Project of the month: A Transistor RTTY Terminal Unit—Pg. 16

CQ

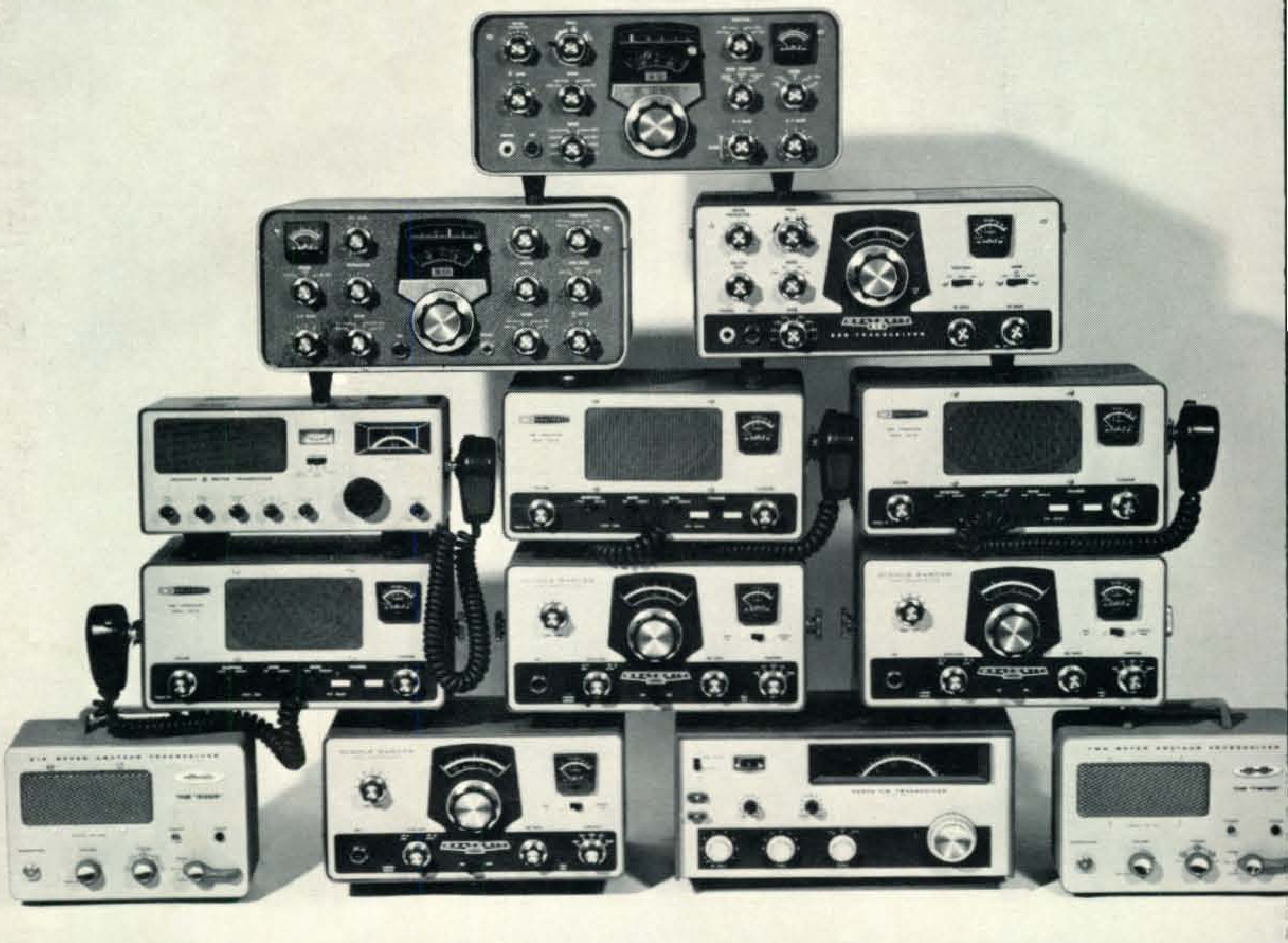
ICD

November 1968

75¢

The Radio Amateur's Journal

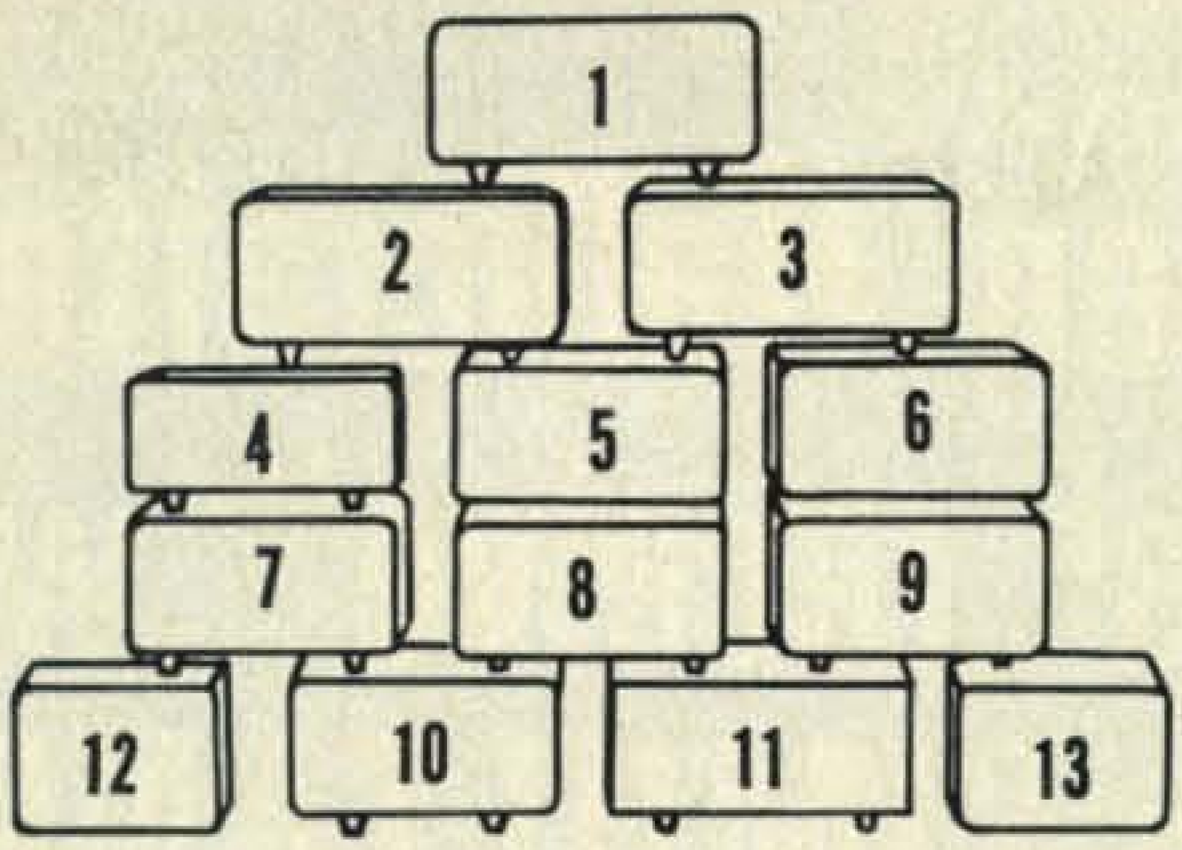
WHO MAKES MORE TRANSCEIVERS THAN HEATH?



NOBODY

(any way you look at it)

There Are 13 To Choose From



. **The SB-101** — the transceiver everyone wants and thousands already have. 180 watts input PEP on USB/LSB, 170 watts input on CW. Operates 0 thru 10. PTT or VOX. Linear tuning with 1 kHz dial calibration & virtually no backlash — ideal for crowded nitetime bands. Front panel switch election of either the standard USB/LSB 2.1 kHz SSB filter (2:1 shape factor) or the optional 400 Hz CW filter. The amazing versatility of the SB-101 an be extended even further with the optional SB-640 LMO. Get on the air with the best — get the Heathkit SB-101.
it SB-101, 23 lbs. **$370.00**

. **The SB-110A** — the "no compromise" 6 meter rig. 180 watts PEP JSB/LSB input, 150 watts CW input. 1 kHz dial calibration. Famous leath LMO. PTT or VOX control. Same crystal lattice filter as SB-101. Built-in 100 kHz calibrator. Switch select either crystal controlled trans- eiver or crystal controlled transmit with variable tuning receive-CW or ross-mode. Go six meters for less, and still get the best — go Heathkit B-110A.
it SB-110A, 23 lbs. **$299.00**

. **The HW-100** — Heathkit's newest 5 band transceiver and second nly to the SB-101 in performance and value. Work 80 thru 10 meters; 80 watts input PEP SSB, 170 watts input CW. High quality crystal lattice ilter. Built-in 100 kHz calibrator. Patented Harmonic Drive™ dial mech- nism. Solid-state (FET) VFO. PTT or VOX. Triple Action Level Control. lake friends & influence people — buy the HW-100.
it HW-100, 22 lbs. **$240.00**

. **The HW-17** — the better way to go All Solid-state 2 meter AM for ess. Perfect for local rag chews, nets & DX, as well as CAP, MARS & G Auxiliary. 25-30 watts input. Solid-state, dual-conversion receiver. re-built, pre-aligned FET tuner. Four crystal sockets plus provision or external VFO. Battery-saver switch & built-in speaker — well suited or rugged mobile work. Overwhelm your friends on 2 with the HW-17.
it HW-17, 17 lbs. **$129.00**

. **The HW-18-1** — the only way to go! This CAP SSB rig is inexpensive nd effective. Covers 4450 to 4650 kHz and provides 200 watts PEP input n USB; 25 watts input with carrier for compatibility with AM stations. rystal filter sideband generation. 1 uV sensitivity; 2.7 kHz selectivity. crystal-controlled channels, switch selected. PTT mike and mobile ount included.
it HW-18-1, 15 lbs. ... **$119.95; wired HWW-18-1,** 15 lbs. **$179.95**

. **The HW-18-2** — A 4450 to 4650 kHz MARS transceiver at a fraction f the cost you've had to pay before. 200 watts input on either USB or SB (you specify); 25 watts input with carrier. Fixed tuned for simple TT operation. Crystal filter IF for high selectivity. Switch select either f the two crystal controlled channels. ALC holds output constant under arying voice levels. Complete with PTT & mobile mount. Get fast, fficient MARS communication with the HW-18-2.
it HW-18-2, 15 lbs. **$109.95**

. **The HW-18-3** — Good news on 160 M rigs, OM!! 200 watts input n LSB; 25 watts input with carrier. Just select either of two crystal ontrolled channels and push-to-talk — what could be easier! One nicrovolt sensitivity and 2.1 kHz selectivity. Relayless transmit/receive witching. Automatic Level Control. Easy construction, fast alignment. ee you on 160 with the HW-18-3.
it HW-18-3, 16 lbs. **$109.95**

8. The HW-22A — the famous Heathkit 40 Meter Single Bander. 200 watts PEP input on either USB or LSB. Choice of power supplies for fixed or mobile operation. Front panel mike input, gain control & bias adjustment for easy change over. Slow AVC action for ideal SSB reception. 1 uV sensitivity, 2.7 kHz selectivity. Temperature compensated VFO. High quality crystal lattice filter.
kit HW-22A, 15 lbs. **$104.95**

9. The HW-32A — the world's best 20 Meter Single Bander. Operates either USB or LSB — 200 watts PEP input. ALC input for use with external linear. Run fixed or mobile, using either of the two accessory power supplies. Change over is easy, thanks to the front panel mounted mike input, bias adjustment & gain control. Built-in S-meter, PTT, VOX and ALC. Your best buy on 20.
kit HW-32A, 15 lbs. **$104.95**

10. The HW-12A — The popular Heathkit 80 Meter Single Bander. The world's best 80 meter value by far. 200 watts input on USB or LSB. Ten-tube superhet receiver with 1 uV sensitivity, 2.7 kHz selectivity and slow AVC action for superior sideband reception. Operates PTT or VOX. Built-in S-meter and ALC. Easy to change from fixed to mobile. Is there a better buy on 80? Not at this price.
kit HW-12A, 15 lbs. **$99.95**

11. The HW-16 — A high performance CW rig for the newest novice or most experienced old brass pounder. Optimum CW operation on the first 250 kHz of the 80, 40 & 15 meter bands. Power input adjustable from 50 to 90 watts. True "break-in" operation — solid-state TR switching and receiver muting. Crystal lattice filter for extra sharp selectivity of 500 Hz. You're on top of the action when your rig is an HW-16.
kit HW-16, 25 lbs. **$99.50**

12. The HW-29A — One of the very popular "Benton Harbor Lunch Boxes" — this one for six meters. There's a lot of action in this little package. The crystal controlled AM transmitter has a husky 5 watt input — ideal for local nets, CAP or MARS operations. The tunable super-regenerative receiver with RF stage has 1 uV sensitivity. Get on 6 with the HW-29A.
kit HW-29A, 9 lbs. **$44.95**

13. The HW-30 — The other "Benton Harbor Lunch Box", 2 meter transceiver. Interested in VHF? There's no better way to begin than with this one. Features 5 watt input to the AM transmitter and 1 uV receiver sensitivity. Comes complete with ceramic mike, meter jack and power cables for mobile operation. Can operate on USCG Auxiliary freq. of 143.28 MHz.
kit HW-30, 9 lbs. **$44.95**

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Describes these and over 300 kits for stereo/hi-fi, color TV, amateur radio, shortwave, test, CB, marine, educational, home and hobby. Save up to 50% by doing the easy assembly yourself. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

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Address__________

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Prices & specifications subject to change without notice. AM-201

See page 150 for New Reader Service

That's right—*simultaneous dual receive!* Unlike any other transceiver/VFO combination, the SR-400 Cyclone and HA-20 VFO lets you "Double-Team" the competition in any DX contest. You can "Band-Scan" for a second contact while you are working another. You can set VFO's on two separate DX stations, receive both simultaneously, and be instantly ready to "Tail-End" on either station. And of course, Hallicrafters' winning performance features don't stop here. Get in front of this rig and you'll know. Hallicrafters has built another "great one" in the fine tradition of the HT-32 and HT-37.

PS: Want simultaneous dual receive with 2 KW on SSB? Put an SR-2000 in your shack.

the hallicrafters co.

A Subsidiary of Northrop Corporation

600 Hicks Road, Rolling Meadows, Illinois 60008

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NOVEMBER, 1968 VOL. 24, No. 11

CQ

The Radio Amateur's Journal

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DEPARTMENTS

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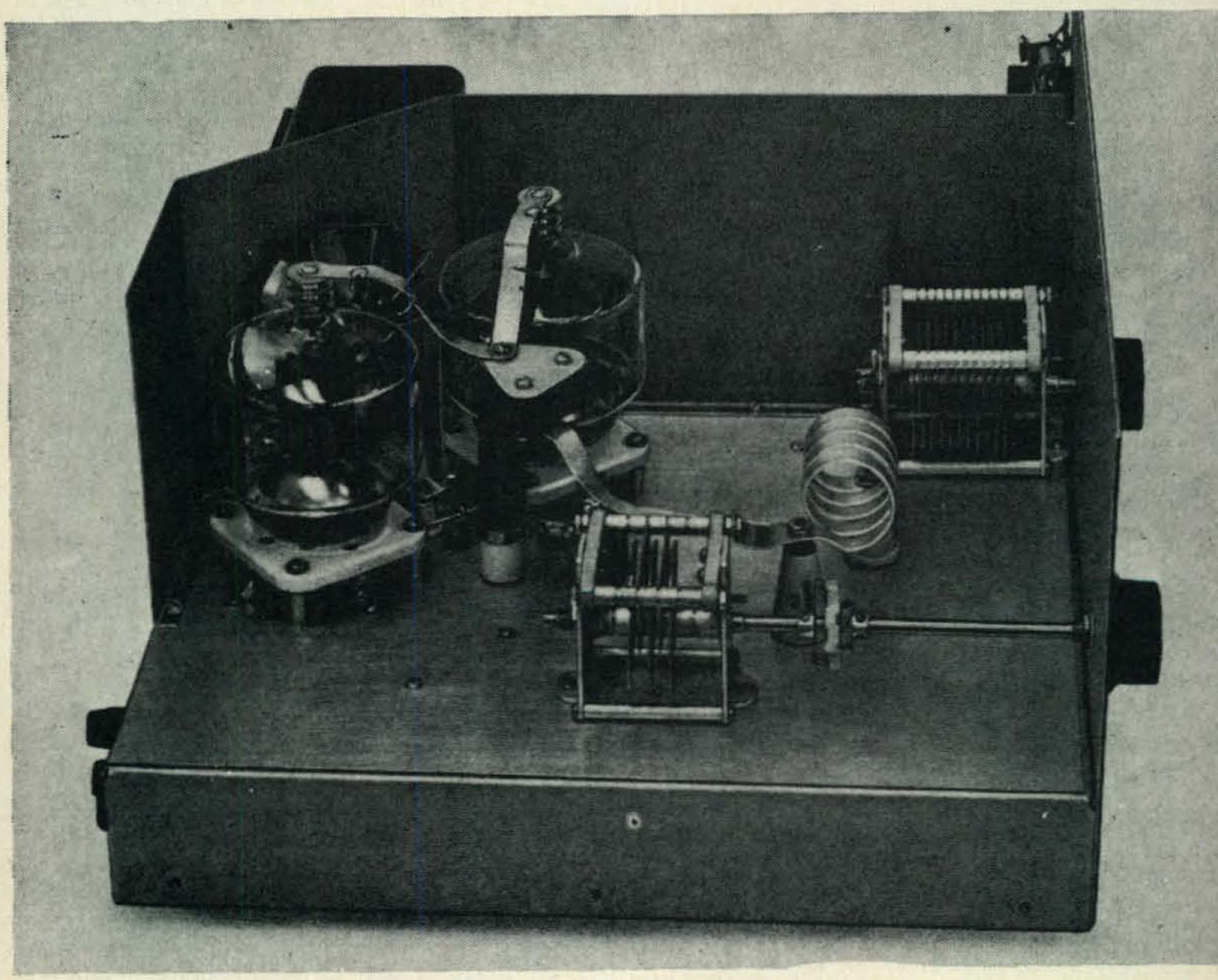

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ZERO BIAS

In July and August *CQ* we printed a two-part article entitled "Modulation Unlimited," describing a system of amplitude modulation enabling the operator to safely modulate a carrier in exess of 100% without creating the spurious interference normally associated with overmodulation.

The article has been the target of pot-shots by a few readers and by the editors of *73*. We've answered the criticism of the concerned readers, but what really irks us is the quick-change attitude and the total disregard exhibited by *73* for technical and legal realities. Facts follow:

FACT 1: "Modulation Unlimited" was accepted by *73* without question of its technical and legal validity. *CQ* investigated *before* it accepted.

FACT 2: The system described is technically valid and produces excellent results without exceeding a 6 kc bandwidth—*when properly operated!*

FACT 3: A recent detailed interpretation of the legality of "Ultra Modulation" by James E. Barr, Chief, Safety and Special Radio Services Bureau, FCC, indicates that the system—*when properly operated*—is as legal as s.s.b. or conventional a.m. Copies of Mr. Barr's letter are available from *CQ* for an s.a.s.e.

That is the extent of our defense of W3PHL's article. Whether or not you like the man, his signal quality or his chosen mode of operation, he writes a pretty good article, and has his feet on solid technical and legal ground. To *73:* try, occasionally, to be sure of the facts *before* condemning an adversary.

Frequency Restrictions

Later this month, the long-awaited Incentive Licensing regulations regarding the use of the most popular amateur bands will become effective—on November 22, to be exact. An awful lot of speculation has gone on this past year since the FCC finally made up its mind to take a stand on the volatile subject, and although the speculators seem about evenly divided between pessimists and optimists, all seem to agree on one thing: Incentive Licensing is going to quickly alter the nature of amateur radio in the U.S.

Surely a most stunning blow will be dealt by Incentive Licensing to this year's *CQ* World Wide C.W. DX Contest, coming only a day after the new band restrictions take place. By prohibiting all but Extra class operation in the bottom 25 kc of the 80, 40, 20 and 15 meter c.w. bands, the rules will bar probably 75% of the usual American DX contesters from some of the choicest DX frequencies. Current FCC licensing statistics tell us that there is a growing movement by General class amateurs towards the advanced and Extra class licenses, but growing movement or not, a large majority of U.S. participation in the *CQ* W.W. DX Contest will operate this year's test with one hand behind their back. It is our hope that overseas participants will take the U.S. restriction into account, and tune above the bottom 25.

To U.S. operators: Watch that band-edge!

Don Miller vs. ARRL

We haven't had too much to say these past few months about Don Miller, W9WNV. Perhaps our silence came at the wrong time, but frankly, it had little to do with the outcome on Don's lawsuit against John Huntoon and ARRL. But, we felt that for better or worse, the case was closed, and amateur radio should go back to being just amateur radio.

Don felt he had accomplished enough of what he had set out to do to be able to retire to his medical practice in peace. We *thought* ARRL was also pleased enough with the suit's outcome to simply report to its members, and get on with the business of being the largest commercial enterprise in amateur radio. The October *QST* quickly brought us back to reality with a two-pronged attack on Don's operations, punctuated, occasionally, with a morsel of unbiased fact.

Now, we're not going to get drawn into a running exchange with the editors of *QST* or anyone else, for that matter, but we feel bound to record our disgust with the vindictive attitude which has been demonstrated by this unnecessary "sneak attack" on the expedition.

On page 99 of this issue is a letter from Don Miller telling, finally, his side of the story of the out-of-court settlement. We hope this is the last time Don has to be "tried" on the same charge. He's proven that he's mature enough to admit *his* error. Is ARRL?

73, Dick, K2MGA

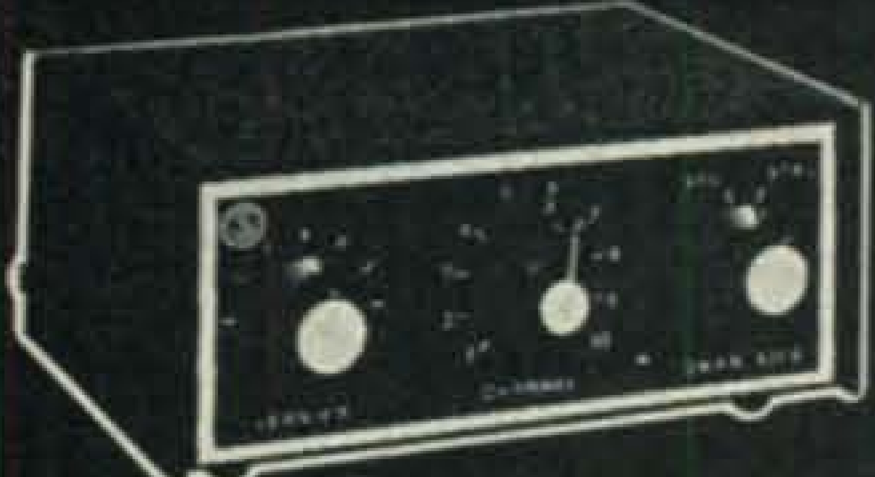
See page 150 for New Reader Service

RELIABILITY QUALITY VALUE

SWAN 508 FULL COVERAGE EXTERNAL VFO

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

$125



MARS OSCILLATOR

Ten crystal controlled channels with vernier frequency control. Plugs directly into Model 500C and may also be used with Model 350C and other Swan transceivers.

MODEL 510X (less crystals) . . $45

SWAN 500C SSB-AM-CW TRANSCEIVER

Five band, 520 watts for home station, mobile and portable operation.

The new model 500C is the latest evolutionary development of a basic well proven design philosophy. It offers greater power and additional features for even more operator enjoyment. Using a pair of the new heavy duty RCA 6LQ6 tetrodes, 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 flattopping!

The 500C retains the same superior selectivity for which Swan transceivers are noted. The filter is made especially for us by C-F Networks, and with a shape factor of 1.7 and ultimate rejection of more than 100 db, it is the finest filter being offered in any transceiver today.

For the CW operator the 500C includes a built-in sidetone monitor, and by installing the Swan VOX Accessory (VX-2) you will have break in CW operation.

Voice quality, performance and reliability are in the Swan tradition of being second to none.

$520

SWAN 117XC MATCHING AC POWER SUPPLY

Complete A.C. supply for 117 volts 50-60 cycles, in a matching cabine with speaker, phone jack, and indi cator light. Includes power cabl with plug for transceiver, and A.C line cord. Ready to plug in an operate.

$105

SWAN 14C DC CONVERTER

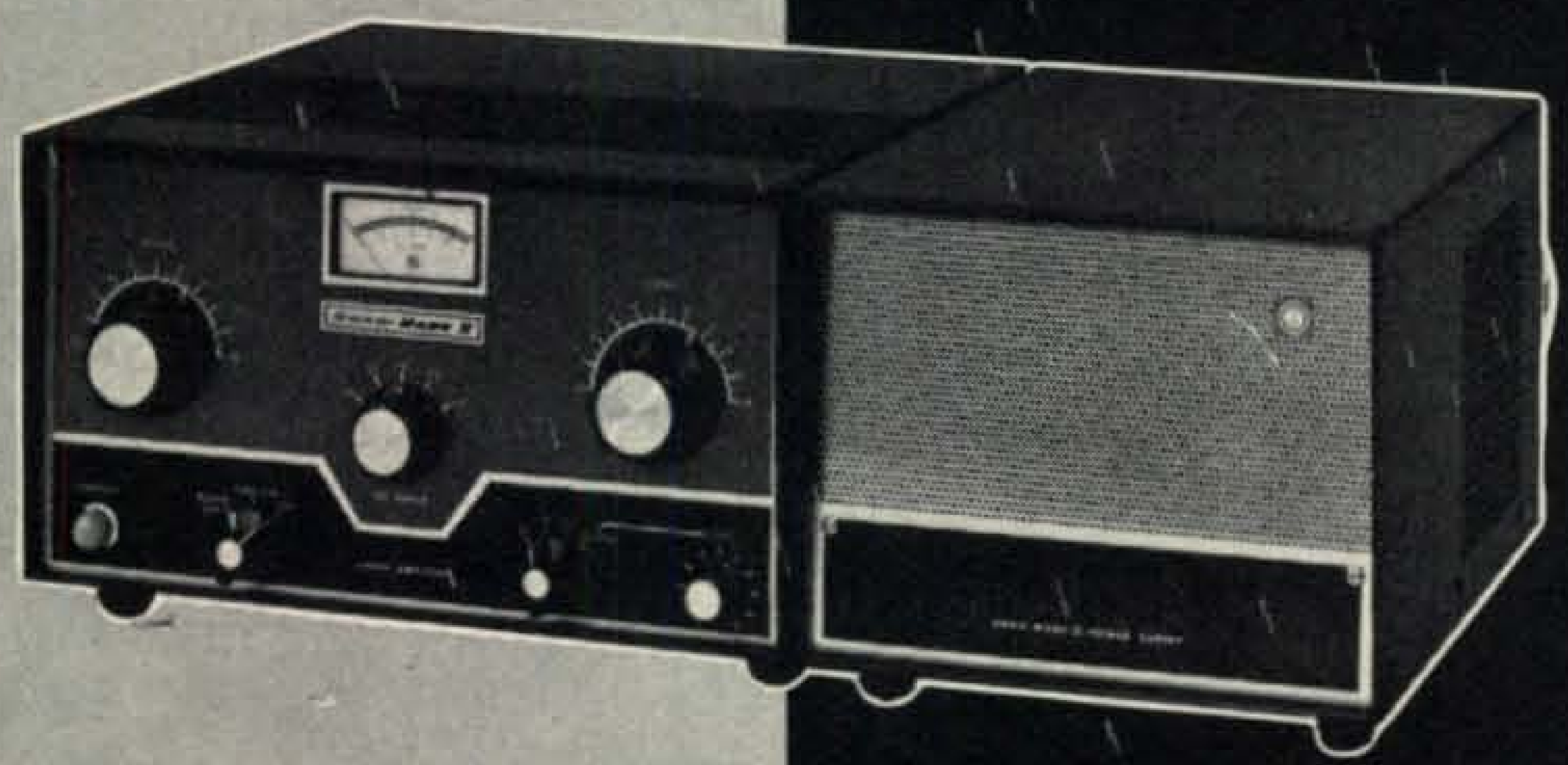
Converts the above 117XC A.C. powe supply to 12 volt D.C. input fo mobile, portable, or emergenc operation.

$65

SWAN SPEAKS YOUR LANGUAGE . . . ASK THE HAM WHO OWNS ONE

POWER

VERSATILITY



SWAN MARK II LINEAR AMPLIFIER

Two Eimac 3-500Z Triodes provide the legal power input: 2000 Watts P.E.P. in SSB mode or 1000 Watts AM or CW input. Planetary vernier drives on both plate and loading controls provide precise and velvet smooth tuning of the amplifier. Greatly reduced blower noise is provided by a low RPM, high volume fan. Provides full frequency coverage of the amateur bands from 10 through 80 meters and may be driven by any transceiver or exciter having between 100 and 300 watts output.

$395

PLUG-IN VOX UNIT

Plugs directly into Model 500C, and may also be used with Model 350C and other Swan transceivers.

