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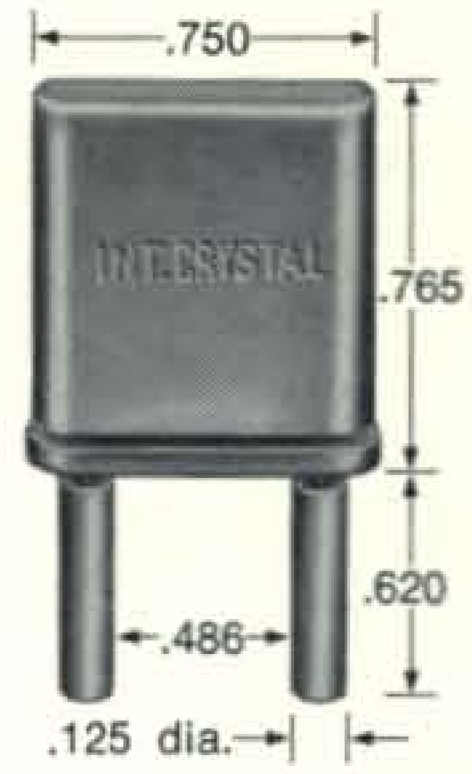
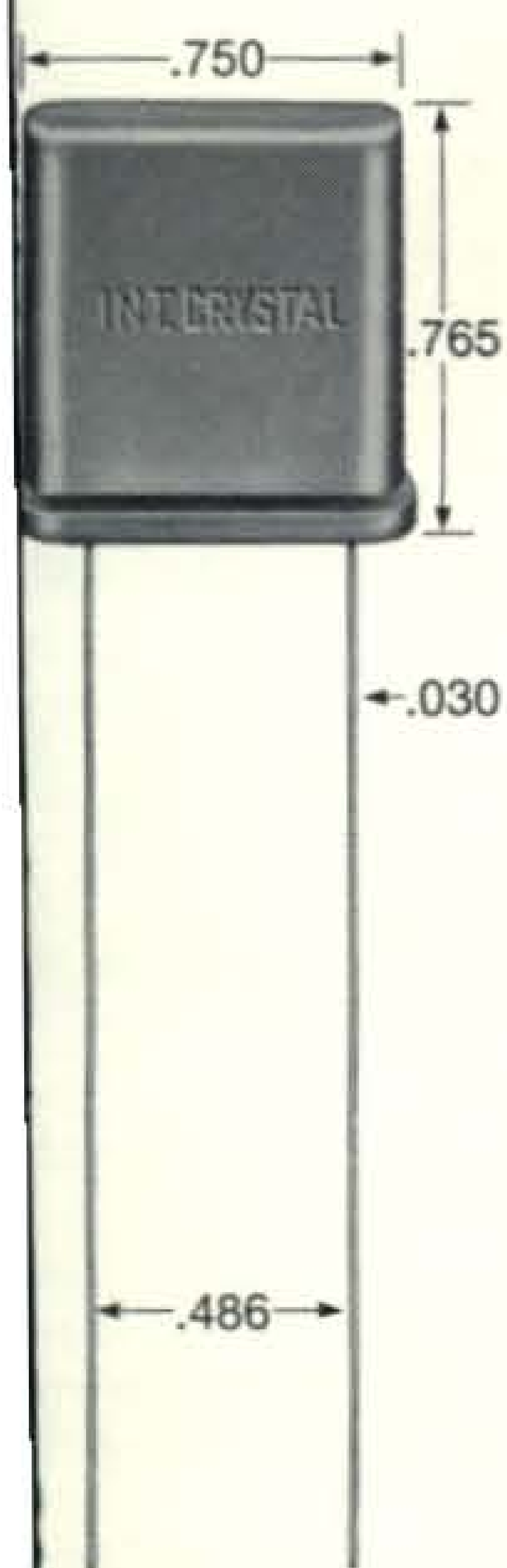


F-612

FM-2



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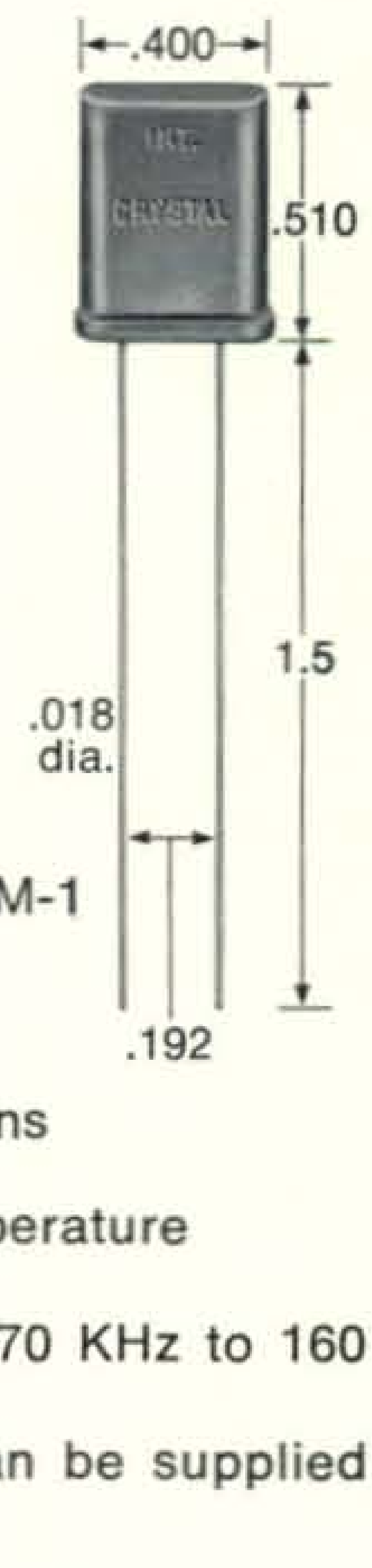

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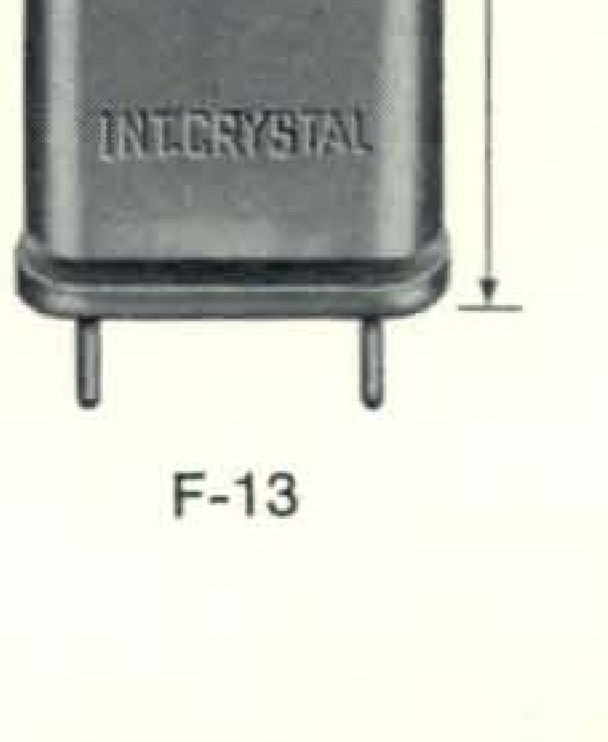

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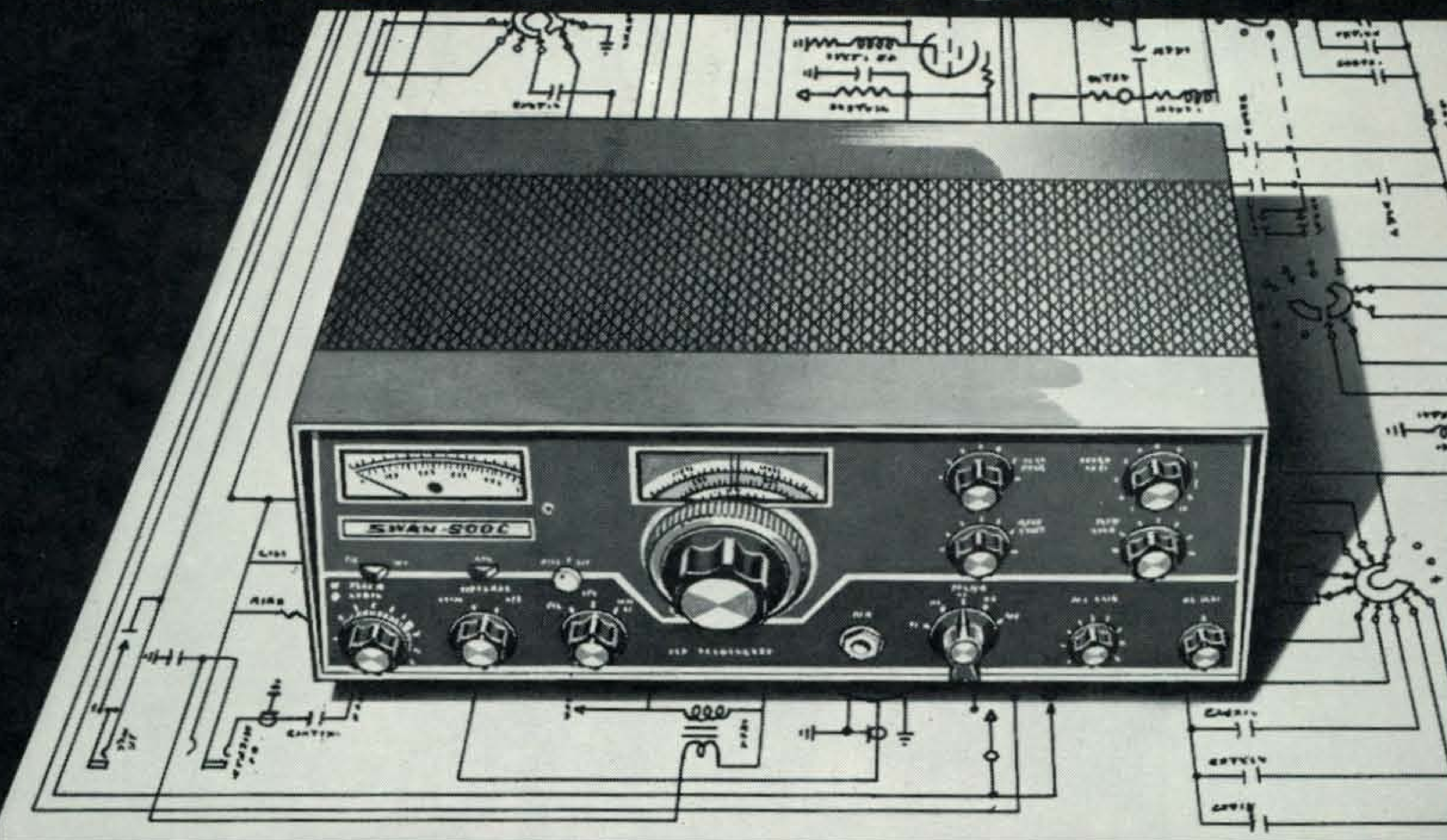

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The new model 500C is the latest evolutionary development of a basic and well proven design philosophy. From the very beginning, with the introduction in 1961 of the first single band SSB Transceiver, Swan has followed a steady course of improvement by evolution. You might think that we would finally reach the point of leaving well enough alone, but with some 18 licensed hams in the engineering, sales and production departments of our organization, it just isn't possible. Thus, the new model 500C, with greater power and additional features for even more operator enjoyment.

RCA recently introduced a new heavy duty "blast rated" tetrode, the 6LQ6. With a pair of these rugged tubes the final amplifier operates with increased efficiency and power output on all bands. PEP input rating of the 500C is conservatively 520 Watts. Actually, an average pair of 6LQ6's reach a peak input of over 570 Watts before flat-topping!

Further refinement of the famous Swan VFO results in even greater mechanical and thermal stability and more precise dial calibration. Custom made planetary drives, machined to extremely close tolerance, provide velvet smooth tuning.

The 500C retains the same superior selectivity, of course, that we have been offering. The filter is made specially for us by C-F Networks, and it's no secret that it is a better filter than is being offered in any other transceiver today. By moving the I.F. to 5500 KC, and increasing the number of tuned circuits in the receiver, we have achieved substantial improvement in image and spurious rejection. These improvements, coupled with additional TVI filtering, result in what we believe is the cleanest transceiver on the market.

For the CW operator the 500C includes a built-in sidetone monitor. Also, by installing the Swan Vox Accessory (model VX-2) you will have break-in CW operation. Thus, the model VX-2 now fulfills a dual function, both automatic voice control and break-in CW keying. Grid block keying of a pure CW carrier is employed with off set transmit frequency.

The 500C embodies the Swan's well known dedication to craftsmanship, performance and reliability, with a service policy second to none. When you visit your Swan dealer and look over the 500C, we are sure that you will be glad we couldn't 'let well enough alone.' **$520**

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CQ

FEBRUARY, 1968 VOL. 24, No. 2

The Radio Amateur's Journal

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OUR READERS SAY

Integrated Keyer

Dear Dick:

There are a few errors or omissions in my schematic for the Integrated Keyer in the December *CQ*.

First, IC_6 has the pins 8 and 4 reversed. Pin 8 is +3.6 and pin 4 is ground. Also, pin numbers are missing for +8.6 and ground on IC_4, and pin 4 (ground) is missing on IC_7. Most readers have figured this out in the letters I received. One omission they are not catching is the .005 mf capacitor in series with the DAH reset line (between pin 1 on IC_6 and the DAH reset) should be similar to the DIT reset.

Thanks again for your treatment on my article and if you can, I would like to have the photos.

Jack Burchfield, W8CRP
Buchanan, Mich.

Good Hams

Dear Editor:

A recent free *CQ* Ham Ad "Wanted Instructograph and Wireless Code Tapes" got very good results. The first response was a package containing a windup instructograph and two high speed tapes. It was from Chris, W4WRJ, in Sterling, Va. who asked only that we keep the machine in use or pass it along to help someone with the code.

Among the many other offers to sell code equipment, was one from John, WB4FXY, Lascassas, Tenn. John *gave* us an electric drive machine needing some minor repair, and a full set of tapes.

At present, my children are using one machine and a friend, who hopes to get a ticket, the other.

After being taken in on a purchase-by-mail several months ago, this ad helped restore my faith in my fellow men.

Curt Fouse, K8UZX
Washington, W.Va.

Have You Any Spare Gear?

Editor, *CQ*:

I have read with interest numerous articles on the idealogy of donating ham equipment to poor residents in underdeveloped countries in order to get more DX countries on the air. We do have a couple of hams locally; they are either American Jesuit Missionaries or American visitors/business people.

How do I, a poor missionary school teacher, with a wife and three kids, on $50 U.S. per month, ever hope to buy a ham rig? Nearly all our work here, for locals is either voluntary or poorly paid and is part of dedicated devotation to the needs *of our* country and its people.

Tell me *please*, is it really true, that it is possible to get a complete ham rig, with antennas donated? Are there really such things happening in the world?

To forstall questions, Yes, I can be licensed locally and *quick!* Yes, I have a 1200 watt, 110 v. generator (donated by Jesuit American Missionaries two years ago!) Yes, I can operate a rig and have technical experience to operate, set up and maintain. Yes, I have no money and *cannot* pay duty on gift through customs (36⅓%). It would be equivalent to 5 months of my salary.

Any preference in my optimism? Yes—s.s.b.—20 & 40 meters, phone rig & rotating (by hand) beam antennae, but will take absolutely any gift.

Even *CQ* has been donated to me (old copies), by American tourists who have passed through and remembered me on going home. Thank God!

Gratefully & Hopefully to American Friends,

Ray Auxillon
Volunteer Director,
Gear Research Station
Box 451
Belize City
British Honduras

Somewhere among our readers there must be someone who has both the spare gear, and the know-how to get it to Ray at no cost to him. What say, fellows?—*Ed.*

Loyal Opposition

Dear Dick:

I was pleased to read your comment about ARRL in the November issue of *CQ*. I've been a ham for about 12 years, though inactive for the past 3 years or so. When I first joined the ham ranks I joined the ARRL, but resigned after about 5 years. There is no question that ARRL, through the services they provided, were of great help to me—more so than *CQ*, although I have always enjoyed your magazine.

But you are entirely correct, in my opinion, that ARRL takes more credit than is their due. I still recall something about an ARRL creed, saying that hams owed their hobby to ARRL and thus owed ARRL their allegiance.

CQ, over the past few years, has disappointed me by "following the ARRL line." I was disappointed because I felt that ARRL should be knocked off their high and mighty pedestal and that *CQ* was the one to do it.

I hope you will continue to praise ARRL when it is due them, but will also take an opposing point of view when such is warranted.

Art Samuelson, WB6MOV
San Francisco, Calif.

Announcements

Penn. VHF Contest

The Southwestern Pennsylvania VHF SSB Club is sponsoring a v.h.f. contest on Feb. 10-11, 1968 from 1700 GMT Saturday to 1700 GMT Sunday. The contest is a single-operator only contest for all bands 50 mc and above. Exchange con-

See page 110 for New Reader Service

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PHONE: 405-232-1431–TELEX: 071-361–TWX: 910-831-3175 sists of calls, ARRL Section, and time in GMT. A Section counts only once regardless of how many bands it is worked on. Club station W3KWH will be on 6 and 2 meters for the full 24 hour period. The highest total score brings a handsome trophy. Logs go to Gary Cooper, K3MPY, R.D. 1, Eighty Four, Pa. 15330.

North Jersey DX Roundup

The North Jersey DX Association is sponsoring its Annual DX Round-Up on Saturday, March 23, 1968. This is the Saturday following the IEEE Convention in New York and it is expected that many out-of-towners will find it convenient to attend.

Site of the Round-Up is the Holiday Inn, Wayne, New Jersey at the intersection of Route 46 and Route 23, just 30 minutes west of the George Washington Bridge. The afternoon program starts at 2 P.M. and banquet at 7 P.M. Further details are available from W2PXR, Walt Knoop, 11 East Greenbrook Rd., North Caldwell, N.J. 07007.

Ham of the Year Award

The Federation of Eastern Mass. Amateur Radio Associations is now accepting nominations for the 1968 John Mansfield Memorial Award "Ham of the Year". Only licensed amateurs in the first call district are eligible for this award and the candidate must be able to meet any one or more of the following qualifications:

1. Performed a meritorius public service to his community through amateur radio.
2. Made a major contribution to the science of amateur radio.
3. Helped greatly to stimulate interest in amateur radio in others.
4. Aided other radio amateurs to acquire a greater knowledge and skill in operating or building amateur radio equipment.

The winner of this award will be presented a plaque and a cash award on June 1, 1968 at the New England ARRL Convention at the New Ocean House, Swampscott, Mass.

Send all nominations to Eli Nannis, W1HKG Chairman Awards Committee, 37 Lowell St Malden, Mass. 02148. The closing date is Apr 26, 1968.

Gary, Indiana

The Lake County Amateur Radio Club, Inc announces its 15th Annual Banquet to be held a Teibel's Restaurant, U.S. 30 and 41, at 6:30 P.M CST, February 13, 1968. Prizes, chicken, entertainment, speeches. Plan to attend with your wif or girl friend. Tickets are $4.00 each from Herbe S. Brier, W9EGQ, 385 Johnson St., Gary, Indian 46402. Sorry, positively no tickets will be sold a the door.

International Convention

The Second International Convention of Radi Amateurs of Spain, Zaragonza Spring Festiva will be held the 23, 24, 25 and 26 of May 1968.

Applications for complete detailed informatio and enrollment cards are available from: Delegacion URE, Apartado 86, Zaragoza. Enrollmen will be accepted up to the 15th of April, 196

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Deer Hon. Ed: Feenix, Ariz.

Have you been listening on air resently, and heering all the to-do about insentive licensing? Hokendoke Hackensaki—you thinking end of world are coming if you listen to some amchoors talking.

Scratchi wondering if these fellers who worrying so much about insentive licensing are reely red-hots concerned, or are they talking about it on acct. they not having anything better to ragchew about?

At least, I not heering about any amchoor who so concerned that he publicly burning his amchoor radio license! No indeedy—they holding on to what they got. And, they talking like furies about what they are losing. Hah!

It all kinda making Scratchi hot under Hon. Collar. So much so I like to kicking about the various "pro's" and "con's" of insentive licensing. Only "con" I can thinking of is losing a few freakwencies. Sure enough—fellers who can't get Hon. Advanced or Hon. Extra Class license are going to find that there are few freakwencies on each band he can't QSY'ing to.

Big deel. Feller can only using one freakwency at a time anyway. Of coursely, it may be a little crowded on regular, anybody-can-get-on-'em freakwencies. But what's a little more QRM? If it gets too bad a feller can either pull the big switch, or start doing a little studying so he can moving up to Hon. Advanced or Hon. Extra type freakwencies.

And most of these fellers I heering sound like they thinking insentive licensing are something new. Hah! Double hah! Back before most amchoors being born we having insentive licensing. Good old class A license. If you wanted to have rig on reel peechy fone bands in the old days—20 and 75 meters—you having to get class A license.

Hon. Ed., you may not remembering QRM on 20 and 75 in those days, but it were fierce. Seemed like all amchoors being class A license holders. As it turned out, some forty percent were holding class A tickets. In fackly, we having this reel neet insentive licensing system until 1952, when FCC desiding to letting just anybody on 20 and 75.

Yes indeedy—I can thinking of only one "con" to this. Howsumever, there are some reel slicky "pro's" to insentive licensing. First of all, you getting to operate on freakwencies where QRM not too bad, and you can talking to other amchoors who bothering to do a little studying, and who maybe knowing difference between p-n-p and n-p-n.

I not saying that are any big deel—knowing difference between p-n-p and n-p-n. Howsumever, there are lotsa guys on air that not knowing difference!

Another nice benefit are that you leerning more about amchoor radio. Besides, I can't buleeving new test are all that difficult. It not like going for your Hon. PHD. Hokendoke!! I'll bet if fellers who doing all the complaining, and using that time to studying, they passing new test in no time.

OK—so I'm a sentamentalist. I'm even glad we not getting special call signs. Who else cares if you are Hon. Extra Class amchoor! Heck, anybody who wants to brag how grate a guy he is can buying lapel button saying "Geenyus" on it at any novelty store. That not meening he a geenyus.

And, oh sure, it takes reeding see-w at 20 WPM to getting Hon. Extra license. It's tough, you say? Maybe so. It's not supposed to be all that easy. Look at it another way. Twenty words a minute is only one word every three seconds. You gonna let a little thing like that stop you? One word every three seconds! Most year-old babies talking faster than that.

Hon. Ed., I sorry I getting so all-fired-up on this insentive licensing bit. Scratchi generally a live and let live kind of guy. So, let the other guys wail and weep—I'm sliding the weights out a bit on the bug and practising on the air so I getting my code speed up a cupple of notches. Also getting out the textbooks and starting to read up on some more theory, so can going out after that Extra Class license.

The other fellers that don't want to bother to do that—well, maybe they don't deserve to be Hon. Extra Class license holders. Hey—Hon. Ed—maybe that's the idea behind this hole thing!

Respectively yours,
Hashafisti Scratchi

See page 110 for New Reader Service

 See page 110 for New Reader Service

The K9LAJ Addaverters

Modular Construction for Simple Converters and Preamps

By DAVID F. PLANT,* K9LAJ/2

STATE of the art electronics usually finds the development of circuitry well ahead of improvements in mechanical design. Recently, the mechanical end took a long needed step forward, in the shape of a newly developed chassis type enclosure by the Sarex Corporation.

Called the Mini-cool,[1] the unit slips completely apart allowing access to circuitry not possible before, the result being a more compact piece of equipment which is easier to service. The heat-sink-style end plates are interlocking, and allow the add-on feature of the Addaverters, described here.

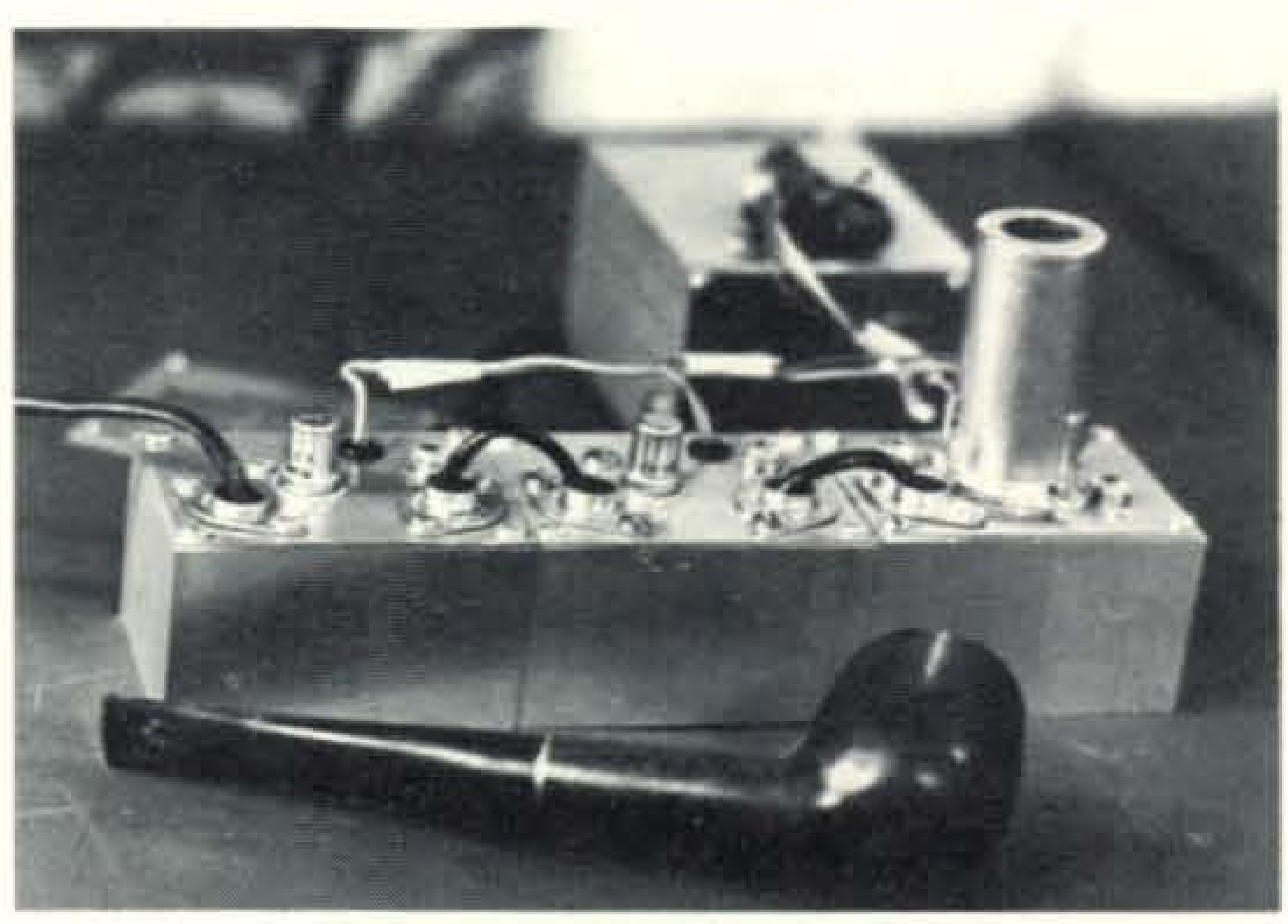
Electrically, the Addaverters consist of a basic converter module for the 15, 10, and 6 meter bands; and two types of preamplifiers covering 15 through 2 meters. Each preamp is compatible with the basic converter, and preamps may also be placed in series for additional gain. The converter module may also be used barefoot—with a preamp added later if desired.

The Basic Addaverter

The basic converter unit consists of a pentode mixer with an untuned output, and a triode oscillator. These functions are combined in the 6U8, V_1. The same circuit, with appropriate changes in the tuned circuits, is used on 15, 10, and 6 meters.

Referring to fig. 1, r.f. to the input is coupled by link. L_1 to the tuned grid circuit consisting of L_2 and capacitor C_1. This circuit is resonated to the desired band. The 50 mmf capacitor between the mixer grid and its tuned circuit is used to minimize loading, consistent with good signal transfer.

Noise generated in the mixer stage is kept to a minimum by keeping the screen voltage low, hence the use of the 100K screen resistor. The plate load is left untuned so the i.f. output can be changed without modifying the converter when a different tuning range is desired. A great deal of experimenting was done, by the way, to try to match the high output impedance of the mixer to the low



This three-unit package houses two 6-meter grounded-grid preamp stages and a 6U8A mixer/oscillator comprising a 6-meter Addaverter. The combination gives sufficient gain for most 6-meter situations and stability on a par with many medium priced receivers. Small diameter coax cable is soldered directly into chassis-mounted Motorola-type connectors rather than using individual connectors. Interstage connections could be made more efficiently through holes in the common chassis sides as shown in the 2-unit 10 meter model.

* 5 Weehawken St., New York, N.Y. 10014.

[1] See New Products *CQ*, December 1967.

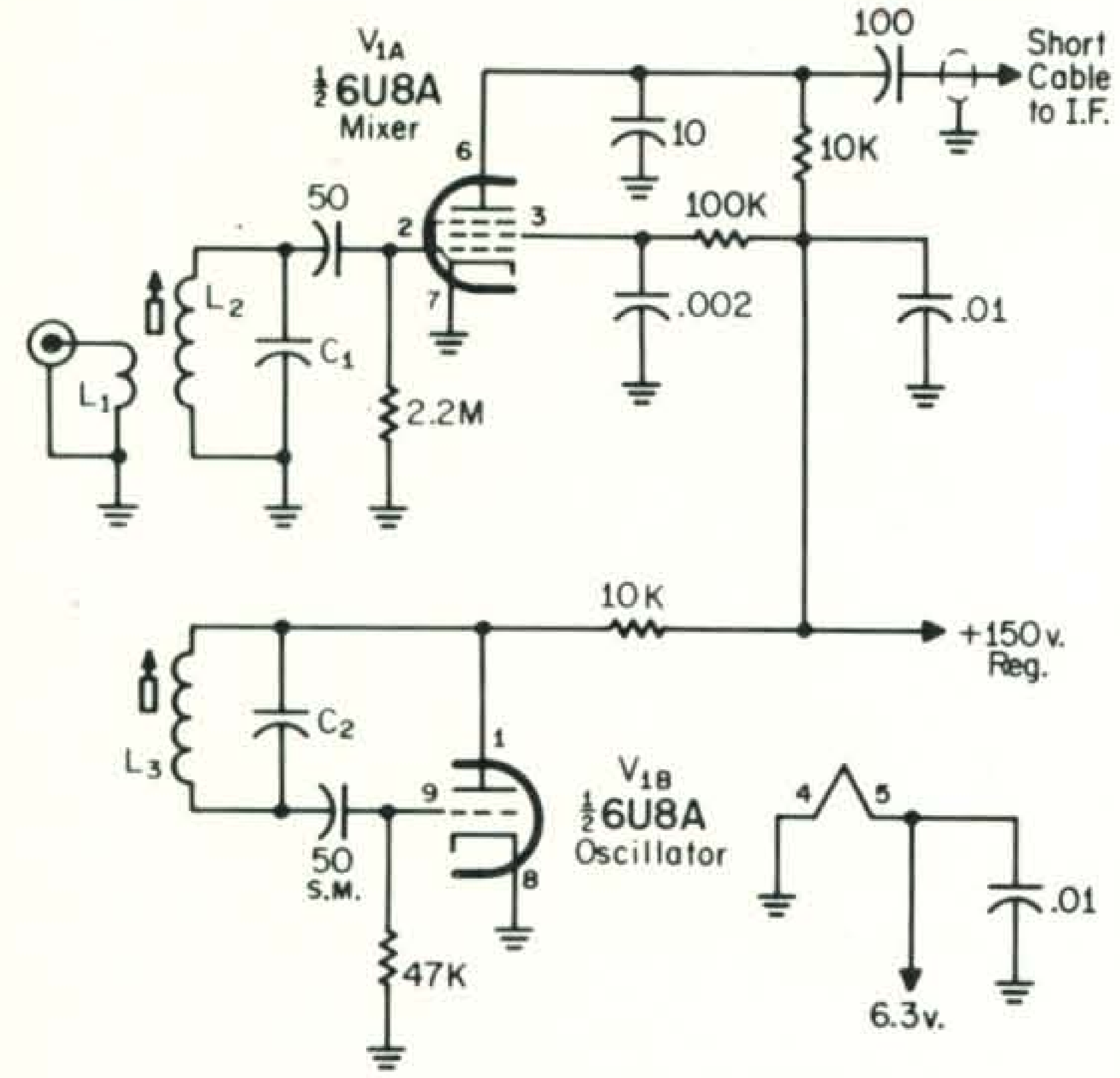


Fig. 1—The basic Addaverter mixer/oscillator circuit may be applied to 6, 10, or 15 meters using coil data supplied. All capacitors greater than one in value are in mmf; decimal values are in mf. All resistors are ½ watt. Coils are wound on J. W. Miller #4200 slug-tuned coil forms which provide excellent thermal isolation of the coil from the chassis.

6 Meters:
C_1—10 mmf disc ceramic.
C_2—10 mmf silver mica for i.f.'s from 600 kc to 18 mc. 33 mmf silver mica for i.f.'s from 18 to 34 mc.
L_1—2 t. hookup wire over L_2.
L_2—8 t. #22e. closewound.
L_3—10 t. #22e. closewound.

10 Meters:
C_1—10 mmf disc ceramic.
C_2—20 mmf silver mica.
L_1—2 t. hookup wire over L_2.
L_2—12 t. #26e. closewound.
L_3—12 t. #26e. closewound.

15 Meters:
C_1—20 mmf disc ceramic.
C_2—33 mmf silver mica.
L_1—3 t. hookup wire over L_2.
L_2—12 t. #26e. closewound.
L_3—12 t. #26e. closewound.

impedance of the coaxial coupling to the tunable i.f. receiver. Mismatch and all, the simplest and most common output circuit worked as well as the more complicated, so we end up with a 10K plate load and a 100 mmf coupling capacitor.

The injection signal needed by the mixer to produce the intermediate frequency output is provided by the triode portion of the 6U8A, V_{1B}. The circuit used is the tunable Colpitts and it allows an adjustable i.f. output from the broadcast band to 10 mc with the 15 and 10 meter versions. The 6 meter converter's output is adjustable from 600 kc (the low end of the BC band) to 18 mc; this range can be changed to cover 18 to 34 mc by changing a capacitor in the oscillator circuit. The parts list for fig. 1 gives the necessary information.

Mechanical Aspects

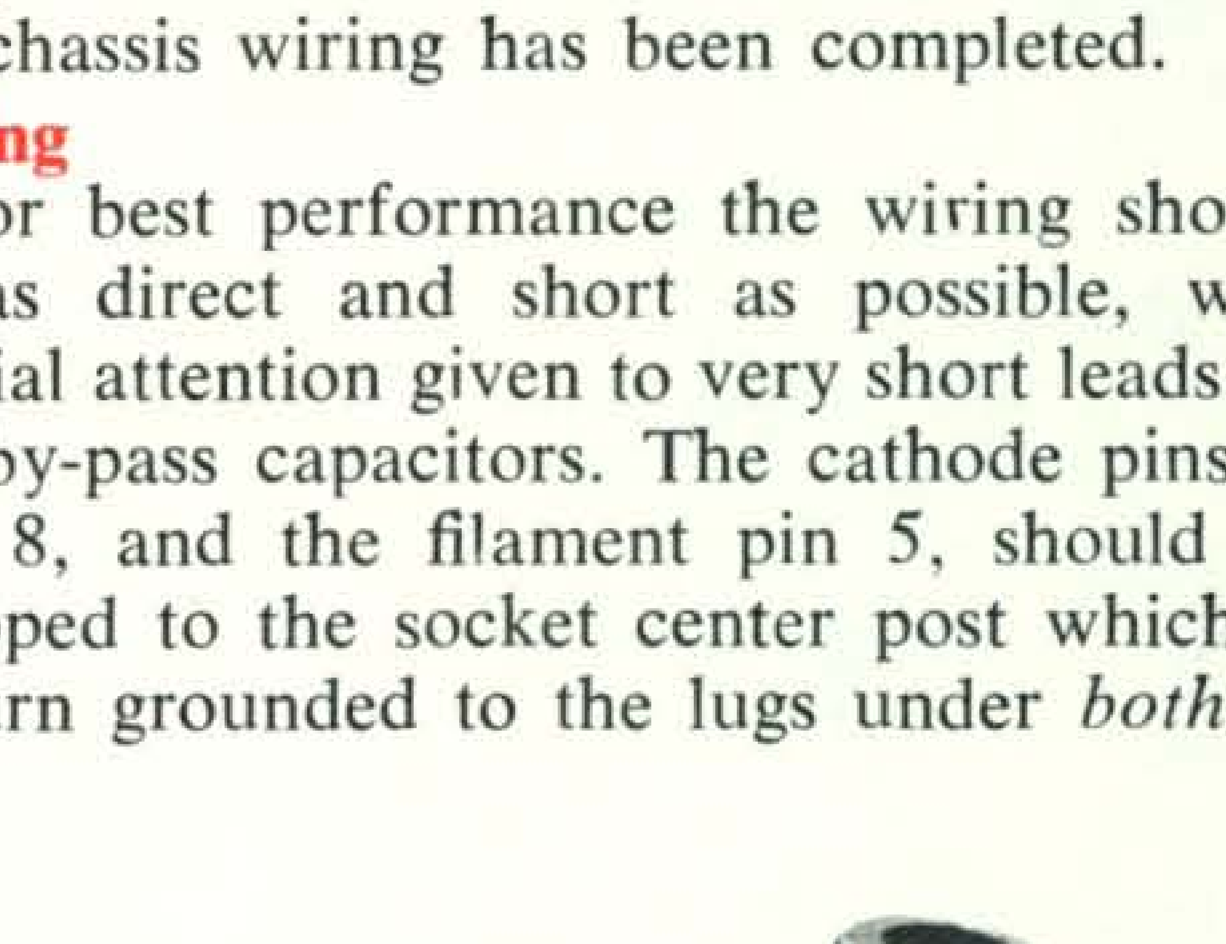
The ease of construction and small size of the Addaverters is made possible through the use of a new chassis-type enclosure called the Mini-cool. The chassis measures 2 × 2.6 × 1.5 inches high and slips completely apart for ease of drilling and wiring.

The templates in fig. 2 are actual size so they may be copied with tracing paper and used for drilling and chassis layout work. The 9 pin tube socket should be positioned as shown for shortest lead lengths, and ground lugs should be mounted with the socket hardware. A one-lug-plus-ground terminal strip should be placed near L_3 for the B + tiepoint, and near the tiepoint a small grommet is also positioned. Coils L_2 and L_3 should not be mounted at this time.

A grommet to fit the output coax and another one lug terminal strip are fitted on one of the 1.5 × 2.6 inch plates; however, the sideplates need not be fastened until most of the chassis wiring has been completed.

Wiring

For best performance the wiring should be as direct and short as possible, with special attention given to very short leads on the by-pass capacitors. The cathode pins, 7 and 8, and the filament pin 5, should be strapped to the socket center post which is in turn grounded to the lugs under *both* of



A complete high performance 10-meter Addaverter consisting of a cascode Nuvistor preamp unit and a 6U8A mixer/oscillator unit.

See page 110 for New Reader Service

the socket mounting screws. The bypass and grid resistors can then be wired.

The plate and screen resistors are wired to the B + tie point as is plate voltage lead. Plate, filament, and ground wires are brought through the grommet on the top of the chassis.

Inductors L_2 and L_3 are wound and wired along with their associated capacitors, and link L_1 is then added. The four sideplates can then be attached and the output coupling capacitor wired. The final count should be: 5 resistors, 9 capacitors; and all the lugs on the tube socket should be wired.

Addaverter Alignment

Initial use of a grid dip meter will greatly simply alignment and is therefore highly recommended. Coil L_2 is adjusted for the band intended, and L_3 is resonated for that frequency minus the i.f. frequency, *i.e.*, 28.5 − 3.5 = 25 mc, if the 80 meter band is used for the i.f. of a 10 meter model.

Exact alignment is achieved by applying power and feeding the output into the tunable i.f. strip receiver. L_3 is adjusted to set the converter to the proper frequency, L_2 is used to peak the converter. With this type of circuit interaction may be experienced between these coils so readjust both as necessary. Alignment should be conducted after the converter and receiver have had a chance to warm up.

A crystal controlled oscillator may also be used if the adjustable i.f. output feature is not desired. A suitable circuit appeared in the "Club Project: The Moniceiver," [2] also built by the author.

The Addaverter On Two?

The author found the tunable oscillator circuit too unreliable for use on the two meter band and does not recommend the basic Addaverter circuit above the 50 mc band. Perhaps the best bet for two would be a Nuvistor mixer and the conventional crystal, oscillator-multiplier circuit. In any case,

[2] Plant, D.F., K9LAJ, "Club Project: The Moniceiver," *CQ*, Jan. 1968, page 34.

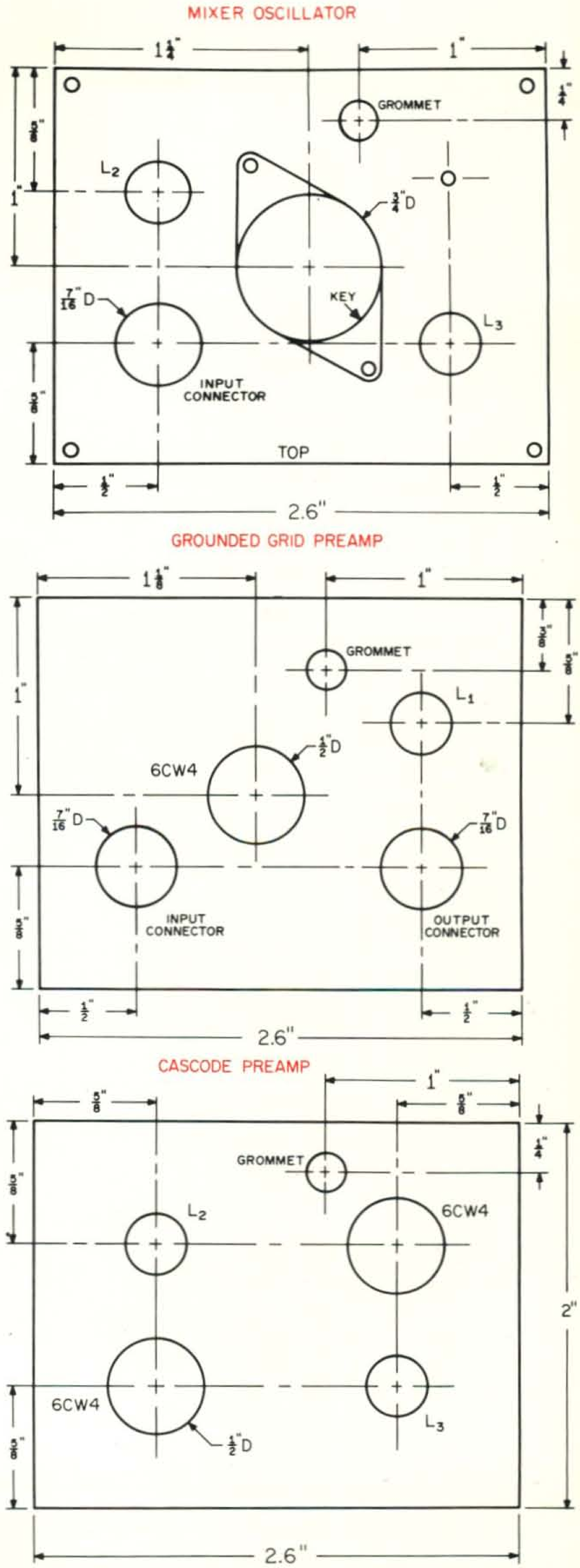
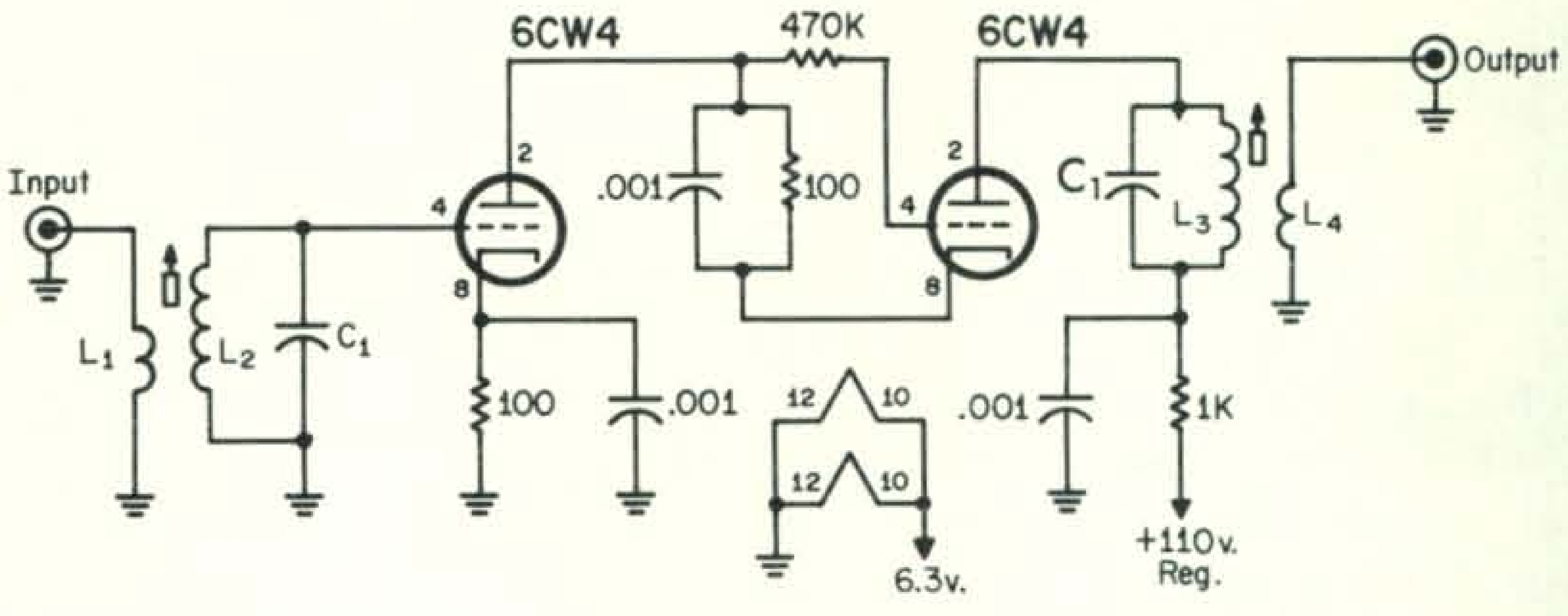


Fig. 2—Full size top chassis layouts for the Addaverter mixer oscillator, grounded grid preamp, and cascode preamp.

Fig. 3—Cascode Nuvistor preamp for 6, 10 or 15 meters easily constructed within a Mini-cool enclosure. Capacitors greater than one are in mmf; decimal value capacitors are in mf. All resistors are ½ watt. Coils are wound on J. W. Miller #4200 slug-tuned coil forms.



6 Meters:
C_1—5 mmf disc ceramic.
L_1—2 t. hookup wire over L_2.
L_2, L_3—8 t. #22e. closewound.
L_4—2 t. hookup wire over L_3.

10 Meters:
C_1—10 mmf disc ceramic.
L_1—2 t. hookup wire over L_2.
L_2, L_3—12 t. #26e. closewound.
L_4—2 t. hookup wire over L_3.

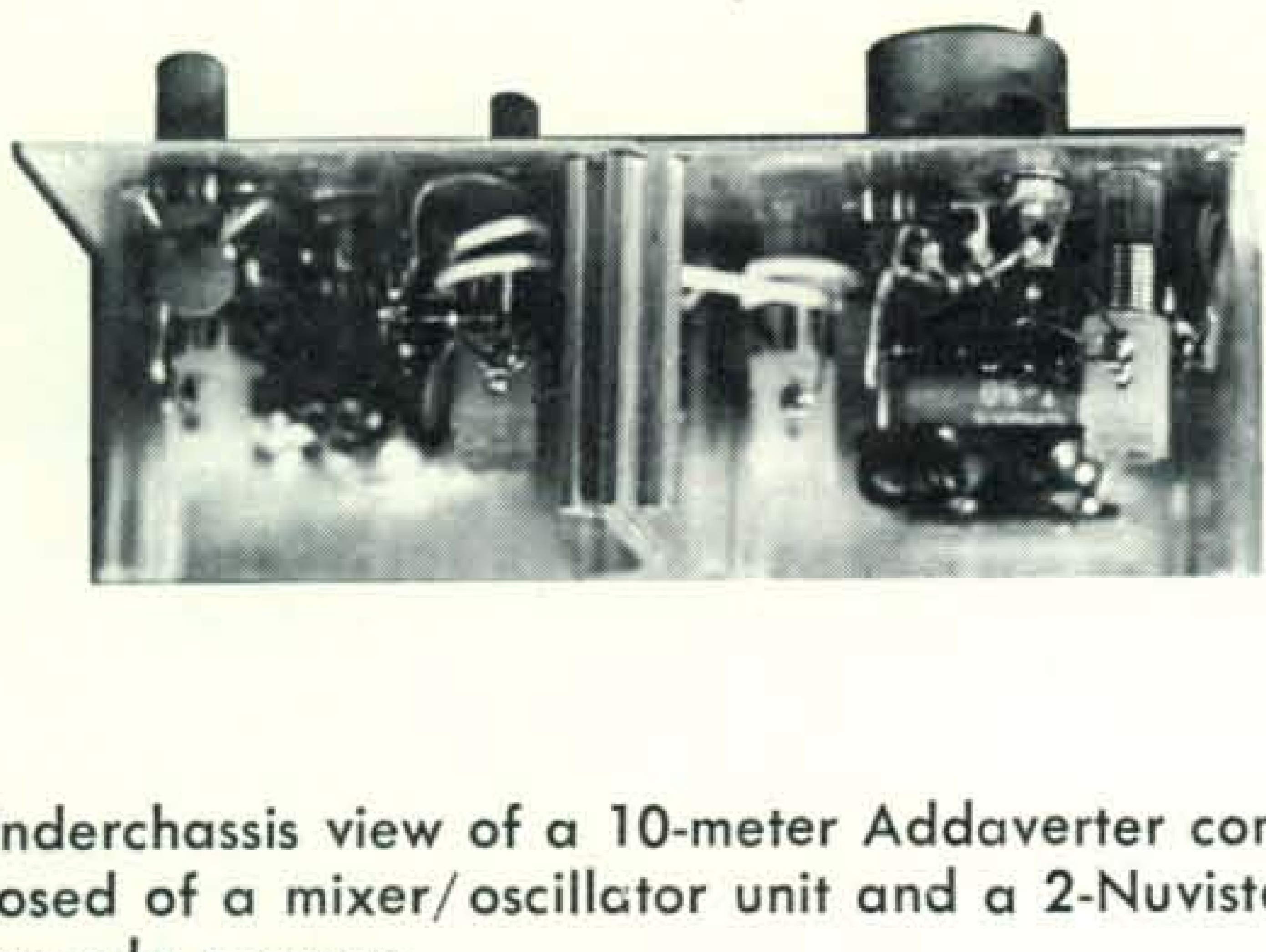
15 Meters:
C_1—15 mmf disc ceramic.
L_1—3 t. hookup wire over L_2.
L_2, 3—12 t. #26e. closewound.
L_4—3 t. hookup wire over L_3.

well publish notes on a two meter Addaverter shortly.

The Addaverter Preamps

Some pretty interesting things happen on the higher frequency bands around dawn in the morning. The band noise sometimes drops down 2 or 3 db and weak signals that are normally masked by noise suddenly become readable. The damp ground seems to extend ground wave coverage, and man made noise is also at a minimum. These are conditions for a very challanging type of v.h.f. DX operation.

A low noise preamp is particularly important to take advantage of these favorable band conditions, for otherwise, the already marginal signals can become hopelessly covered by noise.



Underchassis view of a 10-meter Addaverter composed of a mixer/oscillator unit and a 2-Nuvistor cascode preamp.

A properly designed preamp gives the necessary improvement in the signal-to-noise ratio, and provides gain and additional selectivity as well. And, in the case of the Addaverter, the interlocking endplates of the Mini-cool chassis also give incentive to build an add-on preamplifier. This is where a *con*verter becomes an *Add*averter.

Nuvistor Cascode Preamp

The author found the adaptation of the RCA circuit shown in fig. 3 to work well with a minimum of adjustment on the 15, 10, and 6 meter bands. Gain is on the order of 24 db, and the circuit operates well below the ambient noise level.

Construction

It should be noted that there are two coils tuned to the same frequency so they should be isolated as much as possible. This is accomplished by mounting the Nuvistor sockets in such a manner that leads are short and direct. Grounding and bypass leads should also be short and kept close to the chassis. The Nuvistor sockets should be well grounded.

The keyed end plates on the Mini-cools only lock in one direction, so the two adjacent pieces should be mounted together first. The template at fig. 2 shows the parts layout; wiring is a simple matter.

No output connector is included on the cascode preamp because it was built as part of the Addaverter project. Power and r.f. wiring to the converter was done through holes in the adjacent end plates.

The builder may prefer to use a 10 mmf coupling capacitor between the preamp out-

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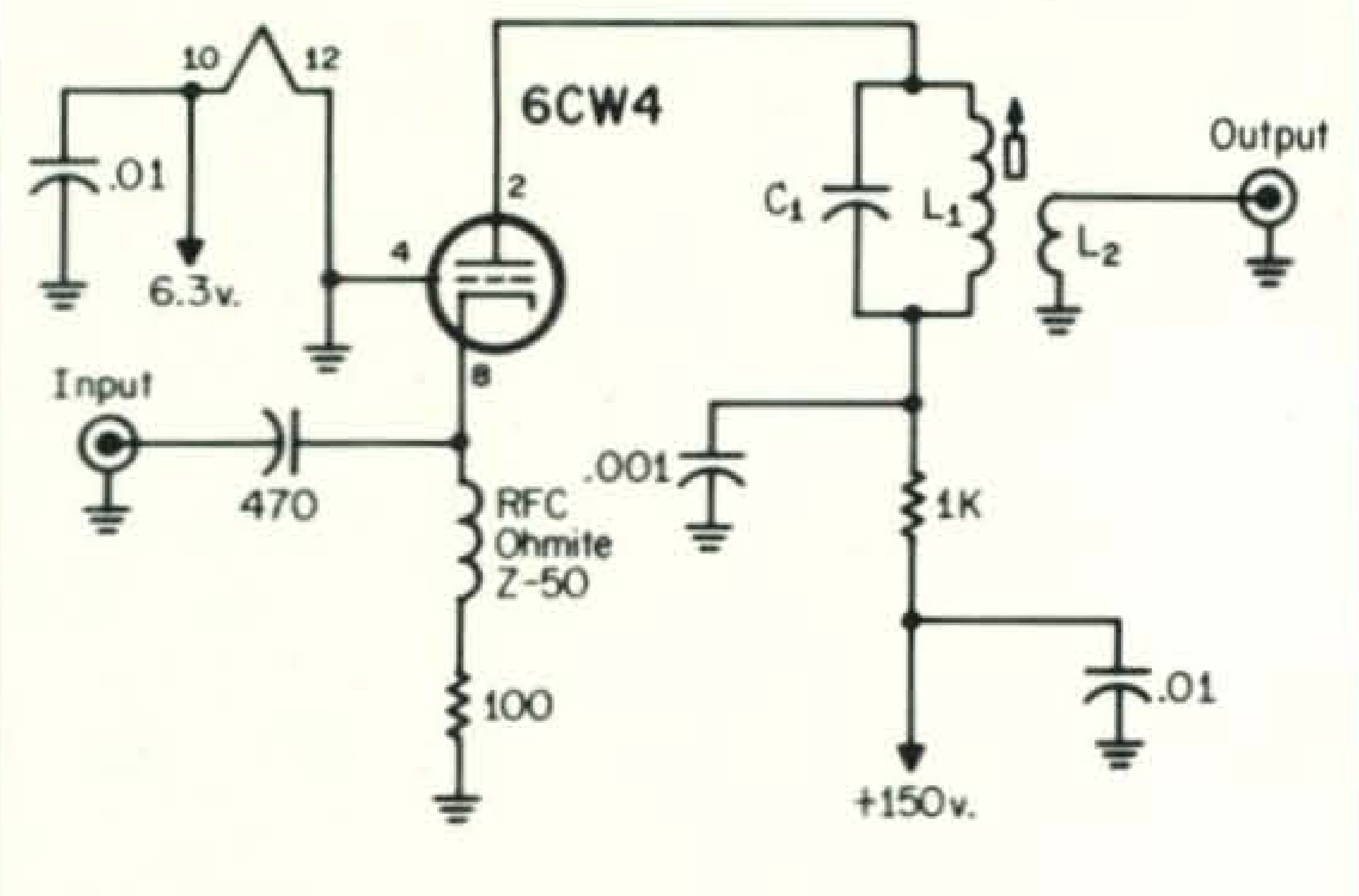

Fig 4—Simple grounded-grid Nuvistor preamplifier for six or two meters. Capacitor values greater than one are in mmf; decimal values are in mf. Resistors are ½ watt. Coil L_1 is wound on a J. W. Miller #4200 slug-tuned coil form.

2 Meters:
C_1—Not used for 2 meters.
L_1—2 t. #22e. closewound.
L_2—1 t. hookup wire over L_1.

6 Meters:
C_1—5 mmf disc ceramic.
L_1—8 t. #22e. closewound.
L_2—2 t. hookup wire over L_1.

put and the mixer input coil rather than two-turn links in both units. The capacitor may be wired to the hot side of each coil and the two turn link eliminated.

Alignment

Alignment consists simply of peaking the two slug-tuned coils on a weak signal in the favorite portion of the band, or staggering the coils (adjusting each to a slightly different frequency to broaden the bandwidth.)

An output connector can be added to the preamp if operation is intended with existing receiving equipment rather than the basic Addaverter.

6 and 2 Meter G-G Preamps

One of the quietest, yet least complicated, r.f. amplifiers is the grounded grid circuit. With just ordinary precautions, the configuration is exceptionally stable (due to the grid isolating input from the output circuit) —its one drawback being that it exhibits less gain per stage than other types of front ends.

As can be seen in fig. 4, the circuit is extremely simple. The signal is fed to the cathode, the grid is grounded, and the output is taken from a low impedance link. L_1 is resonated at 50 or 144 mc.

The author's 6 meter Addaverter uses two of the grounded grid preamps ahead of the basic converter block and each stage is coupled by coax to the next. Gain is excellent and rejection of out-of-band signals is superb.

Powering the Addaverters

The Addaverters require 6.3 v.a.c. for the filaments and 100 to 150 volts d.c. A separate power supply is recommended if the units are to be used with an a.c.-d.c. (transformerless type) receiver because this kind of radio does not easily supply the necessary 6.3 v. A suitable power supply is shown in fig. 5.

Receivers with a power transformer can easily handle the modest power requirements of the Addaverters and some have an accessory socket wired for just such an addition.

The Tunable I.F.

The individual builder may wish to experiment with various i.f. tuning ranges to determine the one best suited for his installation. The flexibility afforded by the untuned mixer output and tunable oscillator are very helpful for this sort of thing, but keep in mind the width of spectrum required to maintain the intended tuning range. For example, the 10 meter converter requires a total width of 1.7 mc and the 6 meter band requires 4 mc. However, both these bands are most active on the lower portions of their respective ranges, so a limited tuning range can be used. The 3.5 to 4 mc band can be used to cover 28.5 to 29 mc or the first half megacycle of the 50 mc band.

The surplus market can provide an excel-

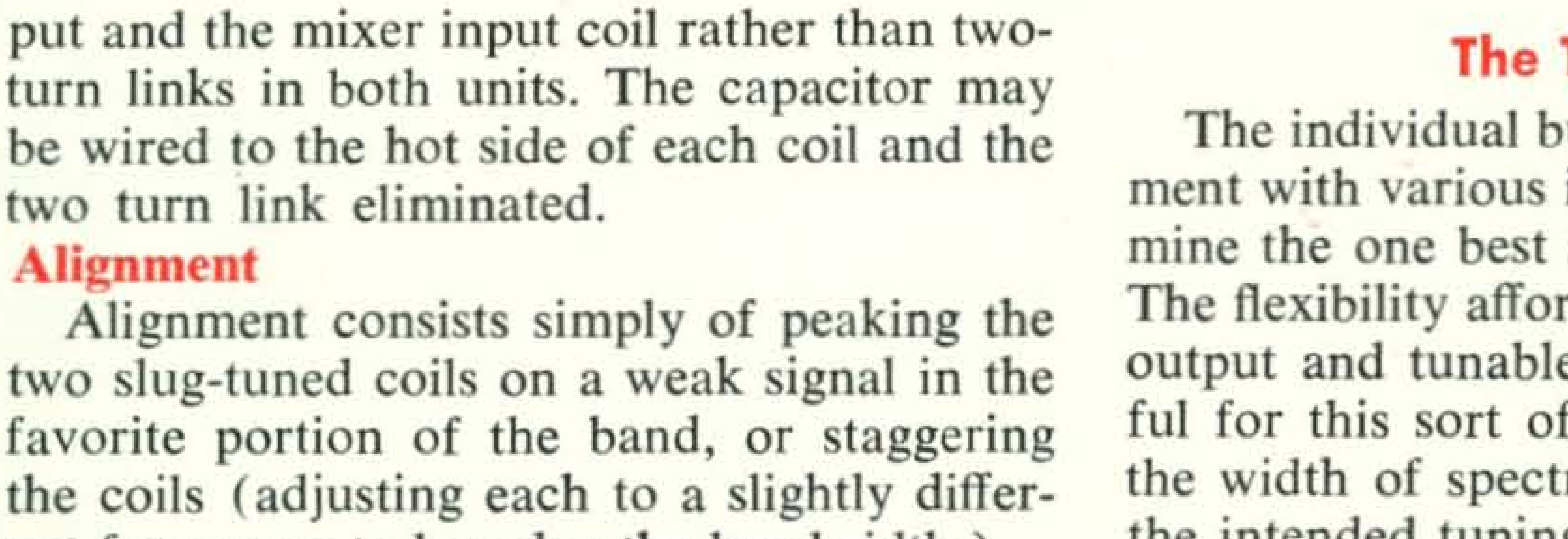

Fig. 5—Simple power supply with ample capacity for supplying several Addaverter units. T_1 is a Stancor P-8415 transformer. Diodes may be any inexpensive power types capable of handling 25-30 ma with a p.i.v. of 250 volts or more.

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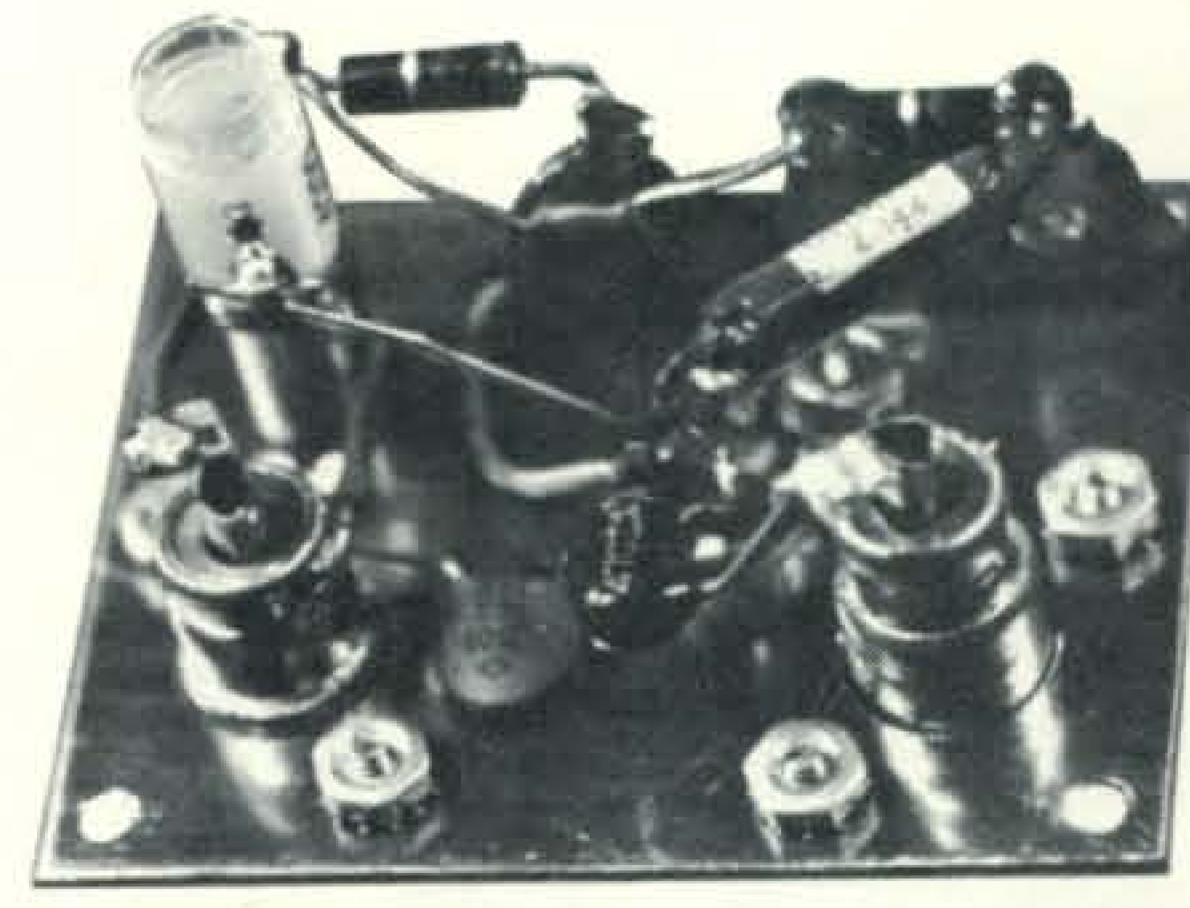

Underside of a 2-meter version of the grounded grid Nuvistor preamp suggests the small and compact construction possible with the Mini-cool enclosures.

lent i.f. strip for very little money and certainly should be considered if no receiver is on hand.

Addenda

A trick used on some ham receivers to lessen the warm-up drift is to power the tunable oscillator tube from a separate filament transformer that is continously on. The tube is then always kept at operating temperature. This same trick can be used with the Addaverter. In addition, a VR-105 regulator can be used to provide a regulated plate voltage of 105 volts.

A very high gain front end can be constructed by running a grounded grid preamp into the cascode one. It is suggested that a gain control be used (a 5K pot in series with the 100 ohm cathode resistor works well in the grounded grid preamp) so, strong signals don't overload the mixer stage.

The Mini-cool enclosures, part #152026C may be obtained from: Lafayette Radio Associate Store, Rt. 38, Pennsauken, N.J. or Pacific Electronic, 1444 Market Street, San Francisco, California.

The author wishes to thank Mr. Fentress Dorn for help with photography. ■

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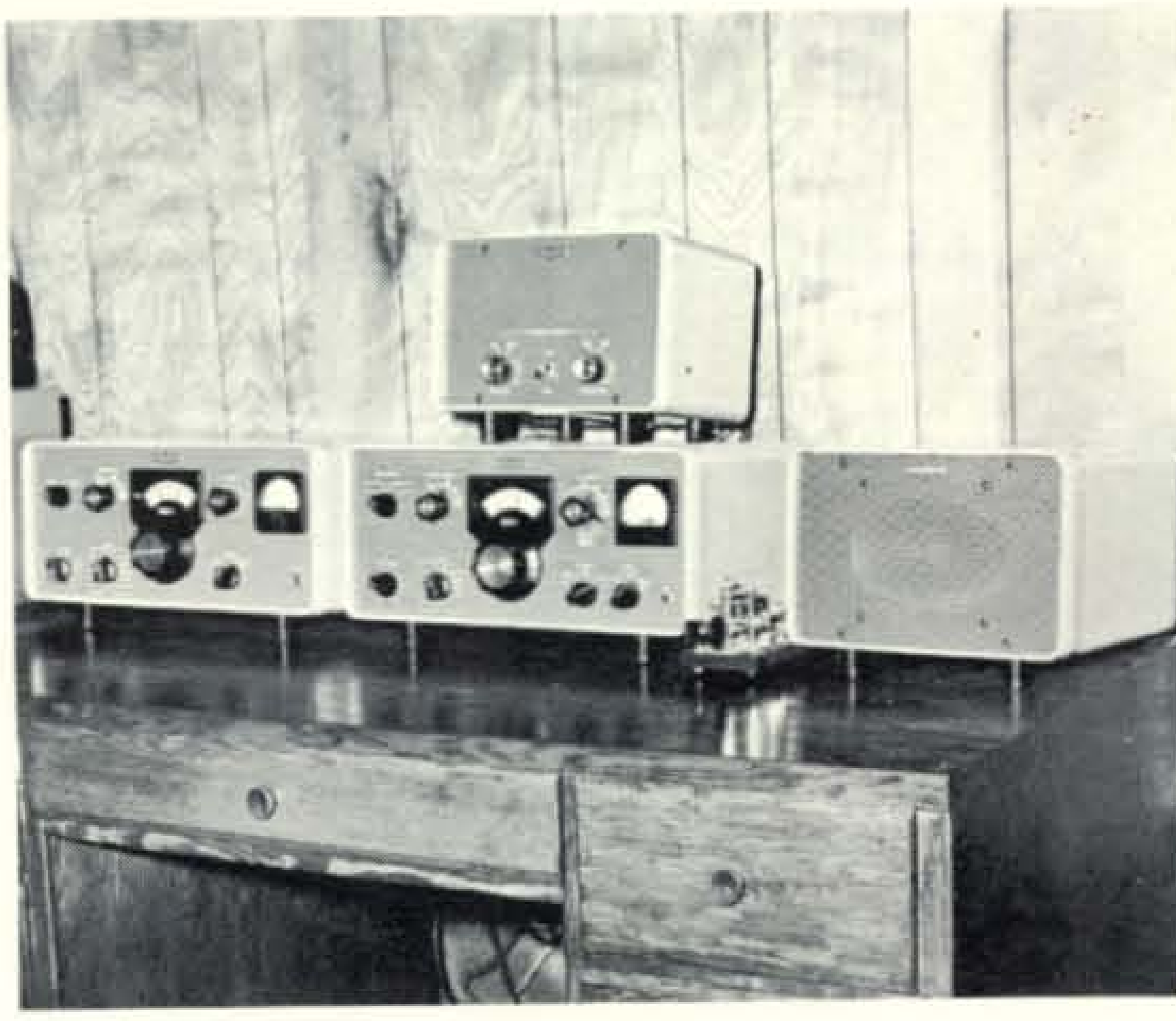
SAVE THAT S—LINE



Collins S-line in its operating position. The speaker for the receiver is mounted in the power supply case on the right. A speaker for the sync unit is mounted in the frequency control built into the 312B-3 cabinet mounted atop the 32S-1.

BY DENNIS P. BRYAN,* W2AJW

Save it? From what? Well, from premature obsolescence resulting from the trend towards transceive operation. The S-line *can* be operated in transceive fashion, but setting it up that way is not a "throw-of-a-switch" task, nor does it offer the utimate in flexibility. These simple modifications change all that.

If you are the owner of an S-line, you have probably experienced the same frustration as this author when it came to switching back and forth between transcieve and independent operation. And when it came to syncing the two in independent operation, you really started to pull your hair out,

* 4 Crescent Drive, Apalaclin, New York 13732

Front view of the new control panel placed in the Collins 312B-3 cabinet.

Well, do not despair—read on and see how you can make a couple of simple modifications and come up with an unbeatable combination. The modifications permit you to:

1. Control receiver frequency by either the receiver or transmitter v.f.o.
2. Control transmitter frequency by either the receiver or transmitter v.f.o.
3. Control receiver and transmitter frequency by the receiver v.f.o.
4. Control receiver and transmitter frequency by the transmitter v.f.o.

All this just by flipping switches, no cables to change, plus a bonus; the receiver and transmitter v.f.o.'s can be synchronized with an honest-to-goodness audio tone by mixing the outputs of both v.f.o.'s

V.F.O. R.F. Alterations

Basically, the previously mentioned four combinations are accomplished by making both v.f.o.'s and both mixers completely independent and running their outputs and inputs through coax to an external switching unit where they are connected together according to the switch settings.

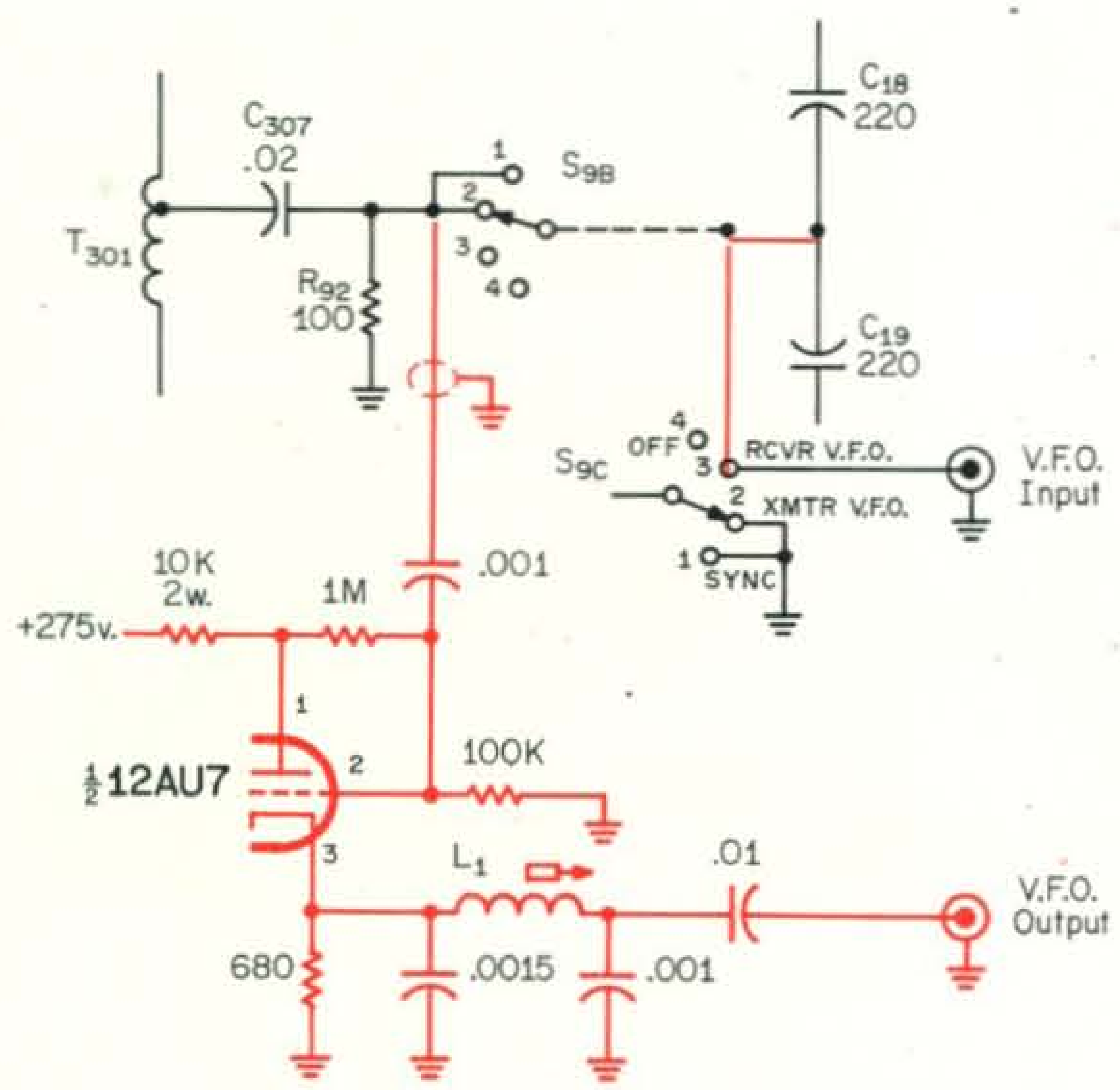


Fig. 1—R.f. circuit changes and additions in the Collins 32S-1. All wiring in color is added. Wiring shown by dotted lines should be removed. Capacitors values greater than one are in mmf, values less than one are in mf. All resistors are ½ watt except where noted. Coil L_1 has 20 turns of # 26 e., ½" long wound on a ⅜" diameter slug tuned form, Miller # 21A000RBI or equivalent.

According to Collins' engineers, a simple conversion of just switching v.f.o. outputs will allow spurious signal transmission when the transmitter is controlled by the transmitter v.f.o. and the receiver by the receiver v.f.o. That is, when the transmitter and receiver are tuned to different frequencies, enough of the receiver v.f.o. output will be coupled around the switches into the transmitter mixer to cause two outputs. This

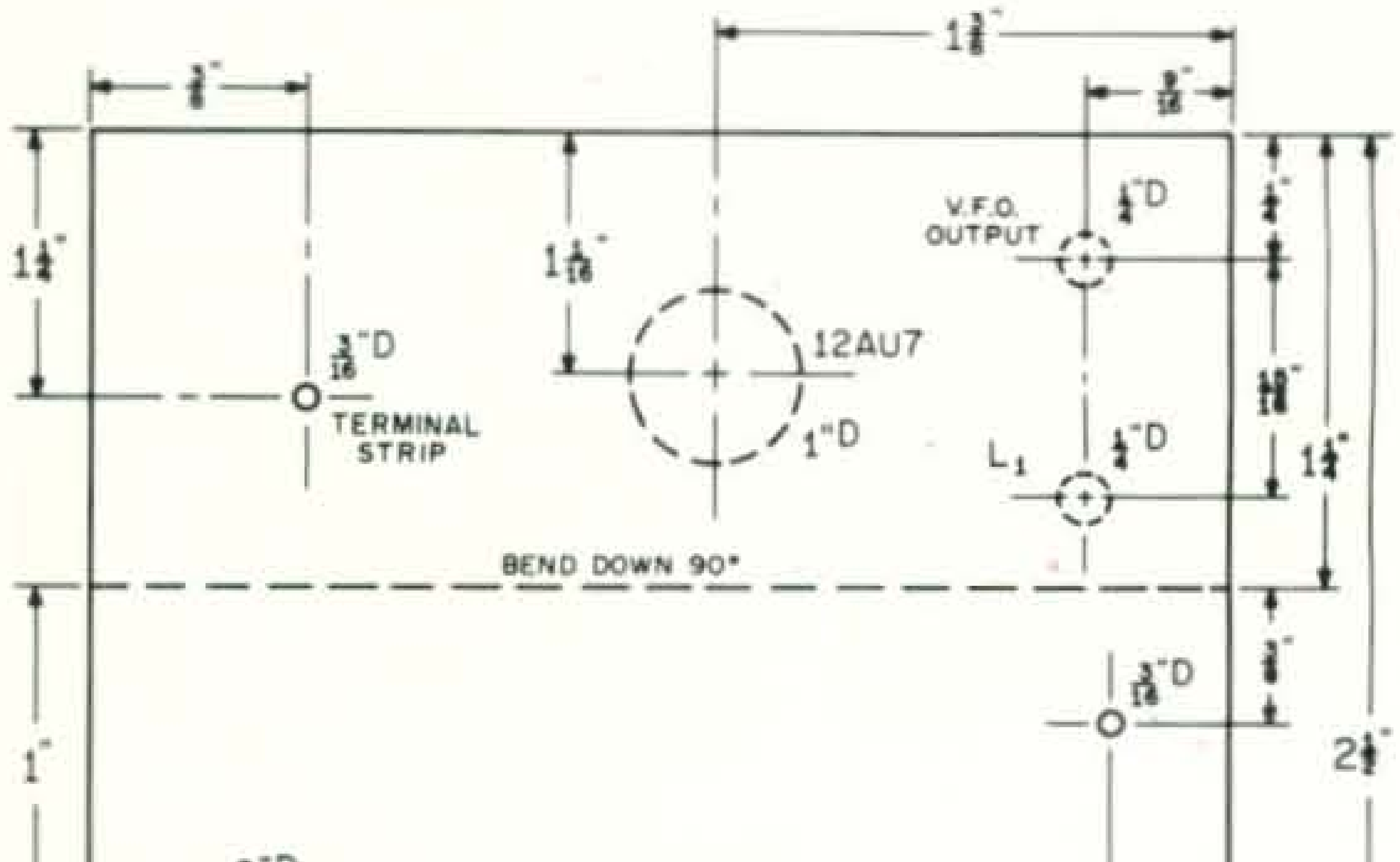


Fig.2—Chassis dimensions for the transmitter v.f.o. line driver mounted on the rear of the v.f.o. assembly in the 32S-1

problem is overcome by allowing only on v.f.o. on at a time by controlling their B plu inputs.

Switching both the r.f. outputs and d.c. in puts to the v.f.o.'s has no detrimental effec on their frequency stability. Both v.f.o.' were tuned to WWV, then switched into n power condition for ten minutes, then bac on again with no drift from zero beat.

The receiver v.f.o. is already brought ou to a phono type socket and does not requir change. The transmitter v.f.o. circuit is modi fied (fig. 1) to provide an output to th switch unit by the following procedure:

1. Remove wire from S_{9B} operating arn (common) that goes to junction of C_{18} an C_{19}. Put this wire on S_{9C}, terminal 3 poin This change gives direct access to transmitte mixer V_{4A} input.

2. Construct a small bracket (see fig. 2 to mount the 12AU7, L_1, v.f.o. output phon socket and the associated circuitry. Thi bracket will be mounted on the rear of th transmitter v.f.o. assembly and is connecte to S_{9B}, terminal 2, by a length of RG-174/U The 12AU7 cathode follower prevents v.f.o frequency variations due to load changes Inductor L_1 is adjusted to give maximun output at the v.f.o. output socket.

The receiver second mixer, V_{3A}, inpu must be isolated, as shown in fig.3, by:

1. Drilling a hole ½ inch in front of an centered on L_4. This is the only hole (UGH that has to be drilled in the equipment bu it is necessary in order to keep the lea length to the mixer input as short as possibl This hole should be drilled to accept phono type socket.

2. Disconnecting C_{52} at the R_{27}, C_{105} C_{307} junction end. Connect this end of C_{52} t the previously installed phono socket. Thi becomes the receiver v.f.o. input to th mixer V_{3A}.

V.F.O. D.C. Alterations

The receiver and transmitter d.c. voltag inputs are modfiied as indicated in fig. 4. Th steps to be followed for the 32S-1 are:

Remove the wire going from S_{9A} termina 1 to S_{9E} operating arm (common). Usin a four foot length of three conducto shielded cable, connect one lead to S_{9A} terminal 1, another to the normally ope point of the K_1 contacts that is also con nected to K_2 coil and the remaining wire t the +275V side of K_1 coil. The shield of th cable can be grounded near the hole in th

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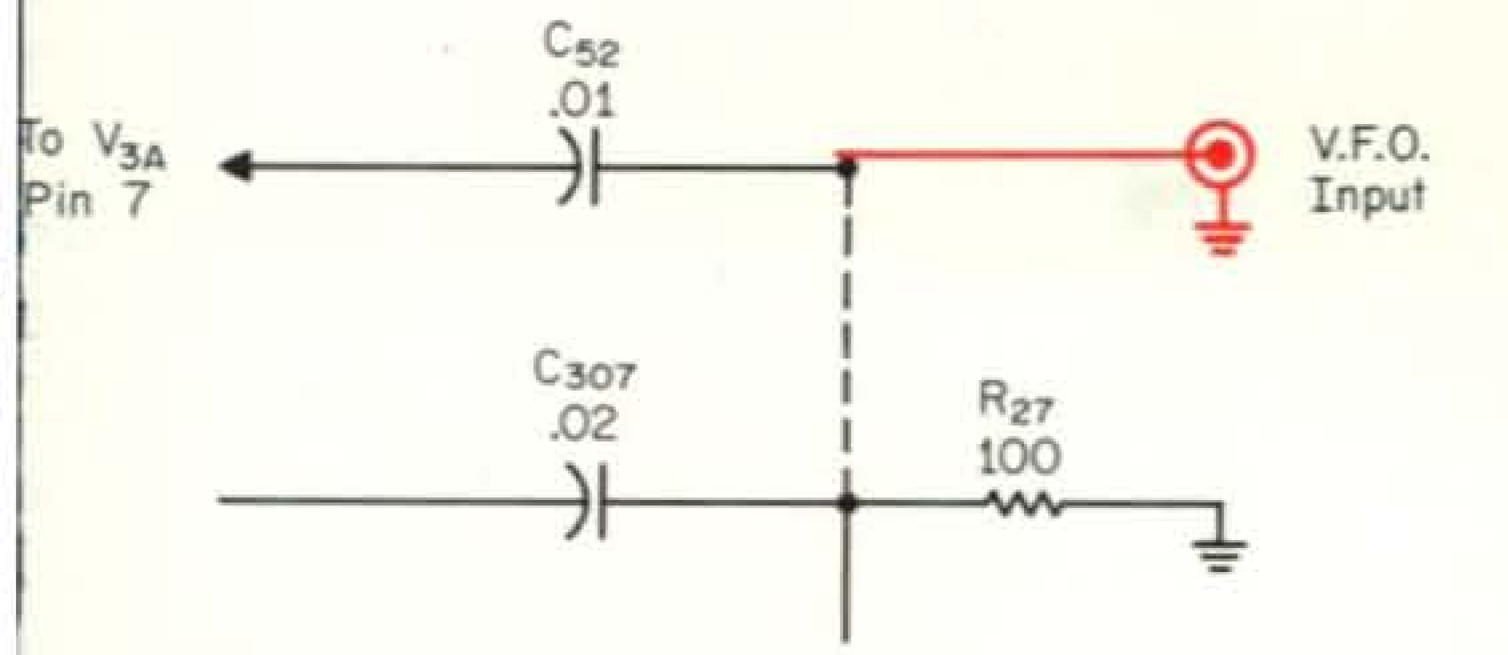
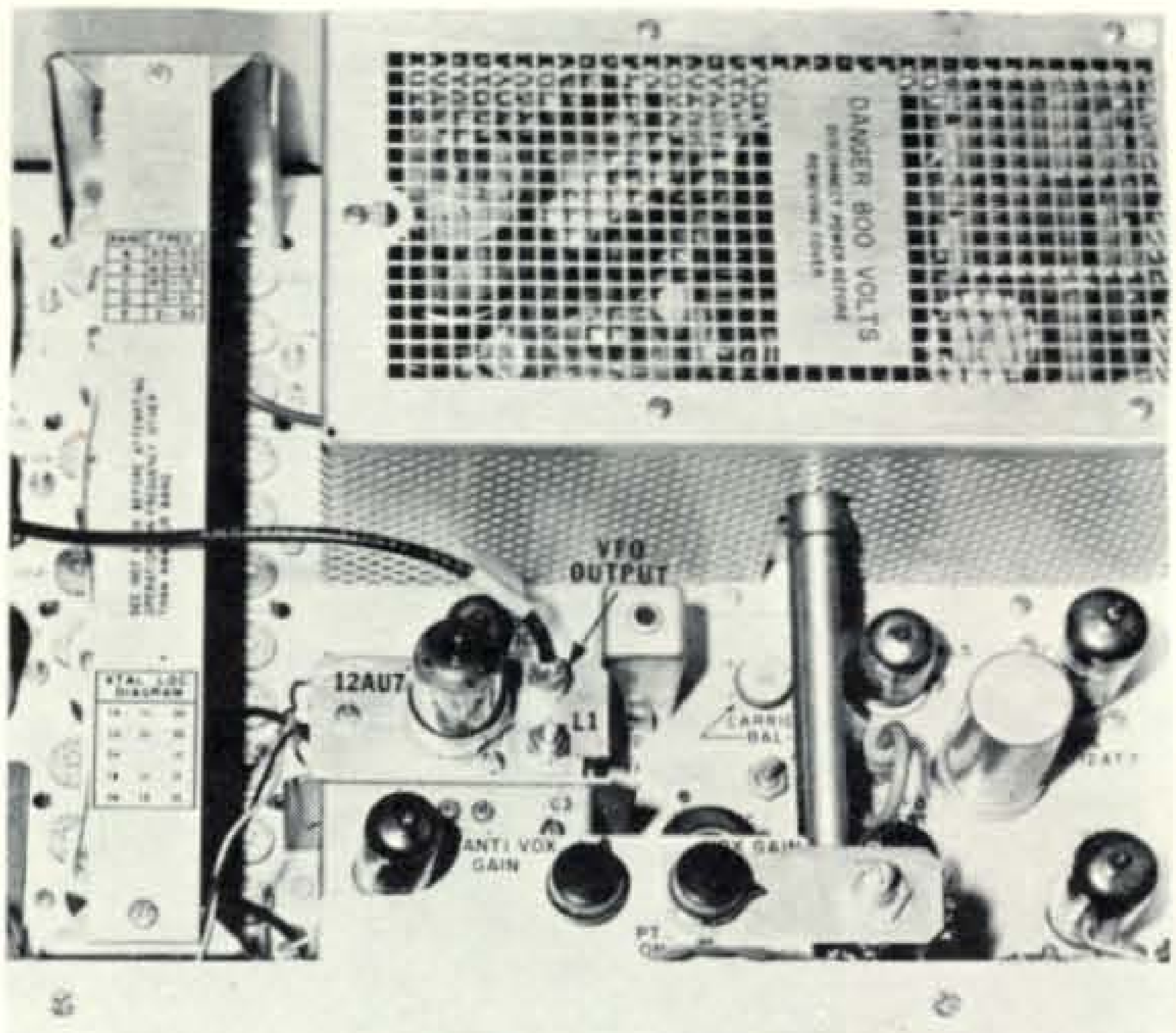


Fig. 3—Modification made to the 75S-1 to isolate V_{3A}, the second mixer, and permit it to be connected into the switching circuit. The wire shown by the dotted line is removed and the wiring indicated by color is added.



Top view of the Collins 32S-1 showing the placement of the transmitter v.f.o. output line driver chassis.

chassis just behind the mic jack. The cable should then be routed up through that same hole and on out through one of the two large round holes in the rear of the cabinet. Spade lugs should be attached to the other end of this cable.

The steps to be followed to modify the 75S-1 are:

Remove the wire going from the B plus input of the receiver v.f.o. where it attaches to the terminal strip under the receiver chassis. Mount a two lug terminal strip under the nut used for mounting the Noise Blanker. Use the nut closest to the v.f.o. cable entry point. Mount a 33K 2 watt resistor on this terminal strip. Connect the previously removed wire to one side of the resistor. Connect a 0.01 mf bypass capacitor and the center conductor of a single conductor shielded cable to the other side. The shield of the cable should be connected to the same ground point as the 0.01 mf capacitor. The cable can be routed to the rear left side of the chassis, then up around the lip, on out one of the two large holes in the rear of the cabinet.

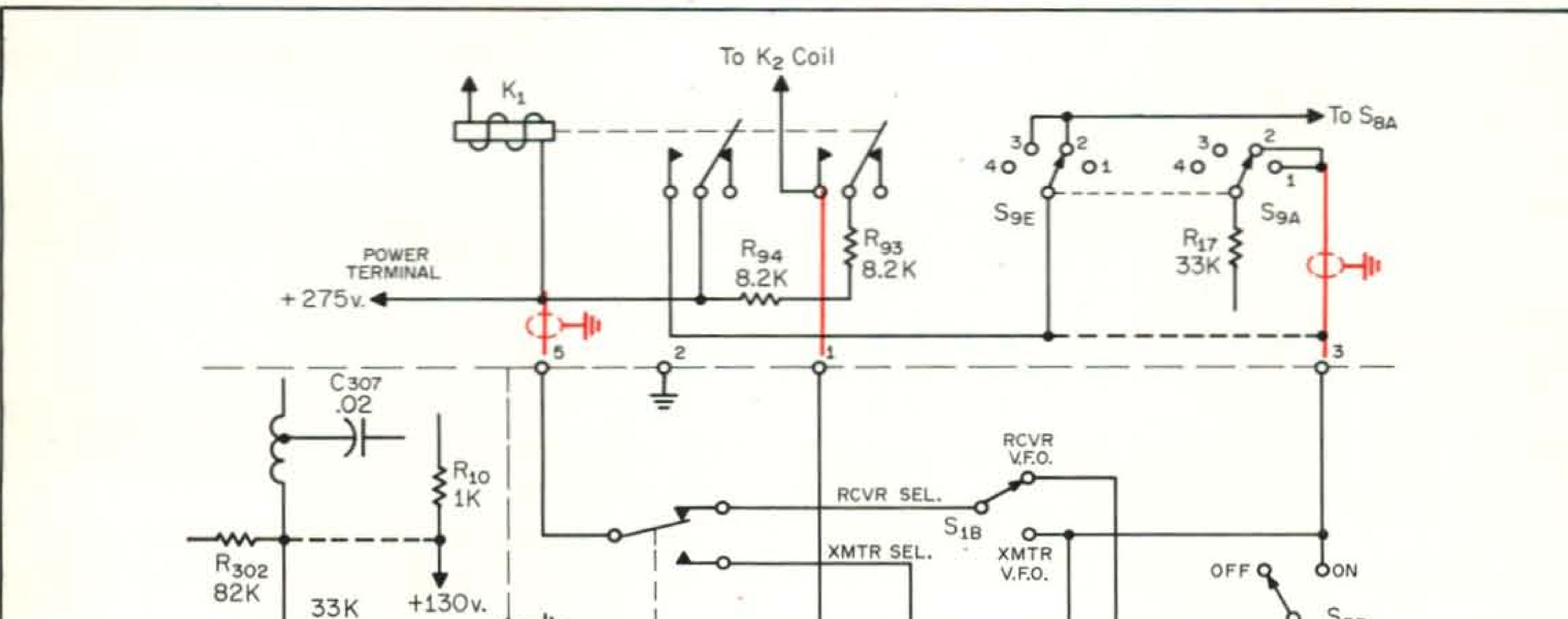
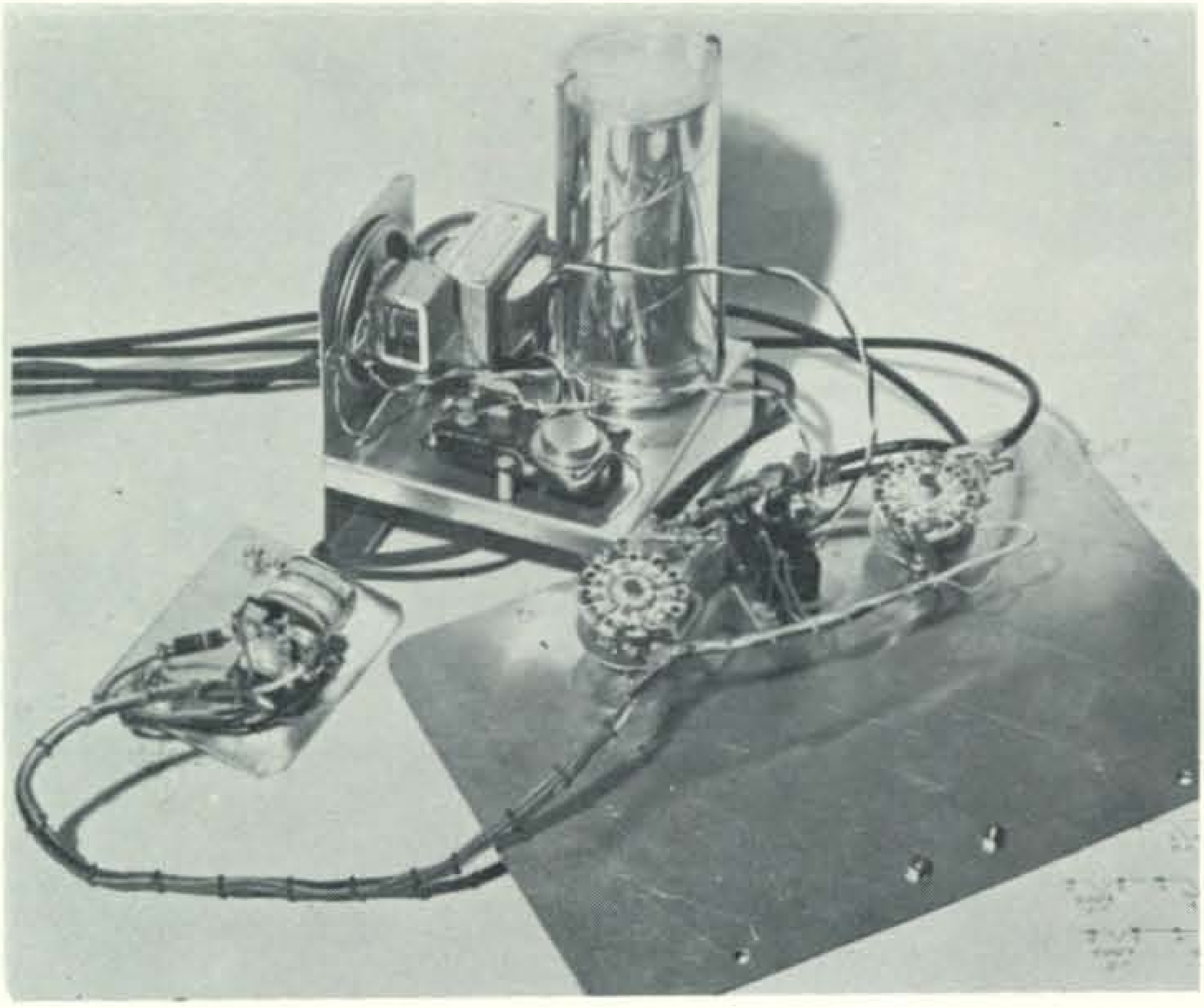


Fig. 4—Circuit showing the a.c. voltage changes and selection system for the v.f.o.'s. The dotted wires shown in the 32S-1 and 75S-1 circuits are to be removed. The wiring in color is to be added as shown. All the wiring shown in the 312B-3 case is part of the selector circuit and is constructed in addition to the circuitry shown in fig. 5, also in the 312B-3 case as explained in the text. Relay K_3 used to control the v.f.o. applied voltages in a Sigma 41F 10,000 SIL, a s.p.d.t. with a 10K coil.



View of the selector assembl components. The chassis in th upper center contains the syn audio amplifier (Lafayette mod ule), speaker and power supply The lower left chassis mounts th relay K_3, and on its underside th five-connection terminal strip. Th front panel mounts the two v.f.o selector switches, S_1 and S_2 an the sync switch S_3. A termin strip below S_3 contains all th mixer components; CR_1, CR_2, etc as shown in the circuit of fig. 5

Frequency Selector

That completes the receiver/transmitter conversion. From here on it depends on where you want to put the selection switches. Since the author had both a 516F-2 power supply and a 312B-3 speaker, it was decided to move the speaker into the front of the 516F-2 and cut a new panel for the 312B-3 speaker box. (The original panel is saved to be reinstalled for equipment resale.)

The new panel in the speaker cabinets wil hold the two selector switches. Referring t fig. 5, r.f. connections between the switche should be made with RG-174/U coax. Th r.f. leads to the receiver and transmitter ar also made of RG-174/U coax, are 30" long and have phono type plugs on the ends.

RelayK_3, the 20K, 2 watt resistor, and th five connection screw type terminal bloc are mounted on an L-shaped bracket. Thi bracket is mounted to the cabinet under th

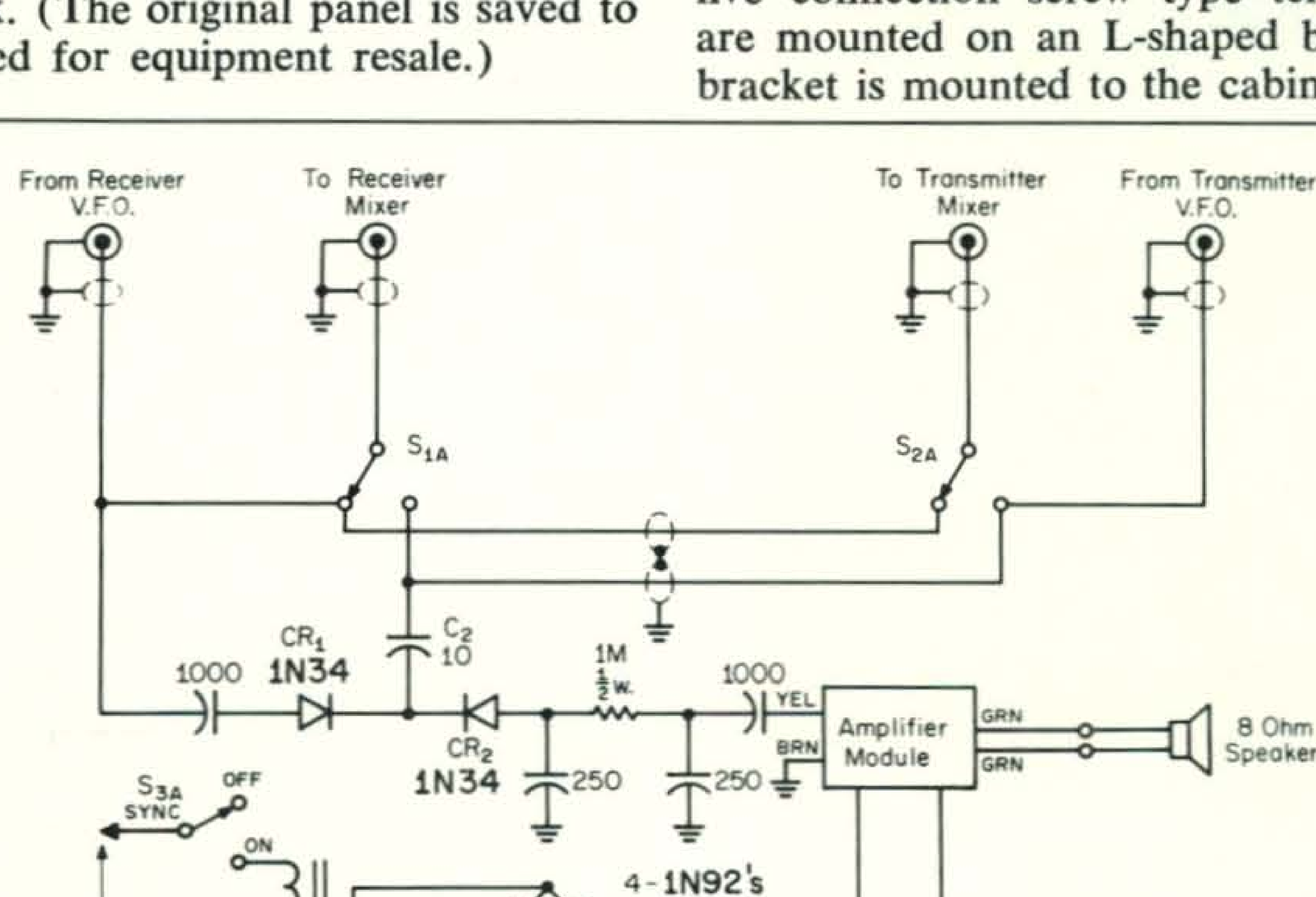


Fig. 5—Signal portion of the control circuit housed shown in the 312B-3 case is shown above. Switches S_1, S_2 and S_3 are sections of switches S_1, S_2 *and* S_3 shown in fig. 4. Switches S_1 and S_2 are d.p.d.t. ceramic rotary types. witch S_3 is a d.p.d.t. toggle. All capacitors are in mmf except C_1 which is an electrolytic. The amplifier module shown is a Lafayette 10-0111. All shielded lines are RG-174/U coax.

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nut holding the left rear cabinet foot.

Relay K_3 assures that only one v.f.o. is running at a time depending on the settings of S_{1B} and S_{2B}.

The Bonus

Since both v.f.o. outputs were in one place in the speaker cabinet and there was plenty of room, it was decided to simplify the process of syncing the two v.f.o.'s when operating in independent mode.

Diodes CR_1 and CR_2, fig. 5, make up a simple product detector with the output fed to an inexpensive Lafayette transistor amplifier module. This amplifier, its power supply, and 1½ inch speaker are mounted in the 312B-3 speaker enclosure. The SYNC switch (S_3) is mounted on the new front panel between the two selector switches.

When S_3 is ON, power is applied to the module, the two v.f.o.'s are turned on and mix in CR_1—CR_2. When they are in sync, the familiar zero beat is heard.

Conclusion

The new speaker panel can be painted and lettered to closely resemble the decor of the S-line; how closely it matches is up to the talents of the builder.

The frequency control switch should be left in the TRANS VFO position. The cable connecting the transmitter XTAL OSC INPUT and receiver XTAL OSC OUTPUT should be installed and left alone. The receiver crystal oscillator will be controlling the receiver and transmitter in all modes of operation: All v.f.o. selection is now done with the newly installed selector switches.

So there it is—take a few evenings and make the changes—your future operating ease will be well worth the effort. ■

The Heathkit Model SB-620 Scanalyzer. It is styled to match the Heathkit SB- series of amateur equipment.

CQ Reviews:

The Heathkit Model SB-620 "Scanalyzer"

BY WILFRED M. SCHERER,* W2AEF

THE Heathkit Model SB-620 Scanalyzer is a sophisticated spectrum monitor or panadapter which, in conjunction with a signal generator,[1] also will function as a spectrum analyzer for test purposes. It thus serves as two instruments in one providing: 1—Bandscanning with a panoramic display obtained from a receiver for determining the presence, shift, absence or character of signals over a band of frequencies; 2—Spectrum analysis with sufficiently-high resolution to permit observations such as that of distortion products, carrier or unwanted-sideband suppression and spurious responses of r.f. equipment. Of particular significance in respect to spectrum analysis is that the SB-620 at long last fulfills the need for such specialized test gear at a price within practical reach of the radio amateur.

The fundamental concept of the SB-620 is like that of its predecessor, the Heathkit HO-13 Ham-Scan Panoramic Adapter,[2] but new features have been added that extend its versatility and usefulness. These include operation with additional receiver i.f.'s wider range of sweep-widths and sweep-frequencies, crystal filter for higher resolution, high-persistence cathode-ray tube with yellow trace and screen filter, linear and logarithmic response with linear and log scale calibrations, r.f. signal and signal-generator inputs for spectrum analysis tests, styling to match the Heathkit SB-series of gear.

The lineup is essentially the same as that of the old HO-13, except a crystal filter has been added in the 350 kc i.f. strip. Referring to fig. 1: when used as a panadapter, a sample of the i.f. from the receiver is applied to an untuned-input r.f. amplifier, after which it is combined in V_{2A} mixer with a heterodyning oscillator to provide an i.f. signal of 350 kc that goes to a crystal filter, is amplified and then converted by a video detector/amplifier for application to the vertical-deflection plates of the c.r.t.

The heterodyning oscillator is frequency-

* Technical Director, *CQ*.

[1] Or a receiver as described later.

[2] CQ Reviews the Heathkit HO-13 Ham-Scan, *CQ*, Sept. '65, page 57.

See page 110 for New Reader Service

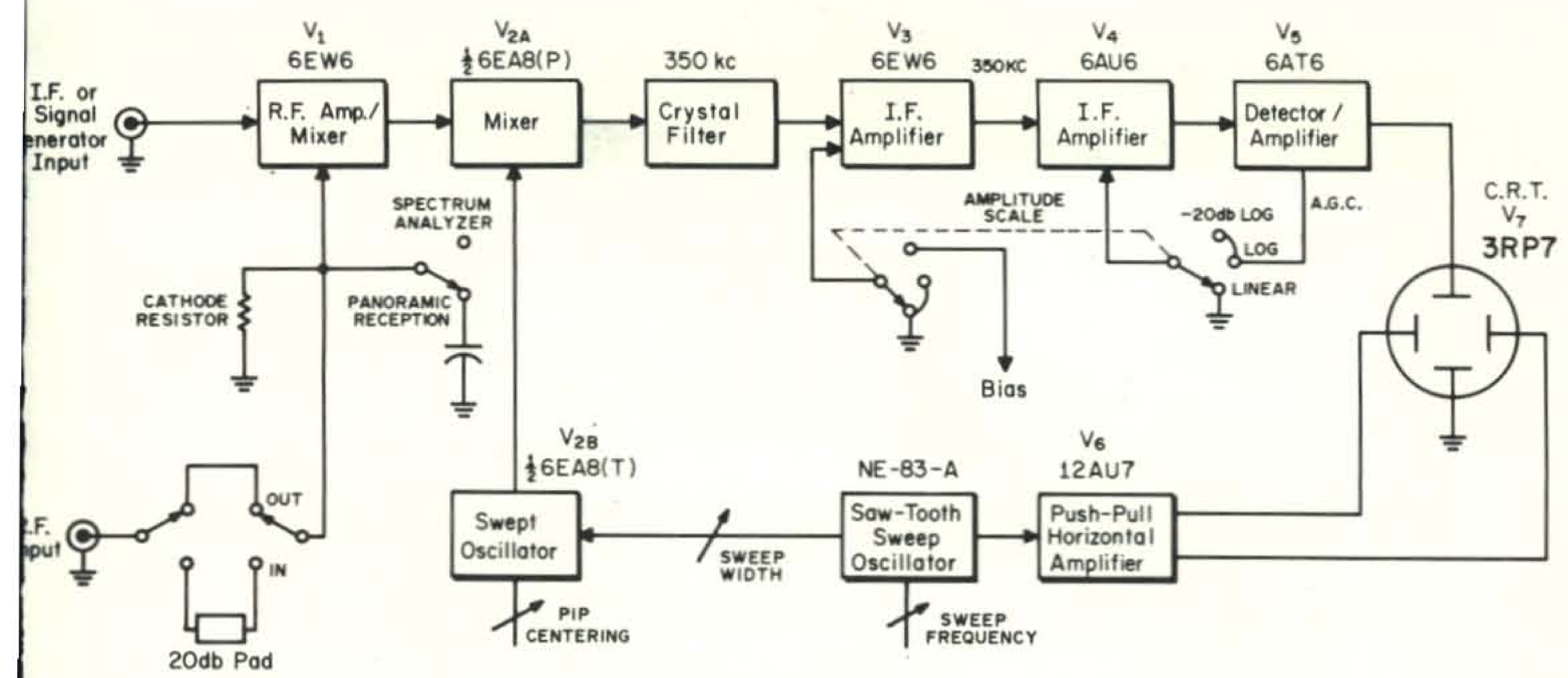


Fig. 1—Block diagram of the Heath SB-620 Scanalyzer.

modulated by a variable-capacitance diode that is driven by a saw-tooth sweep oscillator. The necessary frequency to pass through the crystal filter is obtained whenever the instantaneous frequency difference between the receiver i.f. signal and the swept-oscillator frequency is 350 kc.

The receiver signals thus appear on the c.r.t. screen at the sweep-frequency rate and are in the form of a "pip". The pip shape mostly depends on the response of the Scanalyzer's 350 kc i.f. system which is very narrow due to the crystal filter. A resolution of 1 kc can be obtained (the resolution defined as: The frequency difference between two adjacent signals of equal amplitude that bisect one another at a spot 30 per-cent, or 3 db, below their uppermost point).

Operation with different receiver i.f.'s requires wiring the SB-620 for that particular i.f. This involves the coupling circuit between the r.f. amplifier and mixer V_{2A} and also the constants for the frequency-determining circuit of the swept oscillator. Wiring provisions are made for the following i.f.'s: 455, 1000, 1600-1680, 2075, 2215, 2445, 3000, 3055, 3395, 5200-6000 kc.

When the Scanalyzer is set up for receivers with a 3395 kc i.f., the interstage coupling incorporates a 500 kc bandpass circuit to minimize the possibility of birdies otherwise introduced by unwanted responses from the receiver itself. This was found to be quite effective during operation with the SB-300 receiver, as evidenced by the complete absence of spurious responses otherwise observed with the older Model HO-13.[3]

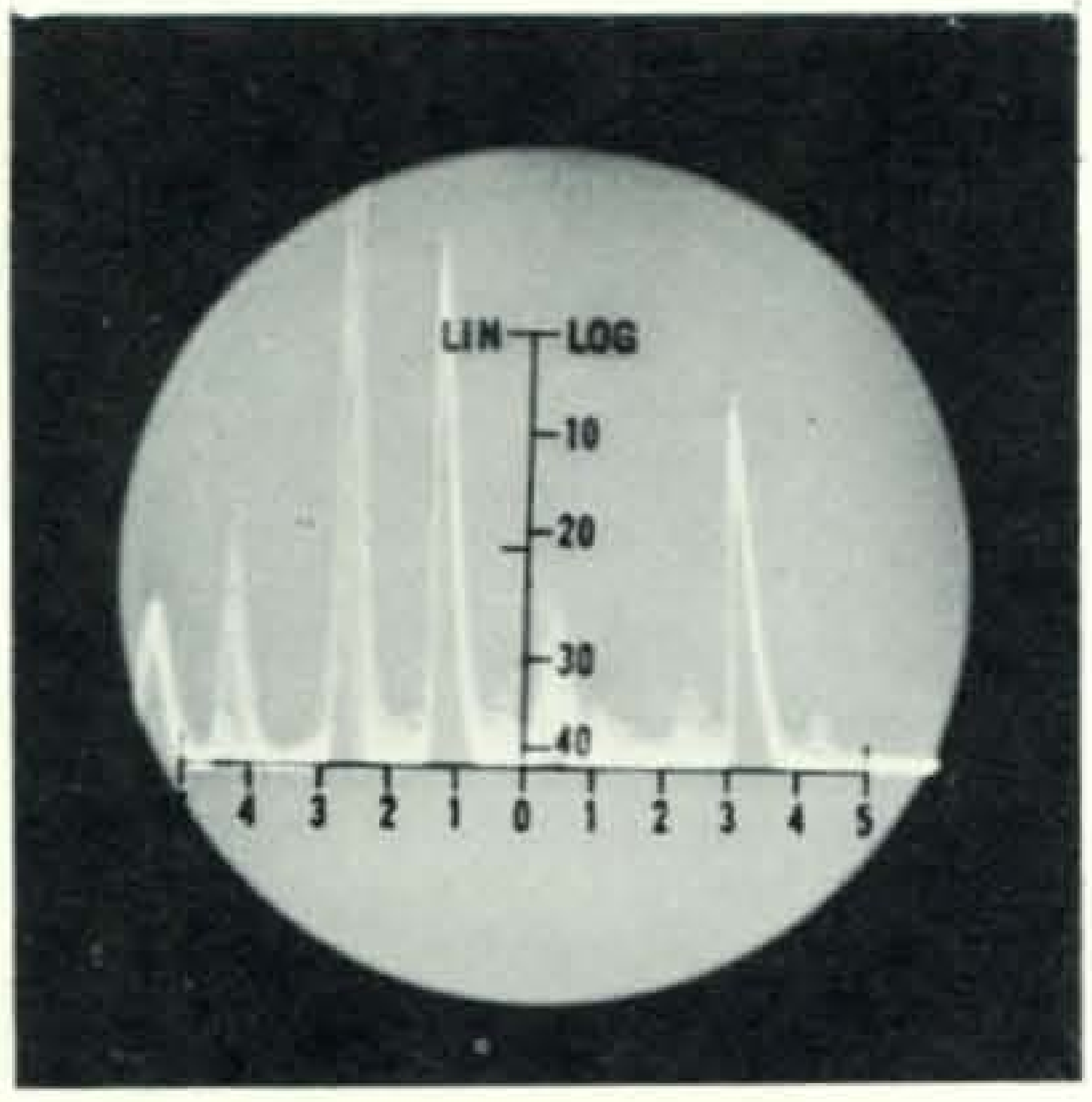
The saw-tooth oscillator is a relaxation type using a neon bulb. It also provides the horizontal sweep for the c.r.t., which thus synchronizes the horizontal trace with the frequency excursions of the swept heterodyning oscillator. This allows the pips to remain fixed at points along the baseline where the oscillator frequency at the same instant produces a 350 kc beat with the received signals.

A control permits the pip of the audible signal (the one that is exactly at the receiver i.f.) to be centered at the baseline. There will be no output from signals related to other pips that appear at either side of center, unless the receiver is retuned to center the pip of interest.

A switch provides the selection of three different sweep-*frequency* ranges and three sweep-*width* ones. These are a 10 kc sweep-*width* position with a half-cycle (2 sec.) sweep *rate,* a 50 kc sweep-*width* position with a 2-2.5 c.p.s. *rate* and a variable-sweep-*width* position with a variable *rate* of 5-15 c.p.s. The variable-sweep-*width* range depends on the receiver i.f. for which the unit is wired, ranging from 10-100 kc with a 455 kc i.f. to a maximum of 500 kc at higher i.f.'s.

For a linear display the gain of the 350 kc i.f. amplifiers is fixed and the signal amplitude is controlled by a *pip-gain* at the input of the r.f. amplifier. For a logarithmic display, the 2nd 350 kc stage is switched to operate with a.g.c. obtained from the video detector. This provides a useful dynamic

[3] Inasmuch as the HO-13 Ham-Scan performed well at several different i.f.'s, as reported in the earlier review, the SB-620 was tested only with a 3395 kc i.f.



Panoramic display on part of the 40-meter band.

range of 0-40 db on the c.r.t. screen. Another position at the switch reduces the bias on the *first* 350 kc stage to increase the gain of the amplifier by 20 db. This expands the display so that the upper 20-db portion is not fully seen on the c.r.t., leaving only the -20 to -60 db region fully visible. More accurate observations are thus possible at lower relative levels. You then mentally add 20 db to the calibrations for determining the actual situation. This is called the *log* scale. The 0-40 db range is called the *-20 db log* scale, because the overall gain is 20 db lower.

For spectrum-analysis bench tests, the cathode bypass at V_1 is switched out to permit the tube to function as a mixer, instead of an amplifier, with a sample of r.f. from the equipment under test applied to the cathode either directly or through a 20-db attenuator; while the output from a separate signal generator is applied to the grid.

The signal-generator frequency must equal the sum of the test-signal frequency and that of the i.f. for which the SB-620 has been wired. For instance: If the Scanalyzer is set up for a 3395 kc i.f., the signal generator must be tuned to 7295 kc for a 3900 kc test signal ($3395 + 3900 = 7295$). About 0.1 volts output is needed from the generator. The SB-620 may be used in this manner up to 50 mc.

The c.r.t. circuitry is quite conventional with positioning, intensity, focusing, astigmatic and amplitude controls. Silicon rectifiers are used in the power supply which may be wired for either 120 or 240 v.a.c. operation. A neon bulb regulates the plate voltage for the swept oscillator and in order to keep the hum level down, d.c. is used for the heaters of certain tubes in critical circuits. The size of the unit is 6⅝" × 1 × 10½" (H.W.D.) and it weighs 10 lbs.

Assembly and Alignment

The SB-620 can be assembled in 12- hours with an additional hour or so r quired for initial tests and alignment. T latter may be made using a signal generat or a receiver with a calibrator or oth signal source.

Panoramic Operation

When used as a panadapter with a r ceiver, the input of the SB-620 is connect to the output of the receiver mixer in whic the signals are heterodyned with t *variable-tuning* oscillator and ahead of t selective circuits of the receiver. This done through a short piece of coax with small amount of capacitive coupling to t mixer plate. The proper size capacito along with the tube number and socket co nection for different receivers of variou manufacturers is given in the manual.

The VARIABLE sweep-width position i used for panoramic displays with the widt control adjusted for a known bandwidth i relation to the baseline calibrations. Cal bration may be easily made using a 100 k calibrator on the receiver to provide pip at 100 kc increments. Typical calibratin displays are shown at fig. 2.

For sweep widths less than 100 kc or i cases where a calibrator is not available the job may be handled by adjusting th *sweep-width* so that the pip for a given signa appears at either end of the scale when th receiver is tuned over the desired bandwidth

With the sweep-width set for a give calibration, signals of the pips that appea near the various calibrations may be hear by tuning the receiver by an amount and i

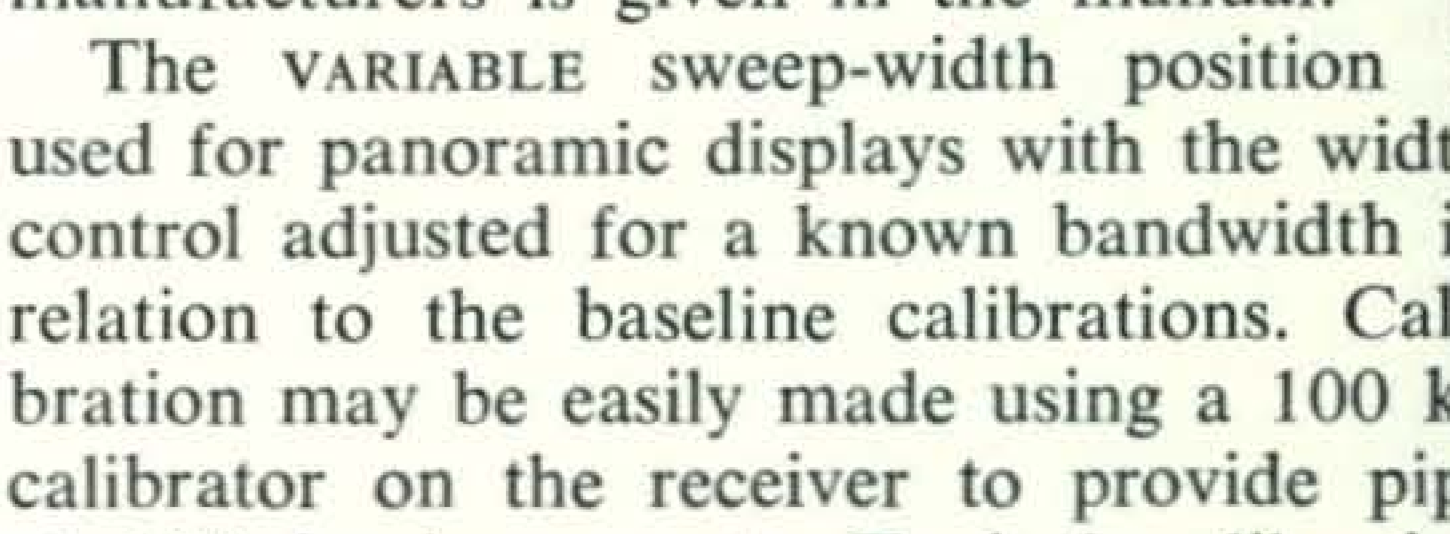


Fig. 2—500 kc sweep-width calibrating pips obtained from 100 kc crystal calibrator. Pips appear tilted due to fast sweep rate. At A, receiver preselector is peaked at the 100 kc interval at right of center. At B, preselector is peaked for 100 kc point at right end.

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the direction indicated by the calibrations. Typical displays for various type signals (s.s.b., a.m., rtty, noise, etc.) are illustrated in the manual.

The sweep *rate* should be set for the best resolution consistent with a clearly defined pip. In this respect, the slower the sweep rate, the better the resolution; however, with the slower rates a complete pip will not be seen all at once as the spot slowly moves along. Its outline will afterward be noted by the retention provided by the persistence of the c.r.t. screen. Where s.s.b. or c.w. signals create a fast rising and falling pip, this might be somewhat confusing. In these cases a faster sweep will be better for observation of such signals.

Spectrum-Analysis Bench Tests

The setup with a signal generator for spectrum analysis on electronic gear was described earlier. In addition, the input end of the r.f. sampling cable must be properly terminated with 51 ohms as indicated in the manual, otherwise a correct display might not be realized. It is usually best to also switch in the 20 db input attenuator if enough signal level is available for doing so.

The required r.f. level is low, so where a transmitter output is involved, sampling must be taken from a voltage-divider network such as that described in the manual or as shown at fig. 3.

For analysis work a narrow sweep-*width* and the lowest sweep *rate* is needed for the best resolution, so the 10 kc width position is best. In this case where the sweep rate is only 2 seconds, it may at first be difficult to exactly locate and center the display while the signal generator is being tuned to the required frequency, but this situation can be alleviated by holding in the knob of a spring-return switch (on the HORIZONTAL-POSITIONING control) that causes the sweep *rate* to increase without altering the sweep *width* or the centering of the display. When

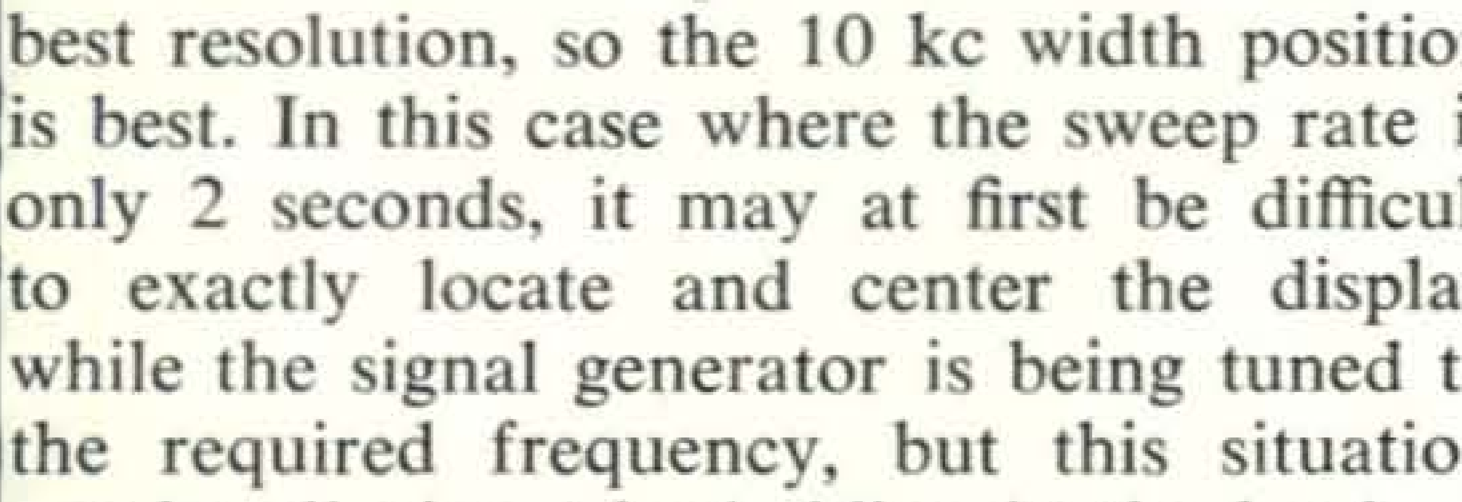
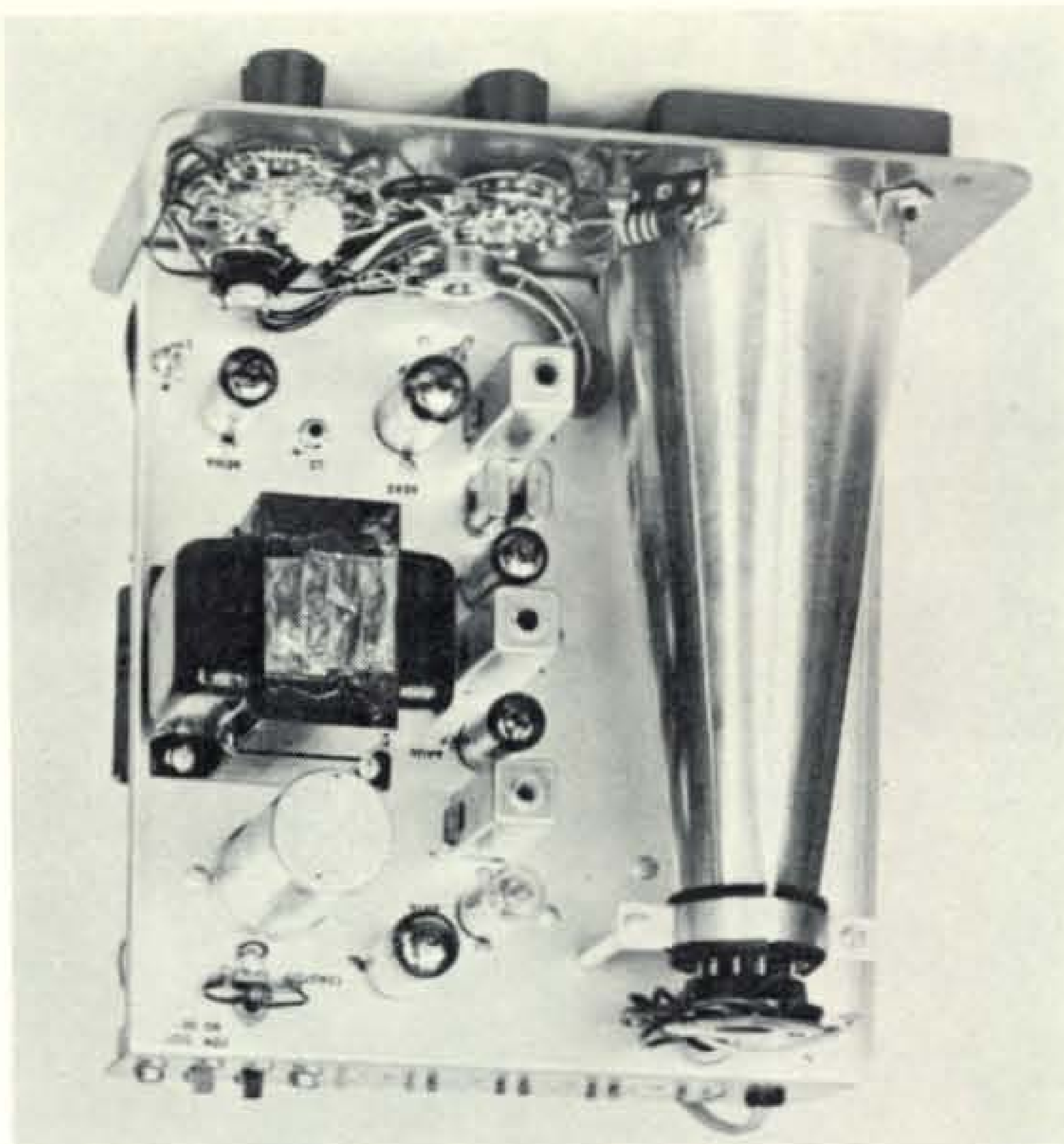


Fig. 3—Sampling network.



Top-chassis view of the SB-620. The c.r.t is enclosed with a metal shield at the left for protection against stray magnetic-field pickup.

the knob is released, the sweep returns to the slow rate and you're all set. Should further minute adjustment be needed, it can be done with the PIP-CENTERING control or by varying the transmitter v.f.o.

During the above procedure, the amplitude scale should be set for a linear display and the signal generator should be *slowly* tuned around the frequency that was calculated as explained previously. The transmitter should be set for a moderate amount of carrier output.

After the carrier pip has been obtained and centered, set the amplitude scale to the − 20 DB LOG range and with the PIP GAIN between three-quarters and full on, set the transmitter-carrier level to maximum and adjust the sampling level so that the peak of the pip reaches the zero-db calibration. You're now ready to read down to − 40 db, and by switching over to the LOG position, readings to − 60 db may be had as described before.

The manual does not show displays of signal analysis tests for determining distortion products, carrier or sideband suppression, etc. We've found that many amateurs are at a loss as how to interpret such displays and since "a picture is worth a thousand words", examples are shown at figure 4.

Signal analysis also may be conducted using the SB-620 connected to a receiver

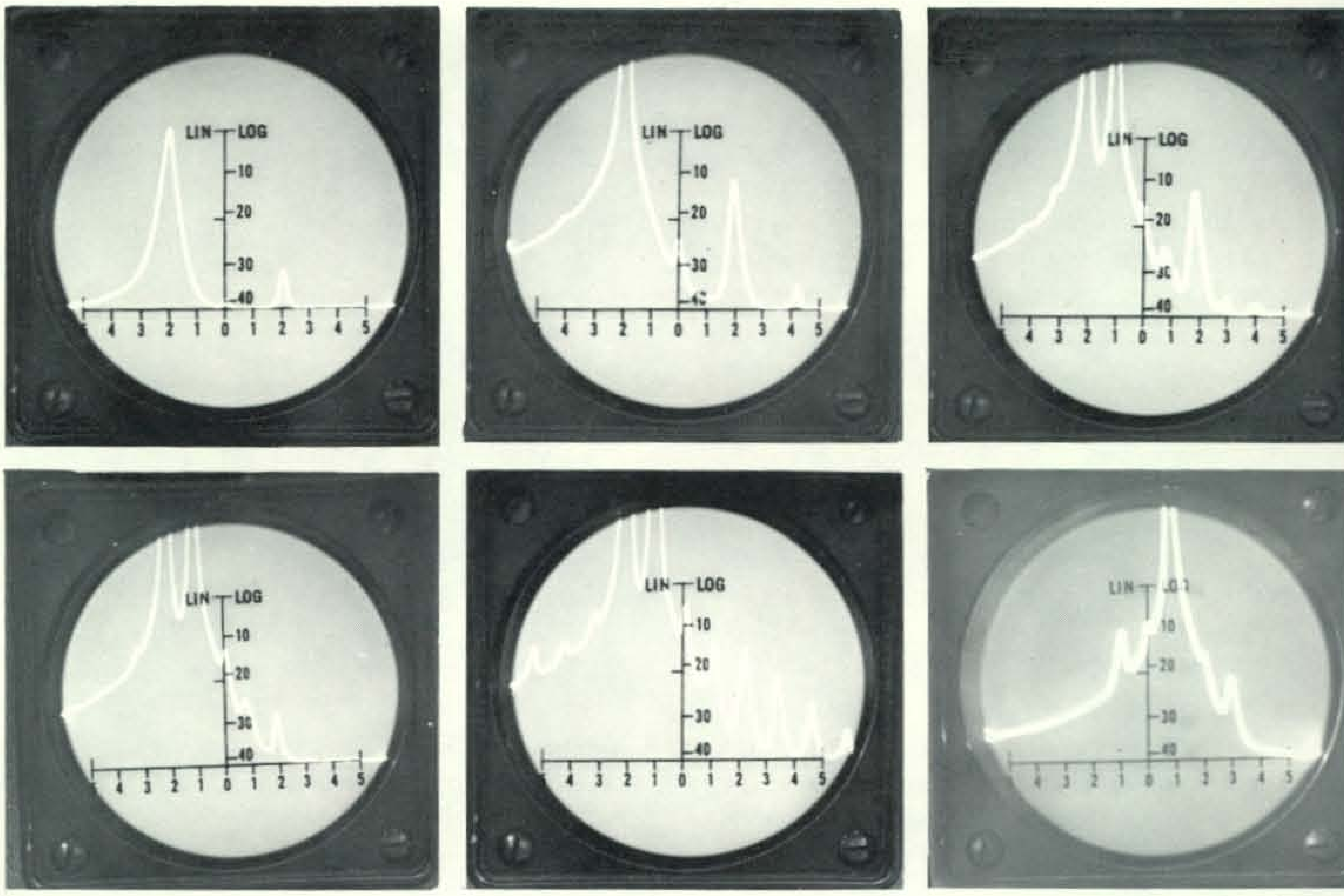


Fig. 4—Spectrum-analysis displays positioned with the carrier at the zero-reference. With such tests the wanted- and unwanted-sideband frequencies are at the same relative point each side of the carrier. The spacing between each odd-order intermodulation (I.M.) product is equal to the frequency difference between two test tones and these products appear as the 3rd, 5th, 7th, etc., starting each side of the test tones. A.f. harmonics of single-tone signals appear at a multiple of the fundamental tone.

A—Phasing type s.s.b. transmitter with 2 kc single tone. The test tone is 2 kc to the left of the carrier. The unwanted sideband is at 2 kc to the right 32 db down (— 20 db log scale).

B—Same as A with display expanded on log scale. Adding 20 db to readings indicates carrier suppression at zero-reference is — 45 db. Note more accurate readability of 2 kc signal on unwanted side and the visibility of 2nd a.f. harmonic at 4 kc, 41 db down on wanted side, 55 db down on unwanted side.

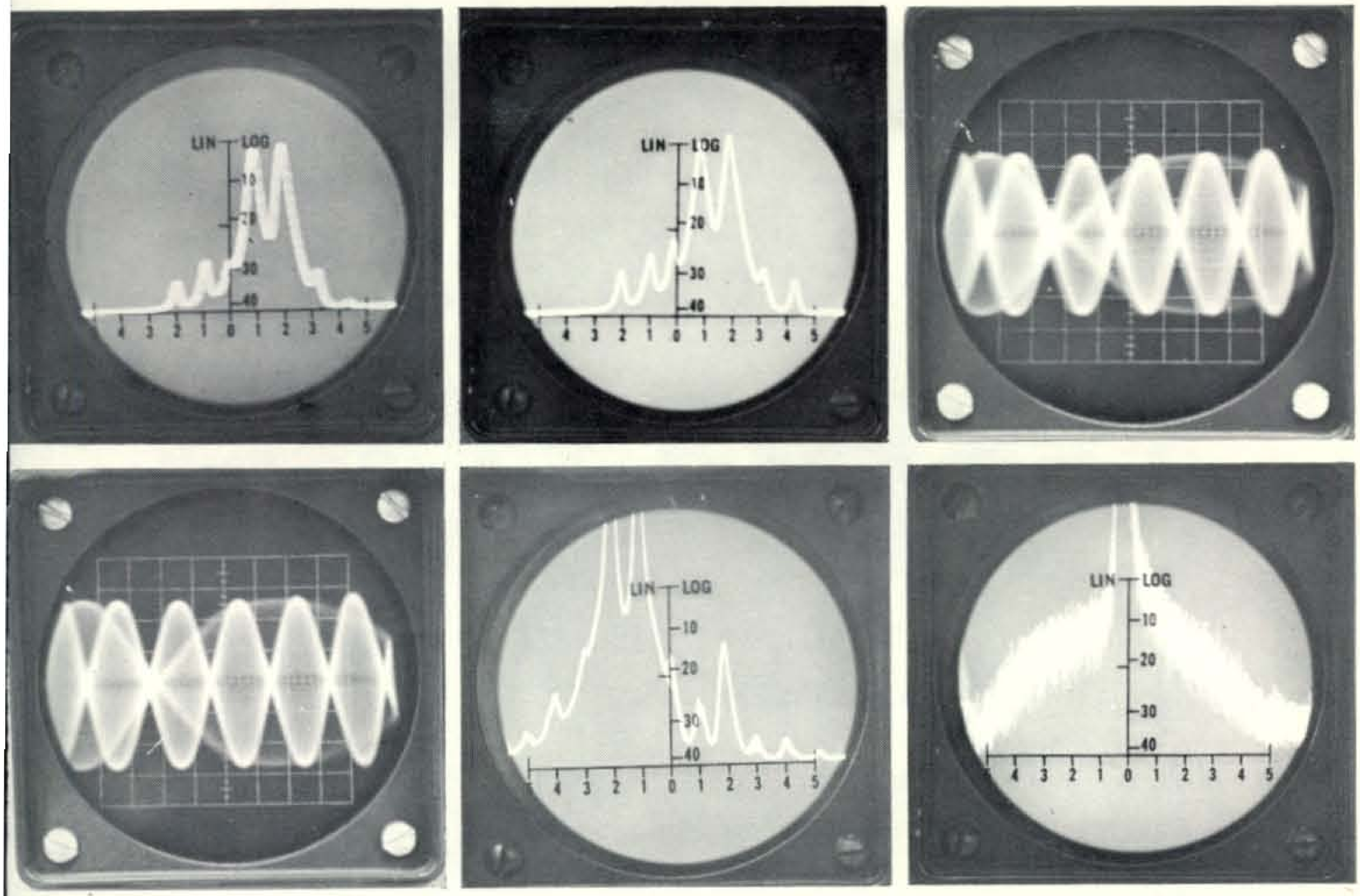
C—Phasing type transmitter with 1kc and 2kc test tones viewed on expanded log scale. The 3rd order product appear at zero and 3 kc to the left. Difference in magnitude of same relative products each side of test tones is often due to incidental amplitude or phase modulation in various stages, causing a component in one sideband to add or subtract from its counterpart on the other sideband. Unwanted-sideband suppression at 1kc is better since the a.f. phase-shift network in the exciter does not maintain exact 90° phase shift over the a.f. range. The 5th order I.M. is — 42 db at 4 kc to the left, but at the right it is masked by the 2 kc unwanted sideband. The 9th and 11th products appear at 4 and 5 kc to the right.

D—Filter-type s.s.b. transmitter with two-tone test on expanded log scale. The 3rd order products are — 33 db at zero and 3 kc to the left. Unwanted sideband is down 45 and 48 db at 1 and 2 kc respectively. Carrier suppression is masked by the 3rd order product.

E—Same as D, but with p.a. driven to grid current and flattopping. The 3rd order products have risen to — 25 db, while the 5th and 7th have developed at — 35 db at 4 and 5 kc to the left and 1 and 2 kc to the right. The 9th, 11th and 13 orders also have appeared further to the right. The test tones

as employed for panoramic reception and will be useful where a signal generator is not available or for analyzing low-level stages. On-the-air signals under steady-state conditions also may be scrutinized if the signal level is sufficient and if there is no adjacent-channel QRM. For bench tests, a short piece of wire should be used for an antenna and if needed, an input attenuator added to prevent overloading the receiver stages ahead of the take-off point for the Scanalyzer.

As for the SB-620 itself, the log-scale calibration was found quite accurate when checked with a step attenuator, the resolution for analysis work work was better than the rating and the sweep was sufficiently linear for close correlation with the equidistant baseline calibrations. The high-persistence c.r.t. provides excellent re-



were not exactly 1 kc apart, hence the greater spacing between pips. The test-tone signals on the unwanted sideband at 1 and 2 kc are therefore still visible near the original level by the slight crook at the left side of the 5th and 7th order pips. By virtue of the larger I.M. products, the overall sideband suppression has deteriorated considerably and the total transmitted bandwidth has likewise increased to at least 10 kc.

F—1 kc single tone (on opposite sideband than shown in previous displays) with a poor-performance filter-type exciter. Carrier suppression is only 30 db at the zero reference. Sideband suppression at 1 kc is only — 30 db at the left. The 2nd and 3rd a.f. harmonics appear 38 and 42 db down at 2 and 3 kc on wanted sideband at right.

G—Same exciter as at F with two-tone test on — 20 db log scale. Carrier suppression is still 30 db, just masking the 3rd product at zero. Unwanted sidebands at 1 and 2 kc to the left are — 28 and — 34 db respectively.

H—Same as G, but with level raised a bit, thus increasing the wanted and unwanted sideband signals by the same amount, but note that the carrier suppression has deteriorated to — 24 db. At the right the 3rd order has not noticeably increased, but the 5th has come up significantly at 4 kc (the related products at the left are hidden by the unwanted-sideband signals).

I and J—Envelope displays of G and H respectively as obtained with an oscilloscope. Except for the difference in amplitude, to the eye they appear the same as far as linearity goes. Comparison with the Scanalyzer displays indicates the unreliability of envelope patterns.

K—In the expanded displays, dissymmetry will be noted at the left where the slope is not as steep. This does not affect the absolute values, but merely lessens the resolution and the visibility of the pips thereat. Unfortunately, it was not until after most of the photographs were taken, that the cause of the fault was discovered to be a poor ground contact with the clip used to secure one of the crystal holders for the 350 kc filter. Since this is not a normal condition, the display at K is presented to show the correct symmetry as obtained after the difficulty was corrected. Compare symmetry with the display C.

L—Display with the 50 kc sweep-width indicates parasitic oscillations that extend over a wide band.

tention of a complete display when the 2-second sweep is used for analysis. With the 10 kc sweep width, occasional re-centering of the display may be needed, particularly if line-voltage variations occur. At this small sweep-width, adjustment of the PIP-CENTERING control is quite critical, but to make the job easier, repositioning by varying the transmitter or receiver v.f.o. can be had, as suggested previously.

From the test displays shown here, it should be evident that for determining the proper performance of his gear, no serious-minded phone operator should be without test equipment such as the Heathkit SB-620 Scanalyzer which also provides panoramic reception for bandscanning with a receiver. It is priced at $119.95 (kit). The producer is The Heath Company, Benton Harbor, Michigan 49022.—*W2AEF*

See page 110 for New Reader Service

PREDICTING ANTENNA PERFORMANCE

BY KEN "JUDGE" GLANZER,* K7GCO

PREDICTING an antenna's performance at a certain location entails many considerations such as the power level, height, ground terrain and conductivity, to mention just a few. Some antenna sites appear to be exceptional and often are. Sometimes they are just average or even below average for no apparent reason. How and by whom the location is evaluated is another consideration. Many times, skilled operators with low power transmitters consistently outperform other operators with higher power and higher gain antennas. The conclusion often drawn is that the skilled operator has a better location.

* 202 South 124th Seattle, Washington 98168.

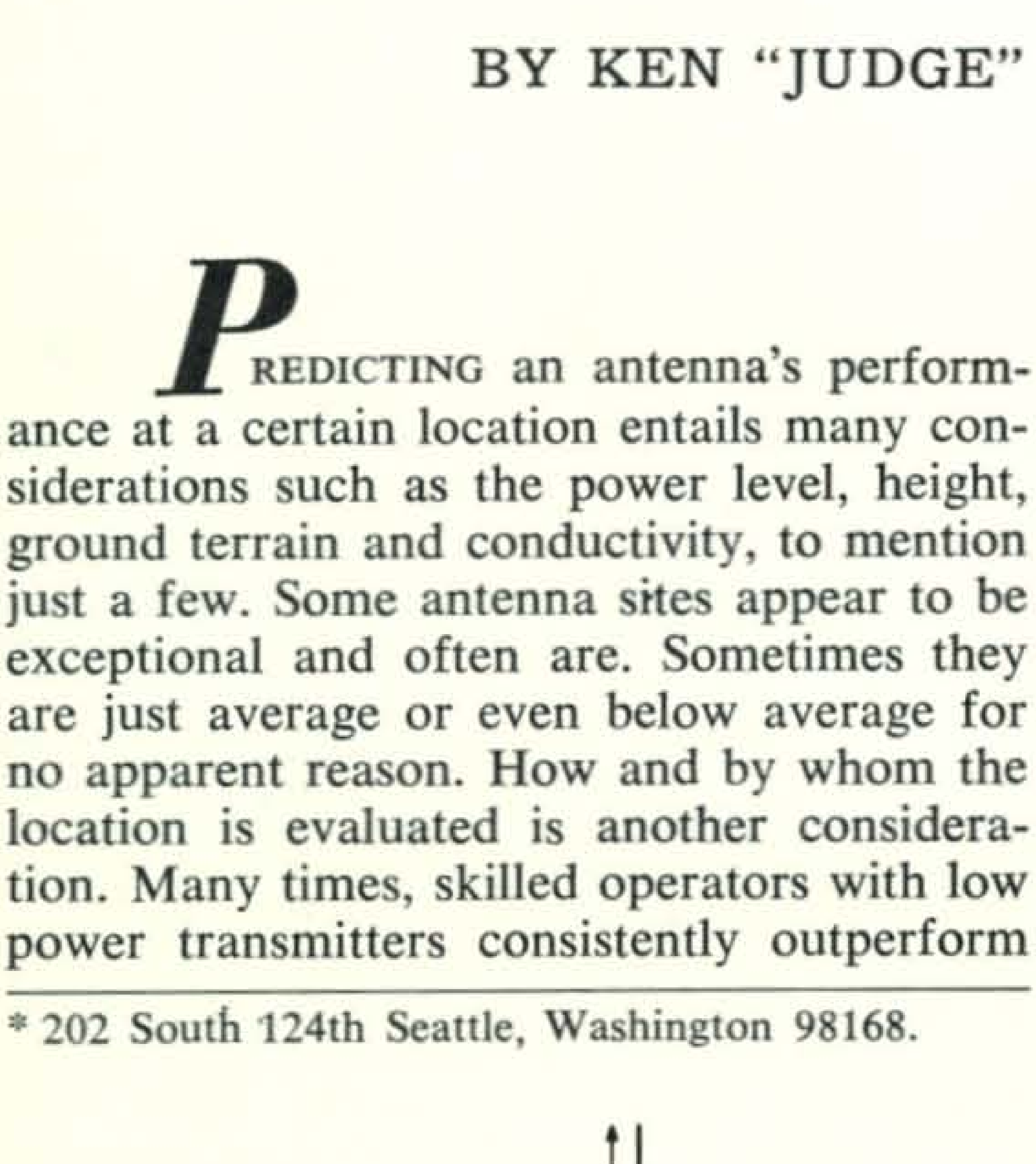


Fig. 1—Free space patterns of several collinear dipoles having 10 db gain. In A, circle #1 as viewed from the end of the dipoles shows the vertical gain pattern of a single dipole. Circle #2 is the vertical gain pattern of collinear dipoles with a 10 db gain showing an increase, but no change in directivity. In B, the top view of the collinear dipoles, the horizontal patterns for the single dipole (#1) and the colinear (#2) with 10 db gain are shown.

Side by side comparisons of signal strength, where skill is not a factor, can tell a true story in many respects. Amateurs are constantly comparing signal strengths in contacts and over a period of time a general overall performance level can be determined. One of the so-called "acid tests" that has proven valuable is who gets the DX station first in the "pile-ups." However, when the competition is the keenest a power factor sometimes creeps in and again invalidates the comparisons. Sometimes even the best of friends will hold out a bit on each other so even they aren't sure how they really compare.

Pattern Importance

The importance of the free space vertical pattern cannot be over emphasized and it is the least understood. Far too much emphasis is placed on the gain of an antenna which, while it is certainly important, does not give the most important characteristic of the antenna. This can best be illustrated by the following example. The patterns of typical dipole configurations are illustrated in fig. 1. Assume that several collinear dipoles are all fed in-phase and their "line of sight" gain is 10 db over a single dipole. As illustrated in fig. 1 the horizontal pattern is a much sharper "figure 8" but the vertical free space pattern (*H* plane) is *still* the same as a single dipole, a circle. Although the antenna has 10 db gain, it has no vertical directivity and this is a serious disadvantage except for high angle radiation on the lower frequencies.

Now assume a number of dipoles are again fed in-phase but stacked one on top of each other until a line of sight gain of 10 db is again obtained as illustrated in fig. 2. The beam width of the horizontal "figure 8" is unchanged despite the 10 db gain. The *vertical* pattern is now a very sharp "figure 8" as a result of the vertical stacking. Both configurations have the same gain but the performance of the two antennas will be substantially different at 1000, 5000 or 15,000 miles away. The antenna with the vertical stacking will have the stronger signal at a distance because most of the energy is concentrated into the lower angles of radiation. Whenever a gain figure is quoted some description of the vertical and horizontal patterns should also be given.

Although the previous example is an extreme case, even minor improvements in the vetrical free space pattern appear to give beneficial results. An example of this is the quad antenna. The quad has proven itself to be an effective DX antenna yet its actual line of sight gain is slightly over 4 db. The horizontal pattern is noticeably wider than the average 3-element beam. The quad is actually a stacked array of two half waves in phase spaced one quarter wavelength apart. This is far from optimum spacing, however, the vertical pattern sharpens beneficially and is the principle reason for the good performance of the quad. An eighth wave at each end of each half wave is bent down or up and results in a slightly broader horizontal pattern. The sharper vertical pattern is obtained at the expense of the horizontal pattern and is a step in the right direction for effective long haul communications.

Another example of this is the popular "ZL Special" 2-element all driven array. The horizontal pattern is a cardioid of about 4 db gain. Yet the antenna is outstanding on long haul communication. The answer again is to be found in its vertical pattern. Vertical patterns are much sharper in all-driven arrays, another being the 8JK array. The 8JK array is an effective antenna on the low as well as the high frequencies as a result of the sharp vertical pattern.

Ground Conductivity

Another important factor in an antenna's performance is the ground conductivity. When an antenna works over a perfectly conducting ground the reflected component (equal in amplitude) combines with the free space pattern and reshapes or alters the pattern with definite lobes and nulls. The new lobes are 6 db stronger than the free space pattern in the vertical plane.

Locations where the antenna works over salt water have always proved to be outstanding due to the high conductivity. In such areas vertical antennas have proved to be outstanding performers and in many cases even better than horizontals. Antennas working over salt water (liquid copper) approach ideal laboratory conditions in nature about as close as possible. The angle of radiation patterns over perfectly conducting ground are closely duplicated in many respects.

Vertical Antennas

Vertical antennas that are ¾ wavelengths long or less always have one radiation lobe close to the ground or water regardless of their height above ground. The reflected component of a vertically polarized wave suffers no phase reversal (in an ideal case) upon reflection and therefore is in-phase with the direct component, forming a lobe next to the ground. At higher angles where the reflected component is out of phase with the direct component a null is formed in the vertical pattern.

Experiments with 2, 3, and 4 element vertical beams on 20 meters over a period of

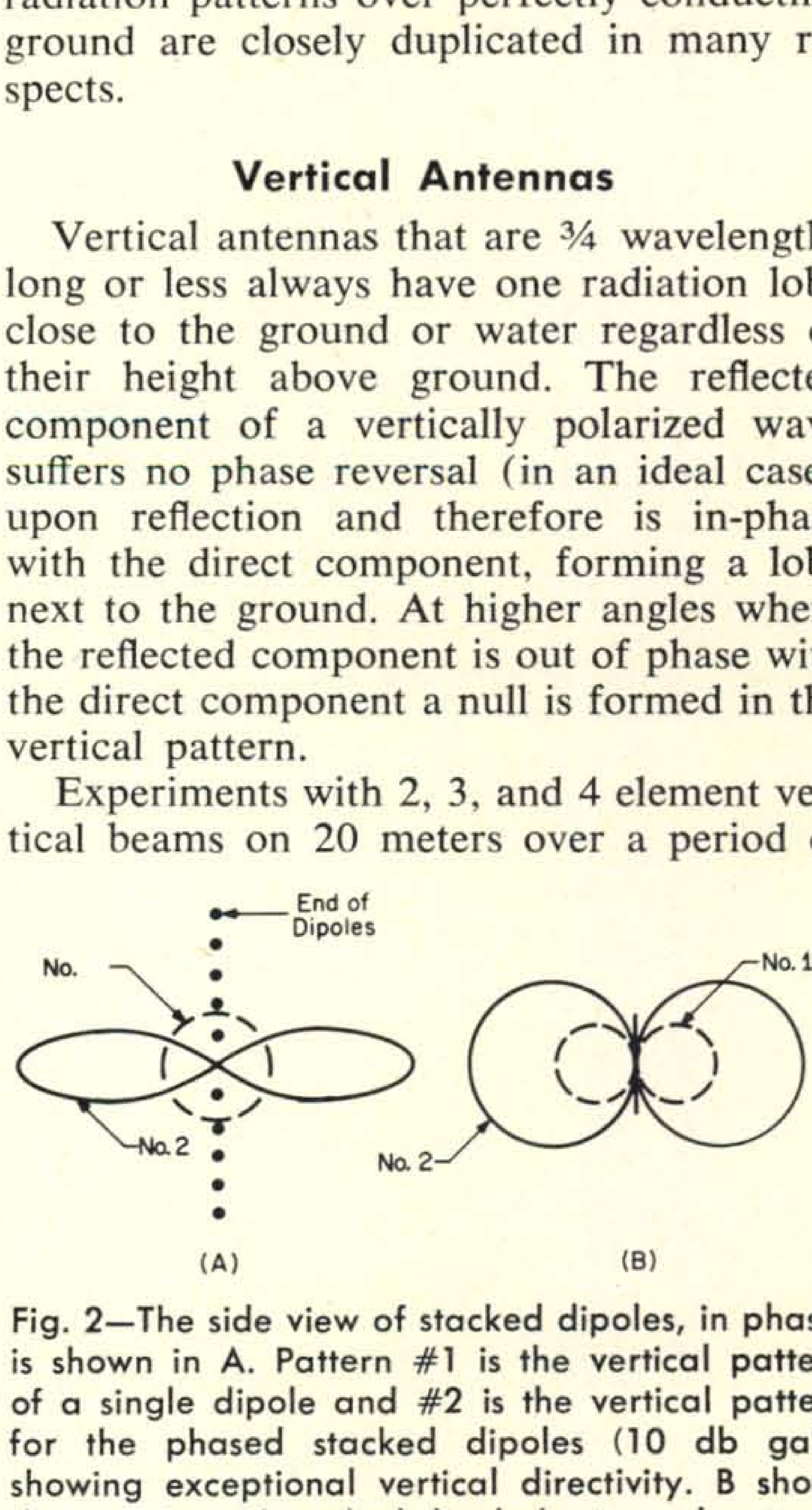


Fig. 2—The side view of stacked dipoles, in phase, is shown in A. Pattern #1 is the vertical pattern of a single dipole and #2 is the vertical pattern for the phased stacked dipoles (10 db gain) showing exceptional vertical directivity. B shows the top view of stacked dipole horizontal pattern. Pattern #1 is the horizontal pattern for the single dipole, the conventional figure 8. Pattern #2 for the stacked dipoles is also a figure 8 with the same beam width but higher gain.

Fig. 3—The antenna view from W7YGN. This has proven to be an outstanding antenna site with Puget Sound below for a ground plane. The view is northeast with the Space Needle looming up in background. Weak DX stations have been heard here when not heard elsewhere in Seattle. Directly north is the antenna sight of W7FA.

Fig. 4—This is the antenna view at K7GCO. With equal antennas and power, signal reports have averaged 6 db higher than those of W7YGN. Lake is fresh-water. Horizon appears curved because the camera was tilted down. View is Northeast. To the southwest the land slopes up. This site has proven to be one of the most effective in the US as unusually strong signal reports have been received from Europe with simple antennas and 1 KW power on all bands.

Fig. 5.—This was the antenna view from W7FA. The salt water of Puget Sound below provided an excellent ground plane (liquid copper) and the signal strength reports were always outstanding. West Seattle is across the water and was the antenna sight of W7YGN. One end of a 75 meter folded dipole was connected to the 20 meter beam tower and the other end down on the beach for a "Slantindicular" polarization. This antenna gave outstanding results. W7FA was probably the only west coast station that heard ZL1ABZ from he Kermadec Islands on 75 meters on April 18, '58. This is the ultimate in antenna sites.

years by W7DND have shown that the 3 and 4 element beam's free space vertical pattern is apparently too sharp for effective communications. The sharper the free space vertical patterns the lower the main angle of radiation and less energy in the higher angles. omparison with K7GCO and with stations in Europe have confirmed this observation. Other facts may have influenced the results but every effort was made to make the comparisons as accurate as possible. The salt water bay next to W7DND's lot was not pure salt water due to the fresh water streams flowing into it. This results in a much lower conductivity but still much better than the highest ground conductivity.

Other tests at W7DND also show that stacked Lazy H antennas of horizontal polarization working over salt water apparently do not suffer from too sharp a vertical pattern. One reason may be that regardless of how sharp the free space vertical pattern may be with horizontal antennas there is never a lobe next to the ground due to the 180° phase shift suffered by horizontally polarized waves.

Horizontal antennas require height and/or stacking to develop a low angle of radiation and a sharp vertical pattern. Vertical antennas do not have to be high or stacked to produce a low angle of radiation or a sharp vertical pattern and this is a big advantage. An antenna's E plane pattern is generally sharper than its H plane pattern so a vertical antenna will generally have a much sharper vertical pattern than the same antenna horizontally polarized. Unfortunately. vertically polarized waves are attenuated more over lossy ground than are horizontally polarized waves. Vertical antennas are more prone to noise pick up which is also a major disadvantage. However, 2 and 3 element vertical beams over comparatively lossy ground have proven very effective. The "Twin Ten" array for 10 meters is an example of this.

The antenna site of W7YGN, shown in fig 3, appears to be one that couldn't be improved upon with the salt water of Puget Sound below. Although it has proven to be an exceptional antenna site, the one at K7GCO shown in fig. 4 seems to have the edge on all bands. The ground slopes down to the fresh water lake at about a 30° angle. The power lines in the antenna's field about 80 feet away do not appear to affect the signal but that would not be known conclusively unless extensive checks were made with the wires removed.

Generally speaking, a rule of thumb has been offered that if the obstructions do not cause a change in the s.w.r. as the antenna is rotated, their effect is negligible. The higher the gain of an antenna, the more effect a metallic obstruction will have on the antenna's major lobe as the reflections will be stronger and the beams tuning, phasing, *etc.*, becomes more critical. Obstructions on the same level and of the same polarization will have the greatest effect on the antenna.

Antennas are affected very little by other antennas that are resonant higher in frequency. The low frequency beams in a stacked array are virtually unaffected by the smaller beams. The smaller beam's vertical pattern is affected by the larger beams to some extent, and if they are mounted too close it will show a change on the horizontal pattern, s.w.r., resonant frequency and bandwidth. The larger beams act as a partial screen or ground or sky plane. The vertical radiation from a yagi is small and decreases with increased gain.

Radials

Radials under an antenna are most useful when the antenna has a high angle of radiation such as a horizontal dipole on the low frequencies. The major part of a yagi's vertical pattern doesn't reflect off the ground much closer than a 45° angle projected down from the antenna and all the way to the horizon. So the neighbors lot and house wiring, plumbing etc. have more to do with a beams's resulting vertical pattern than does the area immediately under the antenna. The pattern is scattered, twisted, deflected, reflected and absorbed so that any similarity between what it would be in an ideal case is small. The effect is more serious on a received signal as nothing can be done about it. When transmitting one can often make up for the disrupted pattern with high power or a high gain antenna. Generally the two balance out but several instances have been observed where one station always received better signal reports than others but had the most trouble receiving other distant stations due to low signal strength. High power was usually the answer but it can also be a receiver in need of alignment. Many questions will be answered some day when some one develops a way to see the r.f. field of an antenna. ■

PROJECT OSCAR

A NEW YEAR REPORT

BY GEORGE JACOBS,* W3ASK

DESPITE some disappointments, it is almost certain that the fifth radio amateur satellite in the OSCAR series will be launched sometime during 1968, with the honors in all probability going to an Australian-built satellite.

AUSTRALIS-OSCAR, containing beacon transmitters in the two and ten meter amateur bands, arrived in the United States during June of last year[1]. A redesigned replacement for the satellite's command receiver arrived at Project OSCAR headquarter during late December, and AUSTRALIS-OSCAR is now undergoing final system and environmental tests prior to acceptance for launch. It is expected that the satellite will pass these tests with flying colors. Launch arrangements have not yet been completed, but Project OSCAR headquarters is hoping for a summer, or earlier date.

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[1] For technical details see "AUSTRALIS-OSCAR Arrives in USA", *CQ*, Aug. 1967, page 32.

Bill Browning, G2AOX, has his equipment all ready to go for OSCAR-5. Bill tracked each of the previous four OSCAR satellites, and generated some of the most accurate orbital predictions for these satellites.

The hoped-for 1967 launching of the EURO-OSCAR[2] communications satellite did not take place. The satellite, built by European radio amateurs under the sponsorship of Region 2 of the International Amateur Radio Union and under the leadership of Karl Meinzer, DJ4ZC, encountered mechanical and electronic difficulties during its testing period at Project OSCAR headquarters. The satellite has been returned to Europe, where it is now undergoing redesign.

When the satellite has been redesigned, it will contain a two meter translator similar to the one that operated aboard OSCAR-3, and beacon-telemetry transmitters in the amateur two meter and 432 mc bands. If all goes according to plan, the redesigned EURO-OSCAR satellite should be back at Project OSCAR headquarters in California later this year, and there is a possibility that it too may be launched before the end of the year.

Projects ARIES and 2-10

The huge ARIES-OSCAR satellite,[3] which was to contain a two meter translator and beacon transmitters operating in the 144, 220, 432 and 1290 mc amateur bands, will not be completed. Project OSCAR headquarters sadly reports that the project has been terminated, due primarily to the untimely death of Ewell Carter, WA6ZIG, who spearheaded the project for the San Fernando Valley Radio Club of California. The partially built satellite has been dismantled, and all donated material has been returned.

At Project OSCAR headquarters, slow but

[2] For technical details see "EURO-OSCAR Satellite Favored to Win OSCAR-5 Race", *CQ*, May, 1967, page 23.

[3] See "ARIES- Another Communication Satellite Planned for the OSCAR Series", *CQ*, Sept. 1966, page 29.

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teady work continues on a two-to-ten meter ranslator satellite. The electronic section of he satellite, being built under the direction of Marvin Wahl, W6FUV, has been com-pleted and is now undergoing preliminary ground tests.

The 2-10 OSCAR satellite will contain a ranslator which will receive two meter sig-nals from ground stations and retransmit hem on ten meters. The satellite will also contain a beacon-telemetry transmitter oper-ating in the two meter band, and possibly a econd one in the ten meter band or on 432 mc.

It is too early to say whether or not the 2-10 OSCAR satellite will be completed dur-ng 1968, but in all probability it won't be available for launch until 1969.

Despite the unfortunate termination of ARIES project and the need to redesign the EURO-OSCAR satellite, the possibility for at east one launch of a radio amateur satellite during 1968 looks quite good.

OSCAR Bulletins

One of the best ways to keep current on OSCAR activities and progress during 1968 s to monitor the weekly bulletins transmitted by W6ASH of Project OSCAR. These bulle-ins, containing up-to-the minute news about OSCAR projects, are transmitted on c.w. at pproximately 18-20 wpm. every Thursday vening at 6 P.M. PST on 14.030 mc, and at P.M. PST on 7.015 mc (Note, these times orrespond to 0200 and 0500 GMT on *Fri-days*). After each transmission, W6ASH tands by on frequency for any questions or raffic for Project OSCAR headquarters.

Join Project OSCAR

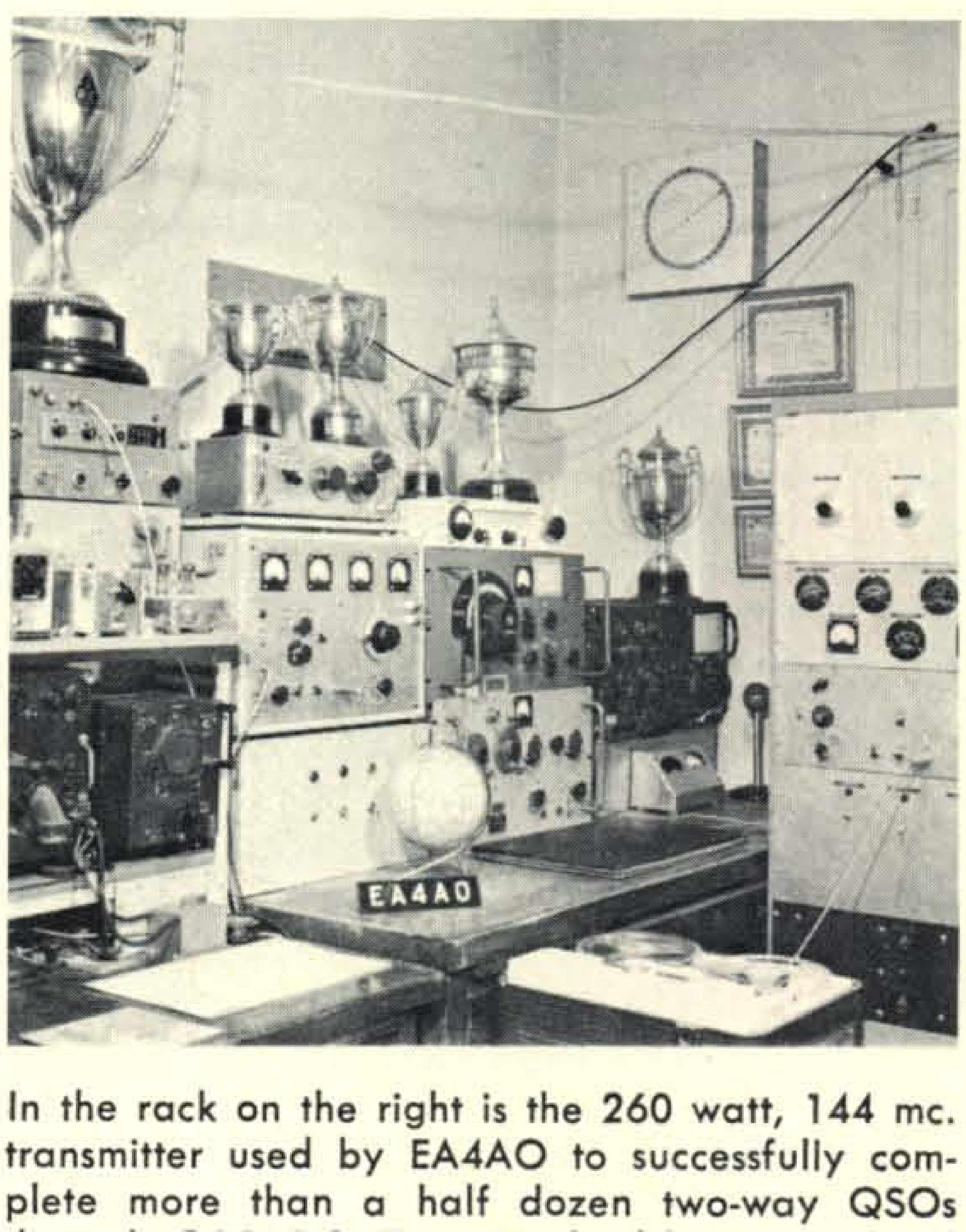
All of the radio amateur-built OSCAR satel-ites are "free-access", that is they are availa-ble for the use of radio amateurs and ama-eur space listeners in every country of the vorld on an equal basis. It is *not* necessary o be a member of the Project OSCAR or-ganization to participate in the project. For he past few years, however, there has been a campaign to increase the number of con-ributing members in order to raise sufficient unds to cover the operating expenses at the roject's Foothill College, California head-quarters. Money is needed for, among other hings, to send out periodic newsletters, to nswer a large volume of mail, to organize rojects, to lend material assistance in the

Lito, LU2EW shown tuning-up his home-brewed two meter station with which he plans to com-municate through OSCAR satellites from his QTH near Buenos Aires.

construction of OSCAR satellites, and to main-tain the radio equipment at the headquarter's stations.

Projects OSCAR headquarters reports that the membership campaign has been moving along very well, and that the number of contributing members is nearing the 200

[*continued on page 100*]



In the rack on the right is the 260 watt, 144 mc. transmitter used by EA4AO to successfully com-plete more than a half dozen two-way QSOs through OSCAR-3. Two British vhf receivers and a home made vhf transistor receiver are among the equipment on the main table. The trophy's attest to the many contributions made by EA4AO to amateur radio.

FURTHER NOTES ON

MIXER SPURIOUS FREQUENCY ANALYSIS

By JAMES G. LEE,* W6VAT

SINCE "Mixer Spurious Frequency Analysis" was published in *CQ* September 1965 [1] subsequent discussions by mail and in person with hams have disclosed that the original article perhaps didn't pay enough attention to the overall concept of using the charts in equipment design. When using the charts, it is possible that a design can be done with only one or two birdies—and rather than scrap the whole concept—if these birdies can be eliminated or diminished greatly by circuitry, then the design could be a very practical one. So let's consider some areas where steps can be taken to reduce certain birdies, provided there are not too many.

Oscillators

Any receiver or transmitter can have one or more fixed or tuneable oscillators. They will be quite strong local signals and therefore all harmonics of the fixed oscillators should be calculated as well as all harmonic *ranges* of the tunable oscillators to see if any fall into the desired transmitting or receiving ranges. Note that no other frequency is involved (or it is considered to be zero frequency, if you prefer). This is one subtlety of the charts that is not immediately apparent.

For example, the Heathkit catalog description of the SB-400 gives a value fo oscillator feedthrough mixer products of 5 db below rated output except for a cross over at 3910 kc which is 45 db down. Col lins Radio Company does not recommen using the 75S-3 receiver between 5.0 an 6.5 mc. Why? Because birdies are presen in the 5.5 to 6.5 mc range and there is a ever present second harmonic of the tun able 2.5 to 2.7 mc h.f.o. in the 5.0 to 5.4 m range. A check of the remaining spectrun covered by the 75S-3 will show no birdie although there are some close approaches These will be outside the tuning range an therefore will not be heard.

Tuned traps can be used to eliminate th higher order harmonics of fixed oscillator which may be troublesome. A built-in lov pass filter can be used on a tunable h.f.o. t reduce higher order harmonics. This usuall requires the best in filter termination, shield ing, and decoupling, since the filter element won't do the job all by themselves. Eve such things as filament wires can conduct small amount of signal out into the chassi area where it will eventually cause trouble Because of linearity considerations in bal anced mixers and product detectors, loca oscillator levels can reach 1 to 10 volts o more. It becomes difficult to shield and filte these relatively strong local signals.

Crystal Types

There has been at least one instance o a ham receiving an FCC QSL for a birdi which the charts said should not have bee there. However, digging a little deeper int the particular transmitter showed that on of the fixed oscillators in the circuit wa using an overtone crystal. These crystals ar processed so as to maximize their output o a certain overtone, but the crystal can stil have output on other overtones. Also, as th crystal ages, it can shift its mode of oscilla tion slightly so that it actually has equa output on two adjacent overtones. Appar ently this crystal was giving sufficient outpu on two frequencies to allow proper outpu and a spurious output near the desired tun ing range but just outside the band. Tuning the v.f.o. showed the birdie crossing ove the desired signal about 20 kc inside th band. The lesson here is that if you con template a design using overtone crystals b sure and check the adjacent overtones t see if they might cause trouble sometim in the future.

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* Box 357, Cupertino, California.

[1] Lee, James G., "Mixer Spurious Frequency Analysis," *CQ*, September 1965, page 42.

Coils

Coil Q's are different between transmitters and receivers. The loaded Q of a properly designed transmitter tank coil is generally around 10 to 20 depending upon a number of factors. The usual receiver coil loaded Q is only about half the unloaded value so that it may be as high as 30 to 75. When a birdie is heterodyned down to a lower frequency, such as the i.f., it remains the same distance away frequency-wise. Consequently, it suffers much more attenuation passing through the i.f. coils because it appears so far out of the bandpass of the i.f. amplifiers.

In the transmitter, if a tuned circuit has a loaded Q of 12 at, say 7.2 mc, the total bandwidth between the 3 db points is 600 kc. Thus any birdie between 6.9 and 7.5 mc will have less htan 3 db attenuation by the tuned circuit. In fact, a birdie within the range of 6.6 to 7.8 mc (twice the 3 db bandwidth) will have only about 9 db attenuation. This is because, generally speaking, a single tuned circuit has only about 6 db more attenuation each time you double the bandwidth.

Bandpass couplers offer more attenuation outside the 3 db bandwidth points but they are more complicated to tune and align properly. This is achieved by a reduction of attenuation to signals close to their resonant center frequency. Thus, birdies close to the output frequency can receive essentially no attenuation at all. This is the price you pay for the flat response. Bandpass couplers seem to be used mainlv at the output of mixers.

Antennas

There are other ways to get more attenuation for unwanted frequencies. For example, using an antenna tuner is not only desirable from a matching and anti-TVI standpoint, it is another way to get additional selectivity. The type of antenna used can also have a significant bearing on the problem. Most full size dipoles and Yagi antennas are relatively broad-band antennas compared to the trapped or loaded antenna. Thus the rig designed to operate into a full size antenna must have a few more precautions taken in its design.

At its resonant frequency, a Yagi will show gain over a ½ wave dipole, but at two frequencies on either side of this frequency, the Yagi will show 0 db gain over a dipole. A birdie at or near these side frequencies will see essentially a resonant dipole as far as gain or attenuation is concerned. If the thought is beginning to occur to you that an antenna can act as a filter, you're right.

Of the four ways an antenna can function as a filter, two are of importance to the amateur. They are off-frequency mismatching and off-frequency de-focusing. With the latter effect, although the Yagi will show 0 db gain over a dipole at two side frequencies, it will not have the same radiation pattern it does at resonance. The directors and reflectors will look like chunks of metal and front-to-back ratios won't mean anything. Just what the pattern *will* look like is very hard to say.

Off-frequency mismatching means that power at frequencies far removed from resonance will be reflected back down the feedline from the antenna and so will not be radiated. The Yagi can have quite wide variation in mismatching (v.s.w.r.) depending upon design [2]. It is possible to write down a resonable expression for just how much filter action this mismatching contributes [3]:

$$L_{db} = 10 \log_{10} \frac{(1 + V^2)}{4V}$$

where: L is the loss in db.
V is the v.s.w.r. at the frequency of interest.

To give you some feeling of this loss, when you have a v.s.w.r. of 40 compared to your resonant frequency, the antenna is offering 10 db of attenuation to signals at this frequency.

If you are now thinking of trap-type antennas and mobile whips, congratulations. By virtue of their restricted frequency response, they can significantly reduce spurious radiation far from resonance. Since many hams sacrifice efficiency off-resonance to gain multiband operation in a small space by using "loaded" antennas, some of them may be getting something for nothing. They may not be periled by FCC QSL's for spurious radiations simply because they are using a high Q antenna.

So it depends upon what you are trying to do and how you intend to do it. The ham

[*continued on page 102*]

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[2] "Building a Wide-spaced 20 Meter Rotary Beam," *CQ*, April 1950.

[3] "The Antenna as a Filter Element", *Technical Bulletin*, Vol 1, Number 7, White Electromagnetics, Inc., Bethesda, Md.

SAVE YOUR EQUIPMENT FROM HARM

BY R. A. GANN,* W5TLY

Described below is a simple a.c. line automatic cutoff device that is tied to the bias circuit of the linear amplifier. When the bias fails, the a.c. line is interrupted.

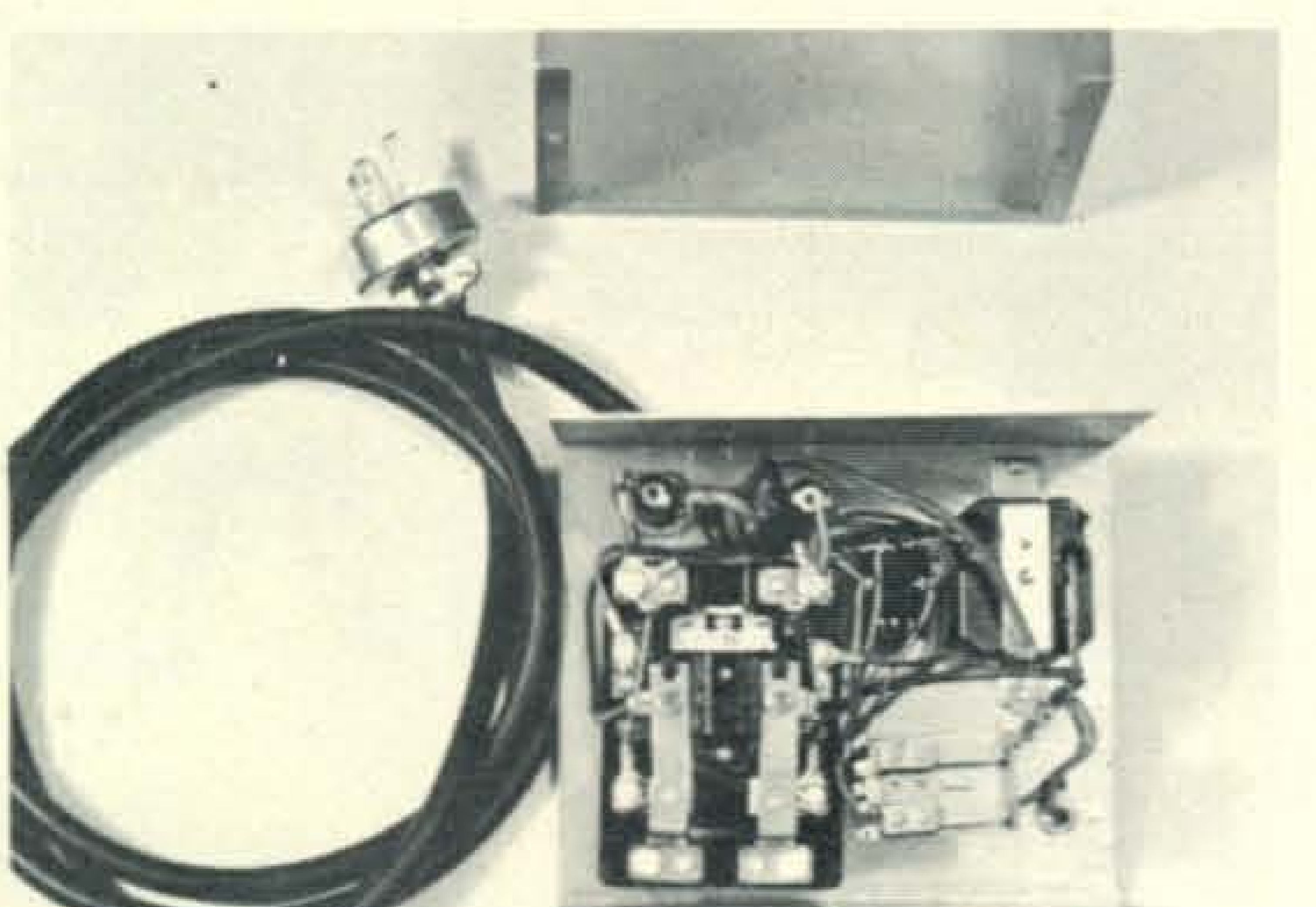
"SAY ED, you sure do have a booming signal this morning. How are you and the family this day? By the way, I have the linear on this morning, and—well, it just happened again. The cut-off bias is gone and in stand by the plate current is too high. Plate voltage is about 1800 and the 811 plates are about to melt."

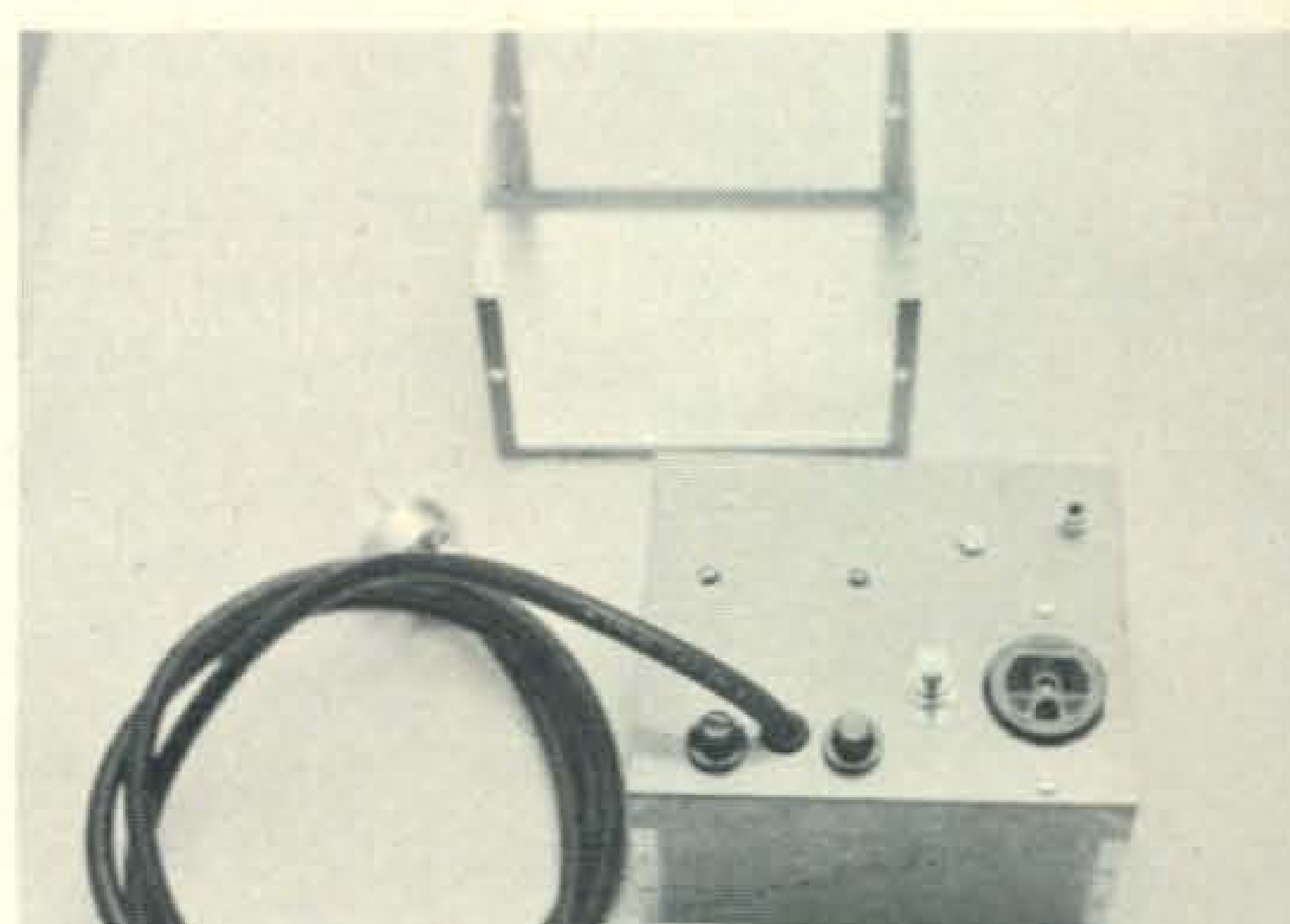
Well this is how it all started. Many of the linears in operation today operate with the p.a. tubes biased to cut off while in STANDBY. This bias may vary from a few volts to three or four hundred. When the amplifier is keyed, the bias is changed to the proper value for linear operation. So far so good.

Well, the linear has been working fine for a few weeks or months; you turn the rig on for warm up, tune around for a CQ or someone to break in on. You look at the plate meter of the amplifier. Golly—what's wrong? The plate current should be zero or close to it with the linear in stand by. Is the linear keyed? You hope not, because the exciter is not keyed. Say, the p.a. plate is higher than it is even when the linear is keyed. I had better turn this thing off. On second thought, let's key the exciter and see what happens. Well what do you know; the p.a. plate current goes down to its normal static condition when it is keyed. OK, I will go back to receive condition—there it goes again—way too high. So the linear is turned off, unplugged from the wall, removed from its cabinet, and work begins.

Well, the trouble was not hard to find. Two resistors, 1 diode, and 1 filter capacitor were shot. Not too much expense, and everything is operating OK again.

* Box 40357, Everman, Texas 76140.





Interior and exterior views of the control box show the simple construction and wiring.

I was not so lucky the next time. I left the near turned on for about 3 days; I had ailed to turn it off after the contacts the ther day. The line fuses were gone, but so as the plate transformer and the bias esistors again. There are several reasons hy the plate transformer could have burned p, but we need not go into that. By the way, cost about $65.00 to repair the linear.

With all this behind me, I decided to use n old commercial trick, and rig up something that would cut off primary power when ormal bias was gone.

Protective Circuit

The basic diagram is fig. 1. Lots of fancy ircuits could be added if you want to, but his is very simple. Figure 2 shows the circuit sed commercially to protect a collins 30L-1.

One thing to keep in mind is the coil resistance of K_2. If your standby bias is, say 6 olts, you should have a relay that would operate on 6 volts. This would mean a coil resistance much lower than the 10K coil shown n fig. 1. The same would apply if your stand by bias were 400 volts. The 10K coil should hen have a series resistor so the coil would ot heat up.

Any type of box that will hold the parts vill work fine. Use heavy wire, #12 or #10, or the leads going to and from K_1. These re your primary power leads and you might et a voltage drop if the wire is too small. You will have to run some type of lead from he linear bias supply, including a common round to the relay connection for K_2. Phono connectors work fine.

Operation

Operation is very simple. Connect the line ord of the linear to J_1. Connect the bias ead to K_2. Set S_1 in the OFF position. Plug P_1 in to your 115 volt source. If all is working, nothing should happen; the linear should be dead. Turn the power switch of your inear to ON. Turn S_1 to ON. The linear should come on, K_1 being activated by S_1. If your bias supply uses a tube rectifier, leave S_1 on until K_2 closes. If your bias supply ses silicon rectifiers, K_2 should come on immediately. When K_2 has closed, S_1 should be placed in the OFF position.

Bias from the linear, through K_2 will keep K_1 closed until bias is removed from K_2. Any time K_2 opens, K_1 will open and turn off the linear. Disconnect the bias from K_2 several times and watch the operation cycle.

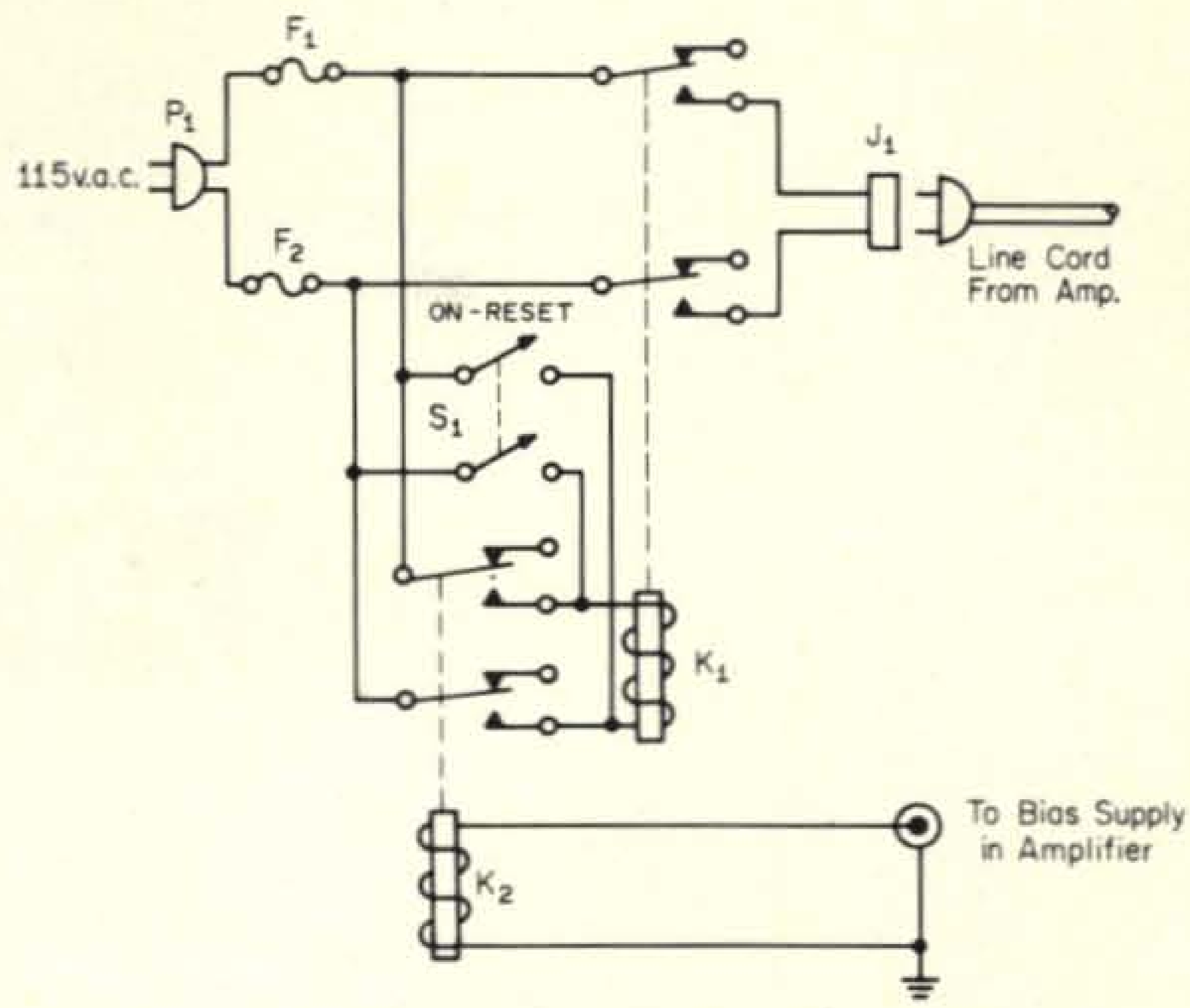


Fig. 1—Circuit of a "sure-fire" protector for a linear r.f. amplifier or any other circuit in need of quick cutoff when the bias fails. Fuse current rating used should be the same or slightly higher than those used with the equipment being protected.

K_1—115 volt a.c. d.p.s.t., 15 to 25 a. contacts. K_2—d.p.s.t. relay with coil matched to linear bias voltage.

Make sure S_1 is turned to the OFF position after K_2 and K_1 are closed. If S_1 is left in the ON position, K_1 will stay closed (ON) all the time, and removal of bias from K_2 will not cut off primary power to the linear.

This little unit works fine and good luck if you decide to build one. ■

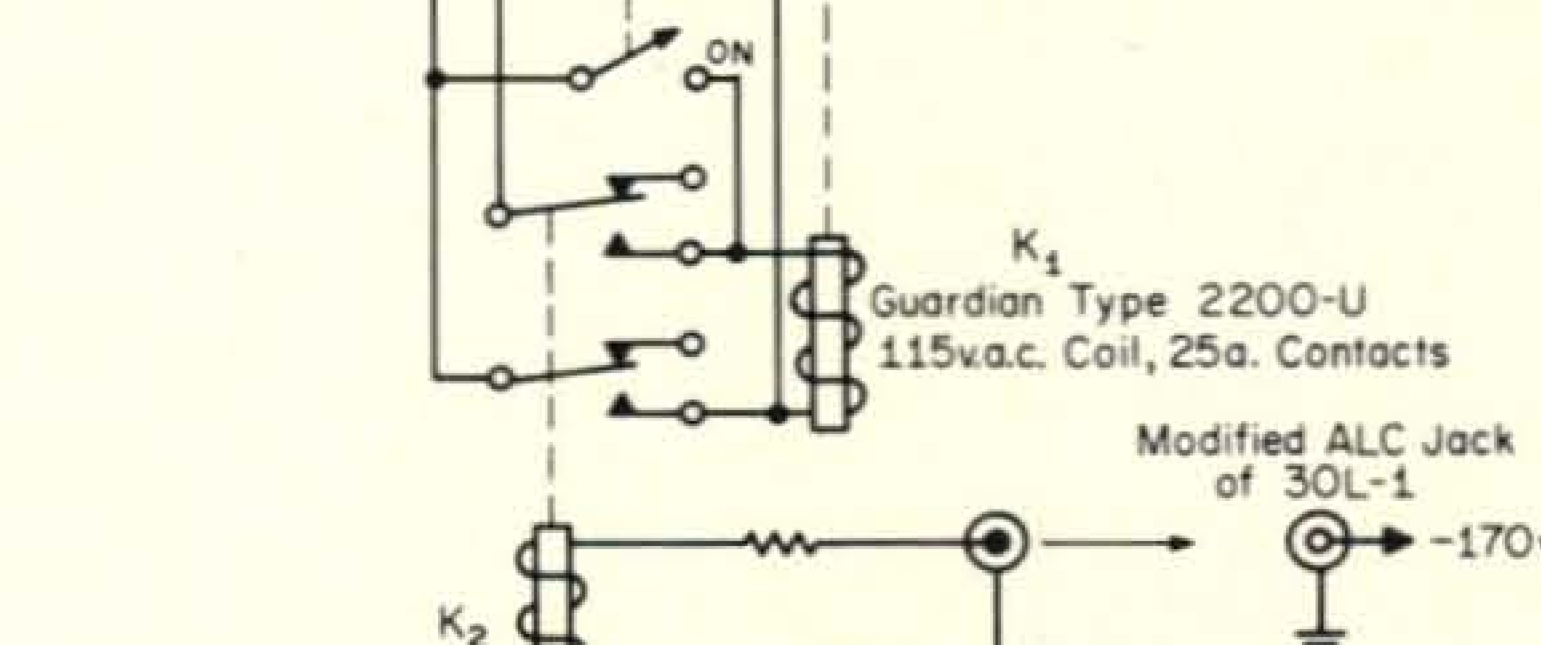


Fig. 2—Circuit of the protective device as used for the Collins 30L-1 transmitter. The a.l.c. jack is modified so that it provides the bias supply voltage for K_2. Relay K_1 is a Guardian #2200-U nad K_2 is a Guardian #200 with a 5K or 10K relay coil.

ADD A CRYSTAL FILTER FOR LESS THAN $10

BY WILLIAM E. HOOD,* W1USM

Upgrade your receiver by the additional of a crystal i.f. filter. Cost? Less than ten dollars.

Crystal filters are a luxury found only in the more expensive receivers, and for some unknown reason, most literature available to the ham and the tinkerer shed little light on how to make them. The advantage of having one is unquestionable, especially with the crowded conditions of today's ham bands. The filter shown in this article is intended mainly for the c.w. man although it will be of some use in s.s.b. It has a continuously variable bandwidth from about 200 cycles each side of center, (or less) to somewhere around 3 kc. A phasing control moves a sharp rejection notch through the passband virtually eliminating interferance almost on top of the signal you want.

* Sr. Engineer Aide, National Radio Co. 41 Circle Asbury Grove, South Hamilton, Mass. 01982.

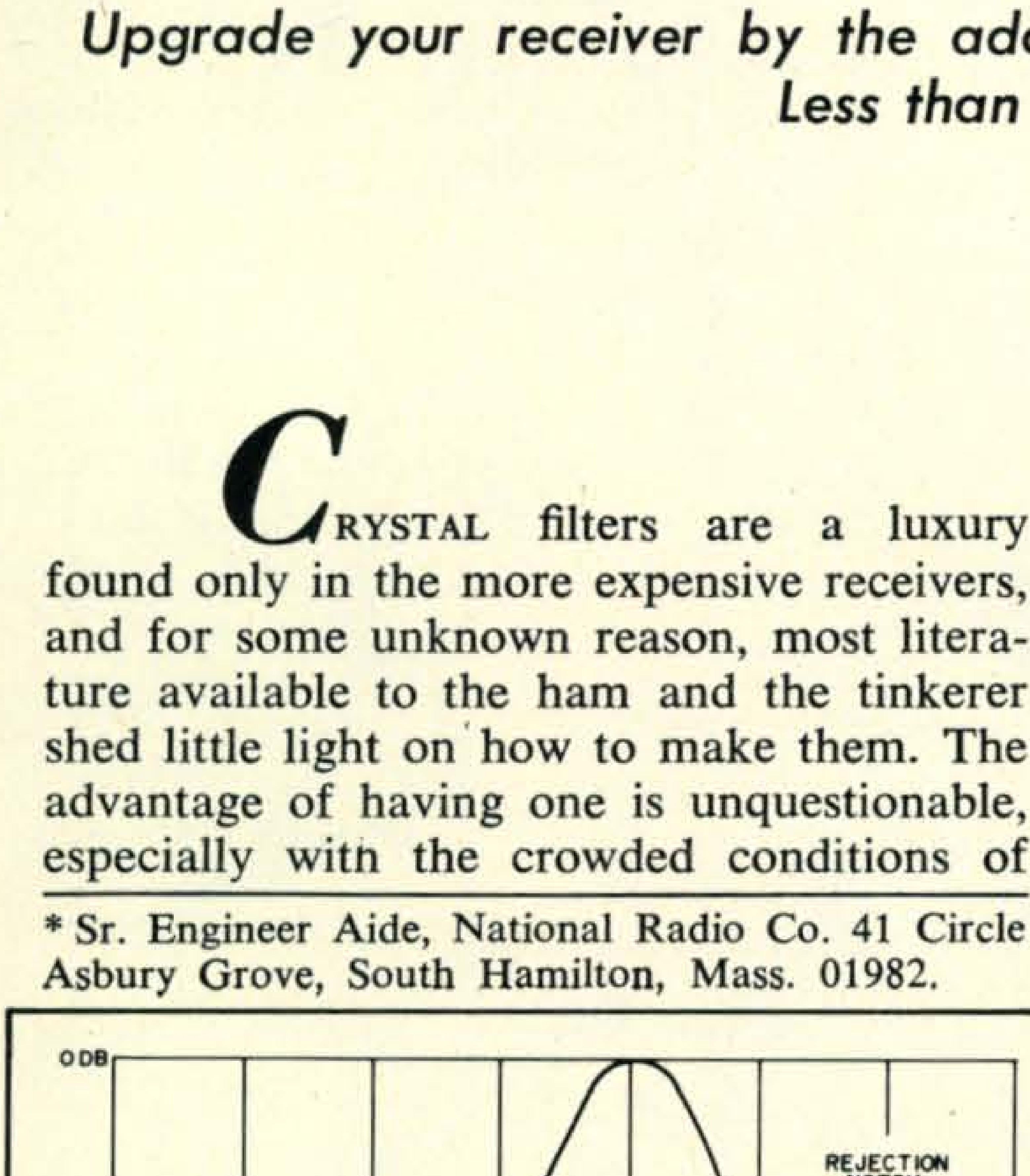


Fig. 1—Typical crystal filter curve at the 3 kc bandpass. The rejection notch can be positioned by the phasing control.

Figure 1 shows the passband of the filter. The steepness of the sides really depends on how carefully you build it. But even a rotten job of construction can provide a tremendous improvement in a low priced receiver with no filter.

Operation

Its operation is really quite simple to understand. Remember that a crystal looks, electrically, like a series tuned circuit with a very high Q. Also, the Q of the whole thing depends on how you load it. Finally, the Q determins the bandwidth. ($Q = {}^{f}/_{bw}$) Figure 2 is a schematic of the filter with part values (for two i.f.'s shown in the caption. The crystal is resonant to the i.f. frequency. The i.f. transformer feeding the filter has a heavy load resistor on it (R_1). This makes the pass-band of the tuned circuit very broad so the filter is the main controlling factor for that stage. When you don't want the sharp band-width the switch (S_1) shorts out the crystal. A parallel tuned circuit (L_1 C_1) loads the crystal. The potentiometer (R_2) varys the Q of the tuned circuit, thereby controlling the bandwidth. The variable capacitor (C_2) balances out the capacitance of the crystal. The position of the notch is influenced by this control.

Construction

All parts for the filter should be positioned to keep lead length at a minimum. Otherwise you will have problems such as oscillation. You would be wise to build the filter in a 2×2×3 "Minibox" and run *shielded* leads to the tie points. Controls can be brought out to the front panel by shaft extensions. Ground all your shields only at the filter end and then run a separate ground wire to the common point in the i.f. section. If the receiver has two or more i.f. stages, insert the filter at the input of the last stage. If the receiver has only one i.f. stage, use a larger Minibox and build another as shown in fig. 3.

You will have to doctor one of the cans so it can feed the filter. My suggestion is that you remove the can from the receiver and mount it on the filter box. This will also leave a convenient hole to bring leads in. Now, most i.f. cans have their tuning capacitor built into the base. This has to go. If you break away part of the base and remove the grid lead, you can break off the lug which connects to the internal capacitor. Then you can build up the base again with epoxy resin. If the can is tuned with a mica capacitor mounted where you can reach it, simply cut it out and you're in business. See fig. 4 for the details of this process.

The two capacitors, C_c, replace the tuning capacitor of the can. Unfortunately most manufacturers don't tell you what this capacity is, so you're going to have to diddle. Trail and error is the best method. Connect the can back into the receiver with the capacitor removed, tune in a strong station such as a local broadcast station, and try different values of fixed mica capacitors. The value which gives the strongest signal is your resonating capacity. When you find this value, make each C_c twice that amount.

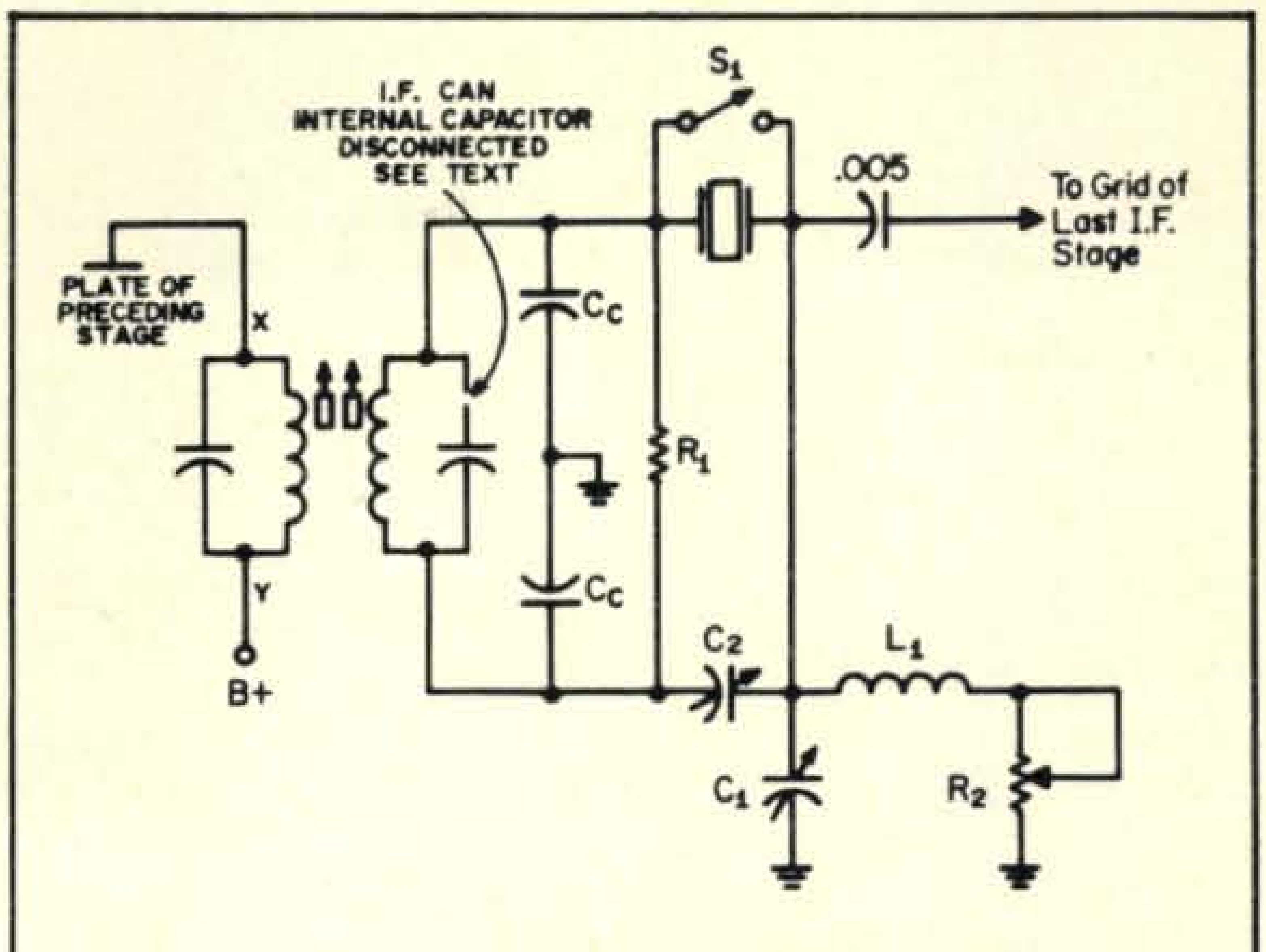


Fig. 2—Circuit of the crystal filter. The parts values for two different intermediate frequencies are shown below.

240 kc	455 kc
C_c—See text.	C_c—See text.
C_1—46 mmf.	C_1—120 mmf.
C_2—35 mmf trimmer.	C_2—35 mmf trimmer.
L_1—6.8 mh r.f.c.	L_1—1.0 mh r.f.c.
R_1—1.8k	R_1—2.7k
R_2—10k	R_2—750 ohms.

Alignment

O.K. So you build the thing and install it. Now you have to align it. If you have a signal generator you're lucky, but suppose you don't? Don't throw in the towel yet. A true ham knows how to make do. You need a steady c.w. signal. (No modulation). You can use a v.f.o. if you have one. However, if you're a poor man like me, use a cheap a.m. radio! Set the radio within handy reach and tune it to the top of the broadcast band. Take a single wire from the antenna lead of the receiver and let it dangle inside the case of the a.m. radio. You will find a nice strong c.w. signal somewhere around 2.055 mc.

Peak up the can with the crystal shorted out. Then tune C_1 for maximum output. Now set R_2 for minimum resistance, (widest

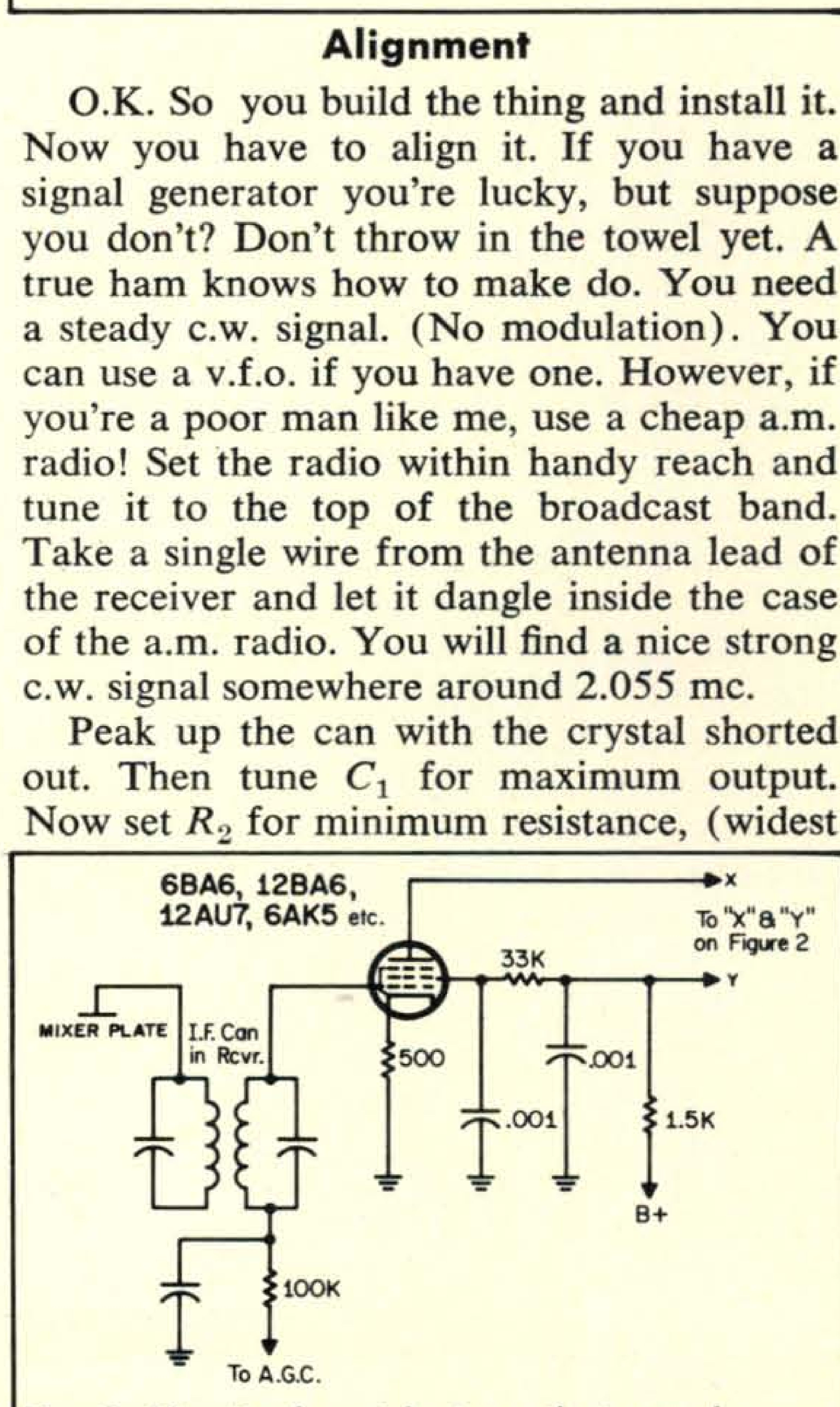


Fig. 3—Circuit of an i.f. stage that may be constructed if needed, as explained in the text.

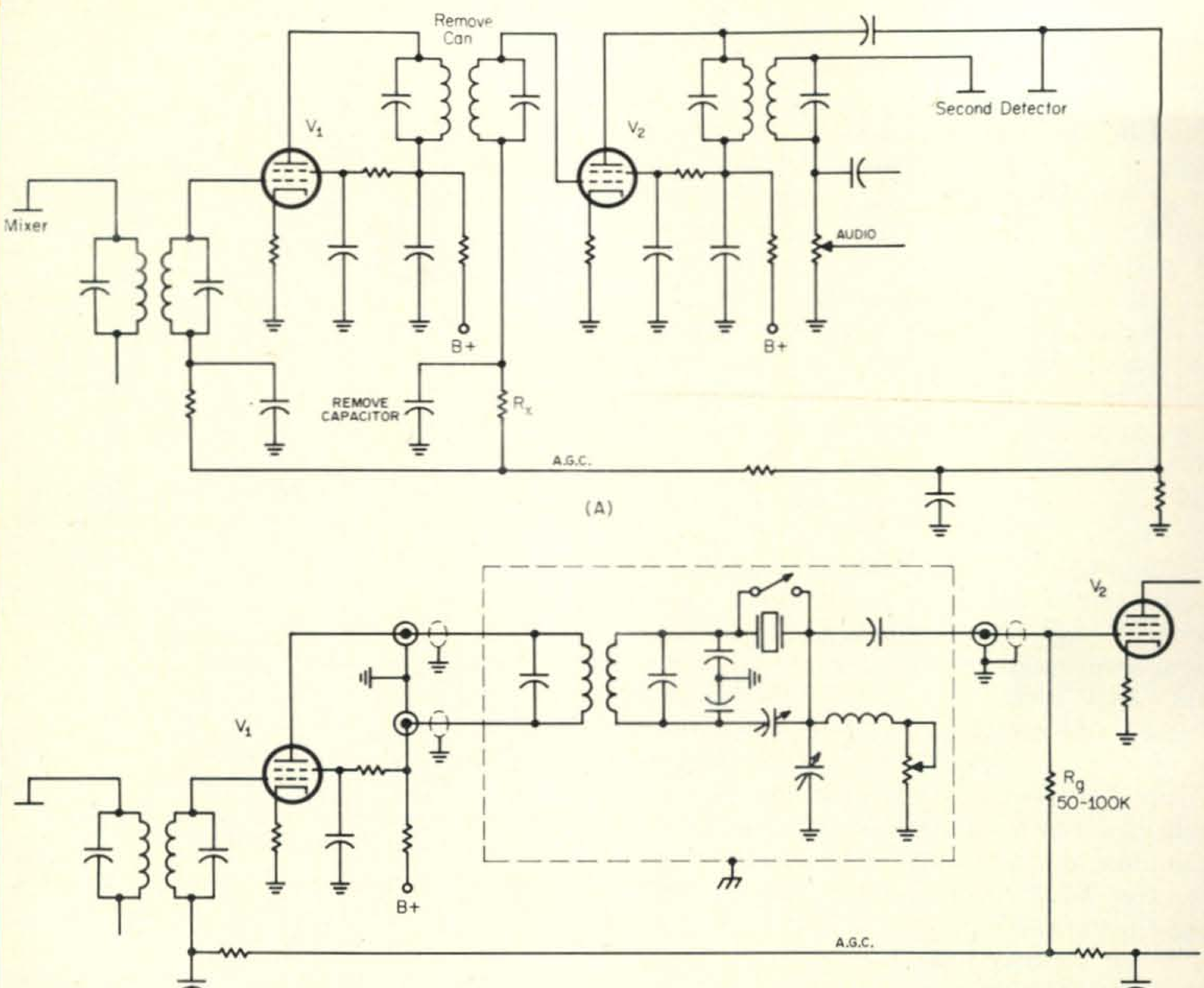


Fig. 4(A)—Circuit of a typical i.f. amplifier before addition of the crystal filter. (B) Circuit of the same amplifier with the crystal filter. Note the new grid return resistor for V_2, R_g.

bandwidth), unshort the crystal and peak up the whole thing all over again. I will warn you at this point that the tuning is very sharp. When you throw in the crystal retune your signal source, or the receiver front end. Do it very carefully. With R_2 at maximum, the signal will almost seem to ring. (I assume you are using the c.w. oscillator) It will be very critical to tune and will sound very peculiar to one who is not accustomed to crystal filters

The filter has the narrowest pasband when the load is heaviest. This is just the opposite to what you might expect. The caption of fig. 4 gives parts values for 240 kc and 455 kc. The calculation of these values involves a lot of math. If you are a whiz at math, or have had a couple of years of college, you will find the whole design process in the Radiotron Designer's Handbook. Otherwise forget about computing it yourself.

The filter is not too difficult to install. The input can of the filter connects to the output of the preceding i.f. stage. The filter is then capacitively coupled to the following stage. Notice that the bypass capacitor which was at the low end of the can before installing the filter is removed altogether. The resistor to the a.g.c. line now goes directly to the grid, thus providing a d.c. return path. Bring a ground lead from the filter to a ground point in the i.f. strip. Shield *all* leads connecting the filter into the circuit. Ground the shields only at the filter end and mount the filter in a position to insure shortest leads.

The crystal is of the same type used for frequency control. When you order it, specify a *series* resonance at the i.f. frequency. You can get one quite reasonably from Abbott Electronics, 85 Elm St. No. Woburn, Mass., if your local supplier can't get it. ■

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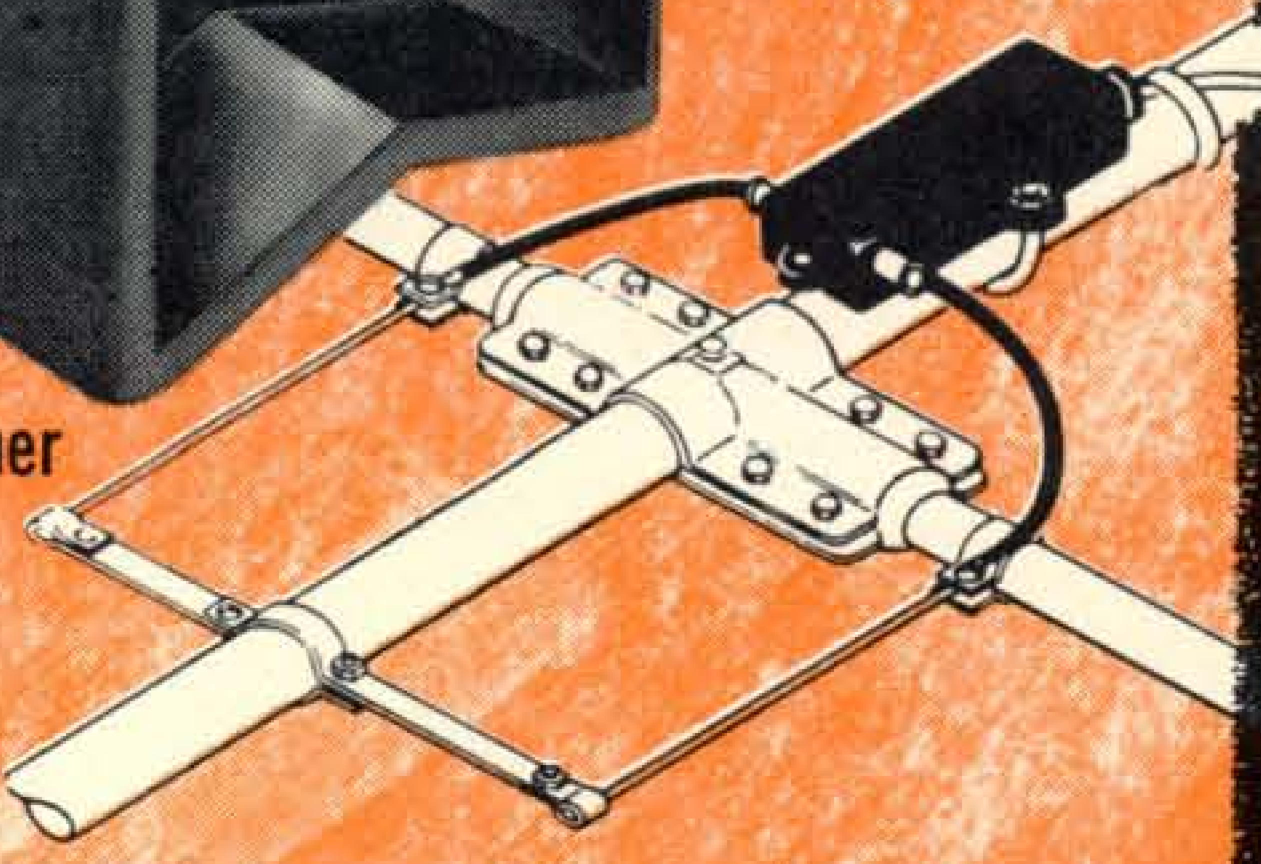
Typical Beam Installation



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PRESELECTOR/CONVERTER FOR MARS FREQUENCIES

BY MERIT ARNOLD,* W6NLO

THE converter described below was designed to fulfill the need for MARS h.f. coverage when used with a "ham band only" receiver. Some of the considerations for the converter are as follows:

a) Frequency range 2.000 to 6.800 mc.
b) High selectivity prior to mixing.
c) Selection of parts shall require a minimum of cash outlay, yet yield a high performance and versatile unit without critical circuits or adjustments.
d) The output frequency shall be approximately 14 mc.
e) The local oscillator shall operate over a wide frequency range without the need for retuning.
f) An r.f. gain control.

* 2451 East Vista Way, Vista, California 92083.

Construction

The converter and power supply shown in fig. 1 were constructed on a 7 × 7 × 2 inch chasis. No special layout of components is [*continued on page 100*]

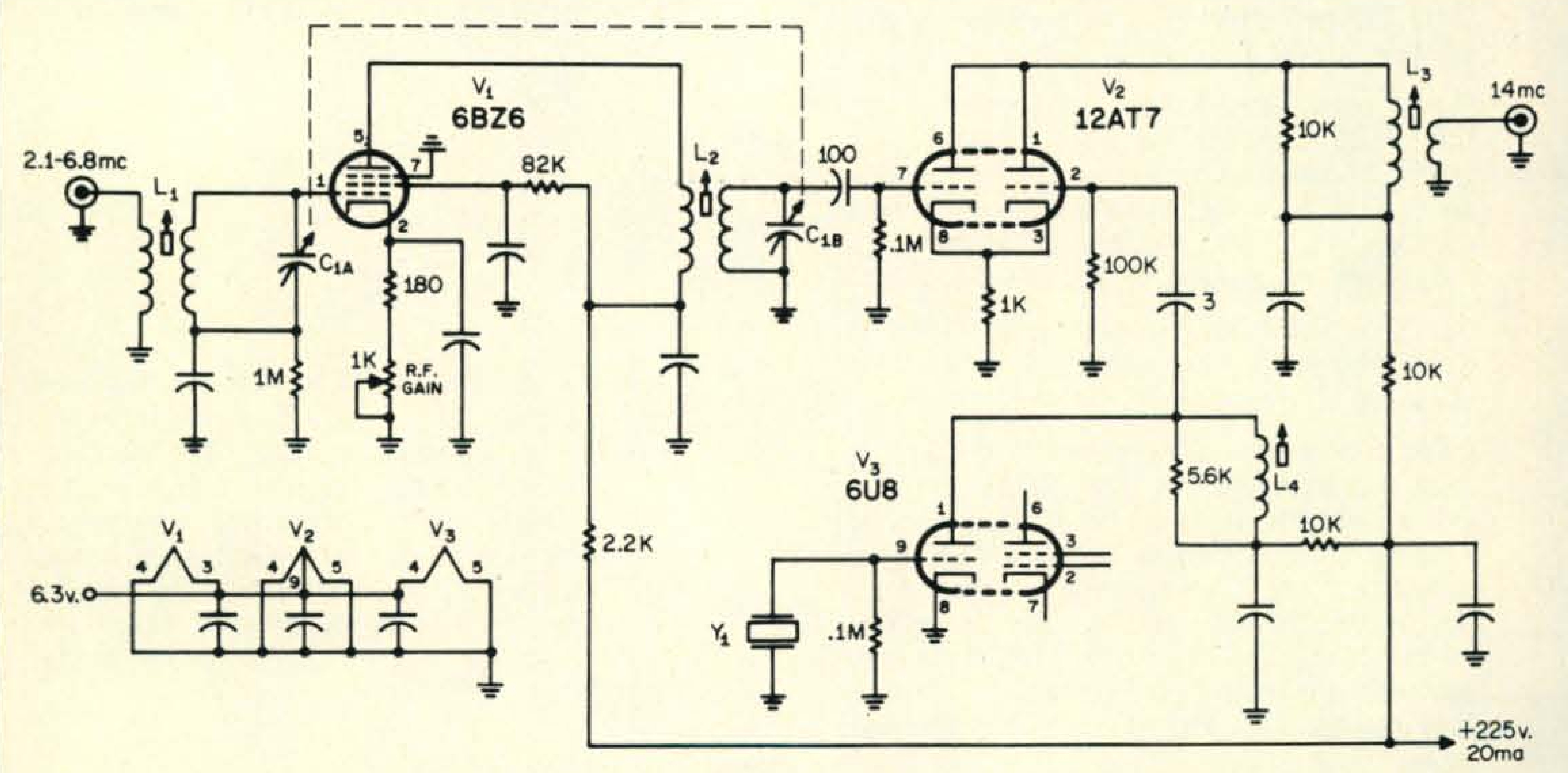

Fig. 1—Circuit of a converter for MARS frequencies to be used with "ham band only" receivers. All resistors are ½ watt. All capacitors marked are in mmf. All unmarked capacitors are 0.01 mf disc types.

L_1—Miller B-320-A

L_2—Miller B-320-RF. (L_1 and L_2 may be salvaged from an old broadcast radio having a short wave band and dual 365 mmf variable capacitor).

L_3—National XR-50 coil form. Wind #28 Formvar "two in hand" to fill form. Link consists of three turns of hookup wire over cold end. Twist leads between link and output connector.

L_4—XR-50 coil from wound full of #28 Formvar.

C_1—Dual 365 mmf variable. Broadcast receiver type.

Y_1—Crystal, 8 to 12 mc; frequency determined by receiver tuning range and desired input frequency.

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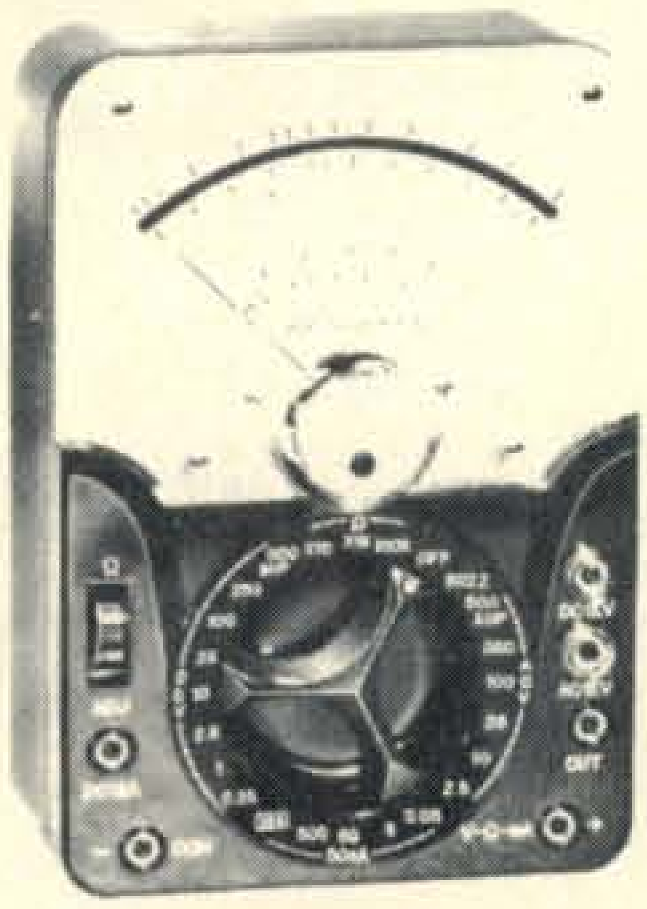

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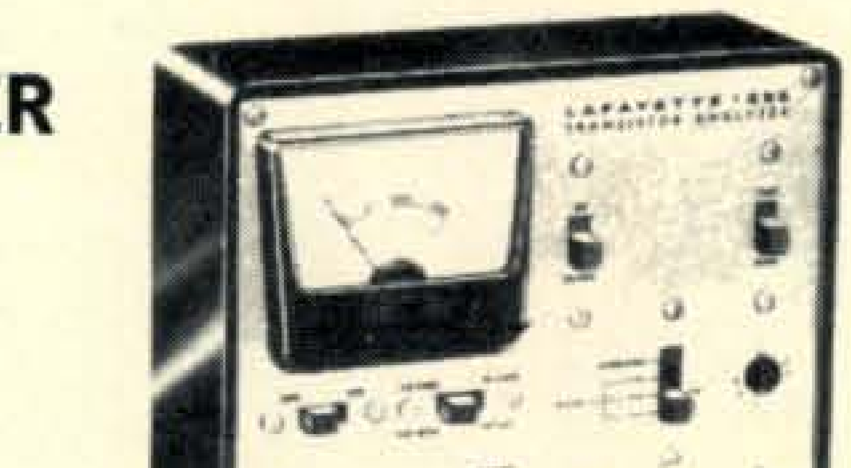

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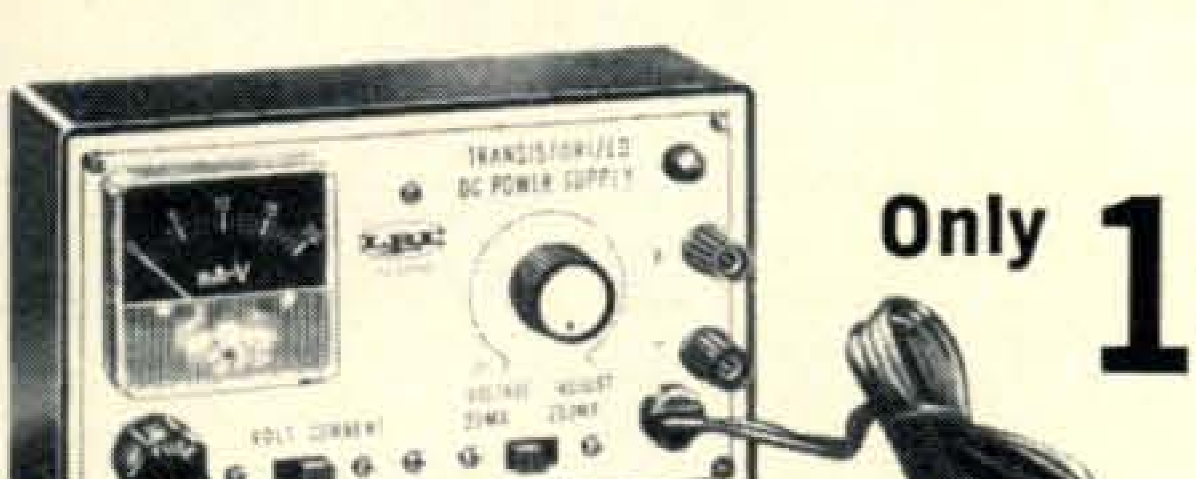

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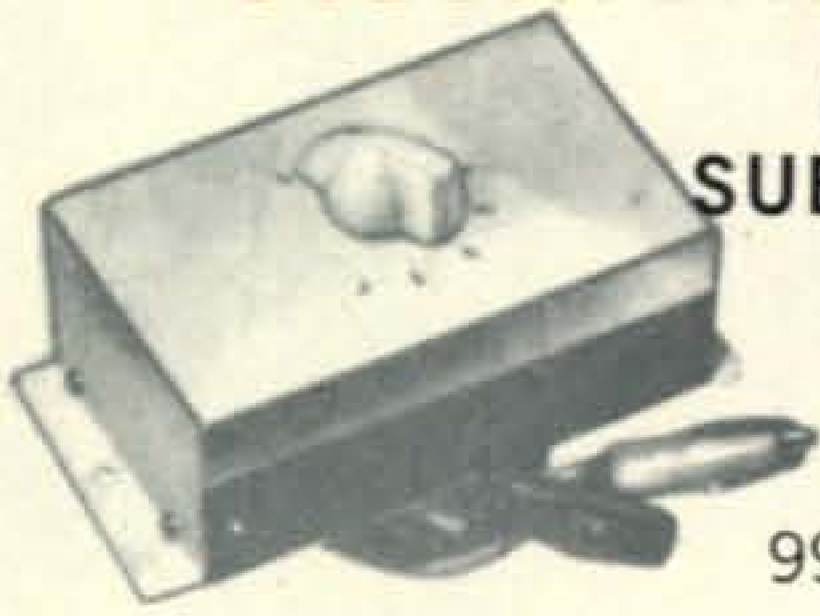

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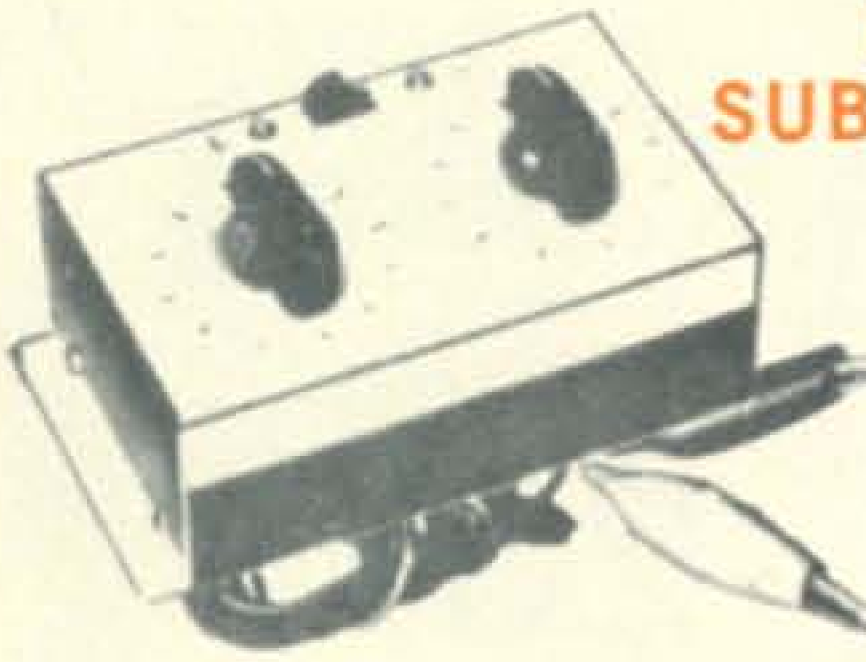

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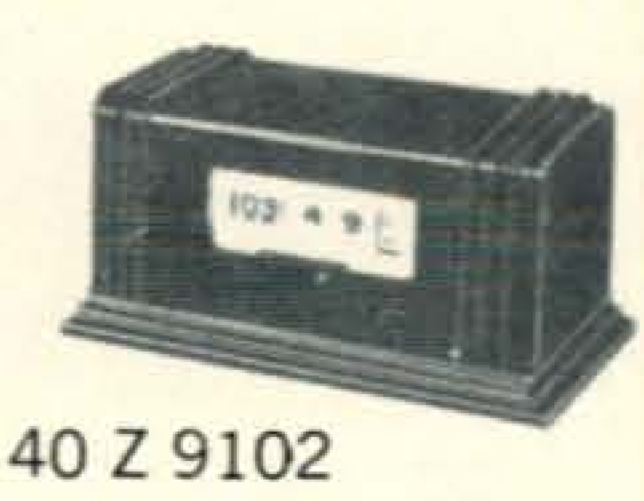

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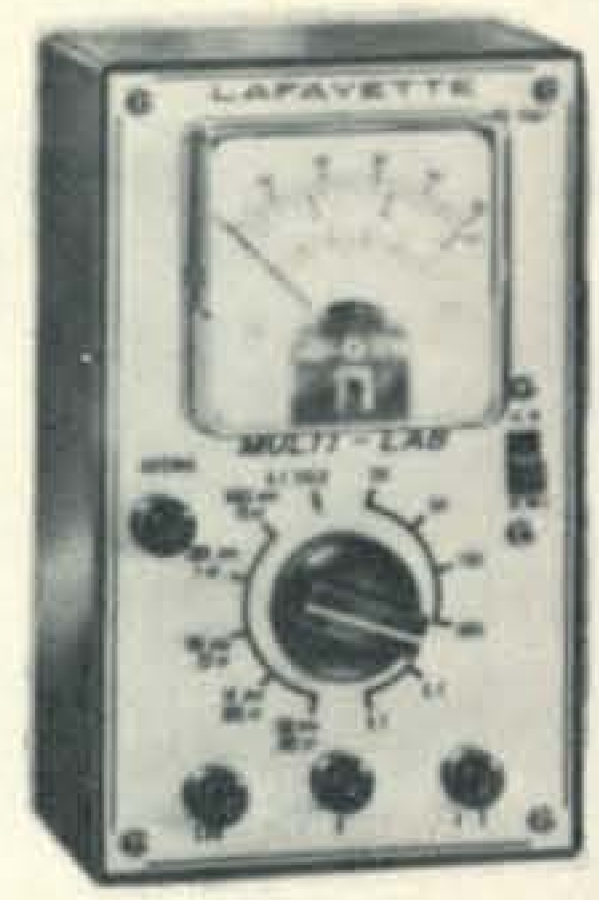

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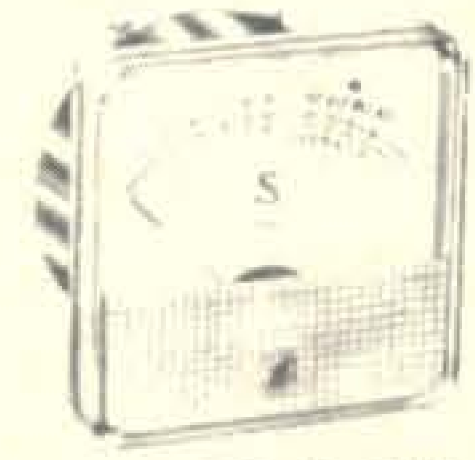

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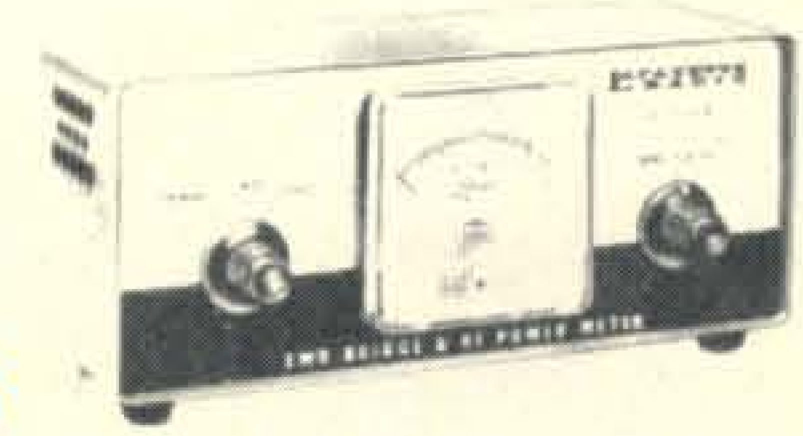

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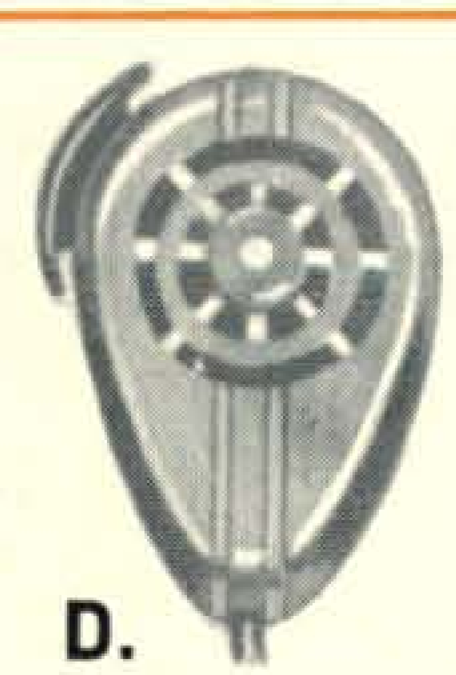

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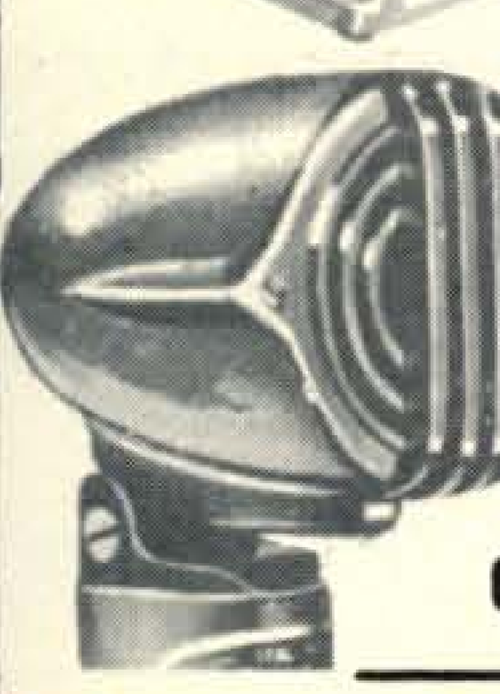

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LAFAYETTE RADIO ELECTRONICS

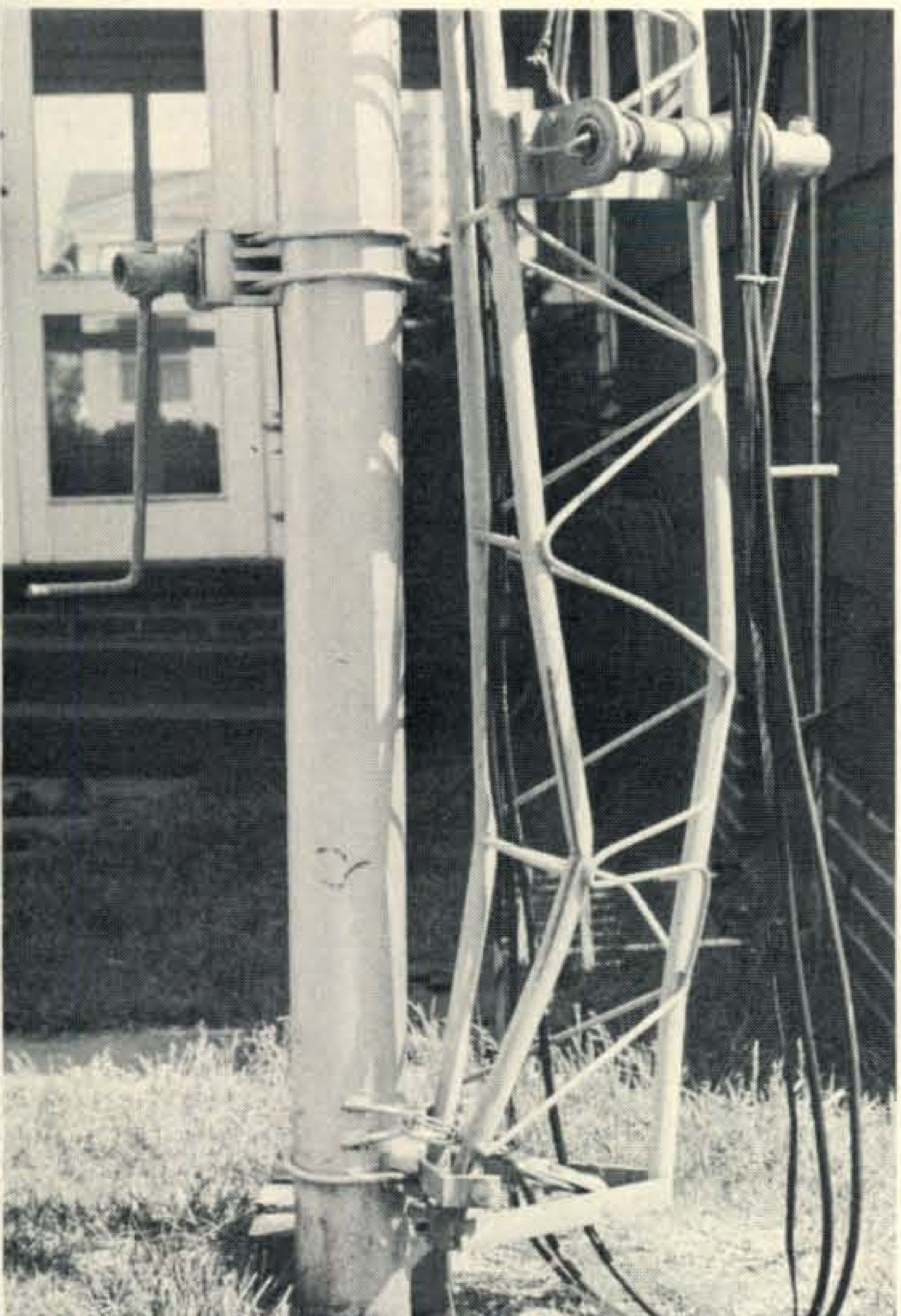
See page 110 for New Reader Service

STRAIGHTENING A BENT TOWER

BY HAROLD TUNE,* W8LZE

WHEN you aren't smart enough to drive a car past a self-supporting, tip-over radio tower that stands nearly two feet from the edge of the driveway, it winds up with a case of the "bends" and you need help. A pair of sympathetic neighbors brought know-how and the proper tools. What I learned beyond "Don't hit the pole!" may help you.

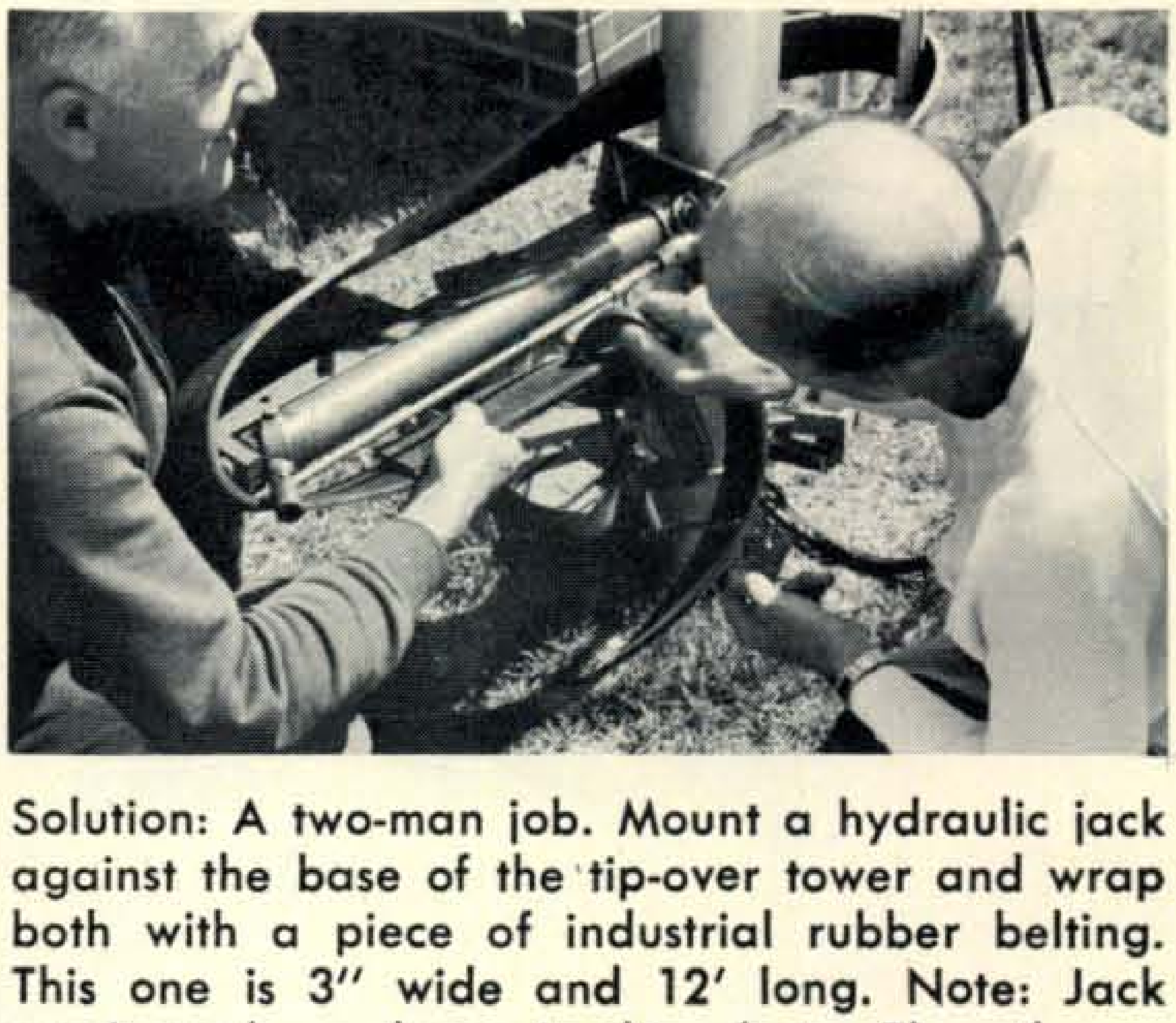
* 468 Molane Avenue, Akron, Ohio 44313.



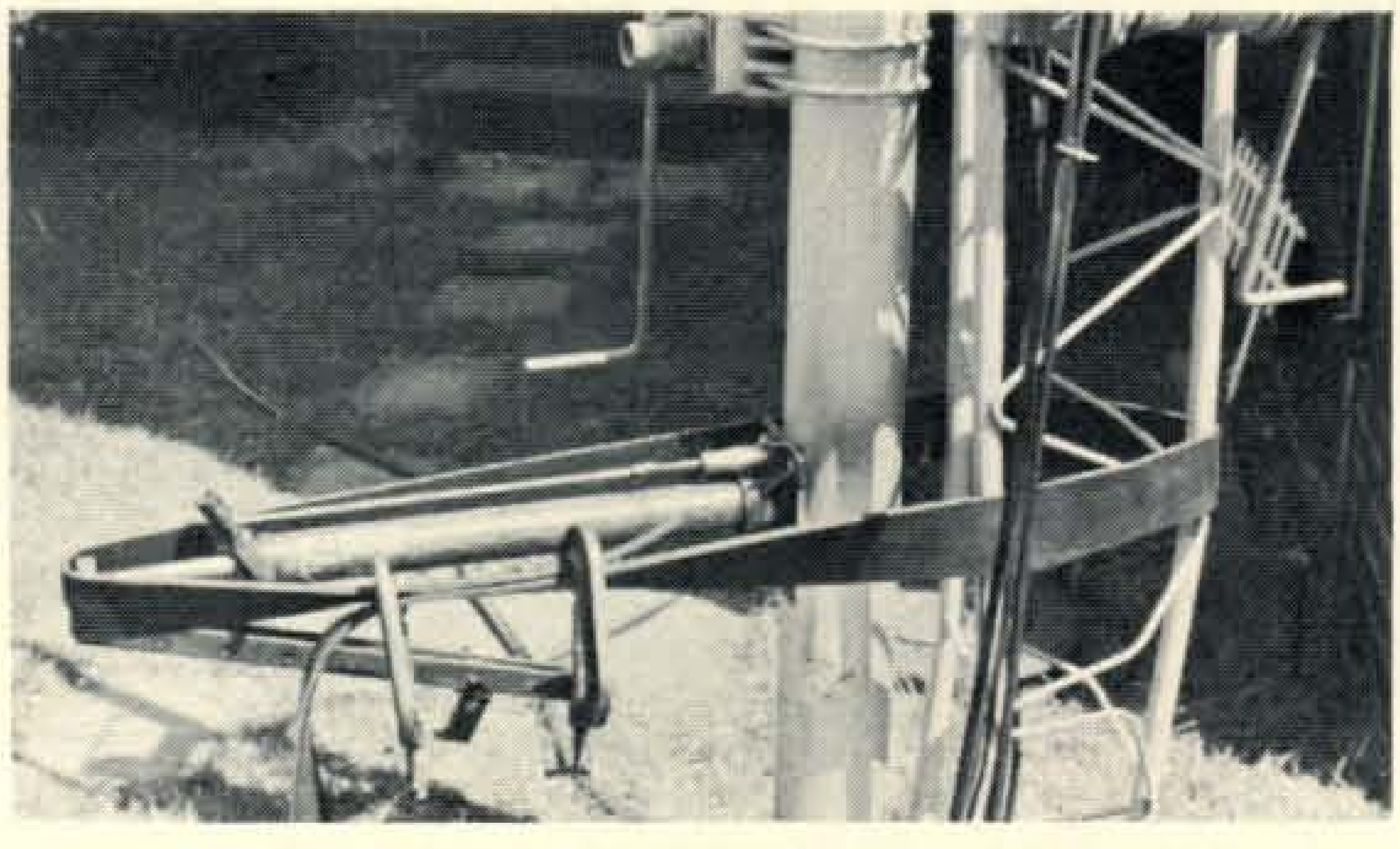
Problem: Straighten a bent EZ-way Tower after striking it with a car. Forget making the XYL understand how you bent it when it is two feet from the edge of the drive.

Basic tools are a hydraulic jack and a piece of industrial rubber belting which in this case is three inches wide and twelve feet long. It is 4-ply transmission belting. The old, hydraulic automobile jack has a lift of 1½ tons.

Getting ready is a two-man job. One man presses the base of the jack against the base of the tower opposite the inside of the bend while the second man wraps the belting

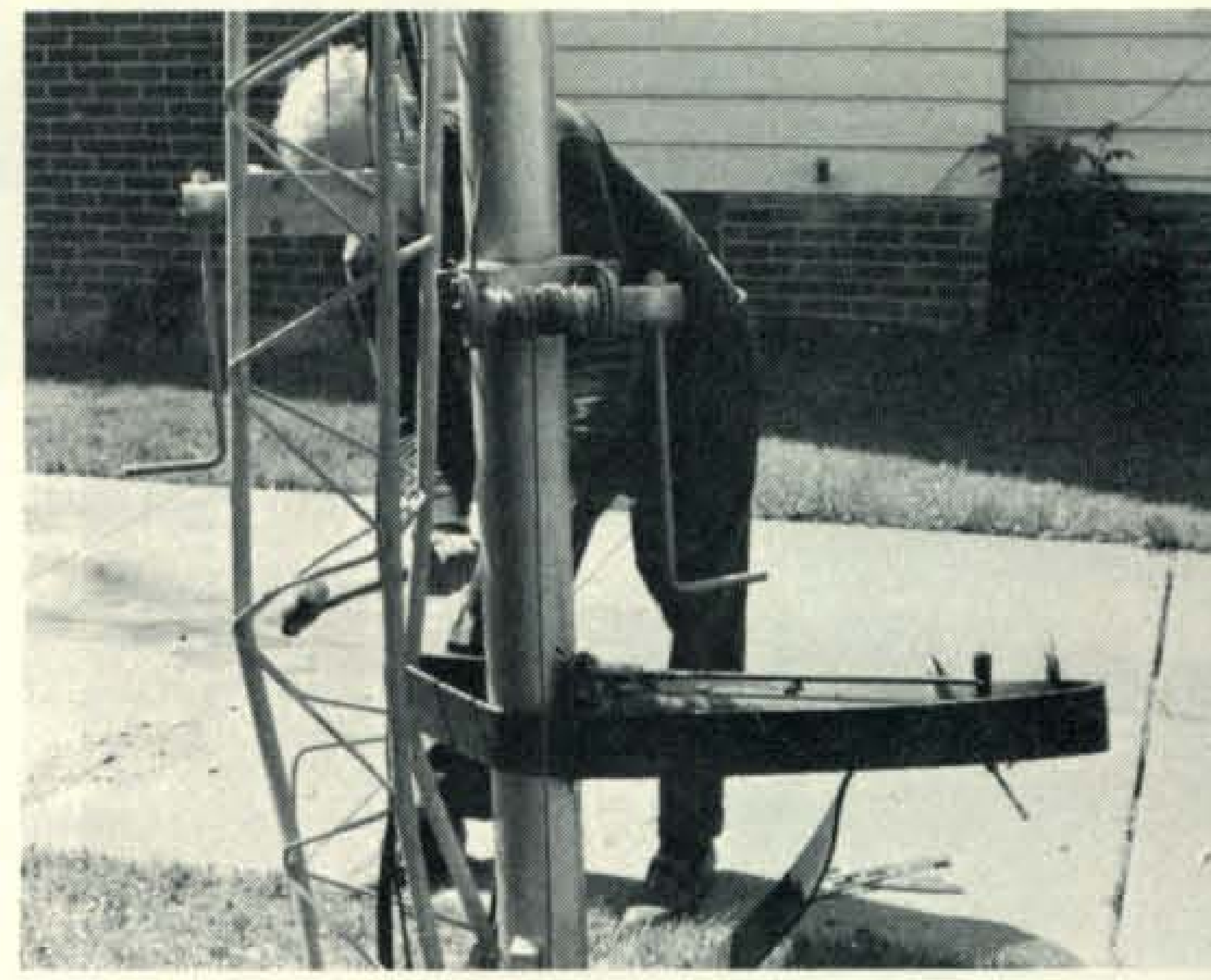


Solution: A two-man job. Mount a hydraulic jack against the base of the tip-over tower and wrap both with a piece of industrial rubber belting. This one is 3" wide and 12' long. Note: Jack won't work as shown in this photo. The oil runs out.



This is properly mounted jack and belting before straightening. The pump handle must be above the jack body instead of as shown in photo #2.

See page 110 for New Reader Service



Pound the bends by hitting the rubber belting with a heavy machinist's hammer or sledge hammer.

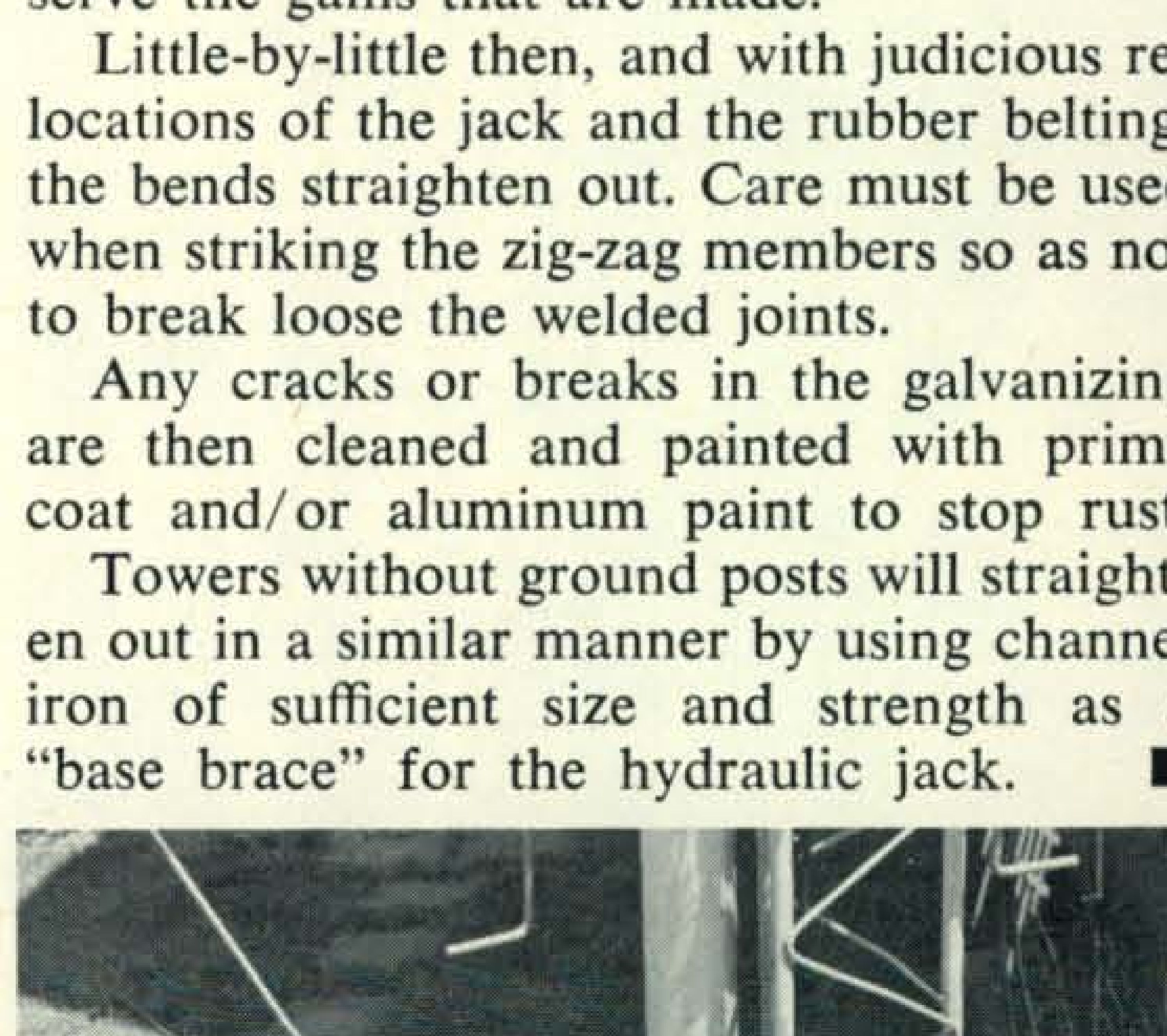
around both the base of the tower and the top of the jack. The second man then laps the end of the belting and fastens them tightly with C clamps.

Then one man pumps the jack to stretch the belting as tightly as possible. Either man then beats the outside of the bend with a sledge hammer. As each blow snaps the resilient metal nearer its straight position, the rubber belting snubs the bends to preserve the gains that are made.

Little-by-little then, and with judicious relocations of the jack and the rubber belting, the bends straighten out. Care must be used when striking the zig-zag members so as not to break loose the welded joints.

Any cracks or breaks in the galvanizing are then cleaned and painted with prime coat and/or aluminum paint to stop rust.

Towers without ground posts will straighten out in a similar manner by using channel iron of sufficient size and strength as a "base brace" for the hydraulic jack. ■



Nearly straight now. Pound cross members carefully so as not to break welded joints. Finish by cleaning cracks and breaks and painting them with prime coat and finishing the whole tower with aluminum paint.

See page 110 for New Reader Service

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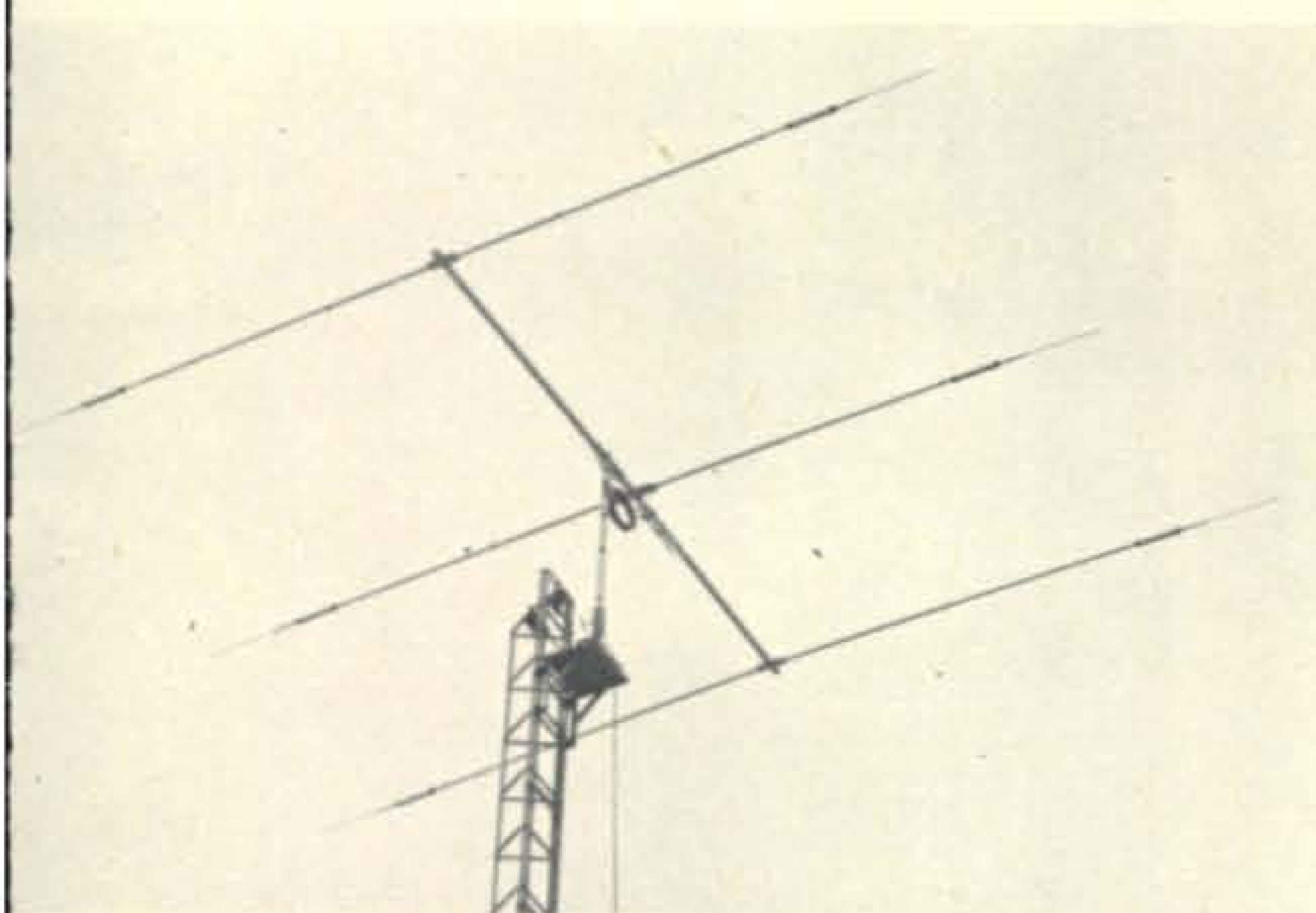

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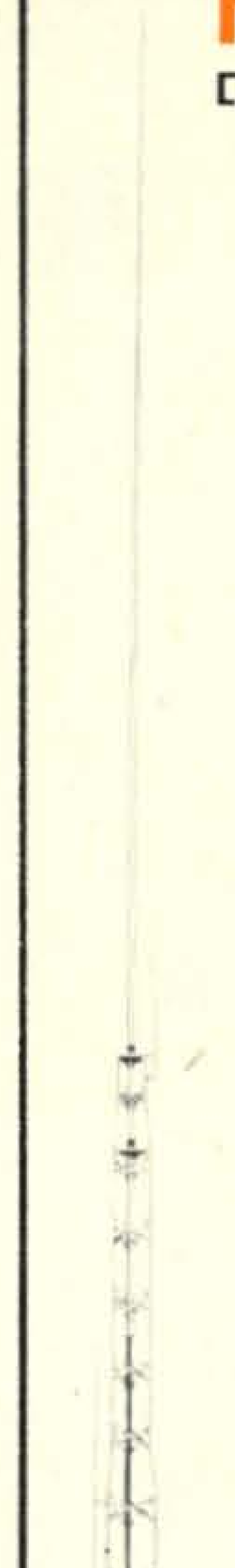

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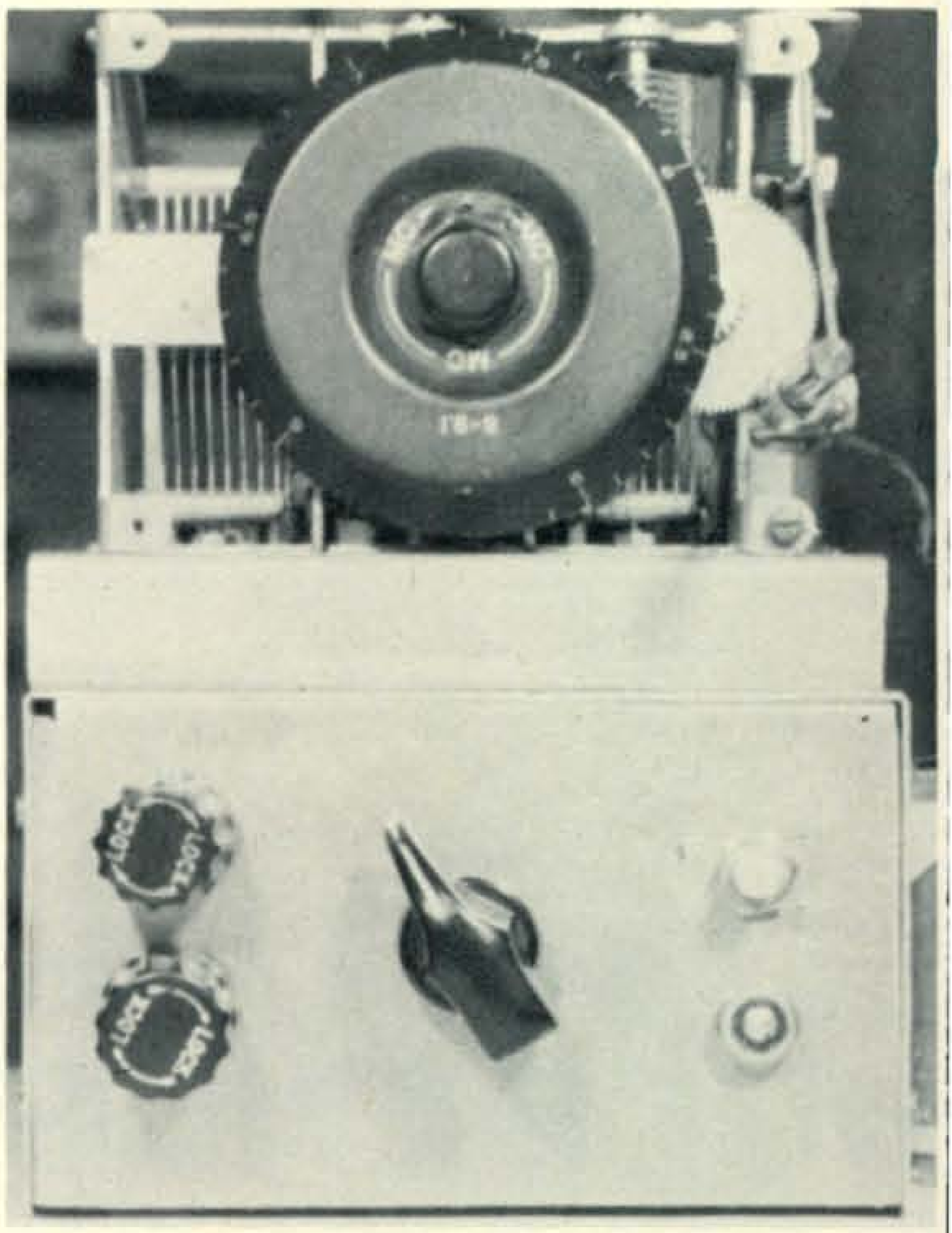
See page 110 for New Reader Service

Front view of the exciter. The knobs marked Lock are the carrier balancing potentiometers; at center there is the LSB-USB-DSB switch and at right the Carrier Level and the Microphone input.



An 80 Meter Transistorized S.S.B. Exciter

BY PIERO MORONI,* I1TDJ

This transistorized 3.5 to 4 mc s.s.b. exciter also provides a.m., d.s.b. and c.w. output. It is a low power unit that is crystal controlled and uses the phasing method for sideband suppression.

If you need a simple and low drain s.s.b. exciter, this one could be an answer. It can give you about 5 v.r.m.s. of s.s.b. signal in the 3.5 to 4 mc band and can be powered by dry cells since the total drain is 50 ma at 12 v., or about ⅓ of the power drain a 12AT7 filament. The transistors used are inexpensive germanium types, made by Philips in Europe and Amperex in U.S.A. They can be replaced by equivalent types as shown later. The only special component is the three sections variable capacitor stolen from a BC-455. The equipment necessary for adjusting the exciter is available in any ham shack.

Description

The phasing system [1] is used for sideband generation at 2.5 mc. A 2N348 transistor, Q_8, is used as a crystal controlled oscillator as shown in fig. 1. The crystal is connected between the base and ground and the collector is tuned at 2.5 mc. In order to develop enough signal across the r.f. phasing network; Q_8 is operated at $V_{CE} = 10$ volts and $I_E = 9$ ma, well below its maximum ratings. The r.f. network is the ZL1AAX design and it is fed by a link wound on the cold end of the oscillator coil.[2] No correcting inductance is used in series with the resistive arm, as suggested in the original article. I thought of adding this inductance, but the performance of the exciter was already so good, that I have not yet found the time for making this refined adjustment.

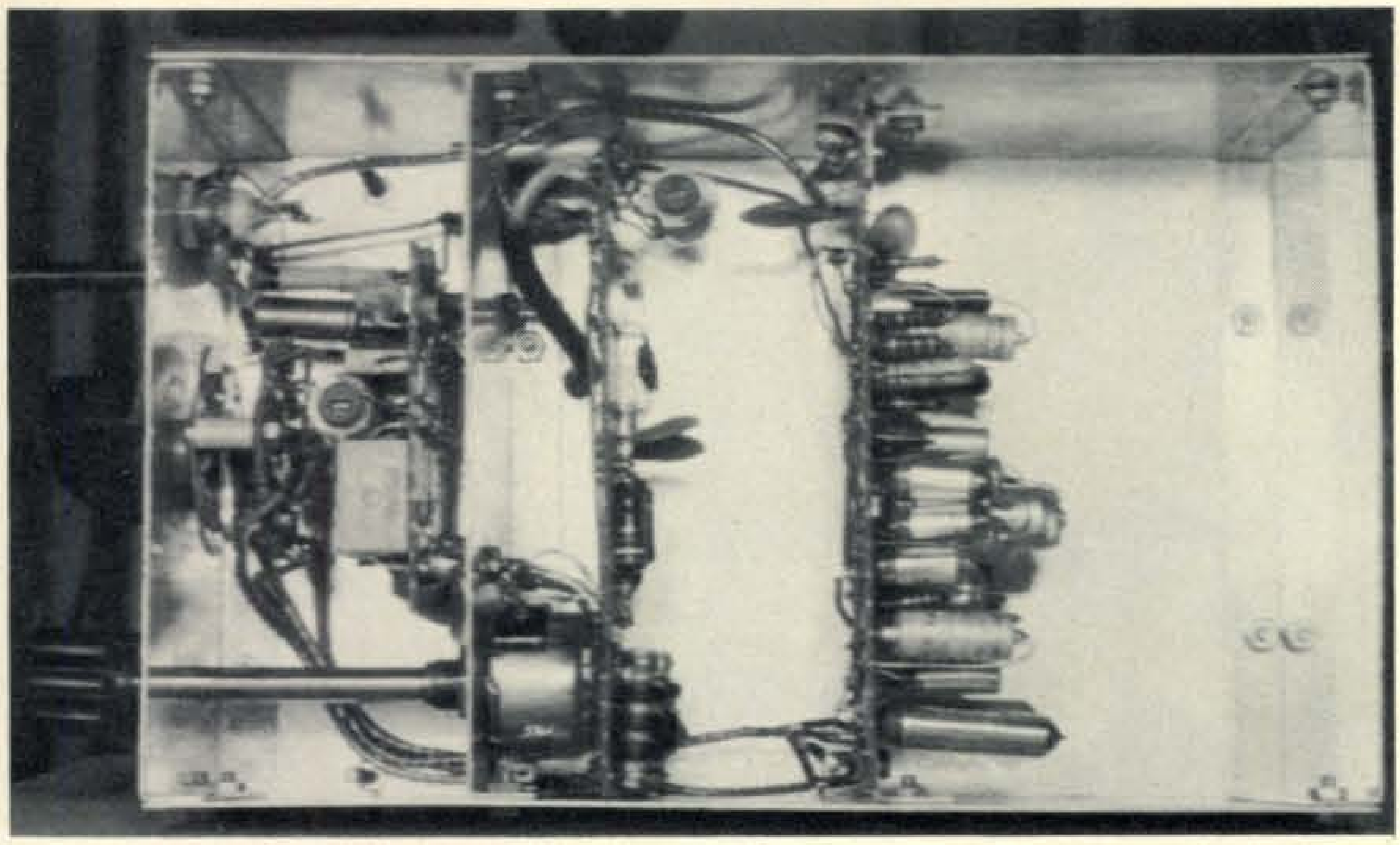
The two balanced modulators are like those described several years ago in Ham News [3] and employed in many exciters. A bifilar coil (fig. 2) is used as the tank for the two balanced modulators. The s.s.b. signal, at 2.5 mc, is fed to the following mixer

* viale Morgani 28, Firenze, Italy.

[1] Stoner, D., "New Sideband Handbook," Cowan Publishing, Port Washington, N.Y., page 79.

[2] Earnshaw, L., "An Improved R.F. Phase Shift System," *CQ*, November 1959, page 72.

[3] Ham News—SSB, Jr. Nov.-Dec. 1950, Vol. 5, No. 6.



Bottom view of the lower chassis. From left to right you can see the 2.5 mc oscillator, to the right of the shield the balanced modulators and then the audio section.

(Q_{11} by a link wound on the center of the coil.

A front panel switch selects the sideband transmitted. In its third position no audio signal is going to one of the balanced modulators and the output is a double sideband signal. A potentiometer supplies a d.c. voltage to the operating balanced modulator; the carrier suppression is so changed and we can transmit an a.m. signal. This carrier unbalancing potentiometer is operating only in the D.S.B. position of the sideband switch.

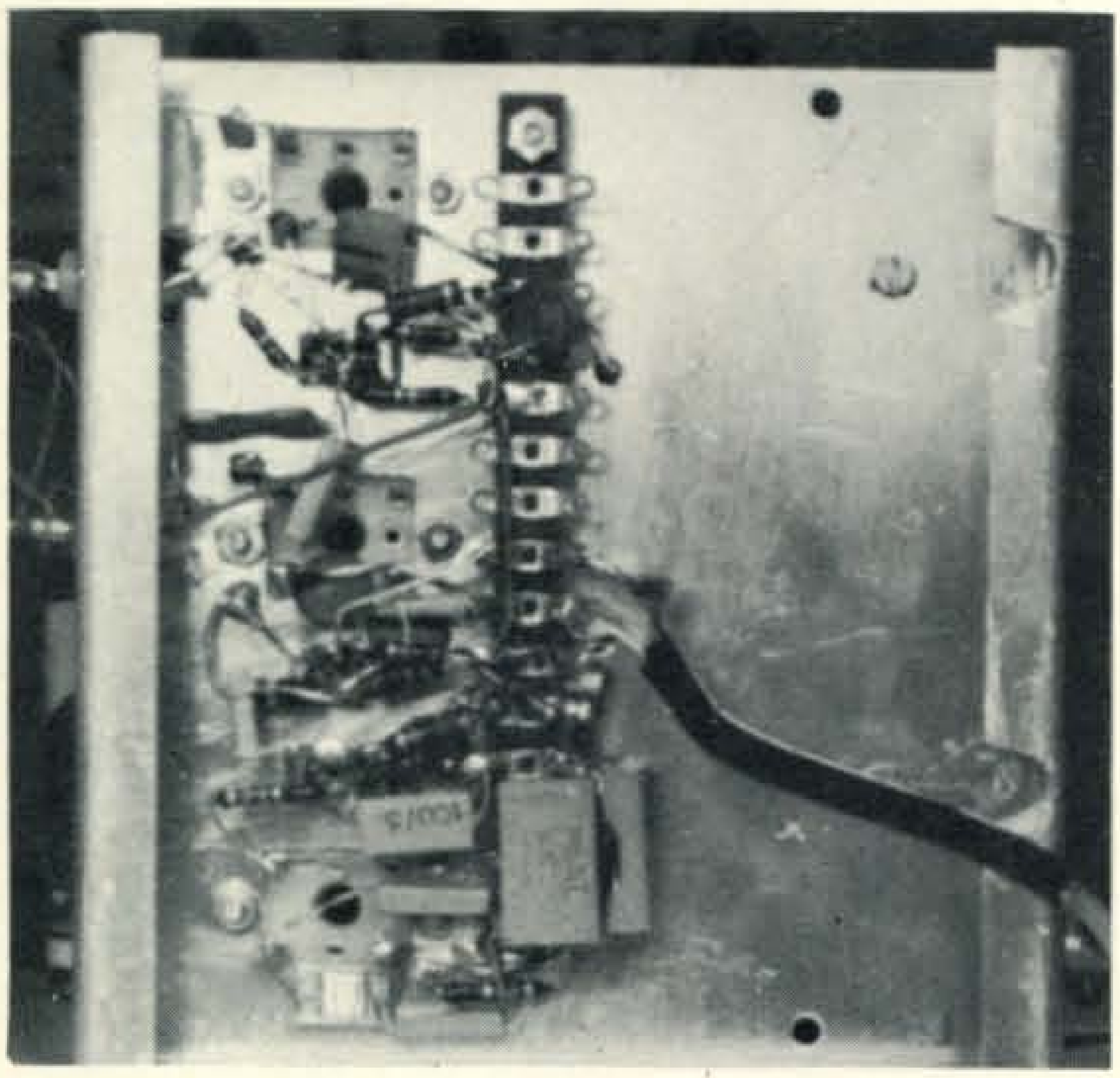
The audio section of the exciter has been designed for high impedence microphones. Therefore, the first stage, Q_1, is an emitter follower and its input impedance is about 100K. It is followed by Q_2, an amplifier, and Q_3, a phase splitter, which drives the audio phase shift network. The collector and emitter resistences of the phase splitter transistor are 220 ohms, to get a low impedance source for the best network performance.

The net work is of the m-derived type; the values are taken from an article that appeared in the Procedings of I.R.E.[4] The corrected values were obtained by multiplying the capacitor values by 10 and dividing the resistances by ten. This provided a lower impedance network, which will is less sensitive to the transistors input impedance load. The components used are standard ones with ± 5% tolerance. The resistors are ¼ watt metal film type and the capacitors are polystyrene film. As shown in Table I, standard values are paralleled to approximate, as close as possible, the design figures. Each one of the two 90 degree audio signals goes to the balanced modulator through two

[4] Weaver, D. K., "Design of RC Wide Band 90 Degree Phase Difference Networks," P.I.R.E. April 1954, page 671.

Item	Design Value	Practical Value
R_1, R_3	56.27K	56K
R_2, R_4	10K	10K
R_5, R_6	22.89K	22K
C_1	5921 mmf	5,600 + 270 mmf
C_2	33,310 mmf	33,000 mmf
C_3	14,560 mmf	10,000 + 3,300 + 1,000 mmf
C_4	1,501 mmf	1,500 mmf
C_5	8,448 mmf	4,700 + 2,200 + 1,500 mmf
C_6	3,692 mmf	3,300 + 390 mmf

Table I.—A.f. phase shift network components. Resistors are ¼ watt metal film, 5%. Capacitors are 125 volt, 5% plastic film.



Bottom view of the amplifier chassis. From top: amplifier, mixer, v.f.o. The coax lead feeds the 2.3 mc s.s.b. signal to the mixer.

transistors connected in a Darlington circuit. Therefore the load across the audio network output will be h^2_{fe} times the balanced modulators impedance, where h_{fe} is the transistor's current gain. Any impedance variation, which will occur with the audio signal in the balanced modulators, will have negligible effect on the phasing network performance.

The 2.5 mc s.s.b. signal is converted to 3.5 – 4 mc by mixing it with the v.f.o. signal, which goes from 6 to 6.5 mc. Both signals are fed to the base of the mixer transistor Q_{11}. The v.f.o. circuit is a modified Colpitts in which the frequency determining elements are well isolated by the capacitive divider which feeds the transistor. The diode between base and ground offsets the transistor reverse base current (I_{cbo}), thus providing a better stability with temperature. The oscillator supply voltage is stabilized at 6 volt by a zener diode.

The v.f.o. frequency is tuned by one of the three sections of a BC-455 variable capacitor. Since the other two sections are tuning two circuits in the 3.5 to 4 mc band, a padding capacitor is used in the v.f.o. circuit for tracking.[5]

An emitter follower isolates the oscillator from the mixer circuit, thus preventing any v.f.o. pulling. The mixer collector circuit is tuned between 3.5 and 4 mc as is the collector of the following amplifier. This provides the good selectivity, necessary to get rid of spurious mixer products from the wanted s.s.b. signal. A certain amount of feedback is permitted in the amplifier stage, by the partially bypassed emitter resistor; the amplifier is thus more stable, has better linearity and the output level is still several volts. (volts from the Hi-Z,0.8 volts from the Low-Z output).

Construction

The exciter is built, as can be seen in the photos, on two metal chassis. The bottom one, 4⅞" × 3" × 8" contains the 2.5 mc oscillator, the balanced modulators and the audio section. The other metal chassis contains the r.f. section consisting of the v.f.o., the mixer and the amplifier. The 2.5 mc oscillator is built on a 2" × 2" Vectorboard

[5] Langford Smith, "Radio Designers Handbook," page 1002.

Fig. 1—Circuit of the 3.5 to 4 mc band s.s.b. exciter. All resistors are ½ watt. All capacitors with values greater than one are in mmf and those with values less than one are in mf unless otherwise noted. Capacitors marked SM are silver mica.

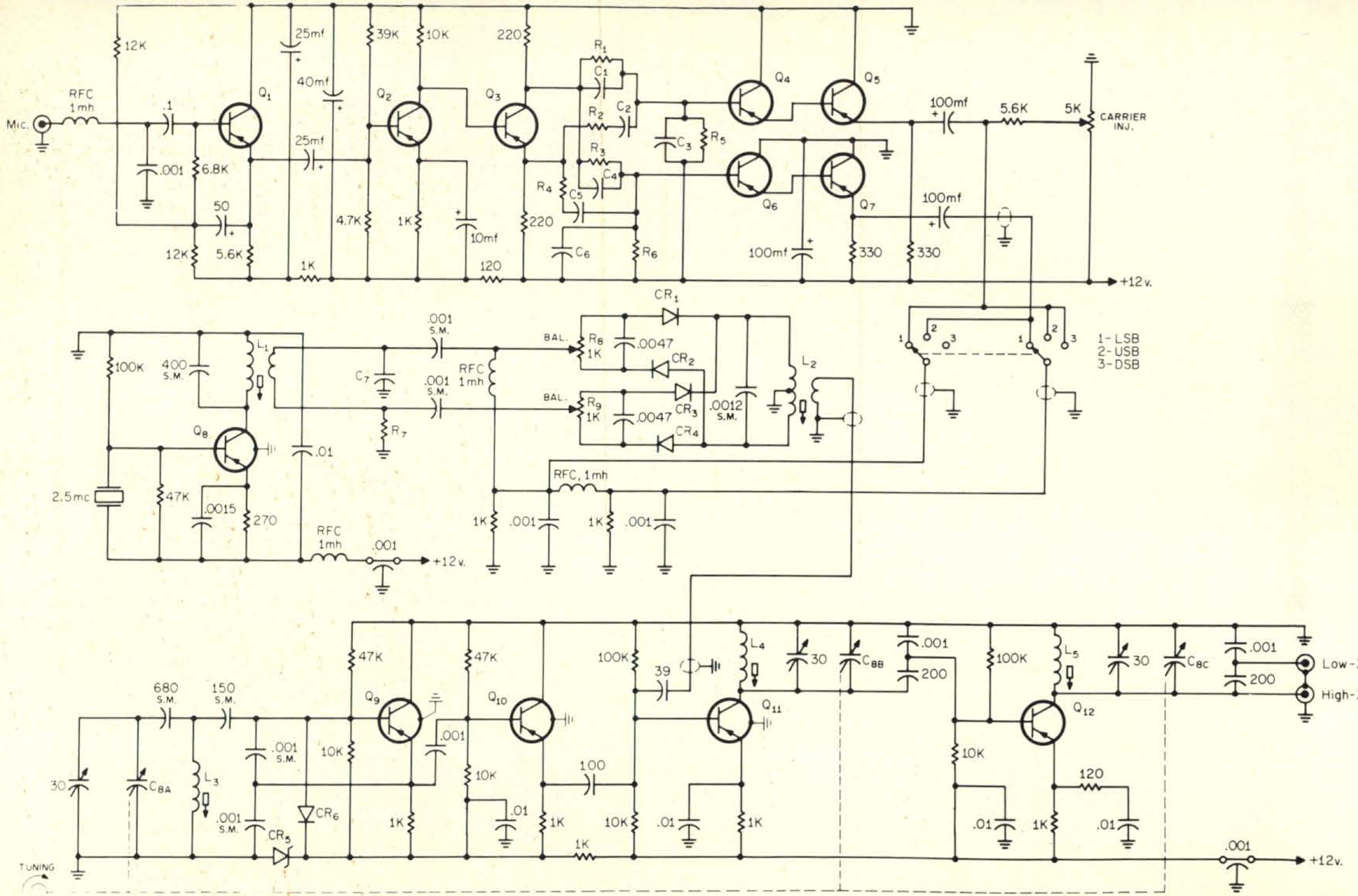
C_1, C_2, C_3, C_4, C_5, C_6—See Table I.
C_7—600 mmf, 5% silver mica.
C_8 A, B, C—BC-455 variable capacitor.
CR_1, CR_2, CR_3, CR_4—1N34A selected for equal forward resistance.
CR_5—6 volt 500 milliwatt zener diode.
CR_6—1N34 germanium diode or equiv.

L_1—10 μh, 33 t # 32 e. closewound on a 0.35" slug tuned form.
L_2—3.36 μh, 12 bifilar turns # 23 e. on a 0.35" slug tuned form. (See fig. 2.)
L_3—2.28 μh, a modified 4.5 mc TV sound i.f. transformers.
L_4, L_5—7 μh, modified 4.5 mc TV sound i.f. transformers.

Q_1, Q_2, Q_4, Q_5—p.n.p. low level a.f. transistors RCA 2N175 or Phillips OC70.
Q_3—p.n.p. 250 mw transistor RCA 2N270 or Phillips AS489.
Q_6, Q_7—p.n.p. a.f. output RCA 2N104 or Phillips OC72.
Q_8, Q_{12}—p.n.p. r.f. transistors RCA 2N384 or Phillips AF118.
Q_9, Q_{10}, Q_{11}—p.n.p. low level r.f. transistors RCA 2N247 or Phillips AF116.

R_1, R_2, R_3, R_4, R_5, R_6—See Table I.
R_7—100 ohms 5% noninductive resistor.
R_8, R_9—Carrier Balance pots 1K, wire wound linear taper.

See page 110 for New Reader Service



	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Q_9	Q_{10}	Q_{11}	Q_{12}
Emitter	5.6	11	8.8	9.6	9.7	9.6	9.7	10	5	5	11	11
Base	5.5	10.9	8.6	9.5	9.6	9.5	9.6	9.8	4.95	4.95	10.9	10.9
Collector	0	8.6	3.2	0	0	0	0	0	0	0	0	0

Table II.—Voltage on the electrodes of the transistors. Figures are in volts, positive with respect to ground.

phenolic sheet [6] which also supports the r.f. phasing network. The whole circuit is separated by a metal shield and the supply voltage enters by a feedthrough capacitor to preventing any oscillator leakage.

The balanced modulator circuit is located behind the shield. The two balancing potentiometers are mounted on the same shield while the other components lay on a second 1⅝" × 4⅞" Vectorboard strip and the audio circuit on a third one, 2⅜" × 4⅞", after the balanced modulators.

To prevent any carrier leakage, the BC-455 variable capacitor and its associated circuits, are mounted on the second chassis, which is a piece 4⅞ × ⅞ × 4¾" of aluminum formed into a the shape shown in the photographs. The v.f.o., emitter follower, mixer and amplifier transistors of this chassis are fitted in sockets, which are useful for supporting the other circuit components. The three coils, L_3, L_4 and L_5, of this circuit, are standard TV 4.5 mc sound i.f. cans with the windings reduced to the necessary inductance value.

[6] Vectorboard, 85624.

Close-up view of the balanced modulators and audio section (rotated by 90 degrees for viewing purposes).

A feedthrough capacitor is soldered on the rear apron for carrying the supply voltage; a feedthrough insulator is used for the 3.5-4 mc output signal. The top chassis is fastened to the bottom one by two screws. As can see in the illustrations, the variable capacitor position is such that the whole generator can be fastened to a vertical panel.

Adjustment

The adjustment is fairly simple. The first thing do to is to check the whole circuit very carefully. A wrong connection can damage transistors since they are not so able to withstand overloads as were the 'old' tubes. But if you have your transistors working within their ratings, you will not experience any trouble with their life. The testing equipment, necessary for adjusting this exciter, can be found in any amateur shack. A v.o.m. (or a v.t.v.m.), a grid dip meter and the station receiver are necessary; an audio oscillator and an oscilloscope will be helpful.

The tuned circuits must be checked for a coarse adjustment, by the grid dip meter, disconnecting them temporarily from the associated transistor. As you know, the transistors junctions can load a tuned circuit so heavily that it is often difficult to find its resonance by the g.d.o. The only transistor soldered to a tuned circuit is the 2.5 mc oscillator, Q_8. All the others are removable so this step can be performed in few minutes.

The exciter can now be connected to a + 12 volt supply, free of hum, like that shown in

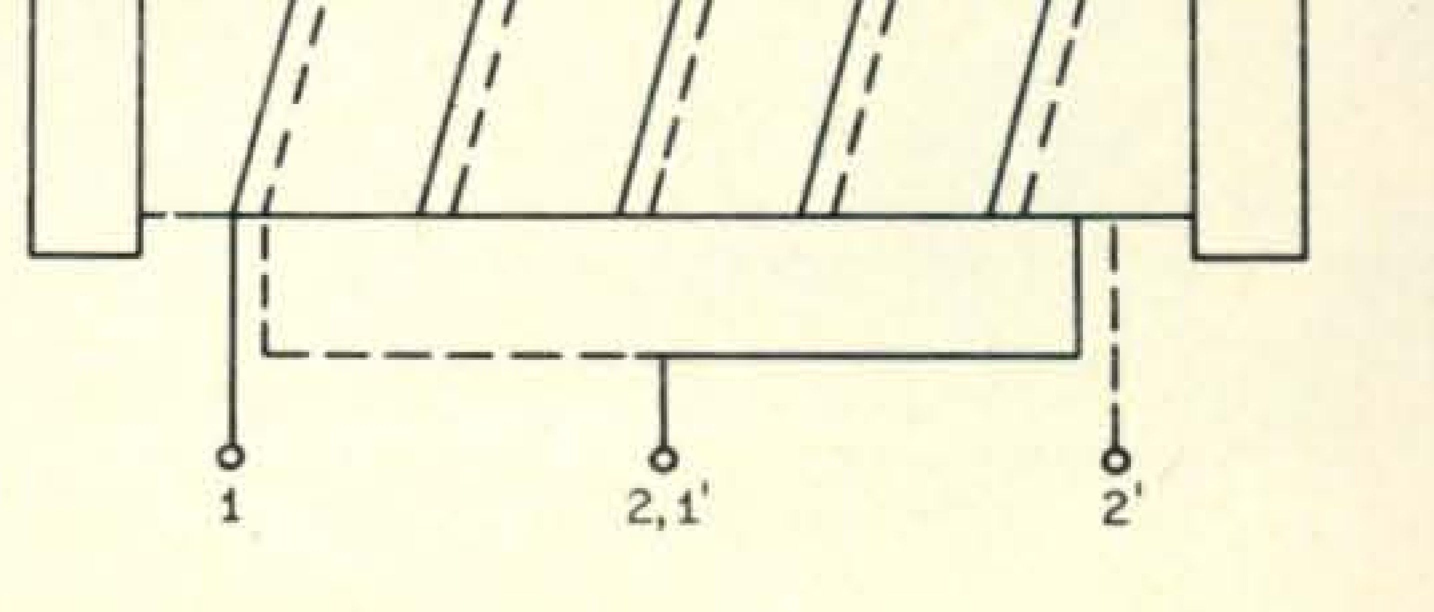


Fig. 2—Method of bifilar winding inductor, L_2.

V.f.o. mixer and amplifier chassis. Note the BC-455 variable and the three i.f. cans L_3, L_4 and L_5.

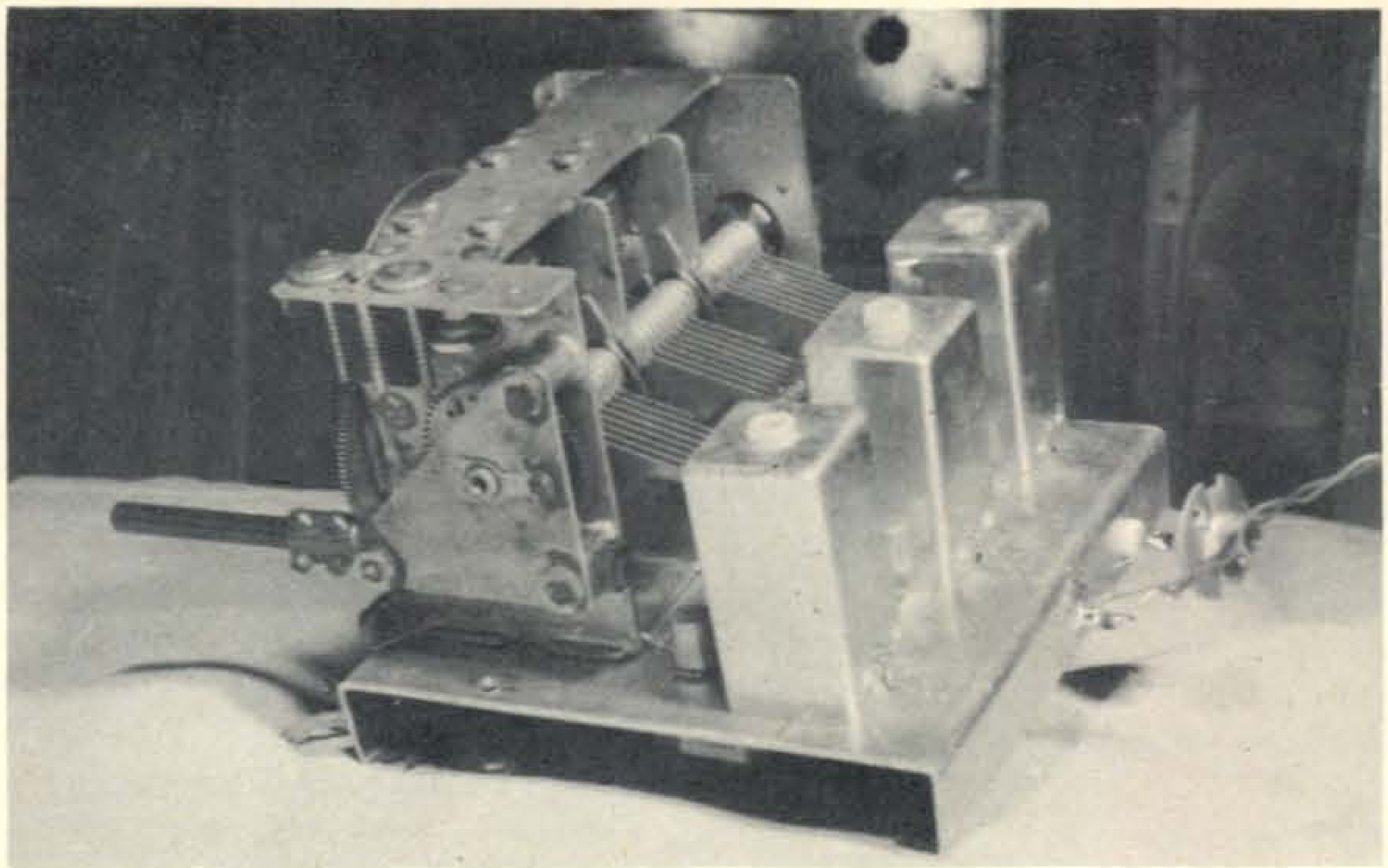


fig. 3 or to a stack of dry cells. Check the total current drain of the exciter; at 12 volts it must be about 50 milliamperes. If you find a much different value of current, recheck the circuit: there is a mistake somewhere. The voltages on the electrodes of the transistors are shown in Table II and they will be helpful in locating a circuit error. for r.f. measurements you have to build a probe, if you don't already have it. Check the r.f. voltage on the arms of the two balancing potentiometers, R_8 and R_9, and adjust the 2.5 mc oscillator coil, L_1, for maximum indication (about 1.4 volts). The voltages on the two arms will be nearly the same; it means the r.f. network is properly working.

Now check the v.f.o. operation, connecting the r.f. probe on the variable capacitor stator C_{1A}; there should be about 0.5 volts. Put the mode switch in the DSB-AM-CW position and turn the carrier potentiometer fully clockwise. Rotate the V.F.O. knob until you have the variable at maximum capacity; this point will be the lower band edge or 3.5 mc. Connect your receiver, tuned to 3.5 mc, to the exciter output through a small capacity (a few mmf and adjust the v.f.o. coil, L_3, until you hear the carrier of the exciter. If the v.f.o. circuit has been already tuned by the grid dip meter, only a small adjustment of L_3 will be required. (The v.f.o. frequency will be 6 mc and it can be checked directly if you have a general coverage receiver in the shack). Leaving the receiver at 3.5 mc, tune the coils L_2 (balanced modulator tank), L_4 (mixer) and L_5 (amplifier) for the maximum S-meter indication. Now move the exciter variable capacitor to its minimum capacity and tune the receiver to 4 mc. Turn the v.f.o. trimmer to hear the carrier (the v.f.o. is now set at 6.5 mc) and adjust the trimmers, in parallel with L_4 and L_5, for maximum S-meter deflection. Repeat these operations at band edges several times until you will have the correct tracking between the v.f.o. and the mixer-amplifier tuned circuits. Inductor L_2 need be adjusted only once, since it is fixed tuned at 2.5 mc. Switch to LSB or USB and balance the carrier with the balancing the potentiometers for minimum output. At this point you can connect a microphone to the exciter and listen to its s.s.b. signal. The carrier suppression will be nearly 50 db and the unwanted sideband about 30 db below the p.e.p. The exciter

[*Continued on page 104*]

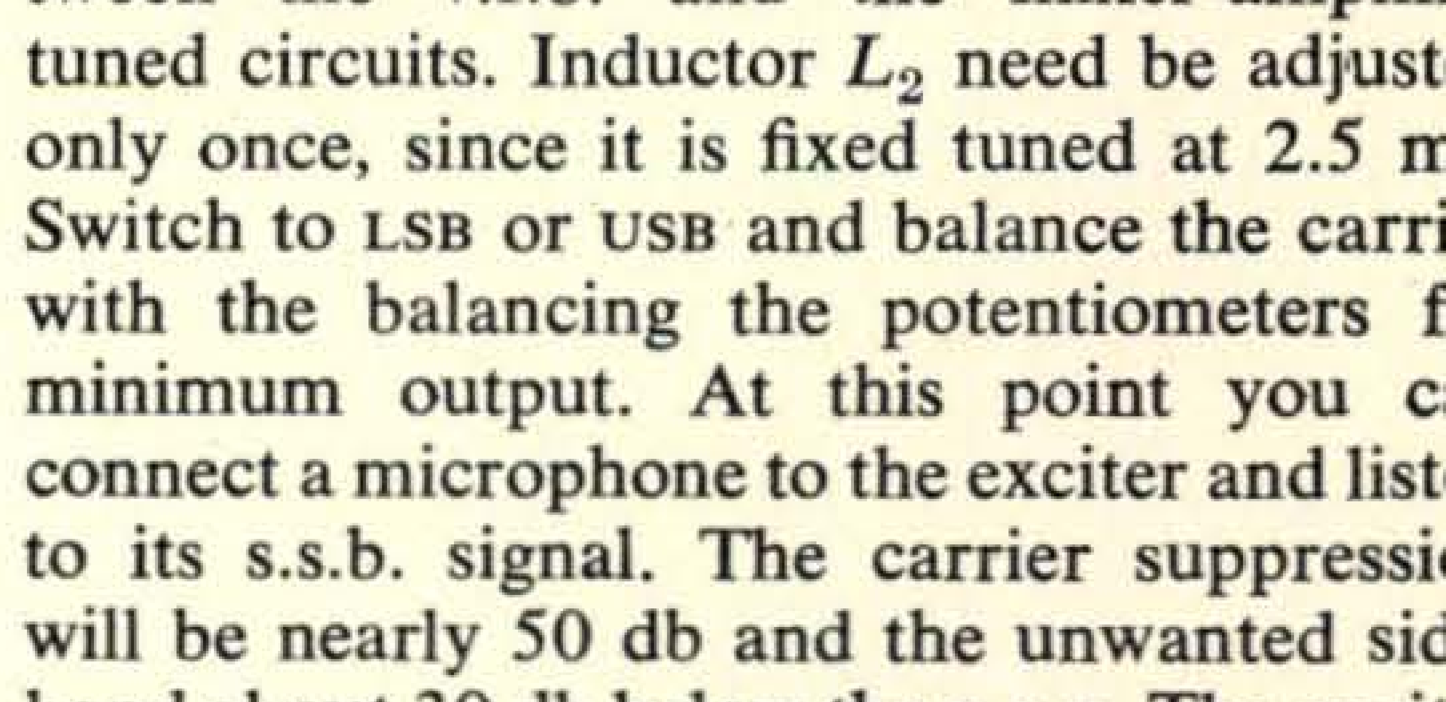


Fig. 3—Circuit of a regulated power supply that may be used to operate the exciter. All resistors are ½ watt and all capacitors are 500 mf, 25 volt electrolytics.

CR_1, CR_2, CR_3—General purpose silicon rectifiers, 100 ma or better.

CR_4—12 v. 500 milliwatt zener diode.

T_1—117 volt to 12.6 volts filament transformer.

THE DXPEDITION

Part II—On the Trail Again

BY DON MILLER,*W9WNV

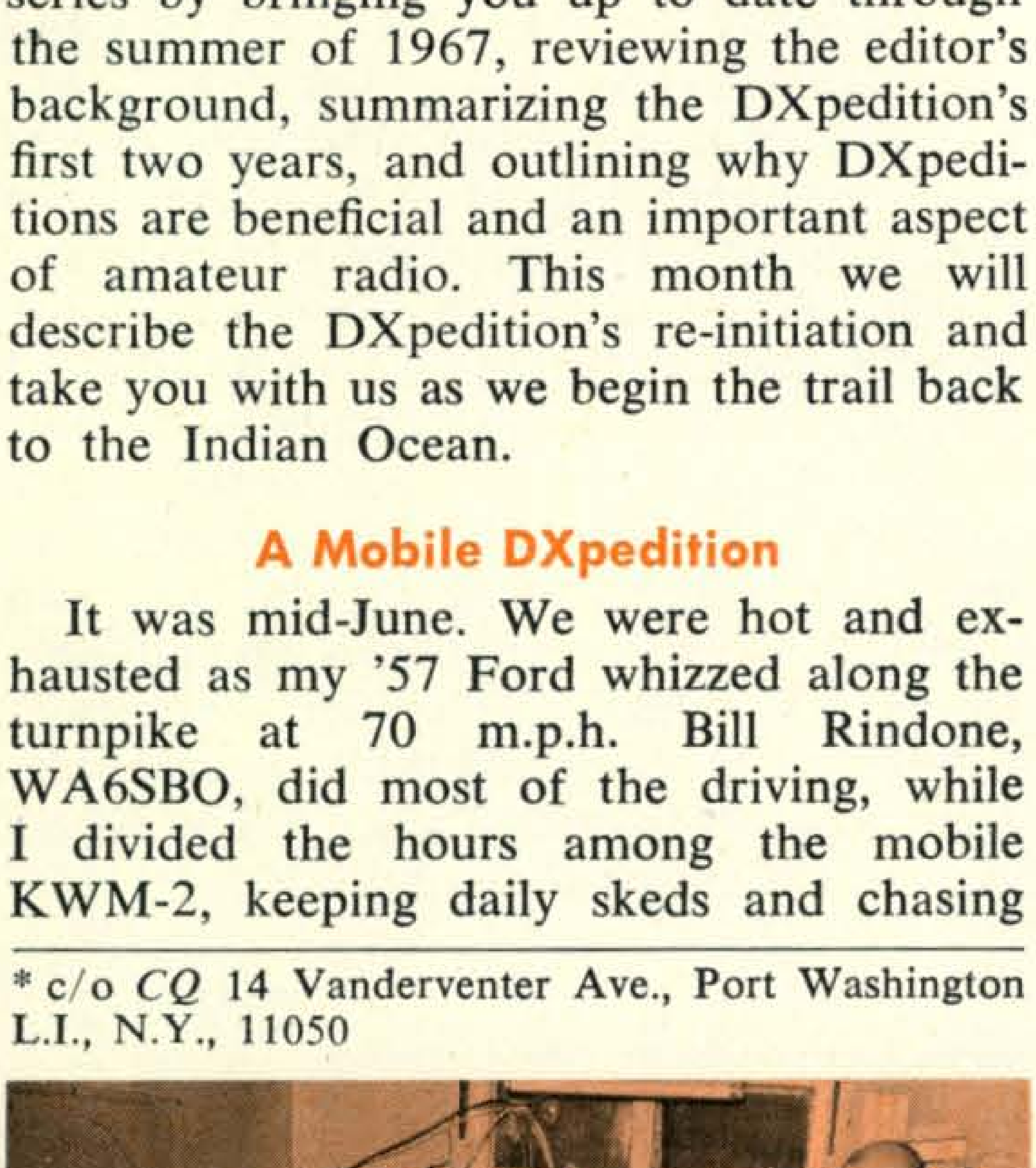
In January, Part I introduced this series by bringing you up to date through the summer of 1967, reviewing the editor's background, summarizing the DXpedition's first two years, and outlining why DXpeditions are beneficial and an important aspect of amateur radio. This month we will describe the DXpedition's re-initiation and take you with us as we begin the trail back to the Indian Ocean.

A Mobile DXpedition

It was mid-June. We were hot and exhausted as my '57 Ford whizzed along the turnpike at 70 m.p.h. Bill Rindone, WA6SBO, did most of the driving, while I divided the hours among the mobile KWM-2, keeping daily skeds and chasing DX, and the typewriter, trying to burrow my way out from under the unbelieveable pile of correspondence that had accumulated since I returned to the States in February. Bill and I were on the final laps of a five-week mobile journey—a "whistle-stop" tour across the USA during which we met with more than 30 DX groups in 30 cities. We gave talks on our experiences and future plans, conducted discussions on DX and DXpeditions, and displayed the collection of DXpedition color slides. On some days we were scheduled to attend two or more meetings, usually lasting two to six hours each and attended by groups numbering as large as 200, mostly DXers. This program gave Bill and I the opportunity to meet the DX gang, the "faces behind the call-signs," personally, to bring them up to date, first-hand, on matters regarding the DXpedition and the recent controversy, and to accumulate the necessary funds to carry out our plans.

We must have been quite a sight! Two weary, usually unshaven young men, driving up around dawn to some DXer's home or an auditorium; the old Ford was stuffed to the gills—typewriter and correspondence, mobile equipment and gear for the DXpedition, personal effects, slides and projector, extra spare tires for the long, gruelling journey, and the usual collection of road maps, cheeseburger wrappers, and pop bottles. By this time we had developed a three-minute ritual for extracting our slides and projector, razors, and change of change of clothes for the evening, removing

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



Visiting at the shack of G4MJ. L. to R.: Bill, WA6SBO; Ken, G4MJ; and John, G3FKM, at Birmingham, England.

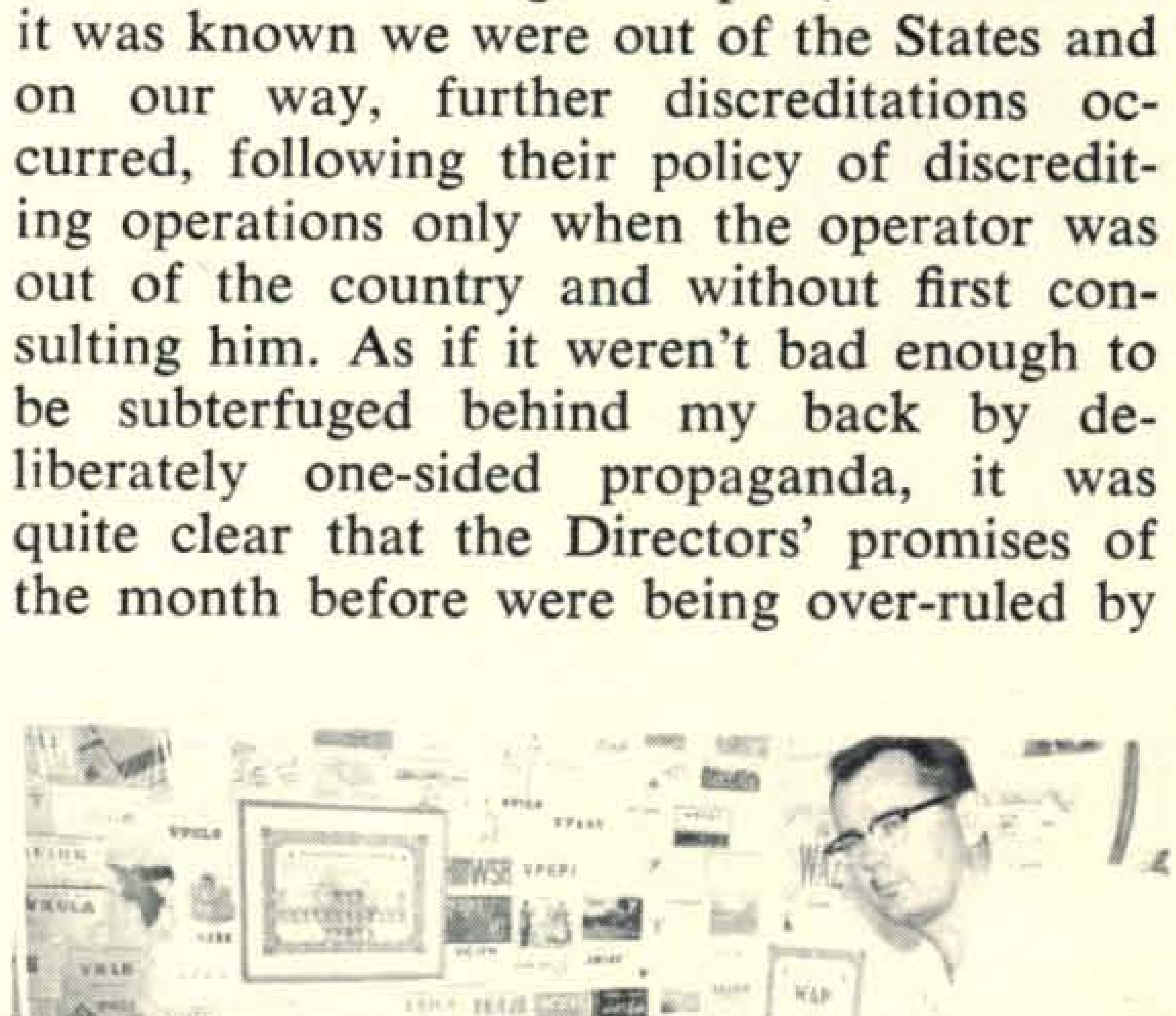
See page 110 for New Reader Service

a minimum of cartons and junk. After being up all hours of the night with the enthusiastic DX gang, we'd try to sleep as late as possible the next morning, having calculated the exact number of hours needed to drive to the next stop with only the essential cheeseburger and fuel stops. How we made it those 12,000 miles without a break-down, I can't imagine, but we were late only once (Pittsburgh—the Western Pennsylvania DX gang).

We became "authorities" on such topics as "Habits of the American Mortorist," "Cheeseburgers I have known," "How to work a hundred countries from your mobile station" (we snagged over 40), "firecrackers" (we "booby-trapped" many a DXer's house, and "Why DXers live in such ungodly, hard-to-find places."

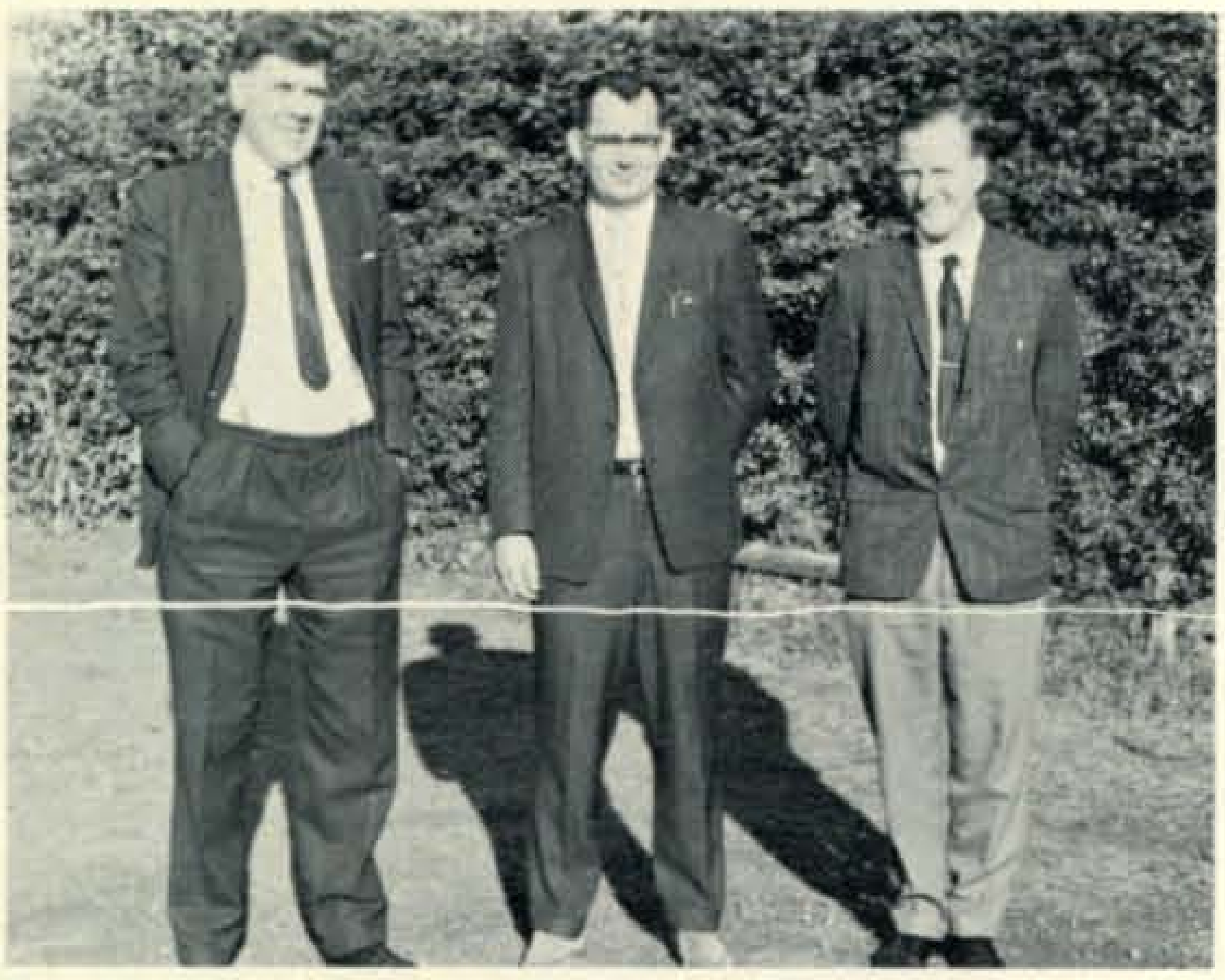
Bill and I kept up this schedule for five weeks, becoming more and more exhausted, but the great enthusiasm and hospitality of the DXers kept our spirits up and we finally staggered into New York. The last three days involved a DX picnic at the home of the late Dr. Harold Megibow, K2HLB, in Ramsey, New Jersey on Saturday afternoon, a dinner that same night as the guests of Jim Lawson, WA2SFP, in Schenectady, New York, and a meeting with the Schenectady Amateur Radio Association, followed by a Sunday-morning drive to Boston to attend a picnic given by Herb Kline, K1IMP, of the Waters Manufacturing Company, and a Monday morning visit with two members of the ARRL Awards Committee at Newington, Conn. The journey, which began in mid-May, gave us the chance to meet over 3,000 avid DXers from the USA and Canada and successfully promote DX and amateur radio. The "campaign" had been initiated with a 10-minute Coast-to-Coast television appearance on the NBC "Today" show, in color, Hugh Downs moderator, with an audience of approximately nine million! The favorable comments from FCC and both DXers and non-DXers alike were a tremendous morale-booster in light of our recent difficulties, and proved the decisive factor in embarking on the "mobile DXpedition." The inspiration and support demonstrated by the DX fraternity during our travels were a highly-motivating factor in encouraging Bill and I to follow through with the DXpedition.

Since we were quite concerned with the perpetual harassment of the DXpedition from Newington, our meetings with four of the ARRL Directors during this trip were quite important; quite notably, all voiced strong opposition to the recent actions of their Awards Committee, but all admitted they were most helpless to correct the situation. I had met with all 16 Directors at the annual Board Meetings in Newington the previous month (annual version of "Director-for-a-Day"), but most of the promises made at that time were in the process of being broken. Release of Awards Committee statements and decisions in advance on 20 meters by members of the North Jersey DX Association didn't help any. One of the tricks which perhaps bothered us most was the quantity of anti-DXpedition propaganda distributed by ARRL to the DXer in charge of each of the planned stops on our mobile venture; the itinerary for which had been published in advance. Since some of these individuals were not DXCC members and a few were not even ARRL Members, it was quite interesting to note their reaction! At our stop in Newington, Bill and I tried to find out what, if any action was planned by the Awards Committee that might affect the DXpedition, past or future. No information was forthcoming, so our plans were not altered. As one might suspect, as soon as it was known we were out of the States and on our way, further discreditations occurred, following their policy of discrediting operations only when the operator was out of the country and without first consulting him. As if it weren't bad enough to be subterfuged behind my back by deliberately one-sided propaganda, it was quite clear that the Directors' promises of the month before were being over-ruled by



G3HDA at his rig, supervised by visting fireman WA6SBO.

See page 110 for New Reader Service



Real live sunlight illuminates the shining faces of Mick, G3HCT, WA6SBO, and G3FKM, at Birmingham, England on the preliminary leg of the DXpedition travel.

the League's General Manager. What a state of affairs! Bill and I reserved no doubts that the harassment would continue. It did.

Bill Rindone

Bill Rindone, WA6SBO, is an intransigent contest operator and DX devotee. Having competed with him in contests and pileups and having worked WA6SBO on most bands (usually the first W6) from most DX locations, I was already aware of this. So I was quite jubilant when Bill showed an interest in getting together. Besides being a capable and experienced DX operator and personable fellow, Bill's going meant a great deal more to the DXpedition. On the stops where I was alone it had been a difficult row to hoe—a 24-hour-a-day struggle to keep the DXpedition moving. Sometimes I would be in an exotic country for a week and not even have the opportunity to relax or enjoy the scenery. Operating 24 hours per day and sometimes for 48 or 72 hours continuously had taken a great deal of the fun and enjoyment out of the project. With the two of us, however, all this would be changed; we'd be able to spend a little more time on public relations, photography, provide more alert operating, and possibly some multi-band, simultaneous operations to keep the gang on its toes.

Some of the more brief, recent operations had been an unbelievable struggle. Consider that, from a rare location for a two or three-day operation on a single band, with the band "open" 16 hours of each 24, if you work two stations per minute for two days running, you can manage to contact most of the hard-core DX fraternity. That leaves 8 hours each day (usually in the middle of the day when 20 meters is dead) for sleeping, but the mid-day sweltering in the Indian Ocean is no time for sleeping and, even if it were there's too much maintenance to allow any sleep. During the operation, besides the logs, several lists are kept. One of these is for maintenance, listing each item requiring attention. After sixteen hours of operations under such adverse conditions as salt air humidity, sand and dust, insects by the thousands, variable voltages, and just plain wear and tear, believe me, there was plenty of repair work lined up, and sometimes eight hours wasn't enough! The most usual items were generator maintenance, tube battery, and component checking and replacing, intermittencies and arcing, and antenna and rotator adjustments and reguying. It ain't easy, in the broiling tropical mid-day sun, when you're half asleep and exhausted, to go about such chores with any degree of efficiency; usually, eight hours was fully consumed and it was then time to begin the next sixteen-hour operating stretch! After two or three days of this I had barely the energy remaining to tear down the station, break up camp, pack and load the gear, and collapse on deck while en route to the next stop. Of course, I'm just trying to clarify one selfish reason why I was happy to have Bill as a partner on the DXpedition.

Bill, assisted by his XYL, Pat, had worked in the W6 QSL Bureau for a few years, finally handling it themselves for the past two, so Pat was a "natural" for a QSL manager and Bill had some revolutionary ideas on how to modernize our QSL service.

Unfortunately, when we first discussed the possibility of getting together Bill had already completed plans for a DXpedition of his own, and he and Pat were soon to sail in their 35-foot trimaran, *Antipodes* on a voyage into the Central and South American areas. The previous month Bill had operated for a few hours from Bishop Rock. Just prior to finalzing my own plans however, I received word that *Antipodes* had run into the worst possible weather off the Lower California coast and was forced to return to San Diego for repairs. A discouraged but spirited WA6SBO

See page 110 for New Reader Service

phoned me from the dock in San Diego and it was then we agreed to try our DXpedition together as soon as possible. We decided to try the cross-country mobile trip and to complete the "DX Handbook" (*Amateur Radio DX Handbook,* Cowan) I was then writing, before departing. Of course, finances were a major factor and would dictate when and where we would go and how long the DXpedition could last.

The DX Handbook

Writing a handbook was no easy task, but there was definitely a *need* for such a volume. The many thousands of DX enthusiasts *have no really authoritative operating manual* or set of operating aids. They royalties were to be used to support the DXpedition and, if successful, other DX and amateur radio ventures in the future. Over twenty amateurs, all authorities on one or another aspect of DXing, contributed a fascinating collection of data and information, little of which we had ever seen in print in any volume. Organizing and assembling this information and putting my own experiences and ideas into formal print turned out to be quite a chore. Collecting data for an additional hundred pages of accurate operating aids also presented problems, especially in view of our deadline for leaving the States, but everyone cooperated and the task was finally completed. Almost . . .

Wayne Green had promised a $3,000.00 advance for the *Handbook,* but when the manuscript was almost ready he withdrew the offer on the grounds that I had become "too controversial" (quite a statement from that gentleman!). Since this endeavor meant a great deal to the DXpedition as well as filling a gap with a fine collection of DX material, Bill and I visited the Staff at *CQ;* it didn't take long to find out that we all felt the same way about the need for this book and how it should be presented. *CQ* agreed to publish *The Amateur Radio DX Handbook,* to pay us a substantial advance, and also to publish this account of the DXpedition. We were quite happy about the turn of events, feeling the *CQ* staff shared a most reasonable and realistic outlook on DX and on amateur radio on the whole, and believing that we should have established a working relationship

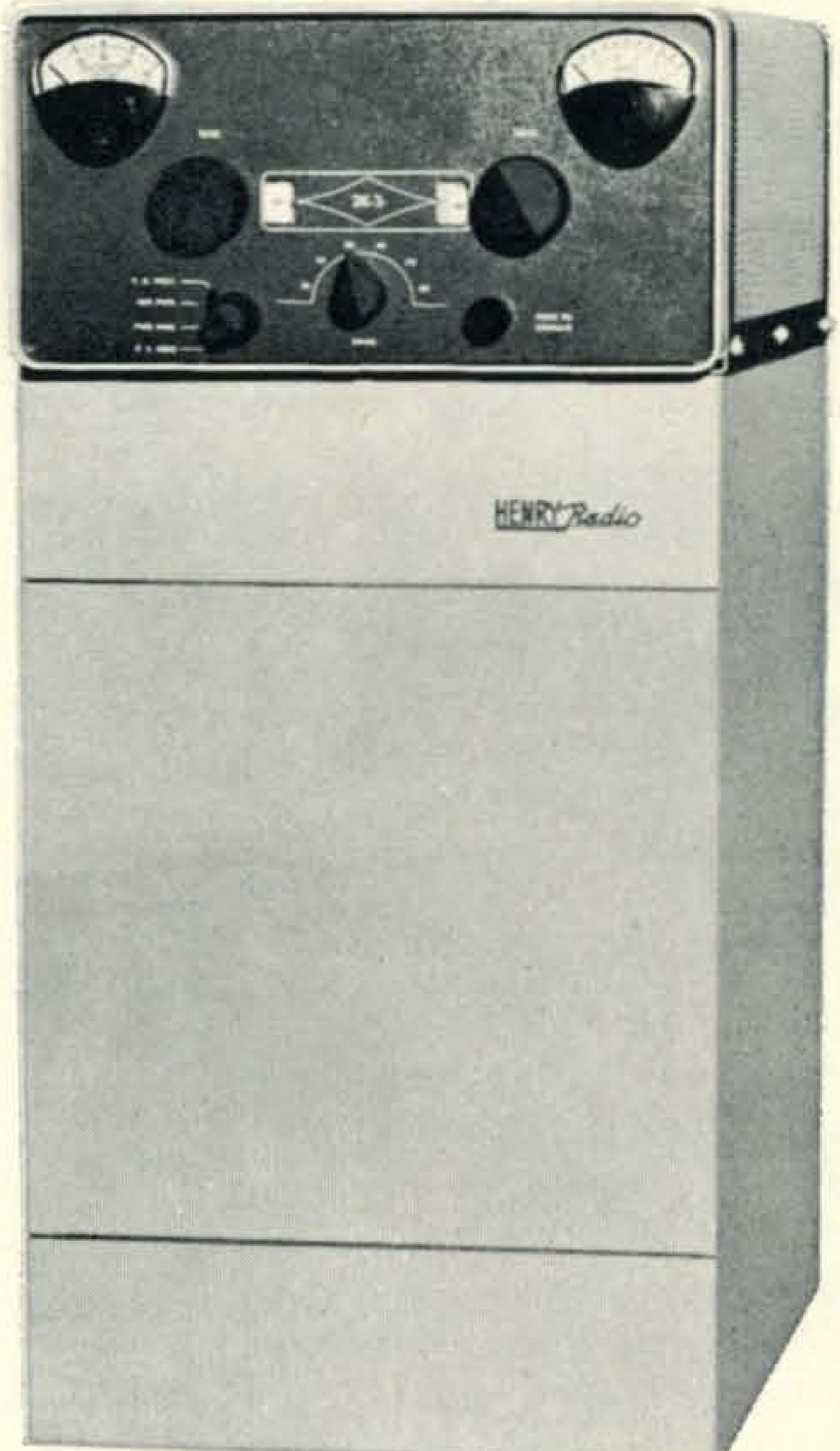
G3BOZ was also paid a visit by Bill and I. John's two sons, G3HCT and G3HDA team with him to provide a triple-threat in those DX pile-ups.

with *CQ* in the first place. Many of the "old-timers" will remember that it was *CQ* who published, in 1947, the first and only real DX Guide, *CQ DX* by W2IOP, Larry LeKashman. Shortly after you read this, *The Amateur Radio DX Handbook,* 1968 Edition, will be in circulation. Once again, all royalties received will be re-invested in DX and amateur radio. I hope you think enough of the *Handbook* to send a copy to some DX friend overseas. We've tried to make this volume a "must" for every ham shack; its 200 pages contain valuable data and information on every phase of DXing and virtually every conceiveable operating aid.

Unfortunately, when Wayne learned that we had decided to publish with *CQ,* he began a series of tirades against the DXpedition and against me, personally, and finally announced that he was coming out with a DX book of his own. The outline he published contained topics that were, word-for-word, from the outline of my own volume, a copy of which I had given Wayne after he led me to believe he was interested in publishing the material for us. I had been warned by many friends about such an association, but I guess I had to learn the lesson first-hand! It is quite humorous that, in the very same issues of his publication, that editor claims to average 250 QSO's per hour (five times as fast as I've ever heard him operate at his speediest and far greater than I, or any other DX operator I've ever heard, has accomplished), and the same issues contain Wayne's authoritative article on "How to Cheat," and a fairy tale about an

[*continued on page 94*]

WE EVEN SURPRISED OURSELVES



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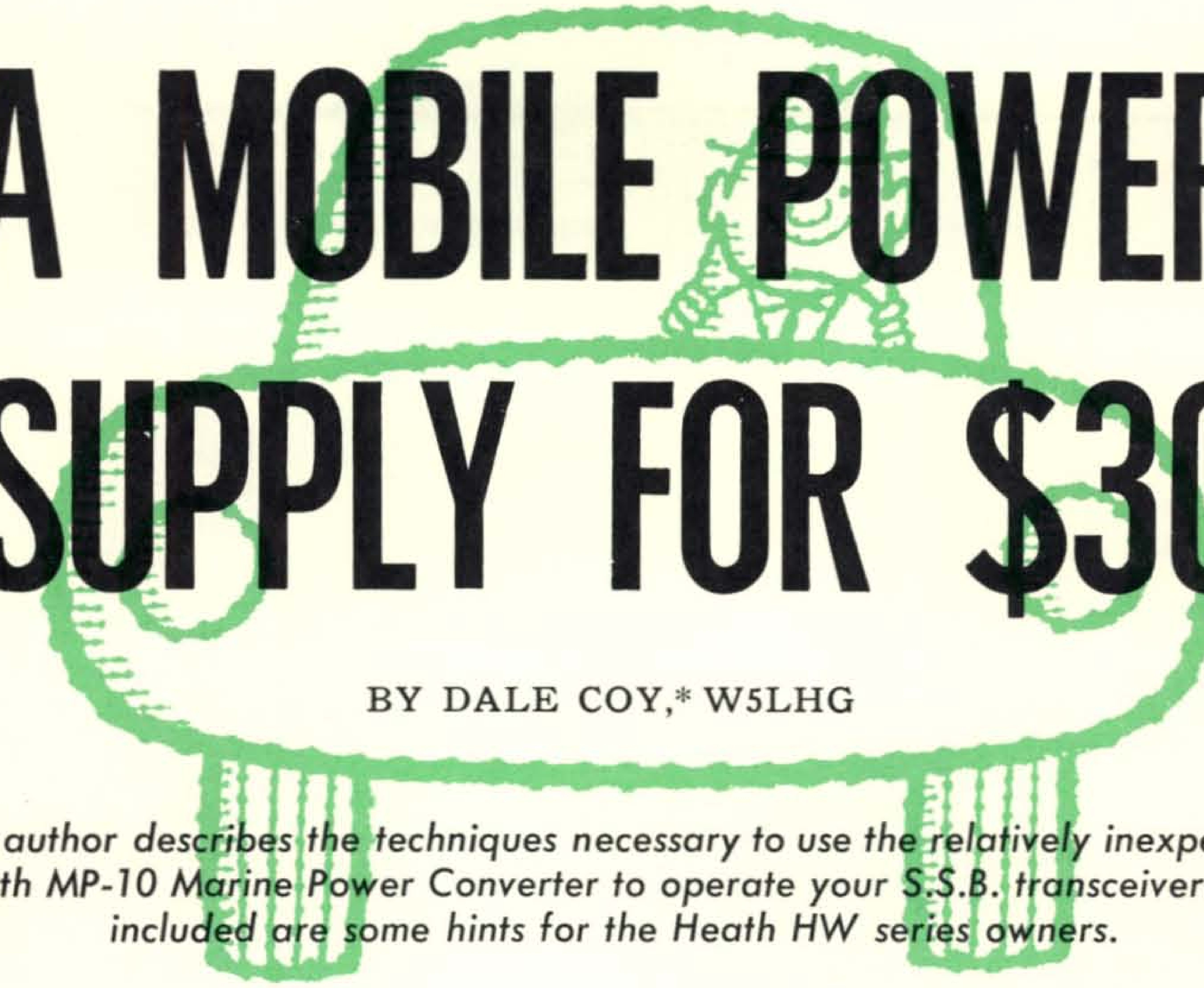


A MOBILE POWER SUPPLY FOR $30

BY DALE COY,* W5LHG

The author describes the techniques necessary to use the relatively inexpensive Heath MP-10 Marine Power Converter to operate your S.S.B. transceiver. Also included are some hints for the Heath HW series owners.

I DON'T really want to upset anyone. Those of you who just laid out $60.00 for a mobile power supply kit go on to the next article. You could have done it for half price. But those with a.c. powered transceivers in the 150-300 watt class, stick around. Mobile is cheaper and easier than you think.

The Heath Company makes a nice mobile supply kit for $60.00, and (much to their chagrin) an even nicer one for $30. It's called the MP-10 *Marine* Power Converter. It works from either 6 or 12 volts, and delivers "175 watts" of 117 volt, 60 c.p.s. square wave power. Don't let the square wave throw you; it's just like a sine to your power transformer. Those of you who have your transceiver booklets out have already compared that 175 watts with the 350 or so needed for your rig, but don't go away yet. Let's look at where those watts go.

First, you probably need at least 50 watts of filament power. Most transceivers use a 12.6 volt filament source, so just match this with the 12 volt battery (actually nearer 13 volts) in your car. If you have a 6 volt filament circuit, get a 6 volt car or a large dropping resistor. (The car might be cheaper.)

Now let's see about the rest of it. On transmissions, you will use about three times as much power as when receiving. In fact, the majority of equipment uses less than 30 watts in receive. At 75% efficiency in your power supply, this is 40 watts of a.c. needed. The MP-10 barely warms up at this rate.

Now that you can hear, what about talking? If you have a 300 watt rig, you'll need about 400 watts of a.c. input *if* you modulate 100% with a continuous signal. If you just talk, this will probably average less than 200 watts. And here comes the kicker; the specs on the HP-10 say that from a "cold" start, it will deliver 240 watts for 25 minutes, after which the power should be reduced to the *continuous* rating of about 175 watts. Remember that when receiving, the power needed (except filaments) is very low. With sensible use, the receive periods allow the converter to rest. By the way, if you need more power, two or more converters may be hooked in parallel.

* 3322 49th Loop, Sandia Base, New Mexico 87116.

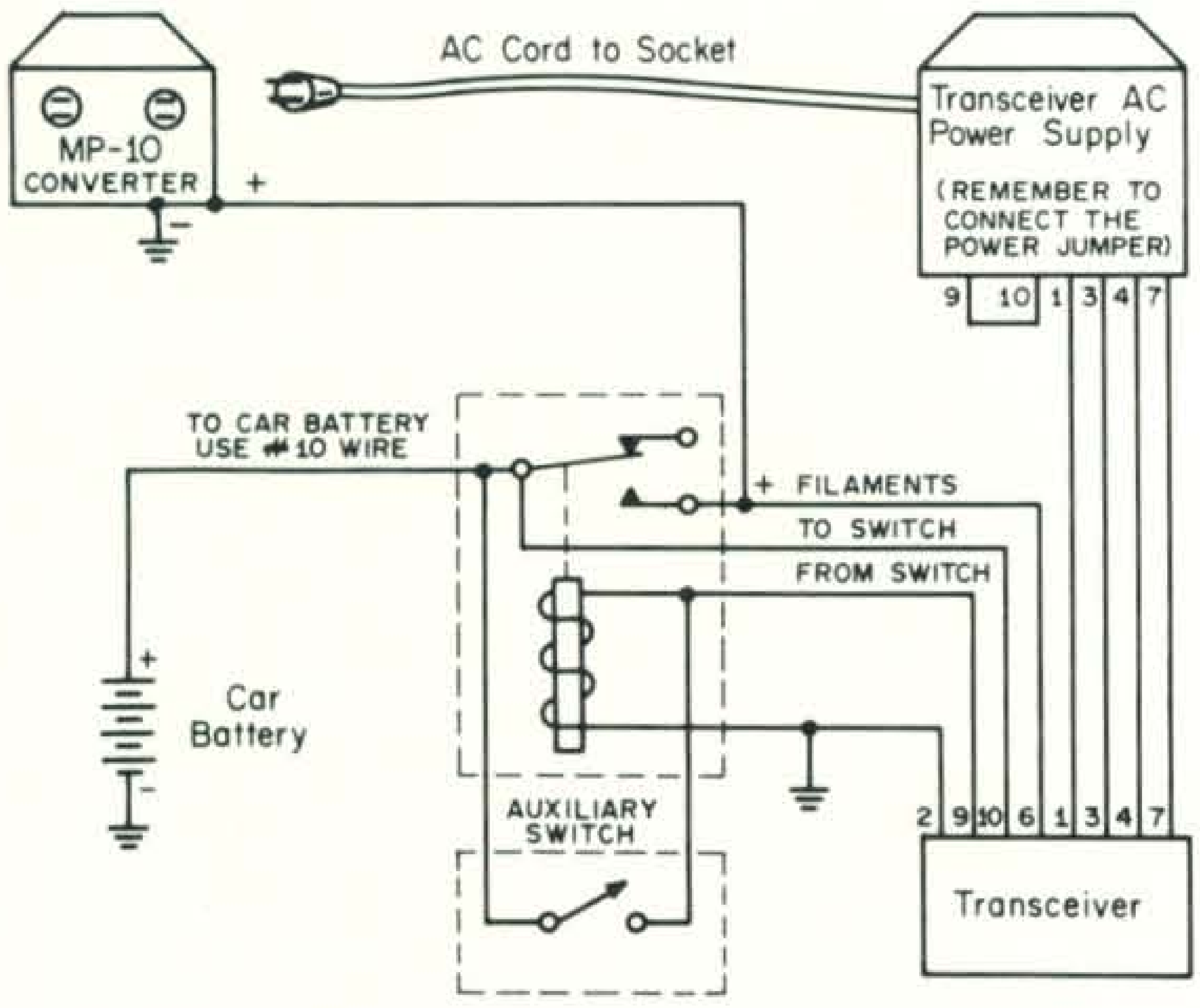


Fig. 1—Wiring diagram showing how the Heath MP-10 converter can be used to power Heath HW-series equipment. The wiring shown is for a negative ground but can also be used with positive grounds. Other equipment will require a different wiring arrangement.

How To Do It

Installation of this system will make only a small dent in your junk box. In an emergency, a $5 bill will buy the parts needed. The diagram in fig. 1 shows the method for the Heath HW-series and HP-23 power supply, but can be easily adapted for other systems. The only real problem to be solved is how to turn it on. The power supply will need 25 amperes at peak output, and the switch in the transceiver is not designed for this rating. The obvious answer is a relay. I used a Leach 1207 S9 from the junk box, but any 12 volt relay with heavy contacts will do. P&B PR3DY is a good choice if you have to buy one. If your junk box yields a good relay, there are two tricks you can use to get the contact rating. (1) parallel all contacts in sight, and (2) remember not to turn the system off while transmitting (if you needed reminding). The last trick takes advantage of the fact that relay contacts are rated on capacity to make or break current. Most will carry much more once the connection is made.

The MP-10 can be bolted directly to the car, in the trunk or under the hood. Trunk mounting is preferred, as the MP-10 is not completely waterproof. Mount the relay in a small metal box for protection. To mount the transceiver power supply, I used two springs at right angles. The supply can be easily slipped under the springs for mobile use, or quickly removed for use at home.

At the beginning of this article, I said the MP-10 was even *nicer* than the regular mobile supply. To realize this, hook up a parallel switch in the trunk to actuate the relay. You now have 117 volts a.c. in your car to run the soldering iron, electric drill, *etc.* This is quite a bonus, and if you hook it up this way first you can use this power to complete the installation.

Mobile Convenience

Most transceivers use an external speaker. Before you tap into the car radio, or buy another speaker for mobile use, consider this for simplicity, as well as home-station versatility. Mount a thin speaker (Utah's SP3A is nice) under the grill of the transceiver case. Run the wire out through the back of the case, and plug it in at the speaker connection. While you're doing it, you might also mount a headphone jack near the front where you can reach it, instead of in the back of the set. A switch, or a closed-circuit jack, will allow selection of output. And while we're talking about headphones, did you ever consider using a 3 conductor phone jack, wired for monaural instead of stereo? For real comfort, there's nothing like a good pair of stereo earphones.

Notes For HW-Users

In mobile operation at night, the panel lights may be too bright. Replace the black wire between the two pilot lamp sockets with a 39 ohm, ½ watt resistor. This cuts the brightness to about half.

If you're annoyed with the phono pin jacks used for output connections, there are two solutions. (1) For audio output, a standard size phone jack fits the space exactly. (2) For r.f. circuits, use the UG-1094/U connector which also fits exactly into the hole provided. This is a standard BNC-type connector. Don't be afraid of the BNC series—they were designed to fit RG-58 coax, which is as good as RG-8 for these power levels. They are easy to wire, quick connecting and have a number of other advantages. The UG-273 adapter will bring the size up to u.h.f., if you need it.

A final note—the installation of the MP-10 as described has a bonus for HW series users. The bias setting on your transceiver will probably not change enough to matter. Remember to check it with the car engine running at a reasonable speed for the driving you will do. ■

VISUAL S.W.R. MEASUREMENTS

BY AL BROGDON, *K3KMO

This article presents a method of performing rapid s.w.r. measurements of antennas. It represents a system that was developed commercially, and requires several expensive pieces of test equipment. Some readers will have access to the equipment required so they can give it a try. For the remainder of our audience, the method is described as a matter of interest.

THE traditional amateur method of making s.w.r. pattern measurements of antennas is to make a series of measurements with an s.w.r. bridge at a number of points across the band, and then connect these points to form a smooth curve. The method to be described in this article measures the s.w.r. of an antenna by making a repetitive and continuous sweep across the frequency range of the antenna, determining the s.w.r. on a swept basis, and displaying the pattern of s.w.r. versus frequency on the face of an oscilloscope. With such a method, interesting experiments are possible. For example, the test set-up to be detailed can be used to look at the s.w.r. pattern of a rotary beam while it is being rotated. This will visually demonstrate the changes in s.w.r. pattern due to the effects of nearby objects as the antenna is rotated past them.

Such a set-up would be valuable for antenna adjustment purposes, since it would be possible to make adjustments and immediately assess their effects over the entire frequency range the antenna is designed for.

* RD 1, Box 390A, State College, Pa. 16801.

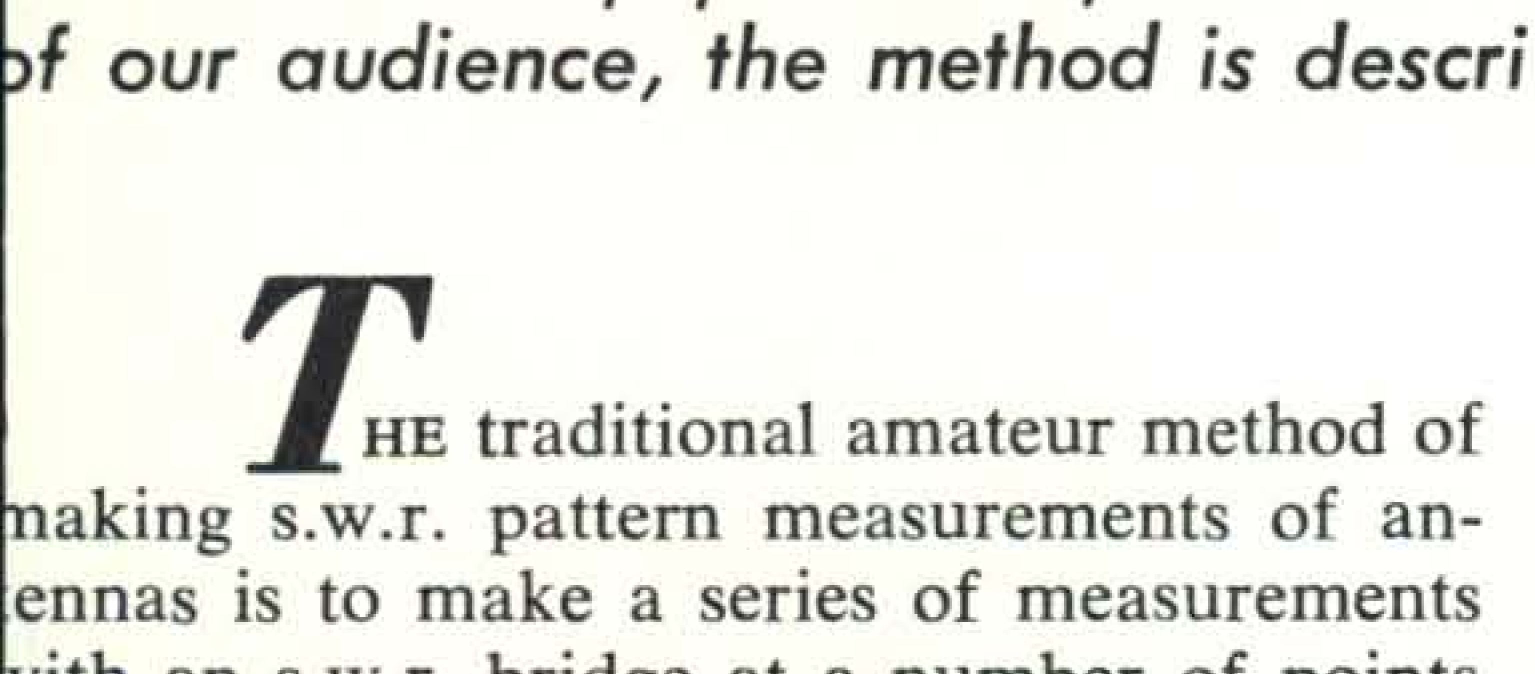


Fig. 1—Block diagram of the basic test set up used to give a visual presentation of s.w.r. on an oscilloscope. The circuit of the bridge detector is shown in fig. 4.

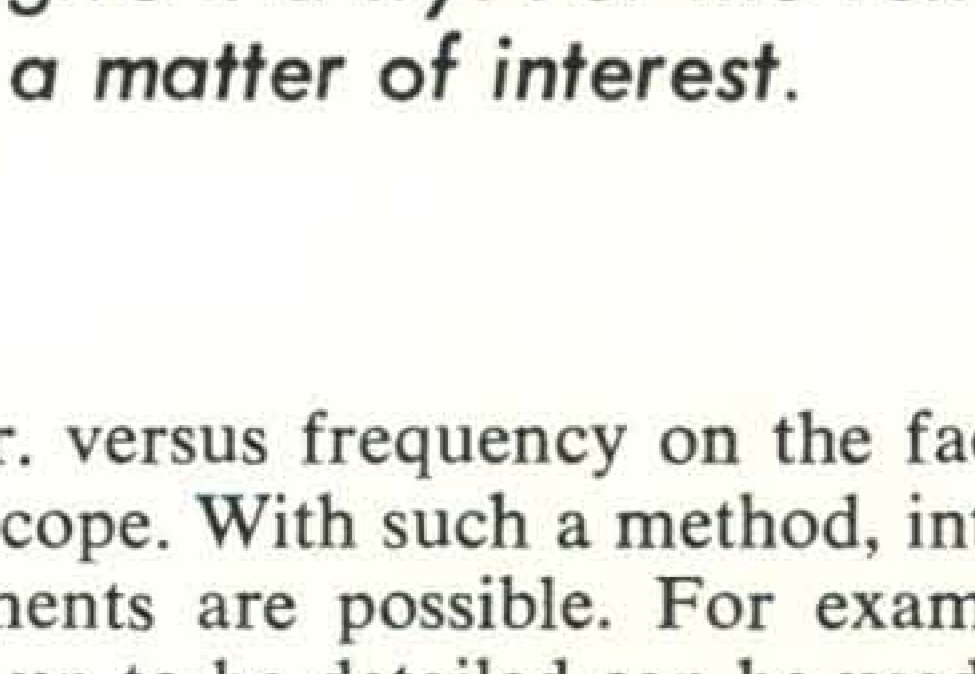
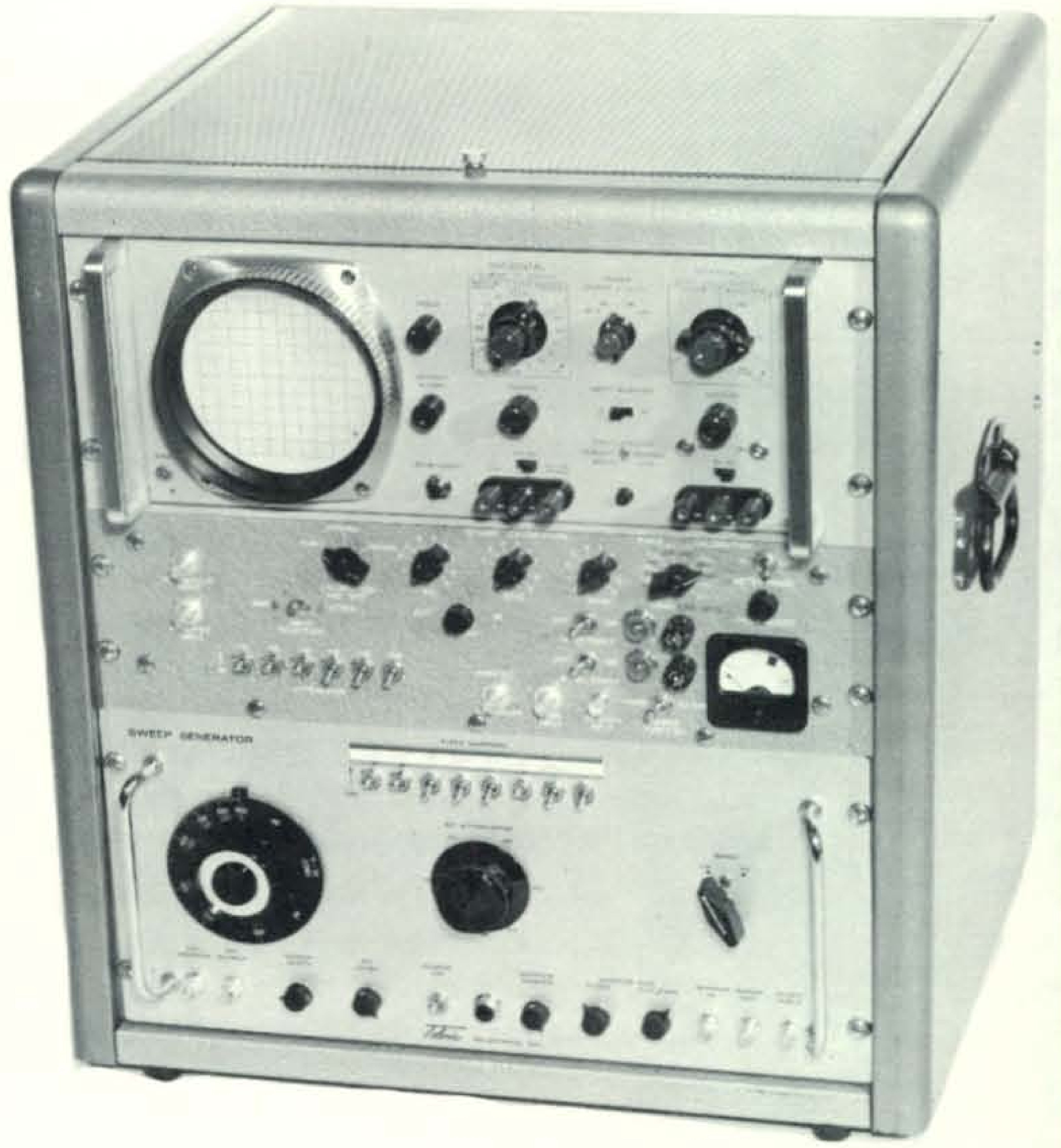


Fig. 2—Typical scope display of a 4:1 calibrating levels. Note the marker pips and grease pencil markings of the calibrated s.w.r. levels.

Fig. 3—HRB—Singer prototype Antenna Performance Test Set used to provide a visual display of the antenna s.w.r. pattern.



Army Development

This method of rapid s.w.r. measurement was developed by two of the author's coworkers at author's co-workers at HRB-Singer, Inc., Tom Kenly and Jack Wurst. It was done on a contract with the Army, for testing their antenna fields in the 1.5 to 30 mc range. These antenna fields typically consist of verticals, dipoles, double dipoles, rhombics, and beverage antennas. Incidentally, the rosettes of rhombics are enough to make any ham turn green with envy, whole families of rhombics designed for different frequency ranges and aimed at all points of the compass.

Sweep Benefits

A prototype antenna performance test set was built by our firm and proved to be a valuable tool in testing these antenna systems. It repeatedly showed up antenna faults that had gone undetected by the Army's normal test procedures. After a bit of practice on the part of the test set operator, it became possible not only to recognize the existence of a fault, but to make an educated guess as to what the fault might be.

Equipment

The basic equipment required for this test set-up includes a sweep generator, a crystal-controlled band edge marker, an oscilloscope and a home-made bridge detector. A variable r.f. attenuator can also be used for more exact measurements, but can be left out for normal amateur antenna installations, as will be discussed later in this article.

Since the sweep generator is not a familiar item of test equipment to the average ham, perhaps a few words of description are in order. It is an r.f. signal generator whose output is swept across a frequency range, chosen by the operator, repetitively, usually at the 60 c.p.s. line frequency. The upper and lower limits of the frequency being swept can be chosen by the use of the front panel controls, as well as the amplitude and other output characteristics. The crystal controlled markers required in this test set-up can be included in the sweep generator. It is common practice to include these oscillators right in the sweep generator, since they are so often needed in checking the range of the frequency being swept.

The test equipment is set up as shown in fig. 1 for the rapid s.w.r. test. Basically, the sweep generator is set up to sweep across the design range of the antenna and fed to the antenna (after test set calibration, which will be described later). The bridge detector circuit is used to detect the r.f. signal and feed the d.c. output to the vertical deflection circuit of the scope. This output corresponds to the s.w.r. of the antenna. The horizontal deflection circuit of the scope is driven by the sweep generator, so the scope pattern becomes an s.w.r.-*versus*-frequency plot of the antenna.

Calibration

In actual use, the test set up is first calibrated by using the set of fixed calibrating resistors instead of the antenna. The values of these resistors are chosen to give a representation of various s.w.r. levels. Table I shows the typical values of these resistors for various s.w.r. levels. It may be seen that the resistor value is such that its value divided by the characteristic impedance of the antenna is equal to the s.w.r. Table I gives both the exact value of each resistor for the s.w.r. indicated, and the closest RETMA resistor value to it, which is accurate enough for our purposes. These resistors should be one or two watt carbon (non-inductive) types. Note that these values are given for a 75 ohm antenna system. Their values as well as the values of the resistors in the bridge detector circuit would be changed for other characteristic impedances.

To begin the caibrating procedure, the sweep generator is first set up to sweep across the design range of the antenna. Appropriate band-edge marker frequencies are used to locate the frequency band on the scope face. The sweep generator is adjusted to sweep the entire band, so that the band-edge marker pips can clearly be seen on the scope face.

2—15172 Visual S.W.R. Measurements CQ Mach. No. 9 Bruce 9-10 T.R. x 15 11-24-67

Once the frequency has been set, the fixed calibrating resistor corresponding to the highest value of s.w.r. to be considered (in our case, a typical value of 4:1) is switched into the circuit. This will give a scope display as shown in fig. 2, with the upper horizontal line being the line corresponding to an s.w.r. of 4:1. A grease pencil can be used to note the height of the 4:1 s.w.r. pattern for future reference. The vertical gain of the scope should be adjusted so that this 4:1 level (or any other maximum s.w.r. level you wish to display) is near the top of the scope face. Also note in fig. 2 the appearance of the band-edge marker pips near the two ends of the trace.

The s.w.r. calibrating procedure is repeated for the other values of s.w.r. desired by switching through the other fixed calibrating resistors and grease penciling the heights of their patterns on the scope face. Note that once the vertical gain of the scope has been set at the highest VSWR level being calibrated for, it should not be touched until recalibrating for other tests.

S.W.R. LEVEL	Exact Resis.	RETMA Resis.
1:1	72	68
1.5:1	108	100
2:1	144	150
3:1	216	220
4:1	288	300
5:1	360	360
6:1	432	470

Table I—Values of Fixed Calibration Resistors for a 72 Ohm Antenna System.

At this point we have the scope face calibrated vertically in terms of s.w.r, and horizontally in terms of frequency. We are now ready to switch from the fixed calibrating resistors to the antenna itself and make the s.w.r. pattern measurement. The antenna is switched into the measuring circuit, and the scope display corresponds to the s.w.r. pattern of the antenna over its design range. The s.w.r. at any frequency within the band can be accurately estimated through the use of the grease pencil s.w.r. lines. It's that simple!

Attenuator

In actual set-up and use after a little practice, the test set can be calibrated and the entire test completed in less time than it has taken you to read about it.

The purpose of the variable attenuator mentioned previously as an optional item of equipment is to eliminate the error introduced in this test procedure due to transmission line loss. Since most decent amateur installations have transmission line losses of less than 1.5 db, this correction may usually be ignored due to its introducing only an insignificant error. However, for the purist who wishes to correct for this factor, here's how to do it. The attenuator is used during calibration with the fixed calibrating resistors to simulate the two-way transmission line loss. Two-way loss to simulate the loss of the signal going up the transmission line, and then the loss to the reflected signal. The attenuation should be set, therefore, for two times the loss of your transmission line. Calibration procedure is the same as before, and the attenuator is then switched out of the circuit for the actual antenna s.w.r. measurement.

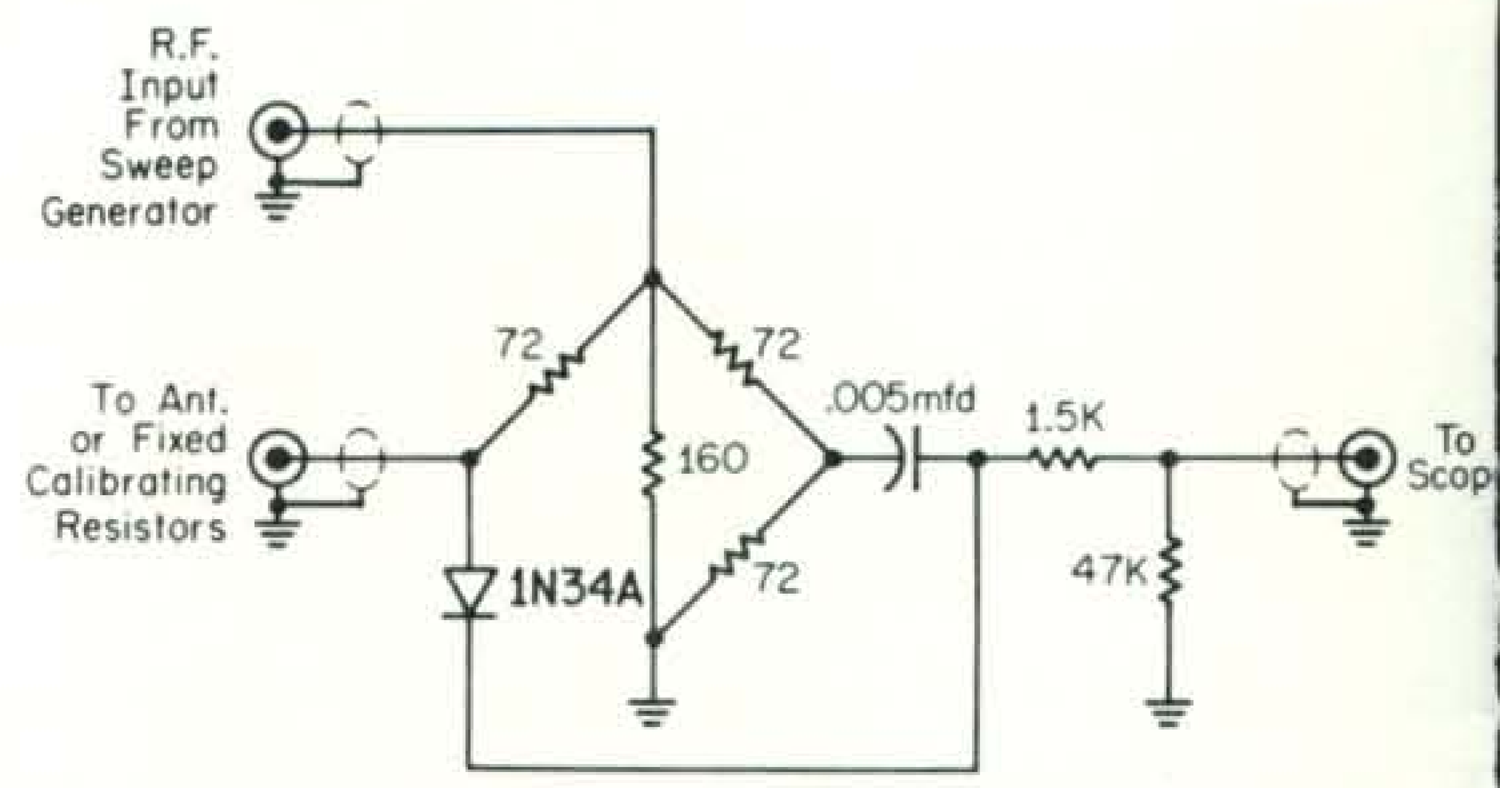


Fig. 4—Bridge detector circuit (shown in the bloc diagram of fig. 1). The values shown are for 7 ohm antennas.

Original Prototype

Figure 3 is a picture of HRB-Singer' prototype antenna performance test set. A the top of the rack you will see a standar Hewlett-Packard oscilloscope, and at th bottom a Telonic sweep generator. Th Telonic generator has built-in crysta markers controlled by the row of toggl switches across the top center of its fron panel. The panel in the center of the rack i the control center of the test set with al other circuitry and control functions. Thi test set's unique feature is its ability to mak rapid s.w.r. measurements, although it is als capable of other antenna performance tests

This prototype test set was used by th two designers mentioned before as well a the author and other co-workers of ours i making hundreds of antenna tests, with ex ceptionally good results. We were able t guide the efforts of the antenna maintenanc crews much more effectively than they coul do for themselves with their older tes methods, which resulted in significant im provements in the performance of the an tenna systems being used.

Even if you can't get the equipment to gether to perform such swept-frequenc s.w.r. tests on your own antennas, this i certainly an interesting method which ha proven to work very well. And for those o you who can muster the test equipment re quired, give it a try. Figure 4 shows th diagram of the bridge detector circuit use with this test set.

For those who may be curious about th price of such an antenna performance tes set, HRB-Singer priced production model out (although the test set didn't ever go int actual production) at something like $400 to $5000, depending on quantity. This wa done in 1963, and would be slightly highe nowadays. ■

DX

BY JOHN A. ATTAWAY,* K4IIF

THIS is the season of "hundreds" in the award's program. Last month we awarded WPX C.W. No. 800, this month WPX S.S.B. No. 300, and S.S.B. DX 100 award No. 500. We also awarded WPX Mixed No. 150 which is an even lot as well. The following are the new winners in the various categories:

WPX S.S.B.: OE3SAA-290, WA9KQS-291, SVØWV-292, F5AN-293, 9Q5FU-294, W4HUE-295, VE1TG-296, LU5AH-297, VK3SM-298, W9WGQ-299, HB9ADE-300, VE3ELA-301.

WPX C.W.: WA9KQS-801, W9CRW-802, W1-DMD-803, K4RDU-804, G3ESF-805, W2MBU-806, OK1ZQ-807, UT5HP-808, UB5IU-809, UA3GO-810, UA3WX-811, SP6SO-812, SM5ACQ-813, PAØMIB-814.

WPX Mixed: W4WHF-147, VE7IG/VE8-148, KØHUU-149, CX9CO-150.

WAZ C.W./Phone: G3ESF-2353, GC4LI-2354, SP6ALL-2355, K4ZKZ-2356, UW9PT-2357, UT5-CC-2358, UW3FD-2359, W2BAI-2360, K5TYW-2361, W6EUF-2362, G3RFE-2363, W8DCH-2364, UW9OU-2365, K1QZV-2366, OK1ZQ-2367, OK3-HF-2368, K2ZRO-2369, SP8AJK-2370, W9ALI-2371.

WAZ 2-Way S.S.B.: DJ2WN-486, XE2YP-487, W2MVR-488, I1PEG-489, W6CHY-490, LA4DJ-491, VE3WT-492, VE3ACD-493.

S.S.B. DX Awards: 300 Countries: WA8AJI-26; 200 Countries: LU5AH-146; 100 Countries: VE3ACU-500, WA2CCF-501.

WPX Endorsement Stickers: *Continent:* Europe: SM7ACB, SP6ALL, W4WHF, VE1TG, W2MBU, OK1ZQ, UT5HP, UA3GO, SP6SO, W9IRH, UA3WX. Asia: SM7ACB, W4BYU, UT5HP. North America: W2FLD, W4BYU, W9IRH. Africa: SM7ACB, W4BYU. South America: W8UMR, W4BYU. Oceania: W4BYU. *Mode:* Mixed: W8-UMR-600, W4HOS-550, W9IRH-550, SM7ACB-500, VE7IG/VE8-500, W2FLD-500. S.S.B.: F2MO-450, W4HUE-350, VE1TG-300, LU5AH-300, W9-WGQ-300, CX9CO-300, OE3SAA-250. C.W.: W2-FLD-500, UT5HP-500, W9IRH-500, G3ESF-450, SP6ALL-400. Phone: W8UMR-400. *Band:* 14 mc: VE1TG, UA3WX, W9IRH. 3.5 mc: OK1IQ. 1.8 mc: OK1IQ.

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

WPX Honor Roll

Last month we listed the Honor Roll for Mixed WPX and Phone WPX. This month we have the C.W. WPX and S.S.B. WPX Honor Roll listings. In each instance the 550 prefix point was arbitrarily selected as the cut-off point. Joe Hiller, W4OPM, is high on both these lists and the 2 earlier lists, and must certainly be regarded as the world's top prefix chaser.

We are still working on the standard prefix list to be used for the permanent WPX Honor Roll. Hopefully this list will be presented in next month's column.

S.S.B. WPX HONOR ROLL

1	Charles J. Hiller, W4OPM	700
2	Gay Milius, W4NJF	654
3	George C. Banta, K1SHN	558

C.W. WPX HONOR ROLL

1	Charles J. Hiller, W4OPM	800
	W. W. Simpson, W8KPL	800
2	Vincent L. Rosso, W5KC	750
3	Michael A. Bakos, W8LY	700
4	Charles W. Rogers, W2AIW	658
5	Bob L. Th. Berge, ON4QX	654
6	Willibald Vollkommer, W2HO	653
7	Helmut Baumert, DL1QT	651
8	Michael E. Bazley, G3HDA	646
9	Henry Denver, VK3AHQ	625
10	Sakae Kamio, JA7AD	624
11	F. D. Cawley, G2GM	616
	Edward Gaudet, K2ZKU	616
12	W. J. Bergman, WØAUB	614
13	Rudolph Staigl, OK2QK	610
	Vladimir Srdinko, OK1SV	610
14	Bud Frohardt, W9GFF	608
15	Edward Goodbout, W9DWQ	605
	L. G. Parsons—W5LGG	605
16	Alex Ekblad, W2KIR	600
17	Rune Rasmusson, SM7MS	591
18	Domenico A.M. Marino, IT1TAI	576
19	Walter W. Johler, W9UZS	564
20	Juan B. Castanera, KP4CC	561
21	Jack du Bois, K2CPR	558
22	Chuck Banta, K1SHN	556
23	John J. Wojtkiewicz, W3GJY	555

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Don Miller, W9WNV, presenting a Swan Transceiver to Paul Caboche, VQ8AD. The transreiver was donated by DXpedition and the Long Island DX Association for general DX use in the south Indian Ocean area. *(Photo courtesy WB2EPG).*

De Extra

The Major Worldwide DXpedition—Are We Witnessing the End?

Will a new knight in shining armor come to the rescue, or is this blazing postwar phenomenon slated for a stormy death? A few years ago the big DXpeditions were fun. Almost every DXer was in favor of them, the chief opposition being confined to rag chewers and traffic handlers who never agree with anything the DXers do. Today, however, this is no longer true.. It isn't fun anymore. The DX world is split wide open by threatened lawsuits and rumors of lawsuits. Bitterness and dissension abound in a hobby that was once almost solidly united. The question now is how can things be put together again?

Lets look back a few years and consider the history behind these grand operations. It all started in 1955 with the appearance in St. Thomas (KV4) harbor of a young English watchsmith named Danny Weil. After spending most of his life at a craftsman's bench in the British Isles, Danny had decided that there were better ways to use the few years allotted to him on this earth, and he set out to fullfill his life's dream of being the first Englishman to circumnavigate the globe singlehandedly. Danny was not a large man physically, but he was agile, hard as nails, and a giant in spirit. Call it nature or call it fate, but it was inevitable that on St. Thomas he would gravitate into the circle around Dick Spenceley, KV4AA, DX Editor of *CQ*. Dick immediately recognized that Danny's goals and the goals of the DX world were far from incompatible, and in a short time a private code and theory course had been established with Dick the master and Danny the pupil. Simultaneously, the YASME Foundation began to take shape in the minds of Dick and his friends, and when Danny became VP2VB/MM a fabulous career began which was to span the lives of 3 ships named *Yasme* and innumerable brushes with death before Danny decided to retire in the spring of 1963. Those were surely among the most exciting years in DX, as the warcry "Where's Danny" echoed across the airways.

The early 1960's were also big years in the career of another man of dreams. Gus Browning, W4BPD, was as different from Danny Weil as night was from day, or was he? True, he had been in radio both commercial and amateur for most of his life, and was a major force in DX affairs before he ever left the U.S.A. He was a solid specimen of the old style Southern gentleman, a different type of man from the young Englishman, or was he? He too was not a large man physically, but he was agile, hard as nails, and a giant in spirit. Gus had always dreamed of going on a big DXpedition, and with the backing of the World Radio Propagation Study Association embarked on a series of trips which, before they concluded, embraced operation from over 100 of the rarest countries of the world. He made stops in Sikhim, Bhutan, Nepal, and even Tibet and red China before going QRT in 1965.

A powerful drive was present in both Gus and Danny. It was their fanatical devotion to the DXers of the world. The DXers came first, selfish considerations last. The welfare of DX was foremost in everything they did. When Danny lost *Yasme II* on the rocks of the Grenadines in 1959 he was more grief stricken over "letting down the hams" than he was over the loss of his possessions. Gus's efforts to keep everybody happy are legendary. Nothing made him sadder than to learn that some hardworking DXer had missed a QSO with him at one of his rare spots. The mid '60's were the years of the "Gus Watchers," another fabulous and exciting era in DX history.

In 1963, as Danny retired and Gus gathered steam, a third major force began to flex its muscles in the western Pacific. The DX and Contest world was startled by the fantastic ability displayed at station HL9KH operated by Captain Donald A. Miller, M.D., of the U.S. Army Medical Corps. It was obvious that Captain Miller took to DX and

See page 110 for New Reader Service

contests style operations like a fish does to water. For sheer QSO's per minute he had few if any equals, so it was only natural that Don was encouraged to undertake DXpeditions in the Pacific sector. He enjoyed it, and was only too happy to oblige, but it's unlikely that this was the fullfillment of any dreams. This young man belonged to a new and more sophisticated generation. He was well-organized, efficient, and a tremendous operator, perhaps the best we've ever known, but he wasn't a dreamer. Dreams belong to the idealists, the Gus's and Danny's of the world.

From Feb. 16-23, 1963 Don operated as W9WNV/KG6R from Rota. He did a terrific job, and the resulting compliments only whetted his appetite. Consequently he studied the DXCC rules carefully with the hope of finding a Pacific island which would meet the requirements for an all new country, and according to his interpretation of the rules he found it. Parece Vela, also known as Douglas Reef, was an obscure island in the North Pacific which by Don's measurements was sufficiently removed from the Bonin Islands to qualify as a new country. Don applied for a call and, perhaps due to a typing error, was assigned the rather bizarre KG61D which he activated in a big way from May 31-June 2, 1963. Most DXers thought they had a new country, but the DXCC Award's Committee didn't agree. They concluded that Parece Vela was a part of the Bonin Islands and was not eligible for separate country status. Don bitterly contested the ruling, but found that he couldn't "fight city hall." This lesson he has been forced to relearn several times in the past four years, but the first time is always the worst, and this skirmish may well have planted the seeds of much of the subsequent turmoil.

In late 1963 Don operated as W9WNV/XU from Cambodia in an operation which constituted his high water mark for that year, and perhaps his entire career, for it was only a short time before he stopped in to fill the vacuum left by Gus Brownings retirement and the controversy erupted. This column hasn't and still doesn't place the lion's share of the blame on one side or the other. We see it as a massive personality clash characterized by inflexible thought and actions by both sides. Unfortunately, it is the hobby as a whole which has suffered the most from this clash, more than Don, the awards' committee, the League, or any other discreet entity. It's taken the fun out of DXing and that is tragic. DX should be promoting international good will, and not be a festering sore.

Up to now all we've done is analyze the situation. Somebody has to come up with a solution, and this isn't easy when so many people are directly or indirectly involved. The situation requires the kind of thinking which can only come with detachment. Consequently, we advocate a massive "retreat." A retreat in the religious sense rather than the military sense. Everybody concerned should take a long look at his actions and determine if they are truely in the best interests of his hobby or only in defense of his own pet ideas. Lets declare a one year moratorium on high-flying DXpeditions financed by large solicitations of money prior to the start of the operation. A dollar bill sent with a QSL card is one thing, but raising thousands of dollars in advance of one of these major extravaganzas is something else. Many people feel that this "professionalism" is at the root of the trouble and they may be right. Lets re-examine this "country" business again. If we cease giving sandbars equal status with the continental U.S. it just might make some difference. Something could be said for eliminating "honor rolls," but this would be going too far. A good honest race is still the basis of competition and we shouldn't eliminate competition.

We have a complex and difficult problem, but as long as men of good will can sit down together in an honest attempt to resolve their differences, it can be solved. However, we

Don, FP8DK and DJØIR, at the rig in FP8 land. This photo is courtesy of Don's QSL Manager, K7GHZ, 3213 -R- St., Vancouver, WN 98663 who reminds you to always send a self-addressed, stamped envelope (s.a.s.e.).

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The grand old man of the Caribbean, Dick Spenceley, KV4AA, busily filling out QSL cards at the famous Spenceley homebrew rotating table. The center ring of the table is rotated by a juke box motor activated by a foot switch. It sure saves a lot of elbow grease when passing the chow.

sincerely feel that there should be no more talk of lawsuits and no more "big money" DXpeditions for at least a year so that the situation can simmer down.

Outstanding QSL Managers

This month's nominee for outstanding QSLer is Arthur O. Milne, G2MI, manager of the Radio Society of Great Britain (RSGB) Bureau. The RSGB Bureau handles approximately 1½ million QSL cards each year which gives you an idea of the magnitude of Mr. Milne's operation. Both incoming and outgoing cards pass through the Bureau. Art advises that membership is open to U.S. and Canadian amateurs for a cost of $7.00 which confers the right to send all outgoing cards through the Bureau. Incoming cards are sent to the appropriate ARRL District Bureau.

Art Milne is a real O.T. in amateur radio. He holds the unique record of continuous membership on the RSGB Council for 30 years except for two years during the war. He was born on Aug. 25, 1907 and became interested in radio while still in school. He obtained the call 2MI on Nov. 24, 1924. His first QSO was with 5QV at Clacton on 200 meters using a 120 volt dry battery to drive a self-excited DE5B tube. Although always keenly interested in DX his early years were limited by having to use dry batteries and h.t. accumulators as a power supply. The acquisition of d.c. mains and a motor generator improved things tremendously, and when he moved to Larkfield, Kent in 1932 he was on the a.c. mains and G2MI was soon firmly on the DX map. He well re members when the only signals to be hear on the 40 meter band in the early winte evenings of 1933-35 were VKs, and he ha many QSLs to prove it.

In 1949 he built the full-sized 20 meter ro tary beam and wooden lattice tower whic are familiar to many as the frontispiece o the *RSGB Handbook*. In that same year h was awarded the ROTAB (Royal Order o Transatlantic Brasspounders) Trophy fo consistent DX, and in 1953 he received th Calcutta Key for his contribution to interna tional understanding through the medium o amateur radio.

From 1950 when he attended the I.A.R.U reunion in Paris, until the Region I meetin in 1958, Art Milne was Secretary of th Region I Division of I.A.R.U. and saw through its formative years. He travele widely throughout Europe in the interest o amateur radio laying the foundation upo which the present virile organization no stands. There is no doubt, however, tha G2MI is best known throughout the worl as the RSGB QSL Manager, a post he ha held since 1939. His quarter century o service in this capacity was recognized b the Council in December, 1964 when he wa elected as an Honorary Vice President an presented with a silver QSL card.

By profession Art Milne is an Executiv Engineer in the General Post Office Eng neering Department where he is concerne with the welfare of technical visitors an trainees who come to the post office from a over the world for information and trainin He has been married for 34 years and h wife Lucy is the other half of the QS Bureau. They have two sons and a daughte The elder son Geoffrey is G3UMI, the Cura tor of the R.S.G.B. Recorded Tape Librar At 60, G2MI is still a keen and active Ama teur, both Fixed and Mobile, and does no mind being referred to as a "Radio Ham."

160 Meter News

W1BB and 160 meter enthusiasts every where are sending bouquets to Ja DL9KRA, who recently made the first eve top band QSOs from Easter Island, CEØPC and Senegal, 6W8CW. Jan, a pilot fo Lufthansa, flew to Easter Island in mi September and made the first CEØ/W QS with Charles, W2EQS, at 0605 GMT on Sep tember 20. He made a second trip to th

[*continued on page 111*]

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Q AND A

BY WILFRED M. SCHERER,* W2AEF

THE discussion regarding the sur-ace area of quad antenna and the required ower ratings, in the SIMON SAYS column for uly '67, evoked considerable interest. We hall, therefore, start off this month's Q AND column with some comments received in he mail. These are as follows:

"In the July 1967 issue of *CQ* you gave the quations for calculating the 'wind area' of a uad antenna. I feel you made several nistakes in analyzing the problem.

First of all, the wind area the manufac-urer gave is not the surface area, but the rojected area of an equivalent square ele-nent. The (⅔) (.707) factor is the derat-ng factor for a cylindrical element. In other vords, the wind area of the boom in your xample is—

$$A = BL\ (2/3)\ (.707),$$

vhere B and L are in feet and A is in feet ^{2}. Your figure for A is—

$$A = \pi\ BL\ (2/3)\ (.707)$$

vhich results in an answer which is 3.14 imes too large.

Secondly, a radio tower's weakest point is t's ability to withstand the moment due to he wind force. Regardless of how many ;usts there are from various directions, it is he resultant wind force that matters. Your nalysis assumed the wind was blowing ıormal to the boom and normal to the 'face' of the quad (parallel to the boom). The ıormal practice is to calculate the wind ırea normal to the boom and normal to the ace and then take the higher figure.

Finally, you can forget about the wind ırea of the wire, because it is insignificant compared to the boom and elements spreaders).

If you want the straight scoop on these calculations, ask the various tower manufacturers and antenna (beam) manufacturers. Your article may have convinced the questioner that a 2-element Quad isn't safe to use with the particular tower he was considering. Actually, the Quad is well under the 7.2 square feet."

James H. Okubo
529 Kevin Way
Placentia, Cal. 92670

"Referring to your calculations of wind areas of antennas in July *CQ*:

According to the EIA Standard RS-222, 'Structural Standards for Steel Transmitting Antennas, Supporting Steel Towers', the wind pressure is applied to the projected (not surface) area of the structure with a factor of π, such that the tower in question is entirely adequate. However, the tower's geographical location is also important as pointed out in the above standard, since the applied loading may be 30, 40 or 50 pounds-per-square-feet in various parts of the country. The rating from the manufacturer must specify at what wind pressure the tower will handle 7.2 square feet (this is usually 30 P.S.F. $\times$ ⅔ for cylindrical surfaces)."

G.A. Cutsogeorge, W2VJN
R.D. #1—Box 659A
Princeton, N.J. 08540

"The article in July issue on quad antenna area left me a little fuzzy on why the surface area rather than the projected area of each component is considered for wind load.

The other reason that prompted me to drop you a line for help is that I have visited a number of book stores in search of books covering sound engineering design of vertical towers. So far I have not had much success. I am an engineer, with cobwebs, and one who has become somewhat rusty on moment-area diagrams, etc., and am now in the process of reviewing the basic fundamentals. However, I am sincerely interested in the technical design of towers, their associated footings and related loadings caused by horizontal wires and rotary beams.

I will appreciate very much if you would supply me with the titles, authors and publishers of some good technical books devoted to this field."

William H. Duffey, W8YPM
428 Fifth Street
Fairport Harbor, Ohio 44077

* Technical Director, *CQ*.

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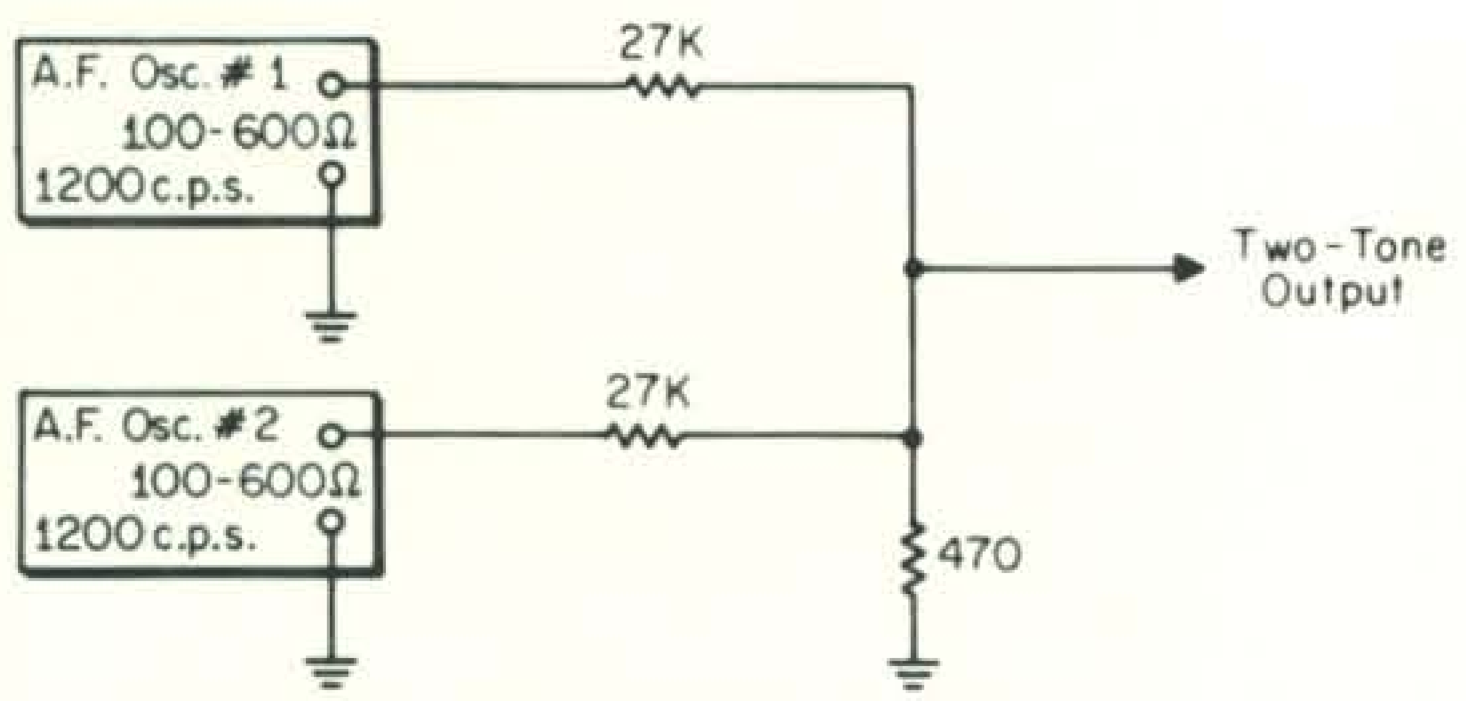

Fig. 1—Isolating network for the prevention of modulation by one a.f. oscillator upon the other when they are used to provide a two-tone test signal. The use of a separate low-pass filter at each oscillator also is desireable to attenuate the 2nd and other oscillator harmonics. This will minimize the possibility of a harmonic from one oscillator mixing with the fundamental of the other oscillator, which could otherwise result in the appearance of odd-order I.M. on a spectrum display.

We wish to express our thanks to these correspondents for providing more light on the subject. We also shall be grateful to any of our readers who can aid W8YPM in locating the technical literature he desires, inasmuch as we do not have the requested information at hand.

Two-Tone Ripple

QUESTION: What is the cause of jitter or ripple on a two-tone test pattern.

ANSWER: Jitter that is mainly distinguished at the crests of a two-tone envelope pattern usually is due to inferior carrier suppression. It can be eliminated or minimized by carefully rebalancing the carrier. It is interesting to note that with some s.s.b. rigs this effect varies as the a.f. signal level is altered, so it thus provides a good indication not only of normal carrier balance, but also of whether or not the carrier balance changes during modulation, as often occurs. This is how it was confirmed that the carrier suppression deteriorated, rather than the 3rd order I.M., at fig 4H shown on page 31 of this issue.

Two-tone displays with ripple that appears to travel along the edges of the envelope generally is caused by the difference frequency between the two test tones that in turn produces a beat frequency with one of the test tones. For example: With 1000 and 1990 c.p.s. tones the difference is 990 c.p.s. which produces a 10-cycle beat with the 1000 c.p.s. tone. $(1000 - 990 = 10)$.

These effects can be minimized by selecting the test tones so that the "secondary" beat is quite high, 100 c.p.s. or so. About 3:5 ratio, such as with 1200 and 2000 c.p.s tones, usually works out quite well, but eve so, a slight readjustment may be required fo the frequency of one tone. Selection of different sweep rate also may be needed.

The 1 and 2 kc tones used for the spec trum displays on pages 30-31 were selecte to make it easier to locate the variou multiples relating the various pips; but on th otherhand, use of the frequencies suggeste above would have better differentiated be tween the unwanted-sideband tones, the I.M products and the carrier.

Ripple also may be due to intermodulatio between the two a.f. oscillators. This gene ally can be avoided by the use of an isolatin network between the outputs of the oscilla tors as shown at fig. 1.

Another cause of ripple may be poor un wanted sideband suppression.

Note also that for a proper two-tone enve lope pattern the a.f. level of each tone mu be adjusted so that the output from each, a the stage on which the observation is bein made, is equal. This is indicated when th negative peaks, at the center of the hor zontal axis for the pattern, come togethe

ICD Mystery

QUESTION: What does ICD stand for on th cover of *CQ Magazine?*

ANSWER: The letters ICD seen in the lette C on the *CQ* emblem or "logo" on the fro cover of the magazine stands for Interna tional Circulation Distributors who delive the magazine to newsdealers, jobbers, etc.

Stable Noise Figure Measurements

QUESTION: When making noise-figure meas urements with a noise generator and an a. meter for an output indicator at the receive the meter bobbles around so much with th noise that I cannot get a reliable reading Any suggestions on stabilizing the meter?

ANSWER: Yes, increase the time constant b connecting a large-size electrolytic capacito across the meter *after* the rectifier. This wi steady the pointer and average out the read ings. We have had good results doing this o a v.o.m., such as the RCA WV-38A, with 1000 mf 15 v. electrolytic connected directl across the meter terminals (the polarity o the capacitor has to be observed). In opera tion, time must be allowed to permit th

[*continued on page 96*]

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NOTE: Above are listed the "Standard - Everyday" Swan Products – Below are listed some Special Purpose items:

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State _______________ Zip _______________

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THE awards PROGRAM

BY ED HOPPER,* W2GT

THE February, "Story of The Month" on Rod, W9CMC, after this data on awards issued. Mixed USA-CA-2500 awards went to Earl, W7KOI (1st to the 7th district); Robert, W8UPH; and Jim, K1QZV, who also received a 2000 award and a 1500 award. John, W5OYG received a USA-CA-2000 award endorsed ALL A3A. Mixed USA-CA-2000 awards went to Walt, WA2HGL; Bill, K4ISE; and David, W5PWG/W4SKI. Mixed USA-CA-1500 awards went to Dave, K1OOJ; Henry, K7NHG; and Paul, WØPLN. A USA-CA-1000 award, endorsed ALL A-1, went to Ram, PY5ASN, this is the first award to a PY. Frank, WAØILV received a USA-CA-1000 award endorsed ALL A3A, and mixed USA-CA-1000 awards went to Dave, K1OOJ; and Phillip, WAØEVO. Jerry, WB2FEQ received a USA-CA-500 award endorsed ALL 50 MC A-3; one endorsed ALL A-3 went to Betty, K8VCB. USA-CA-500 awards endorsed ALL A-1 went to Josef, OK3DG; Bob, WB2NSD; and Ram, PY5ASN. Mixed USA-CA 500 awards went to David, WA2CCF/WA2UZH; William, K4GHR; Russ, WB6HCQ; Phil, K6UVJ/7; Wille, OA4PF (1st to an OA); and to The International Amateur Radio Club of Geneva, 4U1ITU.

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

Rodney S. Starkweather, M.D., W9CMC

Rod's first ham station used a loose coupler, crystal detector, and a quarter inch spark gap obtained from Electro Experimenter Co., about 1917. He was licensed in 1922 as 9EFG and 1CCB, and operated 1YB as a founding member of the Dartmouth College Radio Club. They built a club house and erected radio towers atop the Physics building and handled a lot of traffic with an impressive rotary spark gap transmitter.

There was a lapse of activity during his years at Rush Medical School, internship and two years graduate work in dermatology at the University of Pennsylvania, plus another year and one half at clinics abroad.

In 1939, Rod was relicensed, as, W9CMC, and received his Advance Class license in 1952.

His many and varied activities include and have included: A period of message handling 1948-1950 on TLK, TLJ, ILN plus assorted schedules and making BPL seven times.

USA-CA HONOR ROLL

2500	
W7KOI	19
W8UPH	20
K1QZV	21
2000	
K4ISE	37
W5OYG	38
K1QZV	39
W5PWG/ W4SKI	...40
WA2HGL	...41

1500	
K1QZV	 62
K1OOJ	 63
WØPLN	... 64
K7NHG	... 65
1000	
K100J	118
WAØEVO	..119
PY5ASN	..120
WAØILV	..121

500	
WB6HCQ	.636
OK3DG	...637
WB2NSD	.638
K8vCB	...639
OA4PF	...640
WA2CCF/ WA2UZH	641
K4GHR	...642
PY5ASN	..643
K6UVJ/7	..644
WB2FEQ	..645
4U1ITU	...646

Member of North-western University Medical School Faculty since 1937. Treasure of the North Suburban Radio Club (now defunct) for several years, loyal and continuous supporter of *CQ* and *QST* over the years. Participation as ORS in CD, Field Day and YLOM contests. In YLOM contests, made 1st place once, top district OM score twice and 3rd place twice. Has 20 w.p.m. CPC, member of QCWA, OOTC, ARRL, DXCC (Fone, c.w., and s.s.b.), YLWAS, YLCC 900, A1 Op, ISSB, RCC and etc., Greatly enjoys county hunting and has made so many many good friends this way. Collects Doctors (QSOs)—has 191 confirmed in 42 states and 16 countries and on RTTY has 43 states and 14 countries.

Other interests include: photography, cycling, traveling, oenology and revolver target shooting.

Rod is married and has two married children and two grand-children, but Rod is the only ham in the family.

Rod's vocation is practicing Dermatology in Evanston, Illinois and he has been a member of the American Medical Association Radio Communications Committee since 1957.

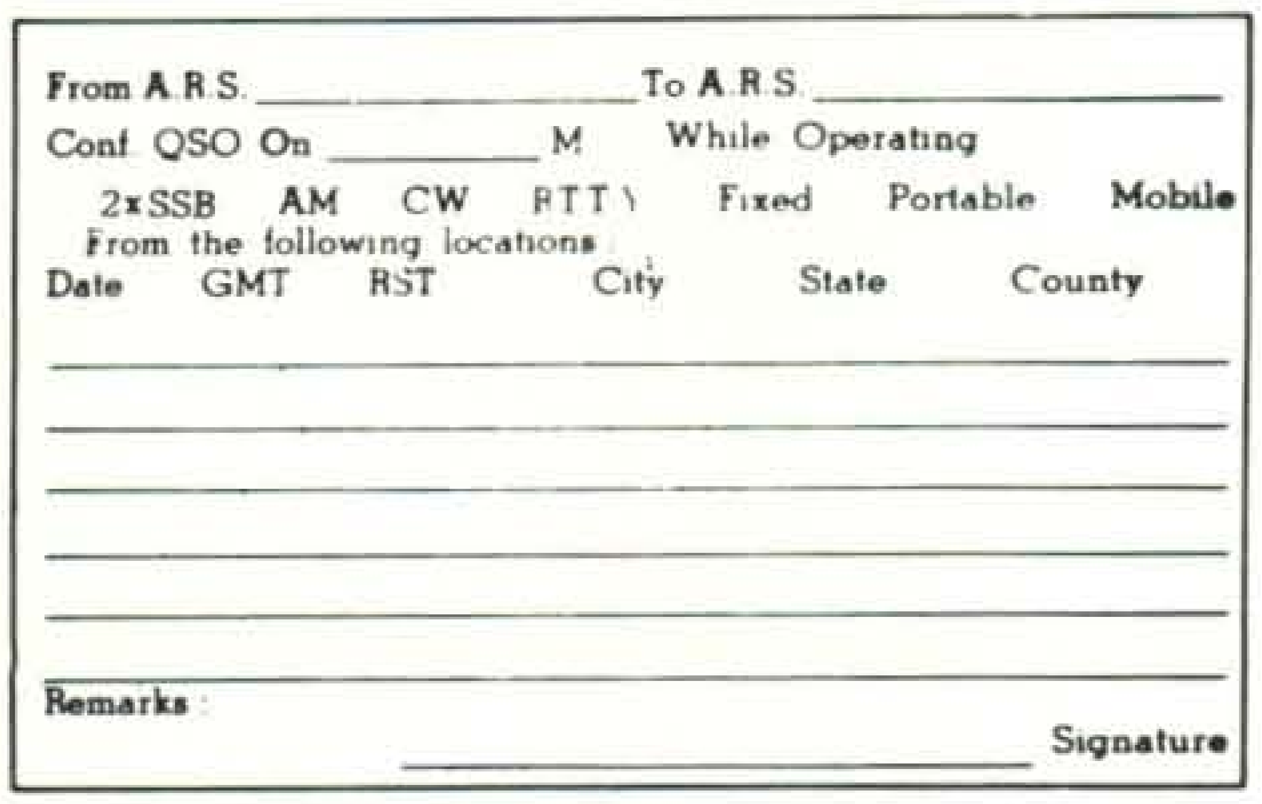
The USA-CA record of W9CMC is: #46 USA-CA-500 in December 1961; #35 USA-CA-1000 in April 1964; #18 USA-CA-1500 in August 1964—all these later received ALL 7 mc s.s.b. endorsement. In May 1965, USA-CA-2000 #20 was earned and #17 USA-CA-2500 in September 1966.

As this is being written, Rod's confirmed county total has reached 2777.

Although the accompaning photograph shows a Johnson KW final, this has recently been replaced by a BTI LK-2000.

Letters

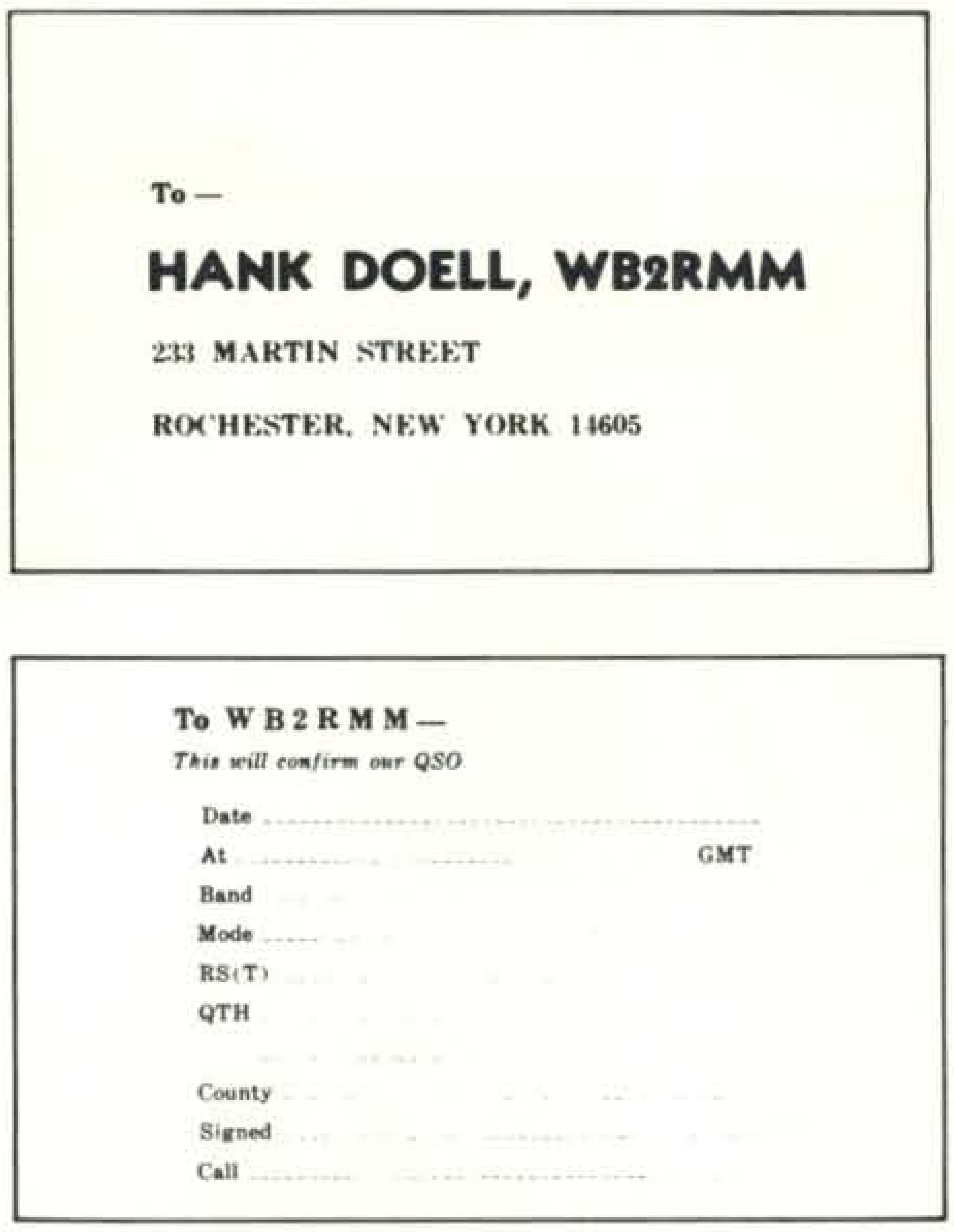
Don, W7IUO, writes: "I will be pleased to sked county hunters on 160 meters from Franklin county, Idaho.



From A.R.S. ______ To A.R.S. ______
Conf. QSO On ______ M While Operating
2xSSB AM CW RTTY Fixed Portable Mobile
From the following locations
Date GMT RST City State County

Remarks:
______ Signature

The Original County Hunter QSL



To—
HANK DOELL, WB2RMM
233 MARTIN STREET
ROCHESTER, NEW YORK 14605

To WB2RMM—
This will confirm our QSO
Date
At ______ GMT
Band
Mode
RS(T)
QTH
County
Signed
Call

WB2RMM QSL.

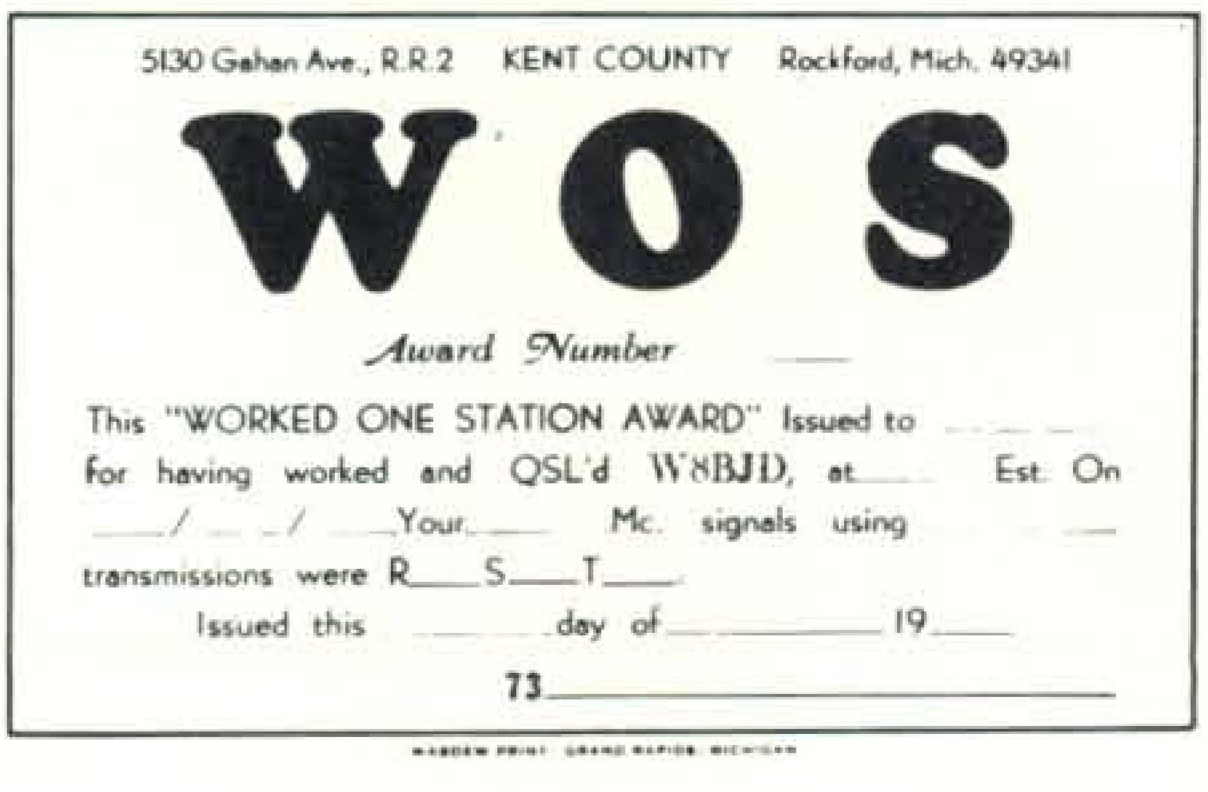
I am working toward your USA-CA on 80 and 160 meters, which is more of a challenge.

Am QRP, 75 watts, and operate c.w. only. Write, Don. H. Strong, W7IUO, 239 S. Second W., Preston, Idaho 83263."

Phillip, K6UVJ/7, writes: "Here is my application for USA-CA-500.

You will note that most of the contacts were made since Dec. 1966 (*Yes, he also included the dates, Ed.*).

When I returned from Germany in Jan. '65, I started working county hunters from my mobile and ended up working them from coast to coast. At first, the idea of collecting counties myself didn't appeal to me too much, but I had a lot of fun giving counties to the others. Then in Dec. '66, I brought the rig into the house and happened to run across some of the boys on 20 meters. I soon started checking into the Independent County Hunter Net and decided to go ahead and collect counties too. I figured it would



5130 Gahan Ave., R.R.2 KENT COUNTY Rockford, Mich. 49341
W O S
Award Number ______
This "WORKED ONE STATION AWARD" Issued to ______
for having worked and QSL'd W8BJD, at ______ Est. On
___/___/___ Your ___ Mc. signals using ______
transmissions were R___S___T___
Issued this ______ day of ______ 19___
73 ______

Worked One Station Award

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.

☐ New Subscription. Start with the _____ issue.

☐ Renew or extend my present subscription.

Name____________________ Call__________

Address______________________________

City________________ State________ Zip______

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only take a month or two to get 500.

It took me about six months of every minute of spare time available to get 500 counties. It also took about $40.00 in QSLs, postage, etc., as well. I'm in the Air Force and can't operate nearly as often or as long as most of the "regulars" on the net. I'm also a student at the University of Wyoming."

Jim, K1QZV, writes: "Well, I've been extremely lucky in picking up many new counties on 15 and 10, and most of them have been people who have been off the bands for quite some time. On 10 they are mostly old-timers who wait for this band to become active each sun-spot cycle. I think it would be a good idea for the hunters to check these other bands.

Although I have been going through postage and QSLs like they have been going out of style, it has paid off. I estimate I have sent out over 2000 QSLs since January 1967.

I have added another person to the list who desire to see me complete this award, along with the XYL, it is the mailman, HI . . . . He stopped me a short time ago and asked what I was doing now, especially after the great influx of mail. He told me a route is determined by how much mail they carry, not by any physical breakdown. He said if he had ten more customers like myself, it would constitute a seperate route. I sure enjoyed this story—wish others than just General Licensed Hams could sign the enclosed affidavit, the mailman would be the best person to vouch for it . . Hi . . . . .

Have been corresponding with WB6GFJ, who is now KH6GJW, trying to work out something from Kalawao county, will keep you informed.

Have 1800 now, so I will close this letter and turn on the receiver and try for a few more".

The QSL Problem

The QSL problem has always been with us and will continue to plague us. Thus, *any* hint or information to help solve this problem, is a step in the right direction.

Here are some such ideas:

The Original County Hunter QSL, designed by the county hunters some years ago, and they have worked wonders. You can put *your* name and address and a stamp on the blank side. On the others side you fill in *all* information on the QSO and then mail it to the station worked. He just checks the QSO

Ham Heaven Certificate

data against his log, signs the QSL and drops it into the nearest mail box. This saves him a lot of work and makes him much more willing to QSL. These QSLs can be obtained from Cliff Corne, K9EAB, 711 West McClure Ave., Peoria, Illinois 61604 for $3.50 for 500, postage paid in the USA.

Hank Doell, WB2RMM, also designed his own QSL with *his* name and address already printed on one side and the proper places for all QSO data on the other side. So Hank puts a stamp on the address side, and all QSO data on the reverse side and mails it to the station worked (in an envelope, of course). This station operator checks the QSO data against his log, signs the QSL and drops it into the nearest mail box.

Clarence Polmanter, W8BJD, designed his own QSL like a small award and calls it **Worked one Station Award.** Athough this is not original with "Red", it is still a fine idea and should interest the amateur who receives it, and hopefully arouse enough interest to have him send a QSL in return.

DR. F. M. Wentz, W8EEQ, issues and unusual Award for each QSO. Dr. Wentz is the Pastor of the St. Paul's Methodist Church of Montpelier, Ohio, so naturally his award should be of a religious nature. The award will admit you to **Ham Heaven.** It states that the sender of the certificate is already in Ham Heaven, highly recommends it, and therefore desires to enable a few privileged friends to join him. It lists many desirable features of Ham Heaven, such as No bait needed for fishing; no work—just loaf, and etc., It ends by saying that admission is free, but a small charge is levied for new wings each year, this being the closest thing to a tax. (I am happy and pleased to find that Dr. Wentz has such a fine sense of humor and I sure want a QSO with him so I can qualify for his award, Ed.).

Notes

Thinking about QSLs, I must say that I

[continued on page 102]

Propagation

BY GEORGE JACOBS,* W3ASK

BEGINNING about the middle of February, and continuing through March and early April, a noticeable seasonal improvement usually takes place in high frequency propagation conditions between the northern and southern hemispheres. This improvement should be noticeable on all h.f. bands between 160 and 10 meters, on circuits mainly between the United States and South America, Africa, Australasia, parts of Asia and the Antarctic.

During the *daylight* hours, optimum propagation conditions are expected on 15 meters during February. The band is forecast to open to all areas of the world during this period, often with exceptionally strong signal levels and little fading or noise. The 10 meter band is expected to be a close runner-up with excellent openings forecast to almost every area of the world during the daylight hours. A fewer number of openings to Europe and the Far East on this band is expected to be balanced by improved conditions to almost all areas in the southern hemisphere. With the number of daylight hours increasing during February, both 10 and 15 meters are expected to remain open somewhat longer each day than during the early winter months. Excellent worldwide DX propagation conditions are also forecast for 20 meters during the sunrise period, and during the late afternoon hours.

During the early hours of *darkness,* both 15 and 20 meters are expected to share honors for optimum propagation conditions. Fifteen meters should have a slight edge for openings in a westerly direction, 20 meters for openings toward the east, and both bands should be about equal for openings to the south. Later in the evening, 20 meters should stand out by itself as the optimum band, with excellent openings forecast to almost every world area. During the late evening and early morning hours, god DX propagation conditions are also forecast for 40 meters, with excellent openings expected to many areas of the world. Some DX openings on 80 and 160 meters are also forecast during these hours. A peak in propagation conditions is expected during the sunrise period on 20 meters, when the band should open to almost all corners of the world

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for February

Days	*Forecast Rating & Quality* (4)	(3)	(2)	(1)
Above Normal: **4, 9, 15, 17, 29**	D	D-E	E	E
Normal: **2-3, 5, 7-8, 10-11, 13-14, 16, 18, 20, 23-25, 27**	C	C-D	D	E
Below Normal: **1, 6, 12, 19, 22, 26, 28**	A-B	B-C	C-D	D-E
Disturbed: **21**	A	A-B	B-C	C

HOW TO USE THESE CHARTS

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

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

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

3—With the forecast rating noted above, start with the numbers in parentheses at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propogation 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 DX Propogation Charts are based upon a transmitter power of 250 watts c.w.; 500 watts s.s.b., or 1000 watts d.s.b., into a diopole antenna a quarter-wave above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

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

6—The Eastern USA chart can be used in the 1, The Central USA Chart in the 5, 9, and Ø areas, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call a-eas; and the Western USA Chart in the 6 and 7 areas. The Charts are valid through Mar. 31 1968, and are prepared from basic propogation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

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during a period of an hour or two.

Sunspot Cycle

A monthly mean sunspot number of 92 was reported for November, 1967 by the Swiss Federal Solar Observatory, the world's official keeper of sunspot records. This results in a running smoothed sunspot number of 83 centered on May, 1967, as the present sunspot cycle slowly climbs towards a maximum value. A smoothed sunspot number of 106 is forecast for February, 1968. ■

FEBRUARY & MARCH 1968

Time Zone: EST (24-Hour-Time)
Eastern USA To:

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

Time Zones: CST & MST (24-Hour Time)
Central USA To:

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

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Central & South Asia	07-09 (1) 18-20 (1)	07-08 (1) 08-10 (2) 10-11 (1) 18-19 (1) 19-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-21 (2) 21-22 (1)	05-07 (1) 19-21 (1)
South-east Asia	09-10 (1) 10-12 (2) 12-14 (1) 16-17 (1) 17-19 (2) 19-20 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-13 (2) 13-17 (1) 17-20 (2) 20-22 (1)	20-22 (1) 22-00 (2) 00-06 (1) 06-09 (2) 09-11 (1) 13-15 (1)	03-07 (1)
Far East	15-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-20 (1)	08-11 (1) 15-16 (1) 16-17 (2) 17-20 (3) 20-21 (2) 21-22 (1)	03-06 (1) 06-09 (2) 09-12 (1) 19-21 (1) 21-22 (2) 22-01 (3) 01-03 (2)	03-08 (1) 05-07 (1)*
Guam, Pacific Islands & New Zealand	10-11 (1) 11-13 (2) 13-15 (3) 15-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	08-09 (1) 09-12 (2) 12-17 (1) 17-18 (2) 18-22 (3) 22-00 (2) 00-01 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-03 (4) 03-05 (3) 05-07 (2) 07-09 (3) 09-10 (2) 10-11 (1)	22-00 (1) 00-01 (2) 01-06 (3) 06-07 (2) 07-08 (1) 00-02 (1)* 02-05 (2)* 05-07 (1)*
Australia	08-11 (1) 13-14 (1) 14-15 (2) 15-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (1) 08-11 (2) 11-13 (1) 13-14 (2) 14-16 (3) 16-18 (2) 18-20 (3) 20-22 (4) 22-00 (2) 00-01 (1)	05-07 (2) 07-09 (3) 09-12 (2) 12-14 (1) 14-16 (2) 16-20 (1) 20-22 (2) 22-02 (3) 02-04 (4) 04-05 (3)	02-04 (1) 04-06 (3) 06-07 (2) 07-08 (1) 04-05 (1)* 05-06 (2)* 06-07 (1)*
North & Central South America	06-07 (1) 07-08 (3) 08-11 (4) 11-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	06-06 (1) 06-07 (2) 07-10 (4) 10-14 (3) 14-18 (4) 18-20 (3) 20-22 (2) 22-01 (1)	02-07 (2) 07-10 (3) 10-15 (2) 15-17 (3) 17-00 (4) 00-02 (3)	18-19 (1) 19-20 (2) 20-02 (3) 02-04 (2) 04-06 (1) 20-21 (1)* 21-02 (2)* 02-05 (1)*
Brazil, Argentina, Chile & Uruguay	06-08 (1) 08-09 (3) 09-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-10 (2) 10-13 (1) 13-14 (2) 14-15 (3) 15-19 (4) 19-21 (3) 21-23 (2) 23-01 (1)	13-15 (1) 15-16 (2) 16-18 (3) 18-00 (4) 00-02 (3) 02-06 (2) 06-08 (1)	19-20 (1) 20-02 (2) 02-05 (1) 21-03 (1)*
McMurdo Sound, Antarctica	11-14 (1) 14-18 (2) 18-20 (1)	13-16 (1) 16-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	16-19 (1) 19-20 (2) 20-03 (3) 03-07 (2) 07-10 (1)	22-01 (1) 01-04 (2) 04-06 (1)

Time Zone: PST (24-Hour Time) Western USA To:

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

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

See page 110 for New Reader Service

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

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	French Phone Contest
February	24-25	YL-OM Phone Contest
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
March	30-31	Florida QSO Party
April	**6-7**	**CQ WW WPX Phone Contest**
April	20-21	Helvetia 22 Contest
April	27-28	PACC CW/Phone Contest
April	27-28	One Land QSO Party

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.

Its the world working the W/Ks and VE/VOs in this one, as if you didn't know. December *QST* had all the details.

Vermont QSO Party

Starts: 2300 GMT Saturday, February 10
Ends: 0300 GMT Monday, February 12

Complete rules in last month's CALENDAR.

Mailing deadline March 31st. Logs go to: CVARC, c/o E. Reg. Murray, K1MPN, 3 Hillcrest Drive, Montpelier, Vermont 05602

Bermuda Contest

Starts: 0001 GMT Sun. February 11 and February 25
Ends: 0200 GMT Mon. February 12 and February 26.

This contest sponsored by the Radio Society of Bermuda is open to all U.S. and Canadian amateurs. The Grand Prize winner gets to spend a week in Bermuda as guest of the Society. (How about that?)

1. Single operator stations only permitted.

2. Operation will be on 4 bands, 7 mc thru 28 mc. (28 mc was added this year)

3. Both phone, c.w. and cross mode contacts are permitted, but only one contact per band permitted with the same station.

4. Exchange will be the RS or RST report. In addition VP9 stations will give the name of their Parish.

Abbreviations for the nine Parishes: DEV, GEO, HAM, PAG, PEM, SAN, SMI, SOU, WAR.

5. Each completed contact counts 3 points. Final score: QSO points multiplied by the total number of Parishes worked on each band. (9 per band, total of 36.)

6. Keep all times in GMT. You are expected to compute your own score and carefully check your log for duplicates and etc. Print your name, call and address in BLOCK LETTERS, and also sign a declaration that all rules and regulations have been observed.

7. A certificate signed by His Excellency, The Governor of Bermuda, will be awarded to the highest scoring station in each call area W1 thru WØ and VE1 thru VE7 including VO.

The Grand Prize winner is not eligible to win two years in succession. Tie scores will be decided by the highest multiplier on 7 mc or each band respectively.

Logs must be received by April 15th by the Contest Committee, Radio Society of Bermuda, P.O. Box 275, Hamilton, Bermuda.

Starts: 2200 GMT Friday, February 23
5 P.M. EST Friday, February 23
Ends: 2200 GMT Sunday, February 25
5 P.M. EST Sunday, February 25

This is primarily a QSO party to renew old acquaintances. This year a simple scoring system has been added to make it more interesting and add a little competition.

There are certificates for the leading stations and the QCWA Plaque for the "Top Banana." (This is a new plaque, the old one was retired by W8BNK last year.)

* 14 Sherwood Road, Stamford, Conn. 06905.

Claimed Scores
CQ W W Phone Contest—1967

Single Operator
U.S.A.
All Band

K1HVV	445,048
K1OBT	370,747
WA2SFP	964,934
K2DJD	343,958
K3HTZ	324,562
W3HHK	256,677
K4CG	465,868
W4KFC	448,678
W5NMA	363,404
W5JWM	150,410
W6NJU	421,889
W6LDA	267,007
W7DQM	302,778
W7EOI	183,162
W8TWA/8	305,928
W3TBF/8	122,639
W9IRK	366,776
K9CUY	110,142
WAØKDI	248,844
WAØOAI	171,264

28 mc

K1IMP	205,625
W2BXA	309,844
W3TLN	190,920
K4VYN	199,550
WA5BFB	166,668
K6ERV	158,002
W7AZG	115,020
K8WIJ	133,840
W9LKI	130,980
WAØGCP	90,792

21 mc

W1RIL	193,600
WB2YEM	136,904
W3AYD	16,302
WA4LMD	136,612
W5EQT	117,593
WA6EKL	205,296
W7PJL	100,415
K8HZU	171,125
W9DRL	20,832
KØIFL	72,716

14 mc

W2IUV	20,808
WA3FGS	102,592
WA4WAO	75,936
K5BXG	86,160
K6UJW	87,376
W7GUV	37,048
K8YBU	364,662
WA9CYV	15,180
WØIYH	113,708

7. mc

K2GXI	60,204
W3PHL	52,955
W4BYB	16,705
K8EUR	21,616

3.8 mc

W2ZPO	5,301
WA8ROJ	4,144

No. AMERICA
All Band

KL7FRY	487,296
VE6TP	359,544
VE7EH	263,471

21 mc

VE3BMB	90,944
VE2AFC	78,108

14 mc

KZ5TW	391,230
HR1KAS	345,554
VE1TG	303,150

1.8 mc

VE3BS	400

OVERSEAS
All Band

ET3REL	619,014
CN8FV	371,085
ZD8HAL	290,780
XW8AX	766,117
JA3UI	666,168
VU2DKZ	560,038
G3HDA	1,567,346
WØGTA/LA	1,247,544
I1BAF	1,239,672
KH6GGJ	135,141
HC1TH	1,023,378

28 mc

7XØAH	141,024
JA6QT	122,460
4X4CJ	72,756
G2BOZ	280,675
DL4FS	127,688
VK9GN	291,194
ZL3AB	55,265
OA8V	416,928

21 mc

ZD8CC	21,420
JA1NUH	134,575
JA4FK	102,240
G3FKM	302,763
SM7DMN	83,293
KØILI/KG6	188,324
PY1ATG	142,600

14 mc

9G1KT	29,815
HL9TM	30,001
JA4BEX	8,428
SM4CMG	420,210
ON5GA	224,213
KG6AQG	226,168
PY7GV	285,439

7. mc

JA2BTV	46,620
DL4RO	17,343
OK3BU	21,514
PY7LAK	15,228

3.8 mc

SM4GZ	15,950
GM3RFR	7,913
PAØHTR	4,309

Multi-Operator
Single Transmitter

WA6ZQU	1,454,838
KA9MF	1,244,910
VE3FHO	1,100,528
XE1WS	1,054,680
WA6IPY	830,725
K6OHJ	702,900
W9EXE	649,288
WAØEMS	626,828
WB2CKS	596,570
W3MVB	522,936

Multi-Operator
Multi Transmitter

4M5A	7,468,117
UA1KBW	1,569,451
W7SFA	953,712
W8NGO	626,894
W1UOP	585,920

Details in last month's CALENDAR.

Mail logs before March 20th to: 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.

This is going to be a crowded week-end but give the ladies a break and look for them on the phone frequencies listed in the rules on page 9 of last month's issue.

French Phone Contest

Starts: 1800 GMT Saturday, February 24
Ends: 2100 GMT Sunday, February 25

The c.w. section has already taken place, Jan. 27/28. Rules brieflly, exchange is QSO nr. and signal report. Each QSO 3 points and the multiplier is the number of French departments (2 figures following signal report) worked on each band.

Activity is also expected from HB, LX, ON, DUF countries and 9U5, 9X5, 9Q5 during the contest period. Contacts with any of the above countries are good for QSO and multiplier points in the French Contest. (It sounds a bit confusing but that's what the announcement said. Which incidently was received to late for the c.w. section.)

Contest contacts can be credited for the DPF, DDFM, DUF and DTA, all French awards.

There were only 14 U.S.A. entries in last year's contest. W4SNU, W2MEL and W3HQU were the top three on c.w. while K2JFV was the leader on phone.

See page 110 for New Reader Service

Your logs go to: R.E.F., B.P. 42-01, 75 Paris RP, France.

CQ World Wide WPX Phone Contest

Starts: 0000 GMT Saturday, April 6
Ends: 2400 GMT Sunday, April 7

This contest will now be known as the WPX Phone Contest. The following modifications have been made over the old SSB rules.

1. Operation is limited to s.s.b. *only*.

2. Operation will still be limited to 30 hours out of the 48 hour contest period, for single operator stations. However the 18 hour non-operating time *may now be taken in up to 5 periods,* any time during the contest. This permits a very flexible schedule for sleep, meals and Church on Sunday. (Multi-operator stations can operate the full 48 hours.)

3. The *multi-transmitter* category has now been added to the contest.

4. QSO points will be the same as in our Fall WW contest, 3 points between stations on different continents, 1 point between stations in the same continent, zero points between stations in the same country, but permitted for the purpose of obtaining a new prefix multiplier. Exception: Contacts between stations in North America *will now count TWO points.* (This applies to North American stations *only*.)

5. The prefix multiplier remains the same, *each prefix may be counted only once during the contest,* regardless of the band.

6. Therefore the final score in all cases will be the total QSO points multiplied by the number of different prefixes worked.

That briefly covers the modifications in the old SSB contest rules. For all practical purposes they are the same as our October World Wide Phone contest, with two exceptions. The limited operating time for single operator stations, and the use of Prefixes instead of Zones and Countries for the multiplier. With the multiplier counting only *once* instead of once on each band.

To date, two Trophies are being donated for this contest. One by Paul Bavassano, I1RB to the world high single operator all band station. And the other by Gene Krehbiel, VE6TP to the leading Canadian scorer on a single band. We hope to have more Trophies before contest time.

This should be sufficient information for overseas stations that sometimes do not receive the complete rules in time for the contest.

Rules in detail will appear in next month's issue.

There were 129 entries received for the 7th World Wide RTTY Contest held last October. Following are the TOP TEN scores. The first 3 being Medallion winners.

PY2CQ	128,310
DL1VR	97,101
ON4BX	82,576
WA4LWE	73,249
UA1KBW	63,320
W2RUI	51,220
WA8BOT	47,723
DJ6ZB	41,836
VK3KF	41,767
W1GKJ	40,512

Editor's Notes

The listed claimed scores are only a cross-section of a few of the higher earlier scores received. The U.S.A. is listed by districts while the overseas scores are by continents.

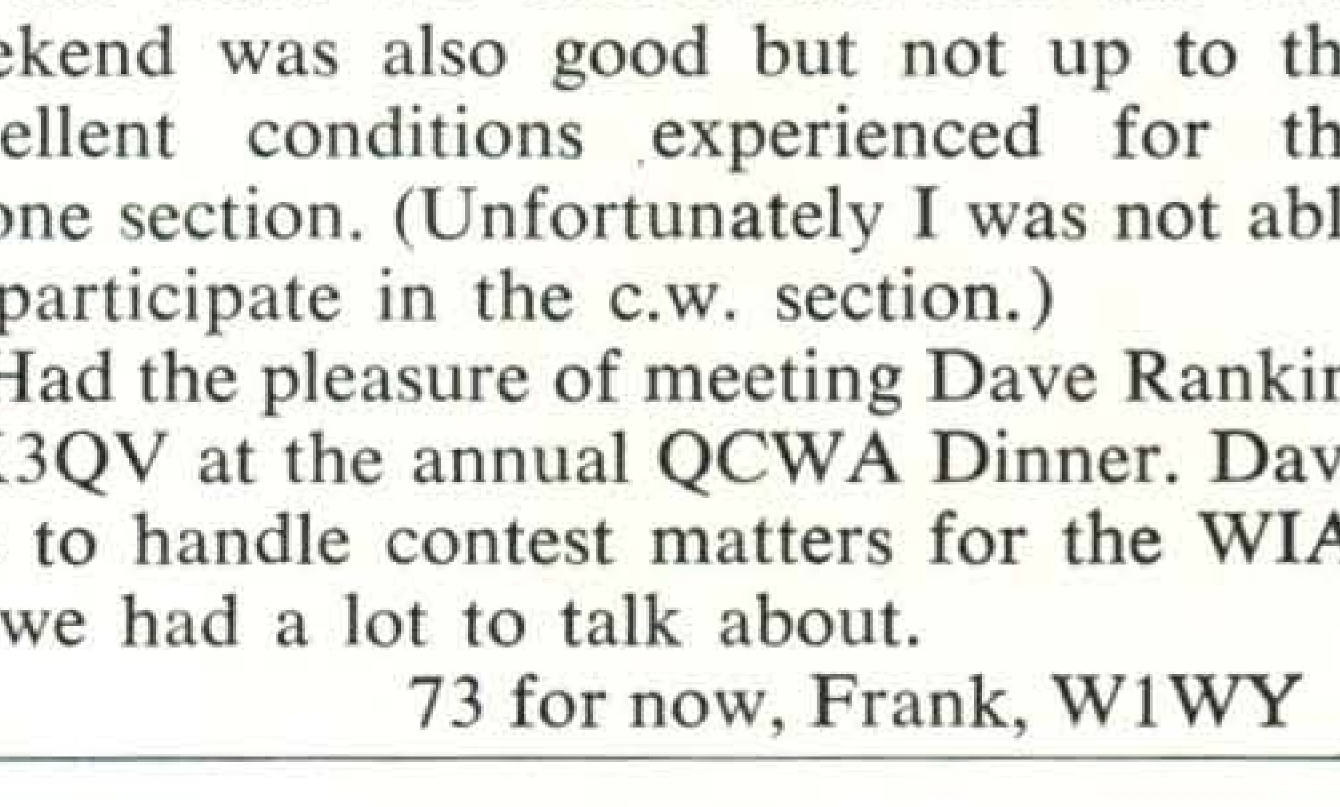
Its quite evident that this year the major activity has shifted to the 10 and 15 meter bands instead of the old reliable 20.

Let me once again emphasize that these are only a few of the early received scores.

George Jacobs really hit this one right on the nose. We understand that the c.w. weekend was also good but not up to the excellent conditions experienced for the phone section. (Unfortunately I was not able to participate in the c.w. section.)

Had the pleasure of meeting Dave Rankin, VK3QV at the annual QCWA Dinner. Dave use to handle contest matters for the WIA, so we had a lot to talk about.

73 for now, Frank, W1WY



I just said, "Look Myrtle, I'm keeping the mobile rig and that's final!"

SURPLUS sidelights

HARD on the heels of my grand European trip last fall, I made a slightly shorter, but still hectic swing through the upper midwest early this winter, hitting Cleveland, Detroit, Chicago and Indianapolis for a look at Surplus and a QSO or two with some of my favorite surplus fanatics, plus a stop for my newspaper with a man called Romney, who seems to live in Lansing, Michigan.

After getting the political side of my travels taken care of I stopped to see Ralph Leland, honcho of the Michigan RTTY Society, who has long directed distribution of commercially-surplus Model 19 and 15 teleprinters from Michigan Bell. Ralph has a very complete RTTY shack—much neater than my own of course, and his converted Model 29-ASR machine does nipups like on-the-air backspacing and reverse line feed —even prints while moving right-to-left, which ought to shake up the Michigan VHF Net if he ever springs it on them.

Seriously, the Model 29 equipment is a version of the well-known Model 28 Teletype system, designed to use an IBM computer code. The line was never popular, and has been dropped by Teletype Corp., and bits and pieces of this oddball gear are turning up in amateur hands because no one else is interested in it. A great deal of #29 machinery will convert to Model 28 or Model 35, though in its uncoverted state it is of no use because of its odd code.

In Chicago I talked for an evening with the king of the Teletype crowd there, Bert Prall, who has a third-floor RTTY shack that would make Teletype itself jealous. Bert must have two of every machine that Teletype ever made, and he has leased lines, U.S. Weather Bureau land-line service, the latest in carrier equipment, and in fact a very complete, Civil-Defense oriented communications center.

Bert observed to me that since Teletype Corp. is no longer producing the standard 5-level machines, amateurs may someday be forced to go on to 8-level, 100 w.p.m. equipment, which will soon be the TWX data, and general commercial standard. Though even the #28 is no longer in general production, the #32 machine is being produced new, and a few Model 28 machines are still being made for the military, and special purposes; that, plus the vast pile of 5-level equipment in government hands seems to indicate that even when all the old reliable 15 machines are gone, there will be 5-level equipment in surplus for many a year.

The federal government is planning to jump to the 150 w.p.m. model 37 one of these days, my U.S.I.A. informants tell me, and Teletype just announced a table-model of their "Inktronic" which spews copy out at a 2,400 word per minute rate, but all that is far in the future for most of us.

Ron Larsen, who works in Research and Development at Teletype showed me around a bit, including a look at the #37 and the Inktronic, plus the assembly line for the model 35 printers. I had wanted to see the famous Teletype museum, but it is part of the R & D operation, and passes are required that cannot be obtained on short notice, so I had to pass that up. If you are out that way and can get a pass, do see the museum —I am told it is a fascinating exhibit going back into the old-timers of RTTY.

Ron whose father Ralph is also a Teletype Corp. bigwig, has developed the only use I have ever seen for the unshift-on-space gimmick in amateur RTTY gear. This is a common extra on most model 15, 19, and 28 printers, and is useful I suppose on certain commercial circuits. As is though, most of us forget it when leaving spaces in sending figures, so we go back all unknowing, to letters, which creates a lot of garble.

The upshot is that the feature is often removed, and good riddance. Ron has noticed however that you can set a printer to unshift on blank, instead of space. This means that when your paper grinder misses the letters shift, or the person on the sending end forgets it, you can merely push the break button on your printer, opening the receiving loop long enough to let your printer "see" a "blank" character, to shift to letters.

Some Kleinschmidt machines have local letters-figures provision, but few Teletype units offer the feature. There are modifica-

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

ARCTURUS SALE

be Bargains, to name just a few:

6	$2.95	#5725/6AS6	59¢	#6AQ5	56¢
0	3.50	#5842/417A	$2.50	#6BQ7	94¢
8	3.50	#5847/404A	2.50	#6CG7	59¢
9	3.50	#1AX2 49¢; 5 for	2.00	#6J6	49¢
5	.59	#6K7 39¢; 3 for	1.00	#6T8	84¢
8	3.75	#12BN6 39¢; 3 for	1.00	#6U8	77¢
21	.49	#25L6 59¢; 3 for	1.49	#12AU7	59¢

be Cartons: 6AU6 etc. size, $1.75 per 100. 6SN7 etc. size, $2.10 00. 5U4GB size, $2.50 per 100. 5U4G size, 03¢ each.

solete Tubes: #UX200, $1.69; #80, $1.20; #10Y, 69¢ etc.

nch 90 degree TV bench test Picture Tube with adapter. No ion needed. Cat. # 7BP7, $6.99.

icon Rectifier octal-based long-life replacement for 5U4, 5Y3, , 5AW4, 5T4, 5V4, 5Z4. With diagmam. Cat. #Rect 1, 99¢ each.

Z4 Silicon Rectifier replacement, octal based. Cat. #Rect 2, each.

Flangeless Rectifiers, 1 amp, 400 to1000 p.i.v. Cat. #RS10, .

Silicon Rectifiers, 750 MA., 50 to 300 p.i.v. Cat. #330F, 99¢

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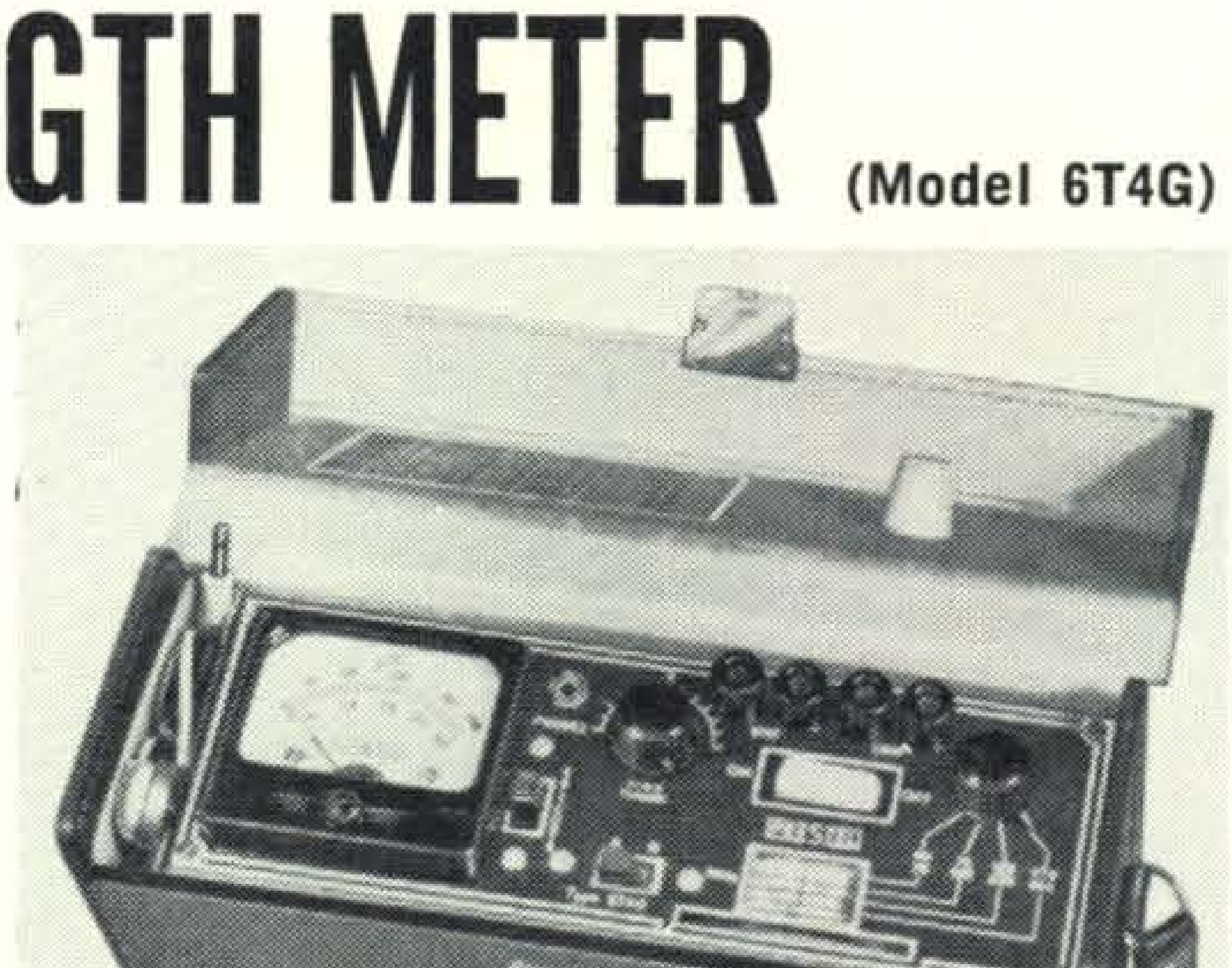

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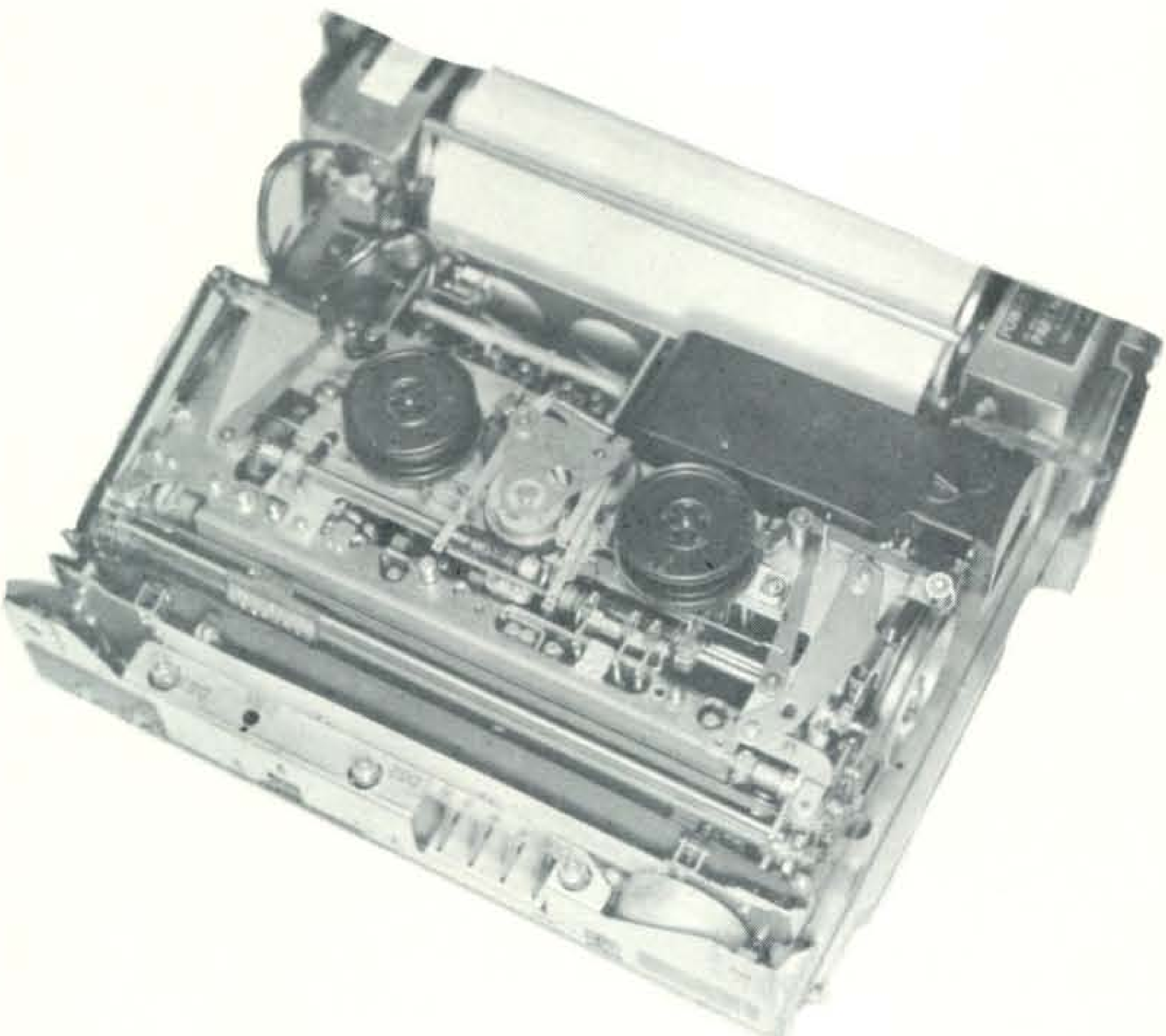

The TT-264 Mite Teleprinter, shown in a partially disassembled view.

tion kits to give either electrical or manual letters-figures control, but these are rare, costly, and/or difficult to install. If your setup allows, the Larsen method is a handy expedient. In the 28 line the change requires only a new function bar. I have a small supply and will send them out for postage: 25¢. In the #15 more surgery is involved; best check your maintenance manual.

I looked around Chicago's once-large Radio Row, but now even Newark Electronics has moved. I didn't see their new location, but their new telephone number is 638-4411, and they are, I understand, still very much in business. Aside from the three old hands on South Michigan Avenue, all the Surplus stores in the Chicago directory are now CB hangouts or out of business.

The three old reliables are still there, though Ben Cohen of B.C. Electronics, 2333 South Michigan Avenue, has been ill, and is only open on Saturdays now.

Arrow Electronics, 2534 South Michigan Avenue, had a very complete stock of the familiar surplus goodies; plenty of Command Sets, including the odd R-23-A/ARC-5 low frequency receiver made by the Lewyt Corp. after World War II. This was the only lemon ever made in the Command line, though Arrow's units have obviously been overhauled and rebuilt. Arrow had the Teletype TS-2 "quick brown fox" RTTY test generator at $67.50, and other interesting surplus buys.

R W Electronics, up the Street at 2244 South Michigan Avenue, also displayed Command Set units, and was having a special on toroids in the works. These little doughnuts can be used as RTTY filter inductances, or with other cores, as d.c.-d.c. converters, plus many other applications. RW has a very complete catalog and date sheet on its units, with references and design data.

The photo this month is of a partially-disassembled MITE Teleprinter TT-264 which is a tactical set bought chiefly by the U.S. Marine Corps. The unit operates generally like the Model 28 Teletype printer—uses the same paper and ribbon—but is mechanically quite different. I was able to examine this one through the kindness of Roy Brougher, W4RRU, and Col. Oscar Heinlein, USAF (ret).

The TT-264 is in some ways a bit temperamental, due, no doubt, to its extremely compact construction. The one I saw had gears stowed inside to operate on 60, 75, or 100 words per minute with a simple screwdriver change.

The MITE printers have been relatively rare, though most RTTYers are aware that they exist. In addition to the Mite Corporation, of New Haven, Connecticut, there is another "mite" printer which types on the three-inch tape similar to that used by the Dow-Jones financial wire. Known as "Codamite" this little unit is now being sold to some police departments for use in patrol cars. If you see any of these gems, you can probably use them on standard 5-level amateur RTTY circuits, though they may be geared for 100 w.p.m. and require a change to run at 60 w.p.m.

At this point I want to mention some of the items that have appeared in my mail, and ask if any readers have attempted conversions:

Jim Header, 3258 Wildwood Drive, Medina, Ohio, has a T-116/APT-5A oscillator and needs suggestions.

Dale R. Blanchard, 216 Carson Way, Henderson, Nevada, has a YG-3 beacon transmitter, part of the ZB-YG navigation set of World War II, and needs a diagram for it.

Al Johnson, W6EPO, 594 Alderson St., El Cajon, California, has the i.f. unit from the AN/APG-18 and needs hookup data.

Alec Burchfield, Box B 20230, Florence, Arizona, has an ID-169/APN-12 'scope and needs conversion data.

On the other side, here is a formula for W6MLZ's "magic fluid." He says it will clean the crud out of any receiver, transmitter, or other electronic goodie—and what piece of surplus doesn't come with cobwebs and other dirt? I can't say I have used it yet, but Magic Fluid has testimonials from K4GEC and W4ZZV. It goes like this:

8 oz household ammonia
3 oz olec acid
4 oz acetone
7 pints water (distilled might be better if your tap water is particularly "hard.")

Mix all this together, giving a gallon of the juice, then dip your goodie right in, scrubbing gently with a paint type brush to get it in all the crannies, without regard for IF coils, etc. (possibly one might want to take care with tuned circuits, not to knock them out of adjustment) Basically though, let the goop do most of the hard work.

After about 5 minutes of soaking, wash the set gently with a stream of lukewarm water, using a small rubber hose to get at all the corners. When well washed-out, bake the unit in an oven at 140-160 degrees, or use a infra-red heat lamp to dry out the water. In the oven method it is well to check occasionally to be sure the temperature is not creeping up to a dangerous level. Also, it is advisable to open the door once or twice to let the steam out. Once the mist stops fogging the oven glass you are probably pretty dry, though high-voltage transformers might in dicate a check with an ohmmeter. Powe transformers are the slowest-drying item usually found of a typical chassis. If it wa easy to remove the transformer that might b a useful precaution before washing the set

The Magic Fluid will keep indefinitely i kept in a tightly corked jug. I suspect i might not help certain plastic components so keep it off knobs and other fine finishes

Finally, I want to offer a partial index o Surplus articles that *CQ* has carried in th past for the benefit of our persistent readers

AN/APS-13 October 1955
AN/ARC-4 November 1955
AN/ART-13 February 1947, Novembe 1946
AN/TRC-8 May, June, 1960
BC-312 & BC-348 February, 1959
BC-357 April, 1958
BC-645 December, 1956
BC-1068 June, 1948
AN/ARC-1 May, 1960
AN/ARR-2 August 1959
BC-221 April, 1959
BC-375 May, 1961
BC-603/683 December, 1959
BC-659 September, 1959
BC-442 March 1960
SCR-274-N, AN/ARC-5 (Command sets Roundup, February, 1954 CRV-59AAE T camera May, 1957 BC-733 October, 1959

This is only a handful of the pre-196 Surplus articles *CQ* printed, but it will un doubtedly assist many readers who are jus starting in on their conversions of these ol friends. ■

The DXpedition [*from page 63*]

Antarctic DXpedition that never took place! Good grief!

Final Plans

Some of the more serious considerations of this DXpedition involved the gear—what kind, how much, and how to ship it to the Indian Ocean. These problems were solved with cooperation from friendly amateur radio dealers and two major airlines. One set of Collins gear was already in Mozambique, having been entrusted to Jose, CR7GF, on my return to the States in February, and that equipment was to be shipped to Mauritius where we would collect all our equipment in a month's time. We purchased a second set of gear, and a third was donated. *Electrovoice* donated microphones, Waters provided Codax Keyers and ascessories, Hy-gain supplied the antennas, and W5EZE and K5AAD of Madison Electronics Houston, donated the valuable ascessories. Galaxy Electronics, Ham Radio Outlet, San Francisco, and Henry Radio, Los Angeles, were also most cooperative.

One interesting item of consideration was how to arrange our itinerary to take advantage of the usual overseas airlines fares. Most American tourists are not aware that overseas air fares are based on a mileage system. Outside of the United States, when you travel from point "A" to point "B," you are permitted "X" number of miles, which is always considerably greater than the actual mileage between the two points. Any number of stops betwee the two points are permitted, and there i no restriction on the length of time whic can be spent in each place. Extensions side trips are almost always permitted, thes flights costing nothing extra! The maximun allowable mileages are published in th airlines guides along with the actual airlin mileages between cities; I carry an airline manual with me to arrange my ow itinerary and calculate the fares and mile ages to get the most travel for the leas amount of money. This has saved th DXpedition into the thousands of dollar over the past thirty months. Most traveller are not aware of the system however an the major airlines rake in millions of dollar annually from unsuspecting or ignoran tourists who could have constructed thei fares differently or visited far more coun tries for no extra money. Bill and arranged our trip to Mauritius to trave through Scandanavia, the U.K., centra Europe, and central and South Africa, fo no extra charge. The purpose of this wa not for sight-seeing. We were faced wit an unbelievable list of items to be accom plished en route to Mauritius; licenses an documents were needed for future opera tions, various aspects of the recent ARRI mess had to be investigated for legal rea sons, and we wished to meet with at leas a few of the European DX groups on th way through.

Bill got a chance to do some operating from the shack of G3FKM with G2MJ and G3FKM looking on. The trophy at the left is John's LIDXA Award for topping the 1966 DX Marathon. Bill won the stateside version of the award.

The usual correspondence load persiste throughout our travels; arranging for th forwarding of mail was a tricky proposi tion. Visas and licenses had to reach us b specific dates in some locations. We sti awaited replies to many of our inquirie and applications.

The mobile venture had been a smashin success, the *Handbook* manuscript was sub mitted, and correspondence was nearl completed. The gear had been shipped. Al though the expected harassment continued Bill and I decided to make a go of it. W hit the road in earnest.

Next Month

Part III will take you with us throug Europe, meeting some of the top DXer and DX groups, and coming face-to-fac with some major problems, on the roa that eventually leads back to the India Ocean. The Rockall mystery is solved an a surprising discovery is made. ■

See page 110 for New Reader Servic

ngineering Technicians

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Q & A [*from page 76*]

capacitor to charge up to or discharge down to the average value when the noise level is respectively raised or lowered. This necessitates altering the noise level very slowly. Also repeat the noise-figure measurements and average the readings for a final figure.

If you are using the N.F measurement technique of increasing the receiver a.f. output level by 3 db (with a linear detector in use) and are employing a meter with a db scale, use the lowest-voltage range as this is the one for which the db scales usually have been accurately calibrated.

Scope Display of Keying Pulses

QUESTION: I have been trying to use an oscilloscope to examine the waveforms of the pulses in an electronic keyer, but I can see only the horizontal portions of the pulses. The vertical parts do not show up. Are these non-existant or is it the fault of the scope?

ANSWER: The vertical traces on the pulses are not visible due to the exceedingly fast rise and fall times at the leading and trailing edges of the pulses. This causes the c.r.t. spot to move too rapidly to be recorded on the c.r.t. screen. A higher-intensity scope would help, but it may not be a complete solution, as the vertical traces might still be quite dim. For the same reason, where there is a very narrow or short pulse, a break in the baseline from which the pulse rises also may not be discernable.

In commercial practice a delay line is often used in the vertical amplifier to slow down the vertical response, but such a line is quite involved for amateur construction.

Swan 250 6-Meter S.S.B. Transceiver

QUESTION: Do you know of any modifications for the Swan 250 6-meter S.S.B. Transceiver? Mine works fine, but I'm wonderir if any need has been found for makir changes.

ANSWER: In the interest of making a goc piece of gear even better, the Swan peop have come up with an easy modification fc improving the receiver noise figure and ii creasing the sensitivity. The information h: been mailed to owners of this gear, but you have not received this, write to Swa for their service bulletin on it. The addre is Swan Electronics Corp., 417 Via D Monte, Oceanside, California.

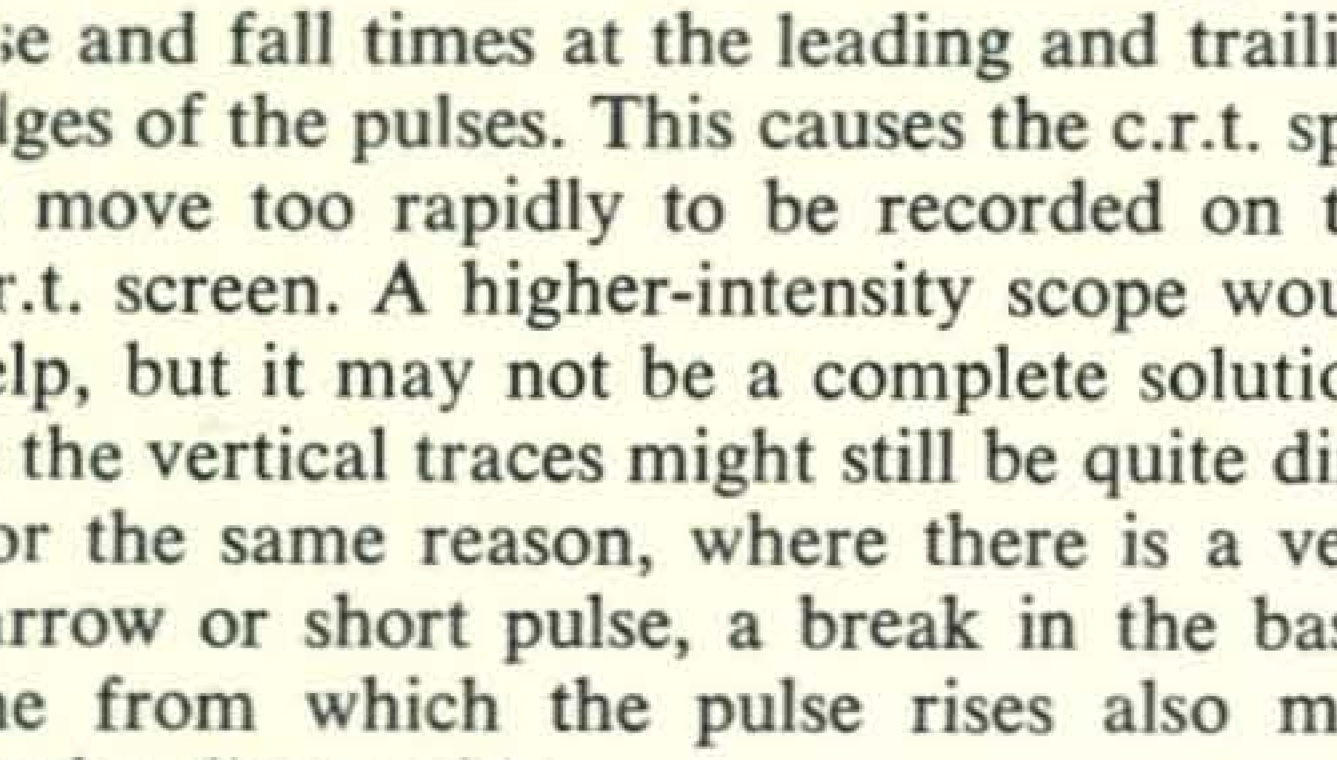


Fig. 2—Noise limiter for TR-4 is installed across the a.f. level control. $CR_{1\text{-}2}$ should be silicon with high back resistance. Degree of limiting (and distortion) may be varied by altering R_1.

Drake TR-4 Noise Limiter

QUESTION: Have you any suggestions for noise limiter that can be easily installed in Drake TR-4 transceiver?

ANSWER: The circuit shown at fig. 2 h: been quite successfully used by W2VTX ar other members of the Long Island Mobi Amateur Radio Club. Two diodes are use back-to-back in a self-biasing arrangeme like that sometimes used in the i.f., but i this case it is installed in the a.f. system. must be connected across a high-impedanc circuit as shown. The degree of limiting ma be altered by changing R_1. Some distortic may be experienced, but in the presence (heavy ignition noise, the signals are at lea readable.

Homemade R.F. Chokes

QUESTION: Have you any data on the co struction of homemade r.f. chokes.

ANSWER: An excellent article on the subje appeared on page 30 in the May '54 issue (*QST*. It is "R.F. Chokes for High-Pow Parallel Feed", by V. Chambers. The bas principles also may be applied to other tyj chokes.

ARC-5 Receiver Bandspread

QUESTION: What is a foolproof way bandspread the BC-454 Command receiv for 3700-3750 kc?

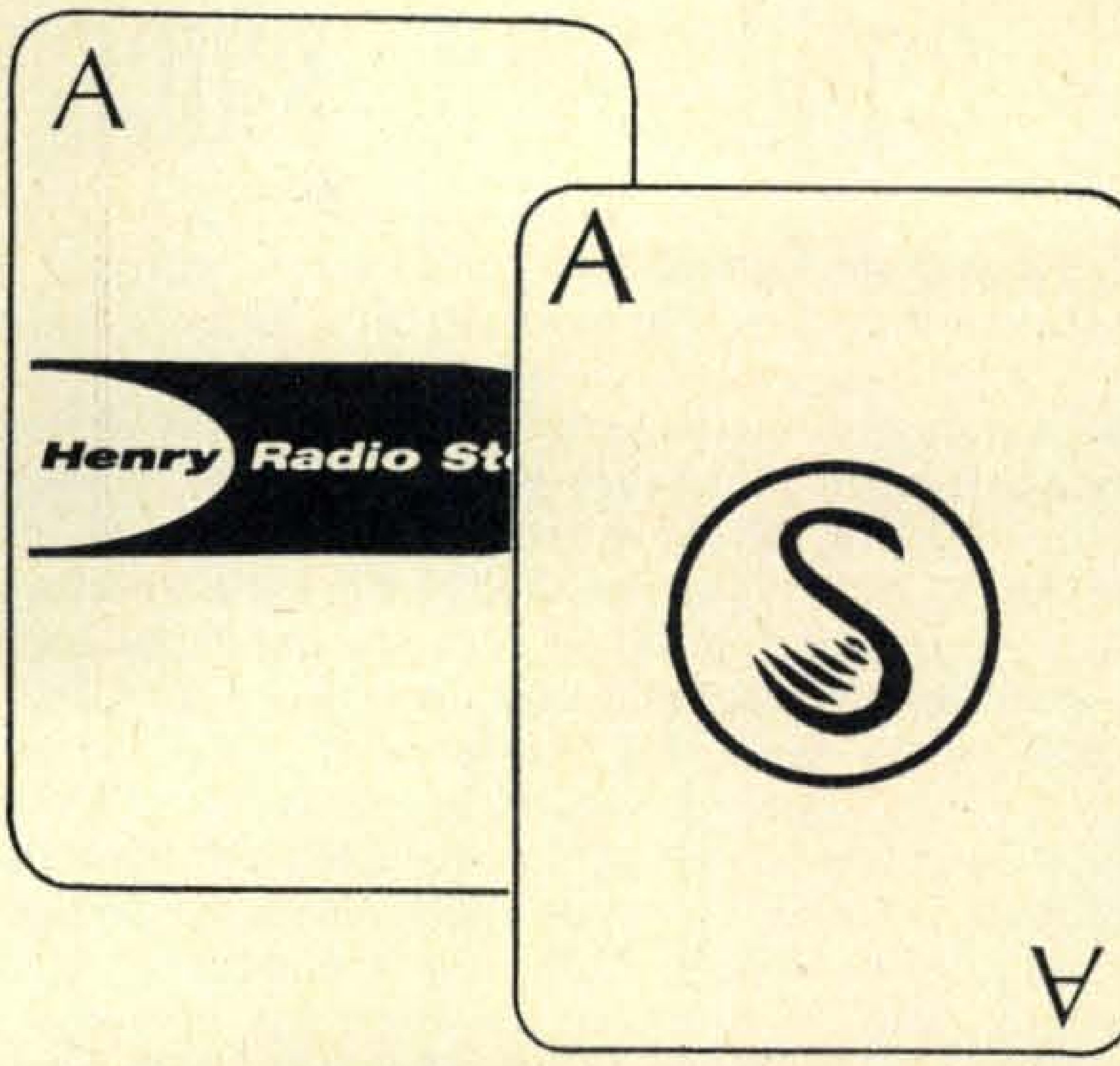
ANSWER: The simplest method of pr viding bandspread for the Command tyj receivers is to install a separately calibrate dial on the vernier-tuning knob.

Bandspread also may be accomplishe electronically, but this requires digging in the set and altering the tuning-capacit plates and installing appropriate paddir capacitors.

Several versions of both methods a described in the *Surplus Conversion Han book*.

See page 110 for New Reader Servi

STILL A WINNING PAIR



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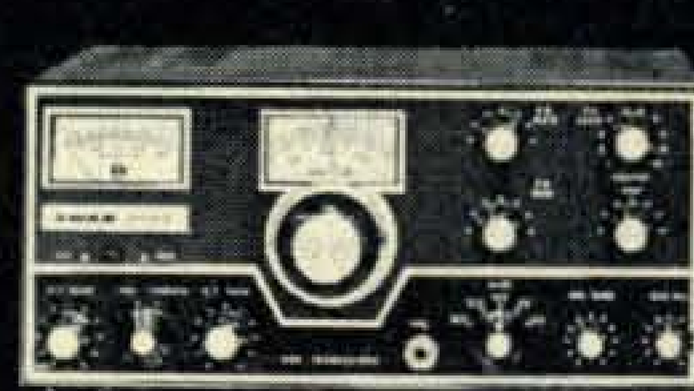

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tisfaction that your money entitles you to have. ıe normal guarantee on a piece of used equip- ent from this company is 6 months from the time is purchased. But, if in the period of 30 days, you cide you made a bad choice, you could return it r full credit, as long as you yourself didn't mar otherwise abuse the set during the time it was your possession, and assuming, of course, that u pay the return transportation charges.

I mentioned in the earlier part of these notes at we had a tremendous inventory. It's literally ıbelievable as to the extent of our inventory. We ve, for example, more equipment here than can found in all of the other radio amateur supply uses in New England. Very likely it is substan- lly more than that. If we were to count the num- r of ham pieces that we have, we'd have close to thousand pieces of ham gear alone. Thus people king the trouble to drive to Harvard to look for a ce of ham equipment are not likely to be dis- pointed.

One item that I would particularly like to com- nt on is the fact that we feature an extensive antity of the very high-priced, better quality re- ivers. We have almost the entire Collins line, the tire National line, the entire Hammarlund line, entire Hallicrafters line. For those of you who buffs, or collectors, let me assure you that we ve a substantial inventory here of old-time equip- ent, not up for sale, but for your observation. We ve the old Howard receivers, the original Na- nal receivers like the SW3 and the FB7, even an GX and an NHU. This type of inventory is rinkled liberally throughout our establishment, as to lend flavor or color to our inventory. And, ile we won't offer to sell these pieces, we will you look at them and if necessary, try them out.

One other point that I'd like to get across is this. you wish to purchase an item from us that is not own on our listing, just ask us. There is a very ong possibility that we know where we can get item. That is, people have offered to sell equip- nt to us if we could find a buyer for it. So, don't sitate to address inquiries of this nature to us.

Don't forget that we'll be pleased to accept your uipment in trade towards this used equipment. n't forget that we can provide good counseling solving your problem. If you, for example, want know the best receiver for communications pur- ses, within the ham bands, within a certain de- able budget, let us know your problem and we n probably straighten you out. On the other hand, you are VHF'er and you want to operate on 6 eters or 2 meters, or even 432 megacycles, we can ine that receiver which will work best with the rks converters that we sell and stock. Above all, 'd like very much to have you stop and visit if u are on your vacation or up in the vicinity.

Thank you again.

73

Herbert W. Gordon W1IBY

S. I almost forgot—we now have a listing of used m gear. Write for your copy today!

See page 110 for New Reader Service

Project Oscar [*from page 37*]

mark. While this is very gratifying, it still is not enough to cover all of the operating expenses, and additional members are needed.

Project OSCAR exists for the purpose of helping radio amateurs participate in satellite communication activities. The program has advanced to its present state (four successful launches since December, 1961, and a fifth expected before the end of this year), because of the magnificent cooperation of the members. With increased membership, the future should bring to amateur radio new and even more interesting activities as well as increased capabilities in the field of space communications. Membership in Project OSCAR costs $5 a year, and it is a sound investment in the future of amateur radio. Additional details and membership applications can be obtained directly from:

Harley C. Gabrielson, W6HEK
President, Project OSCAR Inc.
Foothill College
Los Altos Hills, California, 94022. ■

M.A.R.'s Converter [*from page 46*]

necessary other than the normal short and direct wiring of signal carrying leads and bypass capacitor leads. The crystal frequency, when added to the incoming signal frequency, should place the i.f. in the receiver's twenty meter band. If additional crystal frequencies are required, a switch may be placed in the 6U8 grid circuit to select different crystals. Coil L_3 is wound with #28 Formvar wire "two in hand." (Instead of winding one wire on the form, wind two in parallel. This tends to increase the tuning range of the slug). Should it be desired to use the tetrode section of the 6U8 for V_1, instead of a 6BZ6, the pin connections are shown.

Adjustments

Connect the converter to the receiver. If a signal generator is available, connect it to the input of the converter. Initial tuning slug placement of L_3 *and* L_4 should be approximately 1/3 into the winding. The oscillator should then be operating. (This may be checked by removing it from its socket and hearing the noise level drop.) Tune C_1 and signal generator for a mid-scale S meter reading. Adjust L_1 and L_2 slugs for maximum signal. (The slugs should extend about

[*continued on page 102*]

See page 110 for New Reader Service

the same amount above the cans. If not, adjust the small trimmer capacitors on the side of the variable, C_1. Adjustment of L_1 and L_2 may be repeated if capacitor tracking for each circuit is not uniform. During tests the signal generator and receiver r.f. gain levels should be kept low. Inductor L_3 should be peaked in the center of the receiver's twenty meter band. The crystal oscillator should have enough injection for crystals a megacycle from center frequency. Inductor L_4 should be adjusted to give stable output for the crystals used. ■

Mixer Freq. Analysis [*from page 39*]
with the full size, high efficiency, relatively low-Q antenna needs to be sure his 2 kw p.e.p. rig has no significant birdie output or he may find himself the recipient of a WAFCC award.[4] On the other hand, the mobiler with the 100 watt p.e.p. rig who operates on a restricted frequency range, and whose mobile antenna has a Q of 300 doesn't need quite the transmitter birdie suppression of the first example.

Thus the whole point is that first you must have proper design in your mixing schemes to give you as near birdie-free output as possible. Second, you need to consider your overall operational plan to decide whether further elaboration in circuit design is necessary to get additional attenuation to unwanted frequencies. All of the series elements, from v.f.o. through the transmitter on up to the actual antenna, can help you if you use them properly; it's up to you. ■

4 WAFCC—Worked All FCC Monitoring Stations Award.

USA-CA [*from page 81*]
am quite embarrassed by my, so far unsuccessful, attempts to get a QSL from the ARRL President for an OK friend. Our requests have gone unanswered.

Again thanks to Gil, W8GIU/5, this time for sending a POD 26 to DJ7XC.

Regarding POD 26—Yes they are available now from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 for $2.75. Please note that if one is ordered sent to a foreign QTH the cost is an additional ¼ or a cost of $3.44. Actually it would cost you *much* less than 69¢ to mail it to a foreign QTH yourself.

Again many thanks for all the nice mail, suggestions and etc., Please continue to write and tell me—How was your month? 73, Ed., W2GT.

See page 110 for New Reader Service

or further information, check number 23, on page 126

80M. S.S.B. Exciter [*from page 59*]
is now ready for operation; I have described its adjustment procedure in detail and it will probably take more time to read it than to do it.

Conclusion

This exciter has been in use at I1TDJ since november 1964 and during all this time it has not been necessary to readjust any of its circuits. The sideband suppression with voice signals is better than the figure given above, which was obtained using a single 1000 c.p.s. tone. Up to now, all the reports received on sideband suppression, "Your since November 1964 and during all this sideband is well down or, "I can't copy you on the unwanted side." The power supply I am using is that of fig. 3 which is cheap and very easy to build.

The exciter audio circuits have a band pass from 100 c.p.s. to 5,000 c.p.s. Since the audio network is working between 300 and 3,000 cycles it will be necessary to change the 25 mf capacitor between the emitter of Q_1 and the base of Q_2, to a .27 mf unit. A .0082 mf capacitor can be connected across the collector resistor of Q_2. I did not worry about the wide band of the audio stages, because I am using a transistor speech compressor between the mike and the exciter; the audio gain potentiometer is also built in the compressor and it is not shown in the exciter schematic. If you don't have a compressor, it is very easy to change the above mentioned capacitors and add a volume control. If you need more information on this exciter, I will be very glad to meet you on 20 or 15 s.s.b. during weekends; just fix a schedule. ■

★ **PLEASE** include your **ZIP** code number on all correspondence. ★

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HI-TOWER Model 18HT Works F.B. all bands. Moving to apt. $60.00. Firm or trade even. for Johnson Matchbox with S.W.R. Bridge. Can't ship. Jones, W2CCV. New York City, N.Y. 914-NE4-8187.

GOVERNMENT surplus, transformers, meters, transistor equipment, Millile test equipment, small parts. D. Reed, 1604 Grange Ave., Racine, Wis. 53405.

SELLING RECEIVERS. SP600JX and R-390. Both good condx but need minor tinkering to put in top shape. SP-600 $175.00, R-390 $500.00 both with manuals. Local pickup, no shipping, sold "as is." K2AES, 112 New Highway, Commack, N.Y. 11725. Tel. 516-883-6200 days.

WRL'S used gear has trial-guarantee-terms. NC270—$139.95; HQ170AC—$239.95; HQ110AC—$169.95; 75S1—$299.95; 75A1—$169.95; SX1000—$134.95; HA10—$189.95; HT32—$249.95; GSB100—$179.95; Ranger 2—$169.95; G76—$99.95; 650 & VFO—$89.95; Thor VI & AC/PS—$169.95; Hundreds more. Free "Blue-Book" list. WRL, Box 919, Council Bluffs, Iowa 51501.

AUCTIONFEST—Broward ARC—February 17th. Turn your used equipment into cash. Bargains unlimited. Location—Chaminade High School, 500 North 51st Ave., Hollywood, Florida. Doors open at 8.00 A.M. auction begins 9.00 A.M.

TTY: Model 28 gears (set of 2) KSR or ASR; 60, 75 or 100 wpm, $5.50 pp in U.S. Model 14 Typing Reperforator, $50. 14 TD, $50. Model 19 table. Wanted TM-11-2357K, TM 11-2583A, Model 15 Typing Unit, 15 or 19 cover, R-19/TRC-1. Trade TS-174/U Frequency Meter for CV-89/URA-8A. W4NZY, 119 North Birchwood Avenue, Louisville, Kentucky 40206.

FOR SALE: HT32, new power transformer installed and re-aligned by factory service—$235.00. SX101 Mark 3A with Vernier Dial—$115.00. Both units for $315.00. Both good condition, original owner, prefer local deal or will ship F.O.B. N.Y. W2FX (516) 627-1107.

WANTED: Military, Commercial, SURPLUS . . . Airborne, Ground, Transmitters, Receivers, Testsets, Accessories . . . Specially Collins. We pay Cash and Freight. RITCO, Box 156-234, Annandale, Virginia PH 703-560-5480.

SELL OR TRADE: Knight TR106 6 Meter tranceiver, base or mobile. Professionally wired and aligned with matching VFO; 6 M Mobile Halo and bumper mount; all brand new. Jones 261 and 262 VSWR indicator too. Want Johnson Valiant II in comparable condition—or sell. WA4WIA, 345 Park Road, Pleasant Grove, Ala. 35127. 744-0927 P.M.

DAYTON Hamvention April 27, 1968—Wampler Arena Center, Dayton, Ohio, sponsored by Dayton Amateur Radio Association. QSO in person at the nations foremost radio event of the year. Technical sessions exhibits, hidden transmitter hunt. Bring the XYL for an outstanding Ladies Program. Join the satisfied participants who return year after year. Watch the Ham ads for information or write Dayton Hamvention, Box 44, Dayton, 45401.

NATIONAL HRO 60 with 13 coils; Hammarlund HQ 180. $200 each or best offer. Regency WT4 $30. All perfect. Virgil Pfeifer, 1605 Gilbert, Peoria, Ill. 61604.

WANTED: 2 volt '57 and '58 receiving tubes—W1BB.

GONSET 2 Meter Sidewinder, factory aligned AC & DC supplies $230. John Stiles, Sweetgrass, Montana 59484.

SELL: Brand new Star-Line Xmtr, Rcvr, 50M Converter. Never used. Cost over $1,000. First $800 takes. Yager, Box 176, Prospect Heights, Illinois 60070.

QSL's, SWL's, CB 10¢ N & S Printery, Box 11184, Phoenix, Arizona 85017.

QSL. Second to none. Your personal combination from largest selection, glossy reds, blacks, calypso, pincraft, 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.

WANTED—QST's—Last four issues needed to complete private collection. 1916—FEB., MAY, JUNE, JULY. Any reasonable price paid. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., New York 11050.

QSL's by RUTGERS VARI-TYPING SERVICE, Thomas St., Mi N.J. 08848. Free samples.

POLICE—fire—aircraft—amateur calls on your broadcast Tune the band with TUNAVERTER. Free catalog. Salch Com Dept. CC, Woodsboro, Texas 78393.

QSL's—BROWNIE-W3CJI—3111 Lehigh—Allentown, Pa. 1 Samples 10¢ with catalog 25¢.

WANTED: Tubes, transistors, semiconductors, test equip meters. Bernie W2MNP, Box 257, Canal Station, N.Y., 10013.

YOUR CARD in glittering raised 3-D on blazing backgr becomes a beautiful collector's item. Samples 25¢ (refund 3-D QSL Co., Monson, 4, Mass. 01057.

RTTY gear for sale. List issued monthly. 88 or 44 Mhy to uncased, five for $1.50 postpaid. Elliott Buchanan and sociates, Inc. 1067 Mandana Blvd., Oakland, Calif. 9

EARN YOUR DEGREE in electronics engineering. Highly effe home study courses in electronics engineering technology electronics engineering mathematics. Free Literature. C Institute of Electronics Engineering, P.O. Box 36185, Hou Texas 77036 (Established 1945).

EXTRA SPECIAL OFFER: Galaxy V Transceiver, De lux acce console, Galaxy remote V.F.O., AC power supply. Sound off $450.00 or best offer Mrs. Glenn Imler, (W9LJ). Gary, Ind

RUBBER ADDRESS STAMP including call letters. Three or lines $1.50. Signature stamp $3.50. Free catalog. Jack P.O. Box 443-F, Franklin Park, Illinois 60131.

COLLINS 75A4 3kc filter serial # 4041 $400. W. Kumpost, Story Ave., Bronx, New York 10473.

SELL Frequency meter TS-173/UR 90-540mc. $150. Also uals for Motorola 150mc mobile gear. F. Saltus, 10074 C bal Dr., Spring Valley, Cal. 92077.

FOR TRADE—Knight R-100A with all accessories, 1 year what kind of General coverage receiver have you? Sjulander Jr., Box 231, Ashland, Wisc. 54806.

FOR SALE: Heath HG-10 VFO gud condx. $25. Globe Deluxe Xmtr $30. You pay shipping cost. G. J. Cotelli 1903-32nd St. W. Bradenton, Fla. 33505.

WANTED: F-455J-05 filter (500 cycle) and 270G-3 speake 75A4 R. D. Sever, P.O. Box 14015 US Nav. Comtracen-Corry Pensacola, Fla. 32511.

COLLINS 62S-1 like new $600. or best offer will trad collins 30S-1 KW amp. W. Rogers, 327 Chamberlain St, ville, Tenn. 37209.

SELL: Bc221 HBS up. orig book $50. Bc603 AC converted band police $25. HB KW Class B mod 810's Phatemeter Filters. B. Davis, Box 311, Lonoke, Ark. 72086.

SALE. Elmac-Model P.M.R. 6A 10 to 80 meters plus BC Bands has AC Power Supply. $60. R. Garcia, 52-14 39th Woodside, N.Y.

FOR SALE: HT-37 plus astatic T-3 mike $225 or will trad NCX-3 or Galaxy III. B. Gode, 1036 Hillside Rd, Northb Ill. 60062.

FOR SALE: Johnson pacemaker and 1000 watt Amplifier power supply and extras. $150. Local Only. D. Loewer, Schurr Rd, Clarence, N.Y.

SELL MILLEN 90905 scope 5" $55. Accurate model 151 tester $8. Vangard 6 meter converter with pre-amp & H $15 VF-1 $7; QF-1 $4; Robert Ireland, Pleasant Valley, 12569.

WANTED: high band FM Gear. Prefer converted for 2 m and workable on 146.94. W. Baxter, 402 E. Jacinto St, Tu Arizona. 85705.

A MUST for every home and office. A national zip cod rectory $1 postpaid to you. R. A. Weigand, 177 S. Union Salem, Ohio 44460.

WANTED: 220 and 432 mc equipment. Send list and pric Zalewski, 411 Grove St., Jersey City, N.J. 07302.

WANTED: Velvet vernier dial for national SW3 rcvr. J. Ne 9614 NE 3rd St. Vancouver, Wash. 98664.

FILTER for SSB. Espey, pt. #16.296 for 500 ohm in/out Z a few for $8.75 ea, post paid in US. R. Beams, 4660 E. Rd, Tipp City, Ohio 45371.

MAKE your clock a 24 hour clock with this 9½ x 10½ version chart. A must for every shack & only $.75 PP che MO only. J. Siemietkoski, 3039 E. Thompson St, Phila 19134.

FOR SALE: R-45 communications recvr 550KC-30mc, BFO HB power supply schmeatic and tune up instructions a half current price $75. FOB. H. Lowry, 915 Madison St, chester, Tenn. 37355.

WANTED: Good used swan 350 with P/S State condx and T. Watkins, 4838 Reynolds Dr., Torrance, Cal. 90500.

FOR SALE: Nearly complete set of RTTY Vol 1-12 and bulletins 9-45. Best offer over $20. R. Quenstedt, 512 McD Rd, Leavenworth, Kans. 66048.

See page 110 for New Reader Service

6-150 perfect, $150; Gonset Comm.II-B Saturn Six Halo both $100. Relays, xfmrs, Tubes, Magazines, SASE List. .ankford, 511 Purnell Dr., Nashville, Tenn. 37211.

ITED: 2 sockets for 4X150G. J. Kimbrell, 106 Thompson St, nam, Wash.

Coax ant relay with DPDT Aux contacts $6. Q-tran 1 to 150 75 ohm antenna balun with coax connector $6. Two B&W ile connectors with new RG59U attached $2. ea. G. Counnan, 75E Bay St, Charleston, S.C.

7-HT41 2 extra 7094S included. Come see it working. $400. Mercado, 357 Midwood St, Brooklyn, N.Y. 11225.

ITED: F-455 J filters for 75A-4 1.0,1.5,2.1 kc, state condx price. A. B. Hallaway, 6101 France Ave, So. Minneapolis, n. 55410.

SS-Trader" Ed Moory promotes January Clearance sale on equipment with factory warranty: Drake T4-X, $319.00: ke L-4 Linear, $549.00: R4-A, $319.95: Package Deals: New 3 Band Transceiver Kit, Model 753 and New EICO 751 ply and Speaker, Regular price, $249.00, Cash Price, 9.95: Package Deal: New Mosley Classic 33 Beam and Demo -M Rotor, $199.00: New Displayed Model BTI 2000 Watt ar, $649.00: Demo Swan 500, $419.00: New TR-4 displayed el, $449.00: New NCX-5, $449.00: Special ROHN 50 ft. over tower, prepaid, $189.50: Demo Ham-M Rotor. $94.50: Collins 75S-3B, $725.00: Displayed Swan Mark II Linear, 9.00: Fantastic Special, New National VX-501 VFO, $249.95, n Price, $139.00: Ed Moory Wholesale Radio Co., Box 506, itt, Arkansas, Phone 946-2820.

's Qth in Fla For Sale. Has 66 Ft. Rohn Tower with TA33 & -M rotor, 40 Ft. Crank-up & Tilt over tower with TR-44 r, 3 bedroom house with Deluxe Hamshack. Located 2 ks from marina on famous chain of lakes. April availability. 500.00. K4IIF, P.O. Box 205, Winter Haven, Fla. 33880.

BE King 500A modulator and power supply pair 811A with nets. $75. H. Hopkins, P.O. Box 204, Laytonville, Cal. 95454.

TED: Late model vibroplex original bug mint condx. F. er, 315 SE Wilshire Ave, Bartlesville, Okla. 74003.

RY XMAS and a Happy new year fromWØCVU. See you at National convention in '69 at Des Moines, Iowa. C. Boegel, Center Point Rd, NE, Cedar Rapids, Iowa.

TED: Complete set of QST, '46 to '51. $25. Rlwy exp coll. unther, 1141 N. 26 St, Milwaukee, Wis. 53233.

SALE: Drake TR-3 in ex cond. Used little $325. Bandit A linear $300. New drake R4A instruction book $1. K. ek, 211 Hillwood Dr, No Little Rk, Ark.

57 $8. BC-459 $8. BC-453 $10. Johnson 2 meter vfo $10. et 10 meter converter with info to convert to 6 meters Jack., 7 Elmtree La, Huntington, Sta, N.Y. 11746.

TED: Collins 3051 Linear J. Cottstock, Rte. 2 Shelbyville, 46176.

SALE: DX-60. Mint condition $60., FOB Boulder. Adolph H. er WAØSKE, 1938 Violet Avenue, Boulder, Co. 80302.

OR SWAP: Lampkin 205A Quad modulation mon. Excellent ition. Need Marconi 1064 gen. or equivalent. W. D. urray W4JQO Maynard Road, Cary, N.C. 27511.

SALE: Hallicrafters HT-32 SSB Xmtr. Price $225. Sorry will ship. W. E. Johnson W8VOK, 18595 Westbrook Dr., Livonia, igan 48152.

NO HAMFEST '68: May 4, 5, 6, Tropicana Motel. Main prize 500. Pre-registration prize Tri-Ex 54' tower delivered. FARC, P.O. Box 783, Fresno, Calif. 93721.

TED: Precision model 110 volt-ohmeter; Millen tone gen- r and Wheatstone bridge in good or repairable condition. idman, 735 Greens Ave., Long Branch, N.J. 07740.

TED: DX-35 or DX-40 Good shape reasonable. R. G. Bosc, Box 203, Warroad, Minn. 56763.

TIFUL: 600 watt, 10 to 160, Homebrew, 6 ft. rack, built cope. Fone and CW—xtal & VFO. Sell for $100. Joseph , 54263 Northern Ave., South Bend, Indiana 46635.

SALE: Two variable vacuum capacitors, 20-750 mmf. type . $50 each. W3COG, P.O. box 231, Coatesville, Pa. 19230.

SALE: Antique QST magazines. 1920, 1921, 1922. Send for list. J. Kanode, W4WSF, 244 Parkway, Winchester, 2601.

SALE: Heath HO-10 monitor scope with manual, $40. m vertical V80 never used, $12. Will deliver reasonable nce. Jack Koplin, RD 1, Zionsville, Pa. 18092.

ED: For USA-CA; QSL's From 1,000 stns. worked. 3C6UP, 9st. N., Lethbridge, Alberta, Canada.

ED: PR-4CX250-4CX300A ceramic sockets & chimneys with in by-pass condenser & grd. cathodes. James C. Bennett, Vinewood, Wyandette, Mich. 48192.

E: New Indian 2 cyl. motor. Tran-ign-kick starter. Value For test equipment, converters 2-6-10 meters. Reuben W9NES Rt. 1, Box 271, Marinett, Wisc. 54143.

FOR SALE. Viking II, Factory wired, with push to talk. $85. 122 VFO, $15. Ralph Methany, 212 South Park Ave., Fremont, Ohio 43420.

FOR SALE or trade; 2 meter Navy Transmitter & Beam, $400. L. Horan, 186 St. Mary's St, Norwalk, Ohio 44857.

WANTED: Lakeshore Phasemaster Junior SSB exciter, J. Bell, 208 Pat St, Levelland, Tx. 79336.

A MUST for every home and office. A national zip code directory postpaid to you $1.00. R. A. Weignad, 177 S. Union Ave, Salem, Ohio 44460.

FOR SALE: Heath warrior HA-10 $175. Heath monitor Scope, HO-10 $50. Gonset communicator 111 6 meter, $150. All like New. R. Sipe. Box 157, Willshire, Ohio.

HEATHKIT: for sale a model HD-10 electronic keyer. Flawless $30. Firm. Shipped prepaid. S. Barry, 384 Union St, Uniontown, Pa. 15401.

TELEGRAPHER'S Key tip clip or tack wanted. R. W. Randall, 1263 Lakehurst Rd, Livermore, Ca.

COLLINS Kwm-2/136B-2, 516F-2, 312B-5, $1250. Allmint condx. Ship USA Factory cartons. D. Leddin, 301 Doothy Dr., Richardson, Tx. 75080.

SALE: Radio testing, service instruments, scope meters, generators, military surplus, transmitters, receivers, tubes, coils, resistors etc. Ham Shack, antenna, tower. F. Yonker, 724 W. Fairmount Ave, State College, Pa. 16801.

RTTY—Want 28ASR or KSR Sell typing reperf & TD, new also heath Professional scope excellent condition, Mendelson, 27 Somerset Pl. Murrayhill, N.J. 07971.

TR-4, AC-3 $485. HQ-170C $169. HT-32A $225. RTTY Model 15 $55. FRXC TD & Reperf $60. Cert. CK or MO All mint. D. Burns, 4410 Reading Rd, Dayton, Ohio 45420.

WILL PAY liberally for manual and/or schematic for old Navy model OBQ VTVM. F. Kinsey, 15711 So. Whipple St, Markham, Ill. 60426.

WANTED: CQ, April 1945: r/9, Nos. 40,41,43-49; any SW Craft; Radio, July 1935; 73, Jan 1961; Calling CQ (DeSoto). F. Herridge, 96 George St, Basingstoke, Hampshire, England.

RTTY Equipment. TU, Model 14 TD; Scope monitor; Schematics, manuals, Etc. F. Demotte, P.O. Box 6047, Daytona Beach, Florida 32022.

GPR-90 Rcvr. excl condx and realigned $150 Swap to min trans tv or VX-105 for ncx-5. H. Lowenstein, Short Hills Terr. Apt. 4E, 806 Morris Turnpike, Short Hills, N.J. 07078.

FOR SALE: Mosley TA-40-K 7mc conversion kit for TA-33. Used 2 years, never abused. $20 plus 15 lb shipping. J. Krentz, 8640 Melva St, Downey, Calif. 90242.

MAGNECORDER PT-6 Both amplifier and tape deck, in good shape, want $350. or SSB Transceiver. D. Storm, 2132 West Paris St, Tampa, Fla. 33604.

HEATH "tener" excellent condx. Operates 110, 6, and 12 V. All manuals, cables, and power supply included. $60. Syl Polunsky, P.O. Box 111, San Angelo, Tex.

WANTED: Antique radio tubes made prior to 1920. S. LaDage, 431 Oakland Ave, Maple Shade, N.J. 08052.

WANTED: Dial plate & knob for B&W 850A coil. P. Greenway, 234 Elden Dr., NE, Atlanta, Ga. 30305.

APR-4 recvr w/coils 75-1000 mcs, $100; Cleanup shack similar gear, stamp for list. C. Spitz, 1420 S. Randolph St, Arlington, Va. 22204.

WANTED: HW-32 in damaged or unworking condx. Only dogs and lemons please. M. Ludkiewicz, 143 Richmond Rd, Ludlow, Mass. 01056.

WANTED: Schematic, or information on lyradion No-K551 BC Rcvr. or will trade for ham gear. B. Nevel, 1905 E. Bowman St, South Bend, Ind.

FOR SALE: Drake R4A, T-4X, MS-4, AC-4 Perfect condx. $750. Lafayett HA-650 6 mtr xcvr and 501 power supply new only used for about 10 qso's $99. Knight T-60 with relay $35. B. Bulchis, 64 Summer St, Hawthorne, N.J. 07506.

FOR SALE: Heath apache with SSB Sb-10 Adapter, $130 knight R-100 rcvr, $50. Complete set of accessories—list for SASE. R. Beaudet, 2 Rocky Crest Rd, Cumaberland, R.I. 02864.

WANTED: Antique radio tubes, made before 1920. S. LaDage, 431 Oakland Ave, Maple Shade, N.J. 08052.

FOR SALE: Hallicrafter HT-32 in mint condx. Looks like new. $225. Works Perfect. B. Nastoff, 320 W. 56th Pl, Gary, Indiana 46408.

FOR SALE or Swap—Mosley CM-1 rcvr in perfect condx. W. Drake Q-mult & Spare tubes, $55. Will trade for matchbox, beam, vertical. T. Ginkel, 832 So Payne St, New Ulm, Minn. 56073.

B&W 5100B, 51SBB with GD104 mike $150, Drake 2A,2AQ,2AC $150 both 275-FOB B. 1237 Dumont Richardson, Tx. 75080.

FOR SALE: TH6 2 yrs old with BN-12 Balun, $80. Mosley 3 el zometer. 14' boom $25. P. Neroum, P.O. Box 653, Bristol, Conn. 06010.

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COLLINS 75S-3 recvr. $385. FOB Good Condx. Rm Vaceluke, 17 W. 540 Hillcrest, Wooddale, Ill. 60191.

COLLINS F455 N20 2.0 kc. mechanical filter (good condx). Will take highest offer. R. Wilson. University of Iowa, Iowa City, Ia. 52240.

COLLINS 32V2 mint condx—come and get it for $125. D. E. Farmer, Lafayette Area Voc Sch, Springhill Dr, Lexington, Ky. 40503.

FOR SALE: Johnson 250-39 or B&W 380 T-R switch—$15 ea; H-P 400 HVTM $160. PCa-200 Panadopter, Make offer. C. Gordon, West Main St, P.O. Box 85, West Millbury, Mass.

WANTED: Cq 1945: Jan. March, April, July, Sept. Nov. or bound volume. Also need CQ Feb. 1946. Clean, complete copies, please. W. Womack, 6617 The Parkway, Alexandria, Va. 22310.

FOR SALE: Swan 350 with AC Power Supply original carton. New Jan 67 $375. G. Ted. Anderson, Southland Acres, Box 104, Tuscola, Ill. 61953.

SWAP LN Mamiyaflex C3 professional camera with 80 mm. & 180 MM. lenses for Multi-band S S B Xcvr. S. Schultz, Sheep Lane, Locust Valley, N.Y. 11560.

SB2-LA 1kw Linear 80-15 meters $150. P. Sherry, 55 W. 14th St., N.Y.C., N.Y. 10011.

FOR SALE: FM radio $6. Hetrociter described in Mar 63 CQ $40 —old books wireless telegraphy by Seeling 1915 $1. BC 348 Manual $1. Misc old Eng. Books $1 ea write. E. Marriner, 528 Colima St, LaJolla, Cal.

FOR SALE. Magnecorder Pt-6 tape deck and amplifier. Gud Condx. No toy. $350 or best offer. D. Storm, 2132 West Paris St, Tampa, Fla.

MATCH BOX—250 W with SWR $40. Mini-Beam B-24 6 thru 20M $30. LRL 66 All band antenna $15. $75 for entire package. J. Siegel, Clair Ct, RFD 3, Yorkstown Heights, N.Y.

B & W 5100 and 51SB complete. C. Ludlam, 2309 Bullington St, Wichita Falls, Tx. 76301.

HEATH—SB-300, $180, HA-460 6M transceiver, $125. Will ship. C. Hickman, 184 Park Ave, Binghamton, N.Y. 13903.

ALL types of printed circuit board, QST, CQ, 73, send for list. B. Hayward, 3408 Monterey, St. Joseph, Mis. 64507.

VIBROPLEX origionla Bug with cord and wedge set. Like new. $15. J. Salais, 817 So. Sappington, St. Louis, Mo. 63126.

SELL: HO-13 $40; CT-1 $7; MM-100 $5; SX130 $120—All plus shipping. T. Bornback, 19 W 167 21st Pl, Lombard, Ill. 60148.

WANTED: Good continuous tuning low frequency receiver covering 20kc through 500kc send description and photo, if possible to G. Frazier, RFD 1, Ossipee Trail, Sebago Lake, Maine 04075.

WANTED: 6 & 2 meter transceivers for visually handicapped. Wm Thowe, 10734 Dunawaa, Dallas, Tx. 75228.

WANTED: Hammarlund SPC-10 SSB converter for SP-600 Series receivers. R. Schlosser, 3505 Myers Court, Jackson, Mich. 49203.

MOBILE antennae and body mount. A/S whips for 15,40,75. Bumper mt. Any item $5. J. Mankus, 11431 Ortega Dr, Saint Louis, Mo. 64138.

WANTED: Wilcox F-3 or CW-3 Receiver, FM Recvr., For Sale; Harvey Wells, TBS-50C xmtr., T-90 xmtr., R-9A rcvr., Ameco 2m converter, d R. LaBrenz, 940 W Hampton Rd, Essexville, Mich. 48732.

COMMUNICATOR: I for sale, prefer pick-up cash deal, $75 money back guarantee. Claude Bare, Box 2, Greenbank, W. Va. 24944.

BOOKS on antennas, transmission lines, microwave theory, hardback or paper new or used wanted. State cond and price. D. Etherdge, 12040 Redbank St, Sun Valley, Cal. 91352.

SELL: mint cond Galaxy V MK II, Deluxe Access Console, AC 35 pwr sup never used 80/40 cliff dweller $450. M. Schwartz, 4608N Central Park Ave, Chicago, Ill. 60625.

FOR SALE. Galaxy V ACPS, Speaker, VOX, Cal, Mint. $350. B. Blackburn, 444 Colton Rd, Columbus, Ohio 43207.

WANTED: 30L1 please give age and serial #. C. Kaufman, 231 So. Jasmine St, Denver, Colo.

WARRIOR $140. Wollensak rcdr T-1500 $65. Lot $200. Manjals, Excellent. Shipping FOB. Will trade-in good 5 band xcvr with AC/DC. C. Cordioli, 982 Bonneville Way, Sunnyvale, Cal. 94087.

RTTY Equip. TU, Model 14TD, Scope Monitor, Schematics, Manuals, Etc. F. DeMotte, 4008 S. Atlantic Ave., Daytona Beach, Fla. 32019.

WANTED: Any hams interested in forming a novice worked all states net on 40 meters. R. Hajdak, 4 Homer St. Greenville, Pa. 16125.

WANTED: GDO, VTVM, other test equip. R. D. Seder. P.O. Bx 14015 US Navy Comtracen Corry Field, Pensacola, Fla. 32511.

WANTED: PMR-6A, PMR-7 or PMR-8 receiver. Also have need for techmanual or diagram to T-5x464/ALt-7 will buy or copy and return. J. Beistle, 2738 Wilkie Way, Ft. Worth, Tx. 76133.

FOR SALE: HW-12-A transceiver, build fall 1967, perfect conds, $80. A. Gerhand, 326 W. Third St, Berwick, Pa. 18603.

SELL: QST from '32 to present. Any quantity. Send you quirements. Need QST before '32 and CQ vol #1 to Vol E. Guimares, 17 West End Ave. Middleborough, Ma. 0234

VHF Horizons: Want complete run, what's your price? B. S 1238 Woodcroft Rd, Richmond, Va. 23235.

HEATH HA-10 KW, DB-23 preselector like New. Make Offe Emerald, 8956 Swallow Ave, Fountain, Valley, Cal. 92708.

HT40 ty $42.A1 DX35 tx $20.A1 SX101 Mark 3 $140. Vo Regulator 90-130V or 190-250V input with 115V and or 1½ switch selectable at 20 amp $12.50. W. Baxter, 402 E. Ja St., Tuscon, Az. 85705.

DRAKE 2B $160 TR3 $365. HAIO-Heath Warrior Amplifier Manuals with all. No trades please. Nick, 5750 Yukon Sparks, Nev. 89431.

FOR SALE: HB pair 813's GG.Table top self contained. looking. See QST Nov. '61 forpring. All band. $60. P. Rich, 1208 Cody, Wyo. 82414.

JOHNSON Valiant, good cond with spare tubes, going Transc Best offer around $150. R. Diehn, 3374 Blairmont Ave., To Ohio 43614.

ANTENNAS for sale. All bands, Very reasonable. S. Morton, Wellesley Dr., Cincinnati, Ohio 45224.

HW-32, 200W SSB Transceiver Like new. AC Supply, com $95. W. Pfaff, 12 Marys La., Centerport, N.Y. 11721.

STILL LOOKING for 75A-4 filters, 2.1 kc, 1200, 500 cycles; 3.1 kc for sale or trade. All letters answered. T. Beeler, Oak Hill Rd., Rt. 2 Candler, No. Car. 28715.

SALE—Commercial Geiger Counter, 20,2 and .2 mr. Ranges. new with manual Hophone, and calibrationsource. $35 or J. Thomsen, 8280 Tennessee Ave., Clarendon Hills, Ill. 6

FOR SALE: one Seneca VHFI plate modulated with 730 mod. Also Gonset G 63 receiver 6 throw 10 meters. Best JP Fuqua, Rte. 1 Box 118, Anderson, Texas 77830.

WANTED: Used books. Must be in good cond., and good Also need serviceman for Hickok 292X generator. A. L 3210 E. Mitchell, Humboldt, Tenn. 38343.

HAM CALL covers the tri-state Indiana, Kentucky, Ohio am news. Read Ham Call on the radio page. Cincinnati S Enquirer. Send in your news. Written by J. E. Weaver, Hollingsworth Way, Forest Park, Ohio.

F. HERRIDGE still hunting CQ for April 1945 after 17 trying. Astond me with a flood of offers of this one issu Herridge, 96 George St., Basingstoke, Hampshire, Engla

FOR SALE: Few western elec. #275A Mercury wetted r unused $1 each. Want: Heath or Eico keyer. G. Samofsky Eastern Pky, Brooklyn, N.Y. 11238.

WANTED: to buy; 4-1000 tubes. State price and cond. ne used. 3104 Harrison, Glenview, Ill. 60025.

WANTED: Bird wattmeter model 43 or similar. Have FM n transceivers on 146.94 mc to trade. W. Davis, 4434 Josie Lakewood, Cal. 90713.

CLEAN unused SB-400 xmtr $280. New heath HR-10 RX BC-348 with manual $40. Ranger Xmtr good cond $75. C May '55 thru Dec. '67 $45. Much more—stamp for li Shank, 21 Terrace La, Elizabethtown, Pa. 17022.

ELMAC AF-67 Xmtr with AC and Mobile DC supply $6 Iverson, 2640 So. 133 Seattle, Wash. 98168.

FOR SALE: Challenger w/6146's $60. Keyer for 500w final AM modulator (50)watts. $20, CW Audio Filter $5. M. K 3111 Greenwich, Chattanooga, Tenn. 37415.

BEST OFFER will take a new clegg 22'er in original c mint. Also a new ameco 6 & 2 VFO*. H Snyder, 2185 San St, Penn Hills, Pittsburg, Penna. 15235.

WANTED: Unmodified ARC-5 Receiver to cover the broa band. Lamar Gilbert, Gen'l Del, Section, Ala. 35771.

FOR SALE: Heath kit TX-1 Trans. AM-CW 180W good Condx. O. Gregory, 2134 Oak St, Apt. 1, Santa Monica, Cal. 9040

DRAKE 2C-2CQ-2NT-Bug-14AVQ SWrm Bridge 100 ft. R Phones-Key. All mint condx. $300 takes all. A. Rabinowitz, E 79th St., Brooklyn, N.Y. 11236.

88 MILLIHENRY Toroids for sale, uncased, five for $1.25, paid. L. Smith, 6218 E. King Pl, Tulsa, Okla. 74115.

BARGIN Tri-X-500 Trans. SSB, CW, am, 3.5 to 29.5 mcs. State Rect. 500 Watts pep table top mint cond. Mfg. Tri elec. Org. Price $695. Make Reasonable offer. E. Lubov 46 Middlesex Ave., Edison, N.J. 08817.

ANTIQUE: Tuble tester and inductance and resistance mea ments. Weston Model 565. Tests 01 thru 80 tubes. Wa 4-400's. B. Carlson, 1309 E. Elgenia Ave., W. Covina, Cal. 91

SELL: Gonset Comm III $75. With VFO $100; clegg 99R Both 6 mtrs—Buyer picks up. A. Derosier, 925 Jewett Staten Island, N.Y. 10314.

NEEDED old radio tubes like 201A, 01A, WD11, WD12 U99, and old radio's before 1926, also need Sixer, have citizen transceiver, radio, TV parts, meters etc. F. Holloway, Stratton St, Rockwood, Tenn. 37854.

See page 110 for New Reader Service

.: USC-500 w/turn head $50, Viking I $50, S-40B—$30, w Micromatch Model 262 $17, H/P 430C microwave Power er $125, Want Panscan. G. Trammell, 1507 White Oak Ct., insville, Va. 24112.

TED: Instruction book, heath visual-aural signal tracer, T-3. to make copy or buy. A. Hallaway, 6101 France Ave, So, eapolis, Minn. 55410.

D Companion for HT44.SX117 for sale. Needs light repairs. s, $200., or I will repair $250. H. Martin, Holly Branch Katonah, N.Y. 10536.

SALE: SBE-1MC mic for SB-34 as new $10. Dual TVV43 sistor stereo preams for Dual 1009 using mag. cartridge Extended range headset, 400 ohm $4. Schultz, 40 Rosesie Mystic, Conn. 06355.

T: KWM-1, swan 350, sell trade sig-gen GR-1208-B $100. 211-B $150. PW-SUP GR-1203-B $30. GR-1204-B $40. Wave er GR-566-A $30. All LN w/manual. L. Kulhay, 19 Topstone Shelter Knolls, Danbury, Conn. 06810.

SALE: Johnson pacemaker, $100. Hallicrafter Sx-101, WRL nditioned $135. 1000 Watt Linear Amplifier $75. D. Loewer, Schurr Rd, Clarence, N. York 14031.

EX YAGIS: 6 el.10m. $145, 3 el.20m(26' boom) $145. 00 $185; Drake 2B w/2AC $175. 2BQ $25. Ham-M rotor s 4(late) $88; Knight compressor C-577 $15. A. Balz, Box , Jupiter, Fla. 33458.

SALE: 2 Lafayette HE 15 CB transceivers with mike. One 12 V power pack. $35. for both. REA Collect. J. Miller, 8 Box 364, Springfield, Mo. 65804.

SALE: BC 221D Freq meter with ac pwr supply and calibra- book. Best offer, excellent condx. M. Freedman, 15 Ken- ton Oval, Isle of Sans Souci, Rochelle, N.Y. 10805.

TED: CDR-TR 44 antenna rotator, and a triplett model 850 . Will trade one 4-1000 A, new, for each item. R. Zuraw- Rt. 1 Box 184, Menominee, Mich. 49858.

ESSIONAL Scope, heath, perfect condx. Want model 28 or KSR Have typing reperf and TD. R. Mendelson, 27 erset Pl, Murray Hill, N.J. 07971.

SALE: Wheatstone oiled 15/32" perf tape for boehme key- head, any quantity. P. Lemon, 3154 Stony Pt. Road, Santa , Cal. 95501.

SALE: SBE 34 $300. Recently factory overhauled used less 100 hrs. Certified check, Shipped prepaid 49 states. D. son, P.O. Box 162, Wesson, Ms. 39191.

ING Hallicrafters HT-40 and lafayette kt-340 very good Best offer. A. Zurawski, 290 Ruggles St, Dunkirk, N.Y. 8.

7 orig cal/bk & PS $60. Hamscan HO-13 $45. 500W 811A's nd PS $100. Want Ultramin TV. H. Lowenstein, Short Hills Apt. 4E, 806 Morris Turnpike, Short Hills, N.J. 07078.

: 10 complete sets of CQ '57 to '66 $25.10 complete sets '51 to '60 $25. M. George, 35 Ridgeway Ave, Pittsfield, . 01201.

D 40 Ft crank UP tower under forty dollars $2 cash, or money order. For plans and Specs. Schelter, 1007 e, Burkburnett, Tex. 76354.

SALE: SX 88 Receiver, Original un-modified condx. $180. . Palmdale. W. E. Joyce, 2118 East Q-5 Ave., Palmdale, 93550.

DERBOLT: Latest model, used only ten hours. With power er, $295. Will ship prepaid. Don Woodruff, 15 Castlewood an Rafael, Cal. 94901.

UDEER transmitter 200 W. SSB, AM, CW, RTTY. Brand new, ct used 2 hrs. Best offer. D. Barbour, 2200 Grant Building, burg, Pa. 15219.

SX101 MK III Guaranteed perfect first check for $100. 2 M Transceive Pawnee $125. Ranger I needs repair $35. n 50W Exciter Mod 90801 $25. Millen Gridipper $20. rstein, 2469 Bambilane, San Jose, Cal. 95127.

SALE: Collins filters F250A67, F300X68 respectively 7KCBW, 3W and 6.3BW $15 each. will ship prepaid. F. E. Ferris, Williams Terr., Warner Robins, Ga.

SALE: Three model 14 TDs 75 and 100 WPM Ex. S. Carroll, Webb Ave, Olympia, Wa.

ED: Telrex tripbander and all band trap dipole. Galaxie nd VFO. F. Coble, 251 Collier Ave, Nashville, Tenn. 37211.

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 non-commercial classified ads any and every month absolutely free of charge. All you have to do is send us your mailing label, on a postcard, 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?

See page 110 for New Reader Service

READER SERVICE

NAME ____________________ CALL __________
(Please Print)

ADDRESS ____________________

CITY ____________________

STATE ____________________ ZIP CODE ______

Reader Service numbers below correspond to those at the left of the advertiser's names in the Advertiser's Index.

Please send more information on your ads in the Feb. '68 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	Total Inquiries ☐				

Void after Feb. 1968

CQ MAGAZINE, Dept. RS

14 Vanderventer Ave.

Port Washington, L. I., N. Y. 11050

advertisers index

R.S. # ADVERTISERS INDEX P

DX [*from page 74*]

sland in November and QSOed W1BB/1, K1PBW, WØVXO, W8ANO, W8GDQ, K3EKO, WA4PXP, and others. His signals peaked as high as 579 on Nov. 17 and 18 although he was running only 40 watts with a homemade transceiver.

On November 5 and 6 Jan put on a wonderful show from 6W8CW. His 40 watt signals were steady in W-land from 2300-0540 GMT both nights peaking as high as 589. His first ever G/6W8 contact was G3RPD, and his first ever W/6W8 was W1BB/1. He also QSOed G3OQT, G3RXH, G3SED, K1PBW, K2ANE, WØVXO, W2EQS, K8RNE, W4BGO, W8GDQ, W9PNE, K8BBI, W2IW, W2RAH, K3EKO, WA8EMJ, and others. Considering the *extreme* equatorial QRN his performance was masterful.

Jan hopes to reactivate these two spots and others rare ones as well in the near future. In the meantime, Herb Schoenbohm, WØVXO, is busy arranging his DXpedition to Central America and the Caribbean. This is to be a 160 only affair and should be underway before this column reaches you. Those of you who are interested in these 160 only trips may express their support to Herb at his new QTH: 515 Olive Street, Hannibal, Missouri, 63401.

QSL Information

P2AD — Ahmed Ebrahim, Sr., P.O. Box 94, Lyallpur, W. Pakistan.
P2MR — Via VE3ACD
Y5PX — To VU2IM (If you can work him.)
EØAE — c/o WA5PUQ
EØPK — Via WB6GOV
L2D — To K3JXO
T3USA — New manager as of Nov. 19, 1967 is VE3IG, 287 Kathleen Ave., Sarnia, Ontario.
B8ZZ — c/o FR7ZD
K8AC — Via WA6MWG
M7WQ — To W4OPM
D8BQ — c/o WA6MWG
P8DK — Via K7GHZ, 3213-R-Street, Vancouver, Wash. 98663
Y7YD — To VE3ACD
Y7YN — c/o W4EXO
GB5QM/MM — Via P.O. Box 7493, Long Beach, Calif. 90807
GM5AFI — To WA2KPS
HC5NW — c/o WA6MWG
HC8FN — Via WA2WUV
HC8JG — Rolf Sievers, Isla Santa Cruz, Islas Galapagos, Ecuador
HI8XAL — To W9SZR
HL9KA — c/o W2CTN
HM2BD — Via WA6MWG
JW5YG — c/o Norwegian Bureau
KA9AA — To KA9MF
KP4 QSL Bureau — c/o KP4CL, Box 1061, San Juan, Puerto Rico.
KP4BRD — Via Howard Kelley, K4-DSN, 6563 Sapphire, Jacksonville, Fla.
KP6AP — To Ed De-Young, 1942-A Iwaho Place, Honolulu, Hawaii 96819
KW6EJ — c/o W2CTN
MP4QBW — Via W4SPX
OD5CN — To K4ISV
OD5EP — c/o WB2ISL
OF9ZAA — Via DJ3KR
OX1AA — To K1OTC
PJ3CC — Nov. 25 & 26, 1967 QSOs via W1JYH
PX1GH — c/o W2OEH
PX1JS — Via F9JS
PYØAQB — To P.O. Box 1043, Recife, Pernambuco, Brazil
PYØDX and PYØSP — c/o P.O Box 842, Recife, Pernambuco, Brazil
SVØWL — For contacts after Sept. 24, 1967 send to W2CTN. Earlier QSOs may be confirmed via Capt. W. Corbin, Box 735, APO, New York 09291
SVØWV — Via K1UWJ
TA1KT — To K4IEX, 6316 Lee Lan Drive, Orlando, Fla.
TR8AG — c/o CR6GO
TU2CA — Via YASME
TY6ATE — To W4WHY
VE2XPO — c/o VE2NV
VK2ADY/9 — Via KØTCF, 423 Miriam Ave., Kirkwood, Mo. 63122
VK9DR — To W2GHK
VK9XI — c/o W2CTN
VK9GN — New Manager as of Nov. 1, 1967 is Gerry Johnson, 28056-216th. Ave., S.E. Kent, Wash. 98031
VKØCR — Via VK7ZKJ
VP1JKR — To VE3ACD
VP1LB — c/o VE3ACD
VP2AA — Via VE3ACD
VP2GTL — To W5EZE
VP5RS — Contacts after Feb., 1966 to K7UXN
VP7CC — Contacts after Feb., 1966 to K7UXN
VP8IE — c/o W2GHK
VP8JN — For QSOs after Nov. 6, 1967 send via VE2AGH, 104 Blvd du Coteau, Montmorency, Quebec
VQ9JW — To G3ONV
VQ9TC — c/o Doc, W4HUE, 4108 Southwest 5th. St., Ft. Lauderdale, Fla. Doc is now worldwide QSL manager for this station, not just for N. America.
VR2DK — Via W2CTN
VS6DO — To W2RDD
XE2YP — Non American stations QSL via Franz Turek, DL7FT
XW8AX — c/o W6KTE
YJ8BW — Via W4NJF
YV QSL Bureau — R.C.V., Box 2285, Caracas, Venezuela.
ZC4RB — To G3VIR
ZD5R — c/o VE4OX
ZD8CC — To K7UXN
ZE4JS — Via W3HNK
ZF1ES — To G3UXF
ZF1RD — c/o K8LSG
ZP3CW — Via WB2WFR
ZS9L — To VE4OX
3A2CU — c/o F8FH
4X4BL — Via WB2EDV
4J7B — To Central Radio Club, P.O. Box 88, Moscow, Russia
4W1KV — c/o HB9KV
4X4FQ — Via K2IRK
4X8TP — To VE3ACD
5N2AAF — c/o W7VRO
5R8BA — Via KØTCF
5U7AK — To WB6SSO
5U7AL — c/o W4WHF
5V1KG — Via YASME
5Z4KK — To K1SLZ
6O1GB — c/o W1YRC
7P8AR — Via W4BRE
7Q7LZ — To A. Pomfret, Box 13, Mzuzu, Malawi
9G1KG — c/o YASME
9H1AW — Via RSGB (G2MI)
9J2BK — W2GHK
9M8MS — c/o K2QJM
9U5BB — Via Boite Postale 14, Burundi
9X5GG — To W2GHK
9Y4VT — c/oW3DJZ

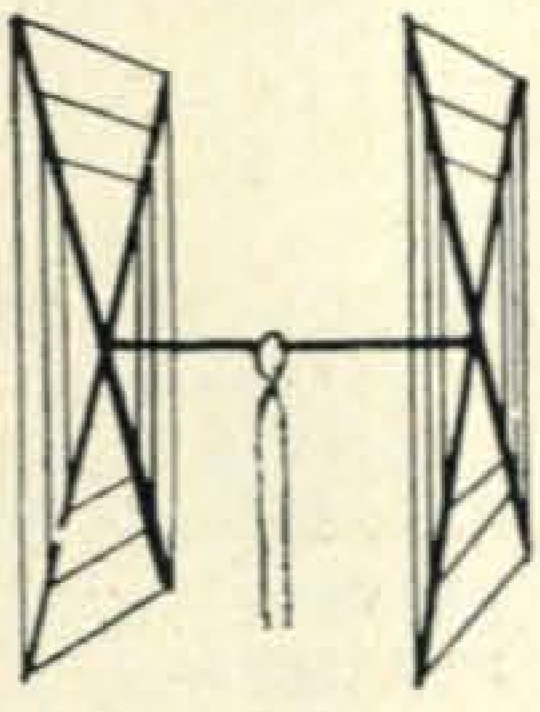
73, John, K4IIF

GOTHAM'S AMAZING ANTENNA BREAKTHRU!!

How did Gotham drastically cut antenna prices? Mass purchases, mass production, product specialization, and 15 years of antenna manufacturing experience. The result: The kind of antennas you want, at the right price!

QUADS

Worked 42 countries in two weeks with my Gotham Quad and only 75 watts...



W3AZR CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16′ square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10′ long x 1¼″ O.D.; 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.
Radiating Elements: Steel wire, tempered and plated, .064″ diameter.
X Frameworks: Each framework consists of two 12′ sections of 1″ OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞″ tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.
Radiator Terminals: Cinch-Jones two-terminal fittings
Feedline (not furnished); 52 ohm coaxial cable

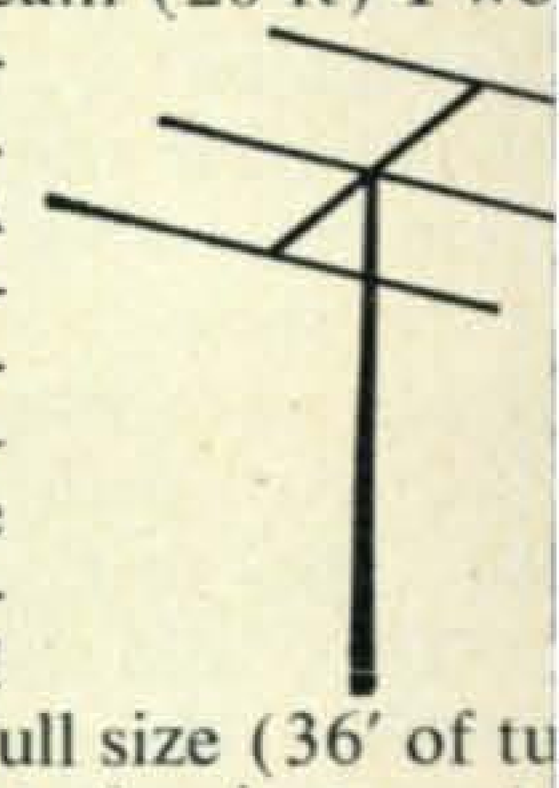
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$35.00
10-15 CUBICAL QUAD	30.00
15-20 CUBICAL QUAD	32.00
TWENTY METER CUBICAL QUAD	25.00
FIFTEEN METER CUBICAL QUAD	24.00
TEN METER CUBICAL QUAD	23.00

(all use single coax feedline)

BEAMS

The first morning I put up my 3 ment Gotham beam (20 ft) I wo YO4CT, ON5LW, SP9-ADQ, and 4U1ITU. THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36′ of tu for *each* 20 meter element, for instance) solutely complete including a boom and all h ware; uses a single 52 or 72 ohm coaxial line; the SWR is 1:1; easily handles 5 KW and 1″ alumnium alloy tubing is employed maximum strength and low wind loading beams are adjustable to any frequency in band.

2 EL 20	$16	4 EL 10	
3 EL 20	22*	7 EL 10	
4 EL 20	32*	4 EL 6	
2 EL 15	12	8 EL 6	
3 EL 15	16	12 EL 2	
4 EL 15	25*		
5 EL 15	28*		

*20′ boom

ALL-BAND VERTICALS

"All band vertical!" asked one ske "Twenty meters is murder these days. Let you make a contact on twenty meter phone low power!" So K4KXR switched to tw using a V80 antenna and 35 watts AM. H a small portion of the stations he wo VE3FAZ, T12FGS, W5KYJ, W1WOZ, ODH, WA3DJT, WB2FCB, W2YHH, FOB, WA8CZE, K1SYB, K2RDJ, K1M K8HGY, K3UTL, W8QJC, WA2LVE, MAM, WA8ATS, K2PGS, W2QJP, W4 K2PSK, WA8CGA, WB2KWY, W2IWJ, KT, Moral: It's the antenna that counts!

FLASH! Switched to 15 c.w. and worked IKN, KZ5OWN, HC1LC, PY5ASN, FG XE2I, KP4AQL, SM5BGK, G2AOB, CLK, OZ4H, and over a thousand other stat

V40 vertical for 40, 20, 15, 10, 6 meters .... $
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters .... $
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters .... $

HOW TO ORDER: SEND CHECK OR MONEY ORDER. WE SHIP IMMEDIATELY UPON RECEIPT OF ORDER BY RAILWAY EXPRESS, SHIPPING CHARGES COLLECT.

GOTHAM, 1805 Purdy, Dept. CQ, Miami Beach, Fla. 331

See page 110 for New Reader Servi