a v.h.f. yagi. Once the proper element lengths have been experimentally derived, the telescoping sections of brass tubing may be soldered together to prevent accidental detuning. Copper pipe may be used for the boom, making it very convenient to solder or silver solder the brass dipole elements directly to the boom. Brass pipe fittings with thread are available at the plumber, which enables fastening the mast to reflector surface T_1.

T_1 and T_2 may be constructed on metal sheet or fine mesh. L brackets are convenient to join T_1 and T_2 to their respective rims. To make the structure more rigid, it is well to guy the yagi boom to the plane re-

5 Ehrenspeck, H. W., "The Backfire Antenna: New Results," *Proceedings of the IEEE,* June, 1965, p. 639-641.

6 Tilton, E. P., "Practical Operating Hints for 1215 Mc.," QST, February 1961, page 27.

flector with nylon cord. (*Don't use wire.*)

Balun

The feed system is a most important part of the antenna. Fifty ohm coax is the best transmission line for this application. Therefore some balancing device must be used to couple the balanced dipole driven element to the unbalanced coax. The consequences of not doing this is that r.f. currents will travel on the outside of the coax and thus destroy the antenna's directional properties. A convenient and symmetrical balun assembly as shown in fig. 6 may be used. Although there are many types of baluns, the one shown provides a smooth continuous and symmetrical boom from reflector to the last director.

This arrangement uses 50 ohm air coax within the boom. The characteristic impedance of the air insulated coax is given by $Z_0 = 138 \log b/a$

where Z_0 = characteristic impedance.
b = inside diameter of outer conductor.
a = outside diameter of inner conductor in the same units as b.

The inner conductor may be held in position by the use of small washers made from Teflon, plastic, etc.

Tuning the antenna is best accomplished on the test site. Pick a location free from surrounding obstructions. The elements may be made from small telescoping brass tubing approximately 3/16″ o.d. This elment diameter is not too particular since the length may be varied. In general, however, a larger element diameter will increase the antenna bandwidth. To start, each element is set near ½ wavelength, tip to tip. If operating on 1296 mc, a wavelength is only a few inches. This permits tuning up the antenna at almost table top height.

With the yagi fastened to the planar reflection, and feeder connected, a reference field strength reading is taken at a distant point (20 wavelengths or more). Next, shorten all directors together in very small increments (1/16″ or less) until the field strength is maximized. After the directors have been adjusted for maximum gain, the driven element needs to be matched for impedance. Since very few of us have impedance measuring facilities, the next best is to adjust the dipole length for minimum v.s.w.r. Impedance does not need to be known exactly if the operator has an s.w.r. bridge.[7]

PART	144mc	220mc	432mc	1296mc
$M_{(DIAM.)}$	164″	107.3″	54.7″	18.2″
$R_{(DIAM.)}$	32.8″	21.5″	10.9″	3.6″
L	41″	26.8″	13.7″	4.6″
r	20.5″	13.4″	6.8″	2.3″

Chart II—Dimensions for the medium gain backfire array shown in fig. 6.

Both the adjustments for gain and matching are a long and tedious process, requiring much patience, but this is perhaps the simplest way without the use of costly pattern recording and impedance measuring equipment. Careful adjustments and measurements at this point will pay big dividends in the form of antenna gain and efficiency.

The yagi must be tuned when coupled to the backfire reflector. The antenna will not perform if the yagi is tuned independent of the reflector and then coupled to the reflector.

Since at the higher frequencies the cable loss is considerable, it is well to keep the length of the transmission line to a minimum.

Conclusion

Endfire arrays with patterns of the quality described in this article are impractical because of length and stacking problems. Construction of a wiring harness for an array of yagis to yield a gain of say 23 db would obviously be a formidable task. Mechanical problems would also be very involved. In this respect the backfire array excells because there is only one simple driven element to feed and match for impedance. Not only is this feed system simpler to construct, but it is also lower in cost, lighter in weight, and less subject to failure because of its inherent mechanical and electrical simplicity. Parabolic reflectors which also yield high gain are not competitive from a cost standpoint as the construction of a large parabolic reflector is far more complex than that of a planar reflector. Therefore, from a gain versus cost and ease of construction standpoint, the backfire array is an extremely competitive antenna.

The author wishes to express his gratitude to Charles Liu (Member Technical Staff Texas Instruments Inc., Dallas, Texas) for his encouragement and advice. ■

[7] Burhans, R., "UHF Coaxial SWR Bridge," *QST*, June 1960, p. 30.

Results of the 1967 CQ World Wide SSB DX Contest

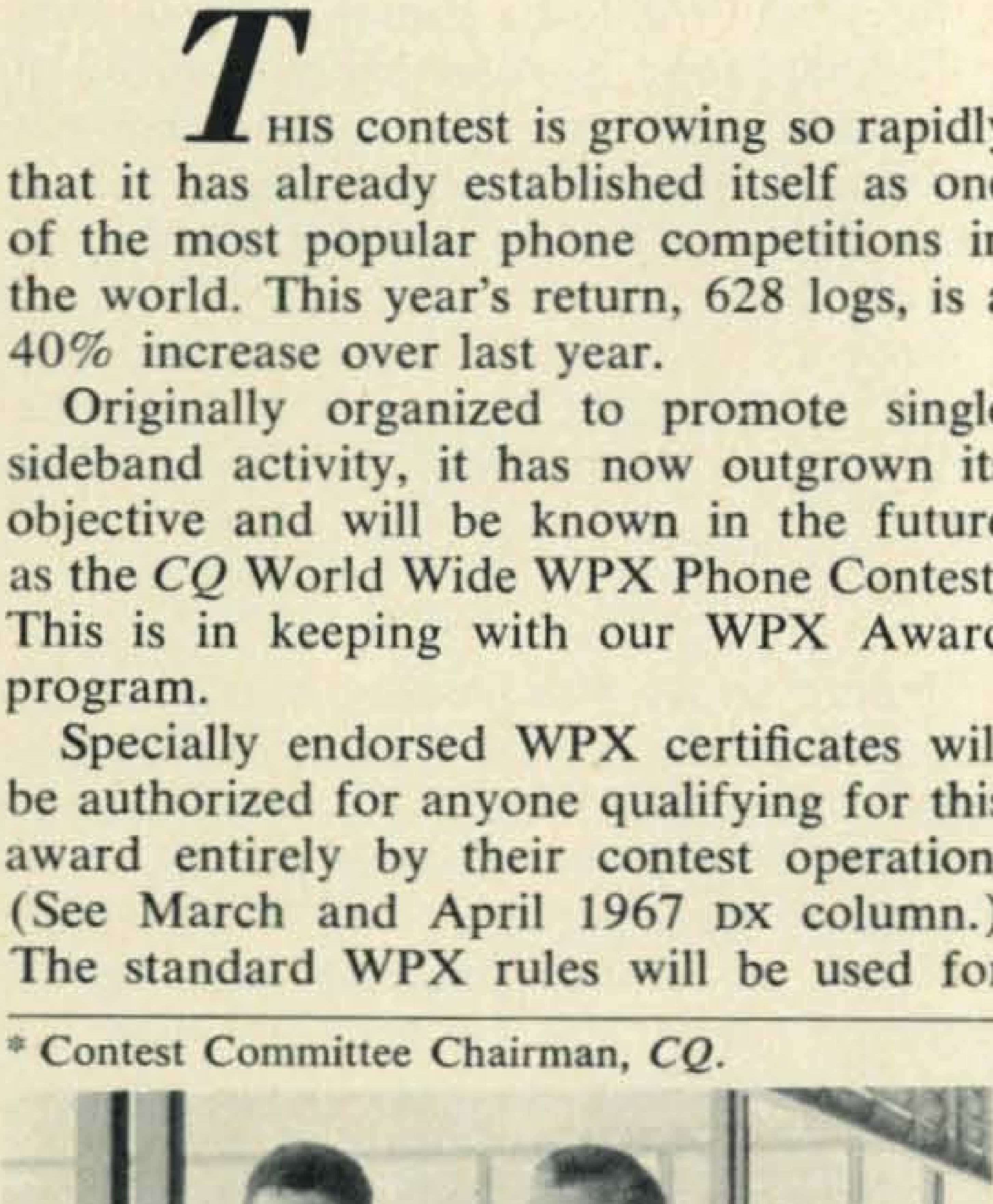
BY FRANK ANZALONE,* W1WY

THIS contest is growing so rapidly that it has already established itself as one of the most popular phone competitions in the world. This year's return, 628 logs, is a 40% increase over last year.

Originally organized to promote single sideband activity, it has now outgrown its objective and will be known in the future as the *CQ* World Wide WPX Phone Contest. This is in keeping with our WPX Award program.

Specially endorsed WPX certificates will be authorized for anyone qualifying for this award entirely by their contest operation. (See March and April 1967 DX column.) The standard WPX rules will be used for these awards. A list of your contest prefixes, in alphabetical order, should be sent to John Attaway, K4IIF our DX editor. This will be checked against your contest log for confirmation.

* Contest Committee Chairman, *CQ*.



The Bavassano's, Jr. and Sr., of the I9RB world high multi-operator winning team. The two Paul's were also winners in 1965 as I1RB and 1966 at 4U1ITU.

The scores and list of leaders in the respective categories speak for themselves so there is not much object in repeating them here. However some merit special mention, like the score of ZL1KG in the single operator division. Roy was the only all bander to break a million, even topping Don Miller's record from 1M4A last year.

And in the multi-operator division, the "father and son" team of Paul Bavassano, Sr. and Jr., put I9RB over the 3 million mark with a fantastic multiplier of 463 prefixes. (They also made WAZ) Operation was from the International Center in Turin, which is under the U.N. administration.

In the Single Band division, last year's 28 mc and 21 mc leaders retained their titles. Jaycee, LU1DAB and Jan, YV1LA taking advantage of improved band conditions repeated with very impressive scores.

Roger, G3NLY and Bill, YV5BTS bucked the commercial invasion of the l.f. bands, improved their last year's score, and are the leaders on 7 and 3.8 mc respectively. Only lack of activity prevented them from turning in even higher totals.

And Hajime, a newcomer to the SSB Contest put JA1AEA at the top of the heap on 14 mc. He is also the "King" of the single banders for 1967.

Realizing the advantage of a new prefix in this contest, many Italian stations took advantage of a new regulation and used

Contest team of G8FC, Hdq. station of the Royal Air Force Amateur Radio Society. Rear: L. to R. —G3JLZ, G3CCN, G3NAC, G3MRP. Front: G3GJQ, G2BVN and G5UG.

other than the usual I1 prefix associated with Italy. It seemed to have paid off.

Another unusual call was PA9CN which was specially issued to I1MOL. Joe made a special trip to the Netherlands and organized a team for the contest. Too bad the boys were not better equipped for 10 and 15, they would have easily made the Top Ten.

The special 3C prefix in Canada was very much in evidence. However a few stations also made contacts using their regular VE calls and fellows were taking double credit for QSOs and multipliers. This of course was taking advantage of a good thing. Double credit was deducted wherever this was found.

Another point of contention was in the multi-operator category. The rule states that only single transmitter operation is permitted in this contest. (Only one signal on the air at the same time.) However an elaborate set-up can take undue advantage of this simple definition by having several operating positions on different bands that can be activated instantly. But because of ingenious design only one transmitter can be on the air at the same time. This might not violate our simple rule of single transmitter operation but it certainly does not meet the intent of this regulation.

Realizing that a better interpretation of this rule is our responsibility, no disqualifications will be made in this year's contest.

The Multi-Transmitter category will be added to next year's contest and operation of this type will be considered in that catagory.

Some fellows still think we should allow credit for the same prefix as worked on each band. However we are of the opinion that with the great number of available prefixes, the present system of only *once* per contest is more in keeping with a practical score. Scores in excess of a million are even possible for single operator stations. Can you imagine what they would be if we allowed prefixes per band.

Over 30 all banders showed a multiplier of over 200 prefixes. At least a dozen made it on a single band. And in the multi-operator division 200 was quite common. Over 300 prefixes would be considered noteworthy.

The question of the compulsory rest period is still a topic of contention. Here again the balance is for the retention of this requirement. There is some confusion as to when it is to be taken, so perhaps it would be best not to specify any time but limit the operation to 30 or 36 hours out of the 48 hour period.

With the increased and wide spread interest in this contest, with exotic calls such as 9M2PO, DU1FH, HL9TQ, VK9GN, VK9KS, XW8AX and ZK1AR taking active participation, we are now asking for Trophy donors to make the contest even more exciting.

To start the ball rolling, two Trophies have already been offered for the 1968 contest. Paul Bavassano, I1RB is donating a Trophy for the Single Operator, All Band division and Gene Krehbiel, VE6TP is offering one for the Canadian participants. We would like to have one for the Top single-bander of the contest. A plaque for the

[*Text cont. on p. 112. Scores overleaf.*]

Joe Molinaro, I1MOL who got special permission to organize PA9CN for the contest.

Top Ten

ALL BAND—SINGLE OPERATOR

ZL1KG	1,042,152	HK4AET	724,129
G3NMH	966,249	UA1DZ	676,056
SM5BLA	954,446	I7AA	634,132
DJ6QT	903,033	WA2SFP	614,320
HI8XAL	820,534	CT1KT	586,264

Top Ten

MULTI-OPERATOR

I9RB	3,030,335	G8FC	1,621,296
I4LCK	2,102,275	DK0AA	1,434,675
4M4A	1,852,311	LA1K	1,404,390
OH2AM	1,828,200	UA1KBW	1,251,513
HC1EY	1,738,486	SM2BJI	1,188,000

Continental Leaders

28 mc		14 mc	
LU1DAB	595,976	JA1AEA	725,190
ZD8CX	416,465	I8JT	465,350
ZS6BEJ	323,390	YV5AGD	352,500
K4YYL	314,820	WA4PXP	350,106
DJ7CP	270,504	VK2APK	348,520
JA3HZT	129,870	CN8AW	128,520
VK3QV	67,368	**7 mc**	
21 mc		G3NLY	32,376
YV1LA	553,776	UW9AF	30,213
SM3CNN	450,560	K2GXI	25,800
W3AZD	325,852	**3.8 mc**	
JA2CWX	247,936	YV5BTS	42,436
9Q5FV	234,780	DJ6TK	22,578
VK2KM	159,768	K8DOC	5,551

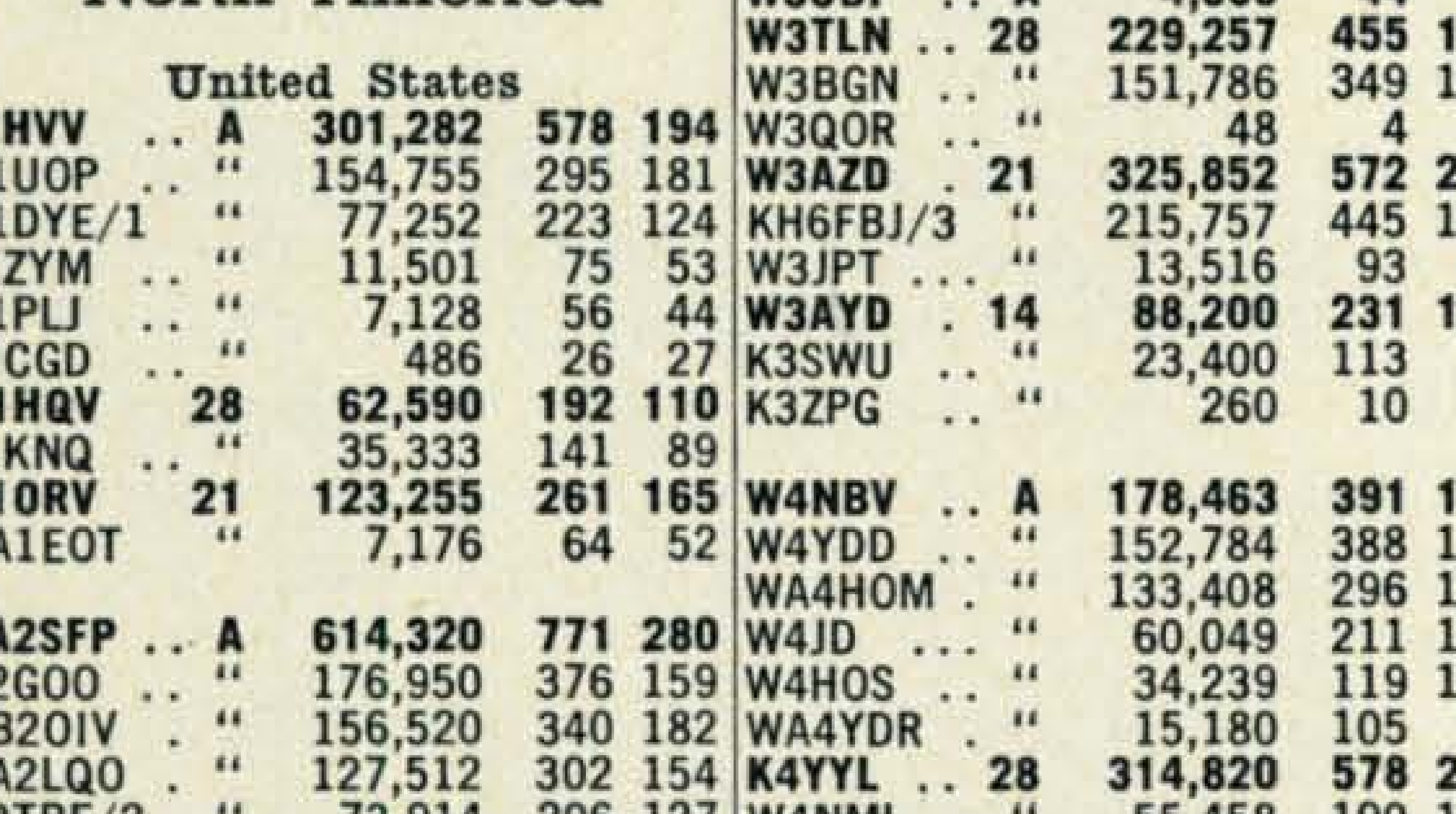
Number groups after call letters denotes following: Band (A-all), final score, number of QSOs and prefixes. Certificate winners are listed bold face.

SINGLE OPERATOR

North America

United States

K1HVV	**A**	**301,282**	**578**	**194**
W1UOP	"	154,755	295	181
W1DYE/1	"	77,252	223	124
K1ZYM	"	11,501	75	53
W1PLJ	"	7,128	56	44
WICGD	"	486	26	27
W1HQV	**28**	**62,590**	**192**	**110**
K1KNQ	"	35,333	141	89
W1ORV	**21**	**123,255**	**261**	**165**
WA1EOT	"	7,176	64	52
WA2SFP	**A**	**614,320**	**771**	**280**
W2GOO	"	176,950	376	159
WB2OIV	"	156,520	340	182
WA2LQO	"	127,512	302	154
W3TBF/2	"	73,914	206	127
W2IUV	"	67,580	194	124
W2QKJ	"	51,623	143	143
W2LEJ	"	45,696	158	102
K2OIJ	"	24,543	121	81
WA2YFB	"	22,200	111	74
W2JKH	"	11,048	71	53
W2BQE	**28**	**231,986**	**473**	**193**
WB2PCF	"	33,704	157	88
W2GKZ	"	8,450	69	50
W2ZV	"	6,396	52	41
WB2FON	**21**	**260,092**	**492**	**196**
WA2CYQ	"	72,960	231	120
W2IIY	"	28,400	135	80
K2DGI	**14**	**10,304**	**69**	**56**
K2GXI	**7**	**25,800**	**146**	**100**
W3CBF	**A**	**4,550**	**44**	**35**
W3TLN	**28**	**229,257**	**455**	**189**
W3BGN	"	151,786	349	166
W3QOR	"	48	4	4
W3AZD	**21**	**325,852**	**572**	**214**
KH6FBJ/3	"	215,757	445	183
W3JPT	"	13,516	93	62
W3AYD	**14**	**88,200**	**231**	**150**
K3SWU	"	23,400	113	75
K3ZPG	"	260	10	10
W4NBV	**A**	**178,463**	**391**	**179**
W4YDD	"	152,784	388	144
WA4HOM	"	133,408	296	176
W4JD	"	60,049	211	103
W4HOS	"	34,239	119	101
WA4YDR	"	15,180	105	69
K4YYL	**28**	**314,820**	**578**	**220**
W4NML	"	55,458	190	117
K4WUY	**21**	**137,712**	**355**	**152**
W4CYC	"	114,444	288	153
K4YMQ	"	60,168	215	138
W4DRW	"	51,408	175	112
W4FVY	"	26,660	110	86
WA4PXP	**14**	**350,106**	**534**	**258**
W4AZK	"	79,242	196	141
W4HA	"	20,224	105	79
W5BUK	**A**	**9,888**	**77**	**48**
K5EXW	"	9,405	65	57
W5MSG	"	1,180	23	20
W5NOP	**14**	**128,128**	**288**	**182**
W5KC	"	35,256	152	104
K6ERV	**A**	**262,676**	**495**	**194**
W6VNH	"	195,888	417	176
W6ITA	"	155,570	297	235
WB6IQI	"	63,244	257	97
K6PIH	"	41,650	187	85
W6QBY	"	17,216	99	64
K6SUC	"	2,028	30	27
WA6IVN	**28**	**73,568**	**244**	**121**
WA6ZQV	"	68,355	255	105
WB6LFR	**21**	**264,328**	**536**	**188**
WA6EKL	"	184,027	506	163
K6YNB	"	126,084	325	158
WA6YMX	"	77,348	233	122
W6NJU	"	73,632	252	118
W6AM	"	840	20	14
K6YRA	**14**	**95,922**	**263**	**154**
WB6EFA	"	59,048	216	121
WB6KIG	**7**	**1,152**	**36**	**24**
W6JTB	"	720	25	15
W7SFA	**A**	**254,553**	**512**	**183**
W7QEU	"	99,918	301	122
W7AYY	"	99,085	312	133
W7YG	"	26,060	121	84
K7JLF	"	6,968	59	52
W7FCD	"	2,739	43	33
W7HRH	**21**	**49,440**	**202**	**103**
W7EVU	"	24,208	129	68
W7LBN	"	24,120	120	72
W7QPK	**14**	**41,471**	**160**	**113**
W7YEX	"	7,285	58	47
WA7AKI	"	945	22	15
WA8RSL	**A**	**180,480**	**374**	**188**
W8PQQ	"	157,745	315	205
K8AXG	"	122,880	285	160
WA8MCR	"	107,568	242	176
W8KC	"	24,750	122	75
W8FBS	"	21,280	107	70
WA8LNE	"	3,277	39	29
WA8LEO	**28**	**99,552**	**290**	**136**
K8EHU	"	82,485	249	141
K8HZU	**21**	**114,000**	**315**	**152**
W8HYV	"	65,582	213	121
K8YBU	**14**	**271,440**	**456**	**234**
W8ILC	"	28,372	126	82
W8GKQ	"	14,632	73	62
K8DOC	**3.8**	**5,551**	**107**	**50**
W9EWC	**A**	**300,186**	**529**	**218**
W9DUB	"	247,744	486	196
K9ZJV	"	46,157	181	101
WA9IBT	"	43,068	157	111
K9YTG	"	6,327	75	37
W9LKI	**28**	**104,280**	**321**	**132**
K9BGL	"	39,867	164	97
WA9IAT	"	1,738	29	22
K9CUY	**21**	**8,164**	**62**	**52**
W9JDJ	**14**	**99,268**	**258**	**166**
W9ZTD	"	69,300	212	140
WØVXO	**A**	**331,078**	**546**	**202**
WAØMOB	"	162,603	339	203
WØLBB	"	121,500	319	162
WAØCPX	"	48,101	171	
WØBAA	**28**	**46,644**	**190**	
WØLBS	**21**	**129,927**	**300**	
WAØMSD	"	44,394	158	
WAØMPS	"	42,978	162	
WAØKDI	"	28,776	127	
WAØMOJ	"	20,475	118	
K8VDV/Ø	**14**	**90,420**	**231**	



This is what it was like at SM4CMG during the contest. Bob was not planning any gardening at the time.

Canada

VO1HI	**A**	**475,767**	**1131**
K3IWW/VO2	**A**	**33,167**	**170**
VE1IM	**A**	**47,250**	**298**
3C2AZQ	**14**	**18,960**	**114**
3C3EFX	**A**	**9,100**	**113**
3C3ES	**14**	**150,332**	**317**
VE4SD	**A**	**94,380**	**386**
VE4RP	"	24,852	112
VE4SC	**14**	**71,944**	**254**
VE5LV/4	"	12,663	80
VE6TP	**A**	**151,437**	**570**
VE6ABR	**14**	**150,810**	**486**
3C6IN	"	4,644	49
3C7BEX	**14**	**25,696**	**126**
VE7APU	**7**	**9,537**	**157**
3C8BB	**A**	**125,097**	**562**

Canal Zone

KZ5MF	**A**	**184,702**	**628**

Dominican Republic

HI8XAL	**A**	**820,534**	**1257**

Guatemala

TG8RH	**A**	**35,640**	**291**

Jamaica

6Y5GG	**A**	**13,020**	**134**

Nicaragua

YN1LH	**A**	**7,068**	**106**

Panama

HP1JC	**A**	**179,568**	**499**

Puerto Rico

KP4AST	**A**	**244,816**	**546**
KP4RK	"	49,660	207
KP4CL	**14**	**83,050**	**248**

Turks (and) Caicos Is.

VP5RS	**A**	**150,620**	**543**

Africa

Angola

CR6DX	**28**	**280,088**	**607**

Cape Verde Is.

CR4BA	**21**	**34,632**	**157**

Congo Republic

TN8AA	**A**	**14,350**	**82**

Gambia

ZD3G	**14**	**18,328**	**106**

Sicily

IT1GAI ..	21	142,720	503	160

Sweden

SM5BLA .	A	954,466	1395	262
SM6AYC .	A	415,830	946	167
SM5AD ..	"	246,170	469	206
SM3AF ..	"	205,530	498	170
SMØBUO .	"	21,054	108	87
SMØKV ..	"	7,839	92	67
SMØANH	28	147,705	420	129
SM5BPJ ..	"	57,222	198	102
SM5AZU .	"	11,480	73	56
SM3CNN	21	450,560	1003	160
SM4CMG .	"	222,288	594	132
SM5BUT .	"	211,464	575	132
SM7DQK .	"	29,008	182	56
SM7CRW	14	430,800	895	224
SM7CSN .	"	195,435	498	215
SM5API .	"	151,081	434	191
SM2CTY .	"	89,784	300	174
SM5CEU .	"	71,850	308	150
SM6CKS ..		59,052	257	148
SM5CAK	7.	21,087	184	99

Switzerland

HB9ZY ...	A	319,800	634	200
HB9AHA .	"	36,120	203	60
HB9IX ..	28	8,184	84	33

Wales

GW3NNF	3.8	16,150	173	85

Yugoslavia

YU1YG ..	14	118,720	439	160
YU2NFJ ..	"	56,316	361	156

U.S.S.R.

Estonia

UR2GZ ...	A	15,762	109	74
UR2IV ..	28	10,149	74	51
UR2CW .	21	312,056	795	152
UR2CC ..	7.	1,692	45	36

European

UA1DZ ..	A	676,056	1326	204
UA3DR ..	"	299,046	643	197
UA6XG ..	"	55,045	261	109
UV3XX ..	"	33,549	213	53
UW3KAS .	"	28,800	242	80
UA3TU ..	28	12,852	112	51
UA3AYN .	"	1,980	33	20
UA1KBB .	"	270	10	9
UA1LL ..	21	53,244	304	87
UW3CX ..	"	40,740	250	97
UA6NF ..	"	3,600	61	45
UW3VT ..	14	181,634	566	197
UA4CZ ..	"	96,278	314	161
UW3EH ..	"	67,497	302	149
UA1CS ...	"	33,535	160	95
UA4KNS .	"	23,552	157	92
UA1WW .	7.	5,096	89	56

Kaliningrad

UA2CD ..	3.8	5,432	91	56

Latvia

UQ2AZ ..	A	64,680	273	147

Lithuania

UP2CP ..	A	158,188	566	142
UP2NV ..	"	77,490	300	126
UP2CG ..	21	22.113	160	63

Moldavia

UO5SA ..	14	70,072	382	130

Ukraine

UB5RR ..	14	43,439	283	121

White Russia

UC2DN ..	28	279	13	9
UC2BF ..	14	11,390	82	67
UC2CU ..	"	1,080	28	27

Oceania

Australia

VK2KM .	21	159.768	432	126
VK2APK .	14	348,520	709	168
VK3AXK ..	A	117,484	439	92
VK3XB ...	"	1,380	25	20
VK3QV ..	28	67,368	276	84
VK3SM ..	21	17,907	134	47
VK3ARX .	14	47,970	199	82
VK3KS ...	"	330	11	10
VK4PJ ...	A	4,176	48	29
VK4WF ..	21	30,016	159	64
VK4DO ..	14	27,000	129	72
VK5AX ..	14	9,702	70	49

Cook Islands

ZK1AR ...	A	239,355	622	135

Hawaii

KH6IJ ...	A	550,197	1790	113
WØPAN/KH6	"	211,014	638	114
KH6BZF .	21	42,903	232	63
WB6FHL/KH6	"	37,296	206	63

Laos

XW8AX ..	A	521,888	1001	188

Terr. of New Guinea

VK9GN ..	A	501,670	1009	170
VK9KS ..	14	51,597	228	81

New Zealand

ZL1KG ..	A	1,042,152	1417	251
ZL1AIX ..	"	556,052	1128	172
ZL3AB ..	28	35,955	248	47
ZL1AGO .	21	112,548	346	113
ZL4BO ..	"	19,494	129	54
ZL1AAS .	14	144,160	363	136

Philippines

DU1FH ..	A	412,344	779	184

South America

Ascension Is.

ZD8CX ..	28	416,465	867	163

Argentina

LU8FP ...	A	15,776	93	58
LU1DAB .	28	595,976	1109	184
LU2DGO ..	"	19,040	174	68
LU8FAO .	14	71,390	213	121
LU2FAO ..	"	34,935	154	85
LU9DM ..	"	5,754	55	42

Brazil

PY7ACQ ..	A	303,800	602	175
PY1BAR ..	"	56,660	227	89
PY7SO ...	"	30,420	135	78
PY7APS .	21	78,125	221	125
PY3HT ...	"	38,220	192	70
PY2SD ...	"	602	15	14
PY7GV ..	14	323,661	581	193
PY3BXW .	"	257,307	478	207
PY1BZY ..	"	49,616	168	112
PY2GE ..	"	34,196	142	103
PY2DCA ..	"	24,297	116	89
PY4KB ...	"	1,464	34	24

Chile

CE6EF ...	A	1,216	22	19
CE3ZN ..	21	422,064	1023	144
CE8AA ..	14	29,848	129	82

Colombia

HK4AET ..	A	724,129	1144	217

Easter Island

KØOXV/CEØA	A	4150	58	25

Netherlands Antilles

PJ2CR ...	A	185,470	630	170

Paraguay

ZP3AL ..	14	18,612	99	66

Peru

OA4WV ..	A	27,252	154	62

Uruguay

CX9CO ...	A	87,171	218	147

Venezuela

YV7AV ...	A	89,139	257	129
YV5CIB ..	"	24,420	126	66
YV1FV ..	28	176,410	467	130
YV3NS ...	"	15,048	116	44
YV1LA ..	21	553,776	1367	139
YV1SA ...	"	175,624	534	116
YV5AGD .	14	352,500	519	235
YV1EJ ...	"	68,370	265	129
YV1QN ...	"	10,985	81	65
YV1BI	7.	6,672	62	48
YV5BTS .	3.8	42,436	154	103

MULTI-OPERATOR

North America

WB2MDH ..	107,735	299	145	(WB2MDH & WB2QZD)
WA3EWJ ..	174,488	385	157	(K3VZV, WA3EGR, W3UCT)
WA5NVZ ..	141,760	367	160	(WA5NVZ, WA5NVY, WA5ALB)
K5VTA ..	128,444	294	163	(K5VTA & W5EHY)
K6SEN/6 ..	1,126,356	1232	276	
WB6CPE ..	258,214	511	194	(WB6: NTZ, VLM, SAZ, VUD, HBK, JAY, JJT, GZM)
WA8GUF ..	390,00	610	240	(WA8GUF & WA8LYF)
KL7FRY ..	382,202	1292	158	(KL7FRY & KL7GAD)
VE1NV ..	293,727	500	213	(VE1NV & VE1AKW)
3C5US ..	555,409	1764	199	(UNIV. OF SASKATCHEWAN)

Africa

5T5KG ..	1,111,350	1558	239	(IRIS & LLOYD COLVIN)

Europe

OE5XXL ..	533,140	945	244	(OE5ANL, OE5DI, OE5KE)
OE1XA ..	20,332	133	92	(OE1WN & OE1WO)
OZ2KT ..	204,578	563	187	(OZ2KT & OZ6GR)
OZ2CV ..	47,908	167	118	(OZ2CV & OZ6TL)
OZ4KY ..	32,513	207	61	(OZ4KY & OZ7DX)
OZ4HAM ..	1,240	38	20	
G8FC ..	1,621,296	1927	324	(G2BVN, G3GJQ, G3HSR, G3LQP, G3MRP, G3NAC, G5UG)
GB2SM ..	1,064,812	1705	238	(G3: JUL, NYY, SZG, HZL, RWL, CRP, JEA, JLB, OLH, TUM, TZH)
G8KG ..	868,140	1447	212	(G2HDU, G3CNW, G3MSV, G3PEO, G8KG)
G3RRJ ..	818,664	1319	231	(G3RRJ & G3JXC)
G3LNS ..	538,128	1018	222	(G3: LNS, KDB, MHM, JFL)
G3LZQ ..	359,856	698	238	(G3LZQ & G3JXE)
G3SKY ..	99,297	376	153	(G3: KOY, NTM, SDD, UCW, VDZ)
GD3VBL ..	87,374	341	158	(GD3VBL & G3VCR)
DKØAA ..	1,434,675	1961	275	(DJ7IK, DJ6TS, others)
DJ9YG ..	622,618	1129	193	(DJ9YG, DJ6WO, DL3LU, DL8RL, DL8RM)
DJ9EJ ..	131,084	540	206	DJ: 9EJ, 8CY, 6IQ, 6TT)
OH2AM ..	1,828,200	2299	300	(OH-DX-RING R.Y.)
OH2TI ..	918,910	1576	215	(OH2BCP & OH2PC)
OH2AF ..	214,812	527	156	(OH: 2BG, 2BCA, 2BGD, 2VB)
I9RB ..	3,030,335	2556	463	(I1RB & I1RBJ)
I4LCK ..	2,102,275	2803	287	(I1: LCK, AUM, BER, GAD, TAE)
I1CKR ..	815,745	1068	255	(I1: BBJ, CZQ, PET, QQQ, CKR)
I1AT ..	296,450	687	175	(I1: AT, BEP, CAS, LG, TIG, TMZ)
I1DFD ..	166,530	562	102	(Club Station)
4U1ITU ...	1,137,672	1991	207	(WA3BZA & HB9AW)
PA9CN ..	1,158,966	1602	279	(PAØ: EEM, GMU, HBO, SNG & I1MOL)
LA1K ..	1,404,390	2033	277	(LA: 1EE, 2UI, 3JJ, 3LJ, 8NH)
SM2BJI ..	1,188,000	1760	270	(SM2BJI & SM2CZT)
SL5ZL ..	543,144	1016	244	(SM5ACQ & SM5CVH)

South America

HC1EY ..	1,738,486	2828	206	(HC1EY, HC1ME, HC1TH)
OA4SO ..	849,585	1358	209	(OA4SO & OA4OS)
4M4A ..	1,852,311	2544	249	(YV5: AAQ, BQF, CDK, CEY)

U.S.S.R.

UR2KAN ..	655,400	1373	226	(Jerry, Mart, Mati)
UA1KBW ..	1,251,513	1920	241	(Al, Alex, Val, Yuri)
UA3KBO ..	589,788	1131	258	(UA3-27308 & UA9-2847)
UA4KED ..	528,000	1043	240	(UA4: 14912, 14913, 14951)
UA3KND ..	123,654	397	188	(Club Station)
UA3RDO ..	104,876	433	167	(UA3: FG, HH, 27179, 27320)
UA2KBD ..	110,814	521	146	(UA2: DX, WJ, 12375)
UQ2KFG ..	327,624	723	204	(Alex, George, Vic)
UQ2KAA ..	324,012	830	201	(UQ2: AN, AO, LL, 22317)
UB5KTF ..	444,672	1032	201	(Nikolai N.E. & Nikolai F.Z.)
U5ARTEK ..	289,110	697	230	(Boris & Tolik)
UB5KIW ..	187,010	566	194	(Club Station)
UA9KHA ..	56,034	230	99	(Club Station)

Check Logs: EL9C, LA3QG, LA4DJ, LA5KK, LA6U, LA7JH, LA8RI, OK1NH, OK2VP, PAØNLC, PY2DBV, PY2DCA, PY3BAD, PY9HB, SM3CER, SM5BBC, SM5BHW, SM5BNX, SM5BOE, SM5DSF, SM5DZG, SM5GA, SM5IC, SM5ZZ, SM6CZU, SM7ACB, SM7CJC, SM7CMY, SM7DK, SM7TY, UN1CC, UP2KNP, UA3FT, UJ8AH, UW9WC, VE3MR, VK2CM, VK2MR, VP8IU, W1BFS, W3MDJ, WA3HAN, W4NJF, WB4EOH, W6CFG, W6FKZ, K7ARR, W7MSI, WA8PYD, W9RMQ, KØHIL, YV5AMP, YV5BPG, 9G1KT.

Morocco

CN8AW	14	128,520	318	136

Mozambique

CR7DS	28	93,496	296	116

Rep. of Congo

9Q5EP	28	189,505	508	151
9Q5FV	21	234,780	536	156

South Africa

ZS50A	A	322,538	668	166
ZS6BEJ	28	323,390	745	146
ZS6BLR	"	136,255	385	119

Tanzania

5H3KJ	A	182,972	430	149

Asia

Afghanistan

YA5RG	A	114,948	345	124

Ceylon

4S7PB	14	6,794	64	43

India

VU2DKZ	14	170,940	394	154

Israel

4X4FV	14	222,642	564	133

Japan

JA1CG	A	272,020	656	145
JA7JM	A	163,520	404	140
JA3LGG	"	96,150	294	119
JA2JAA	"	88,917	282	107
JA8AIP	"	68,478	232	101
JA1DFQ	"	48,134	205	82
JA7FC	"	36,824	130	104
JA8SW	"	28,923	112	93
JA7CDV	"	23,528	129	68
JA7CDU	"	4,556	50	34
JA3DRV	"	1,088	23	34
JA3DNU	"	180	10	9
JA4AQR/5	"	90	7	6
JA3HZT	28	129,870	362	130
JA6AFL	"	91,520	306	104
JA1JUQ	"	34,892	203	61
JA2AXG	"	33,726	158	73
JA1IZZ	"	22,490	122	65
JA1LYZ	"	9,660	83	42
JA2BVZ	"	5,328	48	37
JA2CWX	21	247,936	577	149
JA1MIN	"	154,496	372	142
JA1EOD	"	106,560	310	120
JA9UR/Ø	"	49,011	180	93
JA8CAU	"	17,591	132	49
JA2HMO	"	15,517	91	59
JA2FDZ	"	13,847	81	61
JH1APM	"	5,070	48	39
JA1VZM	"	2,730	35	30
JA1AEA	14	725,190	1082	230
JA1JDP	"	79,335	235	123
JA7JH	"	8,694	63	54
JA1AAT	"	6,888	65	42
JA1IZ	"	2,093	38	23
JA3CF	"	1,738	32	22
JA3BGF	"	1,656	30	23
JA1AG	"	858	28	22
JA3ADW	"	741	19	11
JA8GR	"	55	5	5
KA2JP	A	256,410	594	154

Korea

HL9TQ	A	80,115	284	109

Malaysia

9M2PO	A	169,776	650	131

Ryukyu Islands

KR6LL	A	411,585	761	215
KR6AB	A	377,604	805	204
KR6TAB	28	12,474	94	54

U.S.S.R.

Armenia

UG6SG	14	17,344	93	64

Asiatic

UW9CC	A	481,004	650	276
UA9EU	A	306,319	579	191
UA9VH	"	138,000	425	150
UW9CR	28	24,696	152	63
UW9DZ	"	17,287	104	59
UA9BE	21	40,508	174	82
UW9WR	14	16,464	101	56
UW9AF	7	30,213	132	81
UAØSH	21	15,486	158	58
UAØCO	14	128,590	492	110
UWØIE	"	15,704	166	52
UAØAI	"	12,900	166	43
UWØAA	"	4,692	72	23

Georgia

UF6FE	21	220,007	509	151

Kazakh

UL7JA	A	364,050	628	225

Turkoman

UH8BO	14	77,539	230	133

Europe

Aland Islands

OHØNI	A	178,330	446	186

Austria

OE2EGL	A	95,880	300	141
OE1EV	"	85,428	292	126
OE5DS/1	21	21,484	121	64

Belgium

ON5DJ	28	34,034	158	77
ON4XG	21	51,048	253	72
ON5MG	"	39,840	176	83

Czechslovakia

OK2ABU	A	111,244	350	137
OK1AHZ	"	76,358	296	146
OK1ADM	"	60,590	199	146
OK3EA	"	60,048	301	139
OK2BEN	"	51,216	205	97
OK1VK	"	38,270	157	86
OK1MP	28	35,332	157	78
OK1ADP	14	259,556	560	187
OK1AHV	"	81,792	301	138
OK2OP	"	57,460	222	130
OK1WGW	"	33,384	154	104
OK3DG	"	12,141	171	71
OK2QX	3.8	8,856	132	72
OK2BHX	"	4,482	89	54
OK1VE	"	1,575	48	35
OK1AAE	"	676	32	26

Denmark

OZ3SK	A	454,316	822	212
OZ4FF	"	143,808	402	214
OZ7BG	"	32,550	133	93
OZ7DX	"	21,384	146	88
OZ7SS	"	4,608	52	48
OZ3GW	28	3,828	40	33
OZ4OV	14	1,972	56	34
OZ1FO	7	5,301	86	57

England

G3NMH	A	966,249	1451	237
G3IAR	"	407,885	806	191
G3ORK	"	351,373	661	187
G3CAZ	"	119,382	271	202
G2AJB	"	38,199	214	119
G3RUV	"	31,850	161	91
G3MWZ	"	6,811	75	49
G3RJB	"	2,914	61	47
G4CP	28	88,364	284	114
G3PQF	"	2,816	35	32
G3PEU	21	136,367	410	121
G3NLY	7	32,376	211	114
G3SZG	3.8	16,470	171	90

France

F9MS	A	155,015	331	215
F2YS	"	131,625	414	135
F5FV	"	18,957	118	71
F3IJ	"	4,500	52	36
F5BV	"	3,552	42	37
F3II	28	7,830	100	27

Finland

OH4OO	A	189,879	503	167
OH1UR	"	138,528	424	144
OH1OE	"	99,240	359	120
OH1VA	"	35,334	164	117
OH5SM	28	70,488	259	99
OH2XA	"	3,317	40	31
OH2BCZ	21	241,902	616	151
OH6VE	"	20,300	118	70
OH7OK	"	5,004	86	36
OH2WI	14	431,951	799	223
OH5VT	"	121,198	400	154
OH5WF	"	29,376	192	102
OH3XZ	"	1,248	30	26
OH5UQ	7	1,170	32	26
OH1YW	3.8	9,044	121	76

Iris and Lloyd Colvin and their set-up at 5T5KG in Mauritania. The Yasme DXpedition had to make a hasty exit from this QTH due to sudden unsettled diplomatic relations in that country.

Germany

DJ6QT	A	903,033	1347	269
DJ2QZ	A	564,417	827	289
DL9NF	"	335,220	823	148
DL7AA	"	332,882	715	178
DJ5BV	"	318,539	606	229
DJ2YA	"	248,942	385	269
DL7HZ	"	203,515	477	155
DJ8IF	"	173,004	483	156
DL7EN	"	142,307	358	187
DJ4IZA	"	110,084	308	146
DL9HC	"	89,996	300	149
DJ9JX	"	81,176	294	139
DL1AM	"	64,200	234	150
DJ4JI	"	53,821	208	107
DJ3EJ	"	46,740	200	114
DL6WE	"	29,592	174	108
DL9EM	"	27,950	150	86
DJ2TI	"	27,027	178	99
DL1MD	"	22,576	122	83
DL6KG	"	18,104	105	62
DL7FP	"	15,050	92	58
DL8AJ	"	12,376	88	68
DJ8WS	"	8,150	73	50
DJ2SL	"	6,300	52	45
DJ4HZ/m	"	3,828	49	44
DJ7CP	28	270,504	750	136
DJ4AX	28	245,572	627	146
DJ4PT	"	155,480	473	115
DL9PU	"	147,239	449	113
DL6HW	"	53,940	292	62
DJ5LU	"	52,448	210	92
DJ5VQ	"	32,627	150	79
DL7DI	"	24,704	130	64
DL7EM	"	9,288	61	54
DJ8FC	21	281,813	776	127
DL8PC	"	110,811	325	129
DJ3BW	"	28,386	161	83
DJ9ZB	"	7,600	72	50
DL6DF	"	1,280	28	20
DJ9FH	14	76,640	353	80
DL1IP	"	9,380	125	67
DL9MC	"	7,296	96	64
DJ6TK	3.8	22,578	250	106
DL5HH	A	303,744	634	192
DL5SV	"	37,240	155	98
DL5KS	"	31,164	132	84
DL5MJ	"	26,978	156	82
DL4SK	14	402,160	734	220
DL5LT	"	57,288	272	88
DL5AO	7.	169	13	13
DL4RO	3.8	14,229	192	93
DM4WPL	A	51,660	205	90

Greece

SVØWV	21	91,624	326	104

Hungary

HA5CQ	14	38,675	233	119
HA5BY	"	31,075	218	113
HA5FE	"	25,555	153	95
HA5FQ	"	1,650	35	30

Iceland

TF3EA	A	84,042	229	203

Italy

I7AA	A	634,132	1221	236
I9FLD	"	540,582	1006	211
I1PGL	28	78,561	305	87
I1CWN	"	41,726	169	68
I8JT	14	465,350	1026	227
I2LAG	"	386,260	832	217
I1RRE	"	213,280	498	172
I1KG	"	210,684	500	194
I1KFL	"	63,220	247	116
I1LCF	"	16,646	134	82

Luxembourg

LX1BW	A	36,039	295	123

Monaco

3A2MJC	14	1,018	35	26

Netherlands

PAØXPQ	A	578,240	1020	208
PAØDEC	"	91,440	294	127
PAØVB	"	14,065	112	73
PAØHTR	21	23,322	126	69

Norway

LA4LG	28	11,816	85	56
LA6U	21	4,830	68	35
LA3QG	"	3,520	44	32
LA6XJ	14	45,215	265	115
LA4AF	"	13,272	104	84

Poland

SP8AJK	A	245,700	549	225
SP3AMZ	21	5,043	67	41
SP6AAT	14	59,392	313	128
SP9ZU	"	4,512	91	48
SP9QS	"	700	29	20
SP5BB	"	372	30	12
SP2BSX	3.8	1,974	47	42

Portugal

CT1KT	A	586,264	1098	203
CT1PK	"	265,710	710	170
CT1BB	28	141,540	496	105
CT1BT	14	29,252	216	103

Romania

YO9AFT	A	10,395	135	77
YO2BB	14	158,514	468	174
YO3JU	"	1,085	35	31

Scotland

GM5ACE	A	23,760	186	90
GM3JDR	14	88,935	397	165
GM3SSB	"	4,160	64	52

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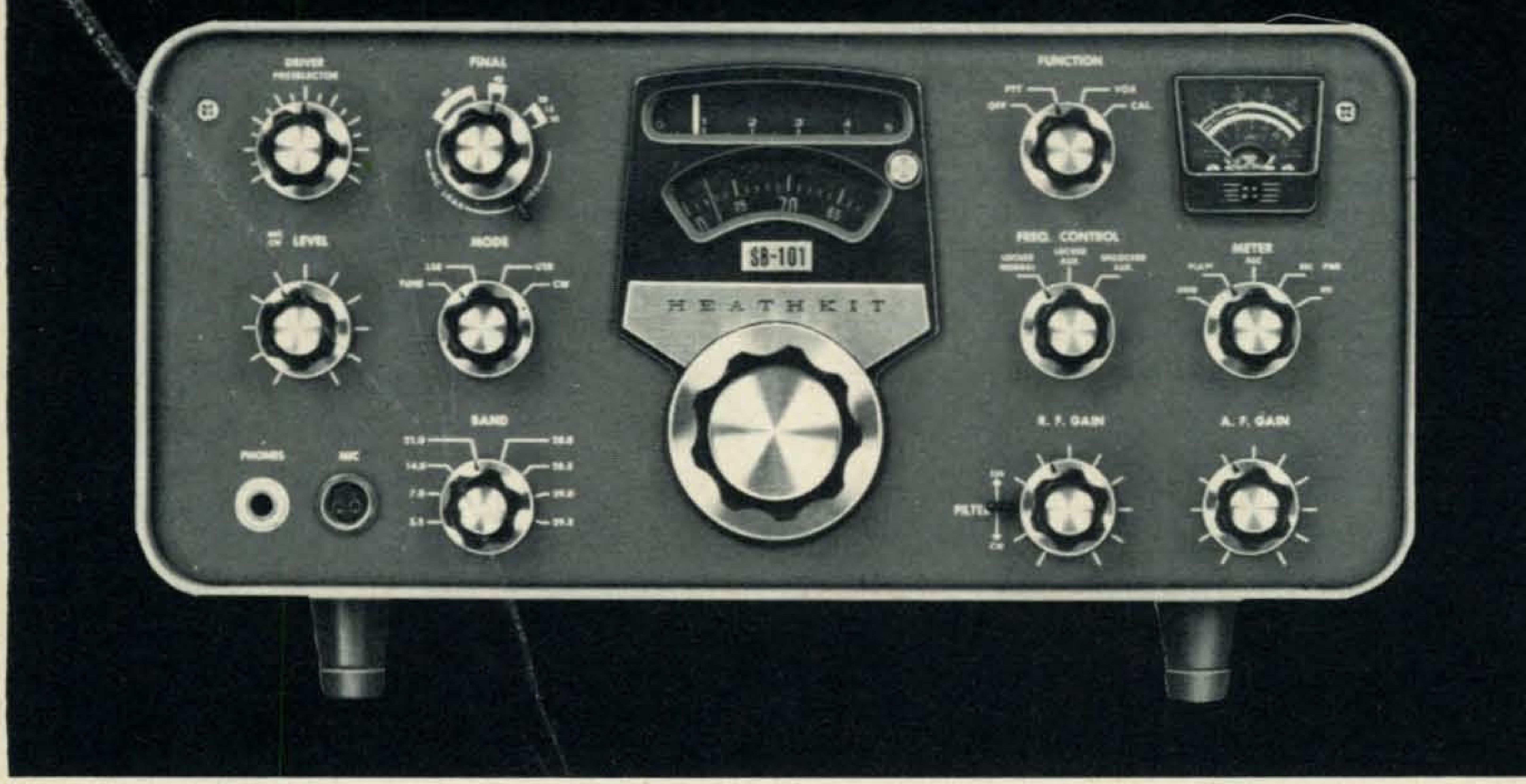

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Assembled SBW-600, SB-Series Speaker, 6 lbs.	**$24.95**
SBA-301-2, Optional 400 Hz CW Filter, 1 lb.	**$20.95**
SBA-100-1, Universal Mobile Mounting Bracket, 6 lbs.	**$14.95**
Kit HP-13, DC Mobile Power Supply, 7 lbs.	**$64.95**
Kit HP-23, Fixed-Station Power Supply, 19 lbs.	**$49.95**

PARTIAL SB-101 SPECIFICATIONS — RECEIVER SECTION: Sensitivity: Less than 1 microvolt for 15 db signal-plus-noise to noise ratio for SSB operation. **SSB selectivity:** 2.1 kHz minimum at 6 db down, 5 kHz maximum at 60 db down — 2:1 nominal shape factor — 6:60 db. **CW Selectivity:** (With optional CW filter SBA-301-2 installed) 400 Hz minimum at 6 db down, 2.0 kHz maximum at 60 db down. **Spurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **TRANSMITTER SECTION: DC power input: SSB:** 180 watts P.E.P. continuous voice. **CW: 170 watts** — 50% duty cycle. **RF power output:** 100 watts on 80 through 15 meters; 80 watts on 10 meters (50 ohm nonreactive load). **Output impedance:** 50 ohms to 75 ohms with less than 2:1 SWR. **Oscillator feedthrough or mixer products:** 55 db below rated output. **Harmonic radiation:** 45 db below rated output. **Transmit-receive operation: SSB:** Push-to-talk or VOX. **CW:** Provided by operating VOX from a keyed tone, using grid-block keying. **CW side-tone:** Internally switched to speaker in CW mode. Approx. 1000 Hz tone. **Carrier suppression:** 50 db down from single-tone output. **Unwanted sideband suppression:** 55 db down from single-tone output at 1000 Hz reference. **Third order distortion:** 30 db down from two-tone output. **Noise level:** At least 40 db below single-tone carrier. **RF compression (TALC):** 10 db or greater at .1 ma final grid current. **GENERAL: Frequency coverage:** 3.5 to 4.0; 7.0 to 7.5; 14.0 to 14.5; 21.0 to 21.5; 28.0 to 28.5; 28.5 to 29.0; 29.0 to 29.5; 29.5 to 30.0 (megahertz). **Frequency stability:** Less than 100 Hz per hour after 20 minutes warm-up from normal ambient conditions. Less than 100 Hz for ±10% line voltage variations. **Modes of operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Dial accuracy — "resettability":** Within 200 Hz on all bands. **Electrical dial accuracy:** Within 400 Hz after calibration at nearest 100 kHz point. **Dial mechanism backlash:** Less than 50 Hz. **Calibration:** 100 kHz crystal. **Power requirements:** 700 to 800 volts at 250 ma; 300 volts at 150 ma; —110 volts at 10 ma; 12 volts at 4.76 amps. **Cabinet dimensions:** $14\frac{7}{8}$" W x $6\frac{5}{8}$" H x $13\frac{3}{8}$" D.

PULSE TUNING OF LINEARS

BY JOHN J. SCHULTZ, *W2EEY/1

Logically, one should tune up a linear at the same input power at which it operates. The difference in value between the p.e.p. and average d.c. power input rating of most linears precludes such tune up in a simple fashion as is done with c.w. transmitters. One method to effect tune up, although not new, but used by few amateurs, is to pulse tune a linear.

No OPERATOR *would normally* tune up a 100 watt c.w. transmitter at only 25 watts d.c. input and then proceed to operate it at 100 watts input without rechecking the tuning, particularly for maximum power output. However, many operators do the equivalent of this procedure when they operate an s.s.b. amplifier at a relatively high p.e.p. input but perform the tune-up of the amplifier at a much reduced carrier d.c. input level. For an s.s.b. amplifier, not only is this procedure insufficient to maximize power output, but the linearity of the amplifier cannot be optimized by adjusting the drive and loading for the best conditions.

* 40 Rossie St., Mystic, Conn. 06355.

D.C. and P.E.P. Input

The low duty cycle of s.s.b. voice operation, which is generally even lower than that of c.w. operation, allows components to be used in an amplifier (tubes, transformers, *etc.*) which have low average power handling capability. Therefore, an amplifier may be rated for 250 watts c.w. service (full, sustained, carrier) and 1,000 watts p.e.p. for s.s.b. service. The two operating modes are different in the important respect that on c.w. the d.c., key-down input is 250 watts while on s.s.b. the instantaneous d.c. input reaches 1,000 watts. The average d.c. input on s.s.b. depends upon the amplifier characteristics, voice characteristics, *etc.* It may be 250 watts or even less, but nonetheless, the amplifier is operating in a different power demand condition than it would be on c.w. and it should be tuned differently. Otherwise, maximum performance will not be obtained from the amplifier.

Some amplifiers are rated for the same p.e.p. input on s.s.b. as their key-down d.c. input on c.w. No problem is presented here as the amplifier can be tuned under key-down conditions to the same peak input level it operates at for s.s.b. transmission. Because of the damping effects involved, the meters (plate and grid current) will read lower (about 50% of their c.w. value) during s.s.b. operation. The peak d.c. input will still reach the c.w. key-down value, as can be seen on an oscilloscope display. No such simple tuning can be performed in the case of other amplifiers when the c.w. key-down and p.e.p. inputs are not the same or when a 2 kw p.e.p. amplifier is tuned while connected to an antenna since, in the latter case, the maximum allowed 1 kw d.c. input value will be exceeded. A dummy load capable of handling 2 kw for a few minutes can, of course, be used for the 2 kw p.e.p. amplifier if it can be operated briefly at the necessary 2 kw c.w. key-down condition.

Pulsing

The necessary conditions of operating an amplifier at its rated p.e.p. input while not exceeding its average d.c. input for tune-up conditions, can be accomplished very neatly by pulsing the transmitter a.f. or r.f. excitation in such a manner that both p.e.p. and average d.c. input conditions are satisfied.

Some simple terms associated with pulse characteristics should be understood as illustrated in Fig. 1. If the maximum amplitude of the pluse represents the peak r.f. or a.f. level necessary in a transmitter to produce the maximum rated p.e.p. input, the average d.c. input will depend upon the time duration (width) of the pulses and the frequency with which they occur. Duty cycle is defined as the pulse time duration divided by the pulse repetition time. For instance, the pulse show in fig. 1(A) has equal on and off times. If the pulse sequence is repeated 60 times a second, each "on" pulse is 1/120 second long. The repetition time for a complete on-off pulse sequence is 1/60 second and, therefore, the duty cycle is ½ or 50%. The average power input is the peak input times the duty cycles or, in the example just given, it would be ½ of the peak input.

If the excitation pulse were modified, as shown in fig. 1(B) so that the repetition time for a complete on-off pulse sequence remained 1/60 second but the "on" pulses were only one quarter the time duration of the entire pulse sequence, the duty cycle would be ¼ or 25%. Therefore, by choosing the proper pulse "on" time as compared to the time of an entire pulse sequence, it is

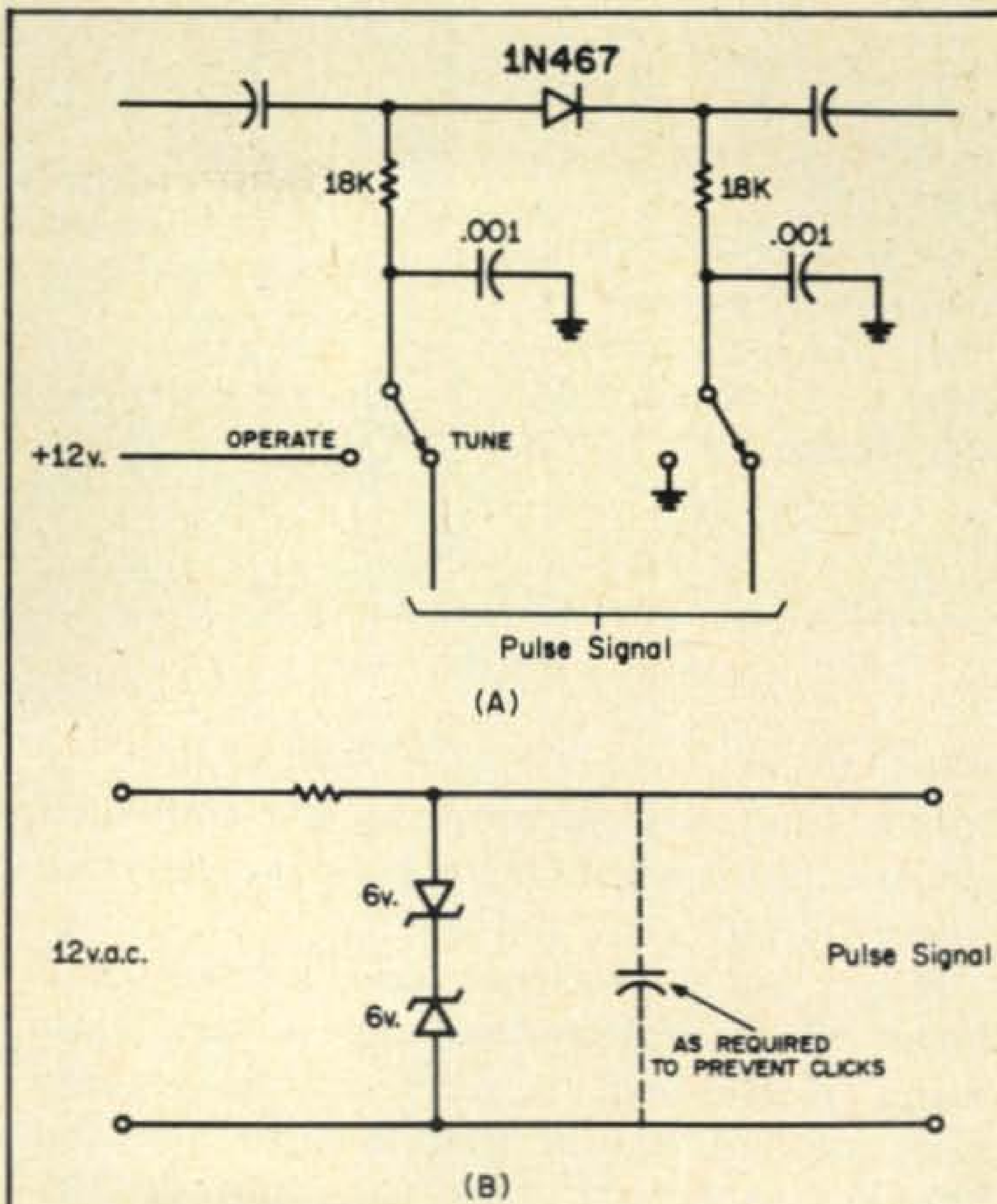


Fig. 2—Simple diode switch (A) and pulse signal generator operating at line frequency.

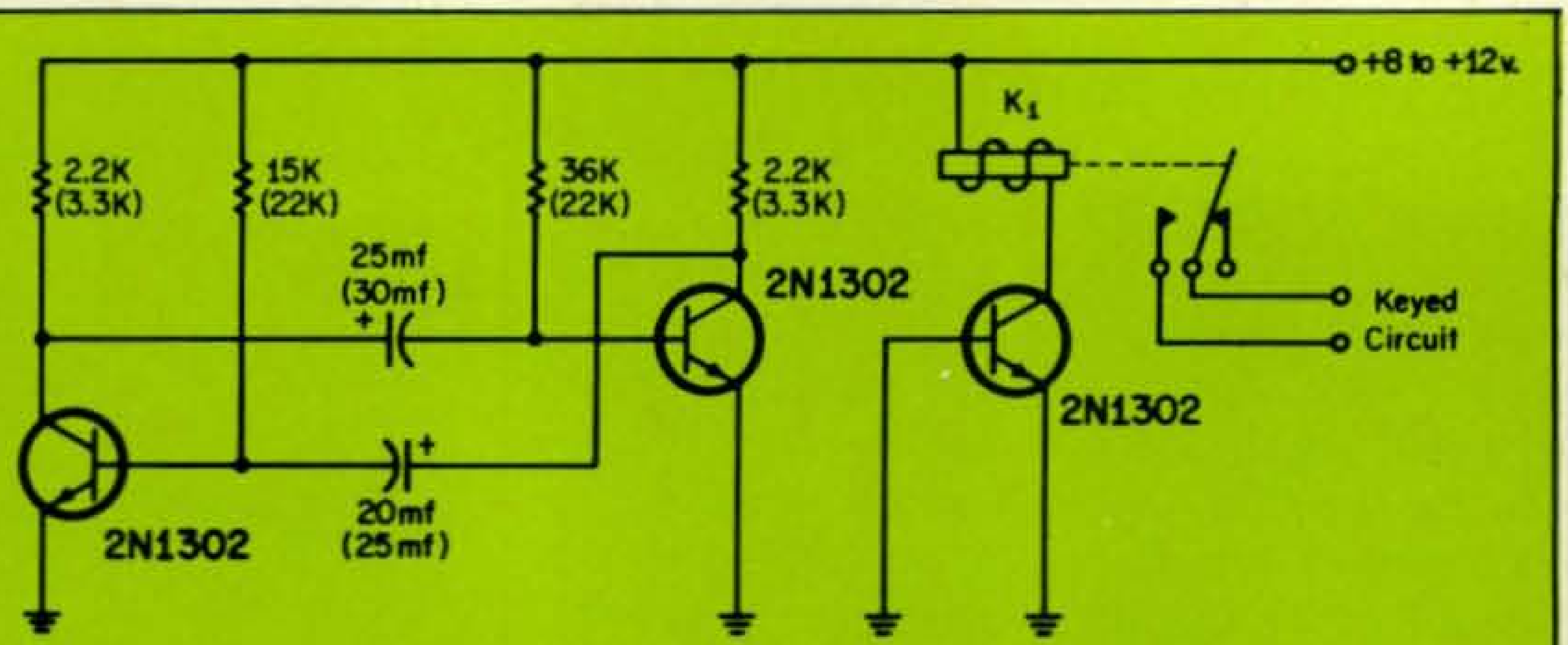
possible to match the p.e.p. and average d.c. operating conditions of any amplifier for tune up purposes.

The on and off keying of an s.s.b. transmitter at the proper rate can be done in a number of ways. The audio input (single tone to produce a single output frequency) or the r.f. carrier using carrier insertion can be controlled. If one were fast and accurate enough, manual keying could be used. One would have to be fast enough so that the plate meter of the amplifier would not move perceptably with the keying of individual on-off sequences and accurate enough so that the on and off periods always had the same time duration relationship. Of course, such performance is not possible with manual keying but the concept of manual keying is useful to remember that key-down conditions represent the peak or highest d.c. power input to an amplifier.

Pulsed Keyers

Various pulsed keyers can be used to actually interrupt either the r.f. or a.f. tone signal input to a s.s.b. transmitter. The simplest situation of all is presented when one has a good electronic keyer and it is desired to maximize power output of a linear which has an average power input capability of one-half its p.e.p. rating. The keyer is set to produce dots at its highest speed and the

Fig. 3—Keyer circuit which can be adjusted for different "on" times. With values shown, duty cycle is ¼ or 25%. With values in parenthesis the duty cycle is ½ or 50%. Relay K_1 is a 4 ma, 2.5K coil, Dunco MMRM or equivalent.



tuning functions adjusted so the indicated power input is one-half the p.e.p. value while power output is maximized.

If one either does not have a keyer or a linear which has an average power input rating of one-half its p.e.p. rating, various other methods can be used to pulse-tune the amplifier. A square wave generator driving either a relay or solidstate switch is one method. With the frequency of the generator set just high enough so the plate meter on the linear does not flutter excessively, the relay or switch is used to key the transmitter. With most generators this method is only useful for applications where a 50% duty cycle is applicable. If one has a generator which allows adjustment of pulse duration as well as frequency, it can be used for any duty cycle requirement.

Figure 2(A) shows a simple diode switch which when driven by a square-wave voltage, can be used to key a low-level a.f. or r.f. signal. It would be possible to incorporate such a switch in a transmitter at any convenient low-level point between two stages. For tuning, the switch is properly driven and for normal operation the diode is forward biased from any convenient source of well filtered d.c. voltage to close the normal signal path. Figure 2(B) shows a very simple 50% duty cycle keying voltage source which could also be simply incorporated into a transmitter. Two low-voltage zener diodes connected back-to-back clip the a.c. input voltage so that an approximate square wave results.

Another form of keying unit is shown in fig. 3. It is simply a multivibrator driving a switching transistor to control a relay. By varying the value of the components in the oscillator circuit, the duty cycle as well as the frequency can be varied. Values for 50 and 25% duty cycles are shown. The latter duty cycle would be typical of many TV-tube type linears where a unit rated at 1,000 watts p.e.p. input might well be capable of only 250 watts average or prolonged key-down input.

Procedures

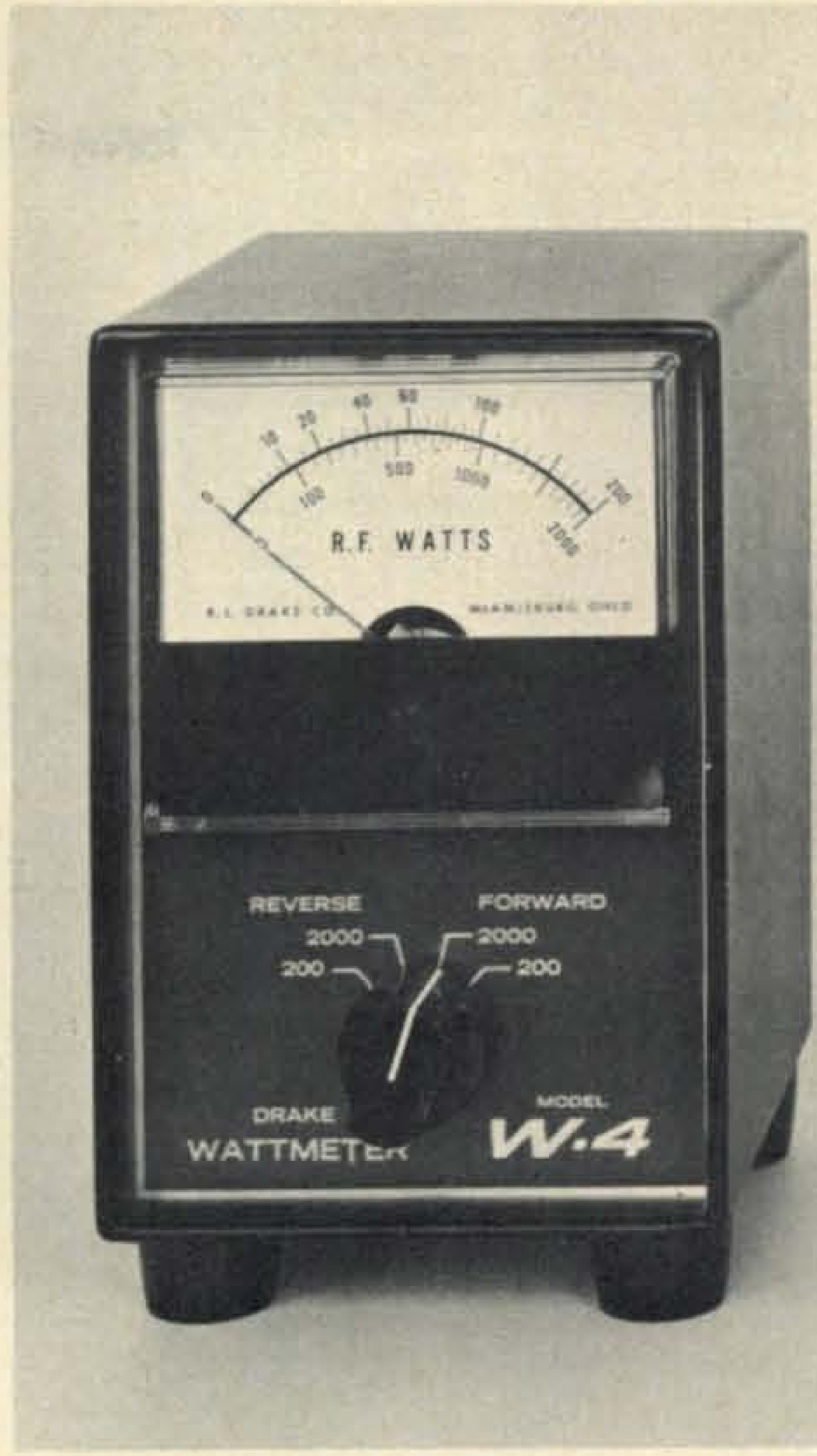
It should be noted that the overall objective when adjusting the drive, loading, *etc.*, of a linear is to produce the maximum *undistorted* power output, not just maximum power output. A pulse-keyer should be used to quickly adjust a linear only when it has been otherwise determined by conventional linearity checks that the linear can operate at a certain output level without producing excessive distortion products. Such checks are best done working into a dummy load rather than on-the-air since they generally take a bit of time to perform. However, if they are desired to be done on-the-air, a keyer can also be used as previously described but to interrupt a two-tone test signal where use of the latter directly would cause the linear d.c. input to exceed 1 kw. Using a two-tone test, the average d.c. input is 0.64 of the p.e.p. input. When keyed, the average d.c. should fall as described before depending upon the duty cycle chosen.

Keyer Waveshape

The form of waveshape which a keyer produces should be checked at least once with an oscilloscope. No keyer produces an exact square wave and, in fact, the latter would be illegal as noted in the next paragraph. The actual duty cycle can be readily estimated from the oscilloscope display by comparing the actual area contained in the "on" pulse to that of the area which would be obtained with a perfect square wave. For a keyer with a nominal duty cycle of 50%,

[*Continued on page 116*]

CQ Reviews: The Drake W-4 Wattmeter



BY WILFRED M. SCHERER,* W2AEF

A NEW addition to the Drake line of amateur radio gear is the Model W-4 R. F. Wattmeter with which s.w.r. may also be determined by using the monograph supplied.

The operation of the reflectometer-type s.w.r. indicator commonly used by the amateur depends on inductive and capacitive coupling between the center conductor of a section of transmission line and a pair of adjacent wires to sense forward and reflected power and consequently indicate the s.w.r. Although it is a simple affair and useful for s.w.r. readings, it does not indicate actual power as may often be desired.

This is due to the fact that the sensing arrangement is a frequency-conscious device in which the sensitivity increases with an increase in frequency. It thus requires a meter-sensitivity control which must be reset for a given scale reading and power whenever the operating frequency is changed. It is not adaptable, therefore, for fixed calibration and its usefulness in respect to power readings is only that of indicating the *relative* power at the *particular* operating frequency.

On the other hand, a directional wattmeter, such as the W-4, is not frequency-sensitive and thus can be calibrated to show actual power as well as provide the determination of s.w.r. It also is a reflectometer, but it senses the forward and reflected power by means of a transformer that has a balanced center-tapped toroid-wound secondary, while the primary consists of the center conductor of a transmission line which passes through the middle of the toroid core. By proper design and selection of components, a relatively flat response can be realized over a frequency range of at least 15:1, making it possible to calibrate the instrument for actual power levels independent of frequency. The s.w.r. is determined from the ratio of the forward and reflected power readings.

The Drake wattmeter is designed for "in-line" use with 50-ohm transmission lines to indicate either forward or reflected power levels up to 2000 watts (continuous duty)

* Technical Director, *CQ*.

over a frequency range of 2-30 mc. It also may be used at 50 mc with a correction factor of $\times$ 1.11. The accuracy is rated at $\pm$ [5% of reading + 1% of full-scale calibration]. There are two ranges, 0-200 and 0-2000 watts. Either one may be switched to read forward or reverse power. A celluloid nomographic-type calculator enables the s.w.r. to be conveniently determined according to directional-power readings. The v.s.w.r. of the unit is rated at no more than 1.05:1.

The W-4 consists of a small case in which is installed the selector switch and the indicating meter. In the rear of the case, that has an open back, is the "sensing" coupler equipped with standard SO-239 coax connectors which protrude to the rear for the input and output cables. In order that the indicator may be placed at a convenient place for easy observation, without making it necessary to extend or drape cumbersome coax leads to the unit, the sensing coupler, which has about 3 feet of cable attached to it, may be removed from the case and placed near the rear of the transmitter.

Installation of the W-4 simply requires connecting it between the output of the transmitter and the transmission line, or in series with the line at some convenient point. With the switch set for one of the forward-power ranges, the meter will read the sum of the power absorbed by the load and that reflected by the load. With the switch set for a reversed range, the reading will show only the reflected power which with a perfectly matched load and an s.w.r. of 1:1, will be zero. The forward reading also is indicative of the applied power or the transmitter output.

Where the s.w.r. is other than 1:1, some of the power applied to the line will be reflected back toward the source by an amount depending on the degree of mismatch at the load. The power taken by the load then is the difference between the forward and reflected powers. Also, the percentage of reflected power, related to the forward power, is indicative of the s.w.r. This can easily be ascertained using a straight-edge on the nomograph chart supplied with the unit.

Performance

The operation and performance of the W-4 Wattmeter was checked against a number of other wattmeters as well as by measurement of the r.f. voltage across a load of known characteristics while using an r.f. voltmeter of known accuracy. Results indicated the calibration of the W-4 to be well within the specified tolerances.

The s.w.r. nomograph chart is handy to use and is always readily accessible at the rear of the unit where it is installed. When forward-power readings are above 1000 watts and the reflected power is more than 10%, the chart is not large enough to indicate the s.w.r., but by *dividing* the indicated power readings by 10 and using the resulting power figures on the calculator, the s.w.r. may then be found. A similar situation exists at low-power levels when the reflected power is less than 10%, in which case you *multiply* the indicated readings by 10 and use the resulting power figures on the chart.

It may not always be necessary to use the calculator, inasmuch as the s.w.r. for a few power ratios may be kept in mind. For easy mentally-determined figures, reflected powers of 1, 5, 10 and 25 percent of the forward power indicate *approximate* s.w.r.'s of 1.15:1, 1.2:1, 2:1 and 3:1 respectively.

Although these references will be handy for quick checks and for letting you know when you are getting close to being "in-the-ballpark" during antenna adjustments, the ultimate goal of course is to obtain zero reflected power for unity s.w.r.

[*Continued on page 113*]

Rear view of the W-4 Wattmeter. The removable sensing coupler mounts in the bottom of the case in the upper part of which may be seen the attached inter-connecting cable coiled up. The s.w.r. calculator is at the lower left.

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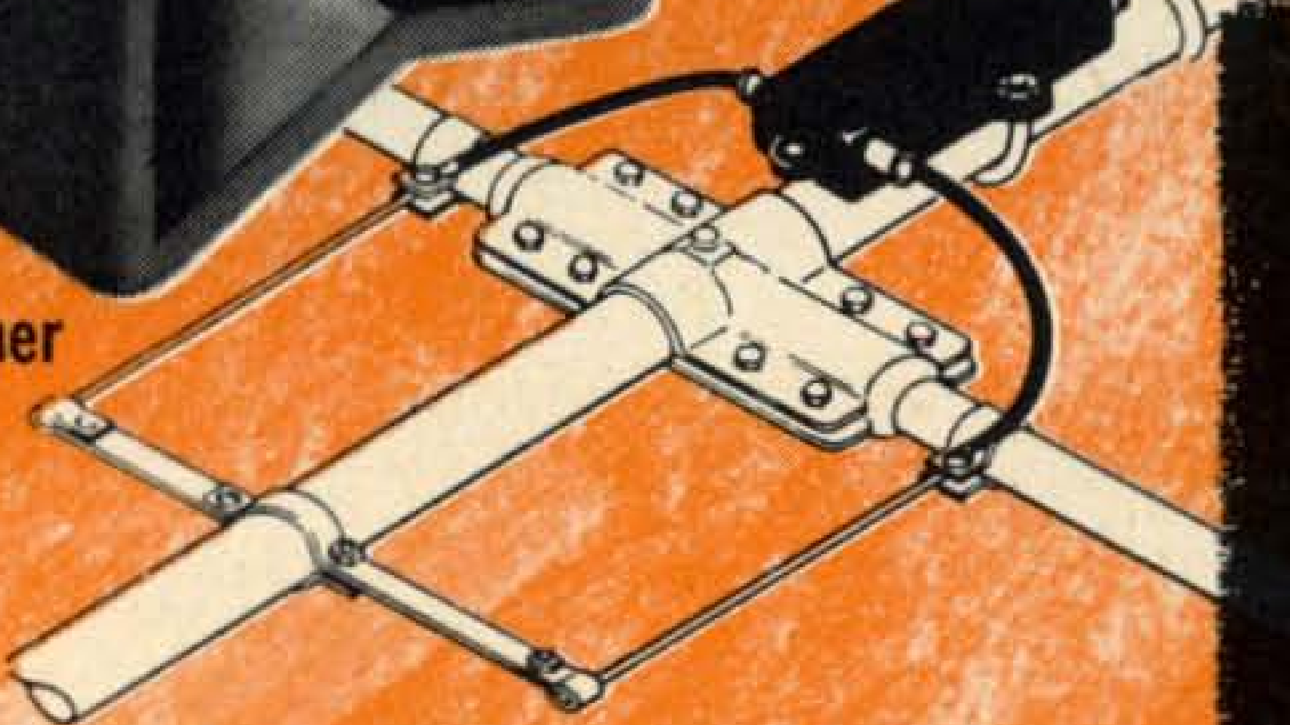

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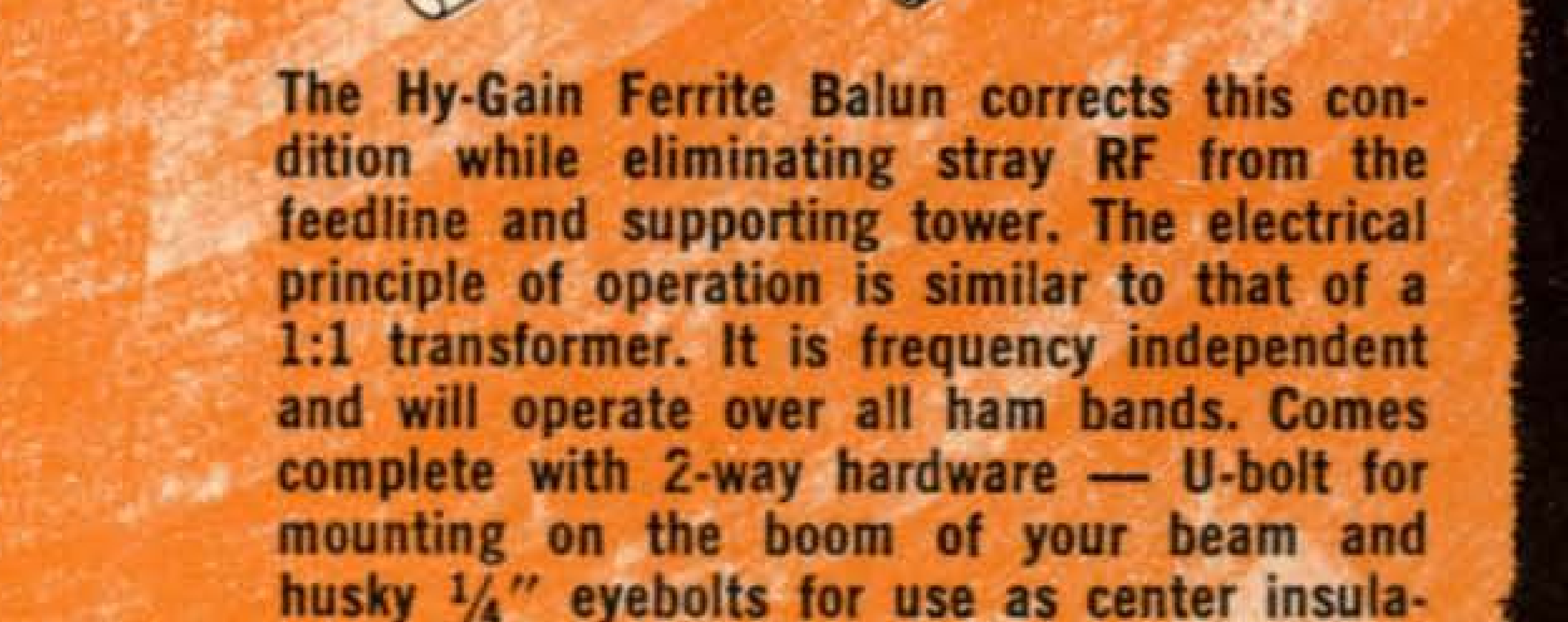
When a beam or dipole antenna is fed directly from a coaxial line, an unbalanced condition exists impeding the transfer of energy to the antenna. This is due to the fact that in an unbalanced condition currents can flow down the outside (shield) of the coax. These currents radiate and thus affect both the pattern and the front-to-back ratio. In addition, they cause TVI and drain away effective power.

The Hy-Gain Ferrite Balun corrects this condition while eliminating stray RF from the feedline and supporting tower. The electrical principle of operation is similar to that of a 1:1 transformer. It is frequency independent and will operate over all ham bands. Comes complete with 2-way hardware — U-bolt for mounting on the boom of your beam and husky 1/4" eyebolts for use as center insulator on a doublet.



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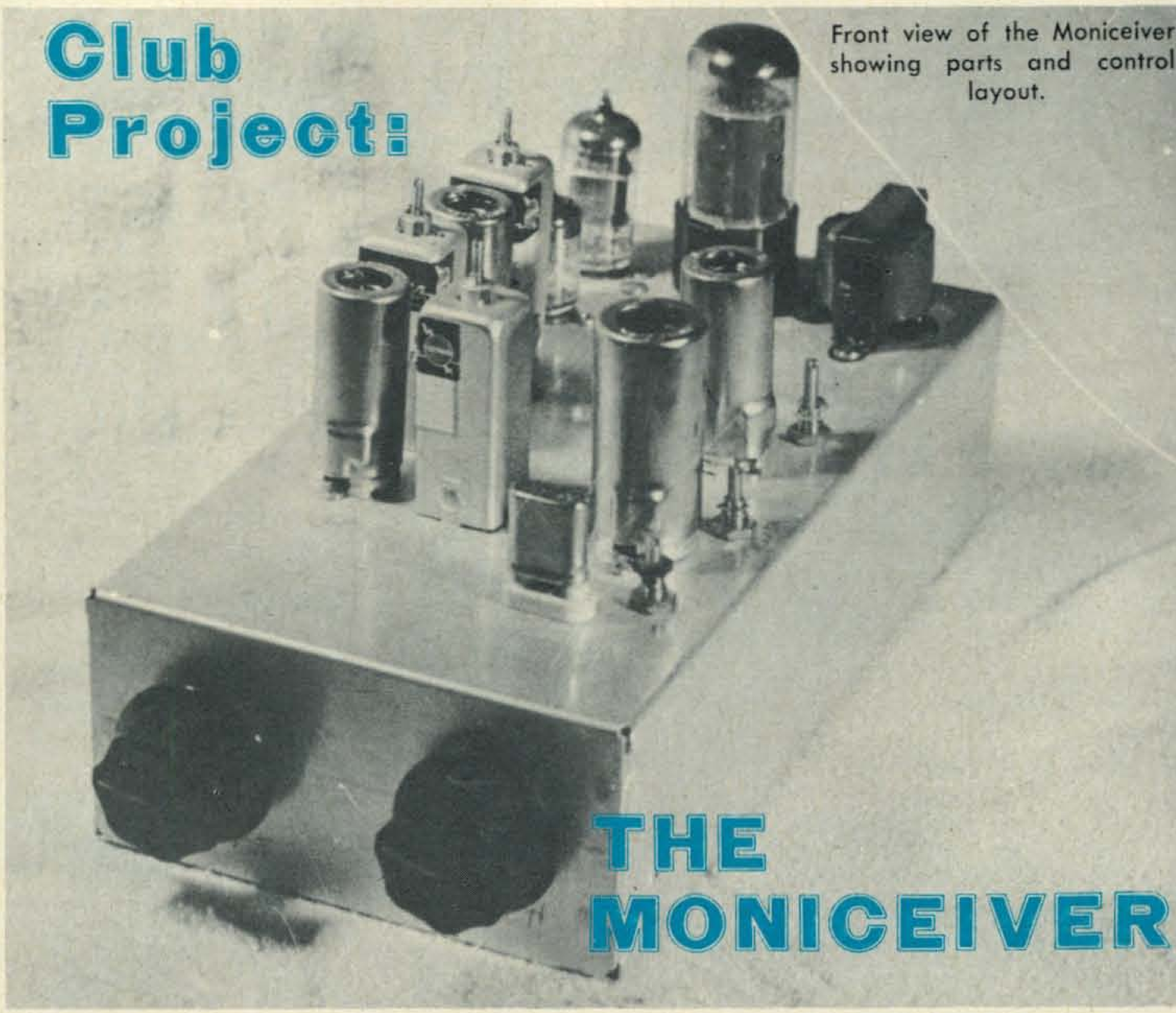

Front view of the Moniceiver showing parts and control layout.

THE MONICEIVER

BY DAVID F. PLANT,* K9LAJ/2

Ideal as a club project, the Moniceiver is a crystal controlled six meter receiver. The single conversion circuitry includes an effective noise limiter and squelch circuit, making it well suited for monitoring or net use.

CERTAINLY it is accepted that public and emergency service are important aspects of the amateur radio service, yet how many hams could fire up their mobile rigs at four in the morning to report a fire or traffic accident? There is always the chance that someone is tuning around the band and would hear the call, but it's a small chance. And then there was the time that you wanted to relay to the wife that you'd be late, or the time that you just wanted some company while driving; seems no one was listening, even on the club frequency.

* Number 5 Weehawken Street, N.Y., N.Y. 10014.

There is, then, a good argument for monitoring a certain frequency. The problem is that not many hams want to keep checking their receivers to make sure that they are on the exact frequency. Also the background noise (like ignition pulses from Dick's Porsche) can become quite fatiguing, to say the least.

The solution is to build a separate receiver for monitoring purposes. In the receiver, incorporate squelch, crystal control, a good noise limiter, and broad tuning. This is the Moniceiver 6, as built for a club project by the 6 & 2 Club of Downers Grove, Illinois.

Circuit Description

Basically, the Moniceiver is a single conversion crystal controlled six meter receiver with a relatively high (1500 kc) intermediate frequency. This choice of i.f. is helpful in preventing images, as the normal image (twice the intermediate frequency) falls well out of the passband of the receiver front end. A high i.f. is also helpful because v.h.f. transmitters are seldom on the exact frequency and the 15 kc i.f. bandwidth enables the operator to copy stations several kilocycles off frequency.

The schematic of the Moniceiver is shown in fig. 1. A 6CB6A r.f. stage is followed by the pentode section of a 6U8A, operating as a mixer. The other section of the 6U8A serves as a crystal controlled oscillator operating 1500 kc below the incoming 6 meter frequency and is coupled to the mixer by internal tube capacity. The 1500 kc signal is amplified by two conventional i.f. stages using the popular 6BA6 pentode and is then detected by one diode section of a 6AL5. The other diode section of the 6AL5 functions as a noise limiter feeding the audio to one half of a 12AX7 audio amplifier.

The other half of the 12AX7 operates as an adjustable a.v.c. controlled clamp (squelch) tube. When the a.v.c. voltage is low, (no signal condition) the clamp tube draws current and this causes an excessive bias to be applied to the audio stage, thus

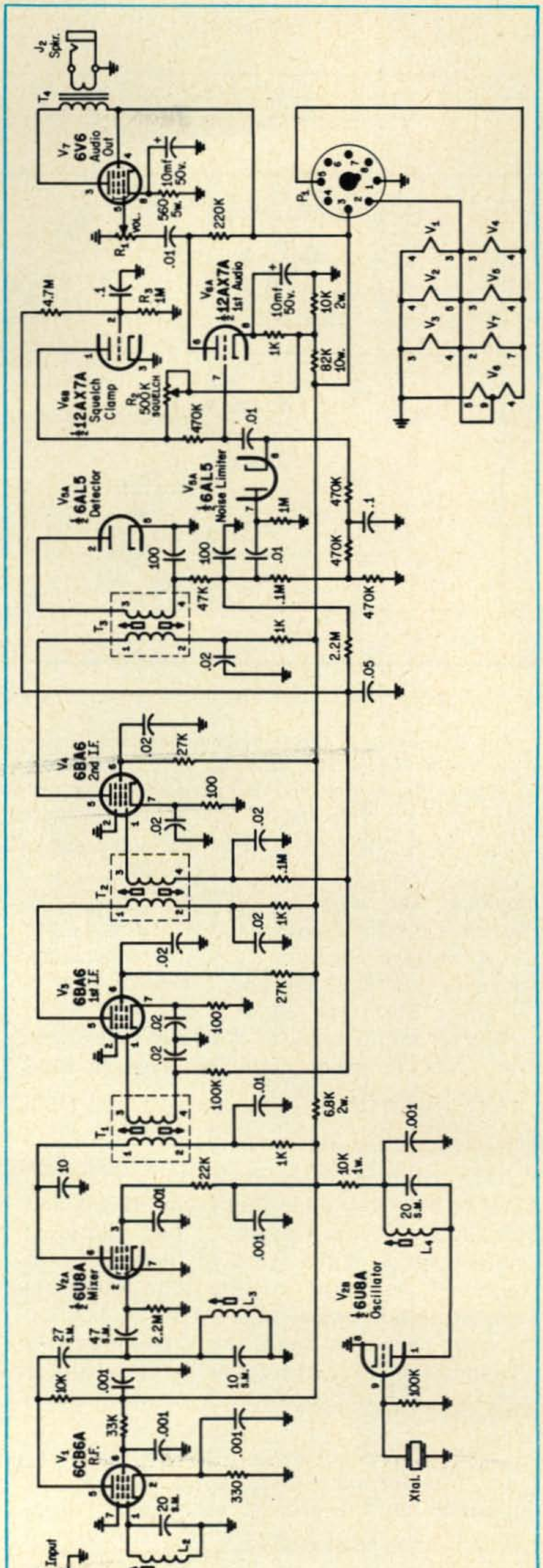

Fig. 1—Circuit of a 6 meter crystal controlled receiver that incorporates a crystal controlled local oscillator and a squelch circuit. All resistors are a half watt unless otherwise noted. All capacitors one or greater in value are in mmf. Capacitors less than one in value are in mmf except where otherwise noted. Capacitors marked SM are silver micas and all i.f. and r.f. bypass capacitors are disk types.

L_1—2 turn link of hookup wire on the ground end of L_2

L_2, L_3, L_4—5 t #24 e. closewound on 3/8" slug tuned forms, Miller #4400 or equiv.

T_1, T_2—1500 kc i.f. Miller 12W-1 or equiv.

T_3—1500 kc i.f. Miller 12W-2 or equiv.

T_4—output transformer 5K ohms to 3.2 ohms. Knight 54B2064 or equiv.

Y_1—Overtone type crystal cut for the desired frequency less the i.f. (1500 kc).

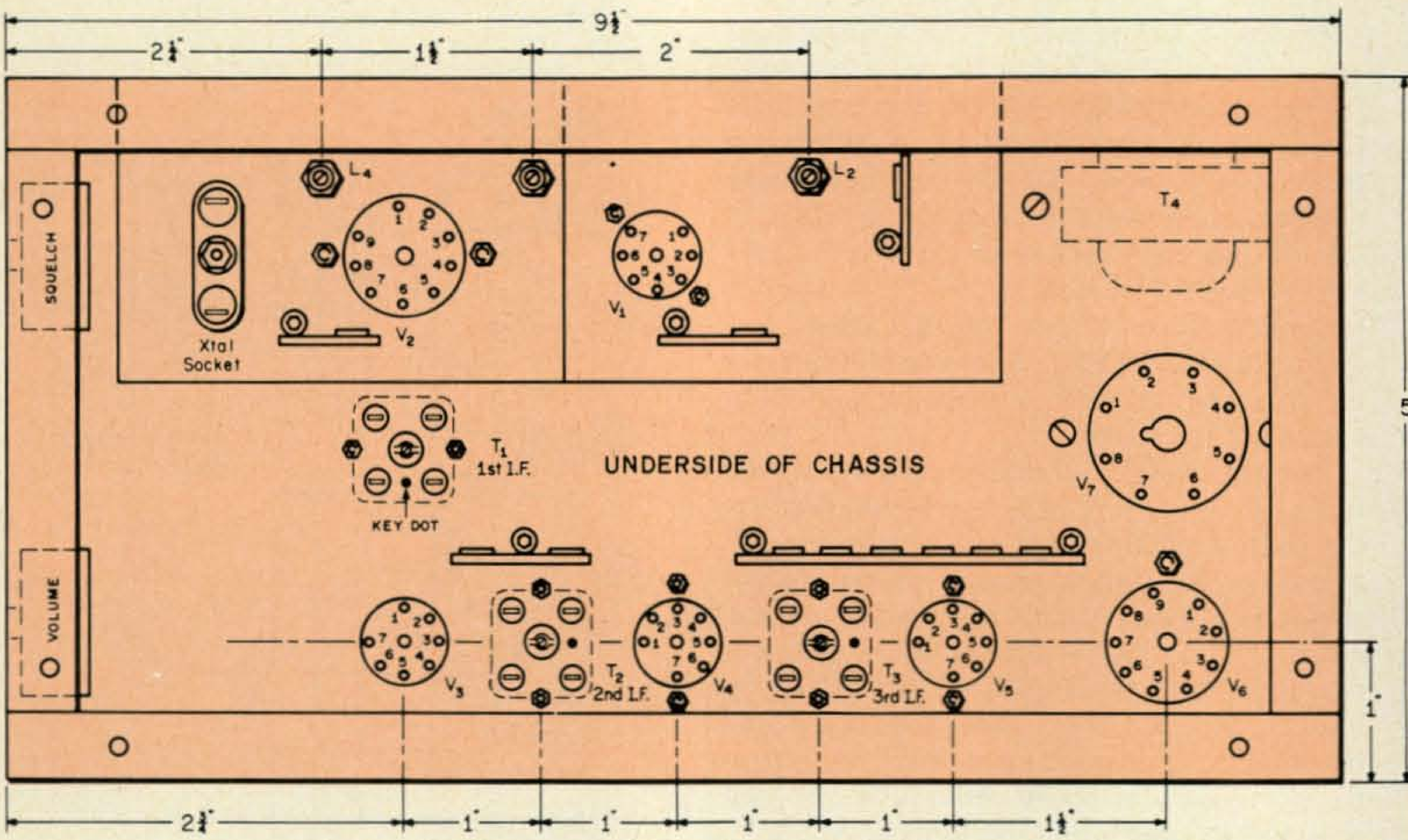

Fig. 2—Layout of the 6 meter Moniceiver. Arrows on the tube socket locations indicate the positions of the keyways. The dates in the I.f. locations indicate the transformer orientation. The terminal strips shown are mounted beneath the chassis as are the shields indicated by the broken lines.

making the audio amplifier inoperative. When a carrier comes on the frequency the a.v.c. voltage goes up, the clamp tube stops drawing current, and the excessive bias is removed from the audio stage. The audio amplifier then functions normally and drives the 6V6GT power amplifier stage to loud speaker output.

Mechanical

The Moniceiver is built on a standard 2½ × 5 × 9½ inch aluminum chassis and the layout is shown in fig. 2. The additional chassis space at the front of the unit is intentional, as some of the club members wanted to add extra circuitry for application to their particular needs. Most common was the addition of extra crystal sockets and a rotary switch to provide multi-channel coverage.

The i.f. transformers, crystal socket, output transformer, and tube sockets are mounted on the chassis and positioned as shown in fig. 2 for ease of wiring and shortest lead length. Holes are provided for L_1, L_2, and L_3 as shown; but these coils are not mounted until the wiring stage.

The speaker jack, antenna connector, and power plug are mounted on the rear apron of the chassis; and the squelch and volume controls are placed on the front.

Terminal strips are mounted under the chassis and positioned as per fig. 2.

Wiring A Club Project

There are two different approaches to wiring a receiver project such as the Moniceiver and each has its advantages. One way is to build stage by stage, starting with the audio and working backward. This technique allows the builder to test each stage as it is completed, thus simplifying testing and experimenting. Most of this writer's prototype and experimental receivers have been built in this manner.

The second approach is to break the wiring down into logical groups or layers such as is done with a commercially made kit. This procedure is better when several units are being built at the same time since the units will then be identical, simplifying any service problems that could arise. Also, this avenue allows better construction practice as all the near chassis wiring, such as filament circuitry and grounding, can be done first.

If the Moniceiver is chosen as a club project, one club member could build a unit initially and then break down the wiring for the rest of the club members. This task should be done by a person with some building experience for the performance of all the receivers is dependant upon his wiring breakdown.[1]

Moniceiver Wiring

Wiring should be as direct as possible, as long leads can become resonant or pick up stray energy at v.h.f. frequencies. The screen, cathode, and i.f. transformer bypass capacitor leads should be as short as possible, so allow plenty of grounding lugs (two at each socket) for this purpose.

The B plus and a.v.c. lines, and the sequelch circuit have many common wiring junctions so several terminal strips were included in the design of the Moniceiver. Near V_1 and V_2 are two used as B plus tie points, and the one near i.f. transformer, T_2, has one lug used for B plus, and the other lug used for a tie point for the a.v.c. circuit resistors. The eight lug terminal strip is used for a.v.c., B plus, and the squelch and audio circuit wiring.

Figure 3 illustrates the best way to wire the i.f. stages. A strap is formed with bare wire between the two ground lugs and the center terminal of the tube socket, and the screen bypass capacitor is placed over the socket in a manner that allows the body of the capacitor to act as a shield across the socket, thus isolating the grid circuitry from the plate wiring. The r.f. stage is wired in a similar fashion with the exception of different part values.

The filament circuit should be wired early so it can lie close to the chassis. The volume control leads do not have to be shielded, but they should be twisted together and kept away from the filament wires and also close to the chassis.

Aluminum shielding will be placed around the r.f. and mixer-oscillator stages so allow room for this addition when wiring. Mounting the silver mica capacitors across L_2, L_3 and L_4 prior to installation will help ease construction in these areas; and the coupling capacitor, C_1, should be added after the shielding is placed, and fed through a hole in the shielding between the r.f. stage and the mixer.

Inductor L_1 consists of a two turn link wound at the ground end of L_2 and is mounted after wiring and shielding of the r.f. stage have been completed. The link is tied to the nearby terminal strip, one end then being grounded and the other end going to the center conductor of a short piece of coax which is run to the antenna connector, J_1.

Testing and Alignment

Initial testing is accomplished by applying filament and plate voltage to the Moniceiver, and plugging in a speaker. Rotation of the volume control, R_1, should increase the background noise.

The i.f. alignment is done by feeding a 1500 kc signal from a signal generator through a capacitor to the plate of the mixer tube, V_{2A}. The three i.f. transformers are peaked for maximum negative a.v.c. voltage, as measured on a v.t.v.m.; or maximum audio output if the 1500 kc source is modulated. Keep the level of the 1500 kc signal as low as possible to avoid overloading the a.v.c. circuit.

The local oscillator is adjusted by holding a neon lamp (such as a NE51) near L_4 and adjusting the slug. It will be found that the output will peak, and then the crystal will stop oscillating. This is typical of an overtone oscillator. Go back with the slug until the oscillator fires again and then add half a turn for luck. Turn the B plus off and on several times to make sure that the oscillator works whenever power is applied. Another

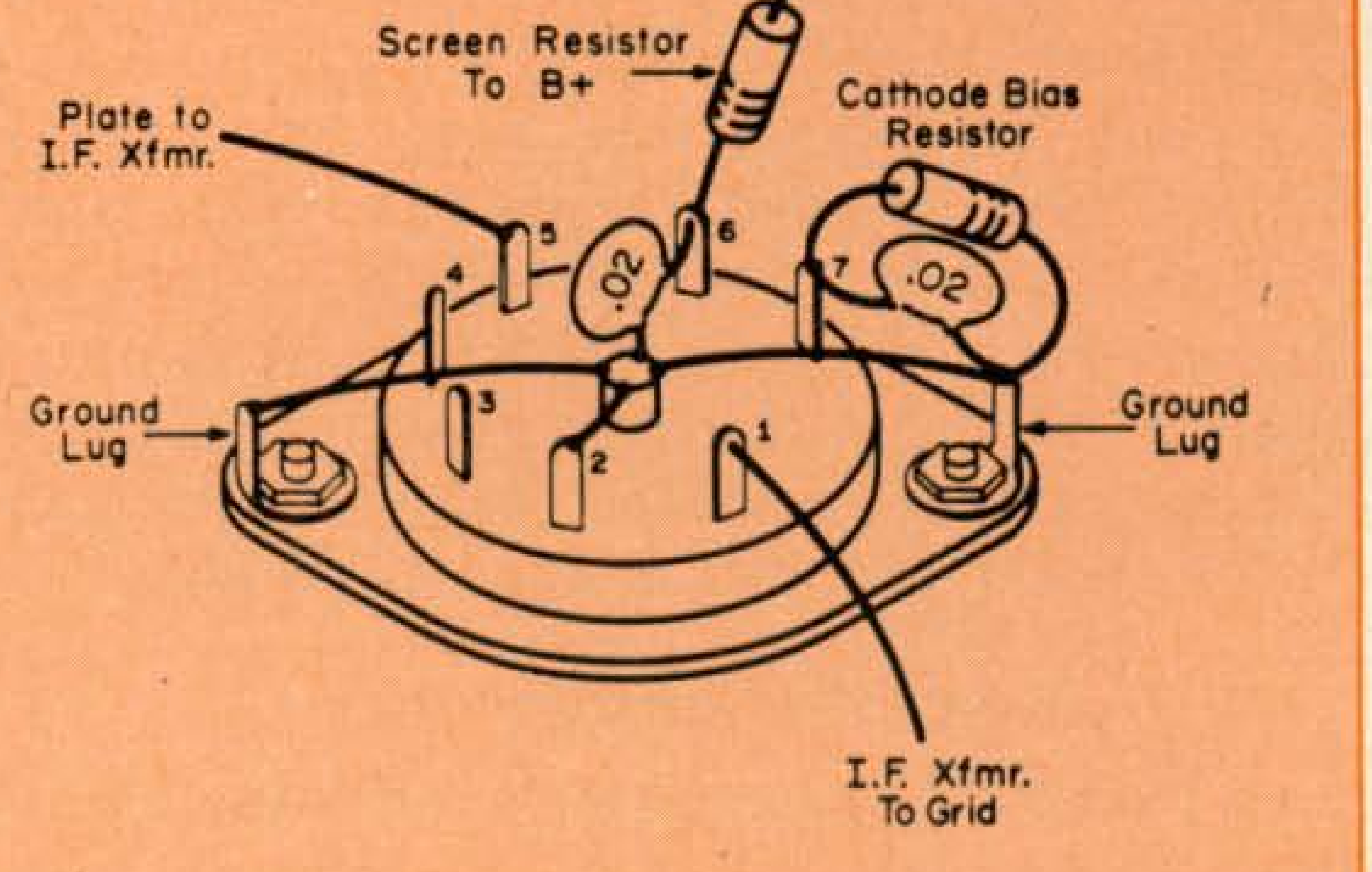

Fig. 3—Pictorial view of an i.f. stage socket wiring showing the grounding techniques and the short lead length on the bypass capacitors.

[1] The wiring breakdown for the 6 & 2 Club had ten operations, with each having a pictorial diagram.

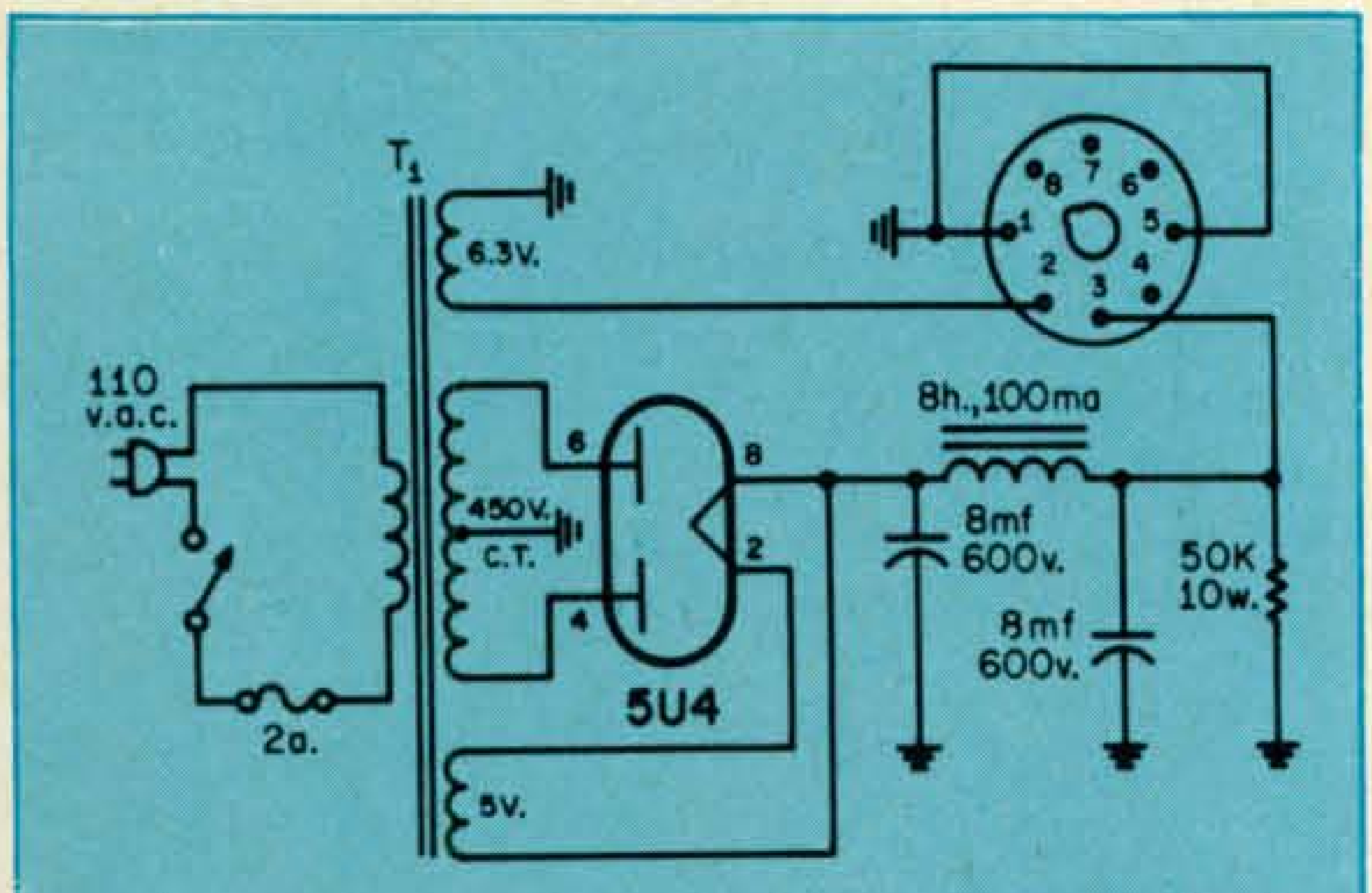

Fig. 4—Typical power supply circuit suitable for the 6 meter receiver. The transformer can be a small receiver type rated as described in the text. If used to power a transmitter also, the transmitter current demands should determine the transformer and choke current rating.

indication of correct oscillator tuning will be an increase in noise (hissing) in the receiver when the crystal is oscillating.

The mixer coil, L_3, and the r.f. coil, L_2, are then peaked with a 50 mc signal to complete alignment.

After alignment the squelch action should be tested. Rotation of R_2 should cause complete quieting in the receiver, and the point where quieting occurs is the most sensitive squelch setting. The 1 megohm resistor, R_3, determines the squelch sensitivity and its value should be decreased if the squelching action is too sensitive, as evidenced by inability to completely quiet the receiver. Resistor R_3 should be increased in value if the squelch lacks sensitivity.

The Power Supply

The supply requirements for the Moniceiver are 6 to 12 volts for the filaments, and 175 to 250 v.d.c. at about 50 ma for the plate supply. The necessary power can be obtained from another piece of equipment, or a separate power supply can be built. Figure 4 shows a suitable supply that can be built from inexpensive components. For mobile operation, a small vibrator supply or d.c. to d.c. converter will more than adequately handle the power requirements. In either case, the receiver's power supply can also be used to power a small transmitter.

Antenna Considerations

A variety of antennas have been used with the Moniceivers, but for monitoring purposes the omni-directional type was found to be the most successful—especially for copying mobile stations. The high gain of the receiver front end makes possible the use of low, or unity gain antennas such as dipoles, halos, and vertical ground planes. The polarization (vertical or horizontal) should be compatible with the majority of stations in the area.

Evaluation

Performance of the Moniceiver was gratifying. It was found to be at least as sensitive as the regular station receiver, and mobile stations 25 miles away would trigger the squelch.

The club project was a success, not only because it gave the club a monitoring receiver, but also because many thought it very instructive.

Using all new parts, the cost of the Moniceiver is around $35, but this amount can be brought down considerably by judicious shopping. Items such as the speaker output transformer, and the i.f. transformers are used in CB receivers, are often on sale, and the controls, connectors, and tube sockets can be found in surplus stores. Barry Electronics, 512 Broadway, New York, N. Y., will supply a kit of the 7 tubes for $6.15.

The author wishes to thank Lou Wardin, WA9BSF, for his many painstaking hours drawing and redrawing schematics; and Dave Arnold, W9DTJ, for many suggestions and help. Special thanks to Mark Ross, W9RHZ, whose encouragement (and basement) made possible Club Project Moniceiver. ■

The moniceiver used in the author's transceiver. See next month.

Large scale drawings and drilling templates are available *from the author* at his cost of $1.25 for the set. In quantities of 10 or more the drawings are available for $1.00 a set. These drawings would be especially helpful if the Moniceiver is built as a club project.

Grumbles

by Sam

"THE rig here is homebrew and using 14 gold plated 3/32 left handed framistran screws and running 10 kilowatts into a 6SN7 modulated by a pair of matched CK722's . . . awk . . . arghahhhhhhhh . . . ."

Only a dream, it's true, but if I can ever perfect my invention it may really come to pass. Right now all I have is a little black box with a push-button switch on the top. When I am on the receiving end of one of these conversations I reach over and press the little button once or twice, good and hard. Nothing happens, of course, but if I can just figure out a way to make some kind of weird horrendous St. Elmo's Fire leap from the Turner and down the guy's esophagus I will have contributed immeasurably to the furtherance of ham radio.

Last month I told you that there was such a large response to my comments on the dullness of being a ham that I might delve into the topic a bit deeper. The fault isn't in ham radio itself, I'd like to dump it in the lap of the FCC—they ought to ask you a few questions on the exam just to see if you are capable of communicating once the contact is established. Knowing how to dip a final is keen, but once the rig is tuned up you're sitting there with a mighty carrier at your fingertips and nothing worthwhile to do with it.

It's like getting a driver's license, buying a Rolls Royce, and then realizing that you only know how to drive in a straight line.

Let's face it, it shows no technical prowess, accomplishes nothing for the state of the art of radio, to plug in a rig, connect an antenna, and ragchew with a guy. This is true even if the rig is homebrew from plans in a magazine, and goes double if the set is high powered.

OK, so you made the contact—you've also made your point that 1. The household wiring is connected to the telephone pole outside the shack, 2. The voltage is approximately 110 to 120 volts, 3. The rig is connected to the power line properly and is functioning as expected, 4. The antenna didn't blow down or corrode since the previous contact, 5. Messrs. Kennelly and Heaviside knew what they were talking about, and 6. The guy on the other end knows at least as much as you do about ham radio since he was able to get his junk working too.

Like, so what? Once you've confirmed the foregoing things to yourself and the fellow on the other end there's not much point in boggling the airwaves with insipid rig rundowns. Do you think that now that I've learned that your dinky signal is coming to me courtesy of a Signal Schpritzer Mark XII (or whatever other lies you feel like peddling that day) that I really give a hoot? Do you think that I'm going out to sell my rig and buy a Signal Schpritzer Mark XII because *you* use one?

Quite frankly, many of the signals I hear are so feeble and poorly modulated that learning what the guy is using would only be a deterrent when I go out to buy my next rig. If I were a manufacturer of ham gear I would listen for the idiots with the rotten signals and then pay them to say that they're using a competitor's set.

[*Continued on page 120*]

* c/o *CQ*, 14 Vanderventer Ave., Port Washington, L.I., N.Y., 11050.

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For more information, see your distributor, or write:

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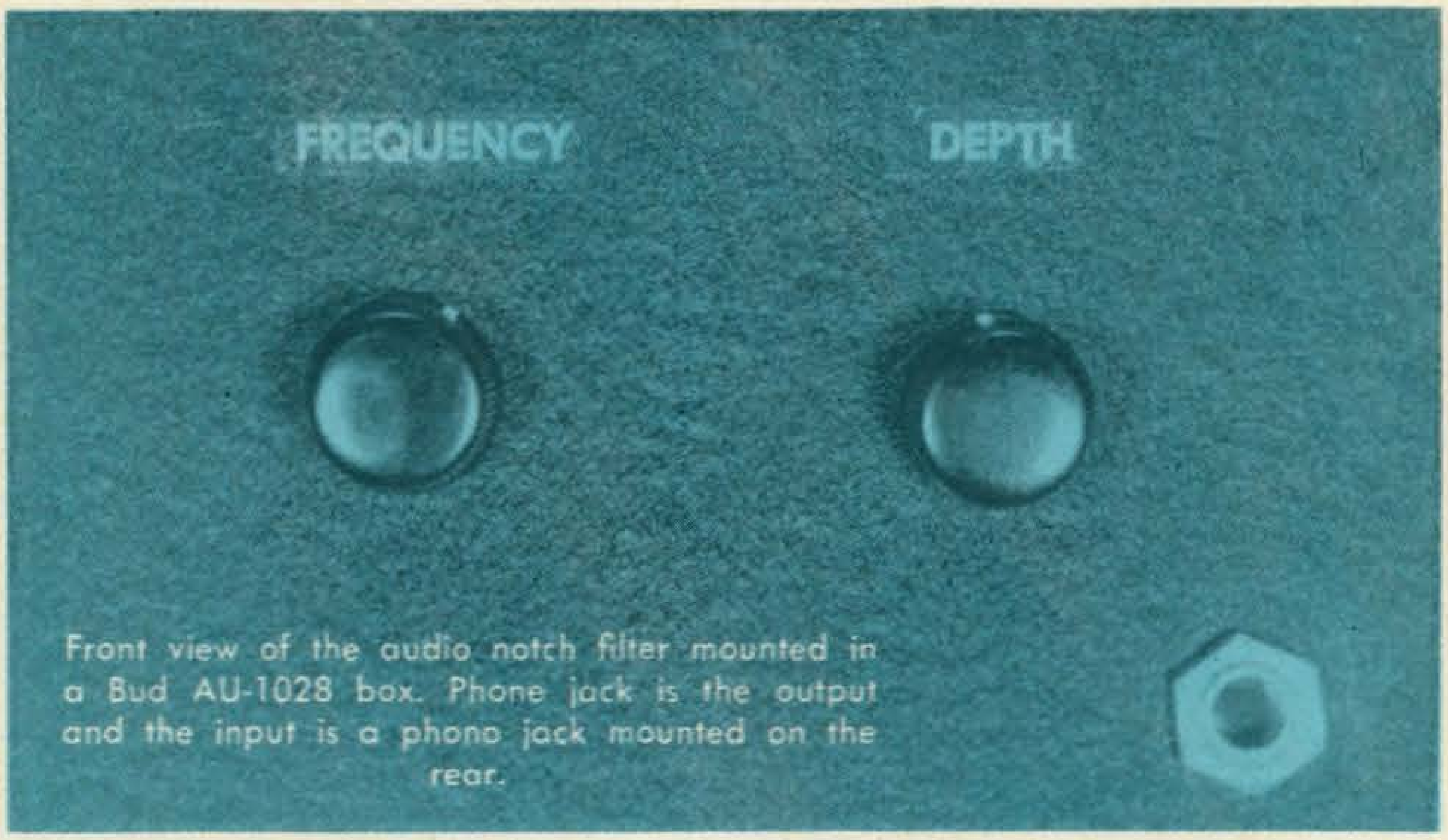


Front view of the audio notch filter mounted in a Bud AU-1028 box. Phone jack is the output and the input is a phono jack mounted on the rear.

AN AUDIO NOTCH FILTER

BY DON M. WHERRY, *W6EUM

This audio notch filter is designed primarily for use with transceivers whose selectivity is not quite adequate for c.w. operation. The unit includes a simple two stage f.e.t. amplifier to make up for the insertion loss of the filter and includes adjustable peaking.

One of the undesirable aspects of the big jump towards transceivers has been the hardships it has imposed on the c.w. operators, the most important of which is the lack of sufficient receiver selectivity for satisfactory c.w. work. With a few exceptions this deficiency is common in all models of this type of equipment.

Several methods for helping this situation have been published including such things as outboard audio filters, outboard i.f. stages using crystal lattice filters, double conversions, *etc.*, but one feature of the better standard receiver has been lacking in all these modifications and additions—a notch filter.

Anyone who has used an i.f. notch filter has, I am sure, been impressed at the effectiveness of this feature and of its ability to time and again save a contact. The audio version described here is slightly more difficult to use because of the interaction between the depth and the frequency controls but a little familiarization with its characteristics will enable anyone to get results comparable to the i.f. version. A notch depth of —40 to —45 db is easily possible; in fact the theoretical depth is infinite as it is a simple phase shift and signal cancellation process. With a pure sine wave, depths of —55 to —65 db are easy. However, with amateur c.w. signals you run into slight signal instabilities and high harmonic contents so depths of below —45 db are hard to obtain. Also at the bottom of the notch you are dealing with a very narrow bandwidth which makes it a little difficult to set in. These same general situations also exist with the commercial

*2121 Grandview Drive, Camarillo, California 93010.

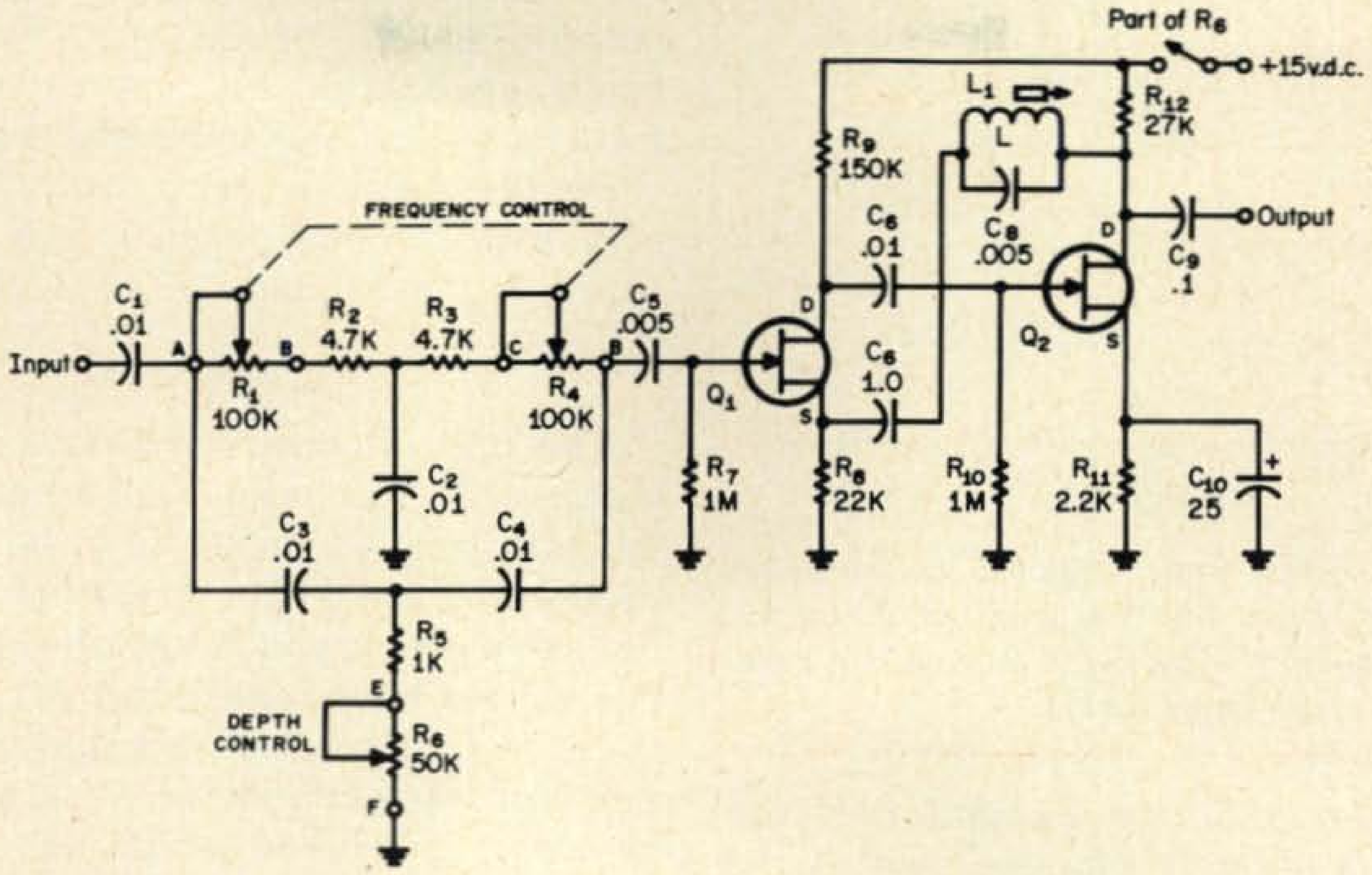


Fig. 1—Circuit of an audio type notch filter to improve c.w. reception

L_1—Variable inductor, 21 hy mean value; UTC VIC-18 equiv.

Q_1, Q_2—FET's, Motorola MPF103 or equiv.

R_1 R_4—Dual 100K pot., IRC PQ 11-128

i.f. notch filter, of course.

Circuit

An examination of the circuit of Fig. 1 shows the output of your receiver feeding into a phase shift network which shifts the phase of some particular frequency 180 degrees from one leg of the network to the other, thus allowing it to cancel out at the network output. This frequency is the notch frequency and can be varied by either changing the value of the resistors or the capacitors in the network. This unit changes the resistors where R_1 and R_4 are the FREQUENCY CONTROL and R^6 the DEPTH control.

As mentioned earlier there is some interaction between the two controls in that as the FREQUENCY CONTROL values are changed the DEPTH pot must also be changed slightly to get a good deep notch. This maneuver is not difficult to do as you become familiar with the units operation, however. The signals passing through the network (all those not in the notch) are then fed into an audio amplifier which uses two field effect transistors (Motorola type MPF103).

Negative Feedback

This amplifier has a tuned circuit in the negative feedback portion consisting of L_1 and C_8. The frequency of this circuit is set by the choice of C_8 and by varying the inductance of L_1 and is adjusted for the beat, or signal pitch, which you like to copy. The tuned circuit presents a high impedance path to the frequency to which it is tuned, thereby reducing the negative feedback and increasing the gain of amplifier. All other frequencies are relatively unaffected by this trap and are passed through as a large amount of feedback thereby reducing the gain. This "peak" feature is not absolutely necessary and you can save some money by not using it if you wish, thus eliminating L_1, C_8 and C_7. Its use is highly recommended, however, for two reasons: 1) it adds to the general selectivity of the receiver and, 2) it allows a steep skirt when the rejection notch is close to the peak frequency. Figure 2 shows this graphically. Figure 3 shows the peak feature with the notch network out—the FREQUENCY CONTROL pot full clockwise. In any event, if you use the peak features or not, you will need some amplification to build up the loss from the notch networks so some type of amplifier is a must. You can use the two stages just as they are, less the feedback components mentioned, or you may eliminate one transistor and use a single stage. If you do this

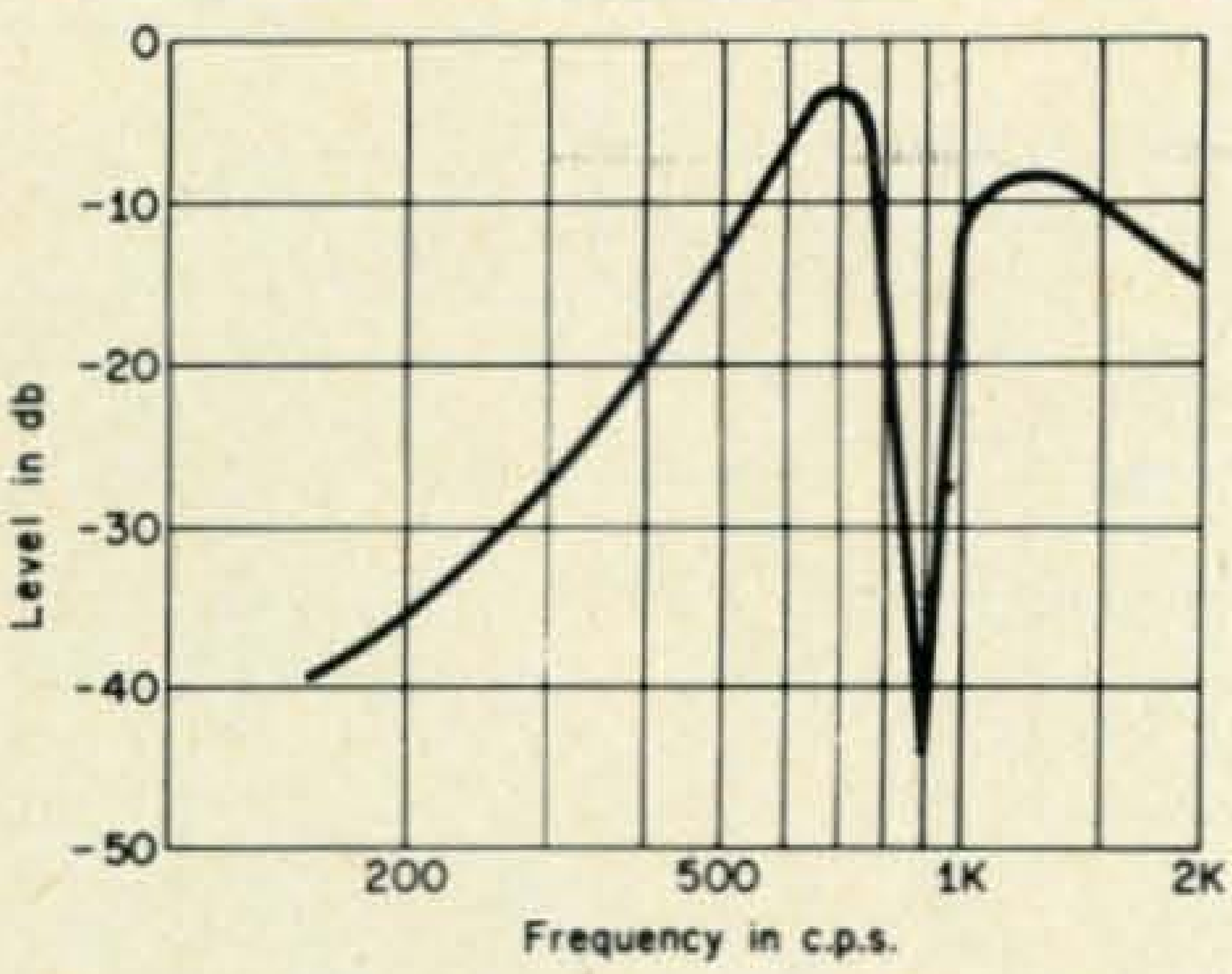


Fig. 2—Audio notch filter response curve shows a notch at 900 c.p.s. with the peak at 700 c.p.s. The notch frequency is set by R_1-R_4 and the peak frequency by L_1-C_8.

it is better to eliminate Q1 and feed the notch network directly into the gate of the last transistor.

F.E.T.S.

A word about these field effect transistors in case you have not used transistors of this type, and you may not have as they have been hard to come by at a price most of us would pay. They are the nearest thing to a tube there is in the solid state field. They have a high impedance input instead of the usual solid state low impedance and can be biased just like a tube. The ones here were obtained from Allied Radio[1] where they cost $1.00 each and are known as Motorola MPF 103. In case you have tried to pick up some FETs at the usual parts house this is worth remembering. Allied has more expensive types also but these 103s are made by Motorola for pulse and audio work where they are very satisfactory. The noise figure of this unit, for instance, is unusually low for solid state, being —65 db below one volt output. The gain of the unit is 8 db with the notch network out (FREQUENCY CONTROL pot full clockwise) and somewhat less than that when the notch is being used. This is not very high but the object is not gain but a workable notch filter.

[1] Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680.

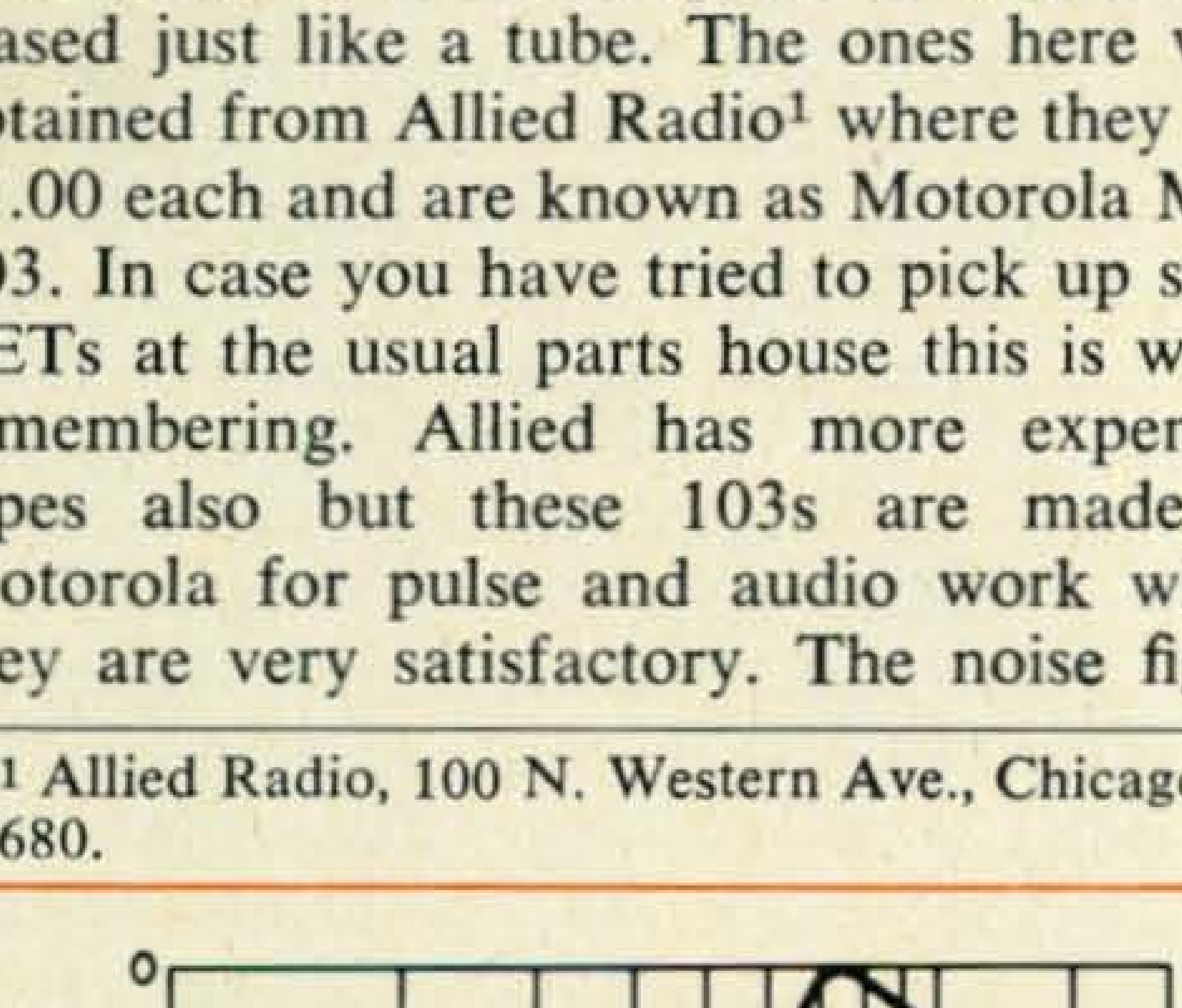


Fig. 3—Response of the audio notch filter with the NOTCH CONTROL set at zero and the peak at 750 c.p.s.

Construction

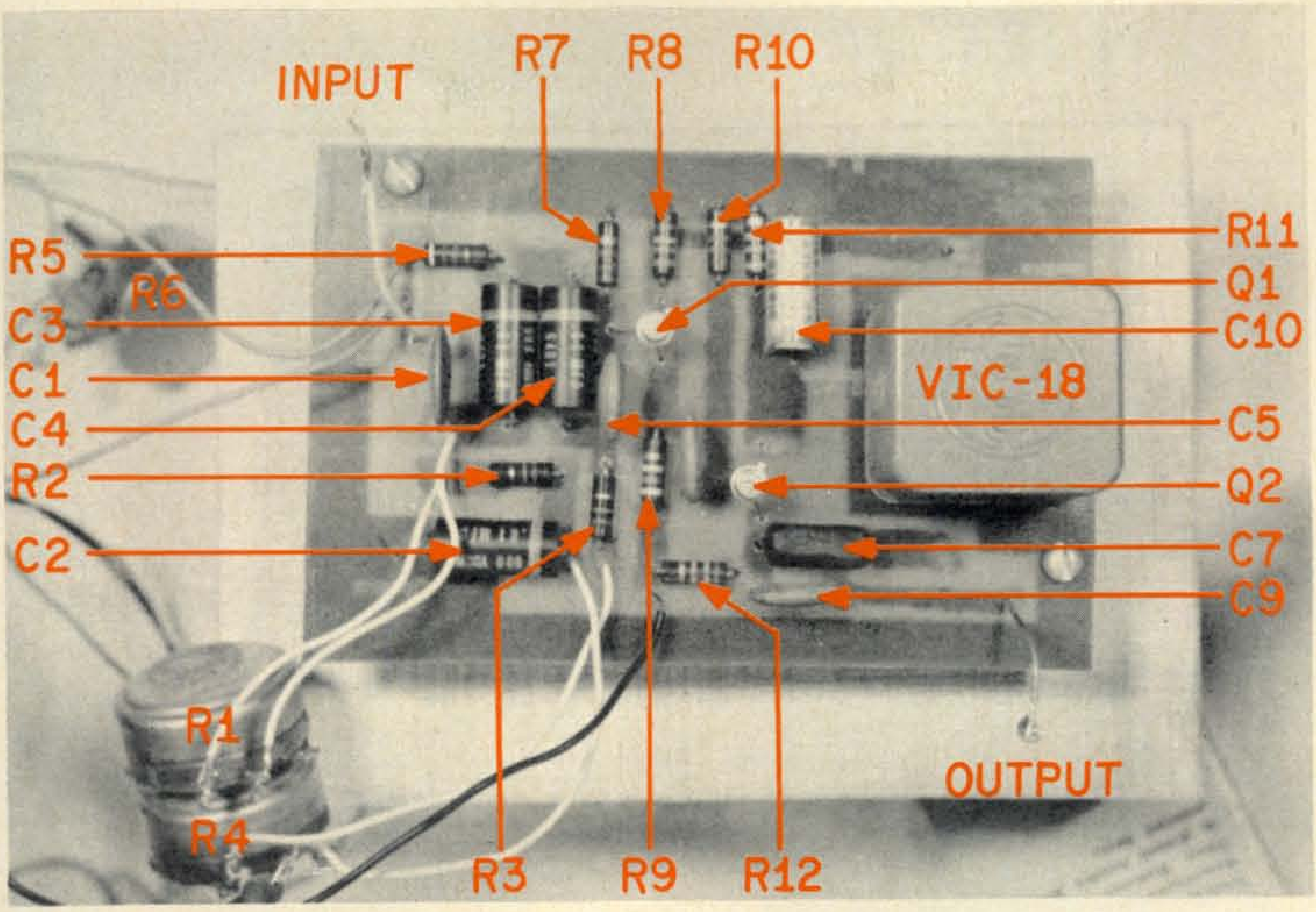
The unit is constructed on a printed circuit board. No attempt will be made here to tell you how to make these boards, it has been explained many times before in CQ.[2] Suffice to say, if you haven't been using these boards you have been missing a good bet as they are easy to construct and make a very fine unit when completed. Figure 4 is a scale layout of this board which you may use as a template if you wish. In case this is your first attempt at printed boards—you might have fun laying out your own, however. You can, of course, use any type construction you wish if you have no boards available.

The unit is mounted in a small aluminum box 5 × 4 × 3 inches in size. The input is an RCA type phono jack mounted on the rear and the FREQUENCY and DEPTH controls along with the phono jack output are on the front. The on-off switch is mounted on the depth control. The circuit board is mounted on the bottom lid on small spacers which hold it up about one-half inch and the battery, if used, can be mounted on the rear wall inside the box by a small home made clamp.

Power Supply

The unit here uses a small power supply which is also used for other functions connected with the station so no provisions for a power supply is incorporated in the box. However, in most cases a battery would be recommended as the easiest and probably best way to do it. The current drain is very small, only 0.4 milliampere for the entire unit which will give long battery life—not too far from the normal shelf life in fact. In case you do want to build a power supply fig. 5 shows a simple unit you can construct. The transformer is a 24 volt low current job which is followed by a half wave solid state rectifier and a brute force filter. The value

[2] Lowenstein, H., "Simple Etched Circuit Boards," *CQ*, September 1967, page 17.



Top view of the completely assembled audio notch filter printed board.

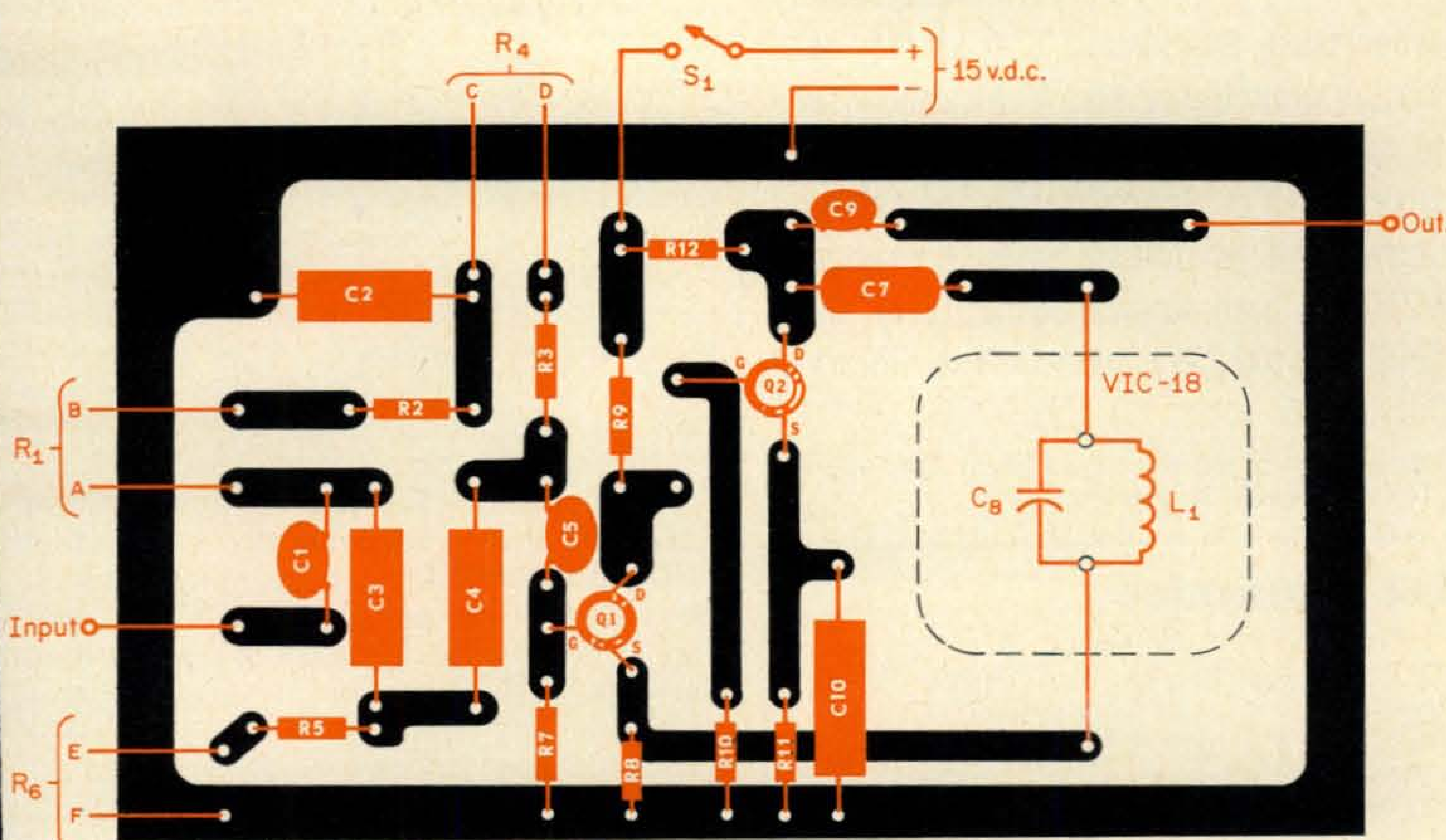


Fig. 4—Bottom view of the printed circuit board for the audio notch filter. Drawing is to scale and may be used as a template if desired. See text about C_{10}. Switch S_1 is part of DEPTH CONTROL, R_6. All resistors are ½ watt and all capacitors are in mf.

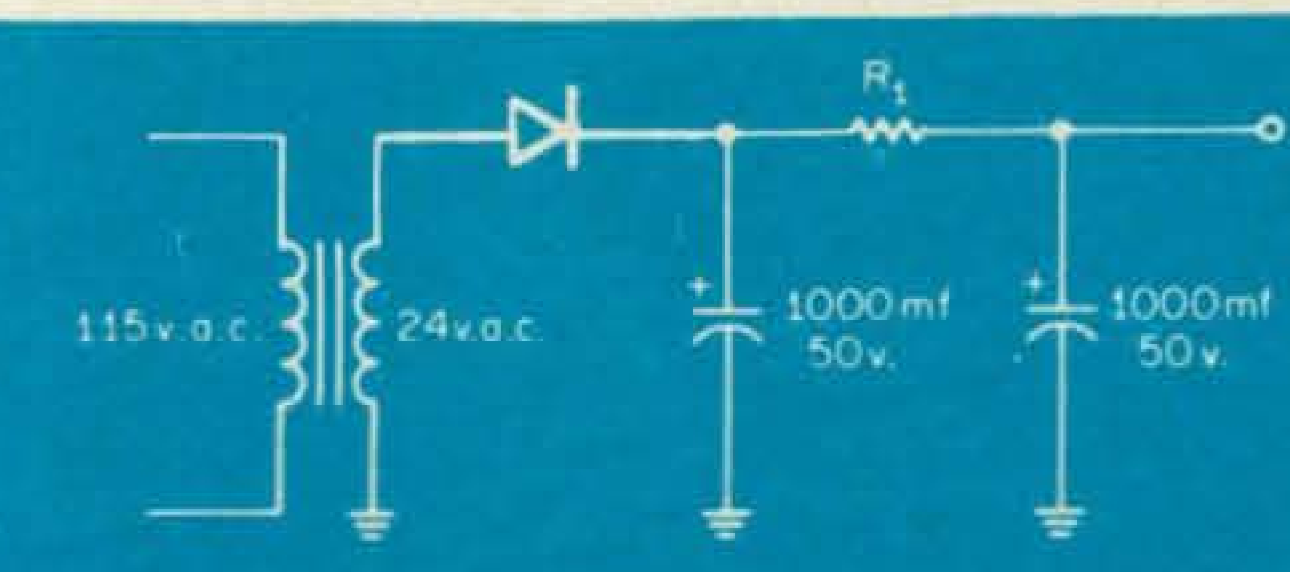


Fig. 5—Simple power supply that can be used to operate the audio notch filter.

of R_1 is set to give you approximately 15 v.d.c. under load.

General

Some general comments on the unit: 1) Figure 1 shows a bypass capacitor across R_{11}, and the printed circuit board layout (fig. 4) also shows a place for this capacitor and the view of the board shows it in place. This picture was taken during the developmental period of the unit and transistor other than the MPF 103 was being used which required more gain out of the unit, hence the bypassed source resistor. In case you do try another type FET you may need this capacitor, so it was shown. You will not need it with the 103s, however. In fact, the unit has a tendency towards oscillations with it in place so omit it if you are following the parts list and using the 103s. 2) For normal operation of the unit without the notch filter in use, turn the frequency determining pot full clockwise, which takes the network largely out of action. The pot should be wired to have the resistance *out* in the full clockwise position. When the pot is turned back counterclockwise to put the notch network into operation there will be a reduction in the output level. This will require a little additional output from the receiver's audio system to bring everything back to the normal level. 3) The feedback inductance, L_1, is the most expensive part of the unit and you might find a cheaper item to substitute. The VIC called out, or any other good adjustable inductor, is by far the best, however. 4) In case you do substitute some other type of FET probably the only change you will have to make is the value of R_9 and R_{12}. Unless you can dig it out of the transistor specs you may need some cut and try there. 5) You will note that the value of C_1 and C_5 is seemingly small; this was done to give a little roll-off at the low frequencies.

The unit isn't very expensive or difficult to build and I think you will find it very useful so why not whip one up? ■

"THE ALL DAY EVERY DAY NET"

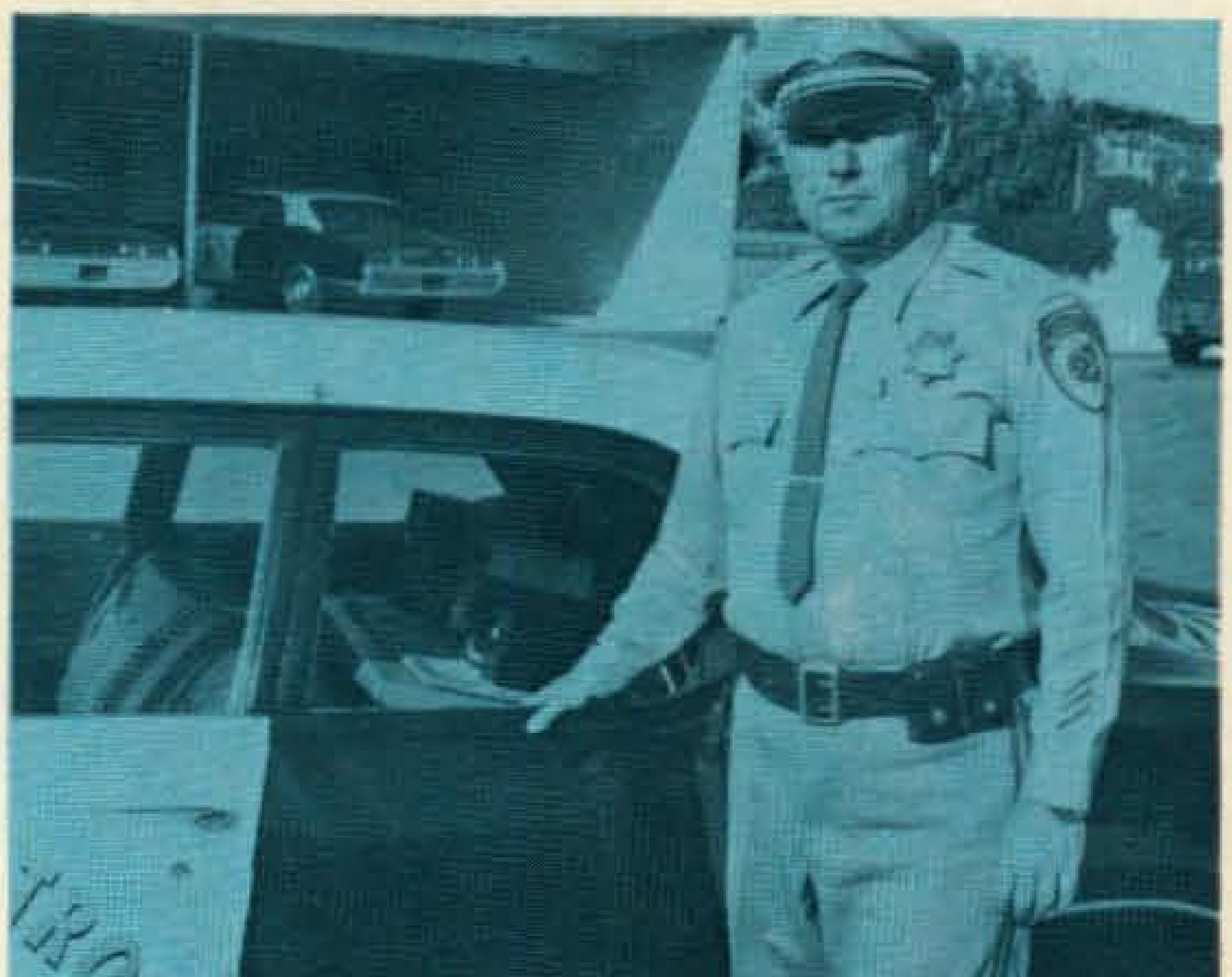
WCARS

BY EDWARD A. GRIBI, JR.,* WB6IZF

MOBILEERS heading for the west, more and more, get the word to "call in on 7255 kc" for any help they might need on the highway. Guiding people through mountain passes and metropolitan freeway mazes is old hat to this able group calling themselves the West Coast Amateur Radio Service, Inc. The unique organization of dedicated amateurs monitor 7255 kc every day during the daylight hours "in an effort to serve the public and other radio amateurs by assisting in emergencies, handling traffic, and facilitating contacts" (WCARS Bylaws). The service net utilizes fast break-in and brief transmissions to maintain an open calling frequency for use by mobiles and others. Starting in early 1963 on 7255 kc, the Net had 170 members in June 1966 when the switch was made to 7255 kc; and in October 1967 there were more than 400 members in seven western states and Mexico.

WCARS holds a formal net session with roll call and formal traffic listings at noon Pacific local time daily consuming approximately 30 to 45 minutes. Net discipline is rigidly maintained during this period (no personal names are used, for instance) in order to train members to operate with efficiency and effectiveness in the event of an emergency or disaster. The bulk of the service, however, is performed during the remainder of the day with informal net operation maintained as base stations pass "Acting Net Control" on to the next taker with no set schedule. In a typical week day in the spring of 1967 in a nine hour period 225 different base and mobile stations, half of them members, used the frequency, many several times. Arrangements were made to handle two priority messages, 14 routines, and 15 phone patches off frequency. Several hundred informal communications and contacts were completed on or off the frequency —probably several thousand transmissions in any given day. A recent check on a quiet midweek midmorning found 55 stations in three states monitoring, probably a base figure. During the morning and evening commuter periods, the lunch hour, and on weekends the count is 100 to 200 ready to serve in any way.

* 229 Vivian Street King City, California 93930.



John, WA6PCY, a member of the California Highway Patrol and WCARS is shown with his patrol car which is equipped with ham gear.

A view of WB6IZF during a typical WCARS mobile Operation.

Day in, day out, 365 days a year, it's mainly routine situations: signal reports, request for a phone patch, all manner of miscellany, but punctuated by the occasional electrifying emergency "BREAK, BREAK, BREAK:" Many stations monitor for hours at a time without ever making a transmission because they find it much more fascinating and satisfying than casual operation. The most important thing to many mobiles and portables is the secure feeling that a broad service ranging from signal reports to emergency aid on the highway is no farther away than the mike button. To all participants, it's where the action is.

10 to 20 emergency messages are handled nearly every month—like the rainy day in April when mobiles called in four different unreported traffic accidents within 15 minutes in the middle of formal net session. Each individual accident took less than two minutes from the emergency triple break to "phone call completed" by a base station—all with net operation proceeding normally in between. Other less typical situations included back-up of a sinking raft near the Galapagos Islands, helping a snow-bound ham get aid, calling an ambulance for a mother going into labor, and providing vital communications during several floods in Utah and California. Recently in response to QST placed on the Net by sightless amateur K6EJT hundreds of hams all over the west cooperated to spread a description of a car with a child that had been given an incorrect and potentially lethal prescription. W6FKQ located the car and prevented the grateful parents from administering additional doses. Less dramatic but very heart-warming are the number of phone patches run for servicemen on maritime mobiles—most ships call in on 7255 whenever in range for any kind of help they might need on shore. The same is true on other bands—whenever a station indicates he has some kind of urgent traffic for the West Coast during the day he is often helped by a relay through WCARS or a station coming from 40 to 20 or 15 to help out. Other services have included the ARRL Pacific-Southweast Division Convention and Oakland Hamfest "talk-ins" both at the invitation of the convention arrangers.

In order to handle these varied situations, Net members have adopted several procedural signals which now are finding wide acceptance on other nets and frequencies:

BREAK-BREAK-BREAK — Emergency only, all stations stand by. Woe betide the uwary station using the triple break for casual interruption.

BREAK-BREAK—Has come to mean priority or urgent type traffic.

CONTACT—Used to notify Net Control that one wishes to contact a station just heard.

INFORMATION—Indicating to Net Control that one has information pertinent to Net operation—this covers all other contingencies.

The one inflexible procedural rule is "never say more than one brief sentence without dropping your v.o.x. or mike button!"

Sideband is the usual mode but any signal that can be copied by any station will be helped. In one notable instance a mobile with a microphone out of action reported a car on fire on a freeway in a jerky but readable c.w. by keying his p.t.t. button.

The variety of participants in the Net operations indicates the wide respect that the Service holds. Two SCM's and a number of members of NTS, AREC, and RACES are active members of WCARS. The California Highway Patrol is a charter member of the Net with three Patrol-owned amateur transceivers and Patrol amateur operators available to maintain official liaison with the Net under prolonged emergency conditions. The Net maintains regular contact with Red Nacional de Emergencia, the Mexican Emergency Net. Active members and participants in WCARS include members of the

[*Continued on page 116*]

Space Communications Enters Its Second Decade

BY GEORGE JACOBS,* W3ASK

October 4, 1967 marked the tenth anniversary of the space age. On that day in 1957, the Soviet Union launched the first man-made satellite, Sputnik-1, into a successful orbit around the earth.

In the ten years that have elapsed since the launching of Sputnik-1, more than 675 man-made satellites have been placed successfully into earth orbits (462 by the USA; 210 by the Soviet Union; 4 by France and 1 by Italy), and an additional 45 have been rocketed to the moon, Venus, and Mars and into orbits around the sun (25 by the USA and 20 by the Soviet Union).

The United States has successfully placed into orbit and landed 14 manned spacecraft; the Soviet Union has orbited 9, landed 8. (Cosmonaut V. Komarov perished on April 24, 1967 when the Soyuz-1 spacecraft he was piloting to earth crashed due to a landing parachute failure.)

Communications in one form or another play a vital role on every satellite and spacecraft launched. The vast amounts of scientific data collected in outer space by satellites are sent back to earth over radio telemetry channels; astronauts and cosmonauts keep in touch with the world below them via spacecraft-to-earth communication links; spectacular still photographs and in some cases live television shots of the earth, moon, Venus and Mars have been flashed back to earth over communication links; beacon transmitters aboard every satellite permit pinpoint tracking from the earth, and the smallest movements of many satellites can be controlled remotely from the earth by means of radio control circuits.

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

Transmitting Satellites

By the end of 1967, no fewer than 60 American-launched satellites were in orbit transmitting radio signals of one type or another back to earth on more than 115 frequencies in the h.f., v.h.f., and u.h.f. bands allocated to satellites. Radio amateurs and space-listeners report receiving many of these transmissions, sometimes with fairly inexpensive receiving equipment.

Table I lists those frequencies on which orbiting satellites launched by the United States were transmitting radio signals back to earth as of November 15, 1967. The transmitters on many of these satellites are expected to continue operating throughout 1968, and beyond.

The USSR has launched over 180 satellites to date in their Cosmos scientific and space exploratory series, in addition to dozens of other scientific, communication, interplanetary and lunar satellites and manned spacecraft. Since most of the Russian satellites remain in orbit or transmit radio signals for only a few days, their frequencies are not shown in Table I. For the most part, however, signals from Russian satellites can usually be heard on either one or several of the following frequencies: 19.540, 19.545,

As we enter the eleventh year of the space age, George Jacobs sums up the world's major space efforts and presents a Table of transmitting satellites in operation as of November 15, 1967.

19.735, 19.775, 19.800, 19.835, 19.994, 19.995, 20.005, 20.035, and 20.084 mc. Russian satellites have also operated on 30.008, 39.986, 89.100, 90.023, 90.158, 90.225, 90.378 and 183.538 mc. COSMOS satellites are usually launched on an inclination of either 49, 56, 72 or 82 degrees, and have periods ranging between 92 and 104 minutes.

France has successfully launched four satellites to date; three are now silent but one, DIADEM-1 or D1-C continues to transmit tone modulated c.w. signals on 149.97 and 399.92 mc. The French satellite's orbit makes an inclination of 40 degrees with the equator and has a period of 104.3 minutes.

On April 26, 1967 Italy launched its first satellite, SAN MARCO-2, from a 90 × 300 foot platform anchored three miles off the coast of Kenya, East Africa. The satellite, being used for air density and ionospheric studies, transmits telemetry data upon command on 136.53 and 136.74 mc. The Satellite's orbit makes an inclination of 2.9 degrees with the equator, and has a period of 95 minutes.

Satellite Power

The transmitters on board most satellites are of very low power, usually less than a watt. Recently launched satellites have somewhat higher power transmitters. For example, the automatic cloud-cover picture transmitters (APT) operating aboard the ESSA satellites on 137.5 mc and on the NIMBUS-2 satellite on 136.95 mc are each rated at five watts. The command-operated c.w. beacon and telemetry transmitters on the OGO series of satellites (operating on 136.2 mc) have an output of ten watts, and the telemetry transmitters command-operated on 400.25 and 400.85 mc are rated at four watts. A six watt transmitter operating on 136.02 mc beams telemetry signals back to earth from the EXPLORER-33 satellite.

The most powerful transmitters reported on any satellite launched by the United States are the 30 watt v.h.f. transmitters aboard ATS 1 and 3. These transmitters, part of a transmitter-receiver combination

Dieter Oslender of Bad Godesberg, Germany has copied signals from hundreds of space satellites at his neat and relatively compact satellite-listening post show above.

(transponder) on each satellite, are being used for experimental transmissions to evaluate two-way satellite communications with relatively small fixed, portable and mobile ground stations, ships at sea and in-flight aircraft. The transmitters operate on 135.6 mc and use frequency modulation with a bandwidth of 90 kc (90F9 emission). Each transmitter feeds a phased-array antenna consisting of eight radiating elements located around the base end of the ATS satellite.

The ATS high-power transmitters are used only when communication tests are scheduled.

Spaceman Frequencies

The frequencies that will be used on the Apollo spacecraft have not yet been announced. In the past American astronauts aboard Mercury and Gemini spacecraft reported to earth on an h.f. frequency of approximately 15.017 mc and on 296.8 and 243.0 mc in the v.h.f. band.

Cosmonauts on board Soviet manned spacecraft have used 17.365, 18.035, 19.996 and 143.625 mc for voice and telemetry transmissions.

Band	Purpose of Allocations
10,003-10,005 kc/s	space research
15,762-15,768 kc/s	space research
18,030-18,036 kc/s	space research
19,990-20,010 kc/s	space research
20,007 kc/s	may be used in an emergency, in the search for, and rescue of, astronauts and space vehicles
30,005-30,010 kc/s	space research
39,986-40,002 kc/s	space research
136-137 mc/s	space research (telemetering and tracking)
137-138 mc/s	meteorological satellites, space research (telemetering and tracking) and space service
143.6-143.65 mc/s	space research (telemetering and tracking)
144-146 mc/s	radio amateur space activities
148.25 mc/s (± 15 kc/s)	space telecommand
149.9-150.05 mc/s	radionavigation satellites
154.2 mc/s (± 15 kc/s)	space telecommand
183.1-184.1 mc/s	space research
267-273 mc/s	space (telemetering)
399.0-400.05 mc/s	radionavigation satellites
400.05-401 mc/s	meteorological satellites maintenance telemetry, space research (telemetering and tracking)
401-402 mc/s	space (telemetering)
449.75-450.25 mc/s	space telecommand
460-470 mc/s	meteorological satellites

A list of satellite bands in use.

Satellite Listening

While the signals from many of the satellites now in orbit are very weak and can only be received with low noise receivers and high gain tracking antennas, the signals from some satellites operating in the high frequency bands can often be heard well on relatively inexpensive shortwave receivers using simple antennas such as an outdoor whip or dipole. Signals from high power satellite transmitters in the v.h.f. and u.h.f. bands (especially in the 136-138 mc range and in the 144-146 mc amateur band) can often be received well on relatively inexpensive v.h.f. and u.h.f. receivers, or on shortwave receivers equipped with suitable frequency converters. An outside antenna, preferably one with directivity and gain is generally required for reception of most satellite signals, especially those from low power transmitters.

The satellites which can be heard with the least difficulty are those which transmit continuous c.w. signals. These signals, which are often used as tracking beacons, can usually be identified by their steady tone when the receiver's best frequency oscillator (b.f.o.) is in the ON position. Telemetry signals are often more difficult to receive, since in most cases telemetry data is transmitted for only brief periods upon command from the ground. Telemetry signals usually consist of two or more musical tones transmitted at the same time, or in the case of the Russian COSMOS satellites, of a series of dots and dashes of different length. Because of the great number of satellites now in orbit, a greater number of transmitters are command-operated than previously, in order to avoid interference between satellite signals operating on the same or nearby frequencies.

Orbital inclination and period data are included in Table I as a further aid in identifying satellites from which signals can be received. Inclination is the angle that the satellite's orbit makes with the equator. If a directional antenna is being used to receive satellite signals, the inclination data can be used for determining the direction from which the satellite's signal should be heard first. The satellite's period is the time it takes, in minutes, for the satellite to complete an orbit. By timing reception on successive orbits, it is often possible to identify a satellite by its known period.

The exact time that a satellite passes overhead, or nearest to a listener's location as it orbits in space can be determined by noting the Doppler shift on the satellite's signal. The relative velocity of the satellite with reference to a listener on earth causes the satellite's signal to change pitch in much the same manner that a train's whistle changes pitch as the train approaches and moves away from an observer at relatively high speeds. The frequency on which the satellite is transmitting will appear to increase as the satellite approaches, and decrease as it moves away from the listener on the ground. The satellite is nearest to being overhead at the instant the pitch of its begins to decrease. At 20 mc the Doppler shift will be approximately one kilocycle each side of the center frequency, while at 136 mc the shift can be as much as six kilocycles.

With a suitable receiver and antenna, and the information contained in Table I, it should be possible to tune into the wide, wide regions of space, and listen to the exciting sounds of the satellites as they flash signals back to earth. ■

Table I—List of Transmitting Satellites as of November 15, 1967

Freq. (Mc)	*Satellite Name*	*Purpose*	*Period (Minutes)*	*Inclination (Degrees)*	*Remarks*
20.000	EXPLORER—27	Geodetic studies	108	41.2	Command, tone modulated beacon
20.005	EXPLORER—22	"	105	80	"
40.000	EXPLORER—27	"	108	41.2	"
40.010	EXPLORER—22	"	105	80	"
41.000	EXPLORER—27	"	108	41.2	"
41.010	EXPLORER—22	"	105	80	"
54.000	TRANSIT—4A	Navigation	104	67	"
136.020	EXPLORER—33	Scientific	23434	49.2	Command, c.w. beacon & telemetry
136.078	ALOUETTE—1	Ionospheric studies	105.5	80.5	"
136.080	ALOUETTE—2	"	121.3	79.8	"
136.141	EXPLORER—34	Interplanetary studies	6358	67.2	"
136.142	RELAY—2	Communication studies	195	46.3	Command, telemetry
136.171	EXPLORER—22	Geodetic studies	105	80	"
136.200	OGO—1	Geophysical studies	3841	53.8	Command, c.w. beacon & telemetry
136.200	OGO—2	"	104	87.4	"
136.200	OGO—3	"	291	51.8	"
136.200	OGO—4	"	97.7	86	"
136.233	TIROS—7	Weather studies	97.4	58.2	Continuous c.w. beacon, command telemetry
136.260	ERS—20	Radiation studies	2831	34.4	Command, c.w. beacon & telemetry
136.273	EXPLORER—26	Magnetic field studies	440	20.1	Continuous, c.w. beacon & telemetry
136.290	OSO—3	Solar studies	95.6	32.9	Command, c.w. beacon & telemetry
136.350	FR—1	Ionospheric studies	100	75.9	"
136.380	EXPLORER—31	Ionospheric studies	121	79.8	Command, c.w. beacon & telemetry
136.380	ERS—27	Radiation studies	2832	34.5	Continuous, c.w. beacon & telemetry *
136.410	PEGASUS—1	Meteoroid detection	97	31.8	Command, telemetry
136.410	PEGASUS—2	"	97	31.8	"
136.410	PEGASUS—3	"	94.6	28.9	"
136.440	EARLY BIRD	Operational Communication	1437	1.4	Command, c.w. beacon & telemetry
136.440	INTEL—2—F1	"	730	17.2	"
136.440	INTEL—2—F2	"	1449	2.14	"
136.440	INTEL—2—F3	"	1436	1.18	"
136.440	INTEL—2—F4	"	1438	0.9	"
136.440	ERS—15	Radiation studies	167.6	90.1	Continuous, c.w. beacon & telemetry *
136.467	SYNCOM—2	Communications	1436	30	Command, c.w. beacon & telemetry
136.470	SYNCOM—3	"	1436	1.5	"
136.470	ATS—1	Applied Technology	1436	0.1	Command, telemetry
136.470	ATS—2	"	197.6	28.4	"
136.470	ATS—3	"	1436	0.5	"
136.500	NIMBUS—2	Weather studies	108.1	100.3	Continuous c.w. beacon, command telemetry
136.530	EXPLORER—30	Solar studies	101	59.7	Command, c.w. beacon & telemetry
136.530	ERS—18	Radiation studies	2831	34.1	Continuous, c.w. beacon & telemetry *
136.560	ARIEL—3	Space sciences studies	95.5	80.2	Continuous, c.w. beacon & telemetry
136.590	PEGASUS—3	Meteoroid detection	94.6	28.9	Command, telemetry
136.590	ALOUETTE—2	Ionospheric studies	121.3	79.8	Command, c.w. beacon & telemetry
136.591	ALOUETTE—1		105.5	80.5	"

Table I— List of Transmitting Satellites as of November 15, 1967 (cont.)

Freq. (Mc)	*Satellite Name*	*Purpose*	*Period (Minutes)*	*Inclination (Degrees)*	*Remarks*
136.620	RELAY—2	Communication studies	195	46.3	Command, telemetry
136.653	1963—38C	Radiation studies	107.3	90	"
136.709	EXPLORER—24	Air density studies	108	81.4	Continuous, c.w. beacon
136.740	EXPLORER—27	Geodetic studies	108	41.2	Command, c.w. beacon & telemetry
136.770	ESSA—2	Operational weather	113.5	101	Continuous c.w. beacon, command telemetry
136.770	ESSA—3	"	114.6	101	"
136.770	ESSA—4	"	113.4	102	"
136.770	ESSA—5	"	113.5	102	"
136.800	FR—1	Ionospheric studies	100	75.9	Command, c.w. beacon
136.800	EGRS—7	Geodetic studies	167.5	90.1	"
136.800	DODGE	Gravity studies	1319	6.25	Command, c.w. beacon & telemetry
136.840	EGRS—3	Geodetic studies	103.5	70	"
136.840	EGRS—9	"	172.1	89.6	"
136.889	PEGASUS—2	Meteoroid detection	97	31.8	Command, telemetry
136.890	PEGASUS—1	"	97	31.8	"
136.924	TIROS—7	Weather studies	97.4	58.2	Command, c.w. beacon & telemetry
136.950	NIMBUS—2	"	108.1	100.3	Command, telemetry & photos (APT)
136.980	SYNCOM—2	Communications	1436	30	Command, telemetry
136.980	SYNCOM—3	"	1436	1.5	"
136.980	EARLY BIRD	Operational Communication	1437	1.4	Command, c.w. beacon & telemetry
136.980	ALOUETTE—2	Ionospheric studies	121.3	79.8	Command, telemetry
136.980	ALOUETTE—1	"	105.5	80.5	"
136.980	INTEL—2—F1	Operational Communication	730	17.2	"
136.980	INTEL—2—F2	"	1449	2.14	"
136.980	INTEL—2—F3	"	1436	1.18	"
136.980	INTEL—2—F4	"	1438	0.9	"
137.140	AURORA—1	Aurora Studies	172.1	89.9	Command, c.w. beacon & telemetry
137.200	NIMBUS—2	Weather studies	108.1	100.3	Command, telemetry & photos
137.350	ATS—1	Applied Technology	1436	0.1	Command, telemetry
137.350	ATS—2	"	197.6	28.4	"
137.350	ATS—3	"	1436	0.5	"
137.500	ESSA—2	Operational weather	113.5	101	Command, telemetry & photos (APT)
137.500	ESSA—4	"	113.4	102	"
137.500	ESSA—5	"	113.5	102	"
137.740	GRAVGRAD—4	Gravity studies	103.4	70	Command, c.w. beacon & telemetry
137.980	GRAVGRAD—5	"	103.4	70	"
150	TRANSIT—4A	Navigation	104	67	Command, tone modulated beacon
150	1963—22A	Gravity studies	99.6	90	Continuous, c.w. beacon & telemetry
150	1963—49B	Not specified	107	90	"
150	1964—26A	"	103	90	"
150	1964—83D	"	106	90	"
150	1965—109A	"	105	89	"
150	1966—5A	"	106	89.7	"
150	1966—24A	"	105.3	89.7	"
150	1966—76A	"	106.8	88.9	"
162	ANNA—1B	Geodetic studies	107.9	50.1	Command, tone modulated beacon
162	EXPLORER—22	"	105	80	Command, tone modulated beacon
162	EXPLORER—27	"	108	41.2	"
324	ANNA—1B	"	107.9	50.1	"
324	TRANSIT—4A	Navigation	104	67	"
324	EXPLORER—22	Geodetic studies	105	80	"
324	EXPLORER—27	"	108	41.2	"
360	EXPLORER—27	"	108	41.2	"
360.090	EXPLORER—22	"	105	80	"
400	TRANSIT—4A	Navigation	104	67	"
400	1963—22A	Gravity studies	99.6	90	"
400	1963—49B	Not specified	107	90	"
400	1964—26A	"	103	90	"
400	1964—83D	"	106	90	"
400	1965—109A	"	105	89	"
400	1966—5A	"	106	89.7	"
400	1966—24A	"	105.3	89.7	"
400	1966—76A	"	106.8	88.9	"
400.250	OGO—1	Geophysical studies	3841	53.8	Command, telemetry
400.250	OGO—2	"	104	87.4	"
400.250	OGO—3	"	291	51.8	"
400.250	OGO—4	"	97.7	86	"
400.850	OGO—1	Geophysical studies	3841	53.8	Command, telemetry
400.850	OGO—2	"	104	87.4	"
400.850	OGO—3	"	291	51.8	"
400.850	OGO—4	"	97.7	86	"

* Transmits only when in sunlight

View of the R-390A sitting atop the 51J-2 (R-388) receiver at the station of W3JHR.

MODIFYING THE R-390A FOR S.S.B.

BY CAPTAIN PAUL H. LEE, USN *
W3JHR

The R-390A receiver requires an outboard converter unit for satisfactory S.S.B. reception. The simple modification outlined below provides a product detector combined with the b.f.o. circuit at a low cost.

As ORIGINALLY designed, the R-390A h.f. receiver is usable, to a certain extent, for s.s.b. reception without an external s.s.b. converter, but it performs very poorly because the a.m. diode detector contributes considerable distortion. The relative levels of signal *vs* b.f.o. injection voltage are not correct for proper s.s.b. detection. The levels can be made more optimum by reduction of the r.f. gain, but then the a.g.c. action is lost and weak signals are reduced so much that they are overlooked or unheard. The R-390A was designed to feed an i.f. signal to an external s.s.b. converter. However, by a simple and inexpensive modification of the internal b.f.o. stage to a product detector, the R-390A can be made to perform as an excellent s.s.b. receiver by itself, with no external converter being required for s.s.b. (For i.s.b., however, an external converter is required, in the form of 2 CV-591s or 1 CV-157.) The modification is very simple, inexpensive, and does not require any contract procurement action, nor does it involve any proprietary designs. The modification requires less than 2 hours work by one man. The parts required for the conversion are few and simple, and cost less than ten dollars.

* 5209 Bangor Drive, Kensington, Md. 20795.

Conversion Procedure

The conversion is performed as follows:

1. Remove the b.f.o. B+ wires from the BFO ON-OFF switch S_{101}. Remove and discard S_{101}, but retain the knob.

2. Cut three 20″ lengths of single conductor shielded microphone cable. From one end of each of these three pieces, remove the outer plastic jacket and carefully unravel 1″ of the shield braid and form a 1″ pigtail lead. Twist the 3 pigtails together and solder them

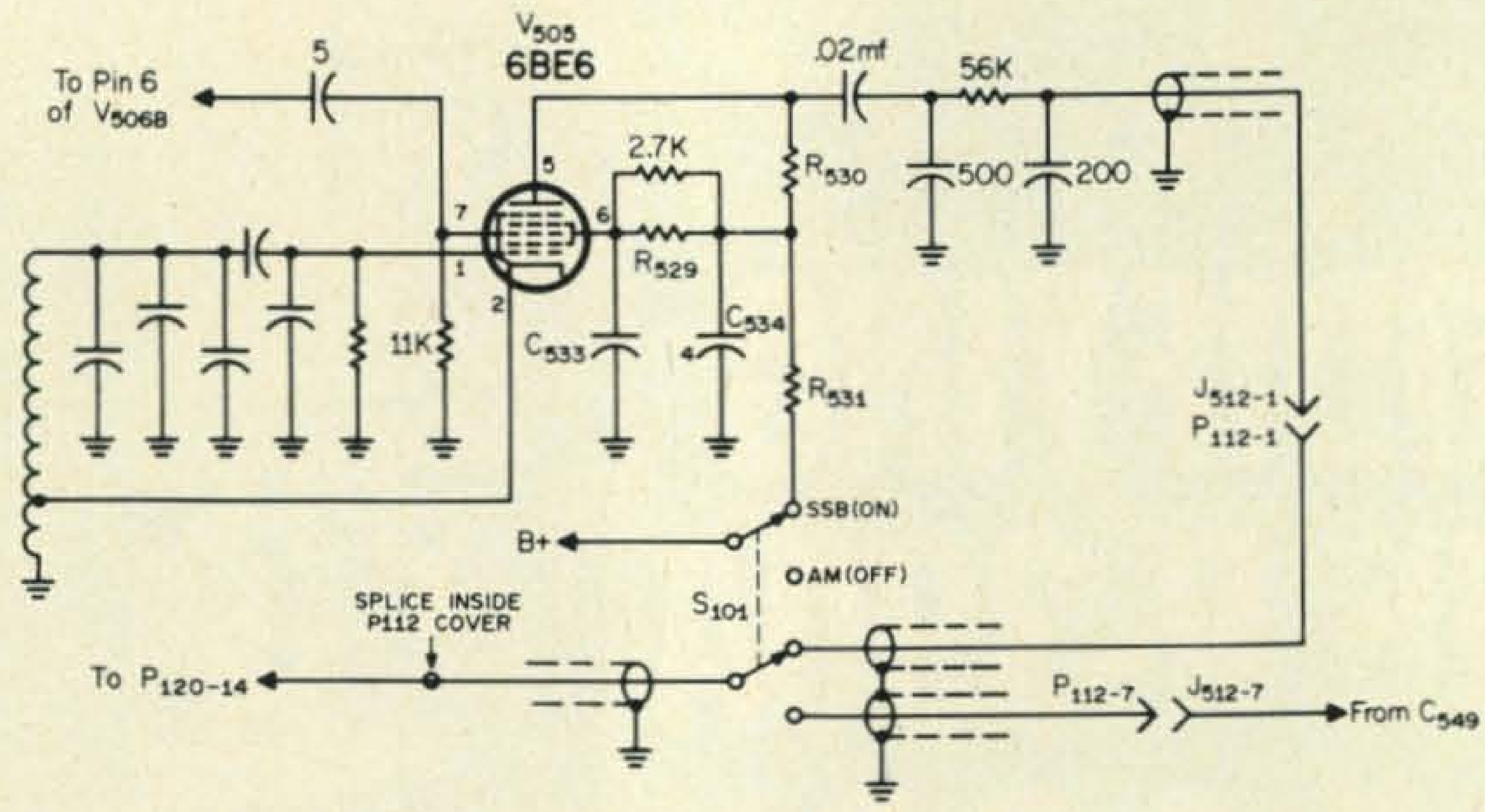


Fig. 1—Circuit of the product detector wired in place of the beat frequency oscillator. S_{101} is the new b.f.o. switch.

together, being careful not to melt the plastic insulation on the inner conductor of each piece of wire.

3. Take the new switch, a 2 pole two to six position unit, (only 2 of the 6 positions are used) for S_{101}, and connect these three shielded leads to it to form the audio change-over circuit. See fig. 1. Under the head of the machine screw holding one side of the switch wafer to the switch frame install a small soldering lug. Solder the pigtail to it, to ground (at this end only) the individual shield braids of the 3 audio wires.

4. Insert the free ends of the 3 wires through the opening at the edge of the i.f. shelf, pull them upward above the i.f. chassis, and mount the new switch in the vacant S_{101} hole in the front panel. Replace the knob. Connect the b.f.o. B+ wires to the other pole of the switch. The b.f.o. B+ is to be *on* in the B.F.O. ON position, which will become the SSB position of S_{101}. See the schematic in fig. 1.

5. Unplug all plugs from the i.f. sub-chassis, mechanically disconnect the 2 control shafts, and remove the i.f. subchassis from the receiver.

6. Carefully remove the cable clamp and cover from multi-conductor plug P_{112}, slipping it back out of the way. There is one spare pin, $P_{112\text{-}1}$. Remove the wire from pin $P_{112\text{-}7}$ and leave it hanging.

7. Twist the 3 shielded wires installed in step 2 into a 3 conductor cable, above the chassis. Wrap with plastic tape at 4″ intervals. Cut this cable to the required length to reach plug P_{112}, leaving sufficient slack for clearance *over the i.f. chassis and tubes.* Strip back 1″ of outer plastic jacket *and shield braid* on each of the 3 wires. Run the 3 wires through the cable clamp and plug cover.

8. Connect the shielded wire from the S.S.B. (B.F.O. ON) audio terminal of S_{101} to pin $P_{112\text{-}1}$. Use an insulating sleeve for protection, as is done for the other wires on the plug.

9. Connect the shielded wire from the A.M. (B.F.O. OFF) audio terminal of S_{101} to pin $P_{112\text{-}7}$. Use an insulating sleeve as in step 8.

10. Slip an insulating sleeve over the free end of the remaining wire, which should be the one connected to the rotary "arm" of S_{101}. This is the "audio input" lead. Solder it to the free end of the wire left hanging in step 6. Slip the insulating sleeve down over the bare connection. Carefully replace the cover and cable clamp on P_{112}. Tape these 3 wires to the existing cable just outside the clamp.

11. Turning the i.f. chassis over, carefully remove the bellows coupling on the B.F.O. PITCH control shaft. Remove the shaft by loosening the panel bearing. This step clears some working space around the socket of V_{505}, b.f.o. tube.

12. Remove and discard the V_{505}, 6BA6, b.f.o. tube.

13. Remove the ground (and all wires) from pin 2 of V_{505}. This may involve shifting several ground leads to other ground tie points on the chassis.

14. Move the existing lead from V_{505} pin

7 to pin 2. (This is the cathode tap on the b.f.o. coil Z_{502}.)

In the following steps, be sure to leave room for replacing the bellows shaft coupling.

15. Connect the 11K ½ watt resistor from V_{505} pin 7 to ground.

16. Remove and discard C_{535}.

17. Connect the 2.7K 1 watt resistor in parallel with the existing screen dropping resistor R_{529}.

18. Connect the 5 mmf capacitor between V_{505} pin 7 and V_{506B} pin 6. This is the i.f. coupling into the injection grid of the 6BE6 product detector.

19. With a pair of small metal shears cut a ¼" V-shaped notch in the lower edge of the interstage partition near the rear of the b.f.o. coil Z_{502}. Cover the edges of this slot with short pieces of plastic tape.

20. Mount the 200 mmf and 500 mmf capacitors on the grounded center post of the V_{506} socket, letting them be supported in space by their own ground leads (about ¼" long).

21. Connect the 56,000 ohm ½ watt resistor between the free ends of the 200 and 500 mmf capacitors.

22. Connect the 0.02 mf capacitor from V_{505} pin 5 to the 500 mmf end of the 56,000 ohm resistor.

23. Use 12" of the shielded microphone cable fo rthe s.s.b. audio lead. Remove 1" of the plastic jacket from one end, and make a 1" braid pigtail on this end. Slip a ⅞" insulating sleeve over the pigtail and ground the pigtail to the center ground post of V_{506} socket. Connect the center conductor to the 200 mmf end of the 56,000 ohm resistor.

24. Lay the shielded wire in the V-shaped slot in the interstage partition, and tape it in position with a 2" length of plastic tape. Cut the wire to length to reach pin $J_{512\text{-}1}$ of the rear cable socket. This is the unused pin. It mates with Pin $P_{112\text{-}1}$ of the cable plug. Strip back ½" of the plastic jacket and braid from this end of the shielded wire. Connect the wire to pin $J_{512\text{-}1}$, using an insulating sleeve over it for protection.

25. Carefully replace the b.f.o. shaft and bellows coupling removed in step 11. Make sure the coupling does not accidentally ground any components or wiring.

26. Replace the i.f. subchassis in the receiver. Insert all the plugs removed in step 5. Reconnect the 2 control shafts and replace their front panel knobs. Make sure the BANDWIDTH knob is properly positioned on the shaft.

Testing

27. Plug in the 6BE6 tube in socket V_{505}. Turn on the receiver. Leave the antenna disconnected.

28. With the b.f.o. switch S_{101} in the ON (S.S.B.) position, a hissing sound will be heard in the loudspeaker. With the bandwidth switch in the 1 KC position, rotate the B.F.O. PITCH knob. The pitch of the hissing sound will vary from high to low and back to high again, as the oscillator portion of the 6BE6 is tuned through the center of the receiver i.f. bandpass. Set the B.F.O. PITCH control for the lowest pitch of the hiss. Without rotating the shaft, loosen the knob set screw, and set the knob pointer to "O." The pitch of the hiss should now rise equally at the −1 and +1 positions of the control.

29. Set the BANDWIDTH knob at 2 KC, and at 4 KC. In each case, the pitch of the hiss will be lowest at the "O" position of the B.F.O. PITCH control, rising an equal amount on each side (−1, +1 or −2, +2).

AGC Action

30. The original a.g.c. action is not satisfactory for s.s.b. voice reception. It is too fast in the FAST position and produces a "pumping" action. In the MED position it is a bit too slow for fast voice break-in operation.

31. From the unused terminal 10 of the a.g.c. switch S_{107} (FAST position) connect the 1.0 mf capacitor to ground. See fig. 2. This may be done most conveniently by soldering one capacitor lead directly to the switch lug behind the front panel, and connecting the other lead to a ground lug placed under the r.f. section top cover screw just

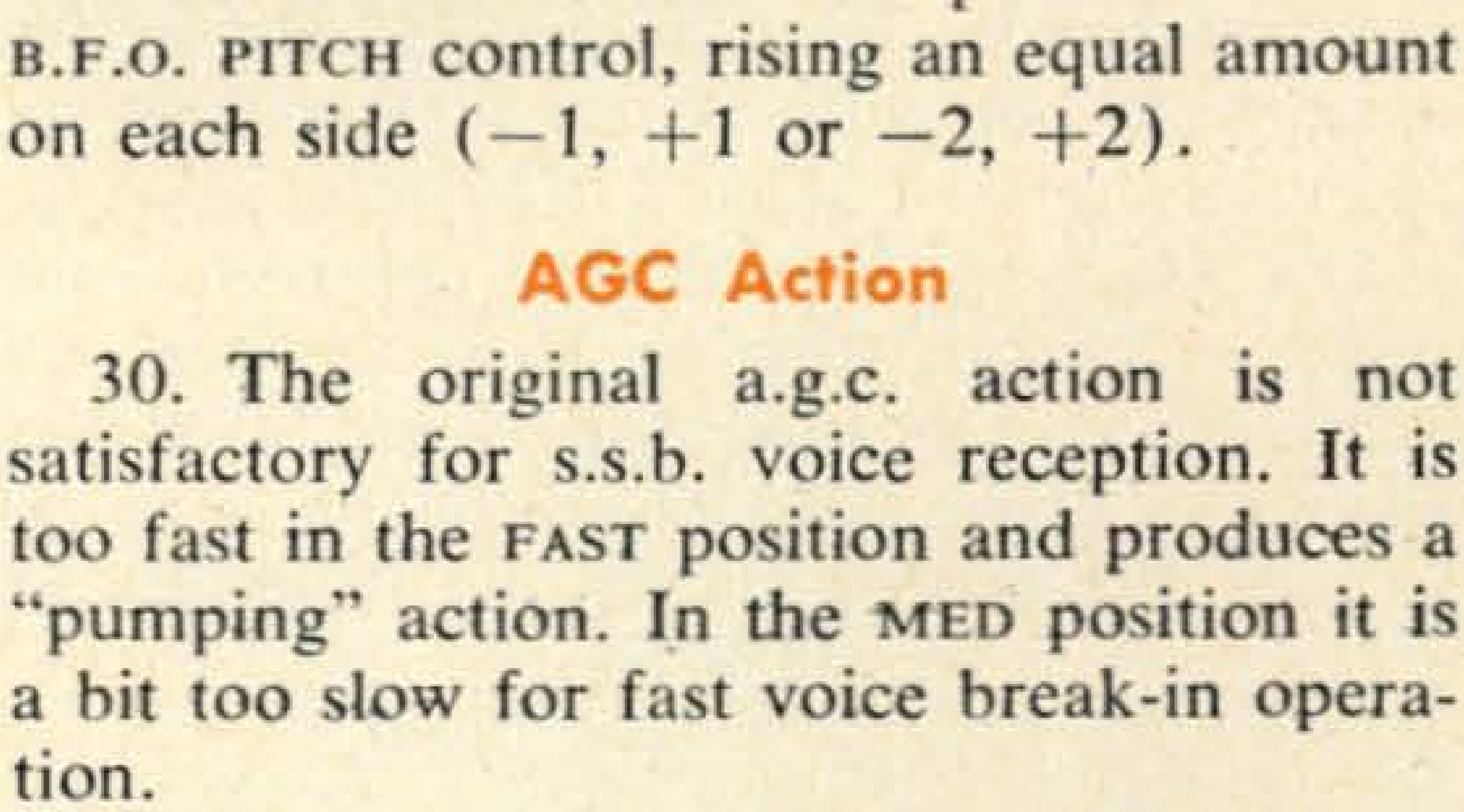


Fig. 2—Modified a.g.c. switch circuit.

back of the center of the front panel. This places 1.0 mf in series to ground with capacitor C_{551} (2.0 mf) in the FAST position, making a total of 0.66 mf across C_{548} in the grid circuit of V_{506A}, the a.g.c. time constant tube. The resulting time constant has been found by experimental use to be quite satisfactory, producing s.s.b. voice signals which are pleasing to the ear to copy. For multiplex or composite waveforms of essentially constant amplitude, the MED or SLOW A.G.C. may also be used, as desired.

Air Test

32. The receiver is now ready to operate. Connect the antenna. With the A.G.C. switch set at FAST, and B.F.O. ON, tune in am s.s.b. signal in the 14 mc amateur band, with the B.F.O. PITCH control set at −2, and the BANDWIDTH control at 4 KC. It should sound very pure, clean, and undistorted (assuming the station's emission is clean and undistorted). The BANDWIDTH control may be set at 2 KC for interference reduction, with the B.F.O. PITCH set at −1 in this case.

33. Shift frequency to the 7 or 3.9 mc amateur bands. Tune in signals here in the same way, but with the B.F.O. PITCH set on the opposite (+) side of "O."

34. Most 14 mc amateur emissions are upper sideband, whereas those on 3.9 and 7 mc are usually lower sideband. Note that the B.F.O. PITCH must be set to the *opposite* side of the carrier ("O") for reception of the desired sideband (− for u.s.b., + for l.s.b.). When you do this, you are in effect placing the locally injected carrier from the oscillator portion of the 6BE6 in the proper position for demodulation of the s.s.b. signal and for positioning the signal correctly within the receiver passband.

C.w. may also be received with the b.f.o. switch on (SSB position), using B.F.O. PITCH and BANDWIDTH controls as desired. For a.m., the b.f.o. switch is OFF, unless a.m. reception in the s.s.b. mode is desired in which case it is ON.

The conversion is now completed, and the R-390A may now be used for s.s.b. with no external converter.

Conclusion

This detailed information applies only to the R-390A. A similar conversion can be worked out for the R-390 or any other good superheterodyne receiver. It has been used with success in several Collins R-388 (51J) [1] receivers and AR-88 receivers by the writer. In the R-388, the oscillator portion of the 6BE6 has been crystal controlled, with 3 crystals (1 for u.s.b., one for exact i.f., and 1 for l.s.b.) selected by a switch in place of the B.F.O. PITCH control. Crystal control is not so practical in the R-390A because of the selectable i.f. bandpass. A multiplicity of crystals would be required. ■

[1] Lee, P. H. Cdr., "The Single Tube Product Detector," *CQ*, April 1961, p. 50.

Q.C.W.A. 20th ANNIVERSARY

At the Q.C.W.A. 20th anniversary banquet held at the Statler-Hilton Hotel, New York on Friday night, October 27th, John Di Blasi, W2FX, President Emeritus and charter member #1 of Q.C.W.A., presented certificate #5401 to his son, John, Jr., W2QNR. Two hundred members and their friends attended the banquet. Steel engraved plaques were presented to about 45 of the original charter members who were present. ■

John Di Blasi, W2FX, presenting the certificate to his son John, Jr.

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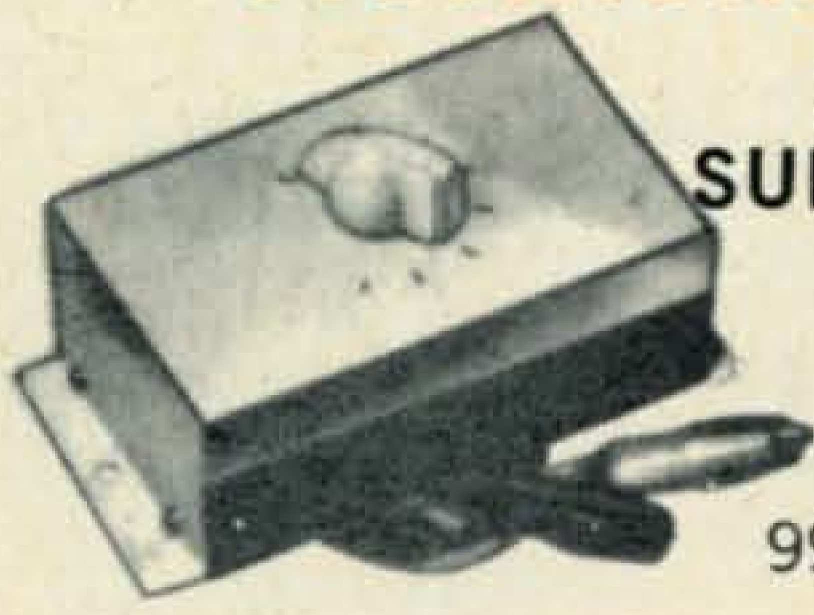

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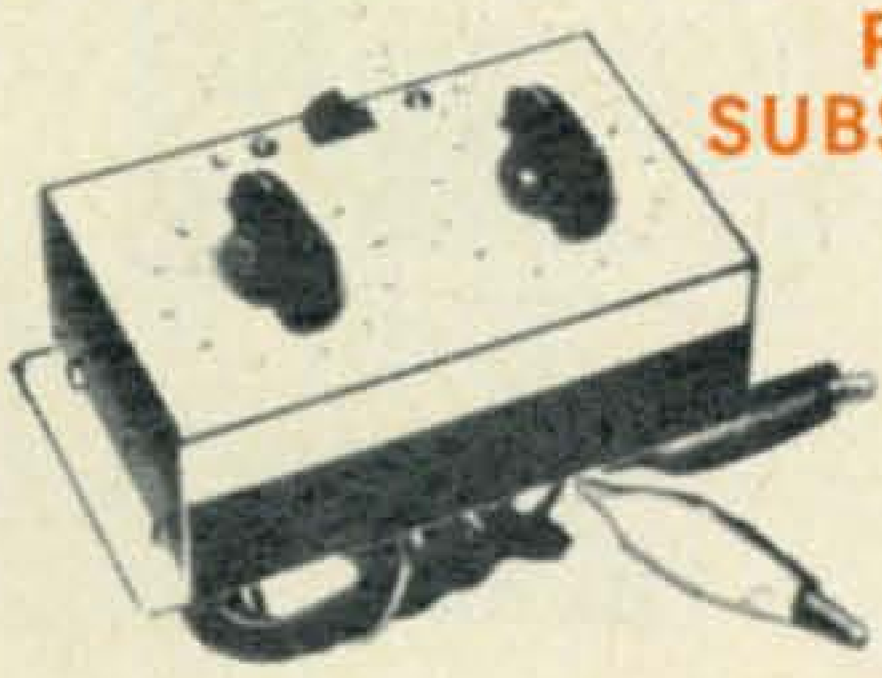

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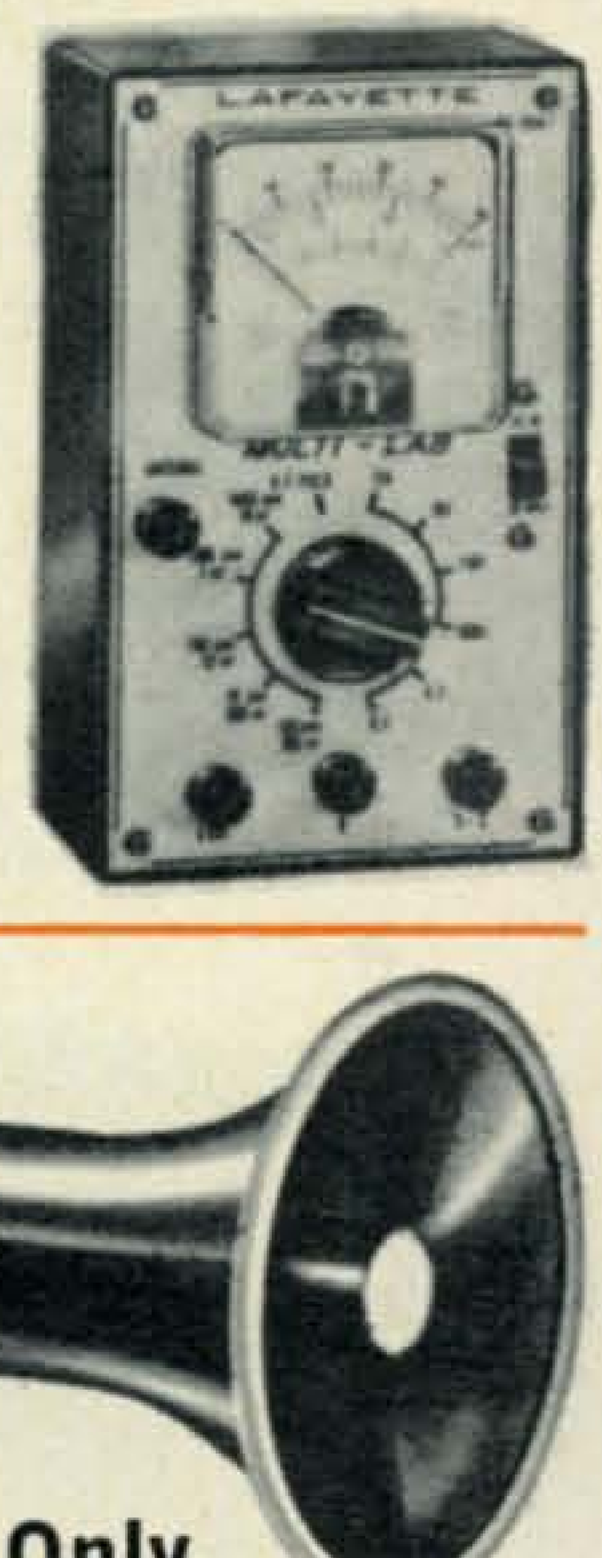

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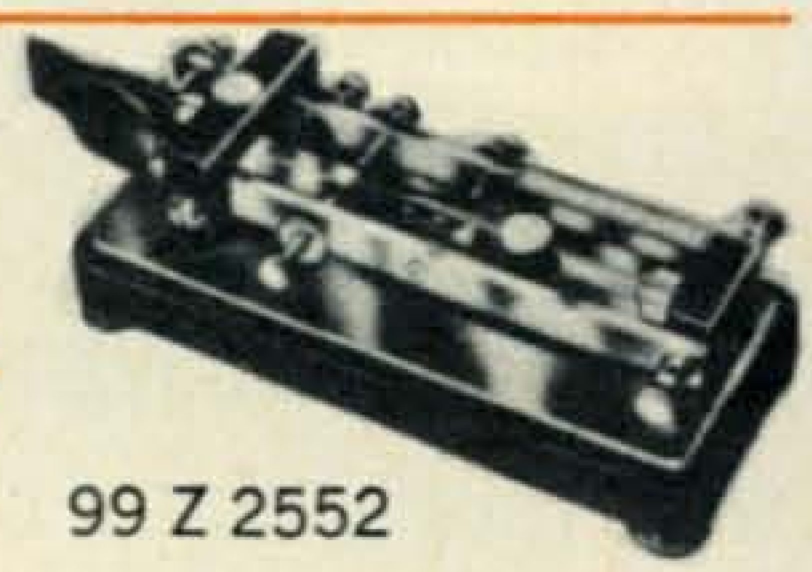

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A LOW LOSS CUBICAL QUAD

BY H. A. RIDEOUT,* WA6IPD

An effective technique to increase both transmitted and received signal strengths of the cubical quad antenna system.

NUMEROUS publications attest to the fact that the cubical quad Antenna is a highly efficient device and a definite competitor of the yagi. Excluding the addition of elements, little can be done to improve the performance of the basic two element quad. Other factors contributing to the quad's overall performance are antenna height, proper matching, and low loss transmission line, the latter being the weak link when coaxial cable is used, as is generally the case. Depending on the type of cable used, its length and age, a loss of several db may be experienced. One practical consideration to substantially reduce this loss is to use open wire transmission line, which coincidentally lends itself nicely to cubical quad design.

By referring to fig. 1A, it will be noted that the conventional folded dipole antenna exhibits a 300 ohm impedance. When expanded into a single wave length loop, the impedance is reduced to 150 ohms. Adding a reflector behind this loop forms the conventional cubical quad array with an impedance of approximately 75 ohms.

In fig. 1B, it will be noted that a double folded dipole exhibits an impedance of 1200 ohms. Expanding this double folded dipole into a loop with a total wire length of two wave lengths will reduce the impedance to 600 ohms. Adding a reflector behind this double loop reduces the driven element impedance to an approximate 300 ohms which may then be directly fed with low loss 300 ohm transmission line.

Construction

The double loop driven element is relatively simple to construct. The only difference between it and a conventional single wire loop is that 300 ohm open wire transmission line [1] is used in place of the single wire.

At the feed point, care should be taken to connect the open wire line to form the double loop as shown in fig. 1B. The two remaining open wires are fed directly by 300 ohm open wire transmission line. Insulation will be required on the open wire line where it circumvents the rotator to prevent the line from shorting.

Using open wire line for the double loop, as well as the transmission line, prevents the double loop wires from becoming entangled or shorting. The use of TV ribbon type wire should be avoided unless the antenna is used in an extremely dry area. The characteristics of ribbon line change drastically in damp weather.

* 2235 Gum Tree Lane, Fallbrook, California 92028.

[1] Allied Radio, 1968 Catalog #270, page 383 #11B1473.

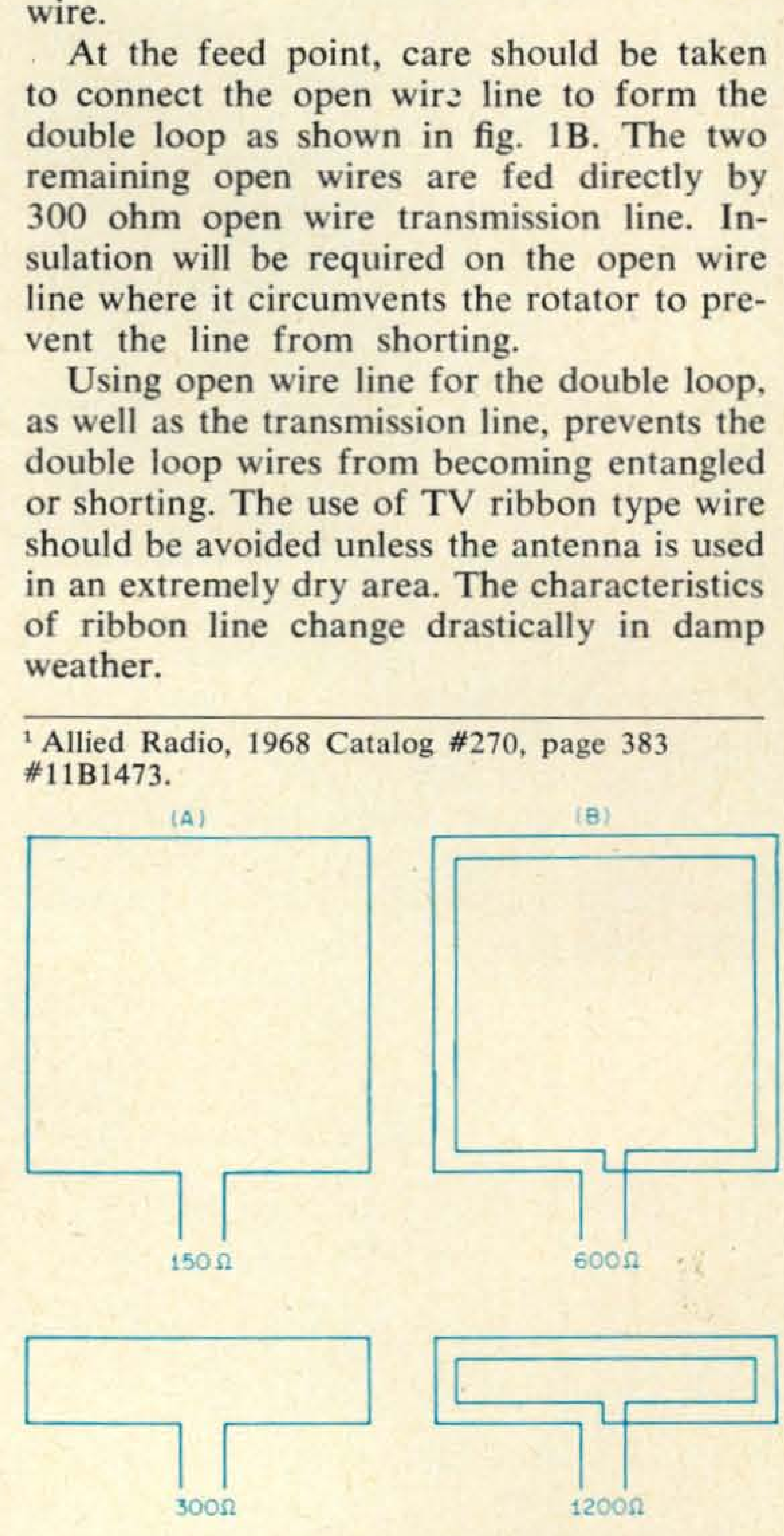


Fig. 1 (A)—The impedance of the half wavelength folded dipole and the expanded full wavelength antenna. (B) The double half and full wavelength dipoles have double the impedance values.

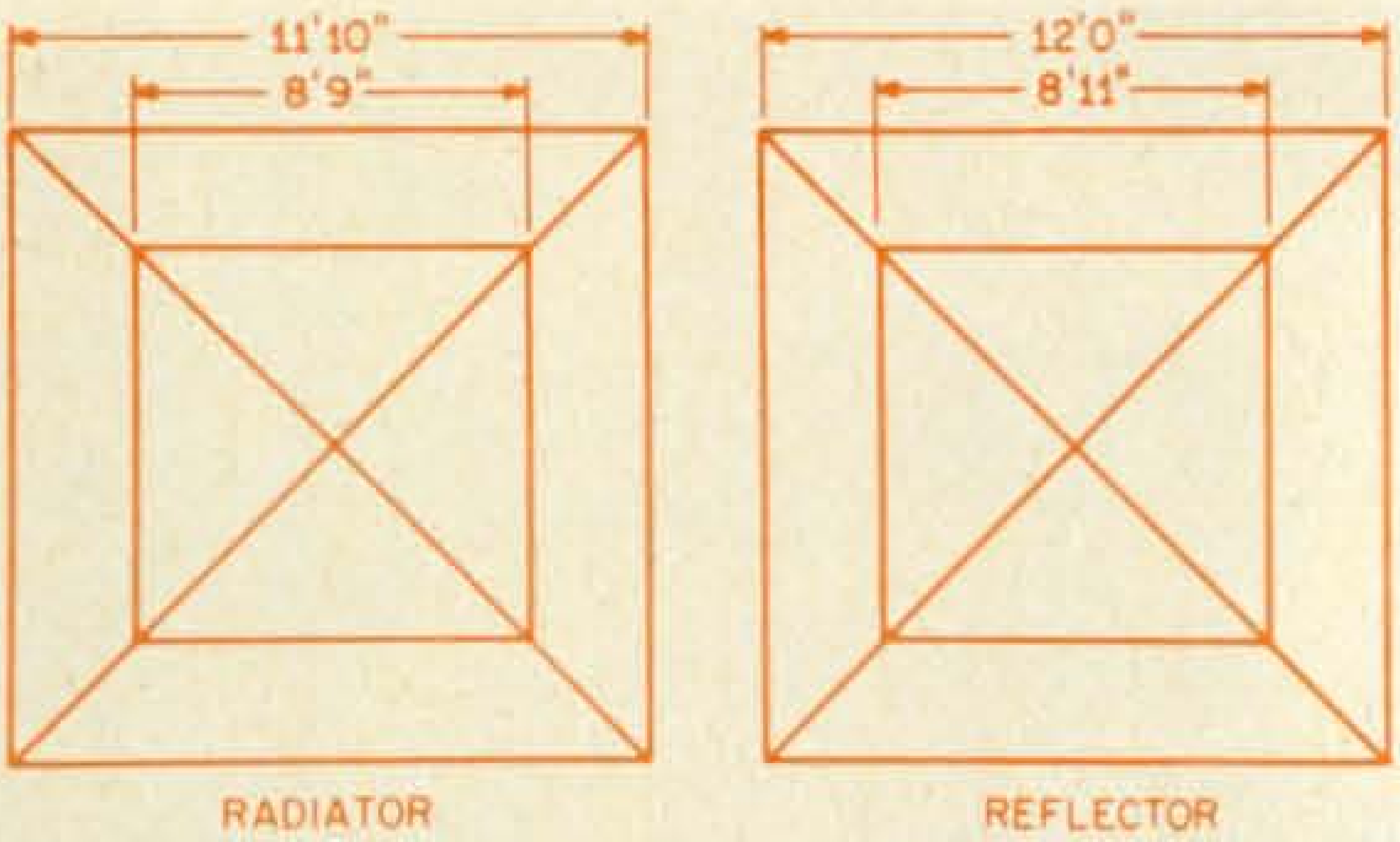


Fig. 2—Dimensions of the driven element and reflector of the author's 10 to 15 meter quad. The boom length is 5'6".

Standard quad dimensions may be used throughout. For imformation purposes, fig. 2 reflects the dimensions used in construction of the author's 10 and 15 meter antenna. It will be noted that the reflector is slightly larger than normal. It should also be noted that no tuning stub is used. Extensive tests were conducted, maximizing on gain while at the same time expanding the reflector dimensions, until the tuning stub was eliminated. Comparisons between a reflector using stub tuning and the expanded reflector without a stub, demonstrated a slight additional gain.

Antenna Coupler

Matching the 300 ohm balanced line to the transmitter will require an antenna coupler, unless the transmitter has provisions for link coupling. Building an antenna coupler is a relatively simple task. The only special tool required is a grid dip meter for checking resonance. The authors coupler,

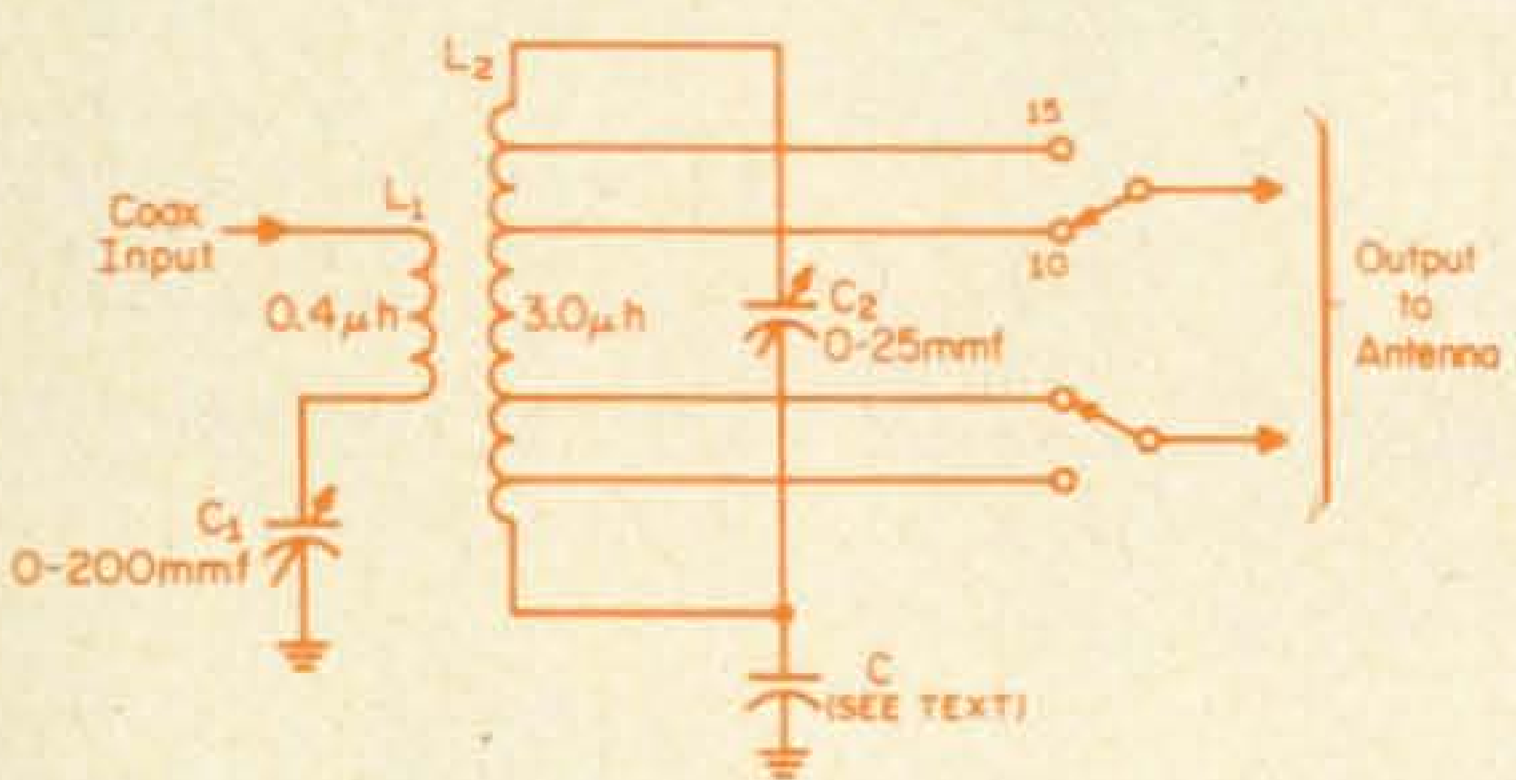


Fig. 3—Circuit of a tuner used to match an unbalanced 52 ohm output to balanced 300 ohm open wire feedline. Inductor L_2, 3 microhenries, may be made from a 10 turn length of Air Dux 1604 and L_1 is two turns of the same stock. This coil can be fabricated from a 14 turn length of the coil stock with L_1 cut from the center as shown above. The tap locations are determined experimentally as noted in the text.

designed for 10 and 15 meters, is shown schematically in fig. 3. The critical components, from the stand-point of value, are capacitors C_1 and C_2. The inductors L_1 and L_2 need only be that value of inductance required to resonate at the desired frequency, the 10 and 15 meter bands in this case. For ease in matching, L_2 should be as large as practicable and will be if it resonates within the given value of C_2.

In the conventional antenna couplers, a split capacitor is generally used to maintain the same ratio of capacitance to ground for both stator and rotor. Unless this capacitive balance is maintained, a balanced output will not be achieved. In the coupler described, a split capacitor is not used; however, the unbalance of capacitance is corrected by capacitor C.

Capacitor C is standard RG-58 coaxial cable which exhibits 28.5 mmf per foot. The shield is connected to ground, and the center conductor to the rotor of C_2. The coax is then trimmed until a balanced output condition is observed. Surprisingly, accurate results of a balanced condition may be achieved by holding a NE-51 neon bulb to each output line and noting the relative brilliance.

Reference should be made to the handbooks for additional information on the construction of antenna couplers.

Operation

The transmitter should be coupled, as shown in fig. 4, to the antenna, Capacitor C_2 of fig. 3 should be adjusted alternately with C_1 for the lowest SWR reading. At the same time, the taps of L_2, should be adjusted on the coil until an SWR of 1:1 is measured at the desired operating frequency.

Signal reports with this antenna have been in excess of those anticipated. The previous system, using coaxial cable (RG-58/U) and Gamma Match, obviously had greater losses than supposed. On 10 and 15 meters with 100 watts input, and the antenna at 30 feet, signal reports of S9 plus are the general rule. ■

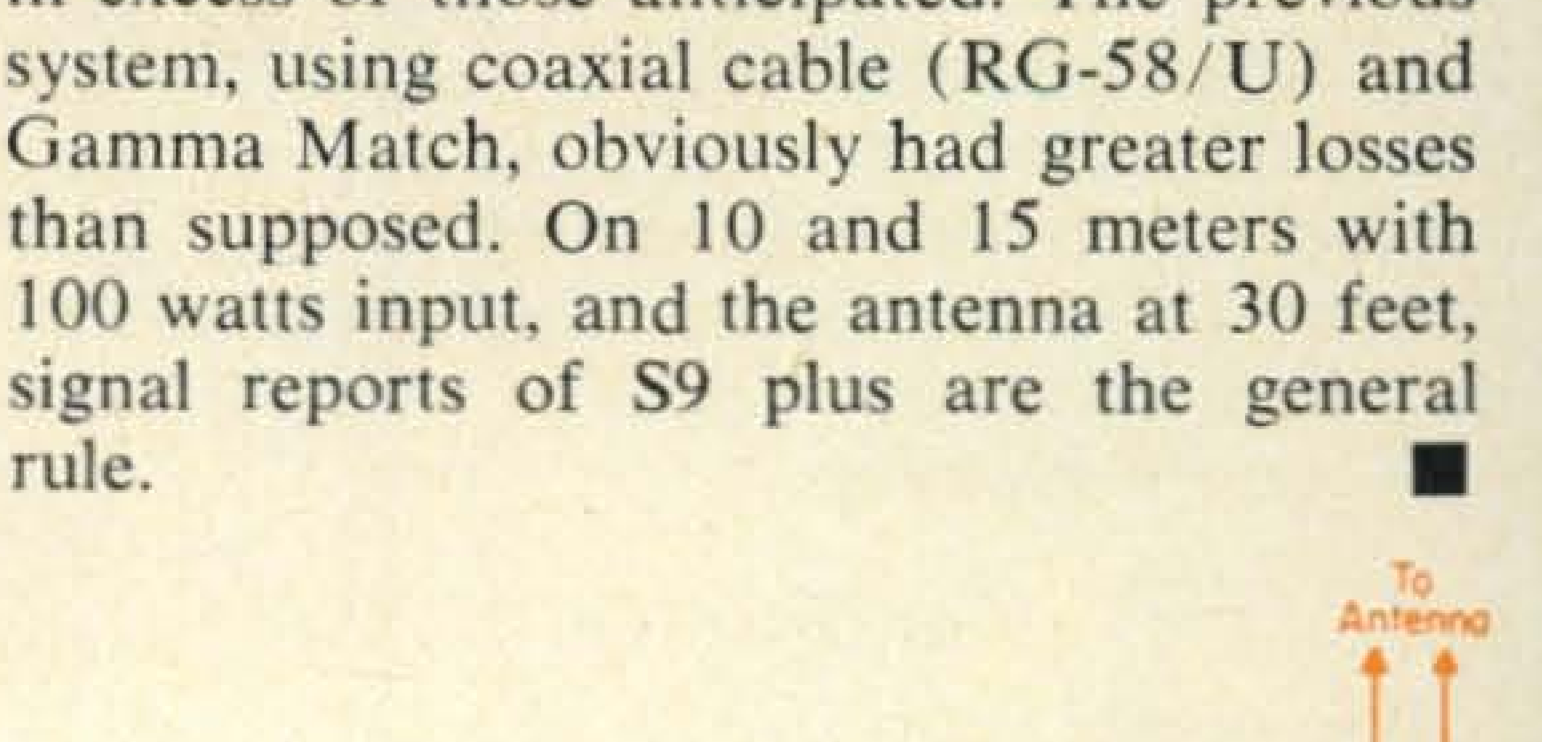


Fig. 4—Tuning set up described in the text.

CQ Reviews: The Drake MN-4 Antenna Matching Network

BY WILFRED M. SCHERER,* W2AEF

MUCH of the amateur transmitting equipment currently in use is designed with a fixed output impedance for matching to approximately 50-ohm essentially non-reactive loads. For other loads, where the s.w.r. or the reactance seen by the transmitter may be high, it is often impossible to sufficiently load the p.a. for maximum output. The same condition might exist even when some degree of variable loading is provided.

Such conditions are not as prevalent with well-designed beams, as they may be with dipoles, long wires, multi-band, loaded or random-length antennas. These antennas are often used either for regular or portable station operation, as a spare or to augment beam installations. In any event, the use of a suitable antenna coupler or matching network will make it possible for the transmitter to work into the required load not otherwise available.

* Technical Director, *CQ*

The Drake MN-4

The Drake MN-4 Antenna Matching Network is a bandswitched unit designed for this purpose, enabling operation with reactive loads that present an s.w.r. up to 5:1, or with resistive loads with a somewhat higher s.w.r., on the 10-80 meter bands. The MN-4 also will provide proper matching between an exciter and a linear amplifier. It is rated to handle 200 watts continuous-duty.

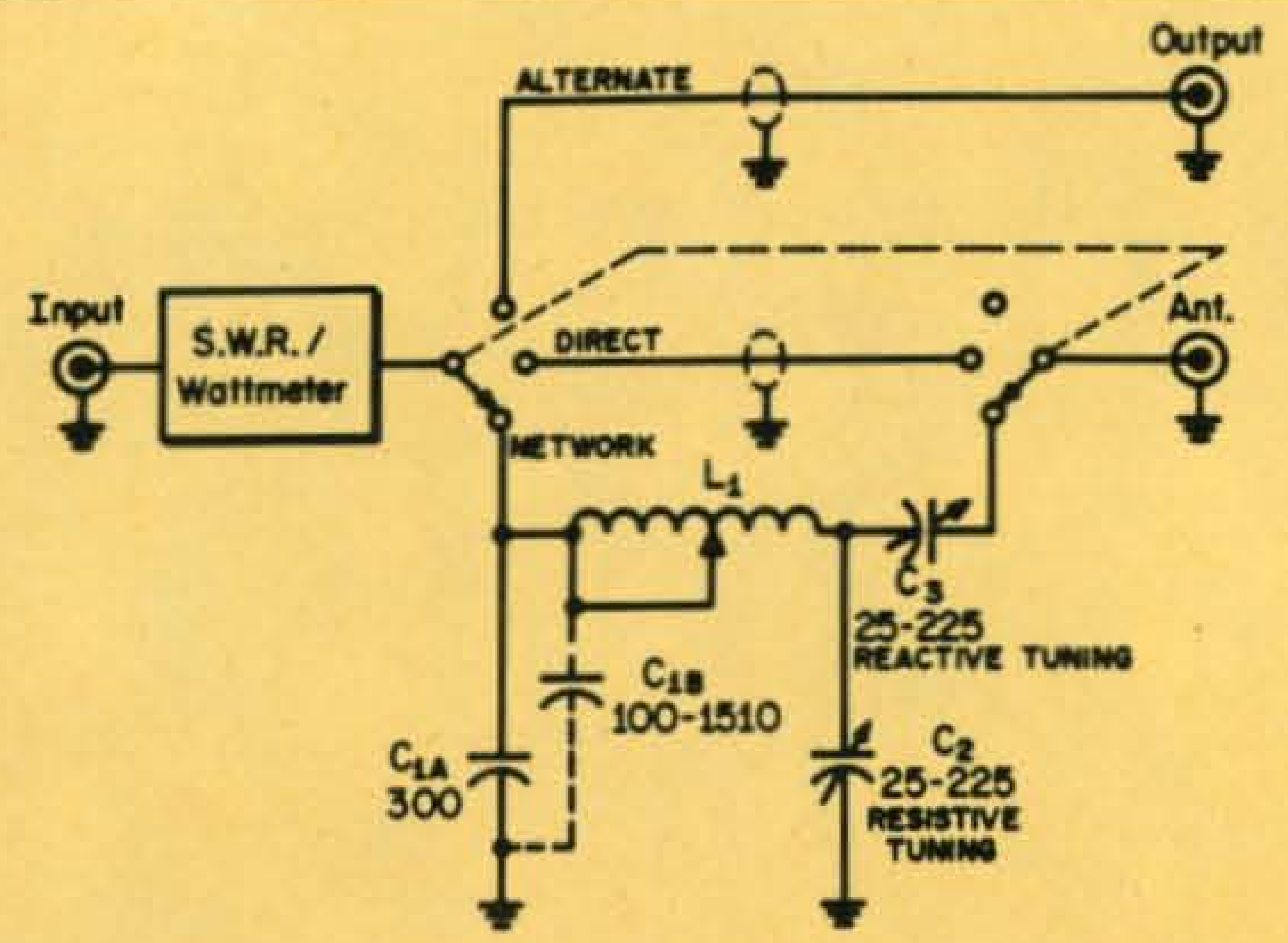


Fig. 1—Main circuitry for MN-4 Network. Various-size fixed capacitors are switched in parallel at C_{1B}, according to the band in use.

Another Model, the MN-2000, will be available for 2000 watts p.e.p.

The job also includes a directional wattmeter which can be switched to directly read the s.w.r. or the power with an existing feed system alone, or for operation in conjunction with the matching network, particularly when adjustments are being made thereon. It also provides output monitoring.

Another feature of the MN-4 is that it will provide 25-35 db of harmonic attenuation and thus possibly avoid the need for a separate low-pass filter to minimize output harmonics that might otherwise be transferred to the feedline and thereby cause TVI, or to provide a further harmonic decrease when a filter is already in use.

Convenient flexibility is provided by the inclusion of two switchable output connectors and with switch positions for feeding through the network or bypassing it.

Circuitry

The main circuitry for the matching system in the MN-4 is shown at fig. 1 and consists of a pi- network which in a way is a depature from the usual arrangement in that the input side is set for 50 ohms with fixed capacitors, while the output is tuned with a variable capacitor, C_2 (RESISTIVE TUNING), to provide the proper impedance ratio between the input of the network and the resistive component of the antenna system. Control C_3 (REACTANCE TUNING) tunes out the reactive component at the output side of the network.

Taps on L_1 and switched fixed input capacitors provide the necessary parameters for operation within the various ham bands. There are two positions for 80 meter band operation to allow a wide matching range without the need for an extra-large variable capacitor at C_2.

The wattmeter is the same type as the Model W-4, described elsewhere in this issue, except that it also has a scale calibrated directly for s.w.r. Although the continuous-duty rating of the MN-4 is 200 watts, the wattmeter scale is calibrated up to 300 watts. The s.w.r. scale is marked for ratios of 1:1 to 10:1. The wattmeter is located at the input side of the network to show when a 50 ohm resistive load is presented to the transmitter (as indicated by a 1:1 s.w.r.) during adjustment of the network.

A sensitivity control is included for the meter, but unlike that in the common s.w.r. indicator mentioned previously, the need for this control is not related to frequency, but rather, is used only to set the meter for a full-scale reading according to the power output from the transmitter, so that s.w.r. readings will be properly correlated.

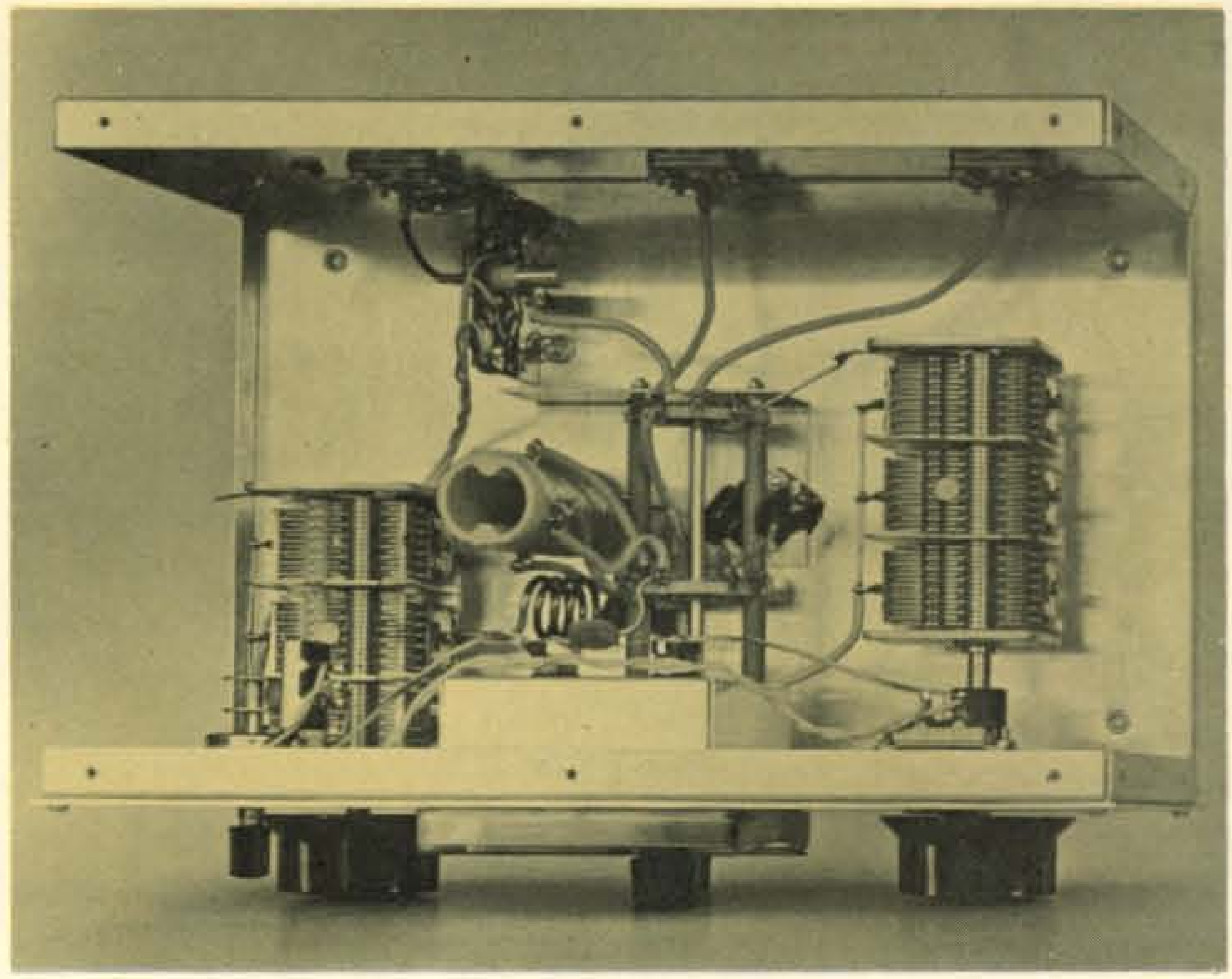
When the selector switch is set at one of the band positions, the matching network is engaged between the input and the *antenna* connector. A separate position connects the input directly to the connector, thus bypassing the network. Another position bypasses the network and connects the input directly to an *alternate* output connector. The setup thus makes it possible to quickly switch to an antenna that requires matching, or to either one that needs no matching, a dummy load or a linear amplifier.

Operation

Adjustment of the matching network can be concluded in a matter of seconds, simply requiring that the RESISTIVE and REACTIVE TUNING controls be alternately operated in a direction which finally results in a minimum or zero indication on the s.w.r. scale of the meter.

During the process, the transmitter p.a. occasionally may have to be repeaked; however, first tuning up the transmitter directly using a dummy load and then switching over to the matching network and antenna, will eliminate the need for further transmitter adjustments. This will hasten the job and reduce unnecessary on-the-air interference, as will the use of low power which also is recommended to avoid damage to either the

Interior view of the MN-4. The network inductor is viewed end-on at the left of the bandswitch with the 10-meter section nearer the panel. The sensing elements for the wattmeter are on a vertical board at the upper left.



transmitter or the matching unit. As little as 10 watts, applied to the MN-4 will usually be sufficient for tuning.

To make the work easier, a set of tuning curves is furnished to show the *approximate* settings on each band for 10-250 ohm resistive loads and capacitive or inductive loads which present a 5:1 s.w.r. Also from these curves, we can find the approximate load impedances according to the dial settings found in practice for a particular situation. Settings for reactive loads with less than a 5:1 s.w.r. are not indicated, but lie somewhere between the resistive and reactive curves.

After the correct settings have been found during tuneup on a specific frequency with a given antenna, they may be recorded for future reference when bands or antennas are to be changed.

The transmitter power *applied* to the matching network or a direct-fed load may be quickly found by depressing a rocker switch which sets up the wattmeter for forward-power readings. If it should be desired to read the s.w.r. presented either by the matching network or by a direct-fed load, such as a dummy or the antenna system alone[1], it may be done by pushing in the sensitivity-control knob and rotating it for a full-scale reading. When the knob is subsequently released, the meter then indicates the s.w.r. directly. In adition, reflected-power readings may be had using a somewhat similar calibrating method.

Performance

The MN-4 was tested using several transmitters with various coax-fed antennas and random-length end-fed radiators working against ground. A 1:1 matching s.w.r. for the transmitter could be easily obtained in most cases, except for a few situations which could not be resolved to better than a 2:1 s.w.r. This was due to the specified limitations imposed by reactive loads with an s.w.r. higher than 5:1, such as can be experienced with end-fed systems. In many cases this match was closed enough to permit full output of the p.a.

Although the MN-4 matches a transmission line or an antenna to a transmitter, it will not alter the s.w.r. between itself and the antenna, nor will it necessarily ensure transfer of all the available power into a radiator, unless the antenna system is resonant, especially if it is a grounded type. Nevertheless, in some off-resonance situations, the MN-4 will bring the system near resonance within about 3 db of maximum-power capabilities.

On the other hand, resonance and better efficiency with such antennas may be obtained by installing a loading coil between the matching unit and the antenna along with an r.f. ammeter connected in series between the *coil* and the *antenna lead,* and then adjusting the coil turns for maximum r.f. current with a given power reading on the wattmeter. The network, of course, must be readjusted whenever the loading coil is altered during this process. A separate loading coil also will often enable the matching s.w.r. to be brought down to 1:1 in cases where it is not otherwise possible.

Grounding

Careful attention to grounding both of
[*Continued on page 115*]

[1] Fed with 50-ohm coax.

Not since the infamous Danny Weil sailed Yasme on its world-wide island-hopping expedition in the late fifties has a DXpedition stirred such strong emotions as has W9WNV's marathon trip. Here for the first time is a first person account of THE DXpedition replete with all the gory details and with no holds barred. Opinions expressed herein are soley those of the author.

DXPEDITION

Part I — The Beginning

DON MILLER,* W9WNV

WHAT sort of a challenge is it that would lead a radio amateur on a convoluted course through all the world's continents and oceans for over two-and-a-half years? What problems must the DXpeditioner face, how does he solve them, and why are DXpeditions important to the future of amateur radio?

These articles are intended not only as narratives depicting and historifying the DXpedition, but also as a reply to these and numerous similar questions and as a discussion of the vital significance of DX in amateur radio's fight for survival.

Editor's Background

I am not an "old-timer," especially not in DX circles. My interest in DX began with my first amateur license, W9WNV, in 1952, while I was a junior in High School, but my activity was seriously curtailed because a mobile whip antenna was all the landlord would allow at our small Chicago apartment. My only real exposure to DX came through north side neighbors, Tony, W9OD, and Dick, W9VXY, and later through use of the club station, W3GQF at Johns Hopkins University, Baltimore, where I pursued pre-medical studies through 1956.

My first real taste of DX came when our family moved into a tall apartment building on Chicago's Lake Michigan shore. At the height of 250 feet my dipoles brought the world into the shack, and later, with a tribander, I was able to compete successfully in the contests and pileups. Serving in the U. S. Air Force in Korea during the period 1962-1964, I was granted the amateur callsign, HL9KH, and served as MARS Director for Korea. This was my first experience at "the other end" my CQ's were never unanswered, frequently by the rarest of DX

* c/o *CQ* 14 Vanderventer Ave., Port Washington L.I., N.Y., 11050

Ted Thorpe, ZL2AWJ

stations, and sometimes the pileups were hundreds deep; I was, for the first time, the "chased," instead of the "chaser," and one CQ could start a pileup that would last for an entire weekend! Over 30,000 QSO's were recorded from HL9KH, which was not exactly in the "rare" category; I could imagine the experience of operating from a new or rare country.

That experience was not long in coming. My first DXpeditions were staged in 1963, to Rota Island, Marianas (W9WNV/KG6R), and Parece Vela (KG6ID); both were "new countries," but the latter operation was discredited by ARRL when they later announced that the separation mileage determining an island's country status for DXCC had been changed from 225 to 500 miles, this "rule" being made retroactive to three months before it was published!

After a year in private medical practice in California, I met Chuck Swain, K7LMU, in Southeast Asia late in 1964, and we conducted a brief DXpedition to Cambodia (W9WNV/XU) and South Vietnam (K7-LMU/3W8), after clearing the activity with the FCC to lift the "ban," at least temporarily. At that time we agreed to stage a more extensive DXpedition in the near future. Chuck Swain was a most remarkable individual, later becoming my closest friend.

The First Two Years

It all began in August, 1964, but the planning had already consumed two full months. Chuck was to travel directly to the Orient, delivering a set of amateur gear for possible use in Communist China and completing the groundwork for planned operations in the Far East. During this time I would make my way across the Pacific to meet Chuck in Southeast Asia, stopping only briefly for one or two operations but obtaining licenses and clearing the way for more activities on our return trip home through Oceania.

We needed plenty of help and we got it. From the manufacturers—Hy-Gain and Collins and ElectroVoice and Waters. And from Ack, W4ECI, who agreed to tackle the thankless jobs of QSLing and lending a financial hand, if necessary. Help came from the entire DX fraternity—in many forms. W6LDA and K6CYG supplied propagation forecast charts for all the planned stops; K8RTW printed the thousands of QSL's for each stop (over 400,000 have been distributed since the DXpedition began!); airlines, hotels, printers, communications authorities. Ambassadors, and shipping companies all volunteered their support—right down the line, all did their part to make the DXpedition a success.

On my swing through the Pacific I managed to operate from two "scarce" countries, Western Samoa (5W1AD), and New Hebrides (YJ8WW), and to obtain permits for later operations from Fiji (WR2EW), Tokelaus (W9WNV/ZM7), Australia (WK2-ADY), and Heard Island (WK2ADY/Ø). One of my first lessons was that most inactive countries are far more rare than one would suspect; naturally, in the higher DX circles and among the honor roll members, there are few rare countries in existence, but this select group of DXers comprises only about one percent of the DX fraternity. Having associated with the upper echelon prior to the DXpedition, I had fallen into the trap of considering only the rarest of DX countries as being desirable DXpedition sites; the operations from 5W1AD and YJ-8WW proved beyond all doubt, (and later activities substantiated), that any DX country from which there has been little or no DX activity over a period of two to three years automatically becomes quite rare. This was quite important to Chuck and I, for when we formulated plans for the expedition and its operations, one of the top objectives was *to work as many different stations as possible* from each location. This is why we tried to limit each station to one QSO on each band and mode for each operation; this is the reason we painstakingly kept "dupe sheets" to avoid working the same stations over and over again. This is the lesson I learned when during my stay in Korea, I listened to a famous DXpeditioner operating from rare locations and working the same stations, day after day, night after night, while hundreds of others called in vain. Of course, that was his choice. But Chuck and I were to do our best to work the "low-power-and-dipole" DXers and not to cater to the big guns. And so, although 5W1 and YJ8 were not by any means rare to the fellows on the honor roll, they turned out to be *rare* countries, for I would guess 80 percent of those working us there had never contacted those spots previously. Since this fit in exactly with our thinking, the lesson we learned from the first two operations was quite valuable in planning the remainder of the DXpedition. Unfortunately, we became so successful at working everybody that, gradually, the big guns lost their grip on the select bracket at the top of the DXCC Honor Roll; when many of these influential individuals began to complain, the DXpedition was given the treatment by ARRL, so unfortunately, I have been forced to change our original policy of working everybody. It is interesting to note that, while the ARRL DX Operating Code instructs overseas amateurs to avoid working those who use poor sportsmanship or operating tactics, the League circulated documents admitting that who we worked and promised to work had a bearing on their decisions to discredit certain operations! It's a pity to see such politics ruin what was once a most cherished DX Award.

In the fall of 1965, BY4SK was activated from Canton, China. Chuck and I met in Southeast Asia and managed to obtain permits to operate in Indonesia (W9MNV/8F3) and Thailand (K7LMU/HS), and to work stations normally forbidden from working these countries, completing our ambition of having operated from all four of the countries on the "banned list." Before leaving Asia we also managed operations from Laos (XW8BF), Burma (XZ2TZ), and Spratly Island (1S9WNV). That "1" call sign from Spratly was actually suggested by officials of both the ARRL Awards Committee and the Federal Communications Commission; since there are no "1" prefixes allocated by ITU, we figured that by operating from an unclaimed, or multi-claimed area with the "1" prefix, we would not be violating the regulations of any country. The "S" was to indicate Spratly, and the remainder of my own callsign completed the

Chuck Swain, K7LMU

call "1S9WNV." We later used the same type of call-signs from unclaimed Minerva, Blenheim, and Geyser Reefs. Unfortunately, it was technically improper to have used a "1" callsign; ITU forbids the use of prefixes starting with "1" and "Ø". Since FCC has informed us that the use of, for example, "W9WNV/portable at Geyser Reef," is acceptable, this procedure will be employed from any future DXpedition operation from unclaimed territory, and we would urge all DXpeditions to do likewise, observing the ITU regulations, which *do* govern amateur regulations in all countries.

Next, we began our return across the Pacific. Ebon Atoll and Cormoran Reef, both located within the Trust Territory of the Pacific, were twice proclaimed as "new countries" for DXCC by the ARRL, but after our operations from these places the Committee changed its mind, because it "forgot" to look into the matter before announcing its decision. Two months of planning and hard work, a substantial sum of money, and the good faith of the DX fraternity, went down the drain.

At this point I continued on to Fiji, meeting Ted Thorpe, ZL2AWJ. After a contest operation from VR2EW, Ted and I sailed aboard the 38-foot ketch, *Marinero,* to Tonga (VR5AB) and Niue (ZK2AF) Islands. Contrary to the claims of a particular editor who fancies himself as a DXpeditioner, the operations from Niue, Thailand, and Burma took place from those countries, and are well-documented, including passport stamps from the authorities. It is a shame when one has to resort to the deliberate spreading of misinformation to promote business at the expense of a beloved hobby and service. When one begins to involve individuals who gave their lives for people of this character, it becomes almost intolerable.

On reaching American Samoa, Chuck rejoined us; I returned briefly to the States to conduct a series of lectures, while Chuck and Ted embarked on that fateful trip to Wallis Island (FW8ZZ). Just before reaching Apia, Western Samoa on the return trip, the *Marinero* was struck by a ferocious tropical hurricane and lost at sea. Those aboard are presumed dead. A massive air and sea search by the New Zealand and United States Air Forces, Coast Guard, and commercial airlines, the largest search in the history of that area of the Pacific, failed to uncover a trace of the *Marinero* or its crew. I would not even attempt to describe here those horrible, emotion-packed days of that heartbreaking, disappointing search.

I don't know why, but I continued on. Three of the families involved urged me to do so, but mostly I think it was because of a pledge Chuck and I had made earlier; having been through some pretty harrowing experiences, we agreed that if something happened to one of us the other would continue on to complete our plans as best as possible. Chuck and I did have plans.

The Pacific phase of the DXpedition was completed with operations from Minerva Reef (1M4A), Maria Theresa Reef (W9WNV/FO8M), and the Northern Cook Islands (W9WNV/ZK1S). The trip to Heard Island (VK2ADY/Ø)—a story in itself—followed, and finally, the operations in the Atlantic and Caribbean with K1IMP from St. Peter and Paul's Rocks (PYØXA), Navassa Island (K1IMP/KC4), and from Bajo Nuevo and Serrana Bank (W9WNV/HKØ).

I had decided to quit at this point. No amount of excitement, accomplishment, or thrills could possibly overcome the tragic loss of two close friends. Some DXers were yelling their heads off because they had not been worked from one place or another. A South American DXer had vowed to sabotage the DXpedition. I hadn't much money left. Still, when Ack suggested continuing in the Indian Ocean area, the temptation was too great and, again, I continued: DesRoches (VQ9AA/D); Farquhar (VQ9AA/F); Aldabra (VQ9AA/A); Gloriosos (FR7ZP); Geyser Reef (1G5A); Cagos (VQ9AA/C); Laccadives (VU2WNV); and Blenheim Reef (1B9WNV) followed. And then it happened. I suddenly learned that the ARRL had circulated an eleven-page document against me, personally, and the DXpedition. Being a staunch League member, and having just spoken to the League's General Manager a few days before, I was totally shocked at this widespread circulation of such a document and at the inaccuracies which it contained. There was no choice. I had to return home to set the record straight.

It is not the intent of these articles to go deeply into the personal and legal entanglements that resulted and still continue. In the articles that follow, wherein we take you along the DXpedition trail, these actions will be referred to and certain questions will be answered for the first time. I have, however, brought you rapidly up-to-date; by the summer of 1967 the air had cleared and the DXpedition was continued. The following installments will describe in detail our return to the Indian Ocean and the operations that follow.

Why DXpeditions?

Most individuals enjoy a challenge, particularly one which enables them to accomplish something while accepting it. DXing itself is a challenge; DXpeditions, even more so. Now, I'm not talking about a vacation to a beautiful Caribbean island where an amateur operates his station between parties and trips to the beach. I mean a trip to a rare or new country, usually involving difficult problems with transportation, licensing, customs, immigration, weather, equipment, expenses, paperwork, and other various forms of obstacles or harassment. If at least one of these problems did not exist, the country would not be rare, for obvious reasons. Besides a healthy challenge what then are the advantages of DXpeditions, and what can be accomplished?

(1) Promotion of international good will and understanding, through personal contacts, through joint activities among amateurs of different countries, through demonstration throughout the world of the art of amateur radio communication and the advantages to the existence of an amateur radio service in the remote areas of the world, and through the promotion of a favorable image of ama-

[*Continued on page 112*]

TOP LOADED 160 M VERTICAL

BY LOUIS B. BURKE, JR.,*
W8QJH/7

Here's a good antenna you can put together for the CQ 160 M Contest. (January 27 - 28)

Since the birth and growth of single sideband, the use of a.m. equipment on most bands has become virtually impossible, especially in the 100 watt power class. However, there are still quite a few a.m. rigs that can be heard on 160 and 10 meters. Since ten meters poses no problems in antenna construction, this would seem to be a very popular choice for the few a.m. operators left on the air. Of course, who wants to be confined to only one band in which to operate that low-powered a.m. rig? Now, have you ever considered the possibilities of 160 meters? More than likely you have, but after some brief thoughts of how and where you could construct an antenna, you soon gave up any ideas of 160 meters.

* 3301 West Turney, Phoenix, Arizona

Because I live in an apartment, operation on 160 seemed to be an impossible task, until I decided to experiment with top-loaded verticals. My original antenna was nothing more than a quarter-wave vertical for 40 meters; just a piece of TV mast, consisting of three sections joined together and about 33 feet high, which is bolted along the side of the house (thanks to the landlord). My first thoughts were to base-load the vertical, which I did, and it seemed to work quite well. Although it seemed as though every time I made a contact with a California station, and the subject of antennas came up, I was told to get the loading coil up off of the ground and into the air where it could do some good. So I decided to look into the problems of top loading and the advantages of doing so.

Top Loading

Any antenna that makes use of a loading coil poses the problem of getting the coil high enough in the air, away from surrounding objects, to really do some good. Of course, in a mobile installation you are limited as far as the height is concerned, but in a fixed location the problem of height is usually limited by nothing except your own imagination. This being the case, the highest possible installation on 160 will probably only be a small portion of a wavelength.

So now, all that must be done to be top-loaded on 160 is to make up some sort of coil and top-section that will be resonant in the 160 meter band. For this purpose, all you need is some number 18 enamel wire, a 102 inch CB whip and some sort of coil form. I know that the first thought that has come to mind now is, how much of a coil is necessary. Actually, it's not nearly as bad as you may think.

Loading Coil

The coil is wound on a hollow card-board form measuring 2¼ inches by 6 inches and is close-wound with number 18 enamel wire, approximately 140 turns. After the coil is wound it is then ready to be mounted on the 1¼ inch wooden dowel stick. This is accomplished by simply passing the dowel through the center of the coil and fastening the coil to mounting bolts. I used a ¼ inch by 20 bolt and large solder lugs to hold the coil in place on the dowel stick. (See fig. 1.)

All that remains is to fasten the C.B. whip on top of the dowel above the coil. In my case, this was accomplished by drilling and tapping a ¾ inch round piece of aluminum in one end, so that I could screw the whip into it. This piece was then inserted into the top end of the wooden dowel. (See fig. 2)

Now we have a completed top-loading section and all that remains is to tune it to the proper frequency. Tuning was accomplished by inserting my top-loading section into a 10 foot piece of TV mast and using a grid-dip meter at the base of the mast to first establish the frequency at which the antenna was resonant. It was around 1800 kc., so in order to raise the resonant frequency, I took off a few turns off the coil and again checked the resonant frequency with a grid-dip meter. This "pruning" process went on until the antenna was resonating around 1950 kc. At this point I put the entire mast together with the top-loading section located on the very top of the vertical and raised the antenna into the air, with the help of Jim Schroeder, an old friend and S.W.L. The purpose of raising the antenna at this point was to determine what effect the height would have on the resonant frequency. The result was a change in frequency of some 30 to 40 kc. Fortunately, at this point, no further adjustments were necessary.

S.W.R. Measurements

Another way in which the antenna could be tuned would be the use of an s.w.r. bridge. Instead of using a grid-dip meter, try tuning the transmitter to the frequency at which you want to operate. If the rig will not load and shows a high s.w.r., increase the frequency and again note the s.w.r. If, with an increase in frequency, the s.w.r. shows an increase this will indicate that the antenna is resonant at some lower frequency than to which you are now tuned. Simply decrease the frequency while noting the s.w.r. until the s.w.r. is as low or as near to zero as possible. Now that you have established the resonant frequency of the antenna, it is a simple matter to raise the resonant frequency by removing one turn at a time from the coil or decreasing the resonant frequency by adding a capacity-hat to the whip antenna above the loading coil. Once you have the top section tuned, keeping in mind that a small change in frequency occurs as the antenna is raised into the air. Note also, that the s.w.r. will be very near zero at resonance and will increase by a noticable amount with an increase in frequency of about 10 kc. This will show that the "Q" of the coil is reasonably high.

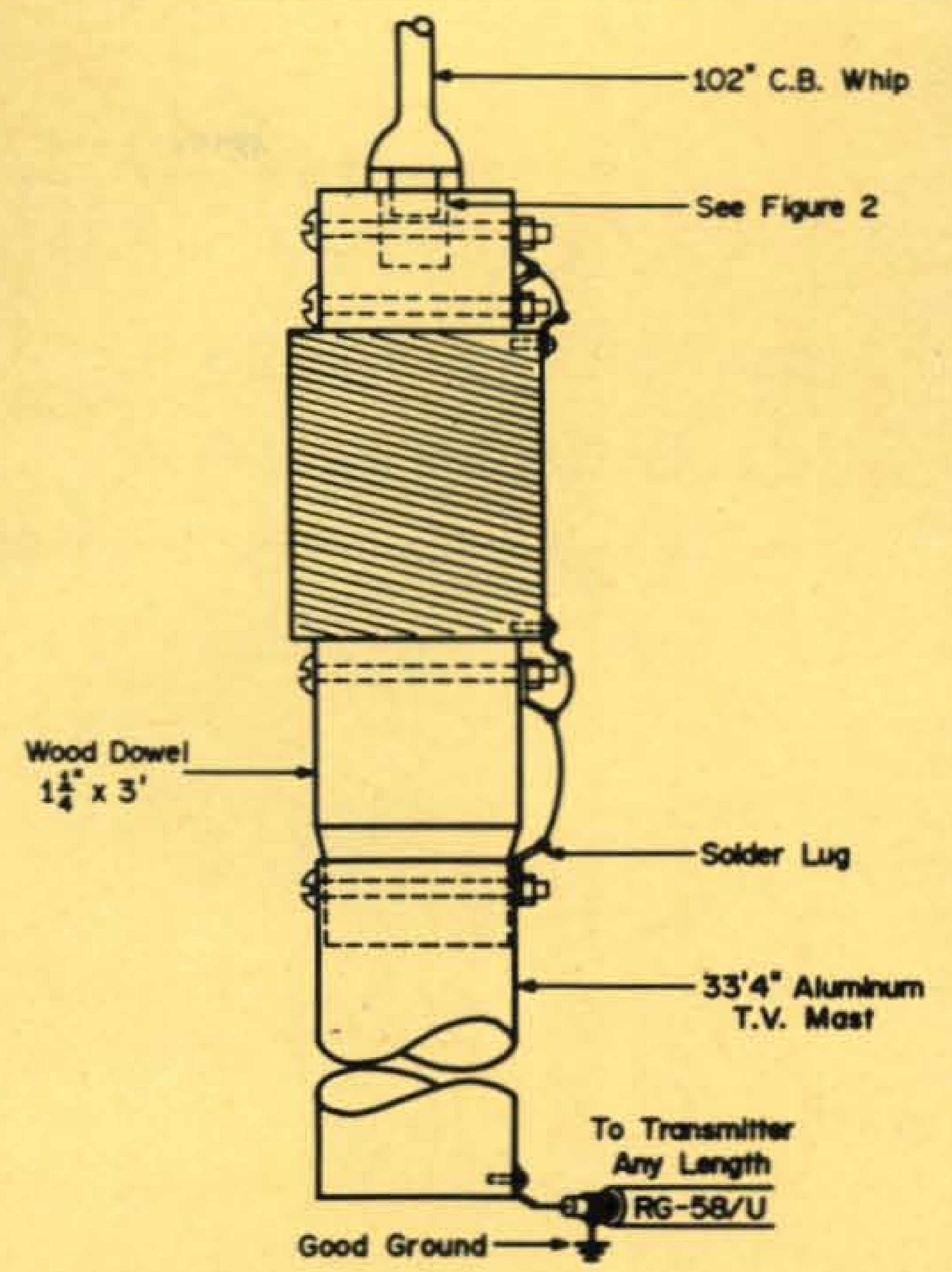


Fig. 1—Construction details for a top loaded 160 meter antenna that also operates on 40 meters. All the bolts used are ¼ × 20. The loading coil, as described in the text, is 6" long by 2¼" diameter. The wood dowel is 1¼" by 3' with at least 1½' to 2' inserted into the TV mast.

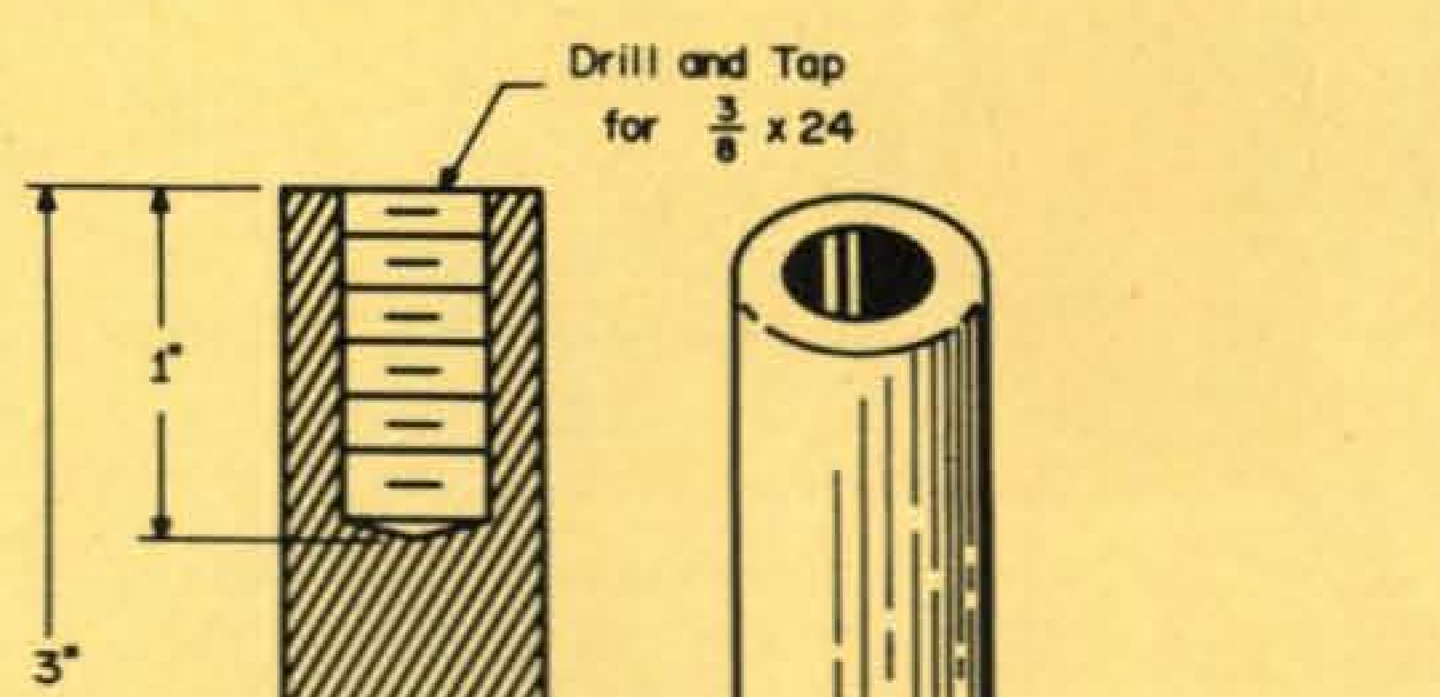
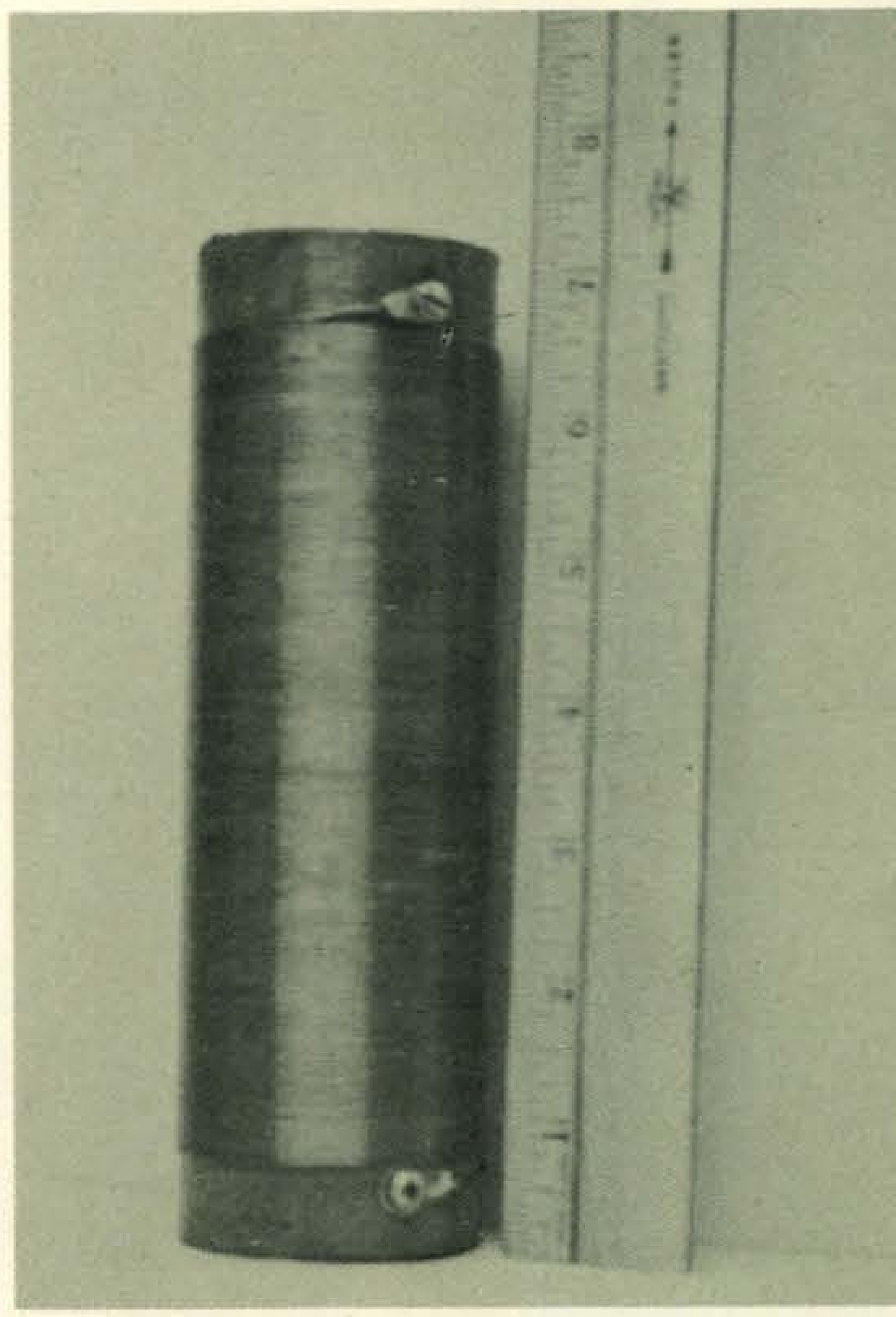


Fig. 2—Aluminum insert used in the top of the dowel to accept the threaded end of the CB whip.



Loading coil wound and ready to be mounted on the dowel.

Theory of operation is quite simple. Electrically, the antenna is a quarter wave vertical. The big advantage of top-loading over base or center loading is the fact that the coil is much higher in the air, which distributes more current along any point of the antenna, compared to base or center loaded antennas. Also, raising the loading coil and top section from the base of the antenna to the top raises the antenna's load impedance which will provide a closer match for standard 50 ohm coax.

Now that the antenna is top-loaded on 160 meters, what effect will this have on the antenna's operation on 40 meters? The answer is none, so without any adjustments at all, you can switch from 160 meter operation directly to 40 meter operation and still maintain a low angle of radiation and a low s.w.r. on the feedline.

I'm very sure that many improvements in the construction of this antenna can and will be made. However, due to the extreme shortage of information on top-loaded antenna's, at least now you will have a place to start experimenting. Good luck, and I'll be listening for you on 160. ■

OPTOELECTRONIC DEVICES

a photocell with a new name

BY JOHN J. SCHULTZ,* W2EEY/1

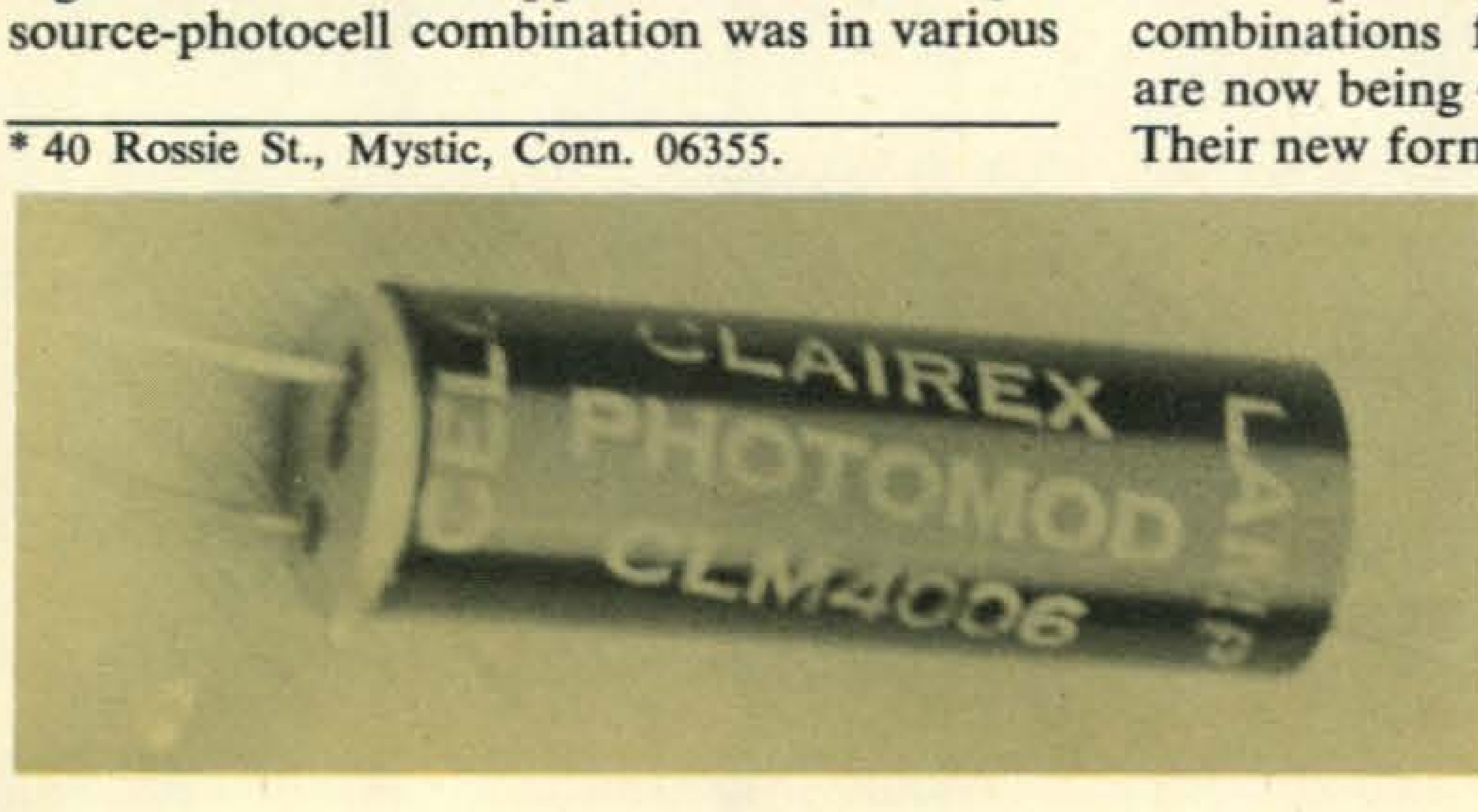
Photocell control circuits have been around for some time but new packaging and performance give them some unique advantages for use in audio and r.f. circuits.

PHOTOELECTRIC cells have been used for control purposes in electronics equipment for a number of years. A light source, controlled by some circuit function, affects a photocell so that the resistance of the latter is changed and it can then control a different circuit function. The advantage of such a combination is that no direct electrical connection need exist between one circuit and the circuit which is controlled. Noise, transients and other spurious responses which may exist in the controlling circuit are not transferred to the circuit being controlled. One application of this light source-photocell combination was in various older, tube-type speech compressors or limiters where a problem existed in obtaining a noise-free feedback control loop to regulate the gain of the amplifier stages. However, the method was awkward because a reasonable amount of power was needed to drive the light source, the resistance variation of the photocell was limited, the light source and photocell had to be carefully enclosed, *etc.*

A New Form

These problems have all been solved and after a period when light source-photocell combinations fell into general disuse, they are now being used again in their new form. Their new form consists of packaging a light

* 40 Rossie St., Mystic, Conn. 06355.



Clairex also produces a series of optoelectronic units. The unit shown is about ⅜" × 2", the lamp voltage is 6 volts maximum and resistance varies from about 500 ohms to 1 megohm.

MODEL	CONTROL LAMP		INSULATION	SIGNAL - PHOTOCELL						GENERAL				CASE TYPES
	Voltage	(MA) Current	DC Peak Volts	Resistance (Ohms) Max. On	Resistance (Ohms) Min. Off	Voltage Max.	Max. Power (MW)	Typical Switch. Time # Sec. On	Typical Switch. Time # Sec. Off	Shunt Cap. (PF)	Coupling Cap. (PF)	Weight (Oz.)	Light Source Type	
CK1101	120	1-3	1000	1000	10^7	100	75	.0012	.060	4	.001	.2	N	Metal Tube
CK1101P	120	1-3	1000	1000	10^7	100	75	.0012	.060	4	.001	.2	N	Printed Circuit
CK1102	0-1	0-50	1000	700	10^8	100	75	.020	.300	4	.003	.2	1	Metal Tube
CK1102P	0-1	0-50	1000	700	10^8	100	75	.020	.300	4	.003	.2	1	Printed Circuit
CK1103	0-5	0-200	1000	150	10^8	100	75	.020	.800	4	.005	.2	1	Metal Tube
CK1103P	0-5	0-200	1000	150	10^8	100	75	.020	.800	4	.005	.2	1	Printed Circuit
CK1104	0-25	0-37	1000	150	10^8	100	75	.010	.450	4	.01	.2	1	Metal Tube
CK1104P	0-25	0-37	1000	150	10^8	100	75	.010	.450	4	.01	.2	1	Printed Circuit
CK1105	120	1-3	50KV	10K	10^8	300	250	.020	1.0	4.4	1.8	3	N	Molded Case
CK1108	0-5	0-200	50KV	250	10^8	300	250	.030	1.0	4.4	1.8	3	1	High Voltage
CK1112	0-10	0-17	1000	700	10^8	100	75	.030	.400	4	.04	.2	1	Metal Tube Molded
CK1112P	0-10	0-17	1000	700	10^8	100	75	.030	.400	4	.04	.2	1	Printed Circuit
CK1114	0-1	0-17	500	850	10^8	100	100	.018	.060	1.5	1.0	.04	1	TO-5
CK1115	0-4	0-55	500	200	10^7	200	100	.020	.300	2	1.0	.04	1	TO-5
CK1116	0-4	0-17	500	350	10^7	200	100	.010	.300	2	1.0	.04	1	TO-5
CK1121	0-5	0-55	500	150	10^7	200	100	.020	.250	2	.1	.1	1	Crystal Can
CK1122	0-10	0-17	5000	1000	10^7	200	100	.030	.225	2	.1	.1	1	Crystal Can
CK1123	0-25	0-37	500	150	10^7	200	100	.010	.300	2	.1	.1	1	Crystal Can
CK1124	150	.2-1.2	500	3000	10^7	200	100	.005	.100	2	.1	.1	N	Crystal Can
CK2000	0-25	0-37	500	40	10^8	100	100	.030	.300	2	.5	.1	1	Crystal Can
CK2003	0-10	0-17	500	225	10^7	150	100	.035	.250	2	.1	.1	1	Crystal Can
CK2006	0-12	0-17	500	1500	10^8	150	100	.040	1.5	2	.5	.1	1	Crystal Can CdS
CK2008	120	1-3	1000	300	10^7	150	100	.0015	.060	4	.001	.2	N	Printed Circuit
CK2009	0-4	0-55	500	135	10^7	200	100	.020	.300	2	1.0	.04	1	TO-5
CK2010	0-6	0-25	500	270	10^7	200	100	.020	.300	2	1.5	.04	1	TO-5
CK2011	0-120	0-25	50KV	300	10^8	250	250	.050	.700	4.4	1.8	3	1	Hi Volt
CK2014	0-3	0-47	500	500	2×10^7	200	100	.050	.700	2	1.0	.04	1	TO-5
CK2015	0-25	0-37	500	1500	10^8	200	100	.015	.075	2	.5	.1	1	Crystal Can
CK2016	150	.2-1.2	500	1000	10^8	150	100	.010	.250	2	.1	.1	N	Crystal Can
CK2018	0-5	0-55	500	150	10^8	200	100	.010	.175	2	.1	.1	1	Crystal Can
CK2019	0-10	0-17	500	1000	10^8	150	100	.040	1.5	2	.1	.1	1	Crystal Can CdS

Fig. 1—A partial chart of the extensive Raytheon line of lamp-photocell units they name "Rayistors."

source and photocell in one light tight enclosure. The enclosures may be of pencil shape, the same size as a small crystal can or even the standard TO-5 transistor case. Along with their new packaging, different combinations of light sources and photocells offer a wide range of operating characteristics. The light sources may be either incandescent filament bulbs or ionized gas (neon bulbs). The light sources require from 1 volt at 17 ma to 120 volts at 2 ma to operate, with almost any combination in between being available. The photocells are semiconductors of such matrials as cadmium sulphide, cadmium selenide or lead telluride. They are selected for speed of operation and resistance range. The resistance range achieved when the light source is off to when it is energized with its rated voltages can vary as much as from 150 ohms to 1000 megohms with a range of about 500 ohms to 1 megohm being typical. In any case, a very wide control range is possible.

The response time depends upon the lamp and photocell material used. The quickest time is achieved with neon lamps and is usually about 1/1000 second for minimum resistance to be reached when full voltage is applied to the lamp. For filament lamps, the response time can go up to 60/1000 of a second. The "off" time, that is the time after the voltage to the lamp is reduced to zero and before the photocell resistance goes to maximum varies from 60/1000 of a second to a full second and a half. This wide variety of response and off-times is of great advantage since resistor/capacitor attack and delay networks are no longer required in most circuit applications, the lamp-photocell combination takes care of it all.

Control lamp-photocell combinations are

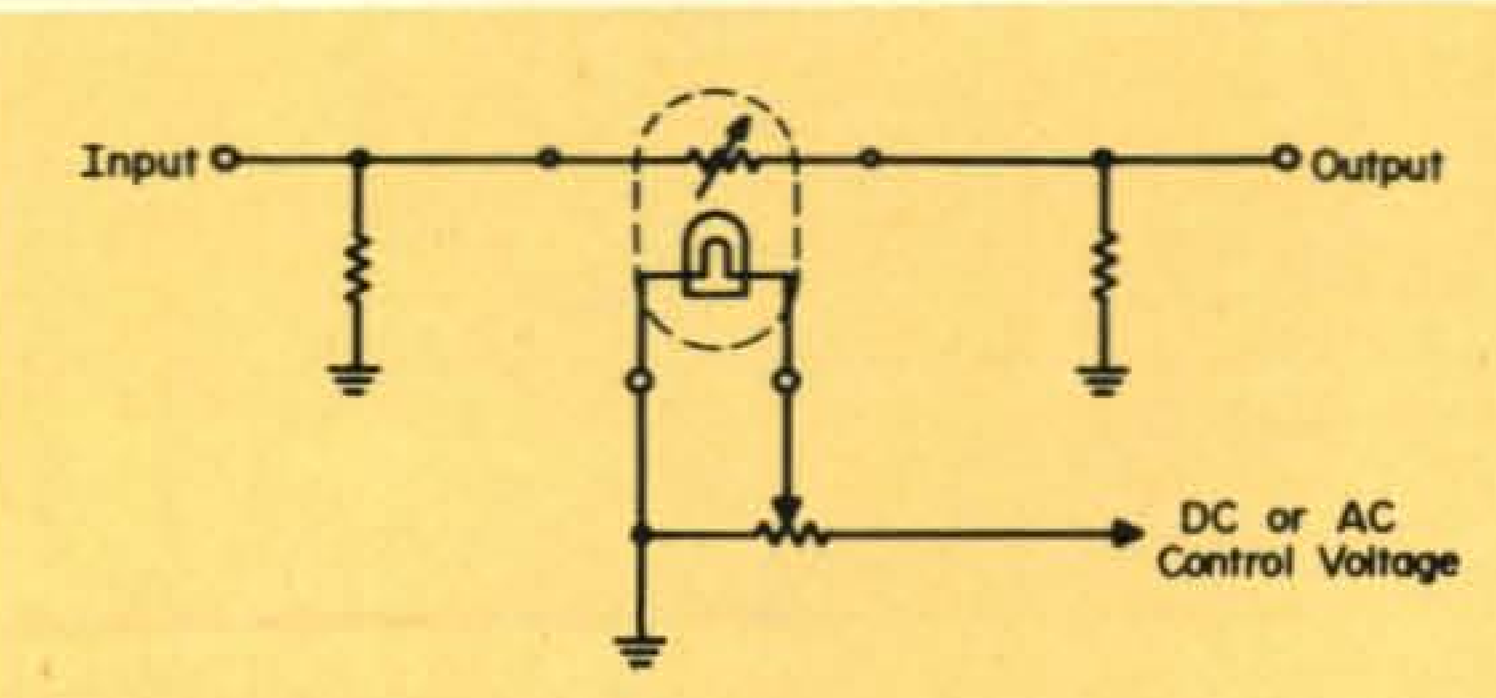


Fig. 2—Remotely controlled attenuator illustrates basic use of lamp-photocell unit.

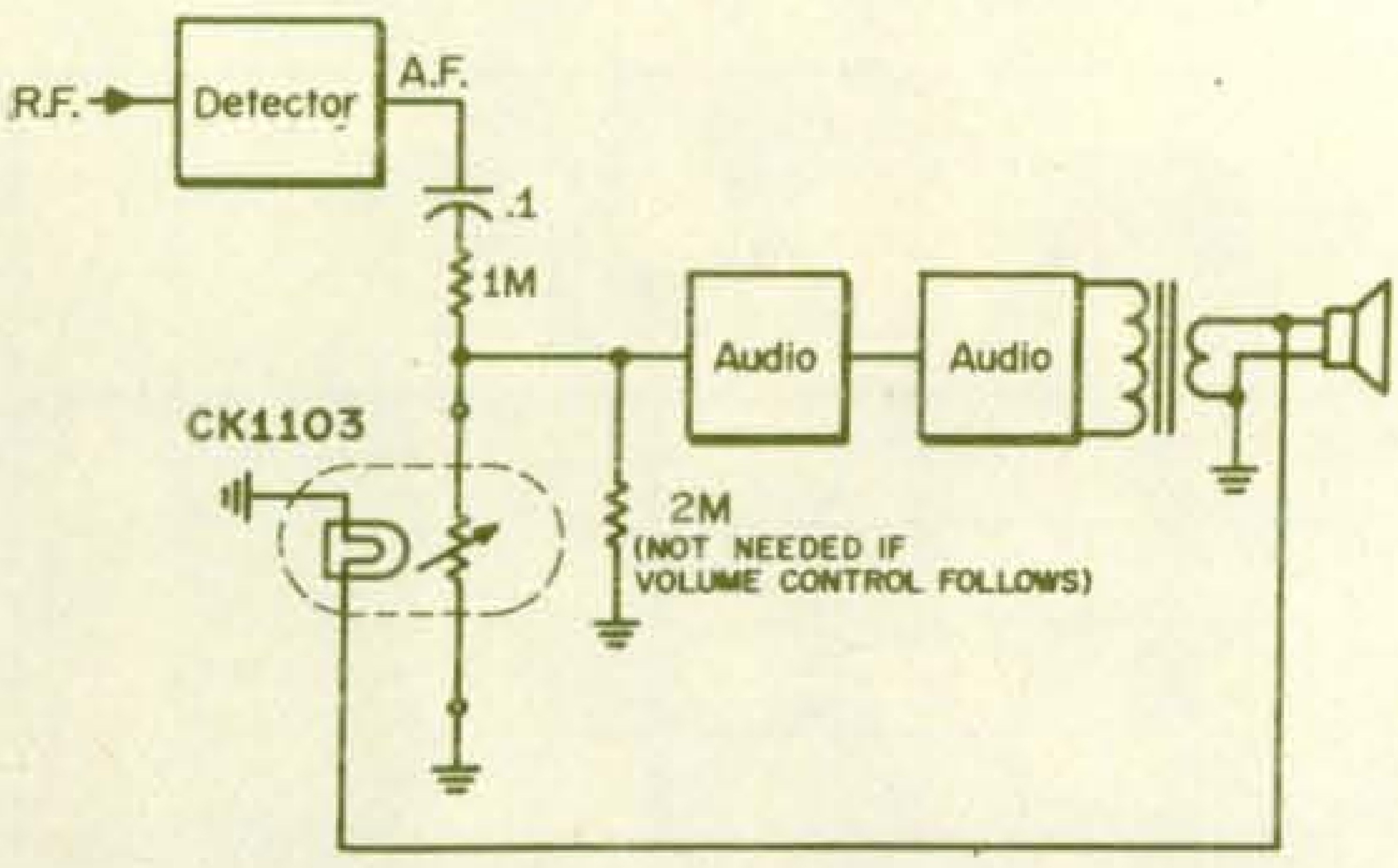


Fig. 3—A.v.c. circuit for receiver using lamp-photocell unit CK1103. CK1103 has a fast attack time of 10 ms and a slow release time of 800 ms. The 1 meg. resistor has to be adjusted for best results.

sold under various names such as photoconductor relays, opto-electronic controls and trade names such as "Rayistor" which is Raytheon's line of such devices. Figure 1 shows a listing of the extensive "Rayistor" line.

Applications

The basic usage of a lamp-photocell unit is shown in fig. 2 where the unit is used to permit remote control of a signal attenuator. A potentiometer is shown controlling the unit but it could just as well be the output of some electronic circuit to provide automatic control. It should also be noted that the lamp control voltage can be either a.c. or d.c. When a.c. is used, the isolation between the lamp and photocell is so great that no hum will be introduced even when controlling a high-impedance audio circuit. The fact that a.c. can be used to control the lamp also eliminates the need for rectifier circuits in many audio frequency applications.

Figure 3 is an application that illustrates some of the foregoing cited features as applied to an a.v.c. circuit for an s.s.b. receiver. The lamp circuit is simply connected across the terminals of the output transformer and the photocell unit is connected in a voltage divider circuit immediately after the detector stage. The Rayistor shown has a fast attack, slow release action which is appropriate for this application. The thermal inertia of the lamp in the Rayistor makes any modulation of the photocell resistance signals of inaudible frequency. This may not be the case in high fidelity equipment where amplifier response extends down to very low frequencies but is not problem with communications receivers since their low frequency response is kept purposely poor. The complete a.v.c. system requires one lamp-photocell unit and 2 resistors—quite a contrast to conventional circuits with rectifier and control circuits, time constant networks, *etc.*

There is no reason why the same idea cannot be used to extend the a.v.c. control back further to the i.f. or r.f. stages in a receiver or even to have an a.v.c. loop only in the i.f. stages. The variable photocell resistance, however, is used to control a voltage divider which supplies a d.c. control voltage to the elements of a tube or transistor in the same fashion as the control portion of a conventional a.v.c. system.

Figures 4 and 5 show two circuits suggested by Raytheon where a lamp-photocell unit is used to control the gain of two low-level transistor stages. Figure 4 shows shunt control variation of the input current to the transistor with one end of the photocell connected to the emitter to give better low-frequency response. The control range is about 10 db. Figure 5 shows a lamp-photocell unit used to control gain by decreasing the collector load resistance. The control range is 15-20 db. The same idea can be

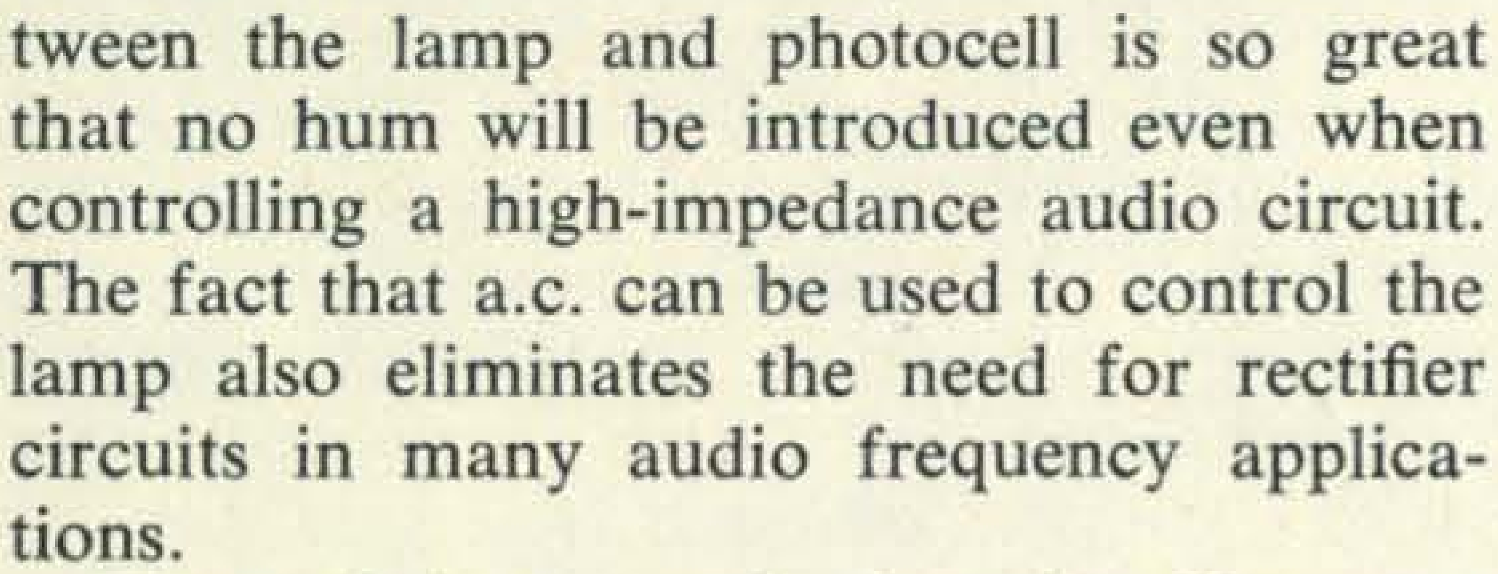


Fig. 4—"Rayistor" used to control gain of a.f. low-level stage.

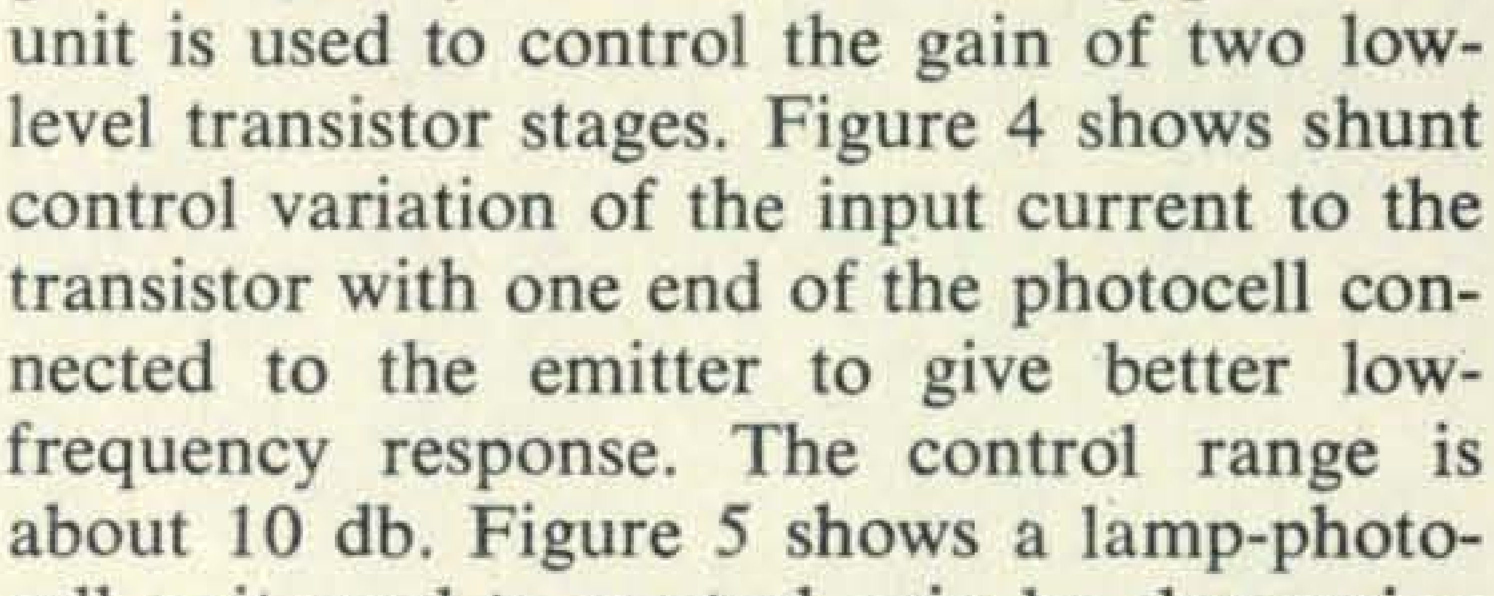


Fig. 5—Another gain control method that can be adapted to stages having fairly high collector load resistances.

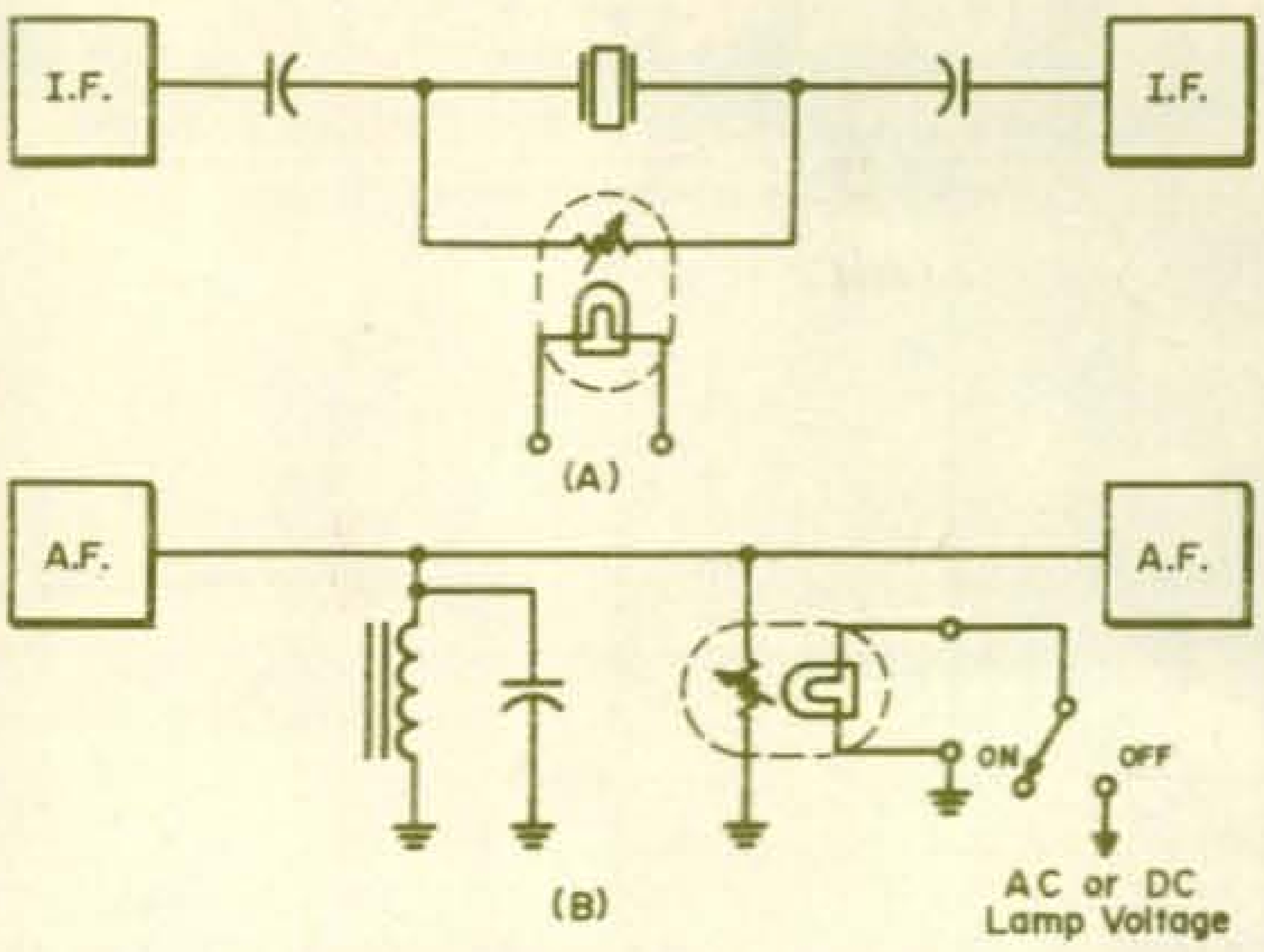


Fig. 6—Lamp-photocell units used as remote switches.

applied to many existing stages in a transmitter or receiver. The application of the control method shown in fig. 4 is particularly simple since the photocell element is simply shunted across the existing collector load resistance. Drive for the lamp can come from any later stage that develops sufficient output. One possibility with a transmitter is to rectify a small portion of the output power and use this to drive the lamp, the same as is done to drive a relative output power meter circuit. In some cases, the existing circuits can be used if the indicating meter has a 0-1 ma or higher movement. Thus a form of a.l.c. can be applied to an s.s.b. transmitter very simply.

As switches and relays, lamp-photocell units have the advantages of providing relatively low and high resistances for straight on-off operations with the option of continuous resistance variation when desired. Figure 6 suggests two ways in which this feature can be used and undoubtedly the reader can think of several more. Figure 6 (A) shows a single crystal filter in a low-frequency i.f. chain. The lamp-photocell can be used simply to effectively switch the crystal in and out or by continuously varying the lamp voltage, a coarse method of selectivity control is achieved. Figure 6(B) is a similar application applied to an audio selectivity filter.

Lamp-photocell units offer some unique advanatges when either resistance control is wanted with high isolation from the controlling source or mechanical extension of a variable resistance element is not feasible. Various small lamp-photocell units cost from 3 to 4 dollars and should find application in a wide varity of amateur equipment. ■

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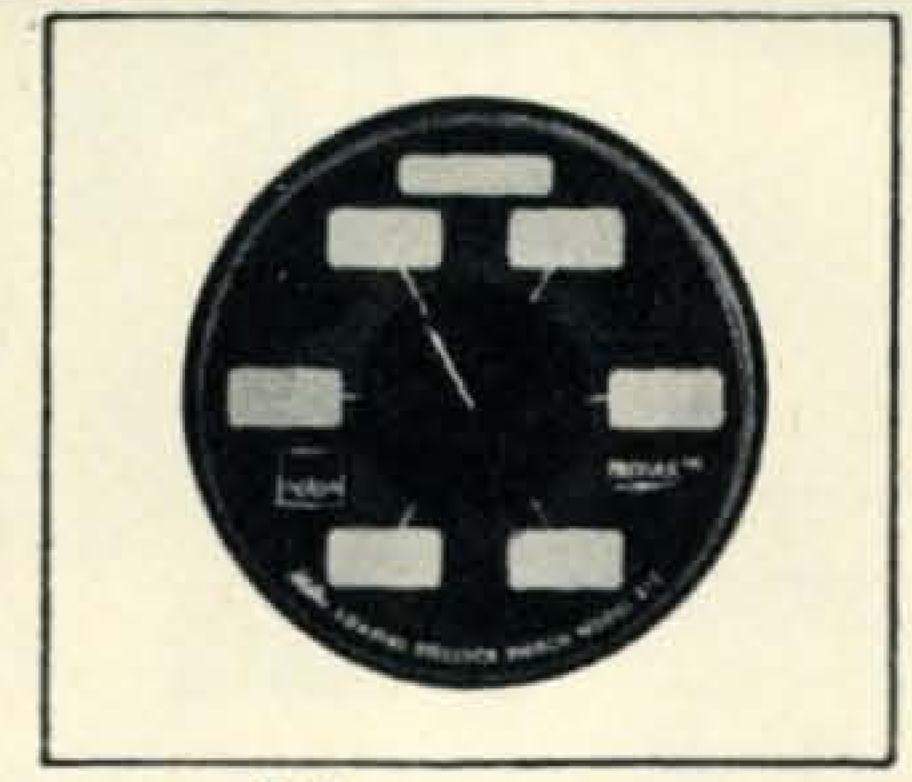

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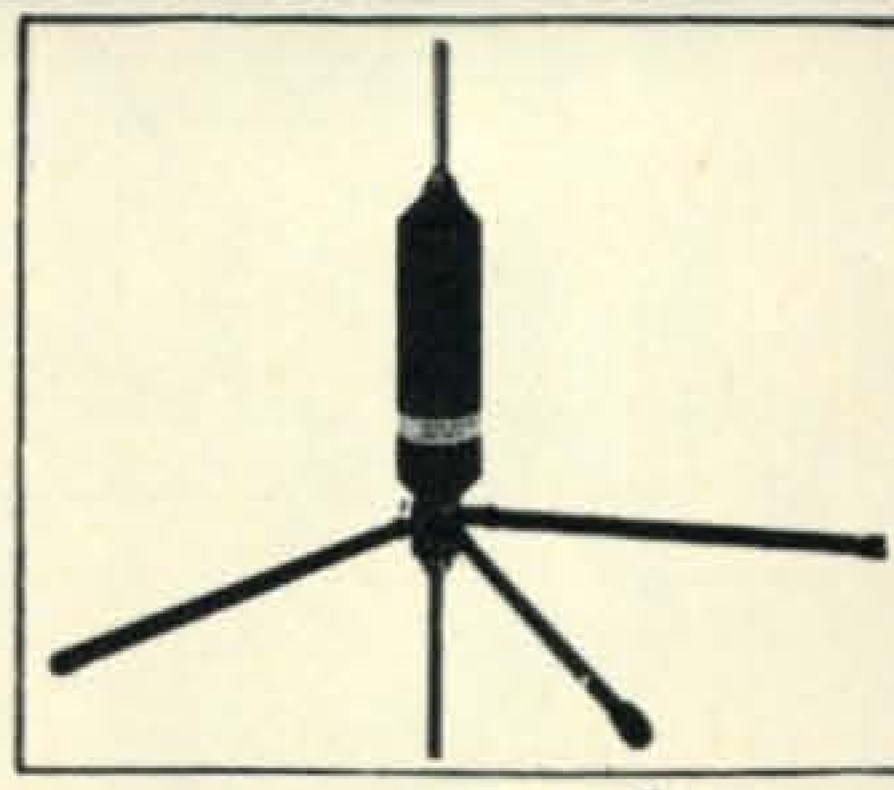

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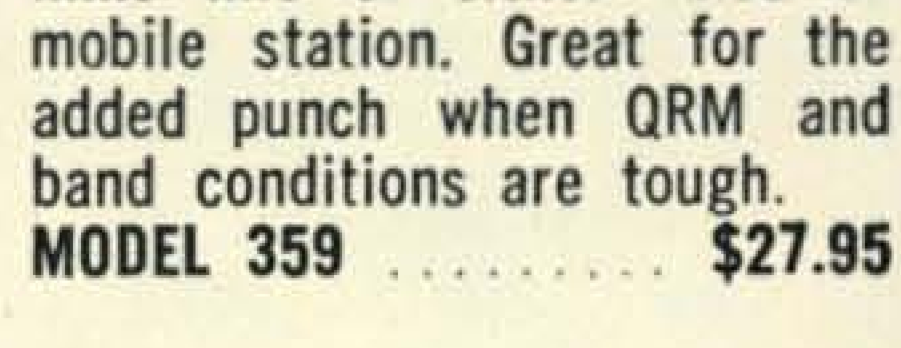

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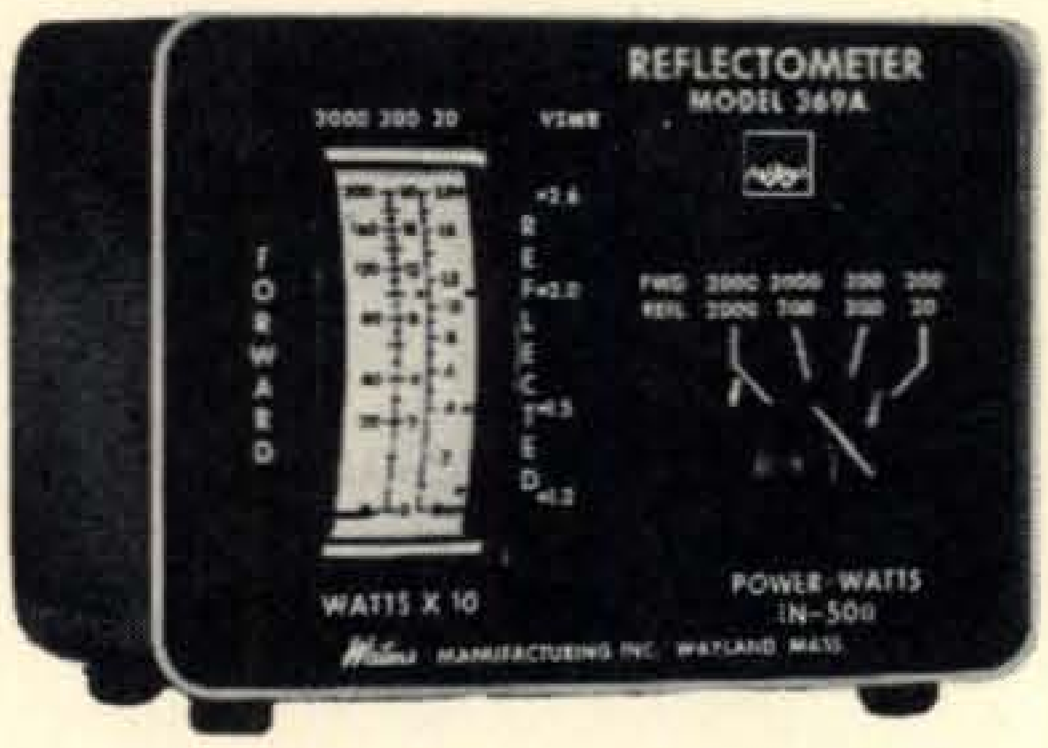

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DX

BY JOHN A. ATTAWAY,* K4IIF

First WPNX Winner

On Monday, Oct. 23 the doorbell rang twice, and the postman was waiting with a Special Delivery package, origin Camp Hill, Pennsylvania; dispatcher, Mary Ann Crider, WN3HUP; contents, QSL cards for 107 valid prefixes representing contacts made since June, 1967. Congratulations to Mary Ann, WPNX Winner *numero uno*.

Let me tell you a little bit about these prefixes. First of all, there is some real good DX involved. I know a lot of general class ops who would be pleased as punch to have a few of Mary Ann's prefixes. Her list starts off with CR4 and CT1 followed by a list of DJ and DL's, then EA1, EL2, FP8, GI6, GM5, KM6, OE1, OH5, UP2, VK2, VK7, YO6, YU1, ZD8, ZL3, ZS6, 4D1, 4X4, 5A3, 5Z4, 6Y5, and 9H1 just to name a few of the best ones.

Now about our winner, Mary Ann is the XYL of Charles, W3HTO, and the mother of three. The harmonics are 22, 19, and 15 so they can pretty well look after themselves giving mama some free time for radio. Here is part of a letter she sent describing her activities:

"The day I received my Novice call I went on 80 meters. I received an answer to my first CQ and my life changed. When I got over my nervousness and improved my code speed I decided to try 15 meters. It was here that I got my first taste of DX when I worked ON4JW. I just couldn't believe that I had actually talked to someone in Belgium, but I had. From that time on I was out to chase DX. I have 72 countries worked, WAC worked and confirmed, and WAS worked but still waiting for a KL7 confirmation. I have made some very good friends in DX. Among them are UA3AJ, CT1LN, LA7PF, OZ1A, LA7TH, F5SF, G3ERC, 3C6AAA, 4X4CJ, SM5DUL, JA9AMR, and JA9BGW. The last two are brothers.

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

"I must admit that I have the advantage of good equipment which is a great help. The rig is an HX-50-HQ18OA with a TH3 for 15 meters and dipoles for 80 and 40 meters. I have a total of 15 crystals of which 6 are for 15 meters. I also put in a lot of time, several hours a day within earshot of the rig. I've learned who is on and when. It pays to listen as one can lose a good DX station by calling too many CQ's. [This young lady has learned something in a few months that many Generals apparently never learn. Amateur Extras or Advanced, either, for that matter.—K4IIF]

"As for QSIs, I send most of my cards direct, and with new countries I write a short note. This small gesture of interest does wonders.

"One must be very patient in working DX. Remember the rules and don't ruin a QSO for someone else. Listen and be sure before you call a CQ."

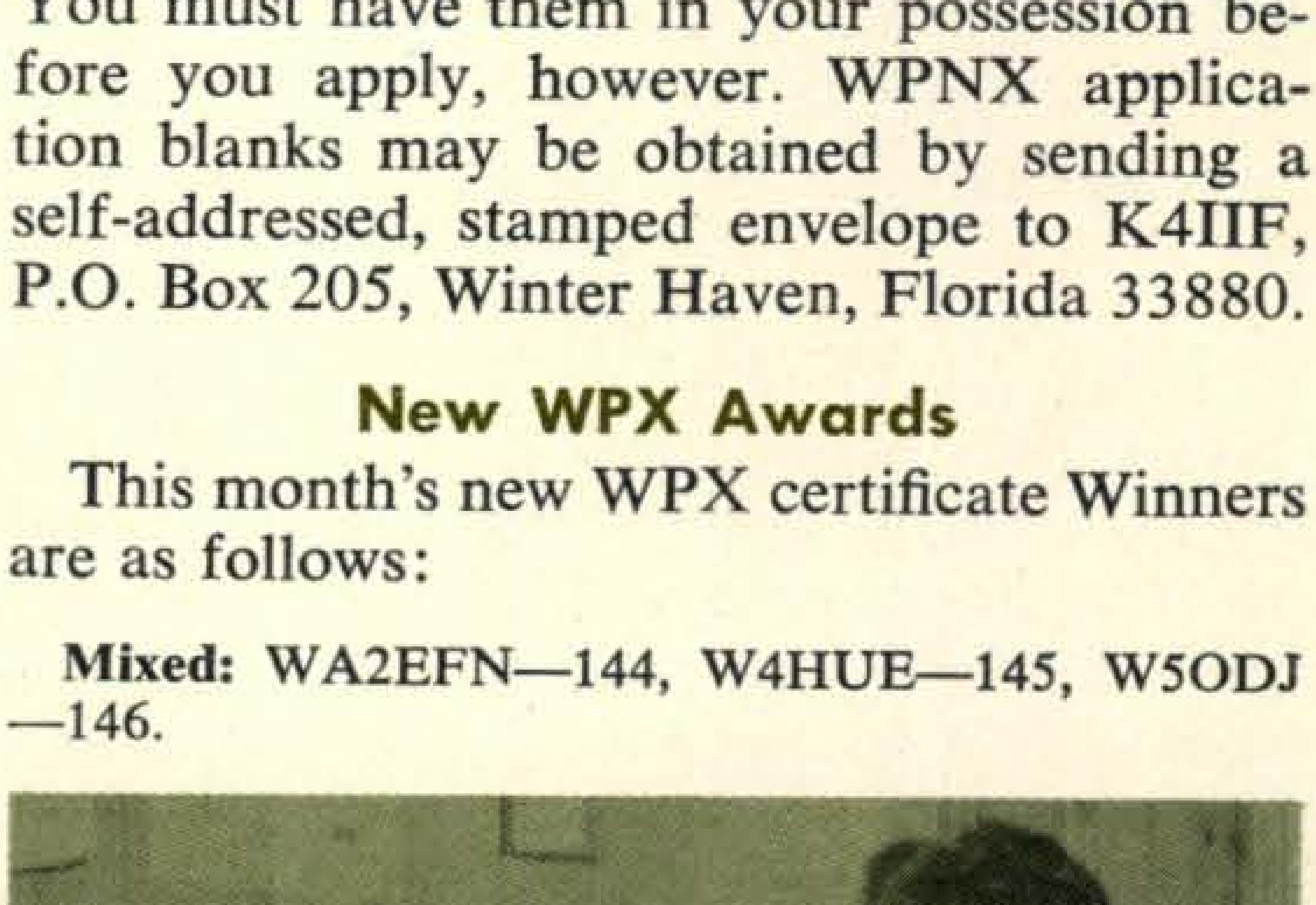
Again that's good advice and should be read and followed by all Novices interested in DX. Generals, Advanced, and Amateur Extras, too, for that matter.

Now that we have a WPNX winner it will no longer be necessary for applicants to send their cards to the DX Editor for checking. You must have them in your possession before you apply, however. WPNX application blanks may be obtained by sending a self-addressed, stamped envelope to K4IIF, P.O. Box 205, Winter Haven, Florida 33880.

New WPX Awards

This month's new WPX certificate Winners are as follows:

Mixed: WA2EFN—144, W4HUE—145, W5ODJ —146.



Here is the first winner of the WPNX Award, Mary Ann Crider, WN3HUP, of Camp Hill, Pa. Mary Ann racked up most of her prefixes with an HX-50, HQ-180A, and a 3-element beam for 15 meters.

Phone: CN8BB—143, HR1KAS—144.

C.W.: SL5CX—795, UA4QP—796, W9HFB—797, SM7CRJ—798, SP7AOD—799, W5ODJ—800.

S.S.B.: W6ADI—287, WA2CCF—288, W5ODJ—289.

The following endorsement stickers have been issued:

C.W. Prefixes: W8LY—700, K2CPR—700, IT1AGA—600, WB2FMK—550, G3HCV—400, SM7CRJ—350, W9QQG-350.

Mixed Prefixes: WA2EFN—500, W4HUE—500.

14 Mc Prefixes: WA2EFN, IT1AGA.

28 Mc Prefixes: PAØSNG, K2CPR.

Oceania Prefixes: W4BYU.

Europe Prefixes: WA2EFN.

North America Prefixes: W4BYU.

7 Mc Prefixes: IT1AGA.

South America Prefixes: W4BYU.

Asia Prefixes: W4BYU.

Africa Prefixes: W4BYU.

New S.S.B. DX Awards

100 Countries: K7TCL—497, W8WAH—498, G2CZH—499.

200 Countries: WA6ESB—145.

New WAZ Awards

New WAZ certificates are being issued to the following:

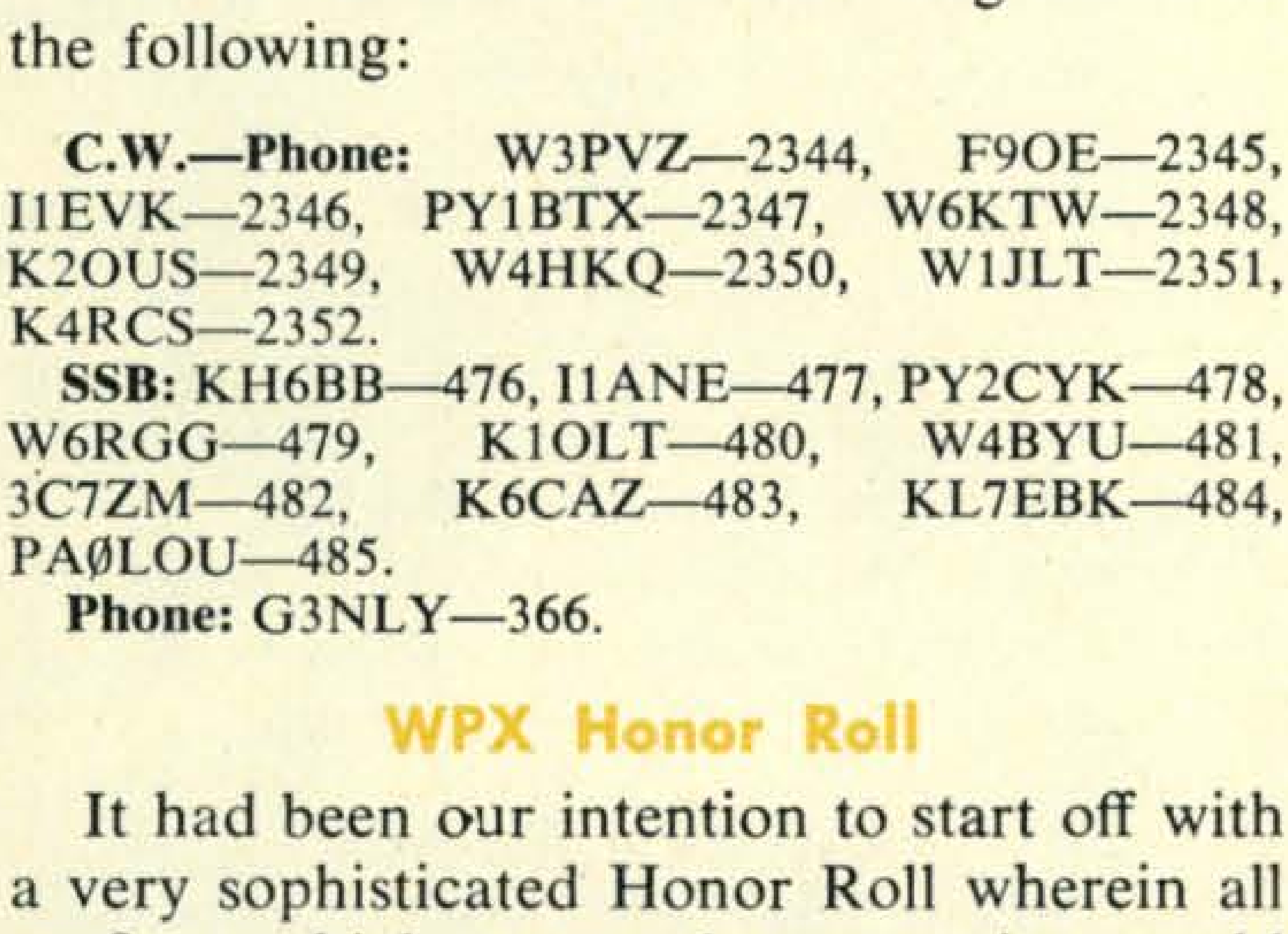
C.W.—Phone: W3PVZ—2344, F9OE—2345, I1EVK—2346, PY1BTX—2347, W6KTW—2348, K2OUS—2349, W4HKQ—2350, W1JLT—2351, K4RCS—2352.

SSB: KH6BB—476, I1ANE—477, PY2CYK—478, W6RGG—479, K1OLT—480, W4BYU—481, 3C7ZM—482, K6CAZ—483, KL7EBK—484, PAØLOU—485.

Phone: G3NLY—366.

WPX Honor Roll

It had been our intention to start off with a very sophisticated Honor Roll wherein all prefixes which are no longer active would have been deleted. However, this has proved to be a very complex undertaking, and as a consequence we are publishing a preliminary Honor Roll to get the ball rolling. Meanwhile, a standard prefix list is being compiled. This list, as nearly as possible, will only contain "permanent" prefixes. When it is complete it will be published, and from that point on will be the basis for the WPX Honor Roll. Supplements will be issued at yearly or twice yearly intervals to keep the list up to date. All "special event" and obsolete prefixes dating from the end of World War II will still be acceptable for WPX certificates, endorsement stickers, band endorsements, and continental endorsements. However, only the "permanent" prefixes will count for the Honor Roll.



Mike, W8LY, one of the world's leading WPXers with a count of over 700.

The following are Phone and Mixed WPX

Honor Roll—WPX Phone

1	John R. Leary, W9WHM	800
2	Dr. Manuel Fragoso de Almeida, CT1PK	750
3	James H. Carnett, W9UZC	671
4	D. A. G. Edwards, G3DO	613
5	Arden B. Hopple, W3DJZ	611
6	Sergio Vieira de Melo, CT1HF	605

Honor Roll—WPX Mixed

1	Charles J. Hiller, W4OPM	900
2	John R. Leary, W9WHM	811
3	Edward A. Goodbout, W9DWQ	762
4	John F. Wojtkiewicz, W3GJY	646
5	Edward Gaudet, K2ZKU	642
6	Lester A. Jeffery, W8WT	631
7	D. A. G. Edwards, G3DO	624
8	"Skip" Franke, W9YSX	622
9	Leonard G. Parsons, W5LGG	615
10	Walter Geyrhalter, DL3RK	609
11	Cliff Corne, K9EAB	606
12	John M. Sulak, W8UMR	604
13	James W. Ringland, W8JIN	605
	Stanley S. Springer, W3NKM	605
14	Hal Hogan, W3OCU	15
15	George Banta, K1SHN	585
16	John Knight, W6YY	570
17	John P. Billon, WA6MWG	562
18	Djuro Borosic, YU1AG	559
	Edmundo Quinones P., HK3LX	559
19	Ed H. Mau, W4BYU	557
20	Michael Soloman, W3AYD	552
21	Rudy Faessler, HB9EU	551
22	Frederick W. Riecks, W8ROC	550

Honor Rolls based on counts of 550 or better. These totals include many rare prefixes which have disappeared from the bands in the realignment of countries and territories during the years since World War II. As you can see, Joe Hiller, W4OPM, and John Leary, W9WHM, have made a "shambles" of the standings. At this point these two gentlemen would seem to be the top prefix hunters of all time. However, when the final Honor Roll based on permanent prefixes is compiled it will be anybody's race again, and some new challengers will doubtless emerge. Next month we will publish the preliminary Honor Rolls for C.W. and S.S.B. WPX

De Extra

There doesn't seem to be too much to climb up on the soapbox about this month so I'm going to use this space to reminisce a little bit about the phone weekend of the *CQ* Worldwide DX Contest. David, WA4-RFB, and I operated from St. Thomas as K4IIF/KV4 and had a great time despite our lengthy and awkward call. Conditions were excellent, particularly on 10 meters where I heard rumors of various people making WAZ. However, this is only rumor and I won't comment on it any further as Frank, W1WY, King of the World's Contest Makers, will have a complete rundown on the contest in a future issue. Frank will have all of the facts and I am sure some of them will be spectacular.

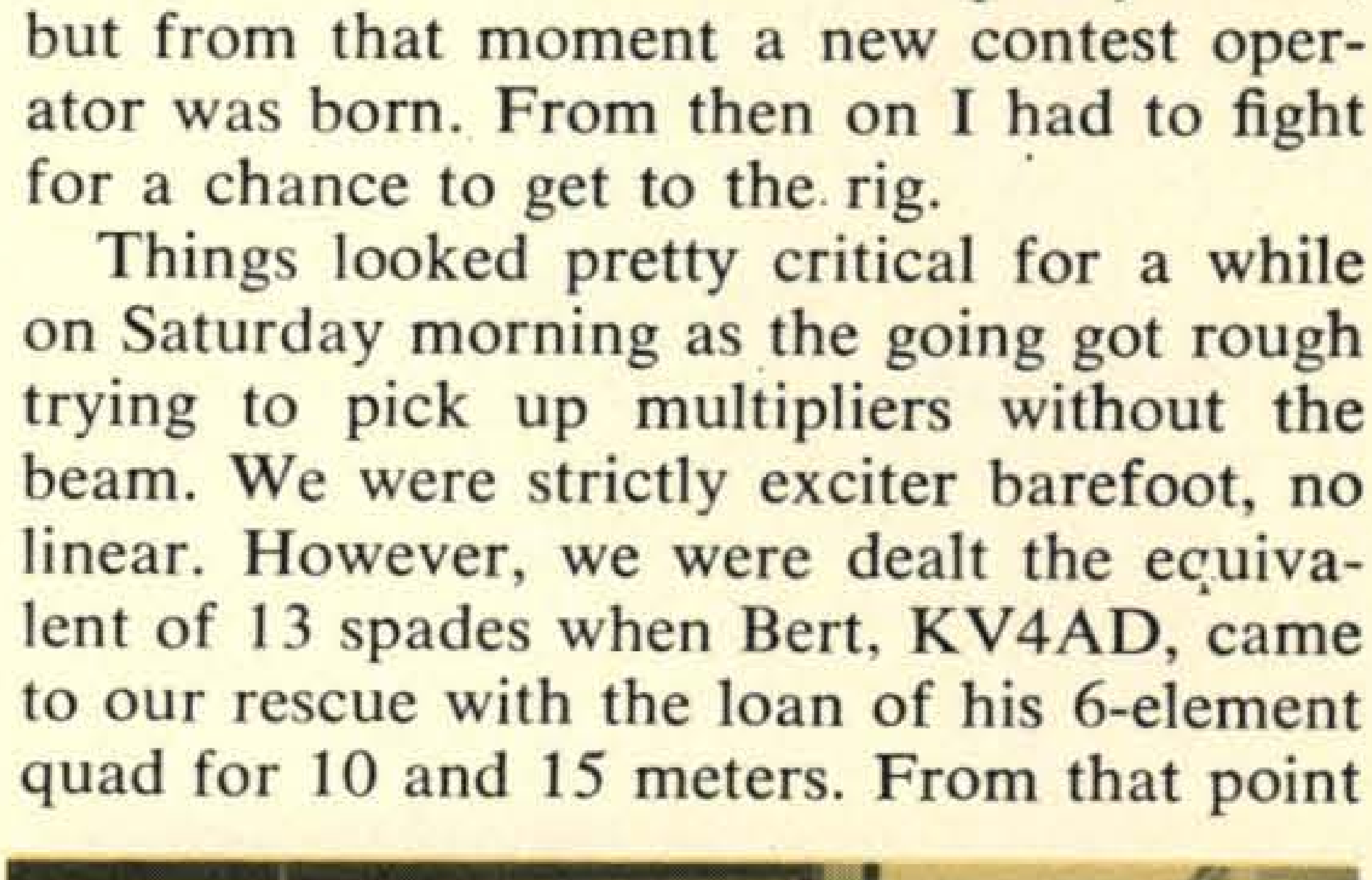
Dave and I had our problems. We flew down on Thursday night and arrived in the middle of the Governor's conference. In all the confusion the airline lost our beam. This is not unusual in that part of the world as I am sure Reg Beck, VE8RG, will be happy to corroborate as he had some similar experiences during his British Virgin Islands—Anguilla operation in 1963. We were assured that the beam would be delivered early on Friday morning so we left the airport for a visit with Dick, KV4AA, before proceeding up the mountain to join our host and hostess, Mr. and Mrs. Joseph Green, at their spectacular residence, Louisenhoj.

Louisenhoj is a mixture of old Danish plantation house and 16th century castle constructed of stones from all over the world. It is situated on the St. Thomas mountaintop about 1000 ft. above the sea. Our "shack" was the castle tower where the balcony and north window overlooked Magen's Bay and the Atlantic while the south window overlooked Charlotte Amalie and the Caribbean. I dare say that no DX or contest operation has ever taken place from a more impressive setting, and the hospitality of the Greens who kept us fed, coffeed, and propped up during the contest was strictly above and beyond the call of duty. We will never forget it.

About 11:00 P.M. on Thursday night we installed our Hy-Gain 5BDQ all band dipole on top of the castle tower to save time for assembling the beam on Friday. However, the beam didn't arrive (that's-the-story-of-my-life sort of thing, you know) until late Saturday and by that time it was too late to assemble it. Consequently, we have a nice, new TA-33Jr. in storage at the QTH of KV4AA waiting for "next year."

At 0000 GMT on Oct. 21, yours truly loaded up the trap dipole on 21 mc and commenced the festivities. About 0130 things were easing up a bit and it seemed a good time for WA4RFB to find out what it was all about so I pulled a trick somewhat related to that of the guy who taught his son how to swim by throwing him into deep water. I tuned the rig up on 14220, turned to Dave, and said "you take it for a while." Well the next 15 minutes were pretty hectic, but from that moment a new contest operator was born. From then on I had to fight for a chance to get to the rig.

Things looked pretty critical for a while on Saturday morning as the going got rough trying to pick up multipliers without the beam. We were strictly exciter barefoot, no linear. However, we were dealt the equivalent of 13 spades when Bert, KV4AD, came to our rescue with the loan of his 6-element quad for 10 and 15 meters. From that point



Anthony A.S. Hordern, GC2AAO, engineer of the big signal from Jersey Island. *(Photo courtesy W4NJF)*

Bob, WA5RRL, author of one of the letters used in this month's 6 meter news. Bob recently passed his General exam and is now DXing on all bands. He resides with his father, WA5TLO, and family on the famous LBJ Ranch in Texas.

on we had a signal 40 over 9 in both Florida and California simultaneously, and needless to say the joint was jumping. Thanks, Bert old buddy, you'll never know how much we appreciated it.

So much for last year. Hope to work you again from somewhere next year.

Six Meter Activity

The sunspots are up and the news is good, particularly if you like to work DX up 50 mc way. The following are exerpts from a couple of fine letters showing what can be done on 6 meters DX-wise.

de Bob, WA5RRL, Box 288, LBJ Ranch, Stonewell, Tx 78671—"After a busy summer of Sporadic-*E* activity on six the band started opening to South America in September via transequatorial scatter. On Sept. 7 at 0045 GMT this and other stations in Texas worked several Chileans including CE4AA (a.m.) and CE3QG (s.s.b.). Signals were moderately strong with reports of 5/6 and 5/7 being received here. This particular opening lasted for roughly two hours, ending at about 0215 GMT. On Sept. 16 the band opened with signals of 5/9+ heard from approximately 2145 GMT until 0200 GMT on the 17th. Signals were so strong that even low power a.m. stations were easily worked. During this opening I was able to work CX7AG and CX6BW in Uruguay and LU4DFN in Argentina, all 3 of which were on a.m. Other stations were heard including CE4BP and numerous Spanish speaking stations.

"The most recent DX worked as of this writing was LU3DCA who broke into a QSO between this station and W5UNU in San Antonio on Oct. 8 at 0025 GMT. Signals started weak but quickly built up to a very readable 5/7. My observations have been rather limited as I have been very busy with school work. Therefore, any daytime openings other than on weekends would go unnoticed here. All contacts were made with a Swan 250 and 5 element beam at 50 feet."

de PY3AKG, Sectional Director of LABRE (Liga de Amadores Brasileiros de Radio Emissao)—"We are glad to enclose the 50 mc log of PY3ADT showing the stations worked between June 4, 1956 and May 25, 1967. All cards were confirmed by our DX and Contest Department. There are 167 1° contacts including 12 Argentina provinces, 6 Brazilian regions, 3 Japanese regions, 2 Chilean provinces, and *17 countries.* Stations representing these countries include CE3ET, LU9MA, PY6FI, PZ1AE, XE1GE, TG9JW, CT3AE, JA1AXE, KP-4CK, FF8AP, YV3BD, HC1FS, PJ2AA, TI2NA, K5DWS, HK3DV, and OA4PZ."

With conditions peaking for 6 meter DX, and 10 meters again wide open to the entire world, how would you feel about a VHF DX contest to be held during the summer months on 10, 6, and 2 meters. The rules could follow those of the *CQ* Worldwide DX Tests except that each of the 50 United States would count as a separate country on 6 and 2 meters to make it possible to score multipliers more easily on those two bands. If you like this idea drop the DX Editor a line and we'll see what we can arrange.

160 Meter News

First W-VQ8 QSO: On Sept. 12 between 2330 and 2355 GMT, VQ8CCR played the VQ/sunrise—W/sunset conditions to perfection in QSOing W2RAA for the first contact

John Winbladh, SM7CRW, winner of the CQ WW contests for Sweden in 1964, 1965, and 1966. John is also very active in the WPX and WAZ Award programs.

between VQ8-land and the USA on 160 meters. History's first VQ8—VK QSO was also made between VQ8CCR and VK5KO. VQ8CCR's 1827 kc signals peaked 5/6/9 at W3BUR's QTH during this operation. Congratulations to all, particularly Don and Steve.

Don't forget the 160 meter transpacific tests which should be in progress right now. The remaining dates are Dec. 30, Jan. 13, Feb, 3, and Feb. 17, and the times are 1330-1600 GMT. For complete details see the December issue or contact W1BB.

Another 160 first, the USA-Easter Island QSO between Jan, DL9KRA at CEØPC and Charley, W2EQS, at 0605 GMT on Sept. 20, 1967. This makes the 55th country on 160 for W2EQS. Upcoming 160 DXpeditions include Jan at 6W8CW and G3UDU and the Royal Signals boys on Aldabra as VQ9JW.

Hither & Yon

Ham magazines you may not know about: "SIRAN"—This mag is published by the Bangalore Amateur Radio Club of Bangalore, India, and is circulated gratis to the licensed hams of India. Inquires may be directed to BARC, Box 53, Bangalore 1, India.

"QUAX"—A magazine devoted entirely to 10 meter news. It is published by SM4DXL, Box 611, Skattkerr, Sweden and the price is a nominal 3 IRCs or 45¢ for 6 months.

Silent Keys in the DX World: The North Jersey DXers suffered their second major loss in the period of only a few months with

It is with a tinge of sadness that we print this, one of the last photos taken of Mac McKnight, W6PQT, prior to his death. Mac was the custodian of the DX Marathon and sent us this picture on Sept. 19 to run with a planned story on the Marathon. He passed away on Oct. 16. (The WAZ on the wall is #96).

Jim Carnett, W9UZC (ex-W2OIU), 3rd ranking member of the WPX Phone Honor Roll with 671 prefixes. Jim has a new call now, TG9UZ, in Guatemala City.

the death of Earl Lucas, W2JT, who passed away only a few hours before the N.J.D.X.A. dinner in honor of Art, G2MI.

Dave, ZS9G, passed away in the spring. Cliff, K4YMJ, is making arrangements to handle his outstanding QSLs. It is requested that no more cards be sent to the home QTH of ZS9G.

The Southern California DX Club mourns the death of charter member Mac McKnight, W6PQT, who died on Oct. 16, 1967. Mac had presented slides at the club meeting only a week prior to his death. (see photo)

QSL Bureau Corrections: The December column contained a listing of the DX QSL bureaus. However, with bureaus, as with life, nothing is static, so revise your listings to show that the Panama bureau, L.P.R.A., is now P.O. Box 9A-175, Panama 9-A, Republic of Panama; the Bahamas bureau, B.A.R.S., is now Box 6004, Nassau; and the correct zip code for the DL4 and DL5 bureau is 09175. Also, cards for the Cayman Islands and for the Turks and Caicos Islands do not go via the Jamaica bureau. At present these islands do not have a QSL bureau service.

Better Late Than Never Dept.: K2JWM has broken the K4IIF record of receiving a DX QSL after 7 years. Mike wrote that he has just received a card from KW6BB confirming a QSO on Dec. 6, 1956. Is 11 years a new world's record?

Where is 9M2UF?: On July 24, 1966 we notified A. L. O'Donnell, 9M2UF, that he was to receive CW/Phone WAZ #2277. The notification was recently returned marked unknown. The fate of his 40 QSL cards is uncertain as they were mailed to the same address but were not returned.

Fred, W5ODJ, racking up another prefix with his Swan-350.

Turkish Stations & Managers: Roland, K4EPI, reports that the following are the only active stations in TA-land at present. Their managers are shown:

TA1AM—via K4EPI	Box 699, Karakoy, Istanbul
TA1AV—via SMØKV	TA1VY—via T.R.A.C., Box 699, Karakoy, Istanbul
TA1DS—via SMØKV	TA2BK—via DJ2PJ
TA1IB—via K4EPI	TA2FM—via DJ2PJ
TA1KT—via K4IEX	
TA1SK—via DL2OE	
TA1NC—via T.R.A.C.,	

TA1NC and TA1VY need QSL Managers. Anyone wishing to volunteer should contact K4EPI.

Special Prefixes: *TGØAA* was used during the contest by Paul, W4YWX, and John, K4BAI. QSL to Box 2344, Macon, Georgia.

4L7A: This rare prefix was activated in the *CQ* contest through a special expedition to Georgia, U.S.S.R. by the Kaunas Polytechnic Institute Radio Club of Kaunas, Lithuania. The QSL address is to UP2KNP, % P.O. Box 88, Moscow, Russia.

9I3: The stations using this prefix from Oct. 20-29 were commemorating the 3rd anniversary of Zambian Independence on Oct. 24, 1967. The 'I' stood for Independence and the '3' showed the 3rd year. This prefix will be especially valuable to those accumulating the 10 points for the Worked Zambia Award. Stateside applicants for this award get 1 point for each 9J2 station worked on 10, 15, 20, and 40 meters and 2 points for each station on 80 and 160 meters. All other prefixes count *double* so the 9I3 should put a few over the top. Anyone interested should contact RSZ Awards Manager, Box 332, Kitwe, Zambia.

de K6CYG: "Effective Jan. 1, 1968 I will no longer handle QSL cards for CT3AR, KS6BH, KZ5AY, and 3AØDX."

de KØGZN/GZO: We plan to operate from Bonaire for several months as PJ5BC and PJ5BD. Most time will be spent on 10, 15, and 20 meters but some on 80 and 40 as well if we can get up a dipole. QSL to P.O. Box 186, Harper, Kansas 67058.

VU Contacts: Ranga, VU2GW, is QRV for W/K stations on 14023 at 1130 GMT via the long path or 0100 GMT via the short path after skeds with W4BGO and K3MNW. K3MNW will be happy to help set up skeds with VU2GW or with VU2DIA or VU2LE.

From the Bulletins

Thanks to the following DX bulletins for these items which appeared in early November and were selected for their long term value:

North Eastern DX Association Bulletin (K1IMP), *Southern California DX Club Bulletin* (WA6GLD), *DX-MB* (DL3RK), *Florida DX Report* (W4BRB), *DX News-Sheet* (Geoff Watts), *DXers Magazine* (Gus, W4BPD), *West Gulf DX Club Bulletin* (WA5LES), Ontario DX Association *Long Skip* (VE3DLC), *DX-Press* (VERON), *Long Island DX Association Bulletin* (WB-2EPG), and the Northern California *DXer* (K6CQF).

AP2, West Pakistan: AP2MR, Rafiq, reported on 14170 s.s.b. tuning 14205 at 1315 GMT.

CEØ, Easter Island: CEØAE is QRV on 21 mc s.s.b. Saturdays from 1400-1700 GMT and Sundays from 1600-1800 GMT. QSL to WA5PUQ.

CEØ, Juan Fernandez: CEØPK was the call used by Luis, WB6GOV. QSL to his home QTH.

FR7, Reunion Island: Guy, FR7ZG, has been heard on 14235 s.s.b. at 1130 GMT.

GB5, Rare prefix: GB5QM was on the final voyage of the *Queen Mary*. QSL to P.O. Box 7493, Long Beach, California 90807.

HC8, Galapagos: Forrest, HC8FN, on 14103 at 0030 GMT. QSL to WA2WUV.

HKØ, Malpelo: From W4DQS through the Florida DX Report comes the news that HK3RQ is eyeing a trip to this rare one.

HZ1, 7Z3, HZ3, HZ1AB, 7Z3AB, and HZ3TYQ are all reported to be active on 20 meter c.w. and s.s.b.

JT1, Mongolia: JT1AG is reported on 14033 kc between 1300 and 1400 GMT.

JW2, Bear Island: JW2BH on 21065 at 1900 GMT. Mailing address is via Bear Island Radio, Bjornoya, Tromsoe, Norway, but no more mail until May, 1968.

JW5, Svalbard (Spitzbergen): JW5YG on 14009 c.w. at 2245 GMT.

[*Continued on page 119*]

Propagation

BY GEORGE JACOBS,* W3ASK

It should be a toss-up between 10 and 15 meters for the best DX propagation band during January. Both bands are expected to open to all areas of the world during the daylight hours, often with exceptionally strong signal levels. Ten meters is expected to have a slight edge from mid-morning through the early afternoon hours, while conditions on 15 meters should be optimum during the late afternoon hours and into the early evening. Excellent short skip openings are forecast for 10 meters during the daylight hours between distances of approximately 1200 to 2300 miles. Similar short-skip conditions are expected on 15 meters from shortly after sunrise through the early evening hours, for distances between approximately 1000 and 2300 miles.

Excellent propagation conditions are forecast for 20 meters, for both DX and short-skip openings, almost around-the-clock. For DX openings, conditions should peak shortly after sunrise and again during the late afternoon and early evening hours. For openings less than 1000 miles, conditions are expected to be optimum from mid-morning through the late afternoon hours; for openings between 1000 and 2300 miles, optimum conditions are expected during the late afternoon and early evening hours. Frequent short-skip and DX openings are also forecast for this band during the hours of darkness.

Good DX propagation conditions are forecast for 40 meters during January, with openings expected to many areas of the world from shortly before sundown, through the hours of darkness, and until shortly after sunrise. During the daylight hours, conditions are expected to be optimum for short-skip openings between approximately 100 and 600 miles. During the late afternoon skip should begin to lengthen on this band, and by nightfall short-skip conditions are expected to be optimum for openings between distances of approximately 800 and 2300 miles.

Some fairly good DX openings are forecast to some areas of the world for the 80 meter band, during the hours of darkness. Optimum short-skip conditions are forecast during the daylight hours, for distances be-

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for Jan.

Days	*Forecast Rating & Quality* (4)	(3)	(2)	(1)
Above Normal: **1, 11, 13, 21, 28, 31**	A	A-B	B	B-C
Normal: **2-5, 7-10, 12, 14, 16-17, 19-20, 22-23, 26-27, 29-30**	A-B	B	C	D
Below Normal: **6, 15, 18, 24**	B-C	C-D	D	E
Disturbed: **25**	C-D	D-E	E	E

How To Use These Charts

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

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

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

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

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

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

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

6—These Propagation Charts are valid through Feb. 29, 1968. These Charts are prepared from basic propagation, data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

tween approximately 50 and 250 miles. During the late afternoon and early evening hours optimum short-skip conditions are expected for openings between approximately 250 and 1500 miles, and by nightfall openings beyond 2300 miles should be possible.

Some 160 meter DX openings may also be possible during the hours of darkness and the sunrise period, especially when static levels are low. Short-skip openings should be possible during the hours of darkness for distances between approximately 50 and 1300 miles, and somewhat less frequently for distances as great as 2300 miles.

All-in-all, fairly good to excellent short-skip and DX propagation conditions are expected on almost all of the h.f. amateur bands during January. Atmospheric noise levels (static) are expected to be at their lowest values of the year in the northern hemisphere, and signal levels are expected to be exceptionally strong during many band openings.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use in the continental United States for distances between approximately 50 and 2300 miles. (The maximum distance possible, under normal conditions, for one hop, short-skip propagation is 2300 miles). Special prediction charts centered on Hawaii and Alaska are also included. The Charts appearing in this month's column are valid through February 29. See last month's column for detailed DX Propagation Charts for January.

Sunspot Cycle

The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot

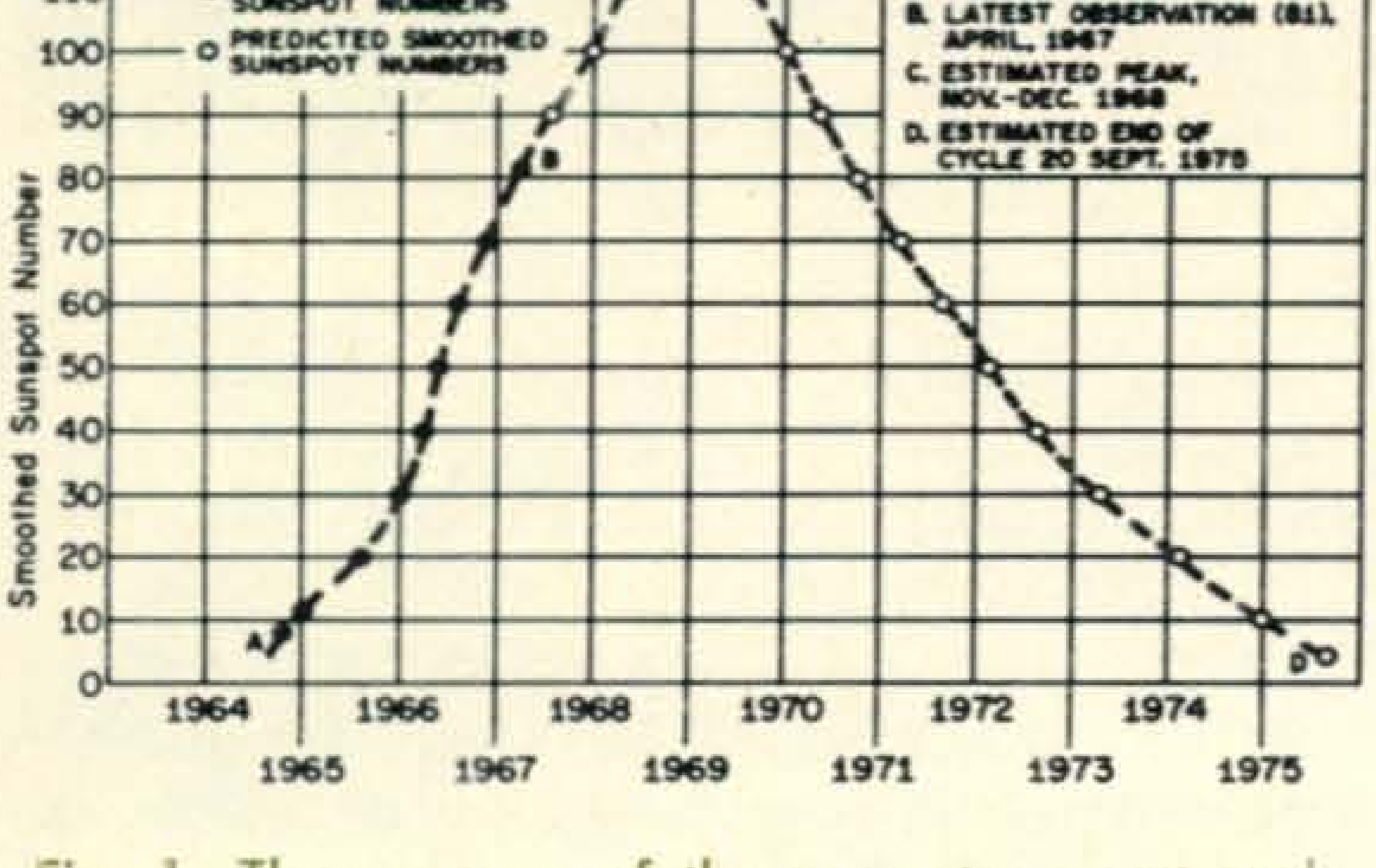


Fig. 1—The progress of the present sunspot cycle from 1964-66 and the prediction for 1967-75.

number of 86.5 for October, 1967. This results in a smoothed sunspot number of 81 centered on April, 1967. This month's *CQ* propagation forecasts are based upon a predicted smoothed sunspot number of 104, as the sunspot cycle nears a maximum. A more detailed sunspot report appears later in this column.

V.h.f. Ionospheric Openings

The *Quadrantids*, a major meteor shower, is expected to occur during the first week of January. This should result in a number of meteor-scatter openings on the v.h.f. bands.

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

Some trans-continental F-layer openings may be possible on 6 meters during January, as well as some openings between the continental USA and Hawaii and between the USA and Latin America. The best time to check for F-layer 6 meter openings is from an hour or so before noon, through the early afternoon hours. There is also a fair possibility that some trans-equatorial scatter openings will be possible on 6 meters, during the early evening hours.

1967 In Review

During 1967, solar activity rose from a smoothed sunspot number of 73 recorded during January, to a level of 102 estimated for December. This was a moderately high level of solar activity, and it resulted in a considerable improvement in propagation conditions on the 10, 15 and 20 meter bands.

The 10 meter band came into full bloom once again during 1967. Excellent DX openings to almost all areas of the world were observed during the daylight hours of all but the summer months. Excellent world-wide openings were also observed on 15 meters, from shortly after sunrise through the early evening hours, throughout the entire year.

During the past year, the 20 meter band became an around-the-clock DX band, with excellent openings possible at almost any hour. During the hours of darkness good DX conditions existed on 40 and 80 meters throughout most of the year, and good 160

Table I Smoothed Sunspot Numbers, Cycle 20
Observed and predicted

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Jan.		12	28	73	104*	122*	100*	76*	52*	34*	22*	10*
Feb.		12	32	76	106*	121*	98*	74*	50*	33*	21*	9*
Mar.		13	35	78	108*	120*	96*	72*	49*	32*	20*	9*
Apr.		14	37	81	110*	118*	94*	70*	47*	31*	19*	8*
May		15	40	83*	112*	116*	92*	68*	45*	30*	18*	8*
Jun.		15	44	85*	114*	114*	90*	66*	44*	29*	17*	7*
Jul.		16	51	88*	116*	112*	88*	64*	42*	28*	16*	7*
Aug.		17	57	91*	118*	110*	86*	62*	41*	27*	15*	6*
Sep.		18	64	94*	120*	108*	84*	60*	40*	26*	14*	5*
Oct.	9.6	20	66	97*	122*	106*	82*	58*	39*	25*	13*	
Nov.	9.7	24	69	100*	123*	104*	80*	56*	37*	24*	12*	
Dec.	11	26	71	102*	123*	102*	78*	54*	35*	23*	11*	

* Predicted values

meter openings were also recorded during the hours of darkness of the winter, spring and fall months.

With no uncertainties, 1967 will go down as a good year for h.f. propagation conditions.

Outlook 1968

As good a year as 1967 was for h.f. propagation conditions, 1968 will be better!

The present sunspot cycle, the 20th observed since the Zurich Observatory began recording sunspot numbers more than 200 years ago, is expected to continue to rise during 1968, reaching a maximum level by the end of the year.

The new year is expected to begin with a solar index of 104, rising to a cycle maximum of 123 by December. Table 1 shows the smoothed sunspot numbers recorded for cycle 20 since October, 1964 when the new cycle began. Predicted levels of solar activity for 1968 and the remainder of the present cycle are also given in Table 1. This information is shown graphically in Fig. 1.

The basis for *CQ's* solar cycle predictions, as well as a comprehensive report on sunspot cycle 20 and its influence upon radio propagation conditions in the various amateur bands is in preparation, and is expected to appear in *CQ* later this year.

The relatively high level of solar activity expected during 1968, should result in a further improvement in propagation conditions on the 10, 15 and 20 meter bands. Ten meters should continue to open to all areas of the world during the daylight hours of the fall, winter and spring months. During the summer months, short-skip will take over on this band, but some DX openings should also be possible, especially to southern and tropical regions of the world. Exceptionally strong signal levels are expected on many 10 meter openings during 1968, and the band should open more frequently and to more areas of the world than during 1967.

Continued improvement is also expected for 15 meters. Excellent DX conditions are predicted from shortly after sunrise through at least the early evening hours during every month of the new year. East-West openings should peak during the fall, winter and spring months, and should occur during the summer months as well. North-south openings should be possible at almost all times when the band is open. The band is expected to stay open later into the evening hours during 1968, and a great many DX openings may be possible during the hours of darkness.

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

Not much change is expected on 40 meters during 1968. The band should behave much the same as it did during 1967, opening for DX shortly before sunset and remaining open through the hours of darkness and until shortly after sunrise. Good propagation conditions are expected to most areas of the world during this period, especially during the fall, winter and early spring months. During the winter months, 40 meters is likely to be the best band for DX propagation during the nighttime hours.

A slight *decrease* in propagation conditions on 80 and 160 meters will probably occur during 1968 as a result of increased solar activity. Somewhat fewer DX openings are expected on these bands, although some fairly good ones should still be possible on 80 meters during the hours of darkness, especially during the late fall, winter and early spring months. Some DX openings will also be possible on 160 meters during the hours of darkness and the sunrise period during all but the summer months.

During the fall months of the past year, the firsts reports of 6 meter F-layer openings began coming in. Several good openings were reported between the USA and Latin America, and maximum useable frequencies on the order of 40 mc were reported in almost all other directions from the USA. With the increased solar activity predicted for 1968, the chances for 6-meter openings are expected to improve with openings across the USA, between the continental USA and Hawaii and between the USA and Latin America expected during the winter and early spring months. By next fall, solar activity should be high enough to permit some openings between the USA and Europe, Africa, Asia and Australasia as well. Regular F-layer openings tend to occur around noon time and during the early afternoon hours. Trans-equatorial F-layer scatter, which also increases with a rise in solar activity, generally peaks during the early evening hours.

In summary, improved propagation conditions are expected during 1968 on the 6, 10, 15 and 20 meter bands; no change is expected on 40 meters, and a slight to moderate decrease is forecast for 80 and 160 meters. Propagation conditions during the new year are expected to be better than they have been during any year since 1960. ■

CQ Short-Skip Propagation Chart

JANUARY & FEBRUARY, 1968

BAND OPENINGS GIVEN IN LOCAL STANDARD TIME
AT PATH MID-POINT
(24-HOUR TIME SYSTEM)

Distance From Transmitter (Miles)

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

ALASKA
Openings Given In GMT ‡

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	18-20 (1) 20-21 (2) 21-23 (3) 23-00 (1)	16-17 (1) 17-20 (2) 20-23 (3) 23-01 (2) 01-02 (1)	11-15 (1) 15-17 (2) 17-22 (1) 22-23 (2) 23-03 (3) 03-04 (2) 04-05 (1)	04-13 (1) 07-12 (1)*
Central USA	18-20 (1) 20-21 (2) 21-00 (3) 00-01 (1)	16-18 (1) 18-20 (2) 20-23 (3) 23-01 (4) 01-02 (2) 02-04 (1)	11-16 (1) 16-18 (2) 18-23 (1) 23-01 (2) 01-04 (3) 02-04 (3) 04-05 (2) 05-06 (1)	05-14 (1) 08-13 (1)*
Western USA	18-19 (1) 19-21 (2) 21-23 (3) 23-01 (4) 01-02 (3) 02-03 (2) 03-04 (1)	16-17 (1) 17-19 (2) 19-23 (3) 23-02 (4) 02-03 (3) 03-04 (2) 04-05 (1)	11-17 (1) 17-18 (2) 18-20 (4) 20-01 (3) 01-04 (4) 04-05 (3) 05-06 (2) 06-07 (1)	04-05 (1) 05-12 (2) 12-15 (1) 15-16 (2) 16-17 (1) 05-12 (1)* 12-15 (2)* 15-17 (1)*

*Indicates predicted 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2) or higher.

[*Continued on page 118*]

1968 CQ READER SURVEY

CUT HERE

YOUR CALL AREA [ ]

It's that time again, the time when CQ takes the pulse of its readership. The survey below has been carefully designed to give us valuable information aimed at helping CQ serve amateur radio better. Fill out and mail your survey answers today to: CQ Reader Survey, 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050.

Personal

1. (a) Your age? (b) Sex? (c) Years of schooling?
2. Are you employed in electronics?
3. If yes, what is your job function: Engineer, Technician, Sales, Communications Specialist, Executive, Other.
4. If yes, which best describes your place of employment: Manufacturer, Distributor, Retail Dealer, Manufacturer's Rep., Military, Industrial Communications, Research & Development. Other.
5. If you don't work in electronics, what is your occupation?

Licensing

1. (a) Are you a licensed amateur? (b) Class of license?
2. How long have you been licensed?
3. Were you in favor of incentive licensing *before* the FCC adopted it?
4. Are you in favor of the program FCC has adopted?
5. As a result of the new licensing structure, will you be applying for a higher grade of license this year?
6. Would you have applied for this license anyway?

Investment

1. Approximately how much money have you invested in amateur radio?
2. Did the long delay in FCC action on incentive licensing cause you to put off new purchases?
3. About how much did you invest in your hobby in 1967?
4. How much do you expect to spend in 1968?
5. Will most of this amount be spent on many small purchases or on a few large ones?

Equipment

1. Is any of your equipment home built?
2. What component(s)? Antenna, transmitter, receiver, etc?
3. Is any of your equipment surplus?
4. If so, what component(s)?
5. What items in your station were built from kits?
6. If your equipment is commercially built, what brand of receiver do you use?
7. What brand of transmitter?
8. What brand of transceiver?
9. What types of antennas do you use?
10. What are your three most vital accessories?

Operating Habits

1. How many hours per week do you spend operating your home station?
2. What bands do you operate most?
3. What mode(s)
4. If you operate mobile, how many hours per week?
5. What band(s)?
6. What mode(s)?
7. Do you enjoy tinkering and building rather than operating?
8. If more equipment and information were available would you operate on (a) amateur television? (b) RTTY? (c) FM?

Reading Habits

1. Do you subscribe to CQ or buy on a newsstand?
2. Are you a member of ARRL?
3. If not, do you buy and read at least 6 issues of *QST* per year?
4. Do you subscribe to *73*?
5. If not, do you buy and read at least 6 issues per year?
6. Would you consider yourself an avid magazine reader or buyer?
7. Do you collect and save your copies of CQ?
8. When CQ arrives, do you read it immediately from cover-to-cover, or do you browse and then set it aside for later reading?
9. What's the first thing you look for in CQ, if any?
10. Have you noticed and appreciated the improved quality of CQ these past six months?

I Personal

1. (a)____ (b)____ (c)____
2. ________
3. ________
4. ________
5. ________

II Licensing

1. (a)____ (b)____
2. ________
3. ________
4. ________
5. ________
6. ________

III Investment

1. ________
2. ________
3. ________
4. ________
5. ________

IV Equipment

1. ________
2. ________
3. ________
4. ________
5. ________
6. ________
7. ________
8. ________
9. ________
10. ________

V Operating

1. ________
2. ________
3. ________
4. ________
5. ________
6. ________
7. ________
8. (a)____ (b)____ (c)____

VI Reading

1. ________
2. ________
3. ________
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Domestic Subscription Price Rise Coming

Effective March 1, 1968 CQ's domestic subscription rates will be increased as follows:

1 Year	$6.00
2 Years	11.00
3 Years	15.00

These increases are forced by an overall increase in postal rates as well as new printing costs. THIS IS THE FIRST SUBSCRIPTION PRICE RISE FOR CQ IN ELEVEN YEARS.

We are making this announcement well in advance to allow loyal CQ readers to get in on the old rates of $5.00 for 1 year; $9.00 for 2 years and $13.00 for 3 years while there's still time.

If you are currently a subscriber, you will be permitted to extend your subscription if we receive your order by March 1st. GET YOUR NEW SUBSCRIPTION IN NOW AND SAVE $$$$.

Readers can look forward to many more improvements and even more changes in the months ahead. If you think CQ is colorful now—just wait! But don't put off sending that order in before the deadline. DO IT TODAY!

P.S. The above rates will also apply to foreign subscribers.

YES, hurry and enter my subscription immediately enabling me to take advantage of the present rates. I am remitting $______ for a ______ year(s) subscription.

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CQ BOOK MART

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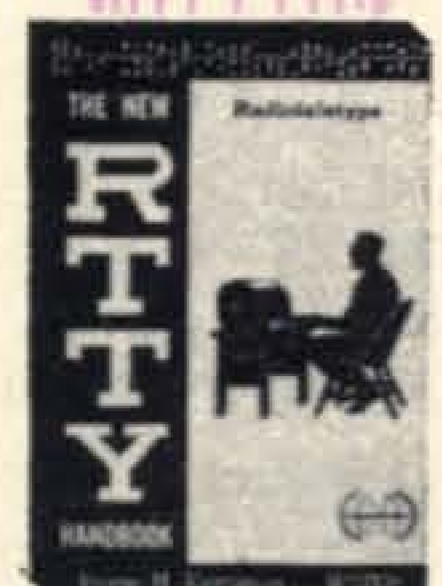

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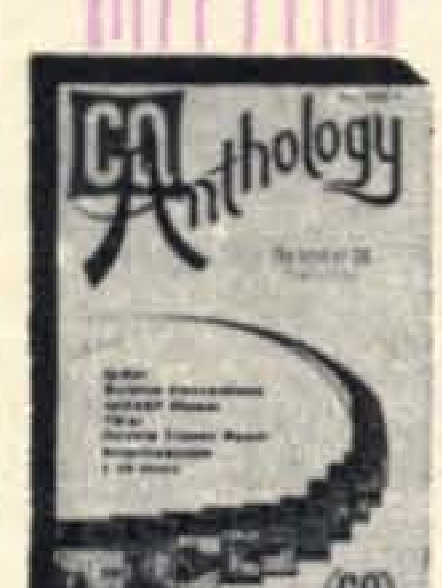

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Cat. #102-1. We've looked back through the years 1945-1952 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out and are unavailable.

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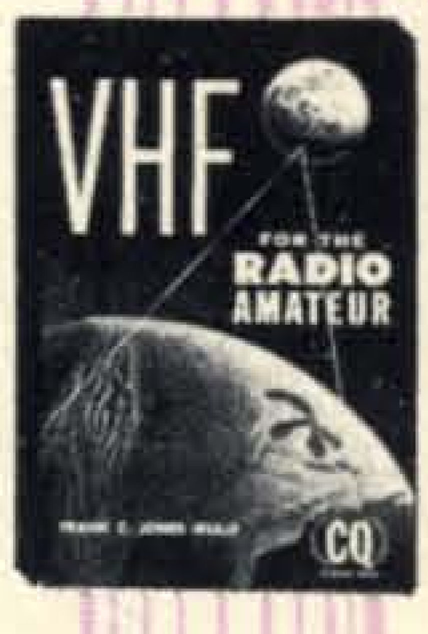
Cat. #117. This is a book literally loaded with schematics for all the currently popular pieces of surplus gear. Most amateurs are well aware of the problems encountered in purchasing seemingly inexpensive surplus units, only to find that no schematic diagram is available.



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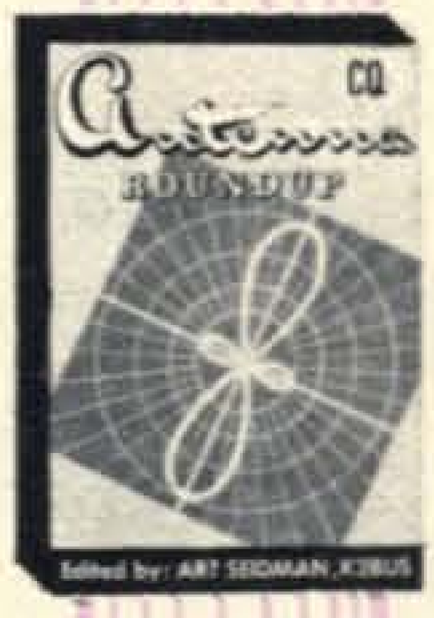

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ELECTRONIC CIRCUITS HANDBOOK

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

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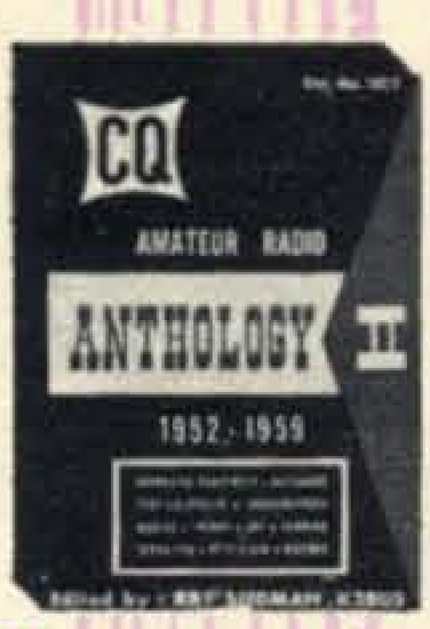

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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

January 6-8	Arkansas QSO Party
January 6-8	Virginia QSO Party
January 27-28	Louisiana QSO Party
January 27-28	**CQ WW 160 Contest**
January 27-28	Arizona QSO Party
January 27-28	French Contest C.W.
February 3-4	ARRL DX Phone Contest
February 10-12	Vermont QSO Party
February 11-12	Bermuda Contest
February 17-18	ARRL DX C.W. Contest
February 23-25	QCWA QSO Party
February 24-25	YL-OM Phone Contest
February 24-25	French Contest Phone
February 25-26	Bermuda Contest
March 2-3	ARRL DX Phone Contest
March 9-10	YL-OM C.W. Contest
March 16-17	ARRL DX C.W. Contest
April 6-7	**CQ WPX Phone Contest**
April 20-21	Helvetia 22 Contest
April 27-28	PACC CW/Phone Contest
April 27-28	One Land QSO Party

Arkansas QSO Party

Starts: 2200 GMT Saturday, January 6
Ends: 0400 GMT Monday, January 8

This 3rd annual QSO party was covered in last month's CALENDAR.

Mailing deadline is January 30th. Logs go to: North Arkansas ARS, c/o Sam Housley, K5AKS, Route 4, Harrison, Ark. 72601

Virginia QSO Party

Starts: 1800 GMT Saturday, January 6
Ends: 0200 GMT Monday, January 8

Once again this party is being sponsored by the Roanoke Valley A.R.C.

With two state parties on the same weekend it might get a bit confusing. If things get dull on the W4 frequencies you can always tune down to the W5s.

There are no time or power limits, phone and c.w. are considered separate contests and separate logs are required.

Exchange: QSO nr., RS/RST and QTH; county for Va. Stations; state, province or country for others. (Va. stations may work other Va. stations.)

Scoring: One point per contact. Virginia stations multiply QSO points by number of states, VE provinces, countries and Va. counties worked. Out of state stations will use Va. counties for their multiplier. (max. of 98)

Frequencies: c.w.—3565, 7060, 14060, 21060, 28060. phone—3830/3930, 7205/7235, 14240/14340, 21310/21410, 28800.

Awards: Certificates to the top scorers in each state, province and country. Virginia stations will compete for 1st thru 5th places.

Logs must be received no later than February 29th and they go to: Roanoke Valley ARC, Box 2002, Roanoke, Virginia 24009

CQ WW 160 Contest

Starts: 0000 GMT Saturday, January 27
7 P.M. EST Friday, January 26
Ends: 1500 GMT Sunday, January 28
10 A.M. EST Sunday, January 28

Rules the same as previous years excep for the ending time which has been mad 3 hrs. later for the benefit of the West Coas boys.

It is recommended that you study th FCC regulations for 160 operation. A cop of the FCC rules as well as contest lo sheets are available from *CQ* upon request Include a s.a.s.e. of course.

Rules appeared in last month's CALENDAR Logs go to: CQ 160 Contest, 14 Vandenventer Ave., Port Washington, L.I., N.Y 11050. Mailing deadline is February 29th.

Louisiana QSO Party

Starts: 1800 GMT Saturday, January 27
Ends: 2200 GMT Sunday, January 28

The Lafayette ARC is once again sponsoring this, the 3rd annual QSO party. Mor participation would probably be assured if did not conflict with the 160 contest. Rule in last month's CALENDAR.

Mailing deadline for logs February 2 and they go to: Lafayette ARC, 308 Kare Drive, Lafayette, Louisiana 70501.

* 14 Sherwood Road, Stamford, Conn. 06905.

French Contest

C.W.: Jan. 27-28. **Phone:** Feb. 24-25

Starts: 1400 GMT. Ends: 2100 GMT.

Rules same as previous years. (See Jan. 1966 *CQ* for details).

Logs go to: REF, B.P. 42-01, 75 Paris RP, France.

Arizona QSO Party

Starts: 2100 GMT Saturday, January 27

Ends: 2100 GMT Sunday, January 28

Conventional State party rules. (See Jan. 1967 *CQ* or write SHSARS for copy.)

Logs go to: Saguaro High School ARS, 6250 N. 82nd St., Scottsdale, Ariz. 85251.

(These were received too late to give full coverage. As I have said time and again, we must have the material at least 3 months before the date of the activity.)

Vermont QSO Party

Starts: 2300 GMT Saturday, February 10

Ends: 0300 GMT Monday, February 12

The Central Vermont ARC once again announces its annual QSO party from the comparatively rare state of Vermont. The same station may be worked on each band and mode for QSO credit.

Exchange: QSO nr., RS/RST and QTH; county for Vt. stations, ARRL section for others.

Scoring: Vermont stations: 1 point per contact, total multiplied by ARRL sections and foreign countries worked. Out of state: 3 points per contact, total multiplied by number of Vt. counties worked on each band. (A max. of 14 on each band.)

Frequencies: 3685, 3855, 3909, 7030, 7240, 7290, 14040, 14225, 14290, 21050, 21300, 28100, 28600, 50.250, 50.360, 144 thru 144.5, 145.8 and Novice frequencies.

Awards: Certificates to the highest scoring station in each ARRL section; plus 1st—4th place in Vermont.

The "Worked Vermont" award may be obtained by working 13 out of the 14 Vt. counties.

Mailing deadline March 31st. Logs go to: CVARC, c/o E. Reg. Murray, KIMPN, 3 Hillcrest Drive, Montpelier, Vermont 05602

Starts: 2200 GMT Friday, February 23
5 P.M. EST Friday, Feb. 23

Ends: 2200 GMT Sunday, February 25
5 P.M. EST Sunday, Feb. 25

This year's party is being sponsored by the Washington Chapter of QCWA. Only members are eligible for the QCWA certificates and Plaque donated by the National Headquarters, and only contacts with other members count for these awards.

This is primarily a party to renew old acquaintances and see how many members can be worked, especially overseas members. This year, to add interest, a simple scoring system will be incorporated.

Exchange: Contact number, RS/RST, QTH, name and QCWA number.

Scoring: One point for each member worked, multiply total points by sum of states, Canadian provinces and countries worked. (A member may be worked only once during the party non-member QSOs have no value. U.S. and Canada do not count as countries.)

Frequencies: c.w.—3525, 7025, 14025, 21025, 28025. phone—3810, 3950, 7210, 14210, 21310, 28510. RTTY—7105, 21140. (These are new spots from previous years.)

Logs should show in this order: Date/time in GMT, station worked, contact number sent/received, RS/RST, band, QTH, name and QCWA nr.

Awards: The QCWA Certificate to the leading stations and the Plaque to the Top overall scorer. (To be held for 1 year)

Mail logs before March 20th to an old contest man; Donald McClenon, W3EIS, 11310 Cedar Lane, Beltsville, Maryland 20705

YL—OM Contest

Phone: Feb. 24-25 **C.W.:** March 9-10

Starts: 1800 GMT Saturday, Ends: 1800 GMT Sunday in each instance.

Rules will be found on page 9 of this issue.

ARRL DX Contest

Phone: February 3-4 and March 2-3

C.W.: February 17-18 and March 16-17

Starts: 0001 GMT Saturday, Ends: 2400 GMT Sunday in each instance.

Leaving myself wide open to criticism for harping on the same old subject, I still think this contest is much too long and should be cut back to single week-ends for each section. There are many other major activities that are deprived of this prime time because of the four week-ends occupied by this marathon.

[*Continued on page 116*]

THE awards PROGRAM

BY ED HOPPER,* W2GT

FLASH
CHARLES O. RICK, WØJWD
HAS QUALIFIED FOR #5
USA-CA-3079
ALL COUNTIES SPECIAL HONORS PLAQUE
SEE HIS STORY AND FOTOS *CQ* OCT. 1966

THE January "Story of The Month" is:

Victor Clarence, WØGYM

"Vic" was born 64 years ago on a farm in Panama, Nebraska. At the age of 16, he started farming on a share crop basis near Union, Nebraska, and continued this for 19 years until 1938. He was married in 1924 and they have 3 children, 4 grandchildren, and 1 great-grandchild.

After he quit farming, the family moved to town and Vic entered the electrical contracting and radio repair service. In 1942, when the war started, his business was sold and they moved to Bellevue and Vic began working at the Martin Aircraft Plant in Omaha. All kinds of electrical work was done, including construction and maintenance, winding motors and then being promoted to trouble shooter, until the plant closed on V.J. day in 1945.

The next year was spent vacationing through the western states and then he did electrical construction work in Omaha until 1955 when he started an electrical business of his own in Omaha and Bellevue.

In 1963, he sold the business, rented the shop and retired. Beulah (his wife) and Vic purchased a 26 foot Airstream trailer and traveled down the east coast of Mexico as far as Oaxaca. They have traveled Canada from Nova Scotia to Vancouver, B.C., and in all the 48 states within the continental U.S.A. They usually go south in the winter and north to a cooler climate in the summer.

Vic first became interested in radio in 1921. At that time it was called wireless and wiring was done by using square wire and bending square corners to give it a pro-

* 103 Whittman St., Rochelle Park, N.J. 07662.

WØGYM operating from the home station.

WØGYM and his mobile station.

fessional touch. Although many receivers and some ham gear was built, interest lagged for some years but was finally rekindled and a license was obtained in 1938, Class C. The first transmitter was 5 watts on 160 meter phone, using 6 volt storage batteries and a small Carter genemotor for power. The 6 volt batteries were charged with a car generator run by a gasoline engine. All 48 states were worked with this 5 watt rig and to his many friends, Vic became known as "The 5 watt station in the heart of the nation".

As the years went by the rigs changed until a kw a.m. phone transmitter was in operation, and a Class A license was obtained and operation was started on 75 and 20 meter phone.

Vic was one of the early hams using s.s.b. starting with a Central Electronics 10A and after many changes, the rig now includes a Collins 32S3, 30 L1 linear and a 75S-3 receiver. The present antennas include an inverted V for 75 and 40 meters and a Telrex beam up 65 feet for 20-15 meters. The mobile rig installed in a 1966 Oldsmobile is a Collins KWM-2, a Heath HA-14 linear running nearly a kw p.e.p. to a Hustler antenna.

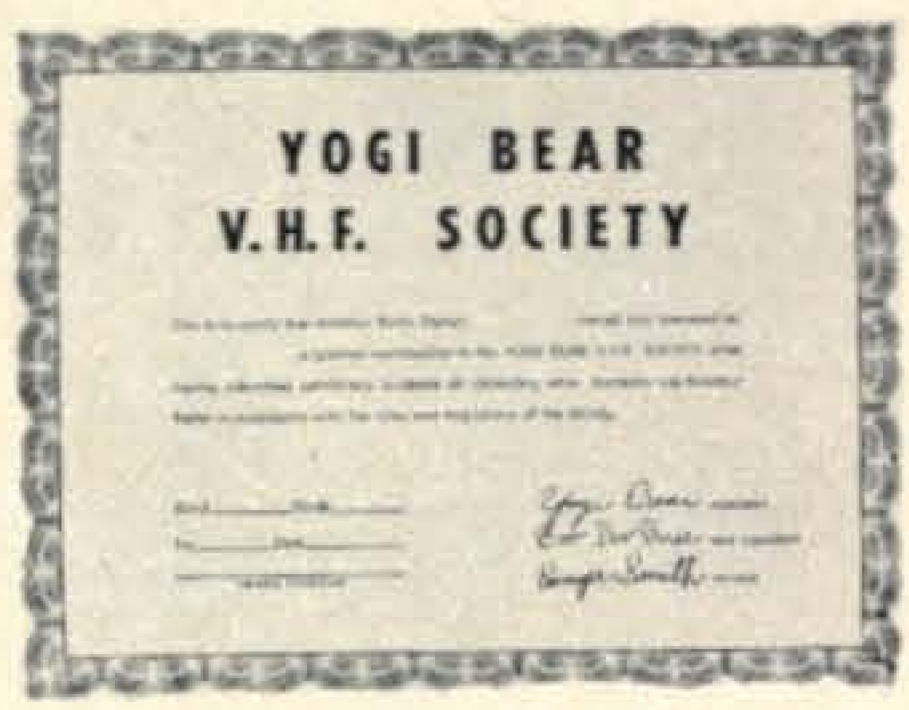
Many counties were handed out as Vic traveled through-out the U.S., but it took a few years of talking to many of the same county hunters and really becoming acquainted with this fine group before Vic decided to join his friends in the art of county hunting.

Vic feels that county hunting has increased tremendously in the past year, in fact, so much so, that it seems like an explosion. He feels that it is different than working DX in that you work the same fine fellows over and over as they travel through different counties in the course of their business travels or on special DX-peditions, and the possibility of meeting them in person is thus greater.

As Vic says, county hunters are all over the world and some of the regulars being G3DO, YV5AGD, many DLs, and of course fellows in all of the 50 U.S. states.

Vic's other interests include his family, fishing and photography.

As this is being written he has some 3035 counties confirmed and his USA-CA Awards are: USA-CA-500 #479, USA-CA-1000 #77 and USA-CA-1500 #33 all issued April 14, 1965. January 10, 1966 a USA-CA-2000


YOGI BEAR
V.H.F. SOCIETY

Yogi Bear V.H.F. Society

#25; May 31, 1966 USA-CA-2500 #15 and on October 10, 1966 USA-CA-3000 #11 was issued, a fine record.

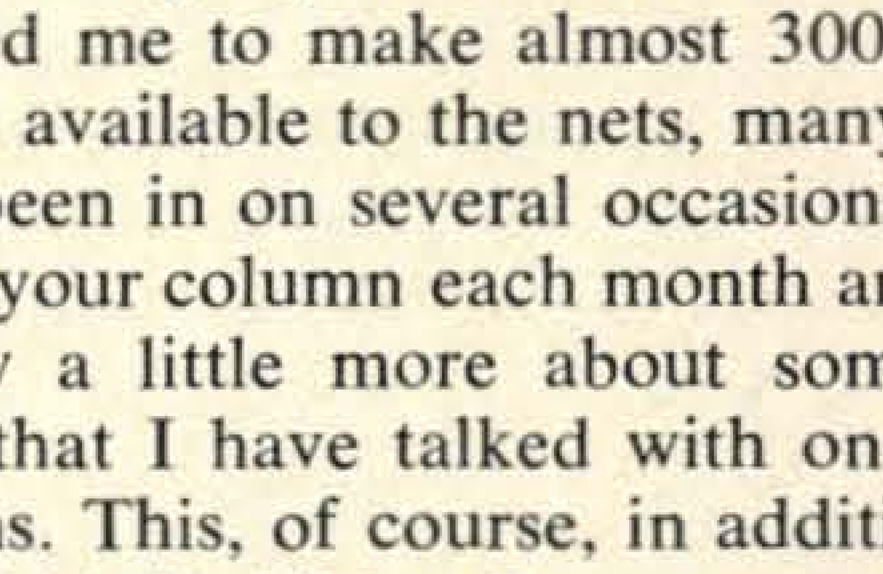
Letters

Ed, W3BWU, writes: "Just received my October *CQ* and noted your fine resume of USA-CA Awards. Under the 50 mc A3, you missed mine, (#604 of Dec. 6, 1966) which you said was the *THIRD* such endorsement". (*Ed., sorry for the oversight, Ed.*)

Bob, WB2NSD, writes: "I just opened the roll which contained my certificate #638 and I want to tell you how pleased I am with it. It surpasses, by far, any other certificate in my shack. Thank you very much for the fast reply to my application".

Bill, K4ISE, writes: "Having been a bit inactive, it sure is nice to get back on the county hunter frequencies and be able to meet up with W2JWK, WØGYM, WA4NBC, WØMCX, WØJWD, WØVFE and K8KOM, all of whom I have met on one or more occasions during my travels. These travels have permitted me to make almost 300 different counties available to the nets, many of these I have been in on several occasions. I enjoy reading your column each month and getting to know a little more about some of the fellows that I have talked with on so many occasions. This, of course, in addition to the other tid-bits". (*Ed.—Congrats on the Masters Degree and good luck on the Ph.D.*).

Hank, WB2RMM, writes: "Your letter and award arrived at the same time. For both,


WORKED ALL PLYMOUTH COUNTY

Worked All Plymouth County (Mass.)

Vulcan Award

I thank you. Your promptness is appreciated, I never could see why it takes some Custodians months to process an award.

My County Hunting is enhanced by a Rand McNally map, 28″ x 42″, which adorns my kitchen wall and at which I stare each morning as I have my coffee. Each new county is filled in with red crayon and even though I have few counties, it is beginning to look real interesting. This map is called the State-County-City Map, #4626 and I believe every county hunter would enjoy one".

Awards

Yogi Bear V.H.F. Society—Is an informal organization of amateur radio operators interested in award hunting activities on the v. h. f. frequencies and uses the name of Yogi Bear with the permission of Hanna-Barbera Productions, Inc. The Society is a non-profit organization and any surplus in funds over and above printing costs will be donated to the JIMMY FUND, Boston, Mass. for cancer reserach in children. Members are expected to assume their own postage costs. Requirements are: For contact with 5 members of the Society (4 members before 1-1-68). No date, time nor band limits. Send log data only with application. Fee for certificate is 35¢, include a large (#10) size s.a.s.e. for return of certificate. Certificate will be endorsed for one band and mode if requested. The certificate may be earned with other band or mode endorsements but will require a new application and fee and an additional certificate will be issued. Send s.a.s.e. for list of members. Awards Custodian is Robert W. Jennings, K1ZGH, 15 Cliff Ave., Scituate, Mass. 02066.

The Sailfish Award

Worked All Plymouth County—Issued by Boy Scout Troop #94, of Scituate, Mass., for confirmed contacts with the 27 Cities and Towns in Plymouth County, Mass. in 3 classes: Class "C" for 10; Class "B" for 20; Class "A" for all 27. Fee for basic class is $1.00 plus GCR list. Higher class seals s.a.s.e. Issued with one class of band and mode endorsement. New band or mode endorsement fee is 25¢ as a new (additional) award will be issued. Send s.a.s.e. for nice form for application use. Custodian, Robert W. Jennings, 15 Cliff Ave., Scituate, Mass. 02066.

Vulcan Award—Sponsored by the Vulcan County Amateur Radio Club of Vulcan, Alberta, Canada. This AWARD issued for working 5 members of the club, which has 21 members and their own club net on 3740KC at 2130 every Sunday. Write—J. L. (Gene) Moyer, VE6AFJ, Box 519, Vulcan, Alberta, Canada.

The Sailfish Award—This award offered free for working any 5 hams in Palm Beach County, Florida. Send GCR List to: West Palm Beach Amateur Radio Club, 823 Newark Street, West Palm Beach, Florida 33405.

Notes

Again for the many new readers of *CQ* and this column, YES, I am the Custodian for the *CQ* USA-CA Award and I'll be happy to send a copy of the rules for an s.a.s.e.

K3WWP reports the first County Hunters Party (c.w.) a big success. About 350 counties in every state but Hawaii were represented, along with about 30 DX counties, and 75 logs were received. Contest leaders were: K6BPC (Multiop), WB6KBK, W4YGO, W1JDS, W4OWE, W8AQ, and K1GMW.

As I write this, the new POD 26 (listing the counties and towns in USA) is now available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and the cost is $2.75.

Many thanks to Gilbert L. Baker, W8GIU/5, 413 Maple Ave., Dalhart, Texas 79022, for sending a POD 26 to each of

[*Continued on page 118*]

Q AND A

BY WILFRED M. SCHERER,* W2AEF

AFTER a lapse of several months, *CQ* is proud to once again offer it's traditional free question and answer service to readers. Following the pattern established by Chuck Schauers, W6QLV, with his HAM CLINIC, and Bert Simon, W2UUN, with SIMON SAYS, we will continue to provide free technical guidance to readers who are in need. Every effort will be made to provide the best solution to your technical problems related to amateur radio; however, we are not infallible and do not claim to have all the answers, about which we express our regrets beforehand.

Under the guidance of *CQ*'s Technical Director, Bill Scherer, W2AEF, the *CQ* staff will join to provide a service that is as helpful and prompt as we can make it, taking into consideration the complex nature of certain problems.

From time to time we will stray from the regular Q & A format to discuss problems, situations and ideas, (both technical and non-technical) which are of interest to amateurs. But our prime concern will remain reader inquiries.

Questions will be answered by mail. Those accompanied by a self addressed stamped envelope will naturally receive promptest service. Those questions of general interest will be used also in the column.

A few ground rules will make our life a bit easier: 1—only one question per letter, please. 2—Where old or obscure equipment is involved, please include a schematic diagram for our use. It *will* be returned. 3—Don't ask for our recommendations on which current commercial gear to purchase. Sufficient information is available elsewhere in *CQ's* equipment reviews to guide you on that point, and besides, only *you* can really judge what is or isn't desireable for your purposes.

If you have a novel approach to an amateur problem, or if you have a tidbit of information that may be of interest to our readers, drop us a line; you'll receive credit for the contribution. Finally, please let us know how you make out with our suggestions—it will help us to help the next fellow still more.

* Technical Director, *CQ*.

Surplus Gear

Requests are quite often received for manuals concerning specific pieces of surplus gear. In order to save your time, as well as ours, it is suggested you first write to the following dealers in surplus manuals as listed below:

Sam Consalvo, W3IHD
4905 Roanne Drive
Oxen Hill, Maryland

R. E. Goodheart Co.
Box 1220
Beverly Hills, California

Propagation Products
P. O. Box 242
Jacksonville 1, Florida

Quaker Electronics
Hunlock Creek, Pennsylvania

Bill Slep
Box 178
Ellenton, Florida

If you are looking for the conversion or just the schematic for a surplus item you might consult the Surplus-Conversion Handbook (Cowan No. 122, $3.00) or the Surplus-Schematics Handbook (Cowan No. 117, $2.50).

If these sources fail, the next bet is to make use of our free, classified, ad section which is available to *CQ* subscribers.

Heathkit VFO With Globe Scout

QUESTION: I have a Heathkit HG-10 v.f.o. that I wish to use to drive a Globe Scout Model 680 transmitter on six meters. I do not get the needed output from the v.f.o. to drive the transmitter. The v.f.o. voltages measure up to specifications. Any suggestions on how to obtain more drive?

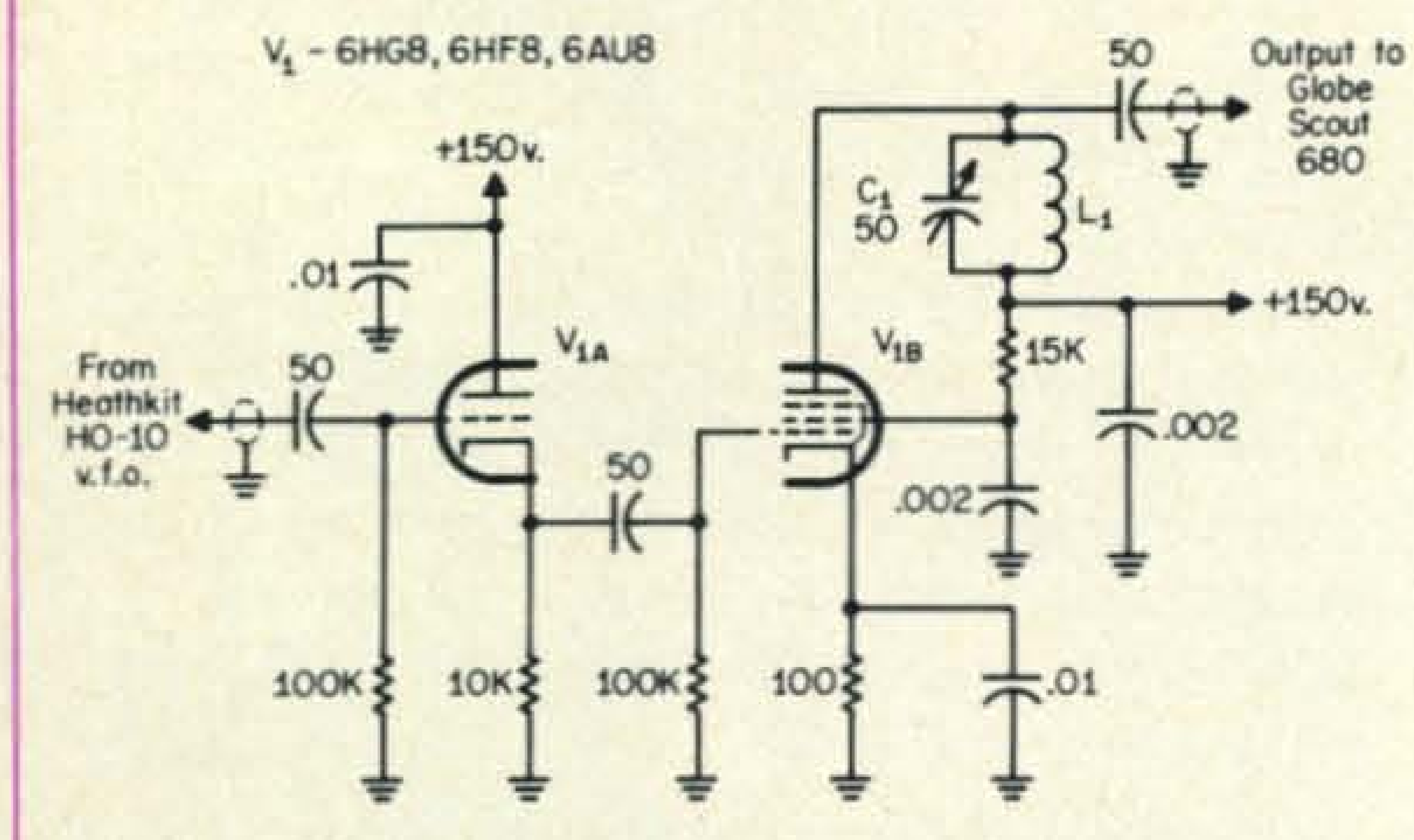


Fig. 1—Outboard cathode follower/amplifier for increasing the output voltage of the Heathkit HG-10 v.f.o. from 5 v. to 10-50 v. to drive the Globe Scout 680 transmitter. C_1—L_1 must resonate at the desired v.f.o. output frequency as described in the text.

ANSWER: The HG-10 v.f.o. r.f. output is rated at 5 v. r.m.s.; whereas, the Globe Scout 680 requires 10-50 volts v.f.o. drive. This may be obtained from a separate outboard unit using the circuitry shown at fig. 1.

V_{1A} operates as a cathode-follower buffer to minimize loading on the v.f.o. and reduce r.f. feedback from the amplifier, V_{1B}. C_1/L_1 should be tuned to 8 mc for six-meter operation. The arrangement also may be used on the other bands, in which case C_1/L_1 should be tuned to 40 meters, except for 80-meter operation where the circuit should be tuned to the 80-meter band, but detuned as far as possible on the high-frequency side while still allowing sufficient drive to be obtained.

Vacuum Tube Rectifier Replacement

QUESTION: I have a Hammarlund HQ-180 and after reading an article by W8PZX on page 65 of June '65 *CQ*, I am wondering if I could use such a modified circuit to replace the 5U4-GB, but how about the heaters which no doubt will have a higher voltage; (at least I believe so). If possible, please give ratings for replacement components.

ANSWER: The modification of changing from a vacuum-tube rectifier to silicon-diode rectifiers may be made on almost any receiver. The circuitry is repeated here (fig. 2) for convenience. Before making the change, measure the voltage at the rectifier output (pin 2 on V_{15}, the 5U4-GB). Then measure the normal current drawn by the set by inserting a milliammeter in series with the lead from the rectifier-tube output. Make a notation of these readings.

If, after the silicon rectifiers are substituted, the voltage increases by more than about 10%, install R_1 and make it a value that produces the necesary voltage drop to lower the voltage at the output-side of R_1 to the original amount. The value may be calculated by $R_1 = E_d/I$, where E_d = required voltage drop, I = current measured earlier. The minimum wattage rating for R_1 will be $W = R_1 \times I^2$. There will be no significant change in heater voltage for the other tubes.

BCI With BC-454 Receiver

QUESTION: I am a Novice using a BC-354 for receiving on 3700-3750 kc. Every now and then I pick up a BC station (WKYC—1100 kc) in the band. How can this be cured?

ANSWER: This is not an unusual condition. Harmonics of broadcast stations often are generated by rectification in non-linear devices which might pick up the fundamental signal. Such elements may be corroded or loose joints on gutters, drain pipes, neighborhood wires, plumbing, etc. Two or more BC station signals may also be mixed therein to produce a new set of frequencies not directly related to the original, ones.

[*continued on page 117*]

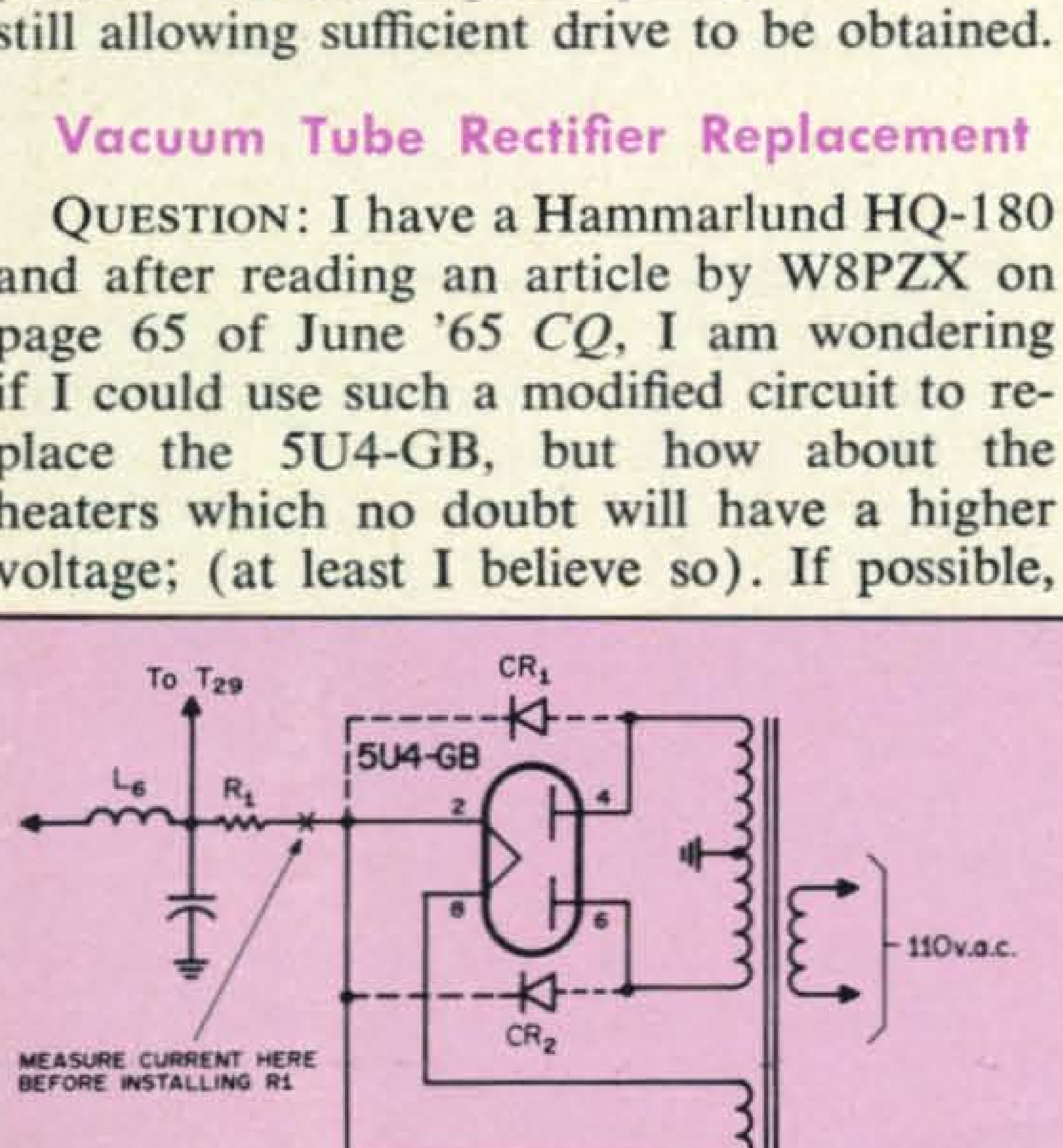


Fig. 2—A vacuum tube rectifier may be simply replaced by silicon diode rectifiers as shown. CR_1 and CR_2 may be any good quality silicon diode at rated p.i.v.; 500 ma.

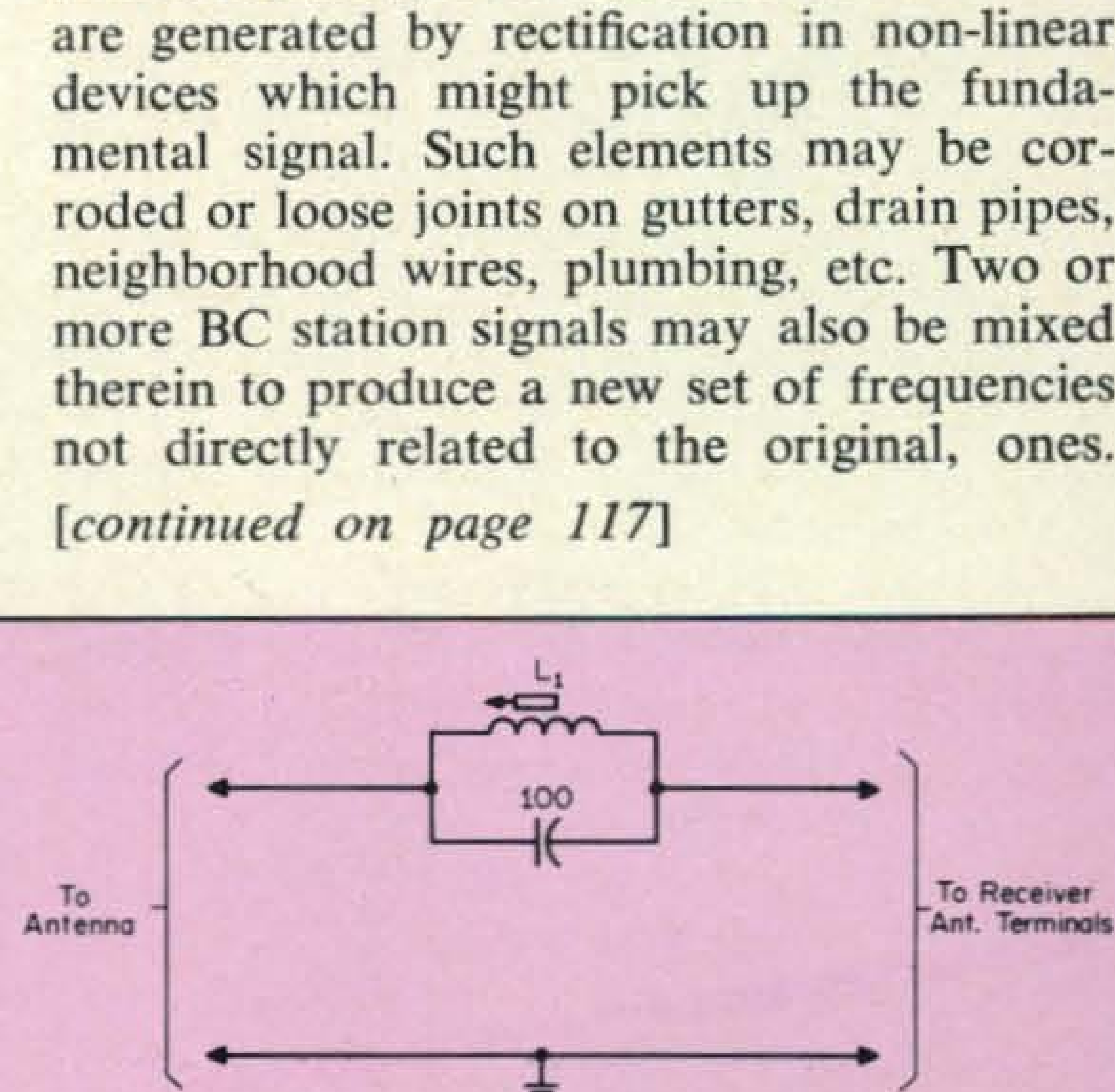
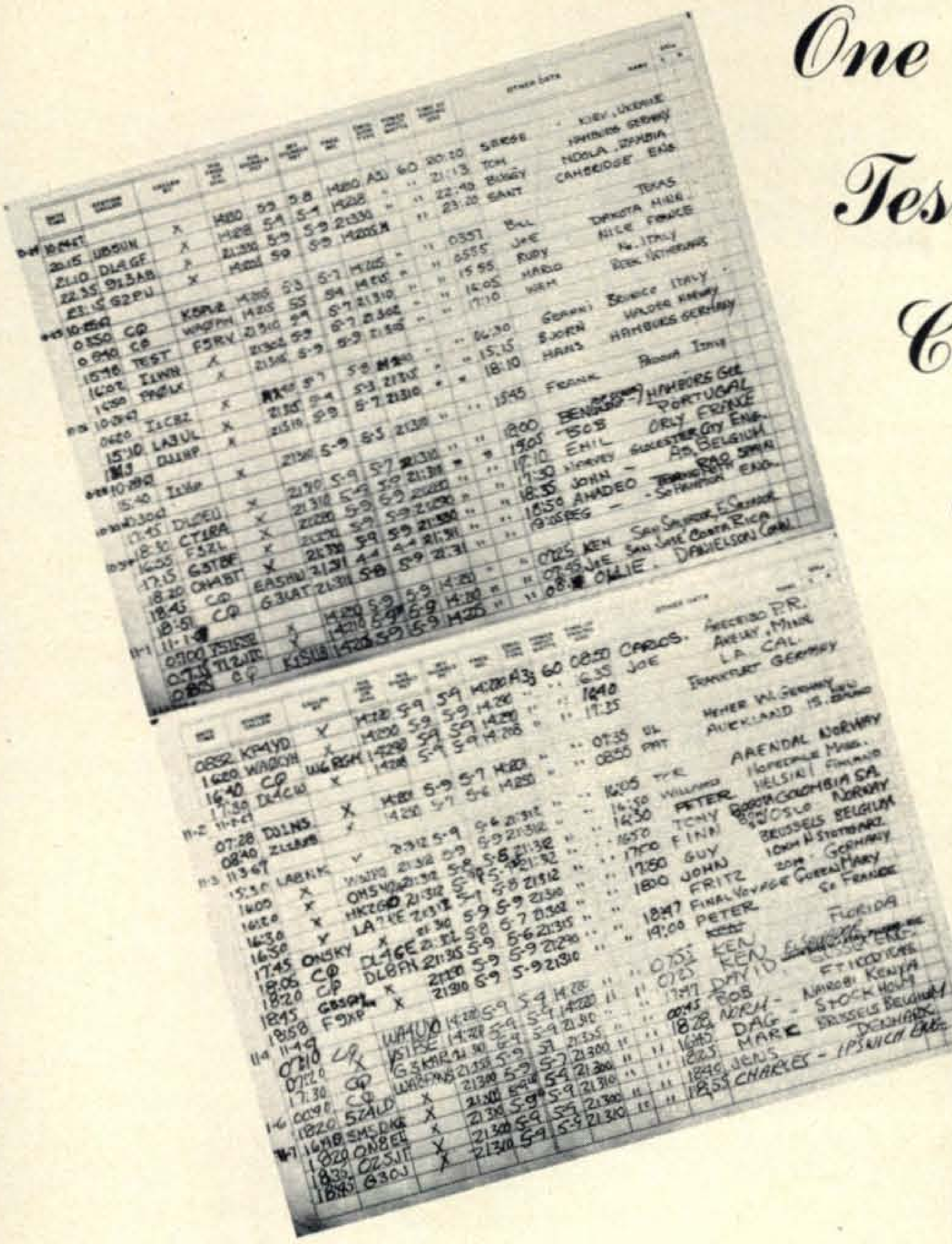


Fig. 3—Parallel-tuned trap for minimizing interference from a strong BC signal. L_1 is a "ferri-loopstick," available from most parts distributors, and should be adjusted to the interfering signal's frequency. Miller trap (812-BC2) may be used.



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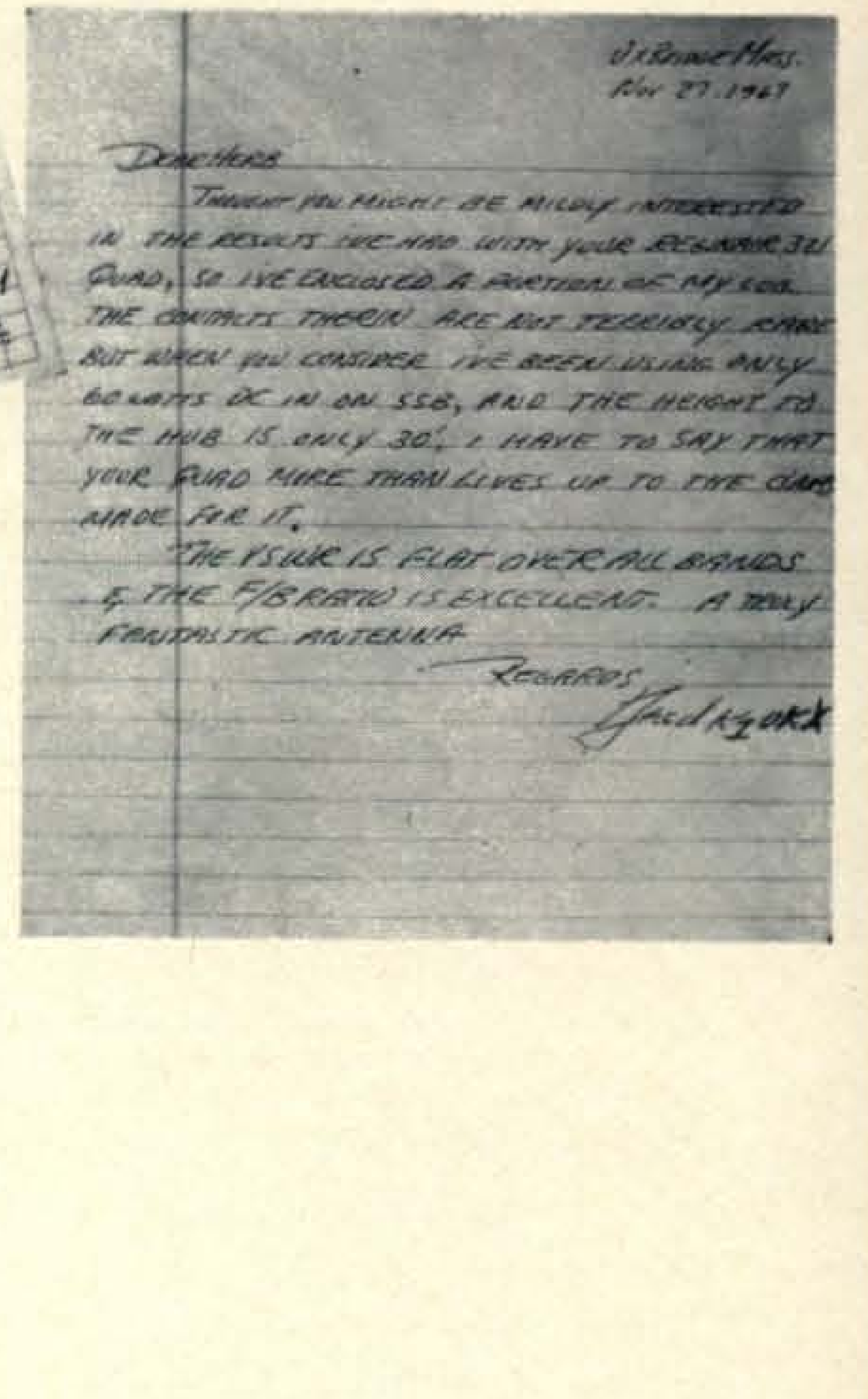

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

AFTER a total of 4,700 miles of travel by car, bus, ship, rail and air in seven Western European nations, through 15 major cities in 30 days, your Surplus Editor can report that it is very good to get back to the States, where he speaks the language, and where the Surplus grows thicker than any place he found overseas.

From my survey of England, Scotland, France, Belgium, Germany, Austria and Italy, I would say that the U.S. was Surplus Heaven, and add that most of the useful ex-military electronics that get to amateurs elsewhere originates in North America.

Not that there is a total dearth of surplus overseas there is a surplus row on Lisle and Newport Streets in London that rivals Canal Street, in Manhattan, but I found no Cortlandt Street in Western Europe. (Of course Cortlandt Street in New York is gone now, demolished to make way for the World Trade Center.)

Some of the same problems seem to afflict surplus dealers overseas as here at home. Along Newport Street most of the shops had as much or more new commercial gear on display as surplus, together with small components from manufacturers' overruns and other non-military items. A few old jewels like the SCR-522 and the Command Sets were still on sale, but their numbers were dwindling.

The armed forces of England, France and Germany have not been a fraction the size of the U.S. Defense Department since 1945, and those less-affluent societies have never been as overburdened with electronic goodies as their U.S. counterparts. As a result, the source of foreign surplus has been a great deal smaller. Also, particularly in England, disposal policies have been far more restrictive. Today a policy of commission auctioning of surplus still seems to insure that only large dealers buy the majority of the salvage material in the United Kingdom. The military is even less helpful on manuals and handbooks than in the U.S., and a great deal more security is imposed on any item that could be remotely considered "classified." The "Official Secrets" Act makes it a crime to handle manuals that are not officially declassified, and official declassification action is worse than glacier-like.

U.S. Forces however, sell surplus overseas in much the same way they do at home. Bidding is fairly honest, lots are made up with what seems to be a modicum of sense, and the individuals I met were agreed that American material was the most interesting available. Quantities however are far smaller as a rule than in the States.

I had been interested in the disposal of material that had to be moved out of France last spring under Operation FreLoc, General DeGaulle's "get out" order to U.S. troops. As far as I could find, much of the material went to England and Germany. Little was sold in France, and certainly no surplus bonanza was created there.

Some French-made communications gear was left behind, but most high-cost items were removed, for parts if nothing else. A few installations were sold to the French in operating condition. For the rest, everything was uprooted and shipped out, down to the door knobs, light fixtures and radiators.

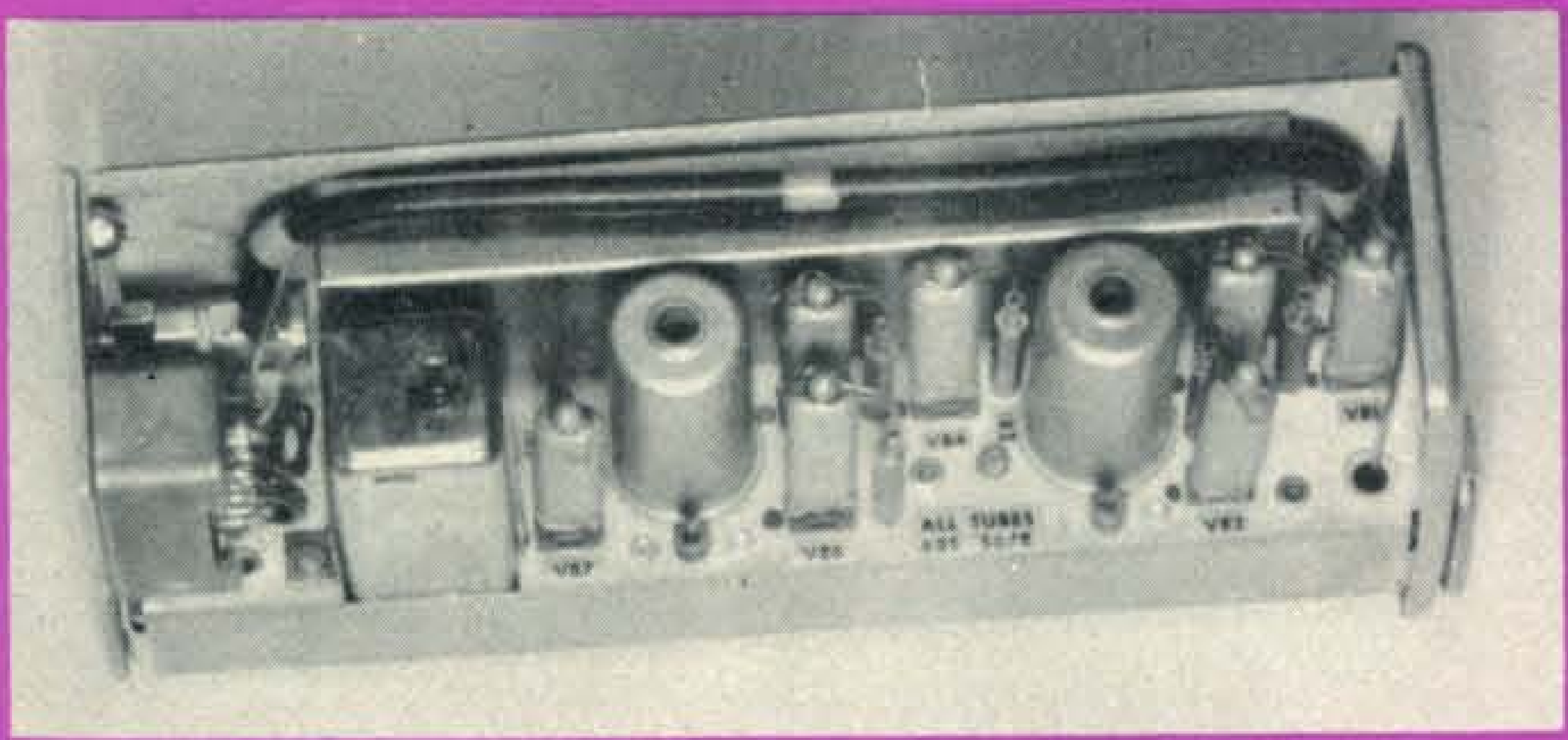
There is a custom in Europe that allows a man who sells a house to take all the removable fixtures with him—the U.S. used this plan to the hilt, leaving le Grand Charles with as little boodle as possible, and certainly little valuable electronic gear.

Most of the electronic material in France was fixed communication gear, with little lab equipment involved. All of the tactical sets were, of course, kept for U.S. use, though sales in Germany and England may eventually benefit from ultimate disposal of material relocated from France.

Actually, outside of England, we saw little of the U.S. style surplus store. There is a large surplus yard just west of Reims, France, but most of the material was heavy construction equipment, with a few pieces of electronics here and there. There was some action in Germany, in "junk" stores, but we saw few interesting pieces there.

In England, stores in Chester, London and Tring stocked goodly supplies of surplus standbys, but little of the more modern

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



455 kc Intermediate Frequency amplifier module from Motorola FM receiver. This unit contains a two-stage limiter and a discriminator, and operates off 145 volts B+ with 1.4 volts for the filaments of the seven subminiature tubes. This unit will make a good receiving unit for FM/PM transmissions such as those from weather satellites.

equipment. Ledsham Trading Co., Tower Wharf, Raymond St. in Chester, was the largest we saw.

In central London there are Smiths, on Lisle Street, Service Trading Co., around the corner on Little Newport Street, London Central stores next door to Smiths, Gee Brothers Radio, also on Lisle and Charles Britain Ltd., on Upper St. Martin's Lane, all fairly close together.

Others in London include Z & I Aero Service Ltd., in Tottenham Court Road, along with Relda Radio Ltd. In Edgware Road are Henry's Radio and I.M.O. Electronics, with Samerous Ltd. at 10 Chapel Street, just off Edgware Road.

Prices seemed not too far above U.S. levels. I saw a #15 Teletype machine for 40 pounds ($100) and BC-221 frequency meters for about 27 pounds ($75). A small oscilloscope that might sell in New York for $50 was 22 pounds ($61). A RACAL diversity receiving switch unit however was listed at what seemed a high 100 pounds ($278) despite its new condition. I am sure it cost 200 pounds originally, but its appeal to most surplus customers was probably not that high! Depreciation of the pound of course lowers these prices 14% in dollar terms.

A Weller 120 watt soldering gun was listed at 57 shillings—$7.14, not too far from the stateside price. Saw a LR-1 signal generator for $70, and an ARN-21 airborne set for $33—probably a bargain. A lot of items however were incomplete, and spares probably are unobtainable.

The problem of finding manuals is especially difficult in Europe, and here at home it is no snap. My mail has contained requests for technical manuals and handbooks since this column began, and the demand is stronger than ever this winter.

While I cannot supply books on surplus gear, I will recommend again, sources I have found helpful:

Sam Consalvo, 4905 Roanne Dr., Oxon Hill, Maryland

Bill Slep, Box 178, Ellenton, Florida

Jim Cooper, 147 Palmer Avenue, Maywood, N.J.

Though I cannot supply technical manuals, I will be glad to offer what advice I can to readers who write to me with problems. I do ask that letters be typewritten if at all possible, or at least written clearly, and that a stamped, self-addressed envelope be enclosed. I answer most questions at once, but occasionally will hold on to a letter in attempt to get the requested information, when it cannot be answered immediately from my own files.

Letters from readers this fall brought the following suggestions and questions, which may be of interest to others:

The CM-14/URA-6 unit is a "comparator" used in diversity RTTY systems. Aside from a loop keying circuit, power supply, and a tuning meter, it does not contain enough independent circuits to be usable as a straight converter on its own, but could be used as the base on which to build a "converted" converter, or so it seems to me. Does anyone have a good idea on such a use for the CM-14?

The AN/PRD-7 antenna system, described in the October, 1967, Surplus column, contains an excellent rotary coaxial joint. Does anyone know of a source for a similar component? Does anyone know of another source for the whole PRD-7? (Mine is now exhausted.).

In another column I discussed receiving weather satellite signals in the 136 megacycle band, and observed that there were few FM discriminators designed for the common 455 kc intermediate frequency of most station receivers which might be used to follow a VHF converter in a satellite receiving system. I now find, thanks to Jack

Hart, that the R-257/U and the R-394/U "police band" military FM receivers, by Motorola, use a 455 kc second IF. The IF and discriminator modules are available from R & R Electronics, 40 South Yellowspring, Springfield, Ohio, at $3.00 postpaid in apparently new condition with tubes.

For any FM work, this ought to be a real bargain. The seven-tube module contains 5 IF amplifiers, two stages of limiting, plus the discriminator. Voltages required are 1.4 volts, d.c. (for filaments) and 145 volts B+. The subminiature #5678 tubes have directly-heated cathodes, so a.c. cannot be used for the heaters.

Bandpass of the filters (*Z*81 and *Z*82) is 30 kc, thus limiting the receiver to a signal deviating up to 15 kc above and below 455 kc. The discriminator (*T*81) has a nominal 76 kc passband, and according to diagrams furnished by the Military, thus it offers an extremely flat response curve in the part of the band (30 kc wide) thus used. This offers the possibility of removing the filters and using a wider passband, up to 70 kc or so. The audio output is rather high-impedance, thus dictating some amplification and matching to the usual ohm recorder or headset load.

Incidentally, a new APT satellite on 137.50 mc went up in November.

Incidentally, for anyone who is trying to identify an odd piece of surplus gear, particularly Navy, the best numbers to work with are those on the nameplate as follows: "A part of type—Radio Equipment". This is the nomenclature by which the items are most often listed. Contract numbers are virtually useless for most purposes. The old contract numbers looked thusly: "Model CXR-47001" which shows only who built it and its bookkeeping number, but either the old-style (type RAB, ARA, MAW) type number or the newer JAN (AN/ARC-5, AN/CRT-3, etc.) designations are the ones used in the military indexes I keep for reference.

Finally, I want to report a great deal of interest has been shown in the 1750 meter band (160-190 kc) which I described in the July, 1967 column. The F.C.C. allows unlicensed operation of transmitters of one watt power or less, with a fifty foot limit on feedline and antenna length in that low-frequency band. Range of reception is typically far greater than for the 100 milliwatt walkie-talkies in the 27 megacycle area. I would love to hear about other operations in this heretofore undiscovered area for ham-type or experimental transmissions.

One of the hardest areas from which to get information on surplus electronics is the U.S. Coast Guard. The USCG uses a lot of military JAN gear, but buys some equipment of its own design to AN/ nomenclature not used by the Navy, Army, or Air Force. It also buys items not made to AN/ specs, such as the TRP-141. If anyone can offer any help on a source of USCG manuals or even an index of CG electronic items, or the TRP-141 book in particular, I would appreciate it.

Another difficult area for the surplus man has been spare parts and paper for facsimile machines. The old reliable AN/TXC-1 TimesFax recorders are subject to damaged half-nuts and lead screws, plus burnout in several transformers. Parts have been well-nigh unobtainable, but now Walter Smisloff, RD2, Fishkill, N.Y. 12524, has picked up several cases of the standard 12 x 18½ recording paper and some parts kits which contain the lead screw half-nuts, transformers, R1130B transmitter tube, motor, ammeter, bearings, worm gear, etc., 38 different items in all, totalling more than 75 items. Those needing to overhaul their TXC-1 machines could do well to get in touch with him.

One more thing: can anyone give me any details on the AN/ARA-1? This was a "radiocompass adapter" for the SCR-274-N Command Receiver set. It has no repeat *no,* relation to the Navy "ARA" nomenclature which was applied to early Command receivers. The AN/ARA-1 was mounted in the middle slot of a three-receiver rack and attached to a receiver on each side through linkages to the tuning splines. It involved use of the first ferrite-core direction-finding loop (a German invention), in the U.S. I would like to find either an intact set or a manual, drawings, etc. The design was completed in 1943, and production was probably small.

The AN/ARA-1 is shown in TM 11-227, a directory of Radio Communication Equipment dated 10 April 1944. The main unit was MD-XA-1/ARA-1, known as a "Compass Modulator". Indicators were the I-65-A and I-75-A, which were also used with other radio compass sets. The SCR-186 performed similar functions, but it of course was an earlier, solely radio-navigating set. ■

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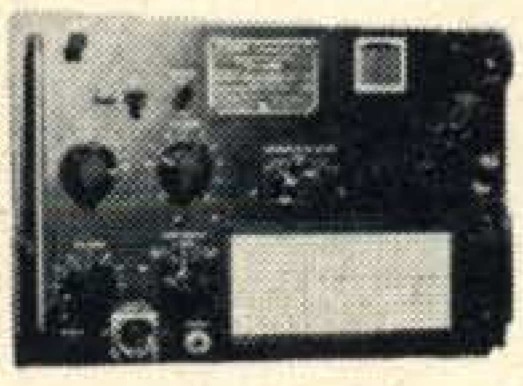

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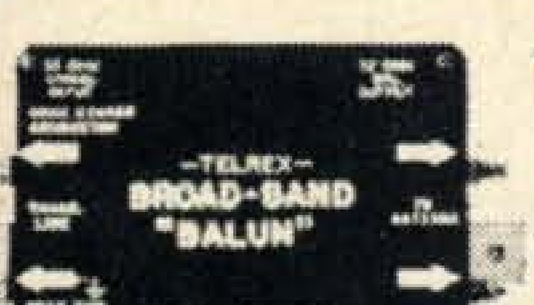

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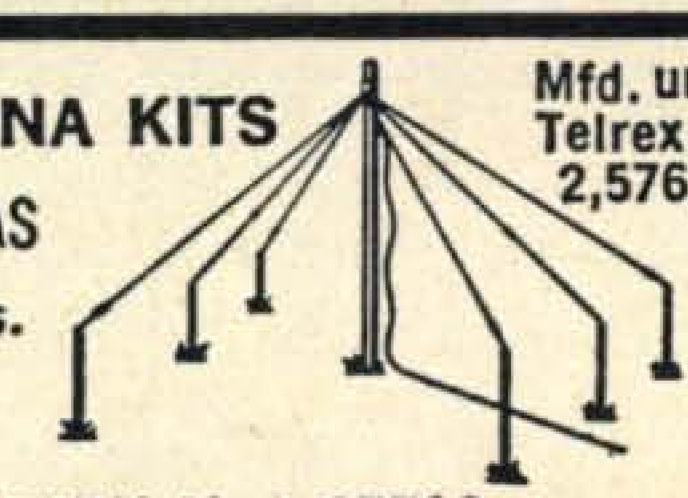

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Announcements [*from page 9*]

II. Rotary Club, assisted by an International Committee. Besides the short-wave station, which will operate on several amateur frequencies, a booth will be staffed to receive the messages from the delegates. A special transmitting license will be requested from the Mexico Radio authorities, which will give the station a special interest to amateurs who are collecting rare contact cards. More particulars will be issued as time draws near to the convention date, May 12, 1968.

Correction

Please note: The date of the Lake Country A.R.C. Banquet is February 10, 1968—*not*—February 13 as previously stated.

DDRR Patents

With regards to articles on the DDRR Antenna, we are advised that Mr. Joseph Boyer, W6UYH holds patents on the design. They are: Boyer US Pat. 3,151,328, Boyer US Pat. 3,247,515, Boyer R.E. 26, 196.

SSB Results [*from page 19*]

Multi-Operator division would also be in order.

No major changes for the 1968 contest are anticipated. However a little streamlining to keep them along the lines of our World Wide DX contest might be attempted. With perhaps only two exceptions, using prefixes for the multiplier and limiting the operating time for single operators.

We are still open to suggestions and invite your ideas. The next contest is scheduled for April 6th and 7th.

That just about wraps it up for this year.
73 for now, Frank, W1WY

The DXpedition [*from page 72*]

teur radio from one's own country to another.

(2) Encouragement and demonstration of a high standard of operating techniques, improving all modes of operating techniques while preparing for possible emergency participation.

(3) Improvement in the outlook for retaining our amateur radio frequencies through the ITU, by initiating amateur radio licensing in areas where it was previously lacking or nonexistent, by encouraging amateur radio in these areas, and by actively supporting utilization of the full amateur radio spectrum.

(4) Improvement in the attitude toward amateur radio in remote areas by bringing recognition to such obscure areas through amateur radio.

(5) Providing a means for improving one's

own operating ability while accepting a challenge.

(6) Promotion of healthy, international competition, through DX awards and contests.

(7) Providing an excellent test for commercial amateur radio equipment under rugged operating and climatic conditions, useful to the design of future equipment.

(8) Providing an excellent source for the study of propagation phenomena, by operating continuously from areas normally devoid of signals on these frequencies, and by providing voluminous logs and data useful in future propagation predictions.

(9) Perfection of long-distance communication under difficult or marginal conditions.

And I could go on adding to that list of already-impressive advantages. Yes, DXpeditions are a most valuable segment of the amateur radio service. DXpeditions are here to stay. We should be thankful for that, recognize their value, and participate to the fullest extent possible. Just how these many advantages of DXing and DXpeditions can be put to use to actively preserve amateur radio throughout the world, will be discussed in future chapters.

NEXT MONTH: *On the Trail Again.*

Drake W-4 Review [*from page 32*]

We have so far related power readings only to s.w.r., but other needs for such readings may be that of determining the power-output capabilities of a transmitter and its efficiency, or the adjustment for optimum performance. This is best done with loads exhibiting less than a 2:1 s.w.r. Such tests should be conducted using a dummy load, not only to eliminate on-the-air interference, but also to avoid illegal operation when the d.c. input to the p.a. exceeds 1000 watts.

The W-4 has a 3″ meter mounted in a clear-view plastic case that has a concave face which minimizes light reflections. The scale is finely calibrated and easy to read. There are four positions at the selector switch: two for reflected ranges of 200 and 2000 watts; two for forward ranges of 200 and 2000 watts. The 2000-watt positions are between the 200-watt ones, so that when you switch from forward to reflected power while high power is being used, you don't have to go through the 200-watt positions, thus avoiding the possibility of slapping the meter pointer against the end of the scale.

[*Continued on page 115*]

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- G-76 DC supply 39
- G-77 Transmitter 49
- G-77A Transmitter 69
- GSB-100 Xmtr 169
- GSB-101 Linear 169
- GSB-201 Linear 199
- Super 12 29

HALLICRAFTERS
- S-38E Receiver $ 34
- S-53A Receiver 49
- SX-101A Receiver 199
- S-107 Receiver 59
- SX-115 Receiver 325
- SX-117 Receiver 199
- S-120 Receiver 39
- SX-140 Receiver 69
- R-46 Speaker 9
- R-48 Speaker 9
- HT-32A Xmtr 249
- HT-32B Xmtr 299
- HT-33B Linear 375
- HT-40 Transmitter 49
- HT-41 Linear 199
- SR-160 Xcvr 175
- PS-150-120 Sup. 75
- PS-150-12 Supply 49
- MR-150 Rack 15
- SR-500 Xcvr 199
- P-500AC Supply 75
- P-500DC Supply 75
- HA-6 Transverter 89
- SR-34 (AC) Xcvr 149
- SR-46 6m Xcvr 119

HAMMARLUND
- HQ-100C Rec. $109
- HQ-100A Rec. 125
- HQ-110 Receiver 119
- HQ-110C Rec. 129
- HQ-110A Rec. 159
- HQ-110AC/VHF 199
- HQ-140X Rec. 99
- HQ-145AC Rec. 199
- HQ-160 Receiver 189
- HQ-170C Rec. 169
- HQ-170AC Rec. 225
- HQ-180 Receiver 239
- SP-600JX (rack) 299
- S-100 Speaker 9
- HX-500 Xmtr 225

HEATHKIT
- MR-1 Receiver $ 49
- HR-20 Receiver 89
- SBA-300-3 6m conv. 15
- SBA-400-4 2m conv. 15
- QF-1 Q-multiplier 4
- MT-1 Transmitter 39
- TX-1 Transmitter 109
- HA-10 Linear 175
- HX-20 Transmitter 149
- HW-12 75m Xcvr 89
- HW-12A 75m Xcvr 99
- HW-22 40m Xcvr 89
- HW-22A 40m Xcvr 99
- HW-32 20m Xcvr 89
- SB-100 Xcvr 325
- SB-101 Xcvr 350
- HP-24 AC supply 49
- VF-1 VFO 19
- HG-10 VFO 29
- HW-10 6m Xcvr 149
- HW-29 (Six'er) 34
- GP-11 DC supply 5
- VHF-1 (Seneca) 125

HUNTER
- 2000A Linear $299

JOHNSON
- Adventurer $ 29
- Challenger 54
- Viking II 69
- Ranger I 89
- Ranger II 139
- Valiant I 139
- Valiant II 189
- 500 Transmitter 275
- KW Amplifier/desk 595
- Audio Amplifier 39
- Pacemaker 139
- Invader 200 275
- Courier Linear 139
- 6N2 VHF Xmtr 89
- 6N2 VFO 34
- 6N2 Conv.(14-18) 34
- Mob. Xmtr (as-is) 15
- Mob. VFO (as-is) 10
- Signal Sentry 14

KNIGHT
- R-100A Receiver $ 69
- T-150 Transmitter 59
- T-150A Transmitter 69

LAFAYETTE
- HE-45B Xcvr $ 75
- HE-61A VFO 15
- HA-90 VFO 29

LAKESHORE
- Phasemaster II $ 79
- Phasemaster IIB 125

LINEAR SYSTEMS
- 250AC Supply $ 39
- 12-400 Inverter 75
- 350-12 DC Supply 69
- 250-12 DC Supply 49

MOSLEY
- CM-1 Receiver $ 99
- CMS Speaker 9

NATIONAL
- NC-57 Receiver $ 49
- NC-300-C2 Conv. 29
- NC-300-C6 Conv. 29
- VFO-62 29
- NCX-3 Xcvr 189
- NCXA AC Supply 75
- NCXD DC Supply 75
- VX-501 VFO 175
- 200 Transceiver 275
- AC-200 AC Supply 59
- NCL-2000 Linear 375

P & H
- LA-400C Linear $ 89
- PS-1000B DC Sup 75

POLYTRONICS
- PC-2 2m Xcvr $175
- PC-6 6m Xcvr 149

RME
- VHF-126 Conv. $ 75
- VHF-152 Conv. 34
- VHF-152A Conv. 39

SBE
- SB-33 Xcvr $189
- SB1-VOX 15
- SB1-XC Calibrator 12
- SB2-VOX 19

SWAN
- SW-140 Xcvr $ 75
- SW-240 (late) 189
- 117AC AC Supply 59
- 400 Xcvr 249
- 406 VFO 49
- 420 VFO 75
- 117B AC Supply 49
- 350 Xcvr (late) 299
- SW-117C AC Sup. 75
- 512 DC Supply 75
- 117X Basic AC Sup 49
- 22 VFO Adaptor 12
- 250 6m Xcvr 275
- Mark I Linear 395

UTICA
- 650A Xcvr/VFO $109

WATERS
- 372 Clipreamp $ 9
- 359 Compreamp 12

WHIPPANY LABS
- Lil Lulu 6m Xmtr $125
- Lil Lulu 6m Rec. 125

COMCO
- 680 Base 30.96Mc w/tone (NEW) $450
- 684 UHF Mobile 310

HEWLETT PACKARD
- 410C Voltmeter $297
- 606A Generator 945
- 608D VHF Gen 910

REGENCY
- RTG-2 Tone gen. $ 85

SONAR
- FM-40 on 30.96 $175
- FM-40 Remote 175
- SC-40 Tone 50

To: AMATEUR ELECTRONIC SUPPLY
4828 West Fond du Lac Avenue
Milwaukee, Wisconsin 53216 C-1

Ship me the following Reconditioned Equipment:

FIRST CHOICE ____________________

SECOND CHOICE (IF ANY) ____________________

THIRD CHOICE (IF ANY) ____________________

I enclose $__________; I will pay balance (if any)

☐ COD ☐ 1 year ☐ 2 years ☐ 3 years

Name ____________________

Address ____________________

City ____________________

State ____________ Zip ________

☐ **Send Latest Ham Catalog.**

The items listed BELOW are brand-new and carry the full manufacturers' New-Equipment Warranty. Some of the items have been on display, but most are Factory-Sealed.

Item	Reg.	NOW*
DESIGN INDUSTRIES		
Presidential Console for S-line	$495.00	$250.00
ELMAC		
AF-68 Transmitter	$205.00	$102.50
GONSET		
G-76 Transceiver	$451.32	$175.00
Communicator IV 6m Xcvr	307.00	207.00
913A 500w 6m Linear	256.00	196.00
G-150 Airport Comm. (122.8)		125.00
HALLICRAFTERS		
SR-46 6m Transceiver	$189.95	$125.00
MR-40 Mobile kit for above	11.50	6.00
HA-26 6 & 2m VFO	59.95	42.00
SX-146 Receiver	249.95	175.00
HAMMARLUND		
HQ-145XC Receiver	$299.00	$199.00
JOHNSON		
6N2 Converter (14-18Mc) KIT	$ 59.95	$ 39.98
6N2 Converter (14-18Mc) wired	89.95	59.98
6N2 Converter (26-30Mc) wired	89.95	59.98
6N2 Converter (26-30Mc) KIT	59.95	39.98
6N2 Conv. (30.5-34.5Mc) KIT	59.95	39.98
Invader 200 SSB Transmitter	619.50	309.75
6N2 Transmitter (wired)	194.50	160.00
6N2 VFO (wired)	54.95	45.00
Ranger II (wired)	359.50	259.50
Ranger II (kit)	249.50	195.00
P & H		
6-150 6m Transmitting Conv.	$299.95	$149.99
LA-500M "Spitfire" Linear	189.95	94.99
POLYTRONICS		
PC-2 2m Transceiver	$349.50	$225.00
REGENCY		
AR-132 Aircraft Receiver	$ 59.95	$ 29.98
SBE		
SB3-DCP Mobile Inverter (1 KW)	$249.50	$124.75
W-72 Control Cable (SB3-DCP)	7.50	3.75
SB1-VOX VOX Unit	39.50	19.25
SINGER		
PR-1 Panadaptor	$144.50	$ 72.25
SQUIRES-SANDERS (CLEGG)		
SS-1R Receiver Ser.	$995.00	$495.00
SS-1S/RS Silencer/Speaker	170.00	85.00
99'er 6m Transceiver	179.95	119.98
Thor 6 6m Transceiver	249.95	175.00
418 DC Supply for Thor 6	159.95	79.98
Allbander Tuner	129.95	64.98
Video Bandscanner	445.00	245.00
Zeus 2-6m Transmitter	745.00	450.00
372 6m Low-pass Filter	14.95	7.48
SWAN		
SW-117B AC Supply for 400	$ 85.00	$ 65.00
TRANSCOM		
SBT-3 80-40-20m SSB Xcvr	$299.50	$198.00
SBA-3 AC Supply	99.50	49.75

The size of the wattmeter case is 6″ × $3^{11}/_{16}$″ × 4″ (h.w.d.) and the removable sensing coupler is 2¼″ × 3½″ × 2½″. Besides the usual installation and operation procedures, the manual includes instructions for alignment or calibration, should this be required at some later date.

The Drake W-4 R.F. Wattmeter is priced at $49.50.—*W2AEF*

Drake MN-4 Review [*from page 67*]

the unit itself and the transmitter was found advisable, especially when an appreciable length of coax is used between both pieces of equipment or when a grounded-antenna system is involved. A separate ground lead for each generally is best, with the ground paths made independent of the coax shield connection between the equipment. Inadequate grounding may be evidenced by hand-capacity effects when the tuning knobs are grasped or released, or by a higher s.w.r. at the transmitter output (shown by a separate s.w.r. bridge) than that indicated by the MN-4's meter.

A thing to keep in mind when the network is in use is that the wattmeter indicates only the power *applied* to the *network, not* that going into the *radiator*. Also, a maximum insertion loss of 0.5 db (12% of power) through the network was measured as per the manufacturer's rating.

The effects of harmonic attenuation on TVI were not checked in practice, but the measured attenuation of second harmonic averaged 28 db for all bands, with higher-order harmonics found somewhat further down.

Although the unit is designed specifically for use with coax-type transmission lines, there may be more cases that relate to the need for matching to other type feed systems. For this reason we have gone into extra details on operation with systems such as the grounded antenna.

Dimensions for the MN-4 are 5½″ × 10¾″ × 8½″ (h.w.d.), including connectors.

The Drake MN-4 Antenna Matching Network is priced at $90. The Model MN-2000, for 2000 watts p.e.p. is $160. There are products of the R. L. Drake Company, 540 Richard St., Miamisburg, Ohio 45342.

—*W2AEF*

WCARS Net [*from page 48*]

U.S. Department of Health, Education, and Welfare, Amateur Radio Emergency Communication System and the California State Health Amateur Radio Emergency Service.

The Net is a non-profit corporation with a set of by-laws, officers, and Directors. President George Lyle, K7ZAU, publishes the monthly *Sentinel* newsletter among his other duties. Net Manager is Vice President Wayne Nail, WB6CBW. Daily monitoring operations are under the overall guidance of Net Coordinators Bob Stone, WA6WHP, and Ed Gribi WB6IZF. Actual operation outside the noon session is quite flexible and informal with a minimum of administration, red tape, or "brownie points." Members travelling can recognize others by the distinctive red, white, and blue decal.

The success of the West Coast Amateur Radio Service indicates that the concept of calling frequencies is exceptionally valid and useful so long as there is enough utilization to keep it open. Is the success of WCARS a flash in the pan or will the concept expand and spread? The needs obviously fulfilled by the present operation guarantee its continuance. Travellers have spread the message about the effectiveness of this type of operation from Europe to Australia. Others are attempting to establish a similar service on the East Coast. A start has been made on establishing a nighttime 80 meter service and other bands and modes have been suggested. WCARS will undoubtedly continue to grow and provide more services. Why? First, it is an extremely logical utilization of amateur capabilities to fulfill a growing need. Second, a broad segment of the amateur population likes to be where the action is. Third, they find the combination of action with the "service" aspect of the amateur radio service most satisfying. To put the most important reason for its success in a nutshell—it works! ■

Pulse Tuning of Linear Amplifiers [*from page 28*]

the actual value will be from 45 to 49%. The frequency of the keyer is no problem if related to the power line frequency or derived from a well calibrated generator. Otherwise, an audio oscillator should be set to the approximate frequency of the keyer and connected to the horizontal scope input. A keyer tone is connected to the vertical input and the audio oscillator adjusted for a stationary pattern. The keyer frequency is then the same as that of the audio oscillator but care must be taken not to lock onto a harmonic of the keyer frequency.

FCC Regs

Does sending a string of dots constitute pulse modulation of a transmitter, a mode of operation not allowed on the amateur bands? The question gets involved in semantics but one point is clear: FCC rules forbid the generation of key clicks which cause interference. The keyed pulses must have finite rise and decay times, or in other words, shaped as any manually keyed c.w. signal is by capacitor or RC networks to prevent key clicks. Since higher keyer frequencies become generally more difficult to filter, the lowest frequency that allows reasonably steady meter readings to be obtained should be used. ■

Contest Calendar [*from page 99*]

Rules will be found in the current *QST* and free contest forms are available from ARRL, Newington, Conn.

Editor's notes.

Conditions for the phone contest week-end were fabulous and at this writing we are anticipating equally good conditions for the c.w. week-end. The whole list of records will have to be rewritten I am sure.

All certificates (except the 1967 s.s.b.) have been mailed. Let me know if you have not received yours. A footnote on your 1967 log is *not* enough, since this is easily overlooked. Make your request in the form of a letter.

Many of the received logs, especially the foreign entries, have incomplete or unintelligible addresses. Use BLOCK LETTERS. And you fellows with APO addresses, give us your address for next summer, not your operating QTH. Better still your home address.

We are not always at fault if you do not receive your award. I sometimes marvel that Bobbie (Mrs. Robertson to you) is able to decipher some of your hieroglyphics.

We have a stack of returned certificates marked "unknown" or "insufficient" address. Maybe yours is one of them.

73 for now, Frank, W1WY

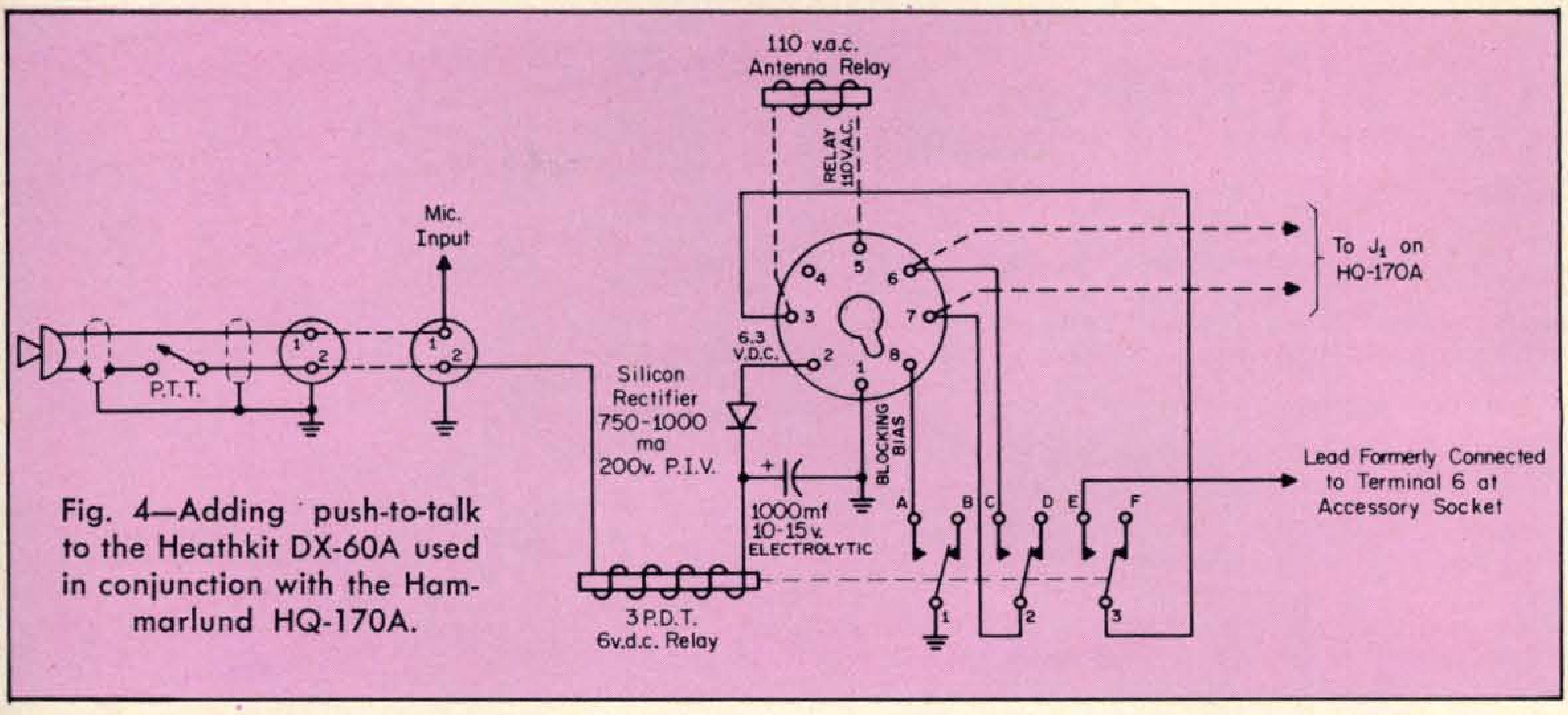

Fig. 4—Adding push-to-talk to the Heathkit DX-60A used in conjunction with the Hammarlund HQ-170A.

Q & A [*from page 104*]

These effects often come and go (as you have observed), depending on changes in the rectifying properties of the device (or devices), such as may be due to vibration, dryness, dampness, etc., which vary with the weather.

The obvious cure is the elimination of the offending elements, but unfortunately, these usually are quite difficult to find, unless by chance they are located on your own premises where you might check for loose or corroded wire connections, for wires or other metal bodies rubbing against other surfaces, poor joints on a TV antenna, etc.

Although harmonics of 1100 kc are not directly related to 3700-3750 kc, it is quite possible that they may appear due to mixing with the reciever's oscillator harmonics, the b.f.o. or its harmonics, etc. On the other hand, overload or cross modulation from a strong local BC signal might be a factor, in which case a trap at the BC frequency should be a help. See fig. 3.

Article Index

QUESTION: Do you publish an index of articles in past issues of *CQ?*

ANSWER: An index for the past 10 years is in preparation. Watch for announcement in a later issue of *CQ*.

DX-60A/HQ-170A Push-to-Talk

QUESTION: How may the Heathkit DX-60A be modified for push-to-talk operation? How should a Hammarlund HQ-170A be connected to it?

ANSWER: On transmit this requires removal of blocking bias, application of necessary voltages and operation of the antenna-transfer relay. It also necessitates operation of the receiver's disabling facility. The setup for doing so is as follows:

Remove lead from center pin of mic connector. Change the connector to a two-circuit type (Amphenol 80-PC2F female chassis receptacle). Connect mic input lead, which was removed, to pin 1 on new connector. At end of mic cable install a matching two-circuit plug (Amphenol 80-MC2M male cable plug) with pin 1 connected to hot side of mic output and pin 2 connected to the mic push-to-talk control switch.

At a convenient place under the chassis install a 6 v.d.c. 3-pole-double-throw relay (Potter & Brumfield type KA14DY, Allied Radio part no. 41-B-5169, or equivalent). Wire according to circuitry shown at fig, 4. First remove existing lead from terminal 6 on accessory socket at rear of DX-60A and connect this lead to the normally-open relay contact E. Do not remove the other existing leads from the accessory socket.

A 110 v.a.c. antenna relay should be plugged into accessory-socket terminals 3 and 5 as indicated by the dashed lines. The HQ-170A disabling circuit (J_1 on the HQ-170A) should be similarly plugged in terminals 6 and 7. For receivers where one side of the disabling circuit is grounded, a d.p.d.t. relay may be used instead, eliminating contacts C and D, and then connecting socket terminal 7 (ground) to relay arm 1 and terminal 6 to contact B.

To operate, insert an open-circuited plug in the key jack, or open c.w. key if one is already plugged in, place the function switch at A.M. (leave it there during A.M. operating sessions) and proceed using p.t.t. control on mic. ■

Propagation *[from page 94]*

HAWAII

Openings Given In Hawaiian Standard Time †

To:	10 Meters	20 Meters	15 Meters	40/80 Meters
Eastern USA	07-08 (1) 08-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-12 (2) 12-14 (3) 14-16 (4) 16-18 (2) 18-19 (1)	12-15 (2) 15-17 (3) 17-19 (4) 19-22 (3) 22-01 (2) 01-06 (1) 06-08 (2) 08-12 (1)	18-19 (1) 19-21 (2) 21-01 (3) 01-03 (2) 03-04 (1) 19-21 (1)* 21-01 (2)* 01-03 (1)*
Central USA	07-08 (1) 08-10 (2) 10-13 (3) 13-15 (4) 15-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	13-14 (3) 14-19 (4) 19-21 (3) 21-23 (2) 23-04 (1) 04-06 (2) 06-08 (3) 08-13 (2)	18-19 (1) 19-20 (2) 20-03 (3) 03-04 (2) 04-06 (1) 19-21 (1)* 21-03 (2)* 03-05 (1)*
Western USA	06-08 (1) 08-09 (2) 09-11 (3) 11-13 (4) 13-15 (3) 15-17 (2) 17-18 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-16 (4) 16-18 (3) 18-20 (2) 20-22 (1)	06-07 (2) 07-10 (4) 10-14 (3) 14-18 (4) 18-21 (3) 21-00 (2) 00-06 (1)	17-18 (1) 18-19 (2) 19-02 (4) 02-04 (3) 04-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-04 (3)* 04-05 (2)* 05-07 (1)*

†To use in other areas of the United States, *add* 5 hours to the times appearing in the Chart in the Eastern Standard Time Zone; 4 hours in the CST Zone; 3 hours in the MST Zone and 2 hours in the PST Zone. For example, when it is 12 hours, or noon, in Honolulu, it is 17 hours, or 5 P.M. E.S.T. in N.Y.C.

‡To convert to Local Standard Time in Alaska, *subtract* 8 hours from the times appearing in the Chart in the Pacific Standard Time Zone; 9 hours in the Yukon Zone; 10 hours in the Alaskan Standard Time Zone; 11 hours in the Bering Zone. To use GMT in other areas of the United States, *subtract* 5 hours in the EST Zone; 6 hours in the CST Zone; 7 hours in the MST Zone and 8 hours in the PST Zone.

USA-CA *[from page 102]*

the following. GM3BCL, DL9PF, G2MI, SMØAJU and 9H1AG.

Mention must be made of the Amateur Radio Achievement Club for the fine Awards they are sponsoring and they hope to have a compilation of all U.S. Awards available by the time this is in print so may I suggest that you send an s.a.s.e. for the data to the Amateur Radio Achievement Club, Box 7326 Euclid Station, St. Petersburg, Florida 33734.

I must also mention the fine work and fine awards also being sponsored by the National Awards Hunters Club, and I would like to suggest you write for any and all data to Jerry Medlin, WB2FEQ, NAHC Trustee, 47 Hicks St., Brooklyn, N. Y. 11201.

No, Santa did not bring me that new linear, but I still can be heard (now and then). Hope you will all make a New Year's Resolution to write and let me know—How was your month?

73, Ed., W2GT.

DX [*from page 90*]

JX5, Jan Mayen: JX2XF on 14065 c.w. at 2100 GMT.

LAØ, Rare prefix: Bob, WØGTA/LAØ is very active from Norway.

ST2, Sudan: Sid, ST2SA, may be heard on 14019-022 or 14034. QSL address is Sid Ahmed Ibrahim, P.O. Box 244, Port Sudan, Sudan. IRCs are now acceptable.

TR8, Gabon: Jacques, TR8AI, has been active on 20 meter c.w., 14022, 053, and 066 at various times ranging from 0700-1400-1700 GMT.

UAØ, Zone 23: UAØKYA on 14012 at 1425 GMT.

UV9, Rare prefix: UV9PP on 28715 kc.

VEØ, Rare prefix: VEØMC on weathership *Quadra*, 14150 kc at 0235-0435 GMT.

VKØ, MacQuarie Island: VKØCR continues active on 14170-198 s.s.b. QSL to VK7ZKJ, 23 Cottesloe St., Lindwood, Lindisfarne, Tasmania 7015, Australia.

VP2, Grenada: VP2GBC operates daily on 15 meters from 2100-2300 GMT.

VP2, Montserratt: VP2ME is partial to the neighborhood of 28567 s.s.b.

VQ9, Aldabra: VQ9JW on 14203 s.s.b. at 0342 GMT.

VR1, Ocean Island: Bob, VR1L, operates frequently on 20 meter s.s.b. from 0900-1100 GMT.

YK1, Syria: Rasheed, YK1AA, is reported to be active again.

ZD9, Gough Island: ZD9BH is active most afternoons on 14 mc c.w. and s.s.b.

ZK1, Cook Islands: ZK1CL is reported GRV with low power.

3V8, Tunisia: 3V8BZ is on 28585 s.s.b. daily at 1600 GMT. looking especially for Nevada and Wyoming for WAS.

4S7, Ceylon: 4S7NE on 14025 at 0150 GMT, 4S7JP on 14015 at 0200 GMT, and 4S7DA on 14018 at 0210 GMT.

5H3, Tanzania: Bill, 5H3KJ, is QRV all bands 80-10 meters.

9K2, Kuwait: 9K2AM is occasionally heard on 14215 s.s.b. around 1500 GMT.

QSL Information

CEØAE—For QSOS after Oct. 1. 1967 send cards to WA5PUG
CR6FW—To W8GIU (new address)—413 Maple Ave., Dalhart, Tx 79022
EP2DM—Javad Mesbahee, P.O. Box 1116, M.U., Macon, Ga. 31207
ET3RB—Via VE1ASJ
ET3REL—c/o W5LEF, 3107 Morningside Drive, N.E., Albuquerque, N.M. 87110
FG7—To W8GIU (see new address above)
FG7XY—Via W8GIU
FM7WI—c/o W8GIU
FP8DJ—To WB2FXB
FP8DK—Via K7GHZ, 3212—R—St., Vancouver, Washington 98663
G5AJG/M—c/o K6ICS, 10425 San Jose Ave., South Gate, Calif. 90280
GM5AJG/M—To K6ICS
GW3AJG/M—Via K6ICS
HL9AA—c/o W4UWC
KH6BZF/KM6—via KH6BZF
KS6CN—via W3LMA, 109 Pinehurst Rd, York, Pa.
M1NJ—To K3KMO
M1SS—Via I1SSK
OK1AKO—Stateside cards to K9BNF
OK3UL—c/o VE1ASJ
KS6CN—To W3LMA
K4IIF/KV4—Via K4DSN
MP4BGA—c/o VE1ASJ
MP4TBO—To VE1ASJ
PJ2CQ—Via WB4EHX, 4800 Riverwood Drive, Sarasota, Fla. 33581
PX1NV—Stateside cards to WA9HJM
TG5WJ—via K2DDIT
TGØAA—c/o W4YWX
TU2CA—To YASME
VQ9TC—N. America QSLs to W4HUE
VR2CC—To VE6AKV, 7612 23rd. St.S.E., Calgary, Alberta
VS9AJM—Via K6EBB, 7633 West Hill Lane, San Jose, Calif. 95129
VU2AJ—New address—B.S. Dutt, Overseas Communications Se. ice, NIC Building, Parliament St., New Delhi 1, India
VU2GW—To K3MNW
XEØICS—c/o K6ICS
ZS9G—To K4YMJ
4X4VL—Via VE1ASJ
5R8AS—c/o W6ZPX
7Q7GB—Via W5UBW, 1518 Lincoln, Alamogordo, N. Mex. 88310
9L1KG—To YASME
9M8II—Via 9VINT
9Y4VT—c/o W3DJZ

73, John, K4IIF

STATEMENT OF OWNERSHIP MANAGEMENT AND CIRCULATION (act of October 23, 1962; Section 4369, title 39, United States Code) (1) Date of Filing—September 29, 1967; (2) Title of Publication—CQ THE RADIO AMATEUR'S JOURNAL; (3) Frequency of Issue—Monthly; (4) Location of Known Office of Publication—14 Vanderventer Avenue, Port Washington, County of Nassau, New York 11050; (5) Location of the Headquarters or General Business Offices of the Publishers—14 Vanderventer Avenue, Port Washington, County of Nassau, New York 11050; (6) Names and Addresses of Publisher, Editor, and Managing Editor: Publisher—Richard A. Cowan, 32 Burham Street, Smithtown, New York; Editor—Richard A. Ross, 90C McLaughlin St., Glen Cove, New York; Managing Editor—Alan M. Dorhoffer, 75-15 177 Street, Flushing, New York; (7) Owner—(If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.)—Sanford R. Cowan, 6 Embassy Court, Great Neck, L.I., New York; (8) Known Bondholders, Mortgagees, and other Security Holders Owning or Holding 1 percent or More of Total Amount of Bonds, Mortgages or other Securities (If there are none, so state)—NONE; (9) Paragraphs 7 and 8 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than of a bona fide owner. Names and addresses of individuals who are stockholders of a corporation which itself is a stockholder or holder of bonds, mortgages or other securities of the publishing corporation have been included in paragraphs 7 and 8 when the interests of such individuals are equivalent to 1 percent or more of the total amount of the stock or securities of the publishing corporation. (10) Extent and Nature of Circulation-Average No. Copies Each Issue During Preceding 12 months, Single Issue Nearest to Filing Date: (A) Average No. Copies Each Issue During Preceding 12 Months—Total No. Copies Printed (Net Press Run)—72,907; (B) Paid Circulation 1. Sales Through Dealers and Carriers, Street Vendors and Counter Sales—36,681, 2. Mail Subscriptions—32,104; (C) Total Paid Circulation—68,785; (D) Free Distribution (including samples) By Mail, Carrier or Other Means—1,381; (E) Total Distribution (Sum of C and D)—70,166; (F) Office Use, Left-over, Unaccounted, Spoiled After Printing—2,714; (G) Total (Sum of E & F—should equal net press run shown in A)—72,907. Single Issue Nearest to Filing Date: (A) Total No. Copies Printed (Net Press Run)—63,084; (B) Paid Circulation 1. Sales Through Dealers and Carriers, Street Vendors and Counter Sales—30,882,—2. Mail Subscriptions—31,269; (C) Total Paid Circulation—62,151; (D) Free Distribution (including samples) By Mail, Carrier or Other Means—839; (E) Total Distribution (Sum of C and D)—62,990; (F) Office Use, Left-Over, Unaccounted, Spoiled After Printing—94; (G) Total (Sum of E & F—should equal net press run shown in A)—63,084. I certify that the statements made by me above are correct and complete. (signed) Richard A. Cowan, Publisher.

Grumbles [*from page 40*]

The one stomping ground for the minimal conversationalist was 2 meters, where you could always scare up a frightened Novice and fill him full of hot air about how great you are without his calling your bluff. Of course, even that's going now.

Fact is, that many hams are simply too bashful or uninformed to get a good non-technical conversation going. If two of these guys hook up on the air it becomes a Mexican standoff with exchanges of finals, final-finals, *final*-final-finals *ad nauseum* after the exchange of technical data while each operator tries desperately to figure out a way to unload the creep on the other end without hurting the other guy's feelings or making himself look foolish.

The trick, of course, is to cleverly sneak a few little subtle remarks into the conversation to let the other fellow know that you are also programmed for non-technical communication. If he wants to he can pick up the ball and run with it. If he ignores it, then nobody's the wiser and you can go right into the *final*-final-final Alphonse and Gaston bit.

"Yeah Sam, I've got to run over to Lafayette and pick up a new 10K pot."

"Careful Fred, if the fuzz hears you ordering 10 kilos of pot you might get busted."

That one will turn on any operator under the age 30.

For older ("Nothing Generation") operators, you might try:

"There's a 60 cycle ripple on your carrier, OM."

"Yeah, we're getting Shep Fields up here next week to put a little rhythm into the thing."

For c.w. devotees I suggest closing your initial transmission to the other station with a crisp "Shave and a haircut—2 bits" tempo.

A little imagination and you'll find a way. You'd better—I'm coming close to perfecting my little black box. Guess that necessity is the mother of retaliation. ■

WHAT'S A CLASSIFIED AD IN CQ WORTH?

NOTHING!

Unless, of course, you happen to have something to sell . . . or buy . . . or swap . . . Then you can only measure the value in satisfaction, time saved, etc. Of course, a typical classified ad in the other major ham magazine costs between $2.50 and $3.00, so maybe that's a way to measure.

Now—What does a classified ad in *CQ* cost?

NOT A RED CENT ! ! !

That's right, you read us loud and clear. *CQ* subscribers can run classified ads any and every month absolutely free of charge. All you have to do is send us your mailing label as proof that you're a subscriber, with your ad neatly typed or printed. There's a limit to three lines in any single month to make space for everybody to get in that needs to.

SO—What's a subscription to *CQ* worth? Well, maybe twelve months of great reading, maybe twelve months of free classified ads, maybe both. That's up to you. In any case, at $5.00 a year, *CQ* is a steal. Do we have your sub yet? If not, why not?

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word in cluding abbreviations and addresses. Commercial and or ganization ads, 35¢ per word. **Minimum Charge $1.00.** N ad will be printed unless accompanied by full remittance **Closing Date:** The 10th day of the second month precedin date of publication.

Because the advertisers and equipment contained i Ham Shop have not been investigated, the publishers o CQ cannot vouch for the merchandise listed therein.

Direct All Correspondence & Copy to: **CQ Ham Shop, 1 Vanderventer Ave., Port Washington, L.I. N.Y. 11050.**

WANTED—QST's—Last four issues needed to complete priv collection. 1916—FEB., MAY, JUNE, JULY. Any reasonable pr paid. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Wa ington, L.I., New York 11050.

GOVERNMENT SURPLUS picture catalog, 25¢. Meshna, Naha Mass. 01908.

QSL's by RUTGERS VARI-TYPING SERVICE, Thomas St., Milfo N.J. 08848. Free samples.

POLICE—fire—aircraft—amateur calls on your broadcast rad Tune the band with TUNAVERTER. Free catalog. Salch Compa Dept. CC, Woodsboro, Texas 78393.

QSLs—BROWNIE-W3CJI—3111 Lehigh—Allentown, Pa. 181 Samples 10¢ with catalog 25¢.

WANTED: Tubes, transistors, semiconductors, test equipm meters. Bernie W2MNP, Box 257, Canal Station, N.Y., N 10013.

YOUR CARD in glittering raised 3-D on blazing backgrou becomes a beautiful collector's item. Samples 25¢ (refundab 3-D QSL Co., Monson, 4, Mass. 01057.

RTTY gear for sale. List issued monthly. 88 or 44 Mhy toro uncased, five for $1.50 postpaid. Elliott Buchanan and sociates, Inc. 1067 Mandana Blvd., Oakland, Calif. 946

EARN YOUR DEGREE in electronics engineering. Highly effec home study courses in electronics engineering technology electronics engineering mathematics. Free Literature. Coo Institute of Electronics Engineering, P.O. Box 36185, Houst Texas 77036 (Established 1945).

EXTRA SPECIAL OFFER: Galaxy V Transceiver, De lux access console, Galaxy remote V.F.O., AC power supply, Sound off m $450.00 or best offer Mrs. Glenn Imler, (W9LJ). Gary, India

HUNDRED QSL's, $1.25, postpaid, samples, dime. Holland, Box 649, Duluth, Minn. 55803.

FAMOUS GIORGIAN HASH TRAP for 6 meters guaranteed $2 prepaid. ABCO. Box 111, Warren, R.I. 02885.

RUBBER ADDRESS STAMP including call letters. Three or f lines $1.50. Signature stamp $3.50. Free catalog. Jackso P.O. Box 443-F, Franklin Park, Illinois 60131.

HIGH Voltage DC Supply Mfg. Kilovolt, 5K-750ma, 2K-200 1K-250ma, individual and common voltage controls mete w/manual like new, write for details . . . 2.5KW Line Transfor four isolated windings 115V-21amps. 50/60cy any combinati of 115-230V possible 12x11x12 . . . $49.95 . . . Ohio AC Motor oz. Torque w/capacitor continuous duty 230V-60cy $9.95 . Tape Recording (metered) and playback amplifiers each 8½x2 6½ combination $24.95 . . . Receiver R-267/ARR-27, 29 tu 465-510Mc w/schematic New $34.95 . . . IFF AN/APX1 Tx, Rx, tubes new $19.95 . . . Electronic, Mechanical Devices . . . Cata 10¢. Fertik's, 5249 "D" Phila., Pa. 19120.

NAVY LM-13 Crystal Frequency Indicator and AC Power Sup Rach mounted. Spare crystal and tubes. Original Calibra Book. Excellent condition. Price $65. Capt. C. G. Barany, 1 Woodcliff Ave., Catonsville, Maryland 21228.

DAH-DITTER. . . . New integrated circuit automatic keyer. F self completing. Built-in AC supply and keying monitor. Isola relay output. Completely assembled ready for operation. P $34.95. See your distributor or order direct. Free Brochu M & M Electronics, 6835 Sunnybrook, N.E., Atlanta, Geo 30328.

FOR SALE: 40 foot EZ-Way Tower, Foldover, Crankup. P & 6-150 6 meter transverter, Eldico 100-F SSB exciter, Panaso solid-state multiplex stereo tuner-amplifier-model RE-787. A 11 element Telrex 6 meter beam, New-Tronics Coveya 6 m antenna. New York Area only. Will Not Ship. Make offer individual items or entire group. Call Dick Cowan, 516-883-6 days, 516-265-6347 nights, or write care of CQ magazine.

RECEIVERS, general coverage, like new: HQ180C, spkr $2 HRO60 spkr, 8 coils $289. HC-10SSB Adapter $98; SP600 $375. Alltronics-Howard Co., Box 19, Boston, Mass. 02 (617-742-0048).

QST 73 wanted for cash. Need all issues, all years—all rs. Please state condition, price in first letter, All replies ponded to. Jon Balch, W3AES, 145 Third Avenue, Newtown, are, Pa. 19073.

TUBES needed. Surplus, in top condition. Need about one en. Quote price. Leonard Zell, K7CNO, 800 Southwest Morri-, Portland, Oregon 97205. Phone 503-227-8471.

LING OUT! 2 Swan 350's excellent. Hy-Gain Tri Bander, E-Z 60 ft. Galvanized with ground post (you move) Collins 1, 3-1000 Z linear (2000PEP) Johnson SWR, Shure Mike, other goodies. Send stamped Addressed envelope for list. Luce, W2PTQ, RF.D. Cutchogue, N.Y. 11939 or call 516--5041.

NTED: Manual for Model UHF-62 Globe Star. Mrs. T. A. er, 2 Garden Road, Scarsdale, N.Y. 10583.

TON Hamvention April 27, 1968—Wampler Arena Center, ton, Ohio, sponsored by Dayton Amateur Radio Association. ormative sessions, exhibits, hidden transmitter hunt and ies program for the XYL. Watch the Ham ads for informa-n or write Dayton Hamvention, Box 44, Dayton, Ohio 45401.

NTED: Coils for HRO 60 W2EEJ, 821 Rutgers Rd, Franklin are, N.Y.

12, 22, 32 OWNER ("A" Series also): Convert your rig to ee bands with SSB & CW coverage. Complete assembly nual $3.95 (refundable) or send 10¢ stamp for illustrated chure. DRC, 215-28 Spencer Avenue, Queens Village, N.Y. 27.

NTED: Military, Commercial, SURPLUS . . . Airborne, Ground, nsmitters, Receivers, Testsets, Accessories. Specially Collins. pay Cash and Freight. RITCO. Box 156-1, Annandale, Vir-ia PH 703-560-5480 Collect.

LITARY Technical manuals, electronic equipment etc. 48 e catalog 25¢. Quaker Electronics, Hunlock Creek, Pa. 521.

NSISTOR SALE—Factory packaged 2N321, 2N323, 2N406, 1.00. 2N1370, 2N1372, 22¢ ea. 2N522a, 18¢ ea. Sample as-tment, 12 new, marked transistors $1.00. WA5FYF/5, 303 ed Hall, Lubbock, Texas 79406.

.00 price plus shipping for quick sale. Hammarlund HQ-C, excellent condition, unmarked panel, recently aligned, nual included. Steve Mintz, W2AZO/1, 19 Everett Street, nbridge, Massachusetts 02138.

00's one new and one used, plus new tube socket and mney assembly $50., or trade for rotor and indicator. iel E. Kreimer Rt. 27, Eastside Drive, Parkville, Mo. 64152.

NTED: Late Swan 350 or equivalent, Cash paid. HY-8-4924. oklyn.

L: Brand new Star-Line Xmtr, Rcvr, 50M Converter. Never d. Cost over $1,000. First $800 takes. Yager, Box 176, spect Heights, Illinois 60070.

L: EICO 730 transmitter $50.00; 720 modulator $40.00; be HG-303 transmitter $40.00; Globe V-10 VFO $35.00; licrafters receiver R-45/Arr-7 $75.00; Johnson "Challenger" .00; Lafayette HE-45 (b) with VFO $55.00; HE-45 (a) $45.00, lloscope Philco, S8200 3" $50.00. William Covert, 9 Long-w Avenue, White Plains, New York 10601.

-60 with HG-10 VFO $80. Perfect condx. Expertly assembled, h manuals & Cables. Will Shiop. Richard C. Vail, 2514 ch Dr., Richmond, Ind. 47374.

METER AM/FM/CW station. Heath Shawnee xcvr. GE FM rig 52.525 MC. 4-el beam, mic. All good cond. Package $200. Gerig, 23523 Paulding Rd. RRI Monroeville, Ind. 46773.

.T. Radio society desires to recover old QSL's and corre-ndence from 1MX and 1XM. Please send to W1MX, MIT dio Soc, Box 558, 3 Ames St, Cambridge, Mass. 02139.

NTED: Lafayette 2.1kc Mech. filter. Part #99F0123, S. mell, 2943 No. 73 Ave., Elmwood Park, Ill. 60635.

3-399, 75S1-300, 312B5-275, 51S1-1175, KwM2-700, SB610-, SB200-175, HO.10-47, HO-13-59, LK2000(BTI) Save, F. Baker, x 546, McComb, Ohio 45858.

ADE Clegg 22Er with clegg mike, never mobile for swan 250 A/C supply. F. Harmon, 314 No. Birch, Owasso, Okla. 055.

-348 Rcvr with AC supply $40. Iverson, 2640 So. 133 Rd., attle, Wa. 98168.

FER Edison Standard Phonograph (1910) with cylinders for 4 MC tunaverter. Write Christian Zangerl, 1 Nachbauer-asse 2B VBG, Dornbirn, Austria.

W Model 5100's, 135W. Am, 150W, CW, 150W, RTTY Factory dified for SSB(250W) $95. Heathkit SB10 for Above $45. P/S SB10 $7.50. All together for $140. J. Popkin, 134 Wheatley , Brookville, Glen Head, N.Y. 11545.

R SALE. Heath HG-10 VFO, $25, you ship. Wanted Galaxy III AC/speaker. Florida only. G. J. Cotellis, 1903-32nd St. W, adenton, Fla. 33505.

NERAL Radio Modulation monitor type 1931A, like new; make er, Carl Drumeller, 5824 NW 58th St, Oklahoma City, Okla. 122.

QSL's, SWL's, CB 10¢ N & S Printery, Box 11184, Phoenix, Arizona 85017.

"HOSS-Trader" Ed Moory promotes January Clearance sale on new equipment with factory warranty: Drake T4-X, $319.00: Drake L-4 Linear, $549.00: R4-A, $319.95: Package Deals: New EICO 3 Band Transceiver Kit, Model 753 and New EICO 751 Supply and Speaker, Regular price, $249.00, Cash Price, $169.95: Package Deal: New Mosley Classic 33 Beam and Demo Ham-M Rotor, $199.00: New Displayed Model BTI 2000 Watt Linear, $649.00: Demo Swan 500, $419.00; New TR-4 displayed model, $449.00: New NCX-5, $449.00: Special ROHN 50 ft. foldover tower, prepaid, $189.50: Demo Ham-M Rotor. $94.50: New Collins 75S-3B, $725.00; Displayed Swan Mark II Linear, $439.00: Fantastic Special, New National VX-501 VFO, $249.95, Cash Price, $139.00: Ed Moory Wholesale Radio Co., Box 506, DeWitt, Arkansas, Phone 946-2820.

WANTED: Reperf for model 15 printer, I am Handicapped from cancer, can not pay over $25.00 for working unit. Must be complete ready to install. Stewart Sheldon, 105 N. Broadway, Trotwood, Ohio 45426.

QSL. Second to none. Your personal combination from largest selection, glossy reds, blacks, calypso, pinecraft, vellum, and crystallon. All ink colors. Many card styles. Fast service. Samples 25¢. Includes your call in beautiful 4½ inch letters. Ray K7HLR, Box 1176, Twin Falls, Idaho 83301.

DISCOUNT Prices—Time payments. New equipment in factory sealed cartons. Swan SW-500 $430, SW-350 $365, SB-34 $360, Drake R-4B $375, T-4X $349.50, L-4 $599, Send for discount price quote on any type amateur gear. Payments as low as $10 monthly. No finance charge if paid within 45 days. New Ham-M rotator $99.95, Galaxy linear $391.50, complete selection of National, Drake, Swan, Galaxy, SBE, Hy-Gain, Mosley, Triex, New-Tronics, at discount prices. Reconditioned specials, HW-12 $75, HW-32A $89, NCX-3 $179, Ranger II $129, 32V-2 $129, Globe King 400 $79, Globe King 500C $199, EDWARDS ELECTRONICS, 1320-19th St., Lubbock, Texas 806-762-8759.

WANTED: NYC Electronic Distributor needs Conscientious man to handle counter sales, semi-technical correspondence and advertising, and stock merchandising. Electronic and/or Ham background necessary. Send resume and requirements to box BKE, c/o CQ Magazine, Port Washington, New York 11050.

WANTED: Full time sales representative needed to sell a quality line of nationally known two-way radio equipment in the North Central and Mid-Western areas of the country. Salary, commission, plus expenses; liberal company benefits. Ideal opportunity for Ham or CB'er with a knack for selling. Must be willing to travel. REPLY: Mr. Warren Whittle, P.O. Box 536, Baltimore, Md. 21203.

WRL's used gear has trial-trade back-guaranteed terms. SB34—$284.95; 650 & VFO—$89.95; HQ170AC—$239.95; HQ110A—$159.95; 753—$119.95; SB300—$249.95; SR150—$269.95; SX110—$99.95; SR46—$99.95; G76—$99.95; 75S1—$299.00; 62S1—$589.00; Thor 6 VFO $169.95. Request free "blue-book" hundreds more. WRL, Box 919, Council Bluffs, Iowa 51501.

DO IT YOURSELF—Build 40 foot crank-up tower under forty dollars. $2.00 for plans and specs. D and D Towers, 1007 Jan Lee, Burkburnett, Texas 76354.

MINT Galaxy V MK II, deluxe acces. console, AC35. Used less than 20 hours. Shipped in orig factory cartons. $450. M. Schwartz, 4608 N. Central Park Ave., Chicago, Ill. 60625.

T'BIRD JR. Tri-band with AR-ZZ Rotor, Head Skis(6'6"), Boots etcl will trade for Gun, Camera or what have you? S. A. S. E. WA5LKY—RT. # 1, Box 114-F, Long Beach, Miss. 39560.

FOR SALE: HR050 Ti with ABCDEF Coils & NBFM Adapter. like new. $125. T. G. Soukup, RFD # 3 Bob Hill Road, Ridgefield, Conn. 06877.

FOR SALE: Several unused 4CX250BS—$10 ea. 4CX250R's/7580W—$10 ea. 41EB's $300 ea. Samkofsky, 201 Eastern Parkway, Brooklyn, N.Y. 11238.

FOR SALE: Gonset GSB201, $200. G. Stillwell, 8114 Irondale Ave, Canoga PK, Ca. 91306.

QST, CQ, 73 and Printed Circuit Board. Bill Hayward, 3408 Monterey St, Joseph, Mo. 64507.

WANTED: Model 15 typing unit, also CV-89/URR-8. Sell or trade: model 14 1D, $45; T-23/ARC-5, $15; BC-733, $6. W. Bauer, 119 N. Birchwood Ave, Lousiville, 6, Ky.

TRADE: Complete Link lo-band f.m.base station for Model 15 RTTY in OK Condx. SASE for details. Prefer within 200 mi. S. Rudin, 807 S. Victor Ave, Champaign, Ill. 61820.

HEATH HA-10 KW Linear, like new, used very little, new tubes, Make reasonable offer. A. Emerald, 8956 Swallow Ave, Fountain Valley, Cal. 92708.

SWAP OR Sell; NC183D very clean with Prod/det Man/HB spkr. Want Vidicon TV camera prefer xistor type. Al, 594 Alderson St, El Cajoh, Cal. 92021.

HW 12 with HP23 Power Supply Clean. M. Morrisey, 752 High St, Harrodsburg, Ky. 40330.

WANTED. Cq Mag month Nov. 1962, to complete back to 1955. $.75 PP. W. R. Montgomery, P.O. Box 27, Gatun Canal Zone.

FOR SALE: Like new B & W 6100 $289.50 Good HW-12 $79.50. You pay shipping. R. F. Dukes, 834 Butler St., Bolivar, Tenn. 38008.

FOR SALE: Globe Champion xmtr model 300 A w/ manual. $85. Will deliver within 100 mi radius, otherwise F.O.B. L. DeWitt, 504 Page St, Avon, Ma. 02322.

FOR SALE: Like new B & W 6100 $289.50 Good HW-12 $79.50. You pay shipping. R. F. Dukes, 834 Butler St., Bolivar, Tenn. 38008.

WANTED: CQ, Volume 1, thru G ANd 1st ear of 73's mag. Will trade QST have hundreds of duplicates. E. D. Guimares Jr., 17 West End Ave, Middleborough, Ma.

NEEDED: Wireless valves, with brass or ceramic bases and others made before year 1920, especially need DeForest spherical "Audion" triode with candelabra type base. R. W. Schnedorf, 610 Monroe Ave, River Forest, Ill. 60305.

FOR SALE. Dual primary 1745-1745, 3490-3490 secondary at 1745 Va. Thordarson' Plate transformer $30. trade for 4-400's or transistors, etc. P. Rich. Box 1208, Cody, Wyo. 92414.

FOR SALE: Johnson T-R switch, Cat. $250—39 $15. DX-100, Vacuum tube keyer and relay switching to external SSB adapter. Manual included. $80. Express collect, B. Southwell, 200 S. 7th St, Dixon, Calif. 95620.

FOR SALE: Factory wired hunter bandit 2000 A. linear in excellent condx. which has worked over 300 Countries. $300. H. Krenek, 211 Hillwood Dr., No. Little Rock, Ark. 72177.

HEATH HO-13 Ham Scan—Professionally wired. First $50 takes it. Original coils on hand for all advertised if freqs. C. V. Detter, 133 Forrest Park Rd, Bartlesville, Ok. 74003.

TRY 420 mc; 2 Brand new BC-645 $8. each, both for $15, APR-13 $7.50 S. F. WADE, 15 Thicket St, S. Weymouth, Mass. 02190.

HI FI Fans: Paco SA-40 Stereo Amplifier, $59; Garrard RC88 Turntable, Wal. Base, Shure M7D CTG, $30; All exc Cond. R. Beatie, 1904 114 Ave, Tampa, Fla. 33612.

WØCVU will be there. ARRL National convention at Des Moines, Iowa, June 20-22 1969, A real way to enjoy ham radio. Chas. W. Boegel, 1500 Center Pt. Rd., Nʳ, Cedar Rapids, Iowa 52402.

NOVICE Station. Heath HR-10 RCvR, Dx-40 Xmtr, and Relay. All perfect. $100. Gus Lucas, 414 Durango St, El Paso, Texas 79901.

FOR SALE. 51J3 with out board Slicer the HT32B + Louden boomer linear (HT45) DRAKE R4A rec. All mint Cond. J. Modeste, 615 Casanofast, Box 10474, New York.

TWO'er Gud Cond. $35 witn Free Xtal. Want 14AVQ. Consider Trade. John, 1243 Sycamore St, Turlock, Ca. 95380.

WANTED: rpe -26 Non-typing reperforator cover assembly (102504) Chad Chute(86865), Gear(78509), Pinion(78510) and Table(4TXRT34). D. Digby, 3134 Tallmadge Rd, Kent, Ohio 44240.

FOR SALE: Drake R-4A Rcvr ex-like-new cond. A steal at $300. K. Neighgors, 121 Johnson St, Garner, N.C. 27529.

GE 30 Watt FM Mobile Transceiver, T-Powered, on 146.94 MC $75. QST's 1946-1958 25¢ ea. New James C-1470 power unit $25. W. Davis, 4434 Josie Ave, Lakewood, Calif. 90713.

COLLINS S Line for Sale: 30S1 $775: 32S3 with 516F2 PS $595; 75S3B $495; 312B4 Control $125; Hallicrafter HA-1 keyer $45. All Mint Condx. Rev. Paul Bittner, 814 4th St., So. Virginia, Minn. 55792.

HEATHKIT Apache TX1 Ex Condx. Low hours. $150 or best cash offer. Heathkit VFI VFO $15. Homebrew 1600 V. D. C. Pwr. supply 200 ma. $20. plus shipping. Plimpton, Box 334C, Rd. 4, Newton, N.J. 07860.

COLLINS 75A4-3KC Filter SN4151 VE Condx $400. W. Kumpost, 2246 Story Ave., Bronx, New York 10473.

HALLICRAFTERS S-120 Receiver, with Manual, original carton; very good condition, $45. R. E. Beatie, 1904 E. 114 Ave, Tampa, Fla. 33612.

WANTED: Back issues of CQ. Vol. 1—Jan thru Dec. 1945 Vol. 2 Jan thru May 1946. Don Scher, 11 Webster St, Irvington, New Jersey 07111.

NC-240D receiver with speaker. Very good Condx. $50. Pick-up only. Dick Nebek, 31 Whitehall Blvd., Garden City, N.Y. 11530.

FOR SALE: Pierson KE93 Receiver with Manual. AC/DC power supplies. Excellent $150. QST Magazines, 1956 thru 1965. Make offer and pay shipping. C. Supple, 3529 Corondado Ct., Ft. Worth, Texas 76116.

WANTED: FR-67/U Frequency meter or similar. State price & Condition in first letter. For Sale: Model 14 Teletype Typing reperforator, $40. Cooper, 834 Palmer Ave, Maywood, N.J. 07607.

PROFESSIONAL Loves to build but can't afford to buy. Will build for you at 10% of cost. 90 day guarantee. Richard Eckhouse, 87 Lincoln, Amherst, N.Y. 14226.

SHACK Cleanup Ultimatum by XYL or else. Sase for list of many years collection of bargain priced Goodies. BC454 new unmodified $15. Megeff, 5015 Weeks Lane, Flushing, New York 11365.

WANTED: Heath HW-30, Cheap, Write, Bernie Welsh, CMR B 4488, APO N.Y. 09057.

EICO 720, perfect, $60. 75A2, $175, Art 13, unmodified, nic $25. H. S. Allgyer, R.F.D.1 Box 149, Gnadenhutten, Ohio 4462

FOR SALE: Hallicrafters Sx-88 receiver in top cond. $295. Or Cost $675. Motorola 50B 2 mtr FM base station w/xtals f 146.94. $95. P. Ballinger, 1331 Concord Ave, N.E. Massillo Ohio 44646.

ANTIQUE Radios early ac vintage free, no more storage roo here. SASE for details. Wanted, National 1-10 receiver. J. Hill, 26107 Basswood, Palos Verdes Penninsula, Cal. 90274.

WANTED: Inst. manual for Viking I and 122 VFO. Will phot copy and return. Names McWain, 3309 Thomas, Midland, T 79701.

FOR SALE. 10-12 Lab scope with probes, $50. TO Keyer wi Key, $80. HDP-21 mike, $15. ID-22 electronic switch, $2 Jim 517 E. Emerson, Monterey Pk, Cal.

SWAP QST's Hve '36 thru '40 ese '45 thru '47 minus 2 mo Need '29 thru '31 es '63 thru '65. Also have a few old books Radio. K. Perry Mercurio, Kingfield Maine 04947.

SELLING Tr44 Rotor 3 E1, 3m. Yagi. 75,40,15 meter mob antennas. Compreamp Rev. G. Gargiulo, 160 Elm St, No Have Conn. 06473.

SELL Heath Warrior HA-10 Linear $140. Wollensak T-1500 ta recorder $65. Manuals. Excellent. Ship F.O.B. Need drake, Sw or Galaxy 5-band xcvr AC/DC. C. Cordioli, 982 Bonneville W Sunnyvale, Ca. 94087.

FOR SALE or Trade, KWM2, SB100 with power supply a speaker. Want Collins S line, C. Johnson, 501 W. Sears Denison, Tx. 75020.

WANTED: non working or Damaged HW-32. M. Ludkiewicz, 1 Richmond Rd., Ludlow, Mass.

SWAP: CQ Mar 45 or Mar 46 for May 45, Aug 45, Nov 45, Jan 46. Rob. Amos, 4301 Usange St, Beltsville, Md. 20705.

SELL Drake TR-3 with RV-3 vfo and AC-3. T.O. Keyer, HO- scope, TH-3 beam. All exc. condx. $550. May trade down good Drake rx. D. Bell, 2437 Rulla Ct, Dayton, Ohio 45439.

FOR SALE: Galaxy V, A.C.35 Power Supply ex cond. Both $3(Prefer local sale. H. Woods, 2346 Clover Lane, Northfield, 60093.

HELP! Need tech manual or circuit diagram for T464/ALT Will buy or copy and return. Also want SB300 Rcvr. J. Beist 3728 Wilkie Way, Ft. Worth, Tex. 76133.

FOR SALE: Unused 4CX1000A, Chimney and Socket $100; Glo V-10 Vfc $30; Glove HG303 $35; Heath GR-54 Rcvr $75; Laf ette Precon HE-73 $35. J. Ross, 1244 Crim Rd., Somervil N. J. 08876.

THRULINE Mod. 43 Wattmeter; Few Calib. Meters for Sa & Line Sections. $15. C. Spitz, 1420 S. Radolph St, Arlingt Va. 22204.

SELL: LM Meter $40. ARC-1 Xcvr $15. Surplus 2000 McR $15, Radar Scope 60 cycle $15. M. Rummel, 117 S. Dill Munice, In. 47306.

BC-779A unmodified, speaker, home-brew power supply, m ual—$60. Bud LF-601A low pass filter—$12.50. Both F C. Rhines, Box 1052, Elko, Nevada 89801.

WANTED: ARRL Book Hinks & Kinks Voll 1. Gladly pay g price. Please write, Sam, Box 308, Wrightwood, Cal. 92397.

CANADIANS: Want top quality general coverage receiver model 80 signal' generator. R. Fransen, 227 Cottonwood A Sherwood Park, Alberta, Canada.

SELL: HRO w/100-1000Kc Calibrator, nine coils 50Kc to 54 perfect $325 or will trade for SSB Transcvr or UR388 R S. Lipsky, 15 Chemung Pl, Jericho, New York 11753.

RTTY Mod 19 excel cond. 14 TD, Perf, printer, table, PS complete $150 C And C. Parts avail also. A. Finley, 8 King's arm Dr. Alexandria, Va. 22308.

CANADIANS: Selling Hallicrafter SX-100 General Coverage Recvr $150. Wanted-Sine and/or Square Wave Generator p sweep generator. D. Wismer, 260 Frederick St, Kitchen Ont., Can.

NEW IP69/ALA2 VHF Panadapter; New Zeils Compact Came 35mm, f2.8 Tessar; Petri f2.8-½ frame pocket camera, stro 2-CB Walkie Talkies, Want Norelco 150 Carrycorder, SB33-ne not work. C. Benson, 732 S. 14th St, Richmond, Ind. 47374

SELL or Trade HQ180A, HT32, B & W Linear—Want Zeuss Interceptor—List for SASE—J. B. Forman, General Elect 570 Lexington Ave, New York 10022.

SELL Solid state power supply, cable, terminal box. page QST Jan 1965 $26. B & W 1 KW 72 Ohm low pass filter 2 new Triplett milmeters $3 ea. G. Countryman, 75 E. Bay Charleston, Sc. 29401.

COLLINS 30Li with 572B's in final $350, 312B-5 $250. Ham Rotor and Control $60. Viking 6N2 VFO $15., vibroplex or inal deluxe $15. SB-300 with CW Filter and SB-600 $225. immaculate, FOB phoenix. A. Schade, 7026 N. 11th Phoenix, Ariz. 85020.

DRAKE 2B $170, Warrion Amplifier 1000 W. Pep $150, Heath QFL, Q moltiplier $7. WRL VFO 755, $15. All fob Spark, Nick, 5750 Yukon Dr, Sparks, Nev. 89431.

SELL: IRE-IEEE Proceedings-'42 thru '67. RCA review '46 thru '67. Make offerO—you pay shipping. Horace Marrina, 312 Wildewood, Terr. Oklahoma City, Okla. 73105.

FOR SALE: APR-1 receiver. 40 to 1000 mc. APR-5A receiver. 1000 to 3000 mc. Make offer. V. Barker, West Drive-No. Haven, Sag Harbor, N.Y. 11963.

WANTED: 2.1 kc or 1.5 kc mechanical filter for use in a 75A4 receiver. P. Uehling, 512 N. 4th Ave., Onalaska, Wis. 54650.

FOR SALE: Heath Chippewa KL-1 linear with KS-1 power supply. A. Martinka, 3723 Magnolia Ave, Chicago, Ill. 60613.

WANTED: Heathkit rcvr Mr-1 or HR-20 write; J. Brown, Box 697, Gravelbourg, Sask, Canada.

TELETYPE-Cover for model 28 ASR(LPBC) Exc, with base, glass, copy holder, transformer, complete $27. J. Thomsen, 8280 S. Tennessee, Clarendon Hills, Ill. 60514.

VHF/UHF Amateurs wanted in Southern California area to be active in VHF contests. AM/CW/SSB, all contacts appreciated, schedules accepted. D. Etheredge, 12040 Redbank St, Sun Valley, Cal. 91352.

WANTED: AM setting up a ham station and would like to purchase ham gear in any condition as long as price is reasonable. T. Dornback, 19W167 21st Pl., Lombard, Ill.

FOR SALE: Wheatstone oiled 15/32" perf. tape for Boehme Keying Head, any quantity. P. L. Lemon, 3154 Stony Pt. Road, Santa Rosa, Cal. 95401.

SELL brand new Hallicrafters VFO model HA-5. Make me a reasonable offer. E. Colliau, 711 Fair Oaks Ave, South Pasadena, Calif.

GALAXY V, AC pwr supl, xtal calib, spkr console, fb cond. $420, shipped prepaid. D. Crowell, 314 E. Main, Ada, Oklahoma 74820.

$1 brings construction data for the new & unique barb wire ant. a lowcost easy to assemble application of the fat-ant. enterprises. P.O. Box 444, Montebello, Cal. 90640.

WARRIOR Linear $140. Wollensak recorder $65. Lot $200. Manuals, excellent. Shipping FOB will trade-in good 5-band transceiver with ac, dc. Cofdioli, 982 Bonneville Way, Sunnyvale, Cal. 94087.

TUBES: 4X150 A's Brand New. RCA Sealed Moisture Proof Containers. $9.25 ea. Pre-paid USA. B. Glassmeyer, 8 Vawter Pl, Hillsboro, Ill. 62049.

CANADIANS: Want top quality general coverage receiver, also model 80 or similar Sig-Gen. Bob Fransen, Box 197, Sherwood Park, Alberta, Canada.

BARGAINS: Excellent—hardly used—SB-400 $280. SB-33, DC Inverter and mike. $190. Volkswagon 6 volt HP-13 mobile supply $50. Heath HR-10 RX-$65. BC-348 and manual $40 much more—stamp for list. J. Shank, 21 Terace La, Elizabethtown, Pa.

FREQUENCY Standard, 10Kc, 100Kc and 1000Kc Model 18-A, $22.50. Scope Calibrator, $12.50. Electronic Switch, $24. J. Boer, 449 Hill St, Boonton, N.J. 07005.

HEATHKIT Apache Xmitter & Mohawk Rcvr. $100 each or both $185. Both Excellent cond. Richard Harker, 2747 N.E. Portland, Oregon 97212.

FOR SALE. Sacrifice: Eico 720,730-Plate Mod. 90 Watts C.W. 65 watts A.M. Plus Knight VFP and Lafayette HA 350 Almost new. All relays. Complete station. Must see to appreciate. $265. takes all you pay shipping. Mike Mardit, 10 Maple St, Brooklyn, New York.

FREE Xtals with two'er, gud $39 also clean DX-100 $69. or consider trades. Will deliver within 200 miles of S.F., J. Daiamo, 2223A 19th Ave, San Francisco, Cali. 94116.

WANTED: ARRL Handbook for 1952 and 1962 must be good condx. Ralph Dorough P.O. Box 61, Terrell, Texas 75160.

WANTED old radio magazines such as Modern Electrics, Electrical Experimenter, Pacific Radio News, RADIO, Radio News before 1935. Handbooks, call books etc. Erv Rasmussen, 164 Lowell, Redwood City, Cal. 94062.

F.M. 100W 2 meter base station $85; QST's 1946-1958 25¢ each; G.E. 30 Watt FM Mobile T-Powered on 146.94 mc $75. W. J. Davis, 4434 Josie Ave, Lakewood, Cal.

WANTED: Unused pair of 4-400A Tubes. C. Fouse, P.O. Box 2, Washington, W. Va. 26181.

THUNDERBOLT, Late model, mint condx with power swamper. $295. Will ship prepaid. Don Woodruff, 15 Castlewood Dr., San Rafael, Cal. 94901.

DRAKE R-4 for sale, $290 or darkroom equip. plus cash. Pete Lammers, 1957 Thornapple Ave, Akron, Ohio 44301.

SALE best cash offer or swap, Antique Patterson PR-10 Circa 1930's 10-BC Bands receiver & uncased speaker. Early Allband comm. ham rcvr. Works. Cndx not bad. Vic Beale, 9924 Hambelton, Divonia, Mich. 48150.

DAGE Vidicon camera, 17" Miratel monitor, turret with 3 lens capacity, 1 lens inc. $300 or swap for SB34 or other xcvr. Roy Cone, 7007 Sheridan Rd, Chicago, Il. 60626.

WANTED: Plate xfrmr for P & H LA400C. Orig. was #A840B. 117c pei., abt 1200-0-1200 c.t. @ 350 ma. Size 4" by 5", abt 5" hi. B. Lindbloom, 512 Grandview, Chillicothe, Mo. 64601.

WANTED: Dial plate & Knob for B & W 850 Coil. Sell 1% Precision resistors, 15/$1. P. Greenway, 234 Elden Dr, N.E. Atlanta, Ga. 30305.

WANTED: Tech manual or schematic for Kahn Research Lab Model RSSB-59-1A or GB Type ANRR-48 (XW-1) receivers. B. Mahrenholz, 307 Old Fort St, Tulahoma, Tenn. 37388.

WANTED: Knight T-175 Linear Amp. or Sonat BR-21. For 10 mtrs. Please state everything in letter. J. Izarelli, 512 Fox St, Joilet, Ill. 60432.

SELL: NC-173 Receiver, Good, $65. or best offer, Knight T-150A transmitter ex. $75. or best offer. R. Neal, 2802 Irwing Rd, Huntsville, Ala, 35801.

WILL except best offer on a Clegg Venus-Apollo linear-Booster-Power Supply/Speaker. H. L. Snyder, 2185 Sampson St, Pittsburg, Penn. 15235.

ANTIQUE Edison Disc Phonograph plus 21 Diamond disc. regeneration records Prod. at Edison Labs, Orange, N.J. Have other records in the 1930's. B. Bason, 31 Whittier Ave, Somerset, N.J. 08873.

SBE34 for Sale, New, complete with cables & manual, in original carton, $295. S. Cohen, 4524 Michigan Ave, 1 Miami Beach, Fla. 33140.

DRAKE R4 $300-NCX5 Ten Meter Xtals(3) $10. Roberts loss stereo tape recorder $175. All mint condx. J. Heffler, 2200 Morris, Bronx, N.Y. 10453.

WANTED: Collins, PM-2, GG-2, 5i6F-2, 312B-4, 312B-5 other "S" Line accessories. Heinlein, 107 Wyoming, Boulder City, Nevada 89005.

75A-4 wideband filter per Jan. 1964 CQ page 50. 6.8 kc-6 db/23 kc-60 db bandpass. Exactly like picture. $12 prepaid. W4FUI, 260 Oak Hill Rd, Rt. 2, Candler, No. Car. 28715.

KITS ASSEMBLE-by electronic Engr., licensed since 1928, now Extra Class. Meet mfr. specs or no charge. Low rates. E. Knowles, 2510 Tune Pl, Lancaster, Cal.

FOR SALE: Gonset Triband converter (10-20-75M). Excellent Condx. $15.;' Heathkit FM Tuner, VTVM, $14 ea. 5 inch scope, $20. J. LA Manna, 3581 Wasatch Ave, Los Angeles, Cal. 90066.

RME-50 Rcvr. .55-30MC with NBFM adapter and manual, less spkr. $39. Sell knight Star Roamer, mint cond. New Kit costs $45. Sell $35. Will mail COD Any usa. J. A. Jamine, US Navy Electronics & Supply office, Great Lakes, Ill. 60088.

HEATH DX-60 $50, VF-1 $15, both excellent condx with manuals. Hallicrafters S200R rcvr with manual $20. You pay shipping. Chas Skilaut, P.O. Box 79, Olmitz, Kans. 67564.

WANTED: June, July and Dec. 62 73, Also March and Dec. 63 73 Magazine plus Jan and March 61. State price and condition. B. Fleitman, 412 E. 80 St, Kansas, Mo. 64131.

HW12 A, DC power, mike & Spkr all Heath and like new. $150 for all. E. Stoughton, 520 Locust St, DuBois, Pa. 15801.

FOR SALE: Complete set CQ to March 1967. Mint condition $125. Col Marcy, 461-3rd Ave., Sea Park, Eau Gallie, Fla. 32935.

WANTED: 32S-3 with power supply and Gonset 2 meter VFO must be mint. Prefer seller within 100 miles. Contact Snyder, 1839 Port Clinton Rd, Fremont, Ohio 43420.

WANTED: APX 6, Matti Niemela OH 1 VC, Linnankatu 53 E. 170, Turku, Finland.

NEW Hallicrafter PS-150-12 power pack in unopened carton $50. Gene Hubbell, 6633 E. Palo Verde La, Scottsdale, Ariz. 85251.

FOR SALE: NCX-3 150; NC-300 $120; Nick Berg, 1115 Ogg West, Madison, Wis. 53706.

FOR SALE: Heathkit Two-er with Lawrence receiver modification, 6 volt Mallory pack included all for $45. E. Marriner, 528 Colima St, LaJolla, Cal.

WANTED To Buy: 2-meter FM Transceiver. Prefer Motorola 2 channel unit. R. Zuccarello, 3104 Harrison, Glenview, Ill. 60025.

GONSET GC-105 meter communicator $140. BC-639-A Receiver 100 to 155 MCAM $45. Heath 6 mtr converter SBA-300 New $14. L. Amundson, 465 N. 18 Ave. E. Grand Forks, Minn. 56721.

LETTINE 6N2 VHF Transmitter with VFO, xtals, & Filter. Excellent $90. 6N2 beam $10. J. Marino, 34½ Park Ave, Caldwell, New Jersey 07006.

PROFESSIONAL-Type 140 watt stereo amp 4 sale; 8 1625s, 2 70w outputs, 2 1500vct xfrmrs, fail lites, etc. Best over $110. FOB Appleton, Wis. ENA, 204 W. Wing, Arl. Hts., Ill. 60005.

SWAP: New 4CX1000A socket or 4CX5000A socket for new tube. Blair, 8063 W. Glen Rd., Norfolk, Va. 23605.

SELL: xclnt kwm-2, 312-5, 516F-2, Waters tuning. $950 firm. Will ship collect. Going RTTY. L. W. Cunningham, 64 Stull, Kincheloe A.F.B. Mich. 49788.

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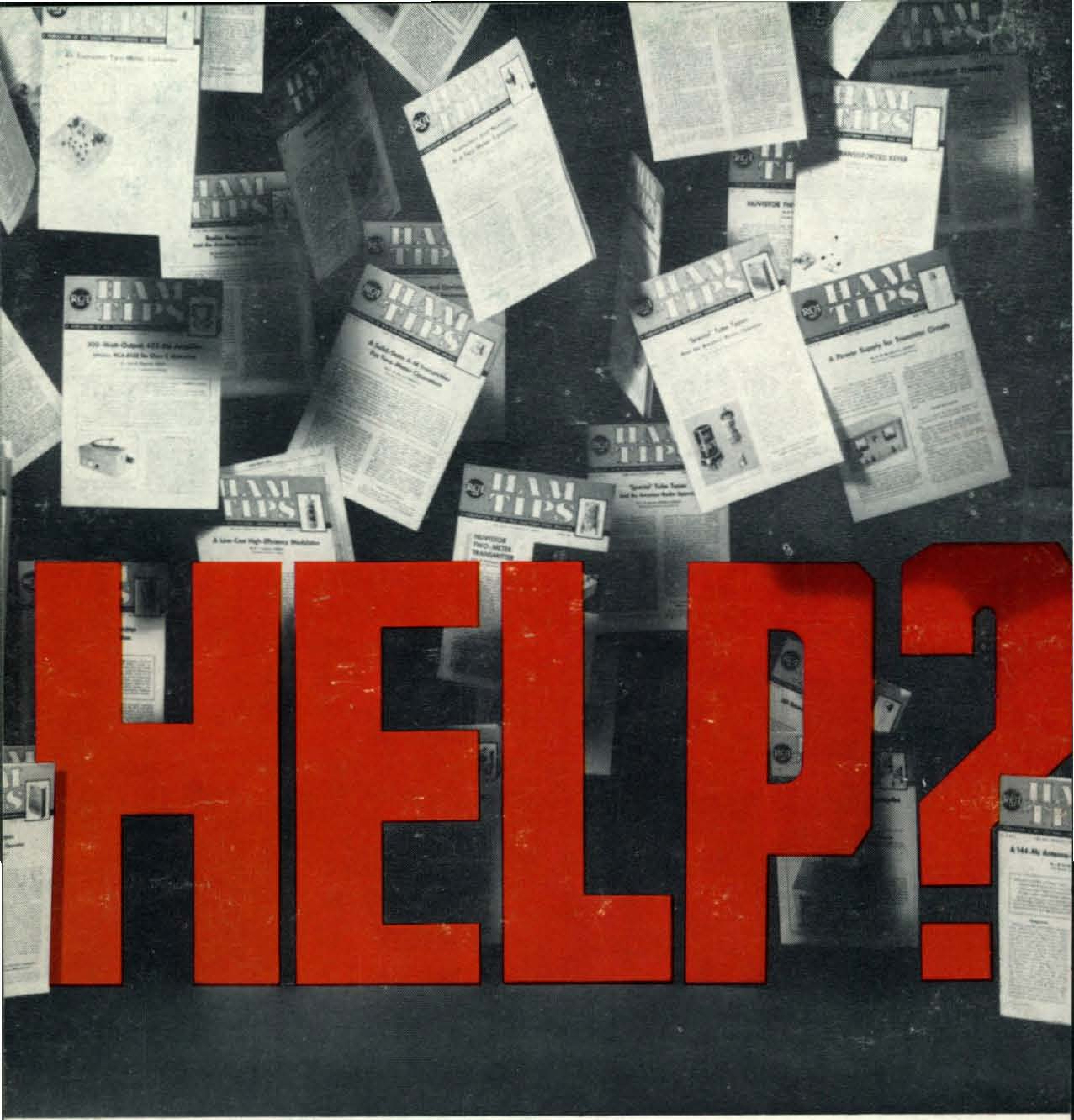
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