MODEL VX-2 . . . . $35

SWAN 350C SSB-AM-CW TRANSCEIVER

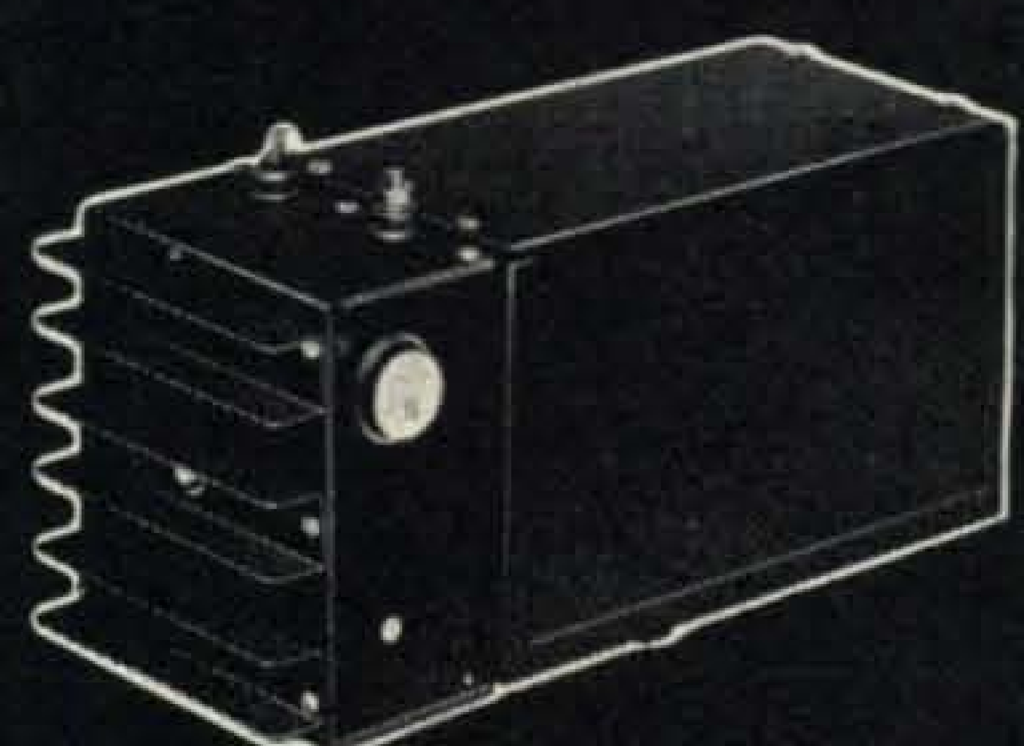
Our improved standard 5 band model, now in production and still only . . .

$420

MARK II POWER SUPPLY

May be placed beside the Mark II, or with its 4½ foot connecting cable, may be placed on the floor. Silicon rectifiers deliver 2500 volts D.C. in excess of 1 ampere. Computer grade electrolytic filters provide 40 mfd capacity for excellent dynamic regulation. A quiet cooling fan allows continuous operating with minimum temperature rise, thus extending the life and reliability of all components. Input voltage may be either 117 or 230 volts A.C.

$265



SWAN 14-117 12 VOLT DC SUPPLY

Complete D.C. supply for 12 volt mobile or portable operation. Includes cables, plugs, and fuses. Will also operate from 117 volt A.C. by detaching the D.C. module & plugging in 117 volt line cord. Negative ground standard. Positive ground available on special order.

$130

Illustrated on these pages is a complete Swan amateur radio station, one of the finest money can buy. Starting with the powerful 500C and an AC power supply, you are immediately on the air with a big, high-quality signal. Thanks to the excellence of the high-frequency crystal lattice filter, made especially for Swan by CF networks, you will have one of the cleanest and most readable signals on the air, as well as outstanding receiver selectivity and sensitivity. The various accessories from the Swan line may be added at any time, providing greater operating pleasure and performance. The tremendous acceptance of Swan products by radio amateurs throughout the world is most gratifying to all of the people at Swan. It is our continuing policy to offer the finest communications equipment we know how to design and manufacture, with quality control, craftsmanship, and service that is second to none.

73

SWAN

ELECTRONICS

OCEANSIDE, CALIFORNIA

A Subsidiary of Cubic Corp

OUR READERS SAY

Amateur Radio Expansion

Editor, *CQ:*

I comment on your editorial in September *CQ*.

1. Surely the EIA is biased–their aim is dollars no matter what the means. I am not concerned with this aspect, however.

2. You, too, are biased–you must surely be–I presume your livelihood depends at least partly upon amateur radio. But we all want the hobby to prosper. I have held a full license for over 30 years and am still active tho' mainly only in contact with old friends locally. I do not think that either the EIA's or your idea are the solution. Indeed I feel the worst step is to try and "sell" amateur radio via any means. The spirit of amateur radio, and there *was* one, (maybe there still is but I am not sure) came from within. It was an indefinable quality some people had. The idea of selling amateur radio like cornflakes appalls me. What is more–long term anyway–it won't work. Almost every amateur I know who has been encouraged to "come join us," yet who lacked the necessary flair previously mentioned, has soon lost interest.

I think there are two main reasons (which can be subdivided) for the decline. They are:

1. The decrease in the essential "spirit," I see no cure for this. This spirit was probably related to many factors such as the fascination of early wireless, the in-born liking of the human male for constructing things, etc.

2. The coming of s.s.b. because,

(a) The aforementioned "spirit" was often triggered by the casual hearing of a.m. phone stations while tuning round on old all wave sets. Today anyone coming across an s.s.b. signal would take no notice.

(b) s.s.b. took most of the constructing fun away–and often even the repairing fun.

(c) s.s.b. brought in a serious cost factor. Even allowing for your greater affluence, $600 or $800 for a transceiver and $1,159 for a tower must be a considerable deterrent compared to the earlier 6V6-807 r.f. and 2×6F6 in a modulator!

(d) The uniformity and boredom of s.s.b. commercial gear. What is there to inspire a youngster? It looks just like any other piece of commericial radio gear. I tell a true story. I have a cousin who is a K6. He visited me last year. I took him to a ham friend of mine who has modern gear (I'm still on a.m.) and what happened. We had a QSO with a German station and a K6 from near Oceanside. My G friend was using a Swan 350, and so was the German. How *un*interesting can you get!...

Martin, Lincoln, England
C. B. Raithby, G8GI

Modulation Unlimited

Editor, *CQ:*

Over the years I have considered *CQ* technical articles to be quite good. However, W3PHL's "Modulation Unlimited" article was, in my humble opinion, inconsistent with the state of the art. Modulation systems, such as single-sideband, conserve spectrum space (as compared to all double-sideband techniques) and ham periodicals should devote space to these rather than outmoded systems.

I have heard W3PHL on the air many times and he labors the point that the "redundancy of the other sideband" allows it to be utilized when QRM is present. Also, he talks about the use of synchronous detection systems for full utilization of the sideband power, etc. I would hesitate to debate the matter with him because of my admitted technical limitations, but I do know that one sideband is better than two when spectrum space is a factor, such as on the ham bands below six meters.

Another negative for his system (or perhaps for the way he's been using it) is that the FCC has taken a rather dim view of W3PHL's sidebands *vs.* spectrum space. As I understand it, their engineers have come out ahead on the argument!

On another matter; Don Miller, W9WNV and any number of other exotic calls both valid and suspect. When can we expect to read about his operations from St. Bradon and Rodrigues Islands, per the footnote on page 26 of August 1968 *CQ*. I can hardly suppress my excitement over his latest installment and I was keenly disappointed when it failed to appear in the September issue! Seriously, if you dropped the series, your readers deserve an explanation beyond the editorial comments in your August issue.

James A. Gundry, W8BW
Dearborn Heights, Mich.

Reader Gundry is not alone in his criticism of W3PHL's signal quality and his article. There can be no defense of a poor quality signal on the air, no matter what the mode, but the article describing the system is another matter. The "Super-Modulation" technique represents a high level of development in the field of amplitude modulation. Our purpose in presenting the article was not to pass judgment on the relative merits of a.m. and s.s.b., but rather to describe the mechanics behind a technique which is generally misunderstood. The technique itself, properly applied and adjusted, is acceptable by the FCC for amateur use, with certain limitations as to peak sideband power.

If W3PHL did run afoul of the FCC field engineers, it was due to deficiencies in his signal quality without regard to the method of generation.

On page 99 of this issue appears a letter from Don Miller to *CQ* offering his final comments on the Don Miller *vs.* ARRL suit. Next month, after some delays incurred by Dr. Miller while re-establishing his medical practice, Don's DXpedition tale will continue – non-politically, and purely amateur radio.–*K2MGA*

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Announcements

Houston, Texas

The Houston Amateur Radio Club will hold its 10th Annual Hamfest and celebrate its 50th Anniversary as an amateur radio club at the clubhouse on November 2, 1968, and at Spring Creek Park near Tomball, Texas on November 3, 1968.

For more information write to the Houston Amateur Radio Club, 7011 Lozier, Houston, Texas 77020.

Syosset, New York

The Nassau Satellite Amateur Radio Tracking Society will repeat its evening course in amateur satellite tracking starting November 4th. The course will be taught by Nicholas Marshall, W6OLO/2. For further details write: P.O. Box T, Syosset, New York 11791.

Los Angeles, California

Channel 13, Los Angeles, KCOP, will salute ARMY MARS Vietnam patch networks on Nov. 24th, Sunday at noon. The program, "The Intelligent Parent" has invited W6BUQ, WB6KPR, and W6NAZ to appear as guests.

Lake Texoma, Oklahoma

The Texoma Radio Amateurs Hamarama will be held at the Texoma Lodge on November 15th, 16th and 17th. The five-state affair will have all programs indoors to preclude weather interference to the wide variety of activities.

ARNS Publication Contest

The second annual Amateur Radio News Service "Publication Contest" is now open to all amateur radio publications except those of a national nature. Those interested are requested to send up to three issues of their 1968 publications to Al Smith, Contest Manager, WA2TAQ, Vice President, Publications; The Amateur Radio News Service: 11 Irving Place, Lynbrook, N. Y. 11563. Be sure to mark each publication "for contest". The closing date is January 15, 1969.

New Prefix

Czechoslovakian amateurs have special permission to use the prefix OM from September 1 to December 15, 1968 to celebrate the 50th Anniversary of the founding of the Czechoslovakian Republic.

Reminder: Incentive Licensing Effective Nov. 22

See page 150 for New Reader Service

Unique opportunity to own one of the world's finest all-band receivers. 500 kc to 32 mc!

R-390A/URR
Radio Receiver

Limited quantity of famous R-390A/URR radio receivers . . . brand new. Original manufacture, 1968 production . . . fully tested to meet U.S. Government specifications. Range 500 kc to 32 mc, 30 1-mc bands, digital readouts. Original pack, includes two instruction books, complete set running spares. New low price $1,700* . . . fully guaranteed.

*A few new, but shelf-worn, units available at lower prices.

WRITE OR CALL FOR DETAILS

EAC Industries, Inc., 20 Bridge Avenue, Red Bank, N.J./201/747-5100, Ext. 51.

HE MOST USEFUL GIFTS FOR CHRISTMAS RE GIFT WRAPPED WHEN YOU BUY 'EM

With more hi-fi kits, TV's, ham radios and electrical appliances being sold this season than ever before, it's a sure thing your friends will be needing topnotch soldering tools. Give them the best—Weller guns or Marksman irons in colorful yuletide packages. Gun kit sleeves are perforated to fit inside the open case, will be a welcomed sight under the Christmas tree . . . a useful gift all year long.

Weller SOLDERING KITS

Dual heat soldering gun kit. Includes trigger-controlled 100/140 watt Weller gun with 3 soldering tips, tip-changing wrench, soldering aid, flux brush and solder in plastic utility case. Holiday wrapped Model 8200PK-X.

Heavy-duty dual heat gun kit. Features 240/325 watt Weller gun plus extra tips for smoothing and cutting, tip-changing wrench, and solder. Holiday wrapped Model D550PK-X.

MARKSMAN pencil iron kit by Weller. Featherweight 25-watt iron for outstanding continuous-duty soldering, two extra tips, soldering aid and solder in re-usable heavy vinyl pouch. Holiday wrapped Model SP23K-X.

At Your Electronic Parts Distributor . . . Available in Canada

WELLER ELECTRIC CORP., Easton, Pa. *World Leader in Soldering Technology*

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Now I knowing why amchoors not building there rigs anymore. It's too hard to getting stuff from male-order houses. Like eggspearyance I having proving self-same point.

Summer before last are thinking it being reel peechy to getting stereo tape playback for Hon. Brother Itch's Jeep. So, searching thru various catalogues, and finely seeing what I wanting. It in catalogue put out by . . . let's be kind and calling it Nameless Electronics, Inc.

Are managing to fill out order form in twenny minutes. That's not a new world record, but it close. Hokendoke, why are those order forms so complicated?? Anyhow, writing check, stamping and sealing envelope, and putting it male.

Next cupple days humming tunes I can playing when getting stereo tape unit. Feeling reel jolly about hole thing. Four weeks later, nothing having happened, are not feeling jolly at all. In fackly, slitely disturbed.

So, dashing off letter to N.E. Inc. asking howcums? Getting order? Doing anything?

Well, something happening–one week later getting letter thanking me for order and saying there be slite delay – unit is backordered, but they expect to shipping in ten days.

Thrice ten days later (that poetical expreshun meening one dawgone month later) I still getting no shipment. So, Scratchi getting off hot note to N.E. asking when they shipping my order.

Shortly after this I are getting form letter saying yes, they getting order, and I be heering something soon. It not seeming like answer to my last letter–more like answer to my previous letter.

See page 150 for New Reader Service

Three weeks later Scratchi's steem pressure up high again, so sending telegram asking if getting my letter asking how soon they shipping and what are happening now.

One week later getting postcard saying sorry for delay in answering letter, but I be happy to know they shipping order in seven days. I not very impressed with postcard, on acct. it all printed, including the words "seven days." Also, this leeving my telegram unanswered.

This must be about time Nameless Electronics, Inc. are going on vaycayshun, on acct. I not heering anything more for cupple months. At this point Scratchi are getting a little panicky, and so I writing and asking for my money back.

This must have struck a nerve somewhere in the organization, as geting speshul delivery letter saying they sorry I find it necessary to sending telegram, that everything is hunky-dory, and yes, they expecting to fill order shortly.

I not reely sure if that letter answer to telegram, or answer to my letter asking for my money back, so I write and ask if money is being refunded or are they sending my stereo tape playback unit.

Two weeks and one set of fingernails later I getting check from good old Nameless Electronics, Inc. After all this correspondence, figyouring leest I can do is thank 'em, so I do.

Howsumever, old business geers are still clashing back at N.E., as next I are getting letter saying they not understanding my letter asking if they refunding money or sending stereo unit, on acct. they alreddy sending me the equipment. Would I straighten them out?

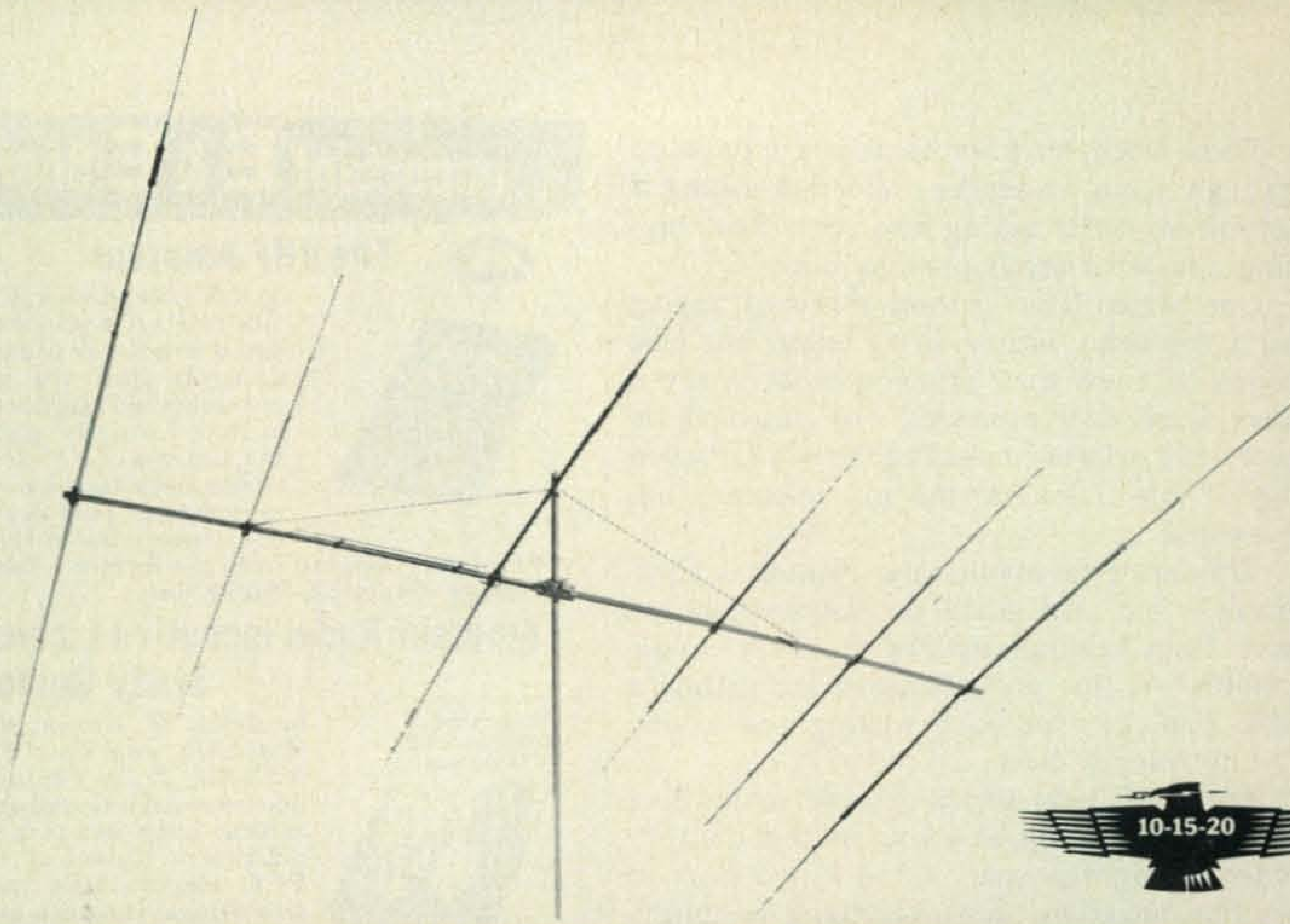
Well, Hon. Ed., if you ever saw a letter straightening sumbuddy out, you should seeing letter I sending post hasty to N.E. Just to mailing it costing me twenny-four cents.

Yesterday hole affair coming to gloryus conclushun. Are getting the unit I ordered, and, a letter from bank saying good old N.E.'s refund check are bouncing.

Now you thinking maybe I happy. Hah!! It taking so long to get it, my 4-track stereo playback unit are obsolete. Everything are 8-track now. Yours disgustedly, and

Respectively yours,
Hashafisti Scratchi

See page 150 for New Reader Service



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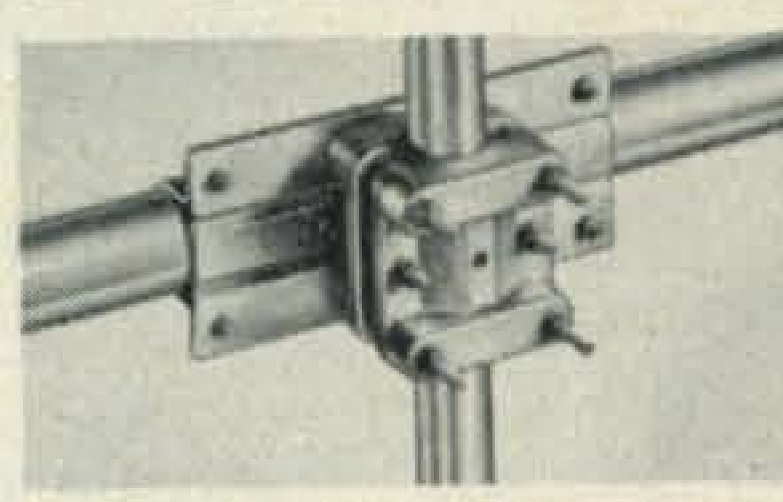

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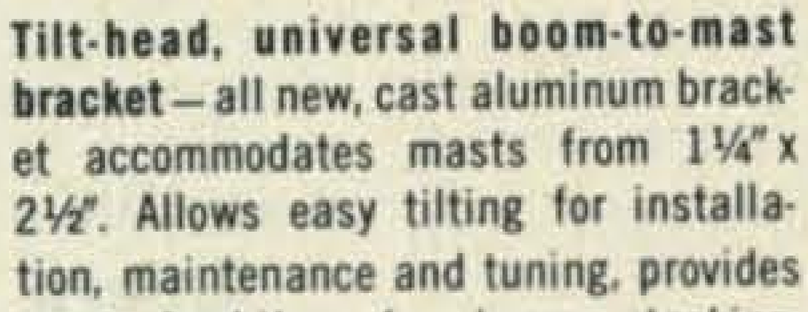

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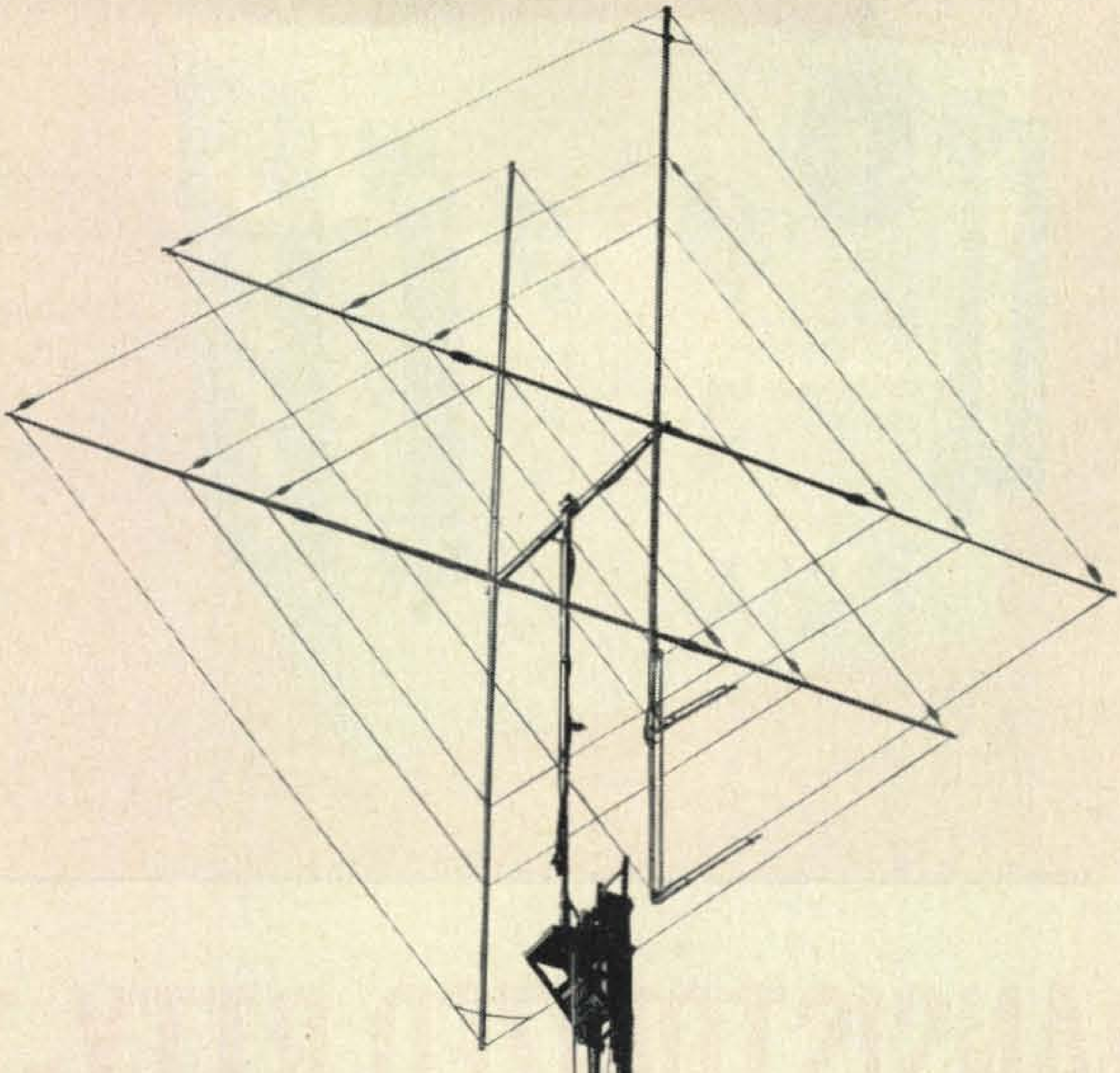

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• Tri-band 2 element construction with individually resonated elements with no inter-action.
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Overall length of spreaders	305"
Turning radius	13'6"
Weight	42 lbs.
Boom diameter	2"
Boom length	8'
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Wind survival	100 mph
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Input impedance	52 ohms
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Power	Maximum legal
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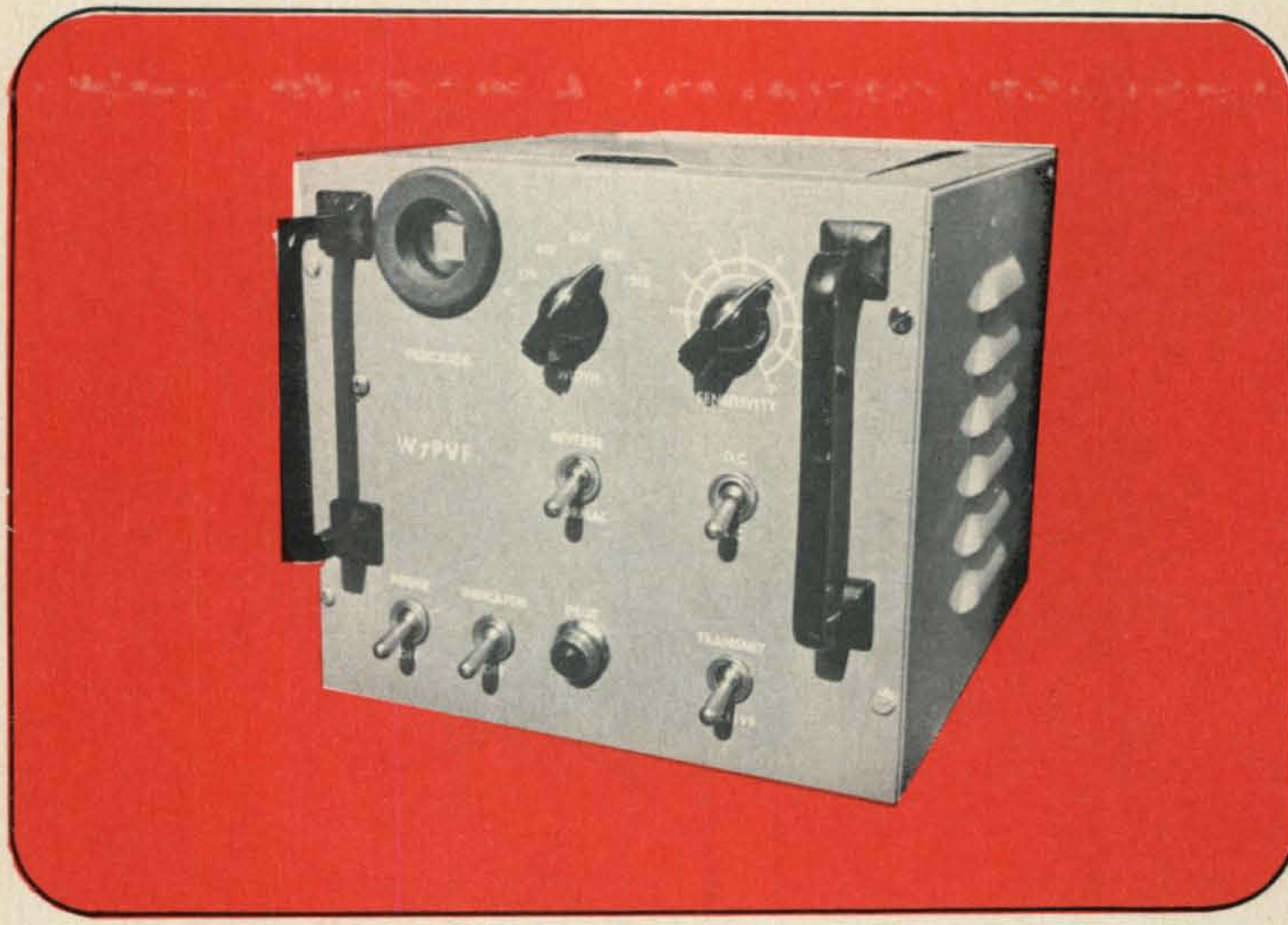

A TRANSISTORIZED RTTY-TU

BY NEIL IVERSON, *W7PVF

THIS TU was designed to fulfill the following requirements: (1) fully transistorized except for scope or indicator, (2) small size, lightweight and low power consumption, (3) performance equal to or better than the best available vacuum tube designs, (4) no relays in the loop, and (5) a proven basic circuit with modern state of the art improvements.

Basic Circuit

A search through my magazine file turned up a real gem of a basic circuit, the WØACV design in August 1959 *CQ*.[1] Surprisingly, this circuit has been waiting all these years with no updating or improvements and is capable of being one of the finest TU's available. Selector magnets require less than 1 watt of driving power and small output transistors are ideal magnet drivers. This circuit is sound. Modifications to the basic circuit include (1) additional front end gain and limiting for greater dynamic input range, (2) an active low pass filter following the detector for better noise rejection, (3) an automatic reset circuit to keep the machine from running open loop for longer than 1 second and (4) a built in simple tuning indicator.

This chassis was assembled using plug in cards to make future additions and modifications a simple matter. Further improvements are bound to happen, so keep it flexible. A 6AL7 indicator tube is used in place

* 2640 So. 133, Seattle, Washington 98168.

[1] Kretzman, B. "RTTY Column," *CQ* August 1959, p. 78.

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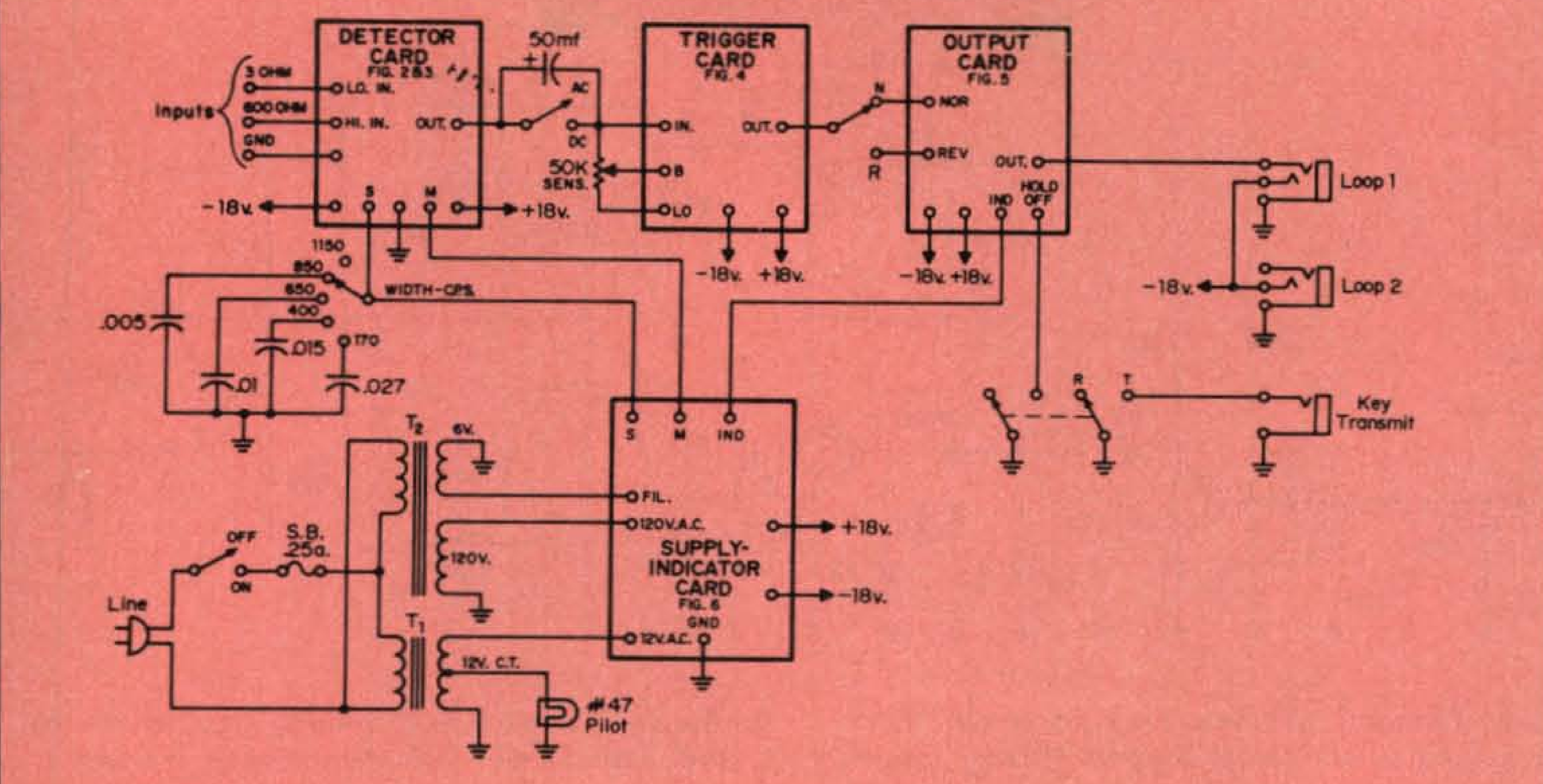

Fig. 1—Block diagram showing the interconnection of the plug-in cards, controls and power supply.

T_1—Filament trans., 12.6 v.c.t., 1 amp.
T_2—Power trans., 120 v, 10 ma, 6.3 v, 1 amp.

of a scope and is entirely adequate for precise tuning. It displays *mark* amplitude in the upper left segment, *space* in the upper right segment and the keyed output signal at the bottom. Many junk box parts were used throughout this unit, so don't be too surprised if your power transformers look different than mine, as an example.

Circuit Description

Note that the chassis is largely interconnection wiring and the few front panel controls. All input and output connectors are on the rear panel. Four cards are shown in the block diagram of fig. 1. A fifth autostart card was designed, but not used in this unit. The detector card provides amplitude limiting, f.m. demodulation, low pass filtering and low impedance output. The A.C.-D.C. switch is normally used in the D.C. position, but can be opened if some frequency drift is experienced. This allows copy of drifty transmitters or slow warming receivers. The SENSITIVITY pot is adjusted for best keying. The trigger card is a multivibrator configuration that squares up the detector output and drives the output card. Note that the output loops in this unit are series-parallel combinations, due to the low value of driving voltage. Typical loop configurations are shown in fig. 7.

Figures 2 and 3 are the detector card and layout. Transformer T_1 can be almost anything that will increase the 3 ohm speaker output impedance to somewhere between 600 and 5000 ohms. If your receiver has a 600 ohm output, you won't need T_1. Diodes CR_1 and CR_2 are limiters; Q_1 provides gain and should be a very high beta transistor, the higher the better. Diodes CR_3 and CR_4 provide further limiting and Q_2 and Q_3 provide drive to the toroids and isolation between them. Diode CR_5 is necessary to equalize the operating points of the transistor pair. Capacitor C_{10} on the *space* toroid is made small for shift widths up to 1200 cycles. Normal and narrow widths are copied by switching in more capacitance from the front panel. The tuned circuits are broad enough to copy intermediate widths between switch positions. The detectors are doublers for maximum output voltage swing. Transistor Q_4 serves a dual purpose; it provides a low impedance output to drive the trigger and with R_{16}, C_{14}, C_{15} and the input resistance, forms an active low pass filter that is 3 db down at about 100 cycles and rolls off at about 12 db per octave. This little filter works as well as the larger passive L-C types with single sections. This roll off is a bit higher than normal, but will accommodate speeds up to 100 w.p.m. without changes.

Control R_{18} adjusts the d.c. output voltage

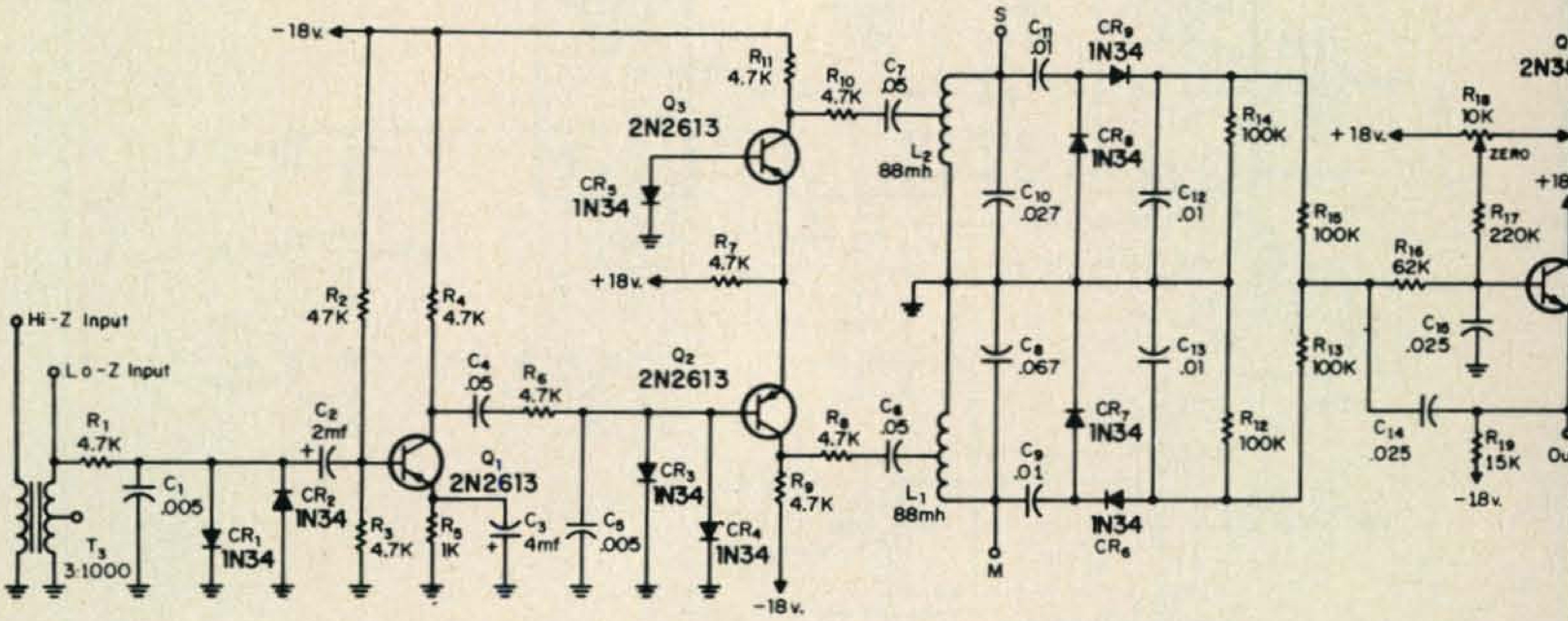

Fig. 2—Terminal unit detector card circuit. Inductors L_1 and L_2 are center tapped 88 mhy toroids. Pot R_{18}, Zero Balance, is a Trimpot, mounted on the card. Transformer T_3 is described in the text.

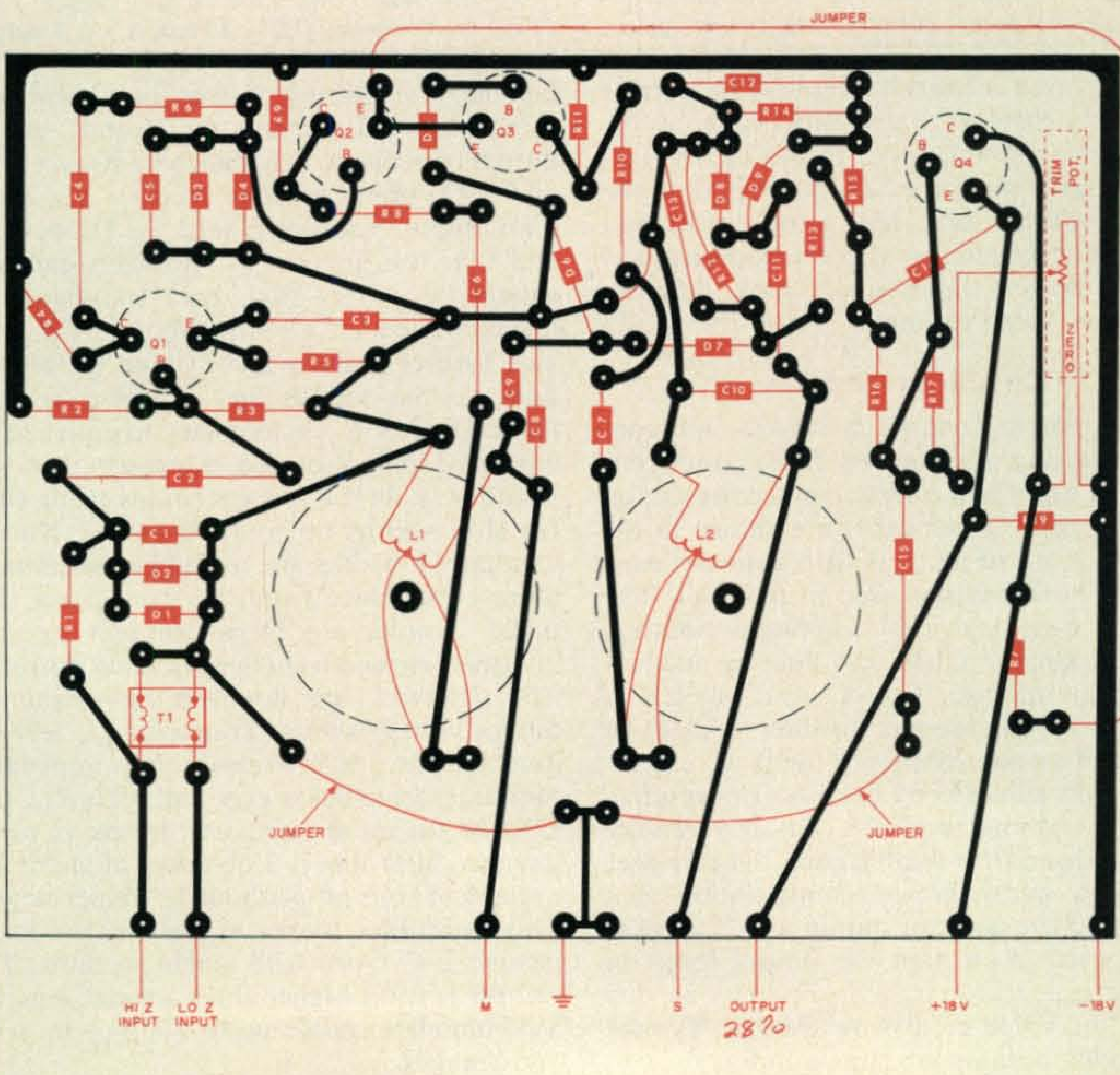

Fig. 3—Terminal unit detector card layout.

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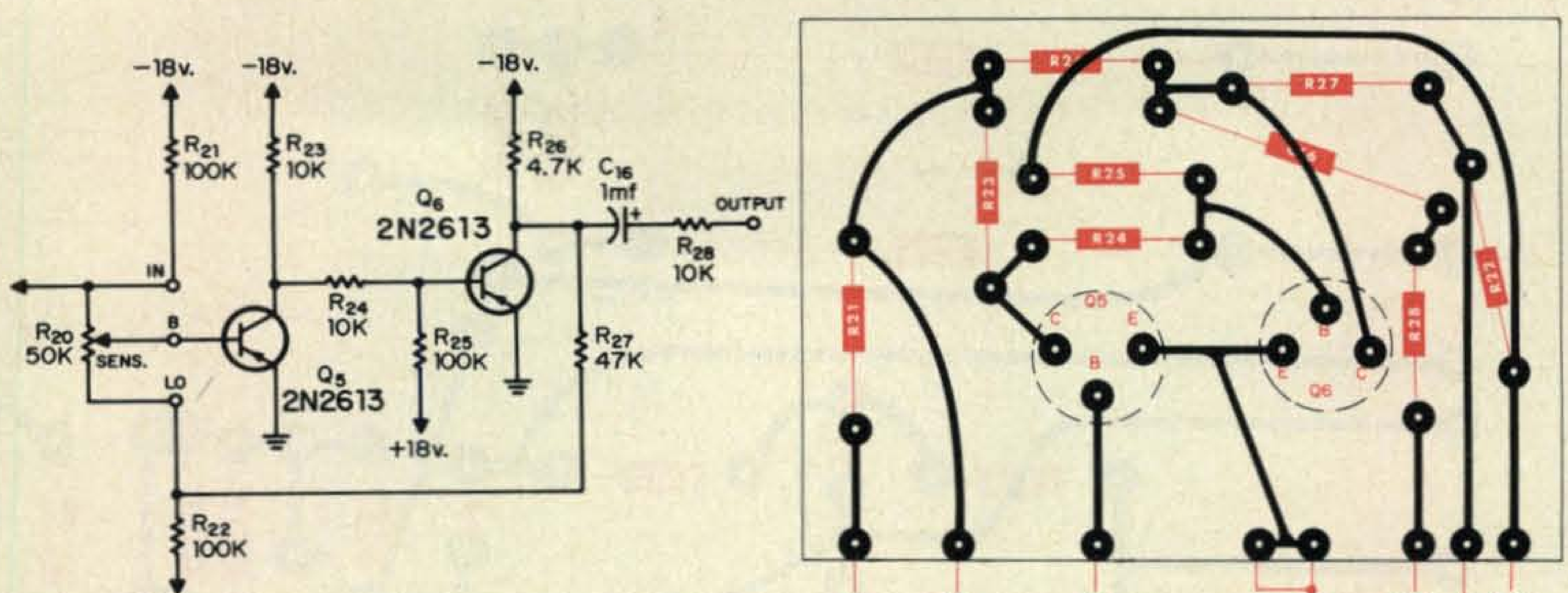
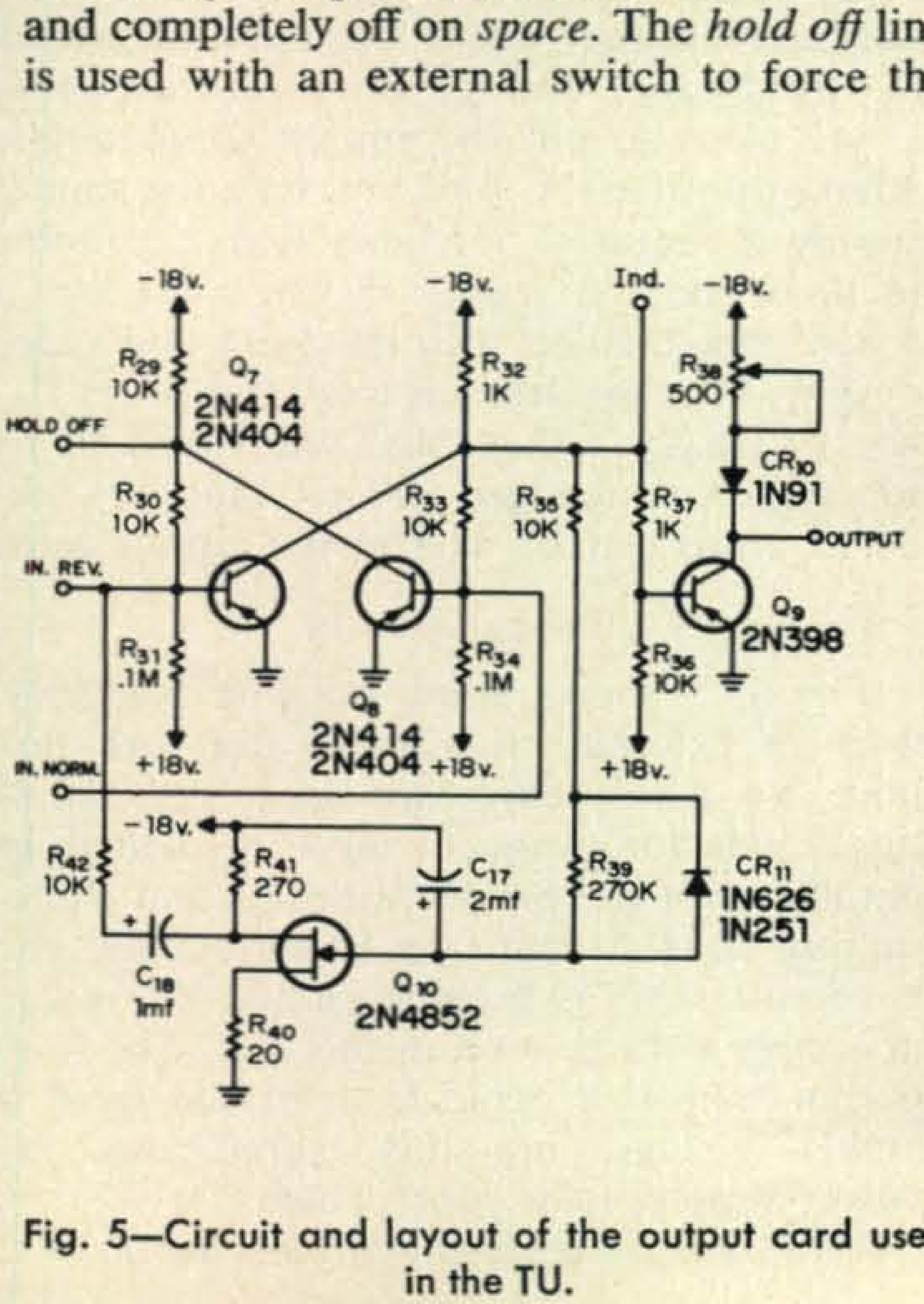


Fig. 4—Terminal unit trigger card circuit and board layout. The Sensitivity pot, R_{20}, is the front panel control shown in fig. 1.

level from Q_4 and should be set to about 0.2 volts negative with no input signal.

Figure 4 shows the trigger card. This card simply is a multivibrator that squares up the detector output signal. The output square wave is differentiated into a pulse by C_{16} and R_{28}, and this pulse triggers the output card.

Figure 5 shows the output card circuitry. The bistable multivibrator formed by Q_7 and Q_8 assures that the output signal must be either on or off and not part way in between. This keeps loop current constant with *mark* and completely off on *space*. The *hold off* line is used with an external switch to force the loop to *mark* and keep it there, in this case to prevent machine feedback during transmit. The indicator output line drives the indicator to display the keyed output signal and can also be used to drive the autostart card. Transistor Q_9 is the output relay transistor used as a switch. Transistor Q_9 must have a high voltage rating, because a rapid fall of current in the loop causes large inductive kicks and a rapid current drop is necessary for clean keying. Diode CR_{10} limits the inductive kick and R_{38} should be set for the maximum value of inductive kick the transistor will stand safely. A safe value is half



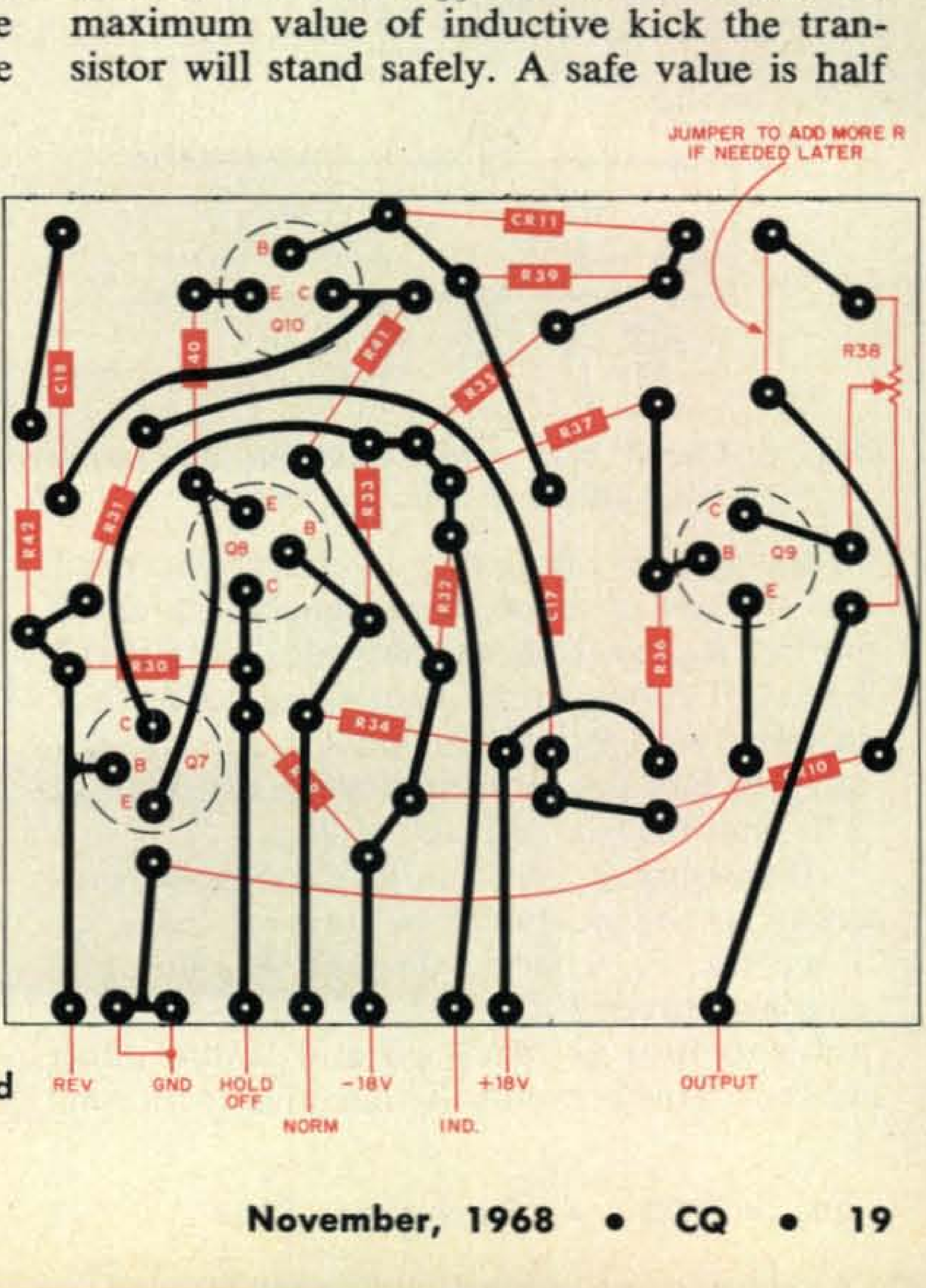
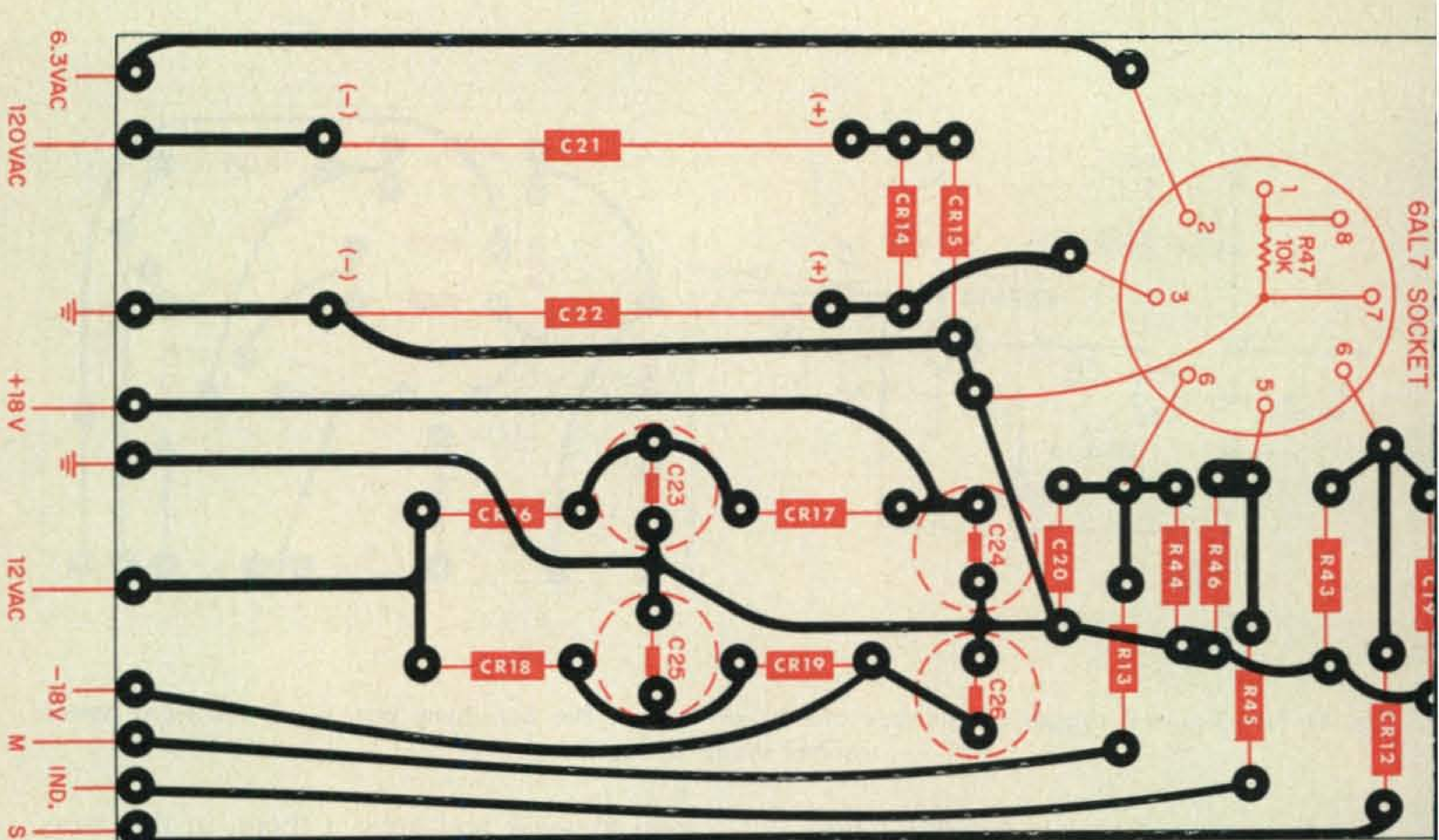


Fig. 5—Circuit and layout of the output card used in the TU.



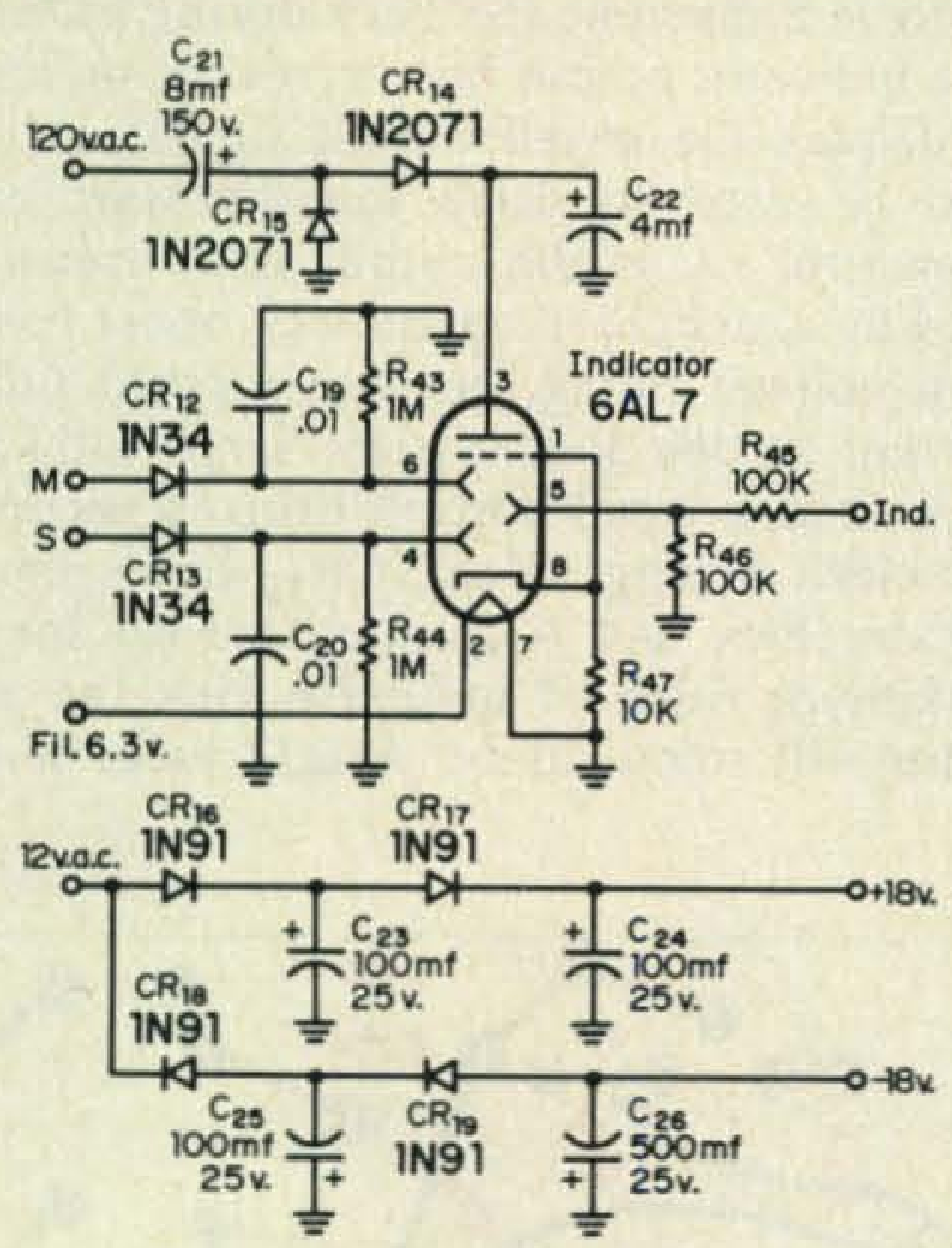


Fig. 6—Circuit and card layout for the power supply and indicator unit.

of the voltage rating or 50 volts. If you can't see this on a scope, a reasonable value to pre-set R_{38} to is about midscale. Note that I have left room on the card to add a resistor in series with R_{38}. If you want to save money at some sacrifice in clean keying, use a single 270 ohm resistor in place of R_{38}.

Transistor Q_{10} is a unijunction pulse generator. If the indicator line stays on *space* for 1 second, C_{17} charges through R_{39} and discharges through Q_{10} which causes a reset pulse to turn Q_7 back off and restore loop current. This prevents the machine from running open loop longer than 1 second. Capacitor C_{17} is also discharged through CR_{11}, and R_{35} on *mark* signals, so a full second is required on *space* before it resets. Note that you can leave the machine running while you tune through the band and it tends to stay off until a copyable signal appears.

Indicator and Power Supply

Figure 6 shows the indicator and power supply card. It was convenient to mount the indicator up high where it could look out of the front panel, and the extra card area was a fine place to put the supply components. After you price this tube and note the simple supply it requires, you may find it possible to do without a scope. If you must use a scope, then connect it to the *mark* and *space* outputs from the detector card. Capacitor C_{26} was originally 100 mf and was found to be too small, so a larger 500 mf unit was soldered on to the foil side of the circuit card.

Loop Circuits

Figure 7 shows some possible combinations of external circuitry to use with this unit. No polar relays are used. Any additional selector magnets must be added in parallel with the printer magnets and transmitting contacts must be in series with the keyboard. This is because of the low value of supply voltage used in this TU. The final output transistor could be operated from a higher voltage, but this complicates the power supply; take your choice.

Two transmitter keying circuits are shown;

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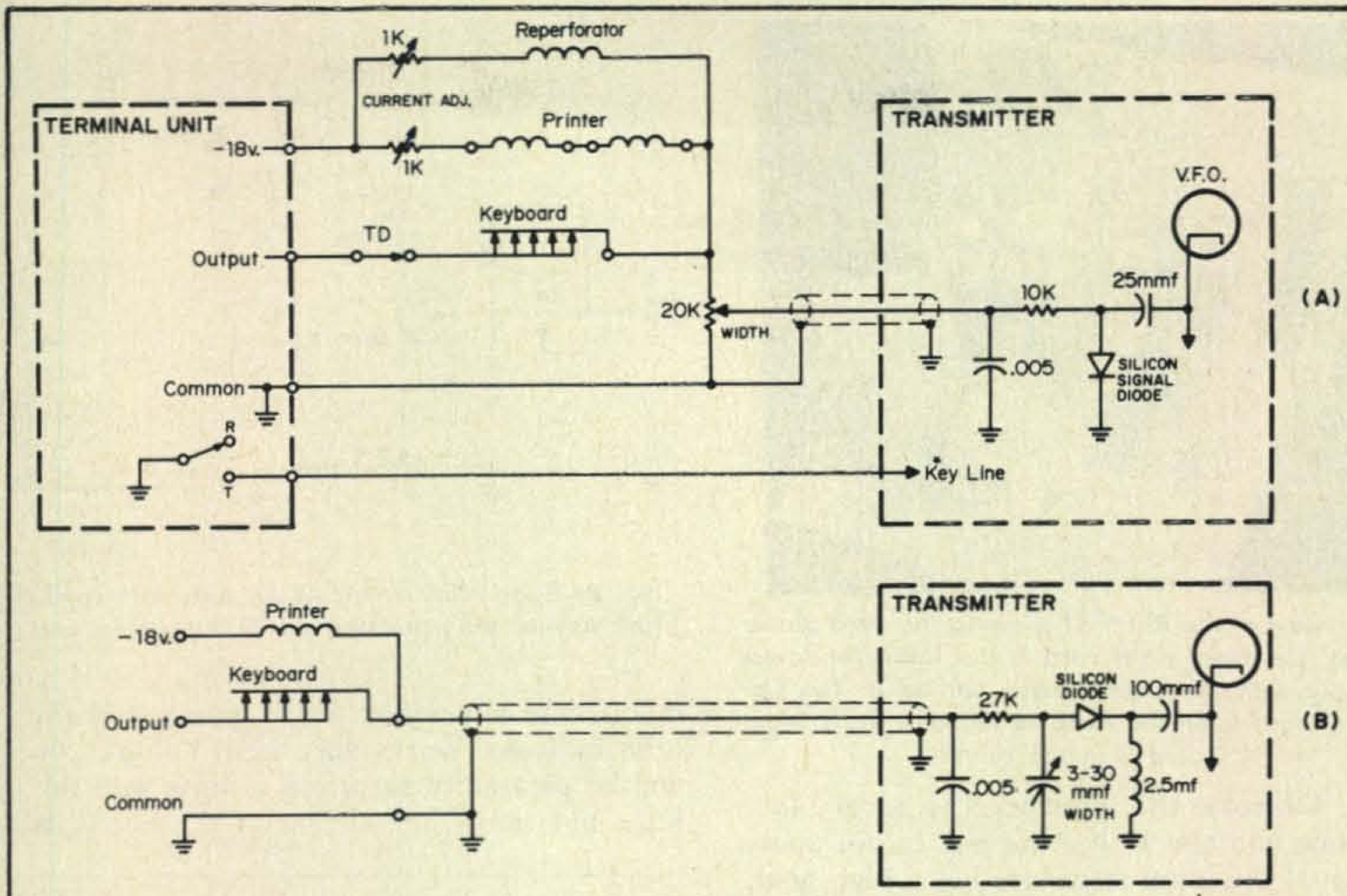


Fig. 7(A)—External loop circuits and keyer arrangement. (B) Alternate keyer arrangement.

circuit (A) uses the silicon diode as a variable capacitor and circuit (B) uses the diode as a switch. The upper circuit is easier to adjust and use but is more difficult to compensate for temperature changes. Both circuits cause the carrier frequency to shift up on *space*.

Autostart

Figure 8 shows a possible circuit to start the motor on the first *space* pulse. I do not use autostart, and show it only as a possibility, not a proven part. The 3 meg pot adjusts the time constant for turn off, and will cause the motor to stop after a set time limit on *mark*. The 5K sensitivity pot adjusts the trigger point of the first stage, and is set to just below cutoff with the input on space.

Initial Adjustments

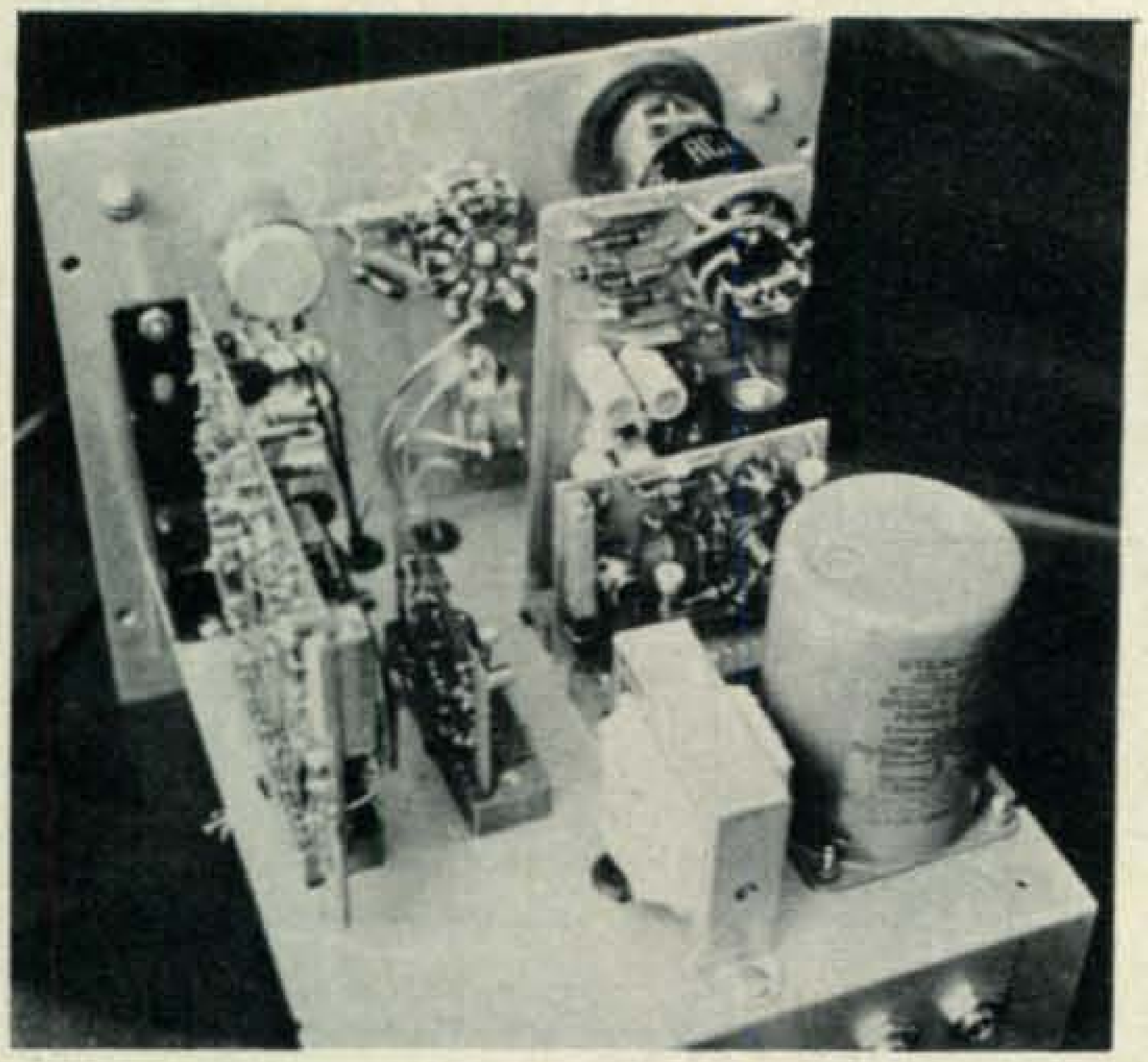
Before applying power for the first time, set the following controls to indicated positions:

ZERO, (R_{18})—Midscale.
SENS., (R_{20})—Minimum.
A.C.-D.C.—D.C.
NORM.-REV.—NORM.
T-R Switch—R.
WIDTH—850 c.p.s.
DAMPING POT, (R_{38})—Midscale.
Ext. Loop Current Pots—Maximum.

Check all power supply output circuits for shorts with an ohmmeter. Apply power and measure the three supply voltages. The two low voltage supplies should be somewhere between 12 and 18 volts, and the indicator B+ should be between 200 and 300 volts. Adjust loop current for your normal operating current. Adjust R_{18} for -0.2 volts d.c. at the top of the sensitivity pot. The adjustment for R_{18} can be improved slightly by varying it for minimum copyable sensitivity on R_{20}. You are now ready to copy signals off the air.

Operation

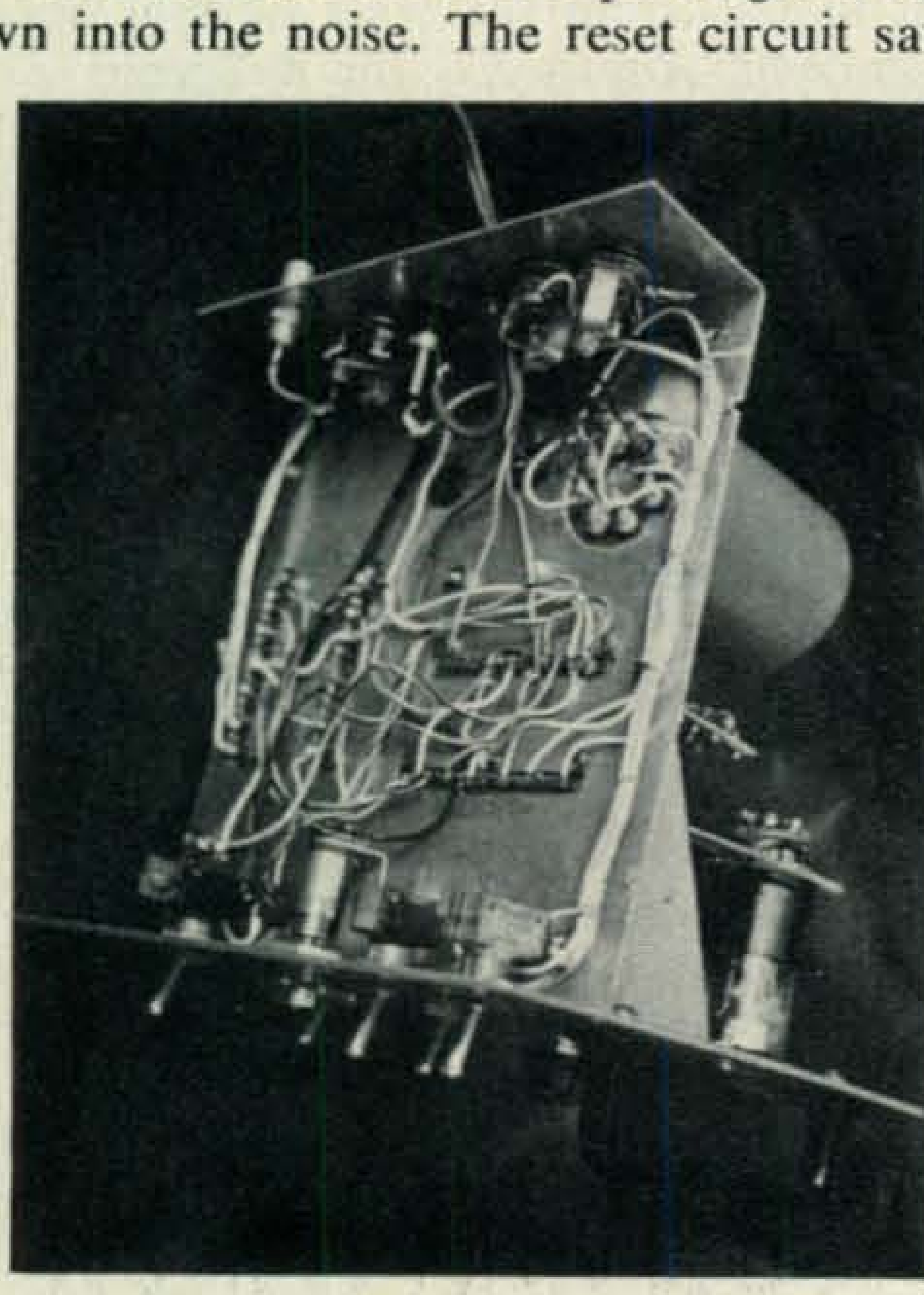
Tune the receiver to center the *mark* frequency at maximum on the indicator (upper left), then adjust the WIDTH switch for maximum *space* signal (upper right). Increase the SENSITIVITY pot just past the point where the output card starts keying (lower bar on indicator). The damping pot, R_{38}, should be increased for highest overshoot as noted earlier in the description of the output card. Remove the input signal several times so that the TU stops on a *space* pulse, and be sure the reset circuit flips it back to *mark* in about one second. This time can be adjusted by changing R_{39} or C_{17}. Larger values cause longer de-



Rear view of the RTTY TU showing the card placement. The front right card is the Indicator-Power Supply with the Output card behind it. The Detector card is on the extreme left and the Trigger card is in the center.

lays. Decrease the input level to a very low volume and check that the unit is still operating. If the input transistor has a high gain, you should be able to copy signals down to 50 millivolts on the 600 ohm input with no change in detector output. Lower gain transistors in the front end cause the minimum copyable signals to be greater.

The performance of this unit is a real improvement over my previous TU, a home copied AN/URA 8. It is independent of input level fluctuations and copies signals right down into the noise. The reset circuit saves



Bottom view of the RTTY TU showing the interconnecting wiring.

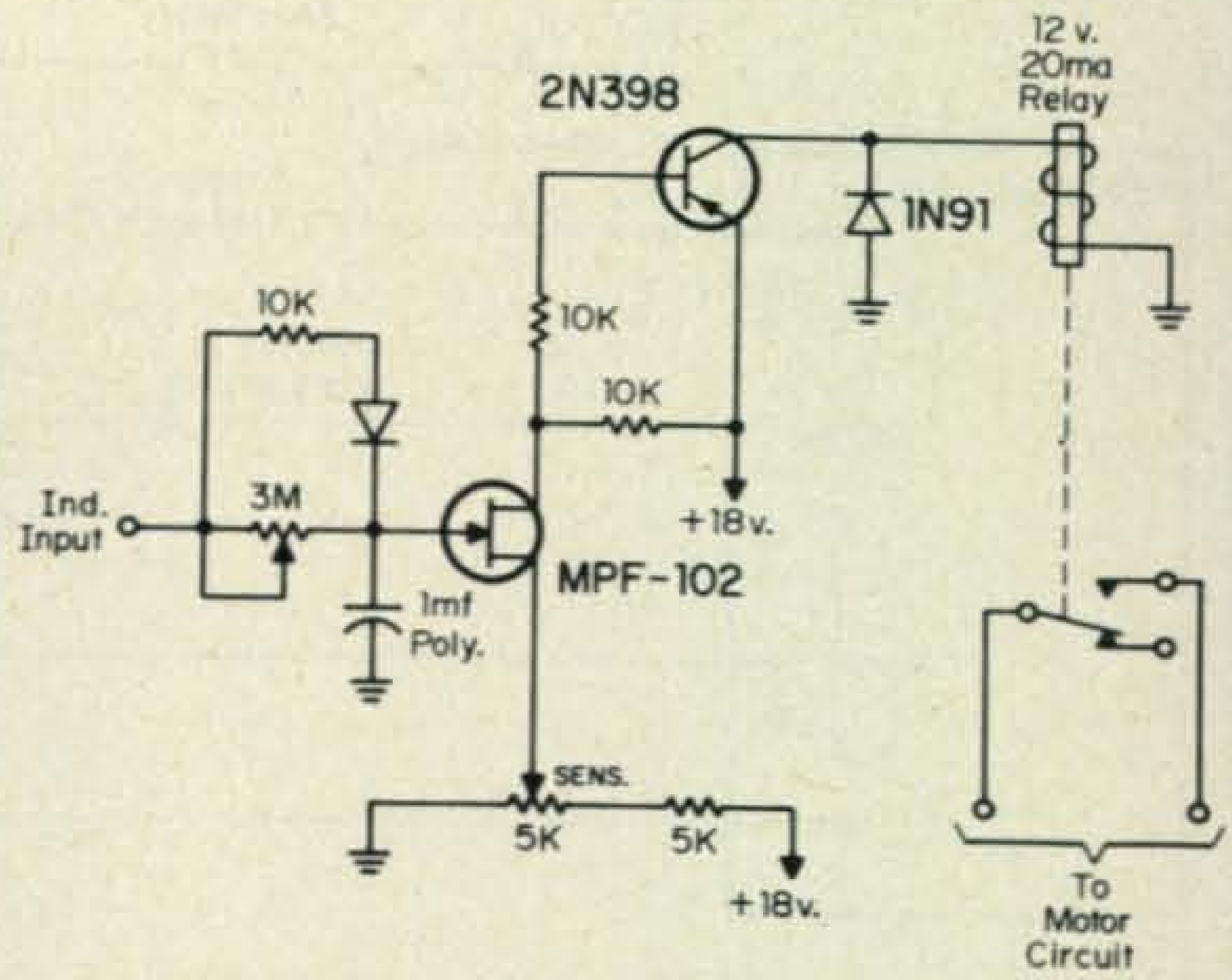
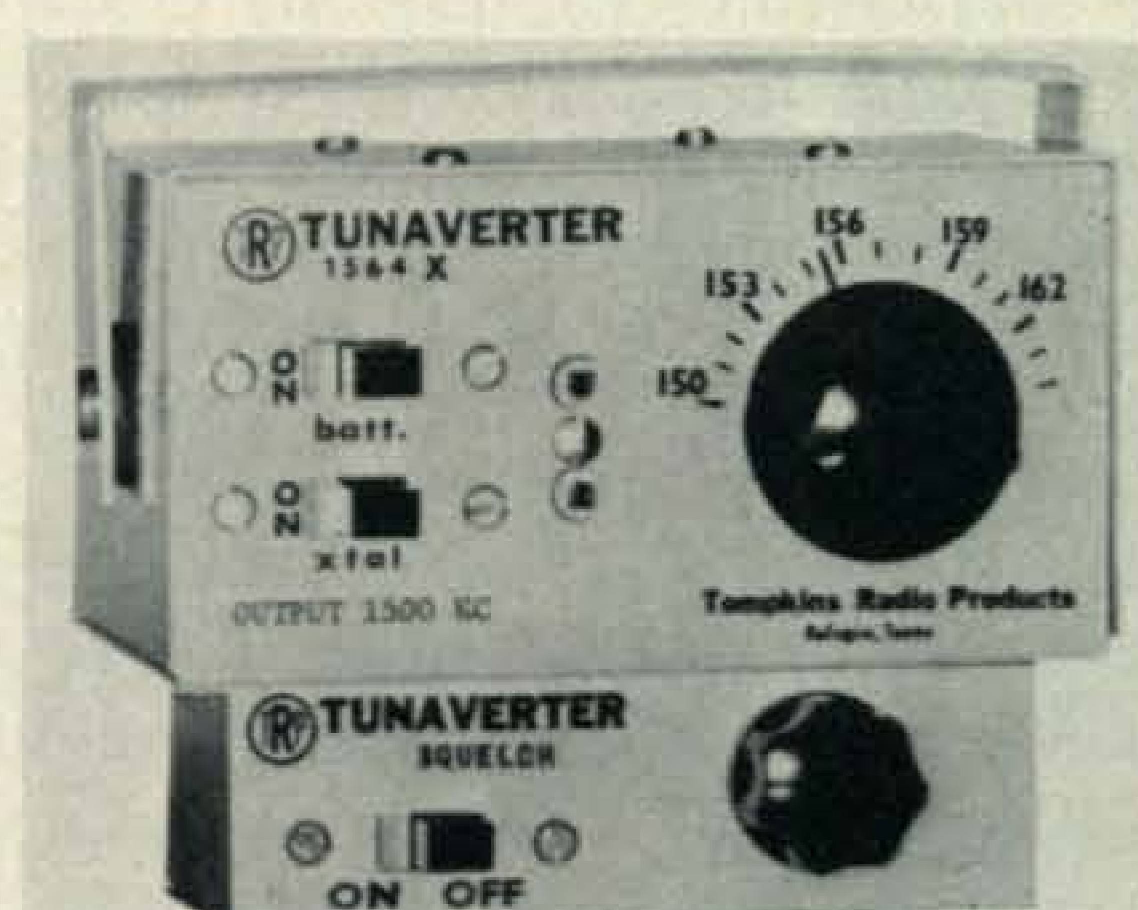


Fig. 8—Suggested circuit of an autostart card. Front view of the transistorized RTTY terminal unit.

much time and effort when tuning and the little indicator works very well. I think you will be pleasantly surprised at how well this little unit works. ■

New Products



Squelch for RF Converter

Tompkins Radio Products announces the first squelch control for noise free monitoring on HF and VHF Tunaverters, making it possible to have receiver squelch performance with economical converter usage. This solid state squelch does not need any connections to the a.m. broadcast radio or converter other than the standard coax cable. Available in 2 models; model ST fastens to bottom of Tunaverter, model SU with its own mounting bracket. Complete with connecting cable for $17.50. For more information write Herbert Salch & Co., Mktg. Div. of Tompkins Radio Products, Dept. CQ, Woodsboro, Texas 78393.

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An Improved Multi-Band Mobile Antenna System

BY JAMES E. TAYLOR,* W2OZH

The mobile antenna system described below comprises a substantial improvement upon previous configurations.[1] The application of loop antenna theory provides important guidance in this design.

In a previous article a folded antenna system for mobile use in the 80 and 40 meter bands was described.[1] Further analysis and development has led to a design which accomplishes even better radiating characteristics, together with substantial mechanical and esthetic improvements.

It is the purpose of the present article to show the applicability of loop antenna theory and to extend this reasoning to provide guidance in optimizing a new mobile antenna configuration.

Theory

The radiating efficiency of an antenna system may be written in the form:

$$\epsilon = \frac{R_r}{R_r + R_L} \times 100 \qquad (1)$$

where ϵ is the efficiency in %, R_r is the radiation resistance, and, R_L is the loss resistance of the system.

From this relationship we see that, for an antenna system having a given radiation resistance, the efficiency can be increased if the loss resistance, R_L, can be reduced.

The conventional low frequency loaded whip antenna comprises a simple series resonant circuit as shown in fig. 1. This circuitry is seen to be directly analogous to that of the simple one-turn loop antenna. The expression for the radiation resistance of such a loop antenna is:[2]

$$R_r = 3.1 \times 10^4 \frac{A^2}{\lambda^4} \qquad (2)$$

where A is the effective area of the loop in square feet, and λ is the wavelength of the radiation, in feet.

Assume $\lambda = 240$ feet (75 meters). Then:

$$R_r \cong 10^{-5} A^2 \qquad (3)$$

The folded antenna configuration of the reference[1] is a loop of much greater effective area than is displayed by a simple loaded whip, which would account for the higher radiation resistance indicated. Equation (3) does not take into account reflection of radiation by the car body or the ground; therefore, quantitative calculations obtained thereby may not be regarded as precise. However, this relationship does provide useful guidance concerning the effect of loss resistance in such a system.

If we assume $A = 17$ ft $\times$ 5′ 10″ = 100 sq. ft., from equation (3) we obtain for the radiation resistance: $R_r = 0.1$ ohms.

If we assume a loss resistance of ten times this or 1 ohm, substitution in equation (1) yields for the efficiency:

$\epsilon = 9\%$, or, roughly, 10 db down.

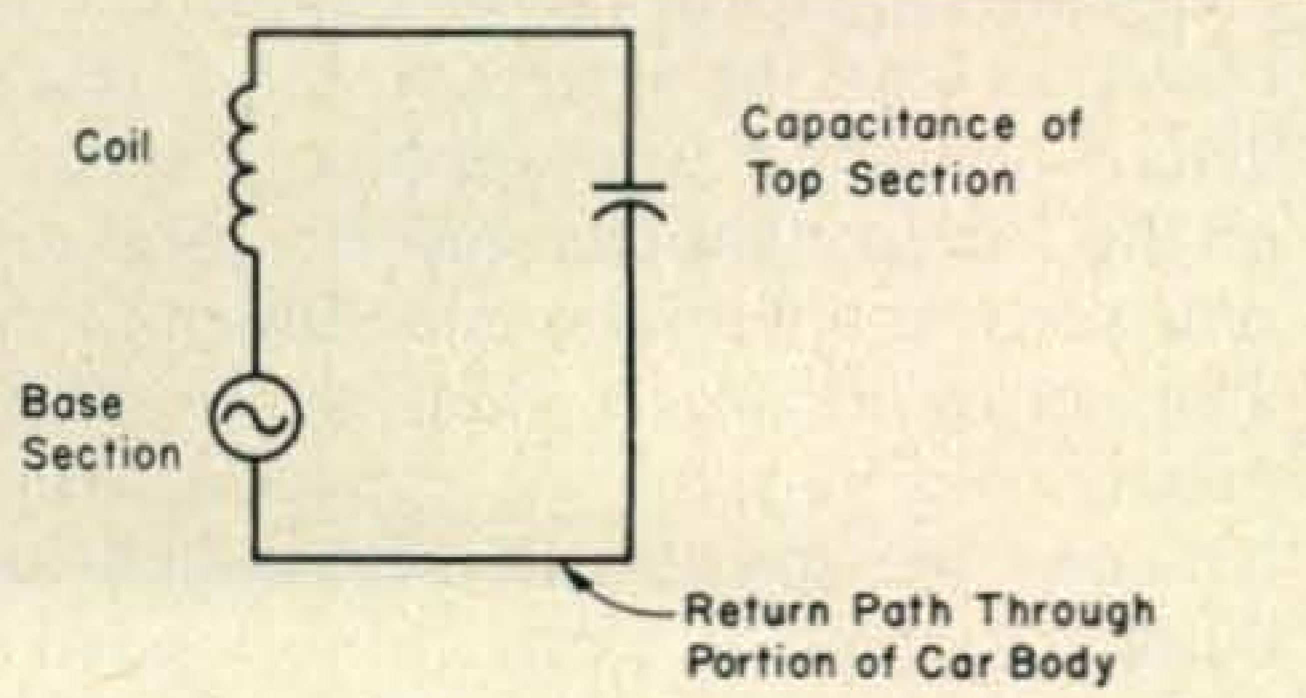

Fig. 1—Equivalent circuit of a low frequency loaded whip antenna.

* 1257 Wild Flower Drive, Webster, New York 14580.

1 Taylor, J. "An Improved Dual Band Mobile Antenna System," *CQ*, May 1968, p. 58.

2 Newman, B., "Principles of Antenna Design," *Electro-Technology Magazine*, Sept. 1967, p. 62.

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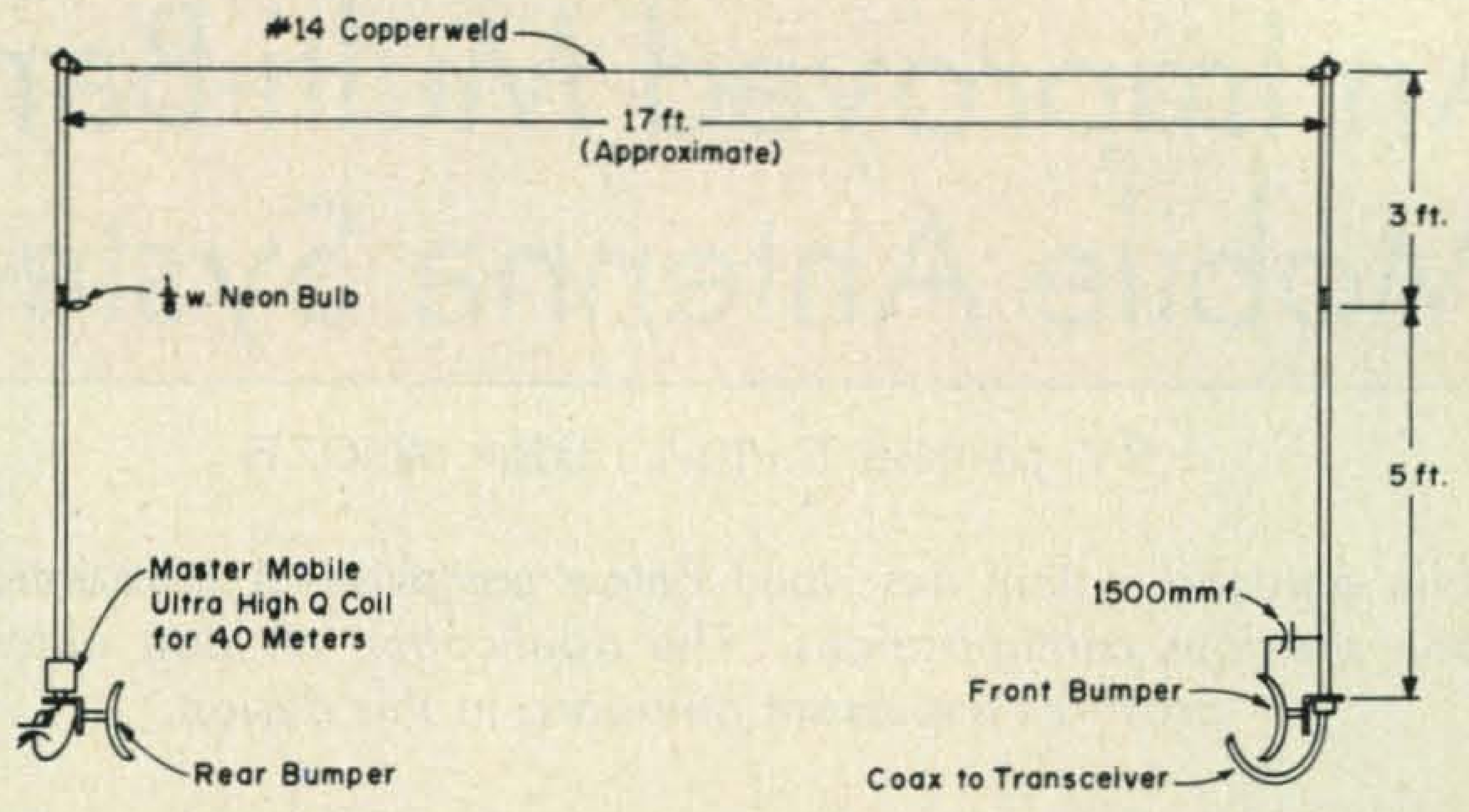

Fig. 2—Dual band mobile antenna system. The configuration shown is for 75 meters. For 40 meter operation replace the coil with a 15 meter unit and adjust the capacitor for resonance in the 40 meter band. For reduction of losses there should be secure electrical bonding from the car body to chassis and to each end of the bumpers. The 5-30 mmf tuning capacitor on the rear bumper is a neutralizing type.

Actually, the radiation resistance is somewhat higher than the calculated value, and also the losses are probably greater than the value assumed. Nevertheless, we see that if we can decrease the loss resistance to a value small compared with the radiation resistance, we will greatly improve the radiation efficiency of the antenna system.

This reasoning is the basis for a very interesting fixed station loop antenna system for military use recently described by K. H. Patterson.[3]

Configuration

Let us study the arrangement of reference[1] in the light of the equivalent circuit shown in fig. 1. In the referenced arrangement the current-carrying base section comprised a vertical section, a horizontal section and another vertical section in series. The capacitance was between the terminating wire and the car body, and the return circuit was completed through the car body.

A substantial simplification can be affected in the arrangement of the capacitance which serves to tune the system to series resonance. This is achieved by mounting the coil down at the bumper-mount and by extending the rear vertical antenna section down to the coil. The series tuning is then accomplished by means of a variable air capacitor connected between the lower end of the coil and the bumper, which is electrically bonded to the car body and chassis, as is the front bumper. The configuration is shown in fig. 2.

This system includes several improvements over the prior system:

The thin whip sections have been replaced by larger diameter rods for lower losses.

The horizontal capacitance section has been eliminated for improved appearance and wind resistance.

The coil has been lowered resulting, also, in improved wind resistance and appearance.

The length of the radiating section has been increased due to the lowering of the coil and due to the fact that the entire length of the car body is now in the return circuit.

All of the above improvements have been achieved with but one disadvantage: the lower position of the coil tends to decrease its high value of Q, due to the proximity of the car body. However, even this disadvantage is minimized because the important Q is that of the entire circuit, not just that of the coil alone. Since the radiating portion of the antenna has an extended length of approximately 50 feet, this is the portion which principally controls the overall Q. The Q of the coil, in its present position, will be much greater than that of the balance of the system, so that its decrease, due to proximity effects, will be of minor consequence.

The importance of decreasing the losses in such a loop radiating system can hardly be overemphasized. We have seen that even a

[*Continued on page 144*]

[3] Patterson, K. H. "Down to Earth Army Antenna," *Electronics*, August 21, 1967, p. 111.

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VERTICAL ANTENNAS

Part VI

BY CAPTAIN PAUL H. LEE,* W3JM

In this part of the series, the author describes several of the broadband typ of vertical antennas which have been used by commercial and military service Design information is given, and practical configurations are shown.

UP TO now the vertical antennas discussed have been designed for specific frequencies or narrow bands of frequencies and the antennas had to be retuned for a QSY of any magnitude. Antennas of this type are usually used by amateurs, whose frequency allocations consist of relatively narrow bands in the spectrum. There has not been much material in amateur literature in the past regarding broadband types of vertical antennas. I shall now describe some broadband verticals and show how they can be applied to amateur requirements and additional types will be discussed later.

First let us examine some of the basic properties which tend to make a radiator broadband. It was described earlier how a structure's bandwidth is affected by its L/D ratio, with a shorter, fatter structure having a wider bandwidth (within certain s.w.r. limits) than a tall, thin one. The concept of a radiator being considered as an open-ended, lossy transmission line, extending into space, was also mentioned. It is well known practice to construct tapered transmission lines[53] to effect a smooth transition of impedance wit out creating standing waves. A tapered (conically shaped) antenna may be consider as an attempt to effect a smooth transition b tween the impedance of a source and the i pedance of space.

The Conical Antenna

A conical antenna may be considered as special case of a horn antenna[54] common used at microwave frequencies. Such devic may be scaled up in size and used at h.f. T reference[54] shows results of model studi made of several conical configurations. Fi ure 48 shows the input impedance plot for typical conical radiator. It will be noted th the cone is fed at its apex against a flat grou plane in this configuration. This type of a tenna is quite easy to build for u.h.f. us where the cone can be made of sheet me and supported on three or more insulato as in fig. 49. The lower frequency limit of t antenna is determined by the length of t side of the cone. As may be seen from fig. 4 it should not be less than ¼ wavelength, f

* 5209 Bangor Drive, Kensington, Maryland 20795.

53 Laport, E. A. *"Radio Antenna Eingineering,"* McGraw-Hill.

54 Radio Research Lab. Staff, Harvard Universi *"Very High Frequency Techniques,"* McGra Hill.

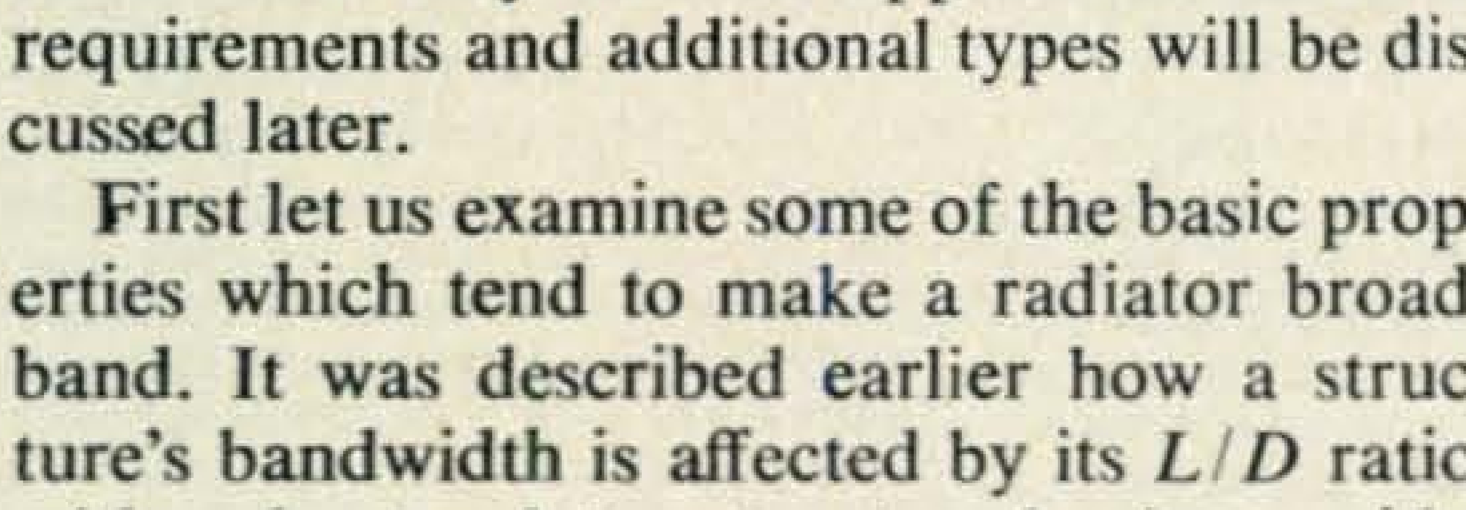


Fig. 48—Configuration and impedance plot of a conical antenna.

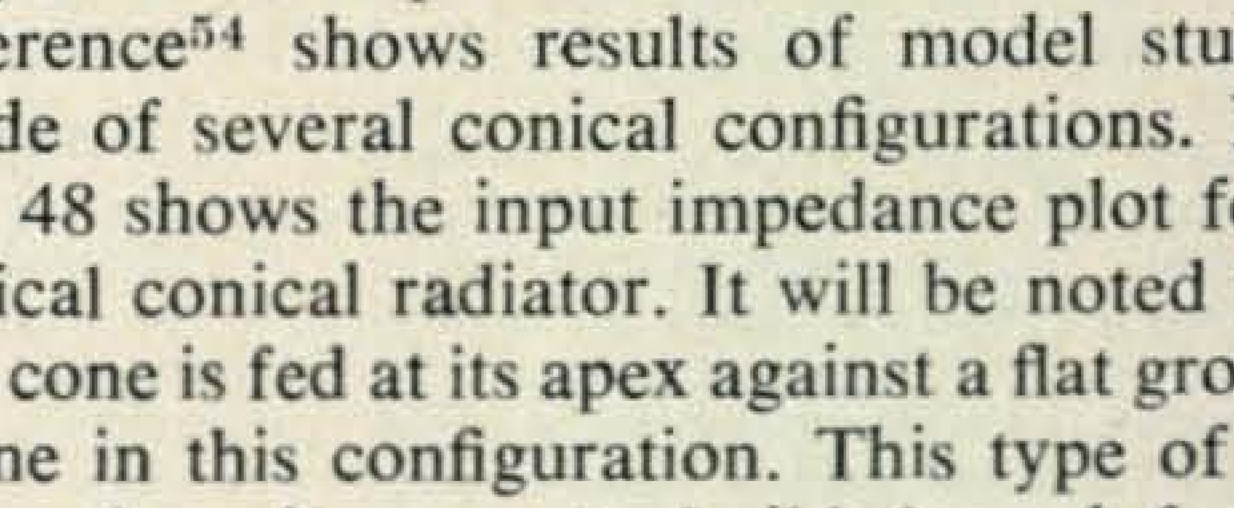


Fig. 49—A practical construction approach for conical antenna at u.h.f.

See page 150 for New Reader Servi

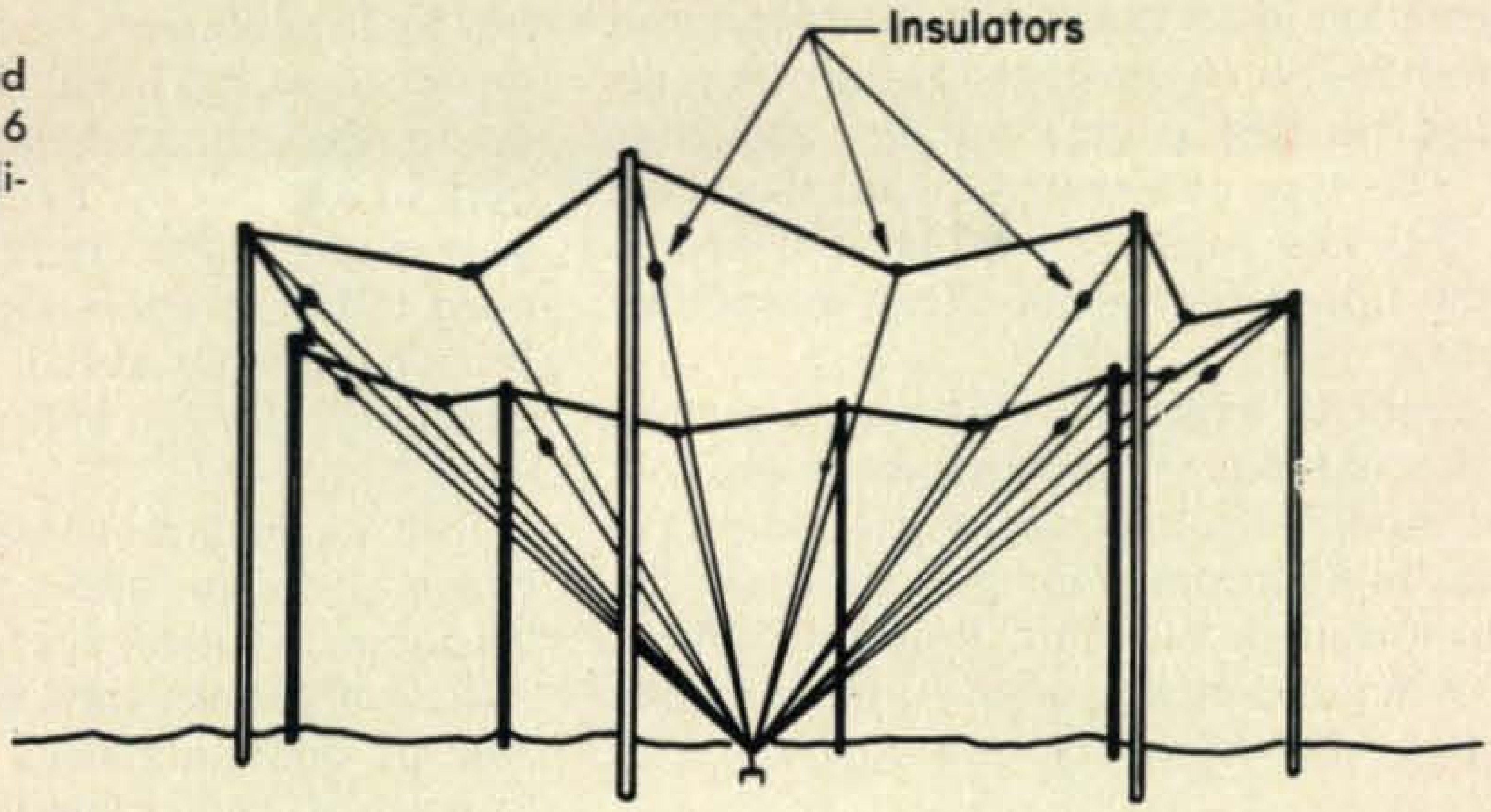


Fig. 50—A h.f. inverted cone consisting of 16 wires. The ground radials are not shown.

ɔod s.w.r. The high frequency limit is deterined by the practical mechanical consideraɔns of construction of the feed point. Due its size at h.f., this type of antenna is rather fficult to construct. Some have been built, ɔwever, using closely spaced wires to form e cone, supported by a number of wood ɔles. Such a configuration is shown in fig. 50. radial ground system is used as the disc.

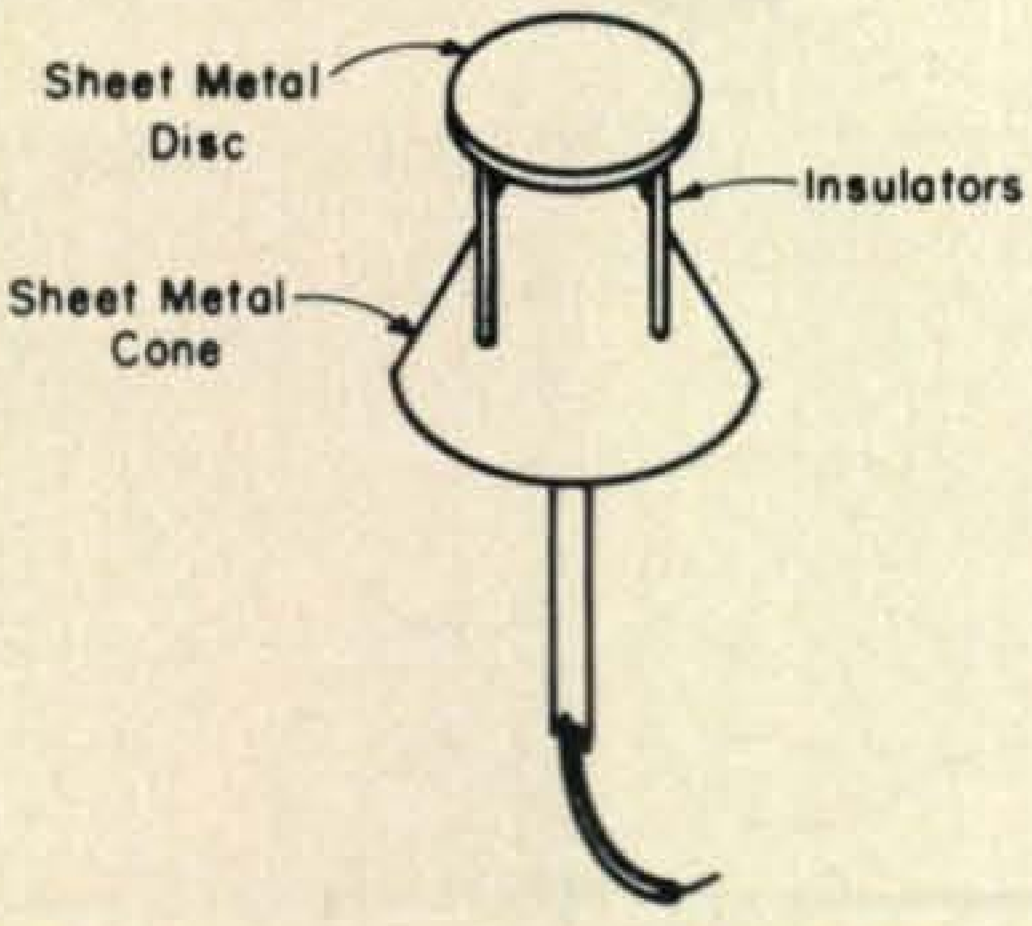
The Discone

It is quite simple to invert the whole strucre shown in fig. 50. This type of configuraɔn is called a "discone." It was devised by andoian[55,56] over 25 years ago. Actually e practice of using a cage of wires to form broadband antenna is much older. The disɔne consists of a disc mounted over a cone hose apex connects to the outer conductor a coaxial feedline. The disc is fed by the ner conductor of the coaxial line. Figure 51 ows the configuration of the discone. As in the case of the inverted cone described in the preceding paragraph, the side of the cone should be ¼ wavelength at the lowest frequency of operation. It has a useful frequency range of at least 10 to 1. For u.h.f. the cone can be made of sheet copper or brass, and the outer conductor of the coaxial line can be soldered directly to it at its apex. The disc can be made of the same material, and supported on three or four fiberglass insulators as shown in fig. 52. The whole antenna can easily be mounted on a pole or other suitable support. Such an antenna would be excellent for use on the 50, 144, and 220 mc amateur bands. In such a case, the side of the cone should be about ¼ wavelength at 50 mc. The diameter of the disc should be 0.7 times the length of the side of the cone.

At h.f., the discone can be built using closely spaced wires to simulate the surface of the cone. The disc can be simulated by a structure consisting of six or eight spreaders, with wires connected between them. As in the case of the u.h.f. type, the h.f. discone can be mounted on a mast or tower. In fact, the

Kandoian, A. G., *"Broadband Antenna,"* U.S. Patent 2,368,663, 6 Feb. 1945.

Kandoian, A. G., "Three New Antenna Types and Their Application," *Proceedings of I.R.E.*, Feb. 1946, p.70W-77W.



g. 51—The discone antenna. Length *D* is $\lambda/4$ at e lowest frequency of operation. The inner conɥctor of the feedline connects to the disc and the outer conductor connects to the cone.

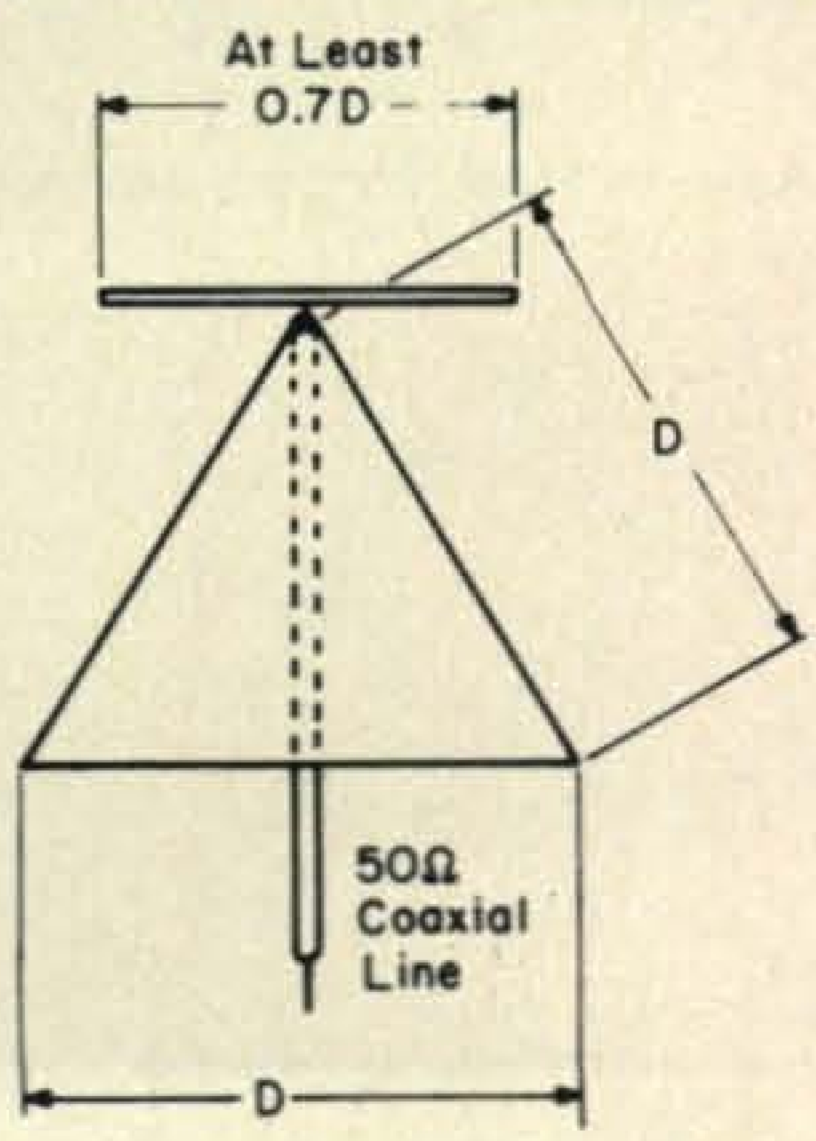


Fig. 52—A practical construction and mounting technique for the discone antenna. The coaxial feedline is run up through the supporting pipe.

configuration lends itself very nicely to tower use, for the wire elements comprising the cone can be used as guys for the supporting tower. This type of elevated discone is shown in fig. 53. The guys are broken with insulators, the upper portion of them comprising the cone.

As might be expected, the vertical pattern from this antenna, supported above ground, will be modified somewhat by ground reflections, exhibiting some lobing as shown in fig. 54. The low angle radiation, however, is quite good. When elevated as shown, this antenna requires no buried ground plane.

Conical Monopole

There is another type of antenna which has come into wide use by the military services. This is the conical monopole antenna, which is a broadband type useful over a frequency range of about 4 to 1. There have been several articles about this antenna in past amateur magazines.[57,58] This antenna, however, was not developed by either of those authors, nor by the commercial companies with whic one of them has been associated. The conic monopole was developed by Mr. M. L. Le pert of the Naval Research Laboratory, give credit where credit is due. It was deve oped to fill an operational requirement for broadband coaxial-fed antenna of superi characteristics for both shipboard and sho use.

The conical monopole has a simple m chanical design, short vertical height, goo broadband impedance characteristics, goo radiation patterns and efficiency, and is ca able of operating with a grounded mast tower as its center support. The antenna co sists of two truncated cones mounted base base. The upper cone may be considered be a solid, whereas the lower one is hollo The inner surface of the cone and the su porting mast or tower form a short sectio of transmission line which is, in effect, co nected across the terminals of the antenn formed by the outer surfaces of the two cone Electrically it is a stubbed conical antenn with the stub being internally containe

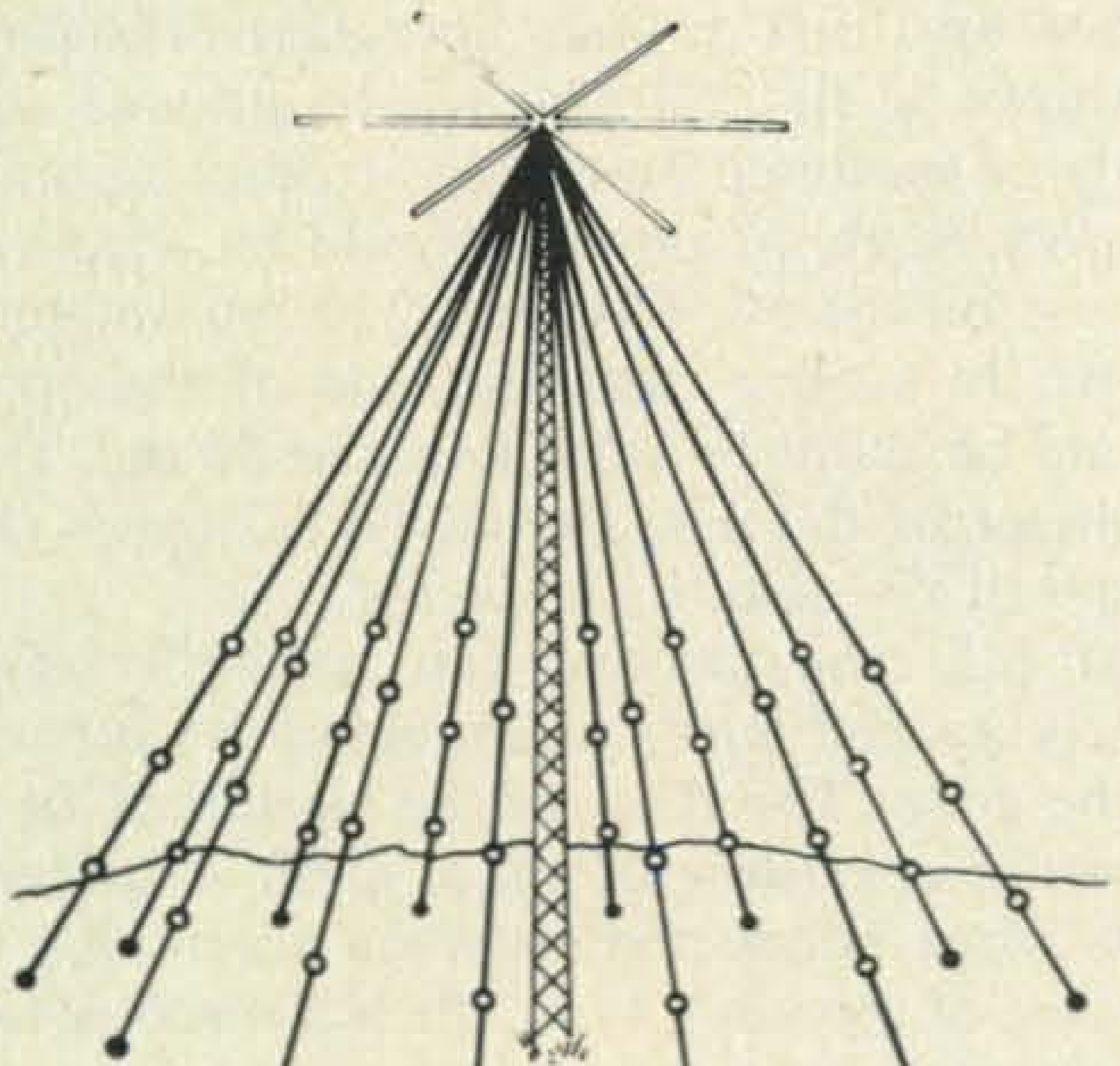


Fig. 53—An elevated discone antenna for h.f. use.

57 Stroup, L. A., "The Conical Monopole," *CQ*, Ja 1966, p. 59.

58 Pappenfus, E. W., "The Conical Monopole," *QS* Nov. 1966, p. 21.

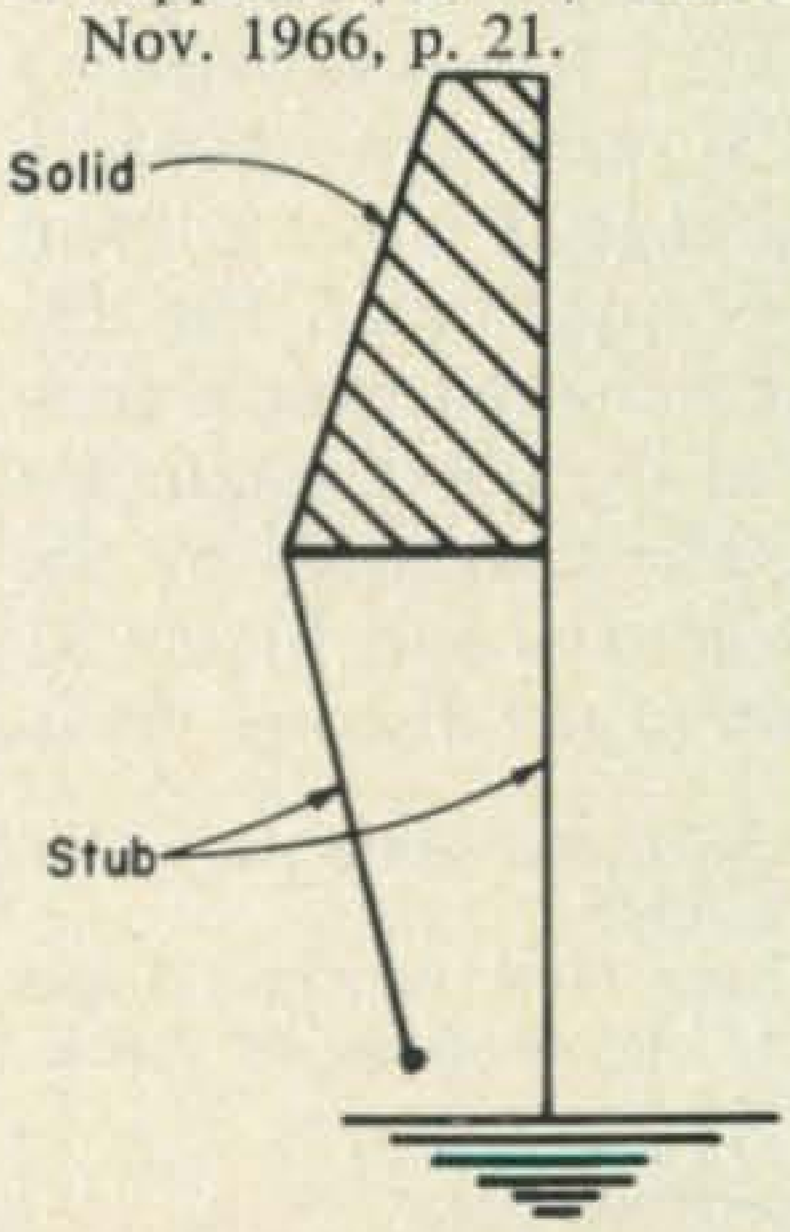


Fig. 55—View of a sli through half of a co cal monopole to sho the concept of a sol top with the bottom h a short section of tra mission line or stub. actuality the structu is simulated by wir and metal spreade

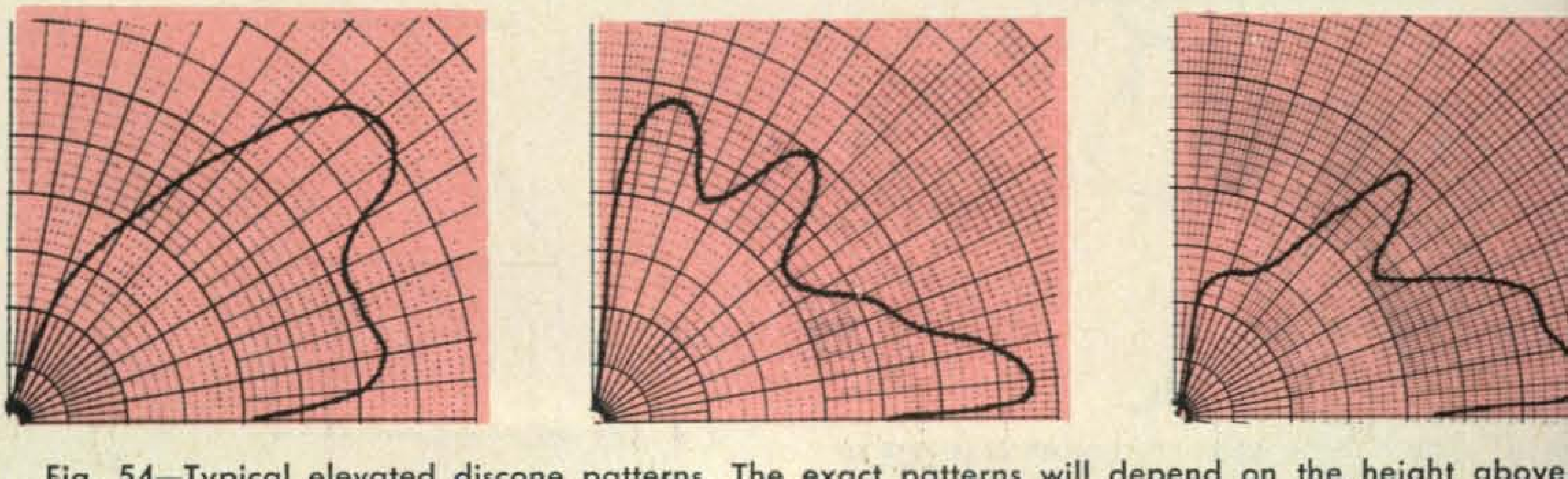


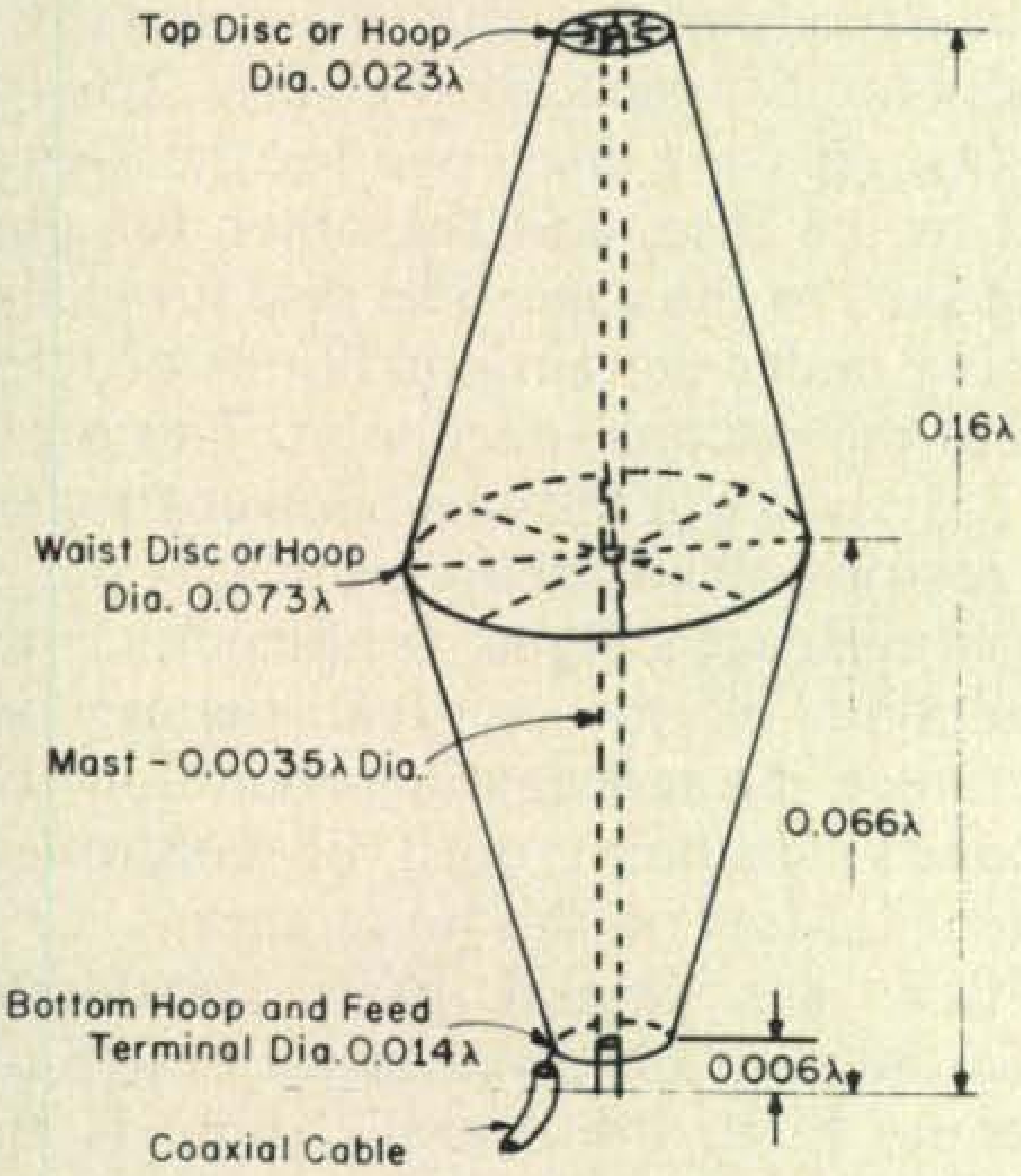
Fig. 54—Typical elevated discone patterns. The exact patterns will depend on the height above ground and the frequency range as well as ground conditions. (A) At lower frequency limit; (B) At midband frequency; (C) At high frequency limit.

See page 150 for New Reader Servic

vithin the structure. This basic concept is hown in fig. 55.

The dimensions of the antenna developed y Leppert are shown in fig. 56. For practical urposes, the discs or hoops are simulated by neans of metal spreaders, and the outer cone urfaces are simulated by wires, as shown in ig. 57. The references show some mechanical letails of construction of antennas of this ype.[57,58] As with the discone type, this anenna can be built around a center tower or nast, using portions of the guys as the active ables of the antenna. The bottom hoop or ing is pulled down by means of strain insuators.

The vertical patterns for this antenna are shown in fig. 58, for frequencies at which the antenna is 0.16, 0.50, 0.58, 0.64, 0.80 and 0.96 wavelengths tall. As may be seen, the pattern exhibits somewhat the same characteristics as that from a uniform cross-section vertical radiator. It consists of one major low-angle lobe for heights up to about 0.58 wavelength; it then starts to split and the lower lobe shrinks while the upper one grows until, at 0.80 wavelengths, there is only one high lobe. Then, at 0.96 wavelengths, the lower angle lobe appears again. It is for this reason that I stated previously that the antenna is useful over a 4 to 1 frequency range (heights from 0.16 to 0.64 wavelengths). With regard to s.w.r., it is useful over a frequency range



ig. 56—Conical monopole configuration and dinensions. The dimensions are in wavelengths at the lowest frequency of operation.

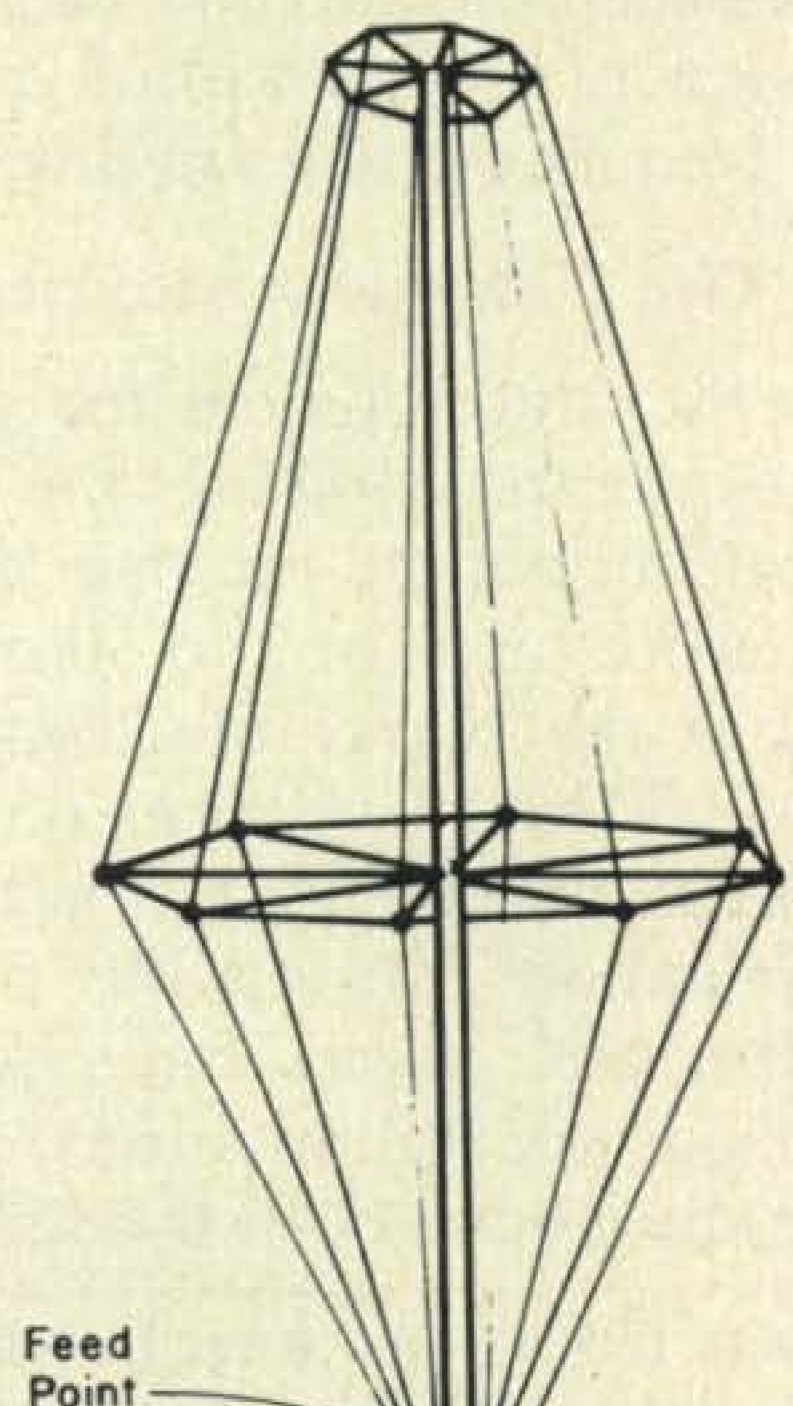


Fig. 57—Sketch of a wire cage conical monopole antenna.

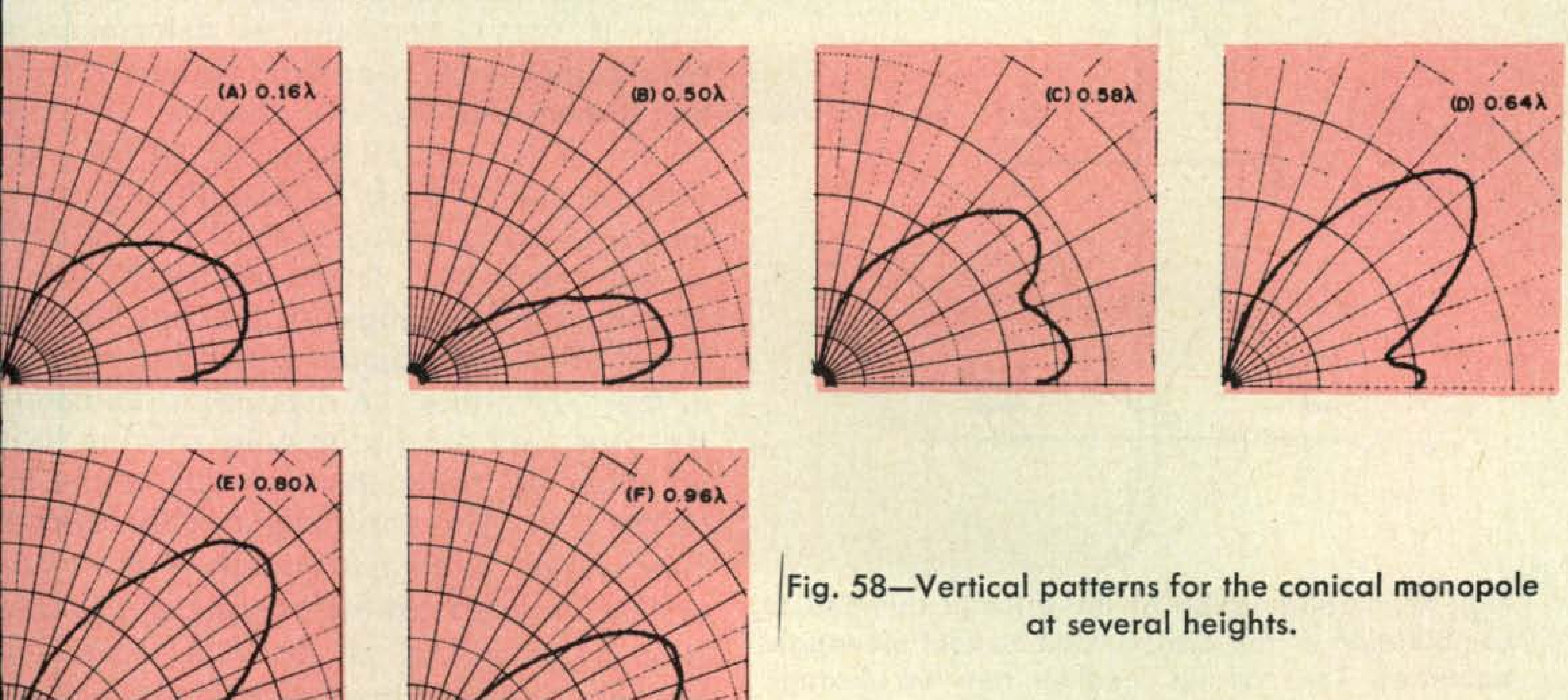


Fig. 58—Vertical patterns for the conical monopole at several heights.

of 6 to 1. Its s.w.r. is better than 2.7 to 1 over this range, relative to 70 ohms.

As with all grounded base antennas, this one must have a radial ground system. At naval shore stations we use ground systems of at least 120 radials a minimum of ½ wavelength long at the lowest frequency of the antenna. Of course, on ships, the metal hull and the sea water serve as the ground plane, a much better one than can ever be found at a shore station. The antenna is fed directly from 70 ohm line. When using 50 ohm line it is necessary to use a transformer section which consists of 0.196 wavelengths (at the antenna's lowest frequency) of 70 ohm line, inserted between the antenna and the 50 ohm feed. The s.w.r. will be within 2.7 to 1 over the 6 to 1 frequency range in this case also.

The Discage Antenna

As a further development for military use, the discage antenna combines the discone and the conical monopole in one structure to cover the entire range of 2 to 30 mc. The idea originated at the Naval Electronics Laboratory in 1954.[59] Many versions of this type of antenna were developed for both ship and shore applications during the past decade. Several sizes and shapes have been used to satisfy various space limitations, and various feed techniques have been used. Antennas of

[59] "Composite Discage Antenna Developed for 2 to 30 mc/s Band," *Naval Electronics Laboratory, Report No. 1504*, 8 August 1967 (Unclassified).

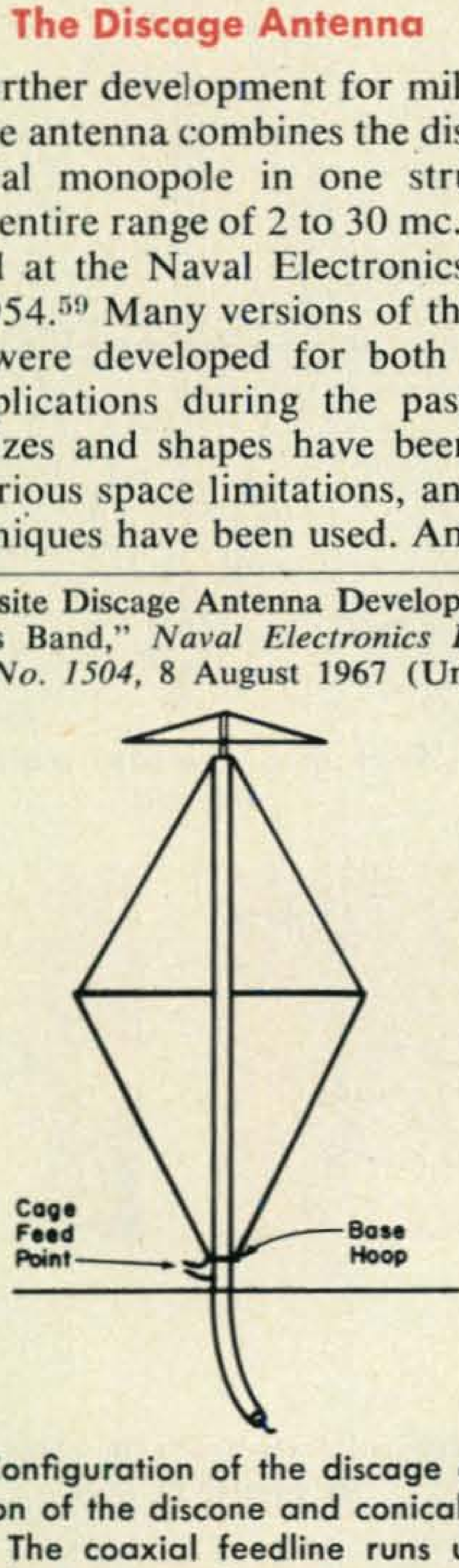


Fig. 59—Configuration of the discage antenna, a combination of the discone and conical monopole antennas. The coaxial feedline runs up through the mast; the inner conductor connects to the top disc and the outer conductor connects to the cage at the top. The second feedline connects to the cage feed point at the base hoop.

this type with a lower frequency limit o mc are quite practical for shore station u whereas limitations on physical size conf their use to frequencies higher than 6 mc shipboard.

Figure 59 shows the configuration of a to 32 mc discage antenna. This antenna co bines the characteristics of the conical mo pole (top-loaded) and the discone into c compact structure. The cage, like the p viously described conical monopole, is fed its base ring or hoop. The discone, which formed of the top disc and the upper port of the cage, is fed by a coaxial line which ru up through the central mast or tower. T outer conductor of the coaxial line conne to the upper portion of the cage, and the in conductor connects to the disc. Thus th are two separate lines, one for the high ba feed to the disc, and the other for the l band feed to the cage. The disc provides to loading under certain conditions of termi tion of the discone's feedpoint. This top-loa ing is desirable at the cage's lower frequenc for reasons of impedance, but it is not de able at the cage's higher frequencies from standpoint of the vertical pattern sha Therefore the terminating conditions of discone's feedpoint must be controlled, switched. More on this point later.

There are several basic consideratio which must be observed in the design of t antenna. First, the overall height is chos on the basis of the lowest operating f quency, with the top-loading taken into c sideration. The transition frequency betwe the operating bands of the discone and cage is very important. It determines maximum diameter of the cage and the ov all dimensions of the discone. Electri height of the overall structure at the tran tion frequency must be less than ¾ wa length to avoid undue vertical pattern lobi at the cage's high frequency limit. For t discone, the flare angle of the cone should about 60°, the diameter of the disc should at least 0.7 times the maximum diameter the cone, and the disc-to-cone spacing sho be about 0.3 times the diameter of the ap of the cone. The slant height of the discon cone should be approximately ¼ waveleng at the discone's lowest operating frequen It so happens that all these parameters f together to make the choice of about 8 m good one for the transition frequency, fo 2 to 30 mc discage. This is near the geomet

[*Continued on page 135*]

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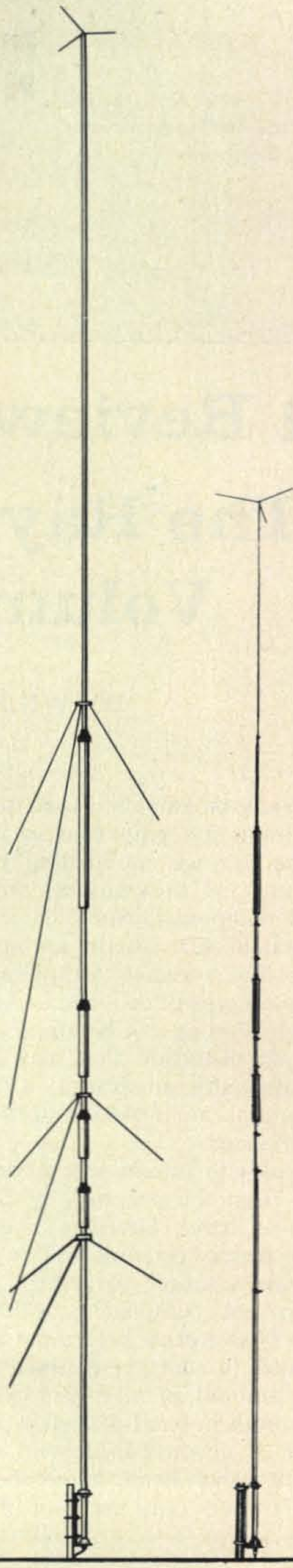

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FOR THE MOST ADVANCED ANTENNAS UNDER THE SUN

See page 150 for New Reader Service

The Raytrack Auto-Level Solid-State Electronic Volume Compressor.

CQ Reviews:

The Raytrack Auto-Level Volume Compressor

BY WILFRED M. SCHERER,* W2AEF

COMPRESSOR amplifiers used in the speech-input circuit are employed to maintain or raise the average modulating power of a transmitter and thus provide more uniform effective talkpower. Such devices engaged with amateur gear usually are no more than clippers that produce a square wave and the inherent type of distortion related thereto. Although filtering can be employed to minimize such distortion that may introduce a wide bandwidth or splatter, a large degree of objectionable in-band distortion still can be experienced.

Systems with automatic level control (a.l.c.) derived from the p.a. may be provided for the job at hand; however, many of these methods depend on some flow of grid current to provide a source of control voltage and thus do not completely avoid a certain amount of overdrive before the level control takes hold. In addition, in some cases where a large amount of a.l.c. is used, the result may be both in-band distortion and a deterioration of unwanted-sideband suppression.

On the other hand, a method that automatically alters only the gain of the speech amplifier, as controlled by its desired a.f. output, to maintain a specific output level with varying degree of input voltages, can preserve the input waveform at the output and thus avoid distortion.

This is just what the Raytrack Auto-Level accomplishes. It is a solid-state volume compressor that is self-regulated by a unique a.g.c. system which makes it possible to maintain a given speech level for maximum modulation without incurring overmodulation or introducing distortion.

Such type systems generally sample the output voltage and rectify it to a d.c. potential that varies the bias and thus the gain of the speech-input stage.

In the Raytrack Auto-Level the job is handled using a small incandescent lamp which is optically coupled to a light-sensitive resistor[1]. The speech-amplifier output is applied to a two-stage d.c.-coupled amplifier that drives the lamp the brilliance of which is therefore dependent on the a.f. amplifier

*Technical Director, *CQ*.

[1] The lamp/resistor unit is made solely for Raytrack and their particular application. It is not available for standard stocks.

See page 150 for New Reader Service

output. This in turn varies the value of the light-sensitive resistor which comprises one portion of a voltage-divider network at the input to the compressor-amplifier output stage.

The divider thus automatically functions electronically as a variable gain control much in the same manner as does a manually-operated potentiometer-type control. The basic setup is shown at fig. 1.

At least 14 db of compression is obtained with a typical mic-input potential of 0.035 volts. The amplifier output under these conditions is rated at 0.07 volts.

The Auto-Level is installed between the microphone and the mic-input of the transmitter. The input impedance of the unit will accommodate medium-impedance (600 ohms or higher) dynamic or magnetic microphones and most crystal types. The output is 50,000 ohms, so the unit must work into a high-impedance load such as the normal mic input to most transmitters.

Operating voltage is obtained from a built-in 117 v.a.c. power supply. An IN-OUT switch controls the power and the routing of the mic circuit. With the switch at IN, the power is applied and the mic signal goes through the compressor. At OUT, the switch removes power and connects the mic directly to the output connector, thus bypassing the compressor.[2]

[2] Only the input to the amplifier is switched. When the mic circuit is connected directly through to the output connector, the amplifier output is also still connected thereto, so the impedance across the output jack always is 50,000 ohms.

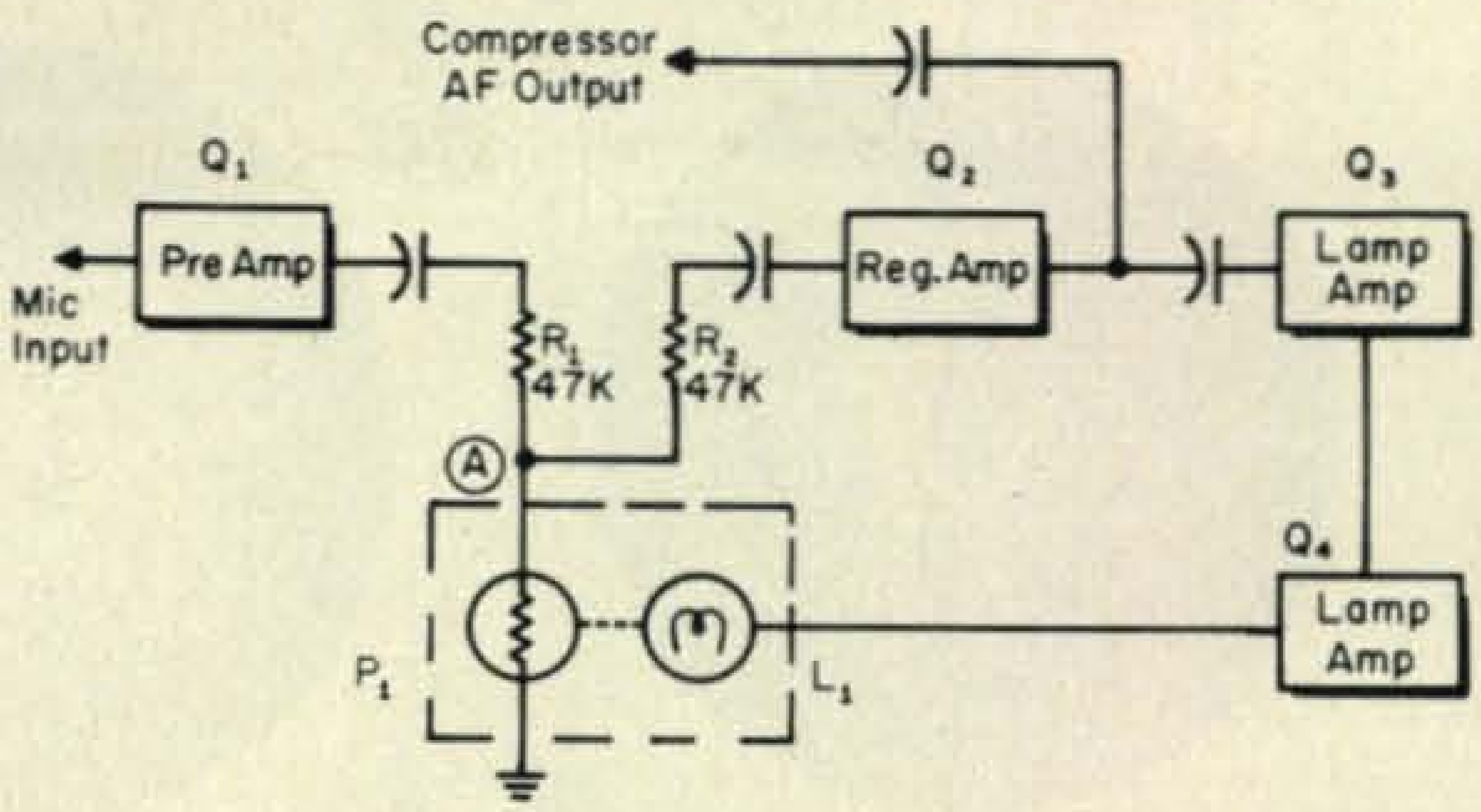


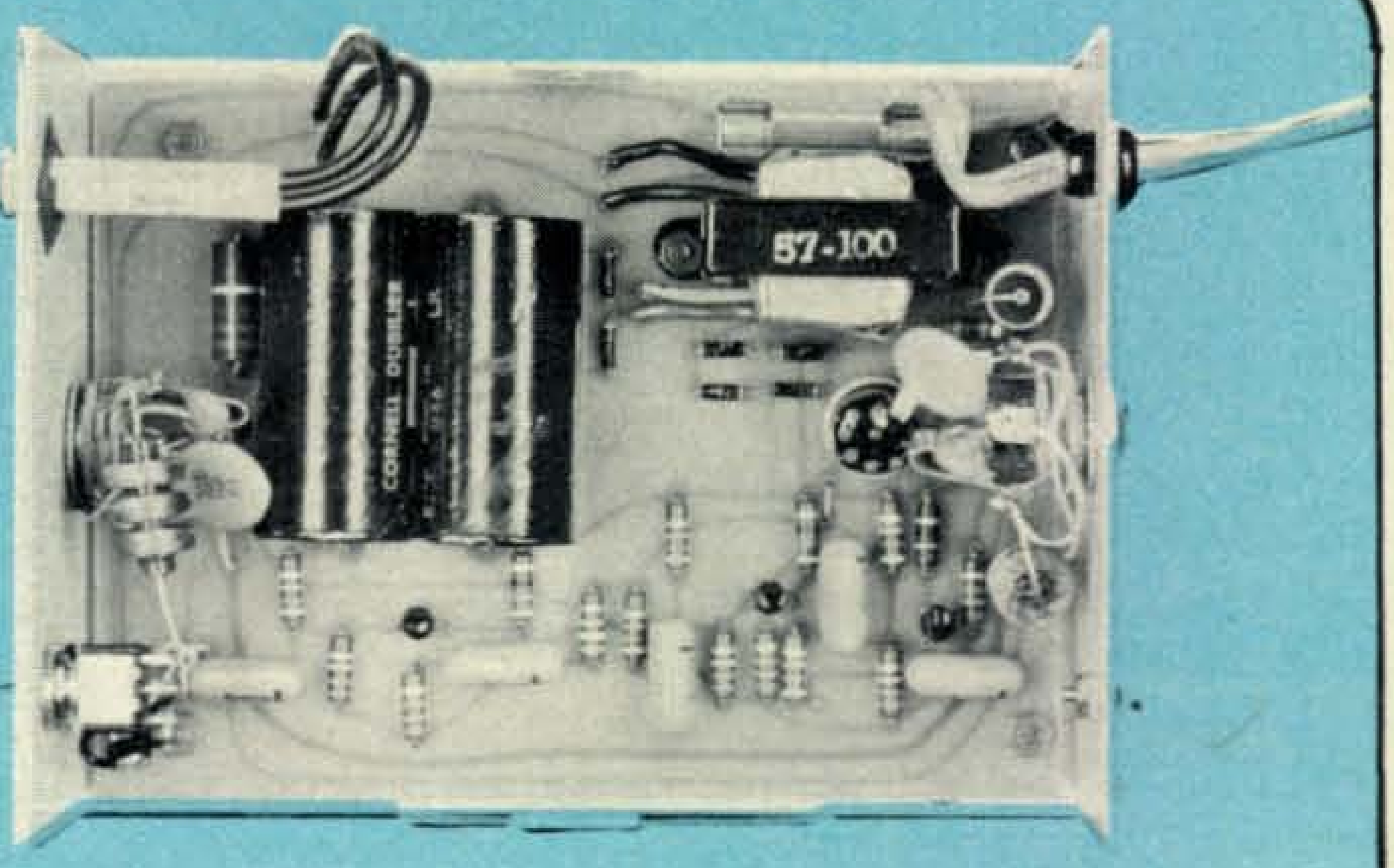
Fig. 1—Basic setup used in the Auto-Level. The light-sensitive resistor, P_1, is optically coupled to the lamp, L_1. The brilliance of L_1 is controlled by the output of Q_4 which depends on the a.f. level applied to Q_2. When the output of Q_2 is low, the lamp glows dimly and P_1 is a high resistance (over 100K). The reduction in voltage at A then is very small and the system operates with essentially maximum gain. As the output of Q_2 tends to rise with higher input voltages from the pre-amp, the lamp brilliance increases and reduces the resistance of P_1 to a low value that accordingly lowers the voltage at A, reducing the input to Q_2 and lowering the system gain. It is thus a self-balancing or regulating affair centered on the desired output voltage for which the system is designed.

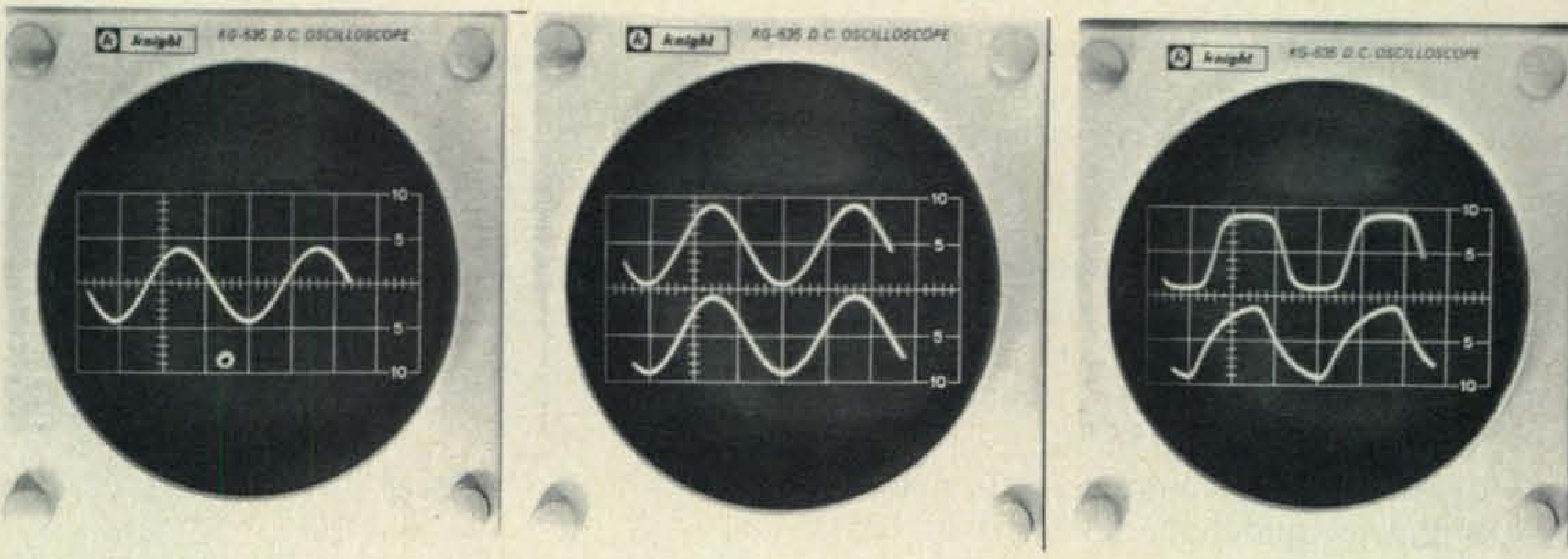
Input and output connections are provided with standard military-type 3-circuit jacks (0.206″ dia. hole), permitting a push-to-talk control circuit to be also fed through the unit.

Construction

The volume compressor is assembled on a glass-epoxy printed-circuit board that is installed in a light-gray metal case size 2¾″ × 4¹¹⁄₁₆″ × 6⅜″ (H.W.D.). The panel is charcoal

Interior view of the Auto-Level showing the components installed on the glass-epoxy printed-circuit board.





(A) (B) (C)

Fig. 2—Oscilloscope displays of output waveforms with 14 db of signal compression or clipping with a sinewave input as shown at A. In all cases the scope sweep has been set to display only two cycles of the signal. (B)—Auto-Level output with 400 c.p.s. (top) and 2000 c.p.s. (bottom). The sinewave is well preserved, indicating no significant distortion. (C)—Output from a typical clipper-type "compressor." The 400 c.p.s. signal (top) is distorted to a square-wave that is rich in harmonics and distortion products. The average level of such a signal applied to an s.s.b. transmitter is not always translated to as high an average r.f. power output, but the large degree of distortion is still retained. Although the waveform of a 2000 c.p.s. signal (at bottom) is somewhat improved over a square wave, due to high-frequency filtering in the particular unit, considerable distortion is still present.

gray and besides the in-out switch it contains the input jack and a pilot lamp. The output jack is on the rear along with the a.c. power cord. The unit weighs 2 pounds.

Operation and Performance

Operation of the Auto-Level requires no adjustment on the unit itself. You simply place it in operation with the in-out switch, talk into the mic and adjust the transmitter mic gain for normal modulation indications such as provided by the p.a. plate current, relative output-power or a.l.c. readings. In respect to the latter, we found it best to adjust the mic gain for a level just about where a.l.c. action commences, letting the Auto-Level handle the job from thereon. Use of an oscilloscope, of course, is the ideal method for determining optimum modulating levels without overload.

Measurements with steady tone indicated that with a 13 db input increase over an average mic level of 0.035 volts, the compressor maintained an output level within 2 db and it was held to within 3 db with a 20 db input change from 7 db below the reference to 13 db above it.

Under dynamic conditions with voice, the Auto-Level reacts to the average speech levels which it then maintains to a uniformly high degree, regardless of the mic-input level above the compression threshold. Occasional peaks in a train of voice energy may be a bit higher in level than that found with compression under steady-state tone, but they will be limited to a relatively uniform extent by the automatic gain reduction governed by the degree of averaged compression. The mic-gain adjustment must therefore be made according to the peak levels.

Where an a.l.c. system is available, it is best simultaneously employed to only a small degree, mainly to hold down an occasional instantaneous overshoot, while allowing the compressor to otherwise maintain the average level. This will produce a highly effective signal at all times without overmodulation or the distortion such as might otherwise be experienced with some systems operating with a high degree of a.l.c. alone.

Because the Auto-Level maintains a relatively uniform output with widely varying mic levels, the modulating level holds up well when the operator moves about the mic, making the actual speech volume or speaking distance from the mike less critical than otherwise.

Besides permitting a good average mic level to be maintained, the unit also may be used to a similiar advantage with conventional phone patches. Its use, of course, also will be beneficial with a.m. transmitters, particularly

[*Continued on page 136*]

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Grumbles

by Sam

We are living in a society where, so it has been said, fame is the name of the game; not money, no longer romance, forget about world travel. Fame, recognition, even notoriety, is what's needed in this world where it is so easy for faces to blend into the multitudes and be lost in a sea of anonymity. For hams, this has been a particularly tacky problem; we are not even known by our faces, we are identified mainly by means of a voice on the air and, haven't you noticed that after a while most hams begin to sound the same? It's because the great majority of the world's 440,000 hams simply do not know how to achieve fame while still getting the maximum enjoyment from their hobby. I've noticed that the number of hams who have learned the secrets of accomplishing this are rapidly growing though, and perhaps even you are part of this group.

To join the fame bandwagon and become well known by your brother operators, you must first realize that the use of ham radio for practical communications is secondary, if, indeed, of any importance at all! Use the telephone or write a letter if you've got a message.

Maximum fame can only be accomplished when the medium is used as a vehicle to promote the ham to a predominant position in the service in the ham community, to raise his prestige and illustrate his superior knowledge of electronics along with his ability to skirt around legal obstacles.

Secondly, to qualify, the ham must have the desire to be Top Dog—an uncontrollable obsession to dominate the scene! If you cannot, due to some psychological quirk, freely admit to this goal, I fear that you are doomed to a ham world of clean, efficient, practical communications and will therefore be destitute of recognition as an (ugh!) average ham.

There is no glory in practicality. To be outstanding, you must differ from the conventional. You must, by all means, dominate.

There is nothing very spectacular or dominating about most ham stations today, even the guys pumping a gallon into a massive array. There are too many of these stations around to let that be the sole thing to set you apart from the rest of the crowd. If you invested $10,000 in such a station with the hope of purchasing fame, you spent far too much. Fame can be achieved with as little as 50 or 60 watts on 6 or 2 meters; of course if you have your $10,000 station already set up. you'll just get to the top of the ladder faster. On the other hand, if you spent all of that money on a fancy station, you might just as well have decided to run 2, 3, or even 5 gallons. To stop at 1,000 watts (or less) actually demonstrates a fear or, at best, respect for federal rulings. What's worse, it could possibly be construed as an indication of courtesy or respect for other operators. It is obvious that you cannot attract full attention if you abide by FCC rulings and you cannot dominate anything if you practice courtesy. So if you can't run a couple of kilowatts, then forget the idea of brute power altogether.

The main thing is to get going hard and fast. You can still clobber other operators with low power—most of us have plenty of local operators who can get swamped under with only a few well placed watts of signal. The more stations you can clobber, the more you will be talked about. This is free publicity and you need it to advance your career as the most recognized and most dominating station around. You can't become a star without publicity.

For starters, 150% modulation is a very important source of enjoyment and will greatly increase your notoriety. The use of speech clippers, compressors, preamplifiers is disdained because most people don't realize that while their range might effectively be increased with these devices, they tend only to make the modulation easier to copy. This is a foolish assumption, since you want a loud, garbled, splattering, type of sound for maximum coverage.

Coupled with a 5,000 watt signal you might be able to destroy communications throughout the hemisphere. On v.h.f. with even 50 watts you could eliminate at least your own county. In any event, with a little fancy footwork, you should be able to get some of your signal splattered out on at least most of the frequency space in whichever band you have chosen.

Assuming that you live in an average sized area, you should be totally wiping out at least 50 other local hams, and rendering more than 60 kc/s useless on an additional 200 rigs in outlying areas. This will certainly cause the operators to sit up and take notice of your superiority.

There are ways of determining if your overmodulation is working well for you. If it is, you will begin to receive timid land line calls saying that, "you are splattering a little." Should this happen, tell the obnoxious pest to stop trying to hear you on a crystal set, or to get his receiver aligned properly.

A couple of the more bold locals might dare to suggest on the air that you are modulating right out of the band edges. If this should occur, run the modulation as far up as it will go, aim the beam squarely on his QTH, and begin reading the telephone directory. This sustained blast of incomprehensive raucous signal should be sufficient to silence even the most aggressive of these creeps.

This is, perhaps, the place to warn the career operator that he may receive an occasional little slip from the FCC monitor suggesting that he is guilty of certain alleged malpractices. These are sent out, you must remember, in order to impede, or if possible halt, the advancement towards ham fame.

One can turn these little instances to an advantage by showing the slips to a select few of the local operators. (It is most dramatic to do this in a furtive fashion.) The word will soon spread and the locals will be awe struck by the impunity with which you by-pass these obstacles. This will greatly enhance your prestige. It may even be whispered in dark corners that you have a few strings attached to Washington. If so, you have passed the first milestone on the road to becoming an unqualified success.

Should the FCC continue its persecution and harassment of your career, your license may be, eventually, revoked. There are accepted face-saving maneuvers that can be immediately executed. Before you are completely removed from the air, be sure that the local ham community fully understands that you feel that you have gone as far as possible on the particular bands you have been using. If you are on the low bands, say you're going to 1296 to do moonbounce. If you're on v.h.f., tell the gang you're going to the low bands and then erect a huge tri-bander on your roof. The aura of mystery surrounding the great silent tri-bander (or 30 foot 1296 parabola) will only increase your prestige and respect for your ability. Therefore, even though you are no longer actually on the air, you are still the center of attraction. Don't forget to occasionally change the position of the antenna to maintain the illusion.

If, however, you can continue to operate due to the fact that the FCC hasn't been able to shoot you out of the saddle, there are a few do's and dont's that should be carefully observed. This collection of operating practices has been proven in many cases to be the best path to instant fame.

DO conduct all modulation, transmitter, and antenna tests only during band openings, and on the busiest portions of the band. This demonstrates the tremendous power and versatility of your station to all. An unidentified dead carrier or 1,000 cycle tone is always a winner—it creates a fantastic amount of interest in you.

DO be sure that all test transmissions contain plenty of remarks such as: "how am I coming in now?" or—"is this any better?" and—"what did that do?" or—"do I have upward modulation now?" These transmitted questions suggest that you are applying your superior ingenuity to constant subtle changes in your gear to further improve its already outstanding superiority.

DO embellish your tests with a great deal of knocking on and blowing into the microphone, or even whistling through your fingers. This maneuver has the distinct advantage of not requiring a station on the other

[*Continued on page 146*]

"It Speaks for Itself..."

BACK IN SEPTEMBER as the deadline approached, we scrapped the copy that had been prepared for this month and instead—because of all the curiosity aroused by our first announcement—we offer you a preview . . .

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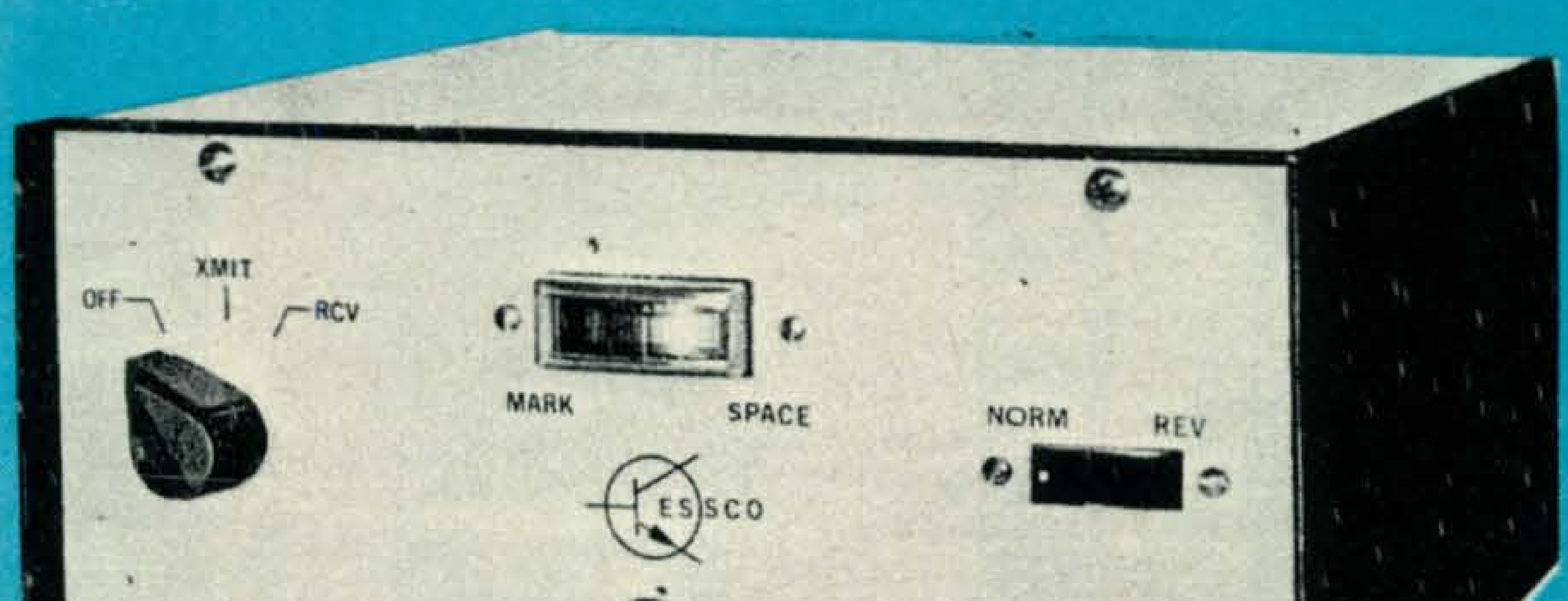

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FINDING TRUE RECEIVER SENSITIVITY

BY JOHN J. SCHULTZ, W2EEY/1*

The rated receiver sensitivity may be drastically changed when the receiver is used in an actual installation. How to determine the extent of this change by using a few simple charts is detailed in this article. Also, the area of how a preamplifier can improve receiver performance is explored in terms of preamplifier placement and required performance. If a receiving setup is desired that will really be able to detect the "weak ones," the basics presented in this article will tell you how to go about developing it.

If a transmitter has an output of 100 watts and is used with a matched transmission line having a 3 db loss on a certain band, the power output at the termination of the transmission line will be 50 watts. The calculation is extremely simple using a power db graph. If more power into the antenna is desired, one can either raise the transmitter output power or reduce the transmission line attenuation. But, what about the receiving situation? How much is receiving sensitivity affected by the transmission line and other losses? Of what value might a preamplifier be and where should it be placed? These questions can all be answered once an analysis is made of a given receiving setup. By a few simple calculations and using some of the original charts developed for this article, one can determine which is the best and least expensive method to improve the receiving side of a station setup.

The material presented is applicable to all bands from 160 meters through u.h.f. Naturally, the reader has to use some judgment in determining how sensitive a receiving capability on a given band is useful. For instance, an ultra-sensitive capability on 160 meters may prove of little value since atmospheric noise will mask weak signals anyway. On u.h.f., on the other hand, increased sensitivity will often result in a direct increase in receiving range. Perhaps the best criteria to use in judging how far one can go in improving receiving sensitivity is to compare the setup with the best that can be found in a given locality and under generally similar antenna locations.

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Noise Figure And Sensitivity

The terms *sensitivity* and *noise figure* are used constantly in the article. One should have a good understanding of their meaning. Sensitivity is a combined measurement of the noise quality and amplification of a receiver. A stated sensitivity *only* has meaning when *both* the output signal-to-noise ratio and bandwidth are stated. Noise figure is purely a measure of the noise producing quality of an amplifier as compared to a theoretically noiseless unit. Most good quality commercial receivers clearly state the conditions under which the sensitivity is measured. Some lower priced equipments simply state "sensitivity of

2 microvolts." Such information is useless and one must try to learn from the manufacturer the rest of the details under which the sensitivity was measured before judging how the receiver can best be improved.

By means of examples, the following paragraphs show how various receiving setups can be analyzed. The method used is applicable, however, to any situation with different values of receiver sensitivity, losses, *etc.*

Basic Receiver Setup

Figure 1(A) is typical of the usual receiver or transceiver installation. The receiver sensitivity shown is typical for many commercially available units. The first step in evaluating the *total* receiving system sensitivity is to sum all the line losses between the receiver and the antenna. This includes the normal transmission line loss for a given length of cable on a specific band as well as the connector, send-receive switch, other switches and measuring and filtering device losses. There is also an additional loss if the transmission line is not operating at unity s.w.r. (which will be the same under receiving conditions if the receiver has a 50 ohm input). This additional loss can be determined from the graph of fig. 2 and should be added to the db sum of all the other losses. The second step is to convert the receiver sensitivity to unity signal-to-noise ratio output and also to express the sensitivity in dbm. This is necessary because receiver sensitivities are expressed by manufacturers for a multitude of signal-to-noise ratios and the only way to compare them is to reduce or convert them to a common base. From fig. 3, for the receiver sensitivity shown in fig. 1(A), it is seen that the 1 microvolt sensitivity is equal to −107 dbm. Since this sensitivity is for a 10 db signal-to-noise ratio output, it must be improved to 10 db less or −117 dbm for unity signal-to-noise ratio sensitivity. The direct reduction in sensitivity with decrease in signal-to-noise ratio is possible because a receiver is a linear amplifying device. If the receiver sensitivity were stated for 15 db signal-to-noise ratio, for instance, −15 db would be added to the value determined from fig. 3. From fig. 4, then, using the bandwidth stated in fig. 1(A) for the receiver sensitivity value, one can draw a line between 3 kc on the left scale and −117 dbm on the center scale to find the noise figure at 21 db. Such a value is fairly typical of medium grade receivers but not really obvious from just the sensitivity figure.

To determine the effect of the cable losses, one has only to degrade the sensitivity and noise factor figures by the appropriate db value. The sensitivity at the antenna terminals is then −111 dbm for unity signal-to-noise ratio and the corresponding noise factor is

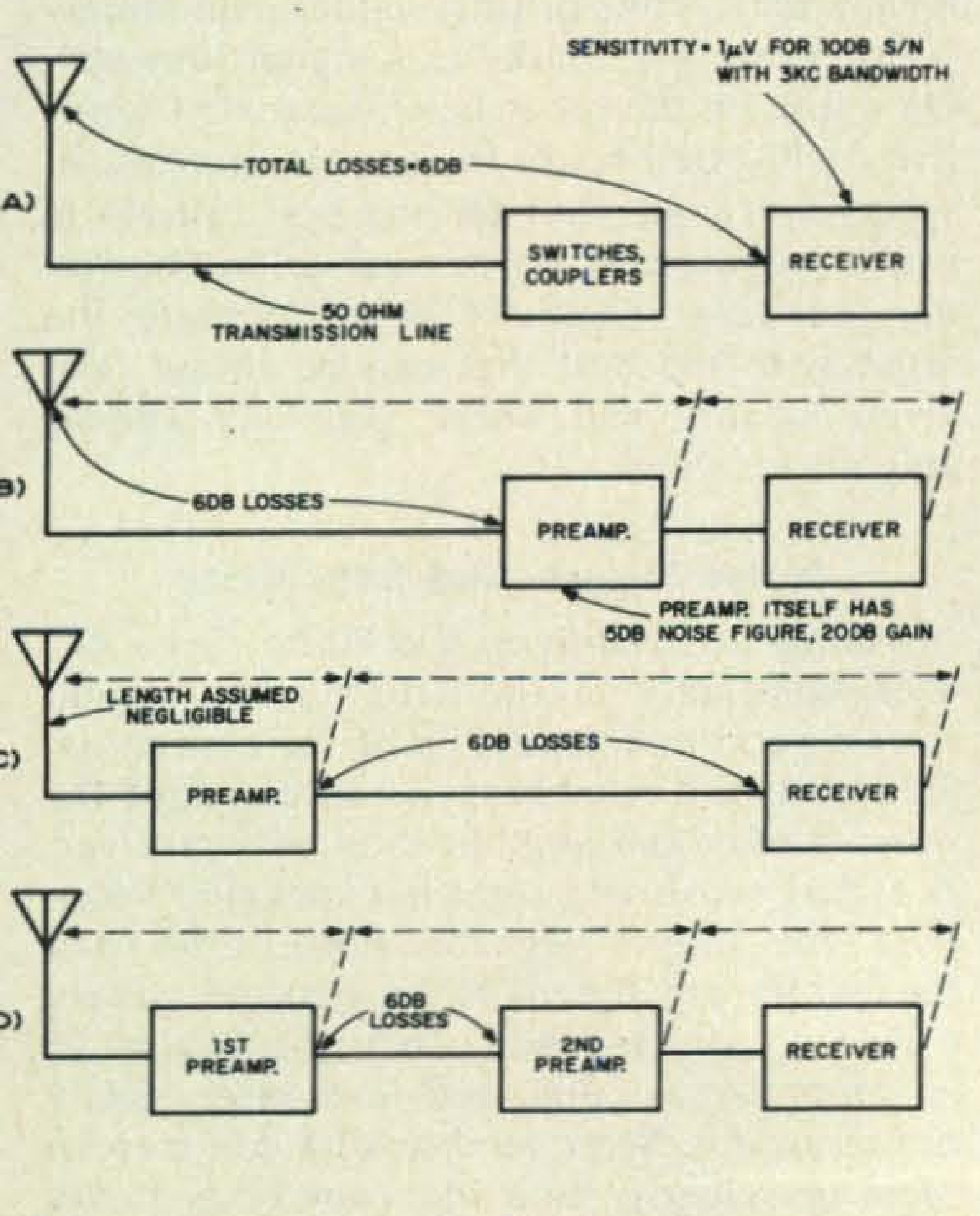

Fig. 1—Various placements of preamplifiers discussed in the text.

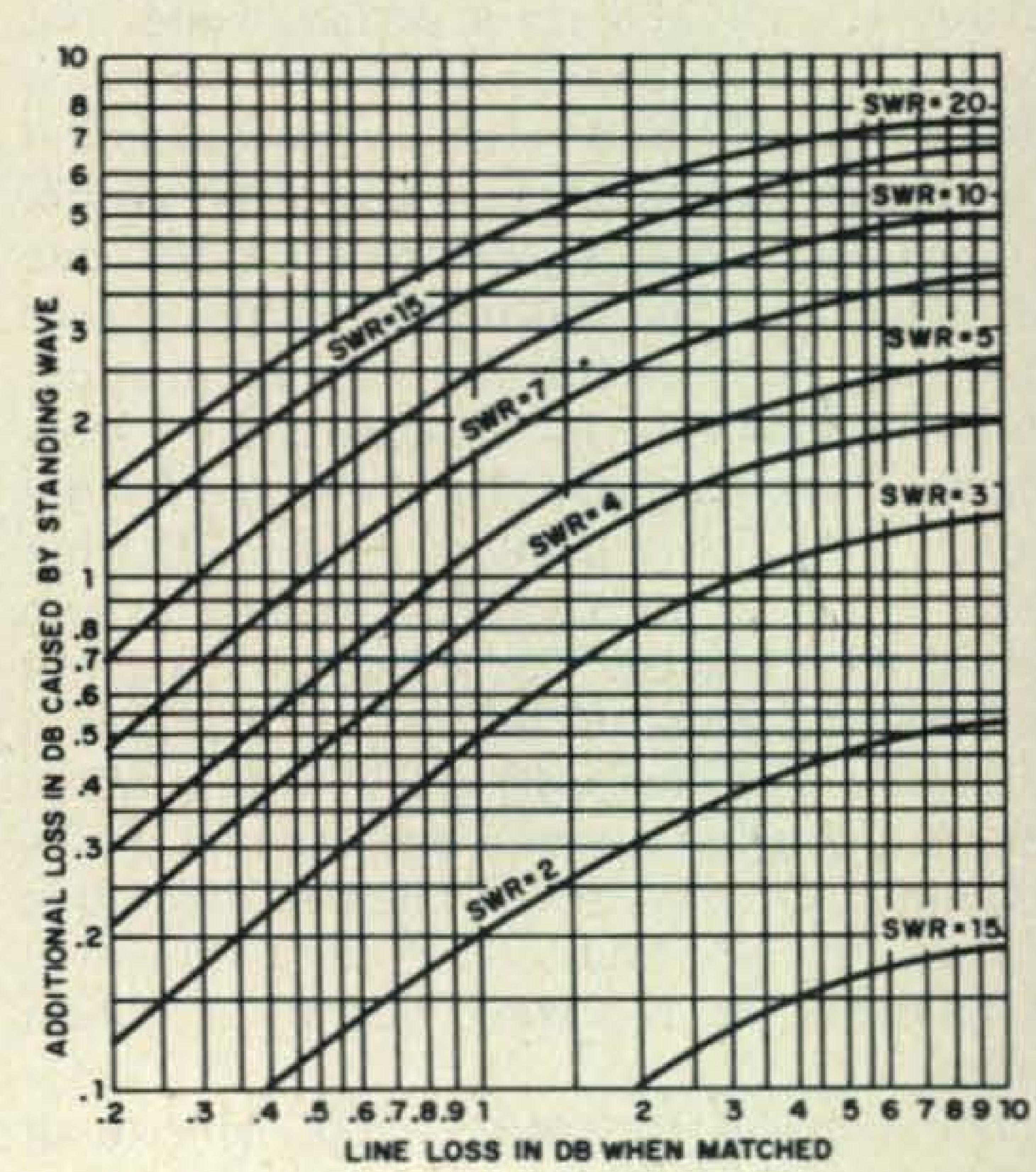

Fig. 2—Additional transmission line loss introduced by various standing wave ratios. This additional loss in db must be added to the sum of all other line losses in db.

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Microvolts	dbm
0.1	−127.0
0.2	−121.0
0.3	−117.5
0.4	−115.0
0.5	−113.0
0.6	−111.5
0.8	−109.0
1.0	−107.0
2.0	−101.0
3.0	−97.5
4.0	−95.0
5.0	−93.0
6.0	−91.5
7.0	−90.0
8.0	−89.0
9.0	−88.0
10.0	−87.0

Fig. 3—Microvolt to dbm conversion scale for a nominal 50 ohm receiving system.

27 db. One can use the charts "backwards" to convert the sensitivity into whatever form of expression is desired. For instance, for a 10 db signal-to-noise ratio, 10 db is added to the sensitivity (producing −101 dbm) and from fig. 3 this is found to be 2 microvolts. Thus, two times the voltage is required at the antenna to produce the equivalent of a 10 db signal-to-noise ratio at the receiver. In this simple case, this factor should be obvious from the transmission line loss since a 6 db drop will produce half the terminal voltage.

Preamplifier At Receiver

One idea that may come to mind to correct the relatively poor receiving situation shown in fig. 1(A) is the use of preamplifier at the receiver as shown in fig. 1(B). A fairly good preamplifier, at least for the high-frequency bands, having a noise figure of 5 db and gain of 20 db is used. No change is made in the

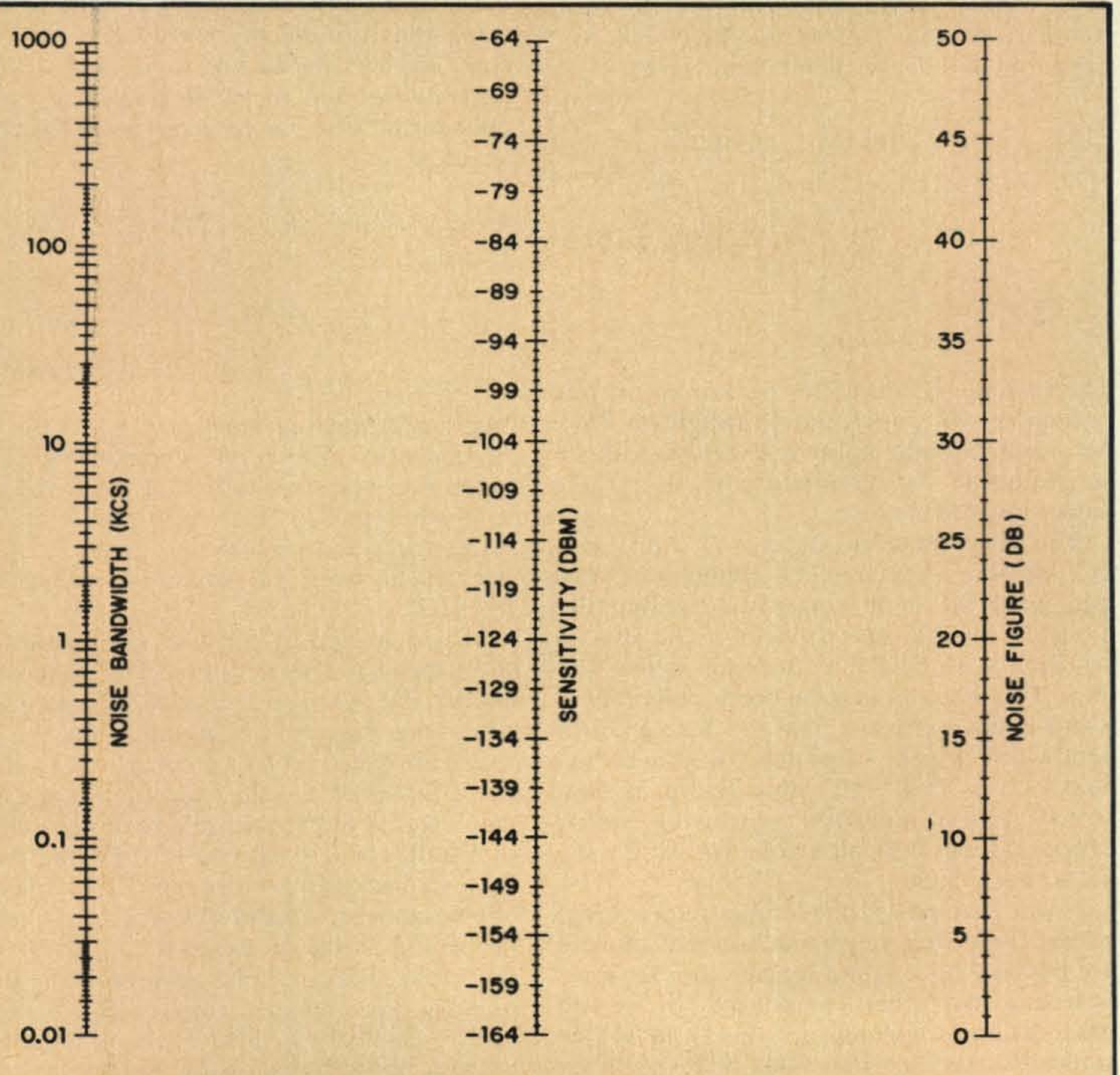

Fig. 4—Nomograph for dbm sensitivity and noise figure comparison.

transmission line between the preamplifier and the antenna and the tranmission line between the preamplifier and receiver is assumed to be of negligible length and loss.

Calculating the overall receiver system sensitivity is done by first regarding the portion from the preamplifier back to the antenna the same as the situation shown in fig. 1(A). Thus, the preamplifier noise figure is raised by the line loss to 11 db and its gain reduced by the line loss to 14 db. The noise figure of the original receiver (21 db) remains unchanged. The total noise figure is found from the following formula which relates the individual noise figures of several successive units to an overall figure:

$$NF_{\text{Total}}\ (\text{db}) = 10\log\left[NF_1 + \frac{NF_2 - 1}{G_1} + \frac{NF_3 - 1}{G_1 G_2}\right]$$

Since only two stages are involved in this case, the part of the expression, $NF_3 - 1/G_1G_2$, drops out and the resultant expression is:

$$NF_{\text{Total}}\ (\text{db}) = 10\log\left[11\ \text{db} + \frac{21\ \text{db} - 1}{14\ \text{db}}\right]$$

$$= 10\log\left[12.5 + \frac{130 - 1}{25}\right]$$

$$= 12.5\ \text{db}$$

The formula is simple to use as long as one remembers to convert the db values for NF_1, NF_2 and G_1 into numerical ratios, using a simple power db scale, before inserting these values into the formula.

The resultant noise figure (12.5 db) is a considerable improvement although it does not equal the 5 db which the preamplifier alone is capable of producing. The overall sensitivity can be found from fig. 4 as −127 dbm. This assumes that the preamplifier bandwidth is not narrower than the 3 kc receiver bandwidth which, of course, would be the actual case. The −127 dbm figure, if converted into a microvolt sensitivity, would produce about 0.3 microvolts for 10 db signal-to-noise ratio.

If one wanted to still further improve the overall receiving sensitivity, several choices are possible. One could replace the transmission line and other components in it with types having a significantly lower loss. One could also replace the preamplifier with an advanced type having only a 1-2 db noise figure. One could also try to locate the present preamplifier in such a manner, that its 5 db noise figure is used to better advantages. Assuming that the transmission line loss cannot be economically reduced and building of a significantly lower noise level preamplifier is not practical, the next situation considers the effect of relocation of the preamplifier.

Preamplifier At Antenna

Since the preamplifier noise figure is increased by the attenuation of the transmission line between it and the antenna, the logical location to preserve the preamplifiers noise figure would seem to be at the antenna itself as shown in fig. 1(C). In this location the noise figure and the gain of the preamplifier are not degraded by the line loss preceding the unit. The transmission line loss does, however, degrade the basic receiver noise figure, the same as in fig. 1(A). The resultant total noise figure and sensitivity can be calculated using the formula previously given. In this case, considering no line losses added to the preamplifier and the 6 db line losses added only to the original receiver noise figure we have:

$$NF_{\text{Total}}\ (\text{db}) = 10\log\left[5\ \text{db} + \frac{27\ \text{db} - 1}{20\ \text{db}}\right]$$

$$= 10\log[8.2]$$

$$= 9.14\ \text{db}$$

The corresponding sensitivity is −130 dbm, or converted into terms comparable to the given receiver sensitivity, 0.2 microvolts for a 10 db signal-to-noise ratio. This resultant noise figure and sensitivity is certainly an improvement over the situation outlined for fig. 1(B).

If one wished to consider still further improvements in the overall receiver system sensitivity, the practical approaches begin to narrow rather rapidly. For instance, the use of a really advanced type of preamplifier having a noise factor of 1-2 db (and the same 20 db gain) would only produce a total noise figure of 8.2 db (or a sensitivity of 0.19 microvolts for a 10 db signal-to-noise ratio). Certainly the effort required to build this type of preamplifier would hardly be worth the minor gain in sensitivity that would be achieved. The other possible approaches to improved system receiver sensitivity involve again either the reduction in the transmission line losses or the use of an additional preamplifier (or postamplifier as it is called when installed in conjunction with a preamplifier). Assuming that economic factors obviate the first possibility, it is interesting to consider the advantages derived from the installation of two amplifiers.

Combined Pre and Post Amplification

Figure 1(D) shows the use of two amplifiers, one at the antenna as a preamplifier and another at the receiver or a postamplifier. If possible, the preamplifier should be of better quality than the postamplifier but it is assumed for this example that both amplifiers are of the same quality in order to derive some direct comparison to the use of the amplifier in the foregoing examples. Looking "backwards" from the preamplifier to the antenna, the noise figure and the gain data remain the same as in fig. 1(C). Also looking "backwards" from the postamplifier to the preamplifier, the noise figure and gain data for the postamplifier are the same as that for the preamplifier in fig. 1(B). The noise figure of the receiver remains unchanged. Combining these noise figures into the previously given formula, we have:

$$NF_{\text{Total}}\,(\text{db}) = 10\log\left[5\,\text{db} + \frac{11\,\text{db} - 1}{20\,\text{db}} + \frac{21\,\text{db} - 1}{20\,\text{db}\cdot 14\,\text{db}}\right]$$

$$= 10\log[3.32]$$
$$= 5.2\,\text{db}$$

Thus, an overall noise figure almost exactly equal to that of the preamplifier can be achieved with this arrangement. Converted into a sensitivity figure, the noise figure produces −134 dbm or, otherwise stated, 0.13 microvolt for 10 db signal-to-noise ratio. If one looks closely at the formula, it will be noted that the overall noise figure goes closer to 5 db as the postamplifier is moved along the transmission line closer to the preamplifier. If one were dealing with an extremely long and lossy transmission line, it might well prove worthwhile to locate the postamplifier in the middle of the transmission line run and even use a second postamplifier at the receiver. Also, it should be obvious that the amplifier with the lowest noise figure should be used as the preamplifier if two amplifiers are available and physical conditions permit this type of placement. To use the lower noise figure amplifier as the postamplifier would be wasting its advantage.

Graphing System Performance for One Preamplifier

From the data which has been presented, it should be possible for anyone to calculate their receiving system sensitivity and to understand what steps might be taken to improve it. Deciding upon which steps are the most economical, both in terms of effort and equipment expense, can often be resolved by graphing the various possibilities as shown in figs. 5 and 6. Both graphs are based upon the conditions noted on the graphs but similar ones can be produced for any given receiving situation.

Figure 5 relates the improvement in overall receiver system sensitivity to the use of receivers with different sensitivities with various quality preamplifiers. Several conclusions can be drawn from an examination of the graph. First, almost any type of preamp-

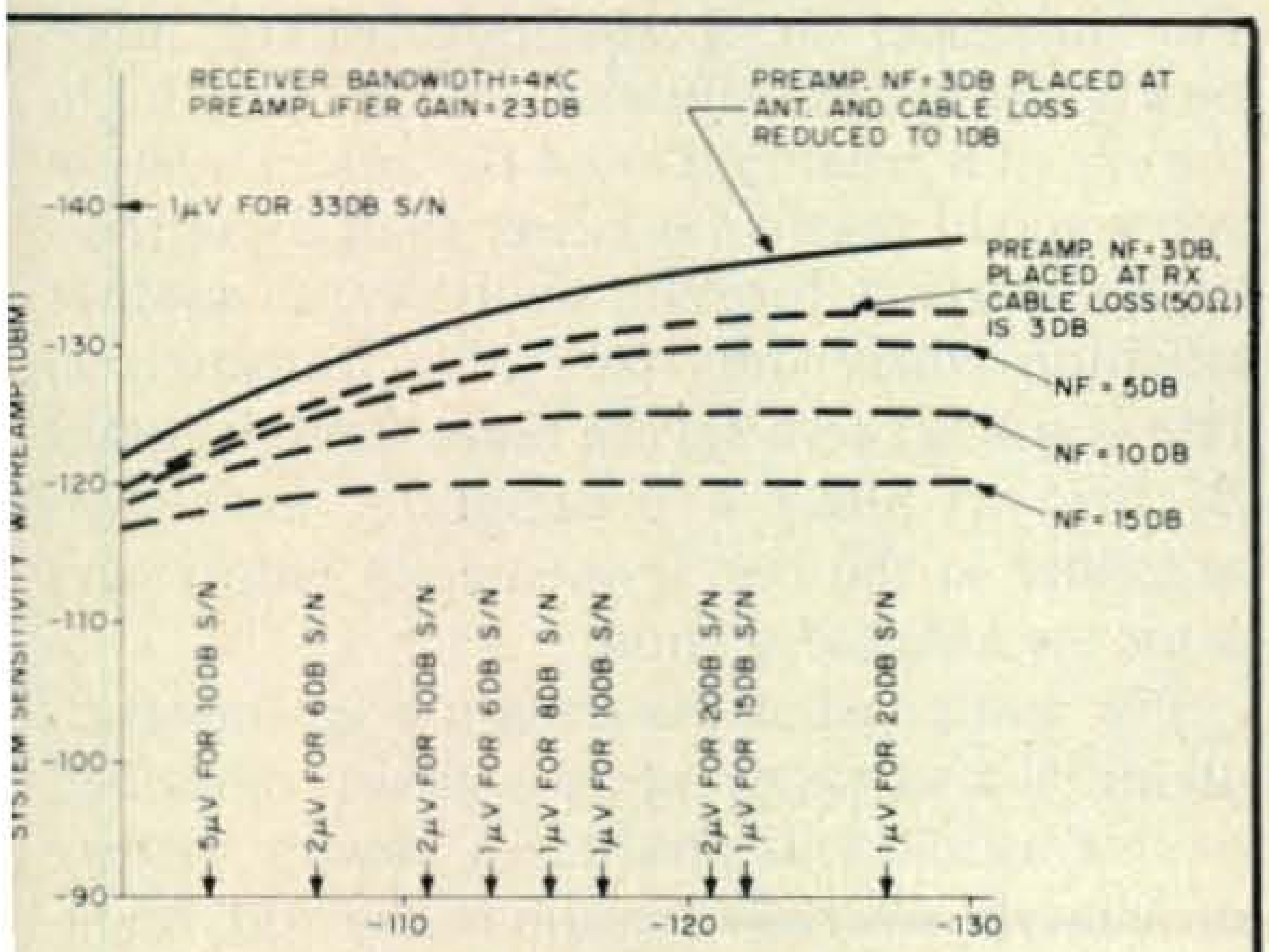

Fig. 5—Resultant overall sensitivity as the result of the use of various preamplifiers.

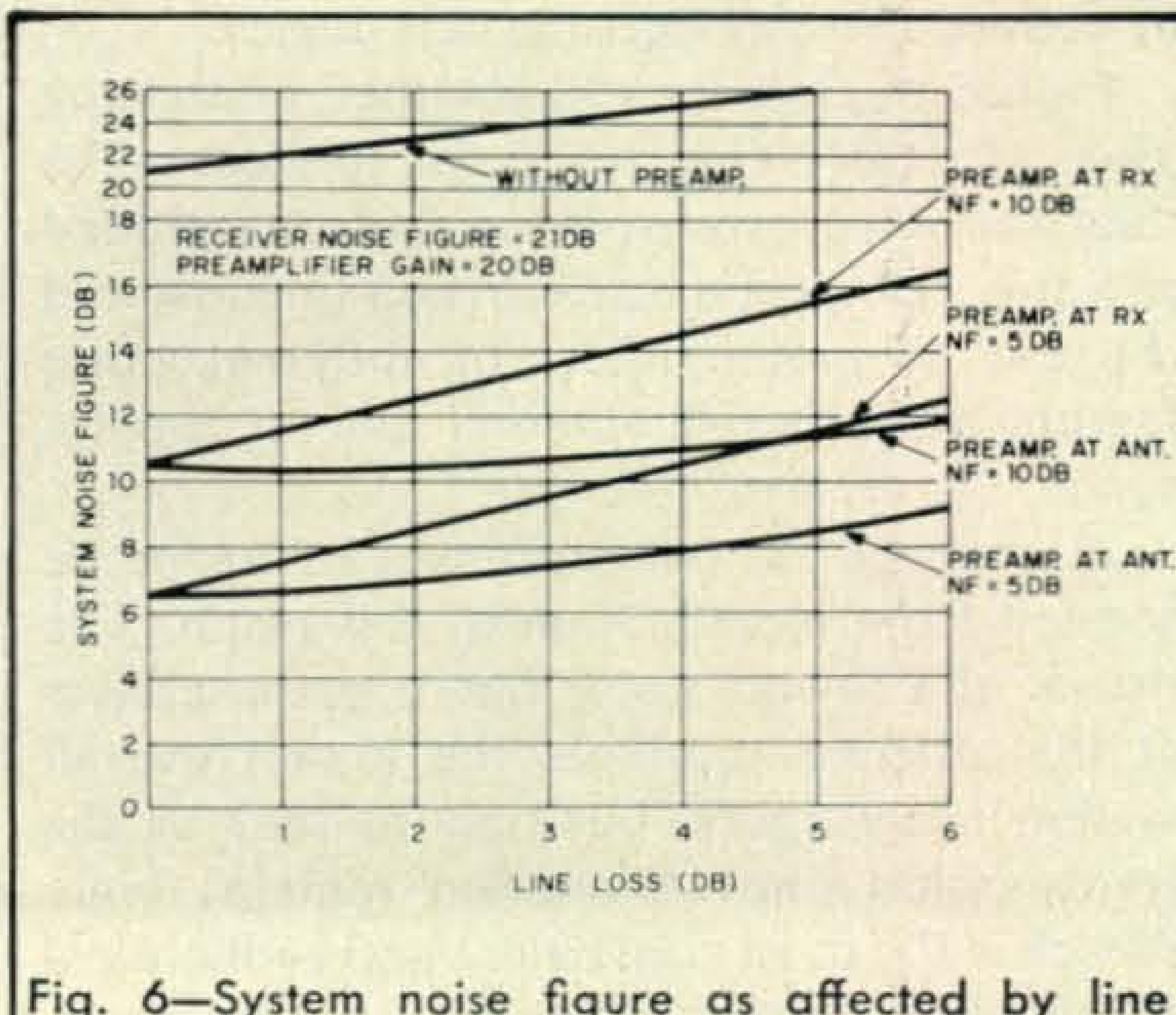

Fig. 6—System noise figure as affected by line loss, preamplifier noise figure and preamplifier placement.

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lifier, no matter where it is placed, can considerably improve the performance of a really poor receiver. Also, the use of an extremely low noise figure preamplifier with a poor receiver produces a negligible improvement as compared to the use of an easier to build and less expensive preamplifier having only a moderately good noise figure. Secondly, the inept use of a preamplifier of poor quality with a good, sensitive receiver can actually degrade the overall receiving system sensitivity. It is important to realize that this condition may not really be obvious when the preamplifier is used. The preamplifier provides gain and an "apparent" increase in signal strength will be observed for moderate to strong signals but actually very weak signals will *not* be heard as well as before. For instance, note from fig. 5, the use of a preamplifier having a noise figure of 10 db with a receiver having a sensitivity of 1 microvolt for a 20 db signal-to-noise ratio. For the conditions shown, the total receiving sensitivity is actually reduced 5 db by using the preamplifier. Thirdly, the graph provides some indication of how worthwhile it is to reduce the preamplifier noise figure to the lowest possible value. Again, for the conditions shown, there is a notable gain achieved in reducing the preamplifier noise figure from 15 db to 10 db or from 10 db to 5 db. There is a smaller gain in reducing the noise figure from 5 db to 3 db and, although not shown on the graph, an almost non-existent gain in reducing the noise figure from 3 db to 0 db. As the noise figure of the preamplifier becomes less and less, the only way to squeeze still better performance from the receiving system is to either relocate the preamplifier or reduce the transmission line losses.

Figure 6 presents still another interesting view of a receiving setup. In this case, the total receiving system noise figure is plotted as a function of the transmission line loss and the use of preamplifiers of different noise factors at both the antenna and at the receiver.

A number of conclusions can again be formed from examination of the graph. The use of the lowest noise figure preamplifiers at the antenna produces the lowest overall system noise figure, but only as long as the transmission line attenuation remains high. Which is the most convenient and economical approach in a real situation, to put a preamplifier at the antenna or to place it at the receiver but replace the transmission line with one having lower losses? A preamplifier of moderate quality (10 db noise figure) placed at the antenna will perform slightly better than a preamplifier having a 5 db noise figure placed at the receiver, as long as the transmission line attenuation does not fall below 5 db for the situation shown. Another interesting point learned from the graph is that a preamplifier having a 10 db noise figure will perform just as well at the receiver as one having a 5 db noise figure, providing transmission line losses are reduced to a minimum. So, the question of which course to follow depends upon whether it is more economical and convenient to build a lower noise preamplifier or to replace the transmission line. As noted before, it is really useless to carry both factors to their ultimate and some choice or balance between the two must be made in any given situation.

Summary

This article has tried to present a method, using the minimum of mathematics, by which any amateur can calculate or graph what is really happening with his receiving setup. The material presented is only valid absolutely for 50 ohm [transmission] line systems but the relative results are applicable to other impedance systems also. Some technical inaccuracies are present in the methods used but they really are of a minor nature and probably will never be of concern in an actual situation. For instance, signal-to-noise ratios instead of signal-plus-noise to noise ratios were used for the receivers.

There may also be other reasons present in a specific situation for the choosing of a location for a preamplifier or postamplifier. For instance, in a situation where noise pickup by the transmission line is fairly high, the use of a preamplifier by the antenna might show actual results far better than those indicated by strict formula analysis. In another situation where only part of a transmission line is subject to a severe noise field, it might be best to place a preamplifier and postamplifier in the line immediately before and after the affected section.

No matter what the situation is, however, an initial analysis using the methods described in this article will produce a clearer picture of what the overall situation is like and, hopefully, produce some ideas on the best way to go about hearing the weak ones with a minimum of strain. ■

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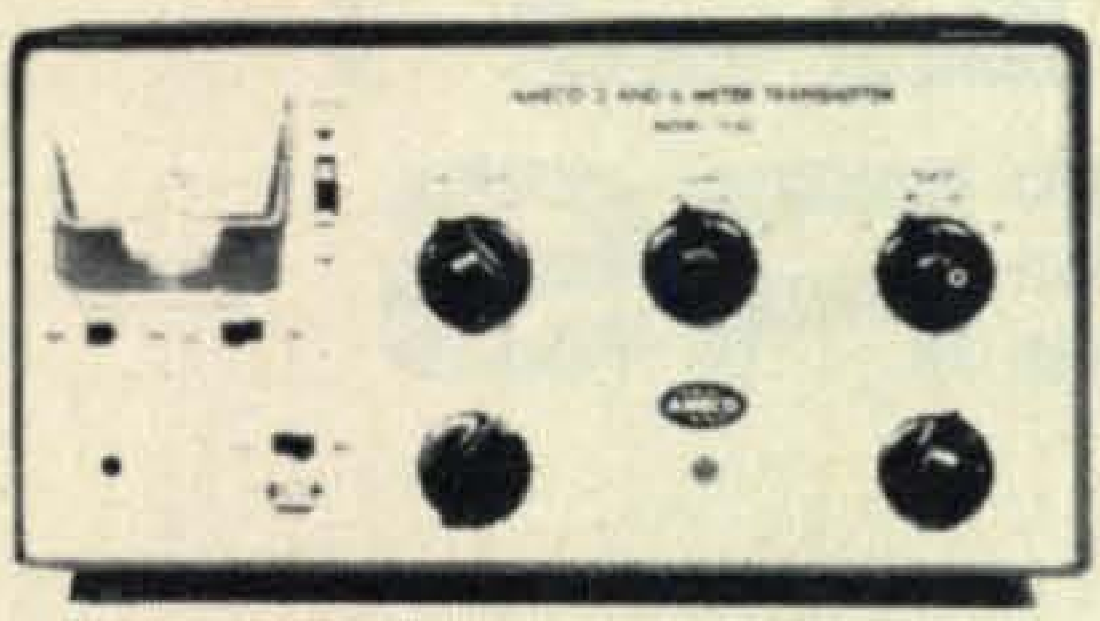

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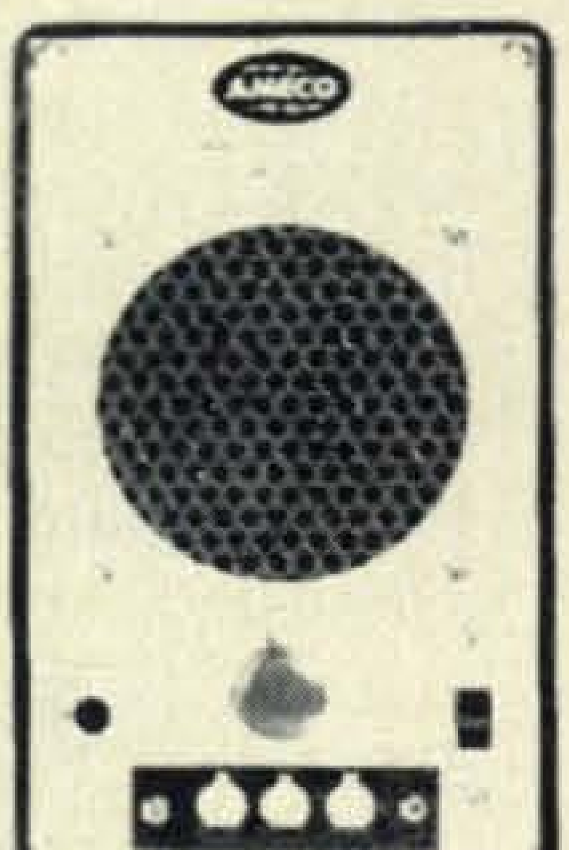

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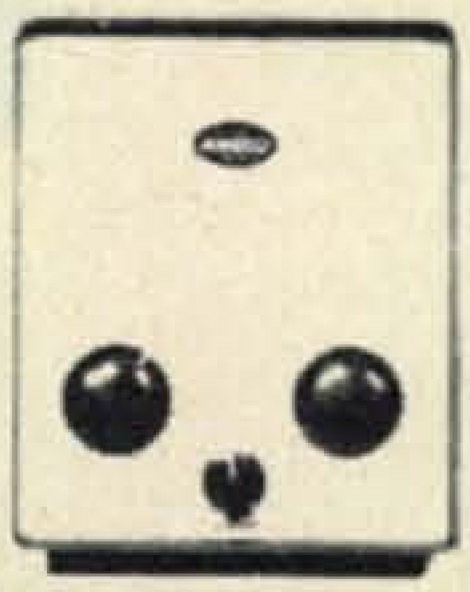

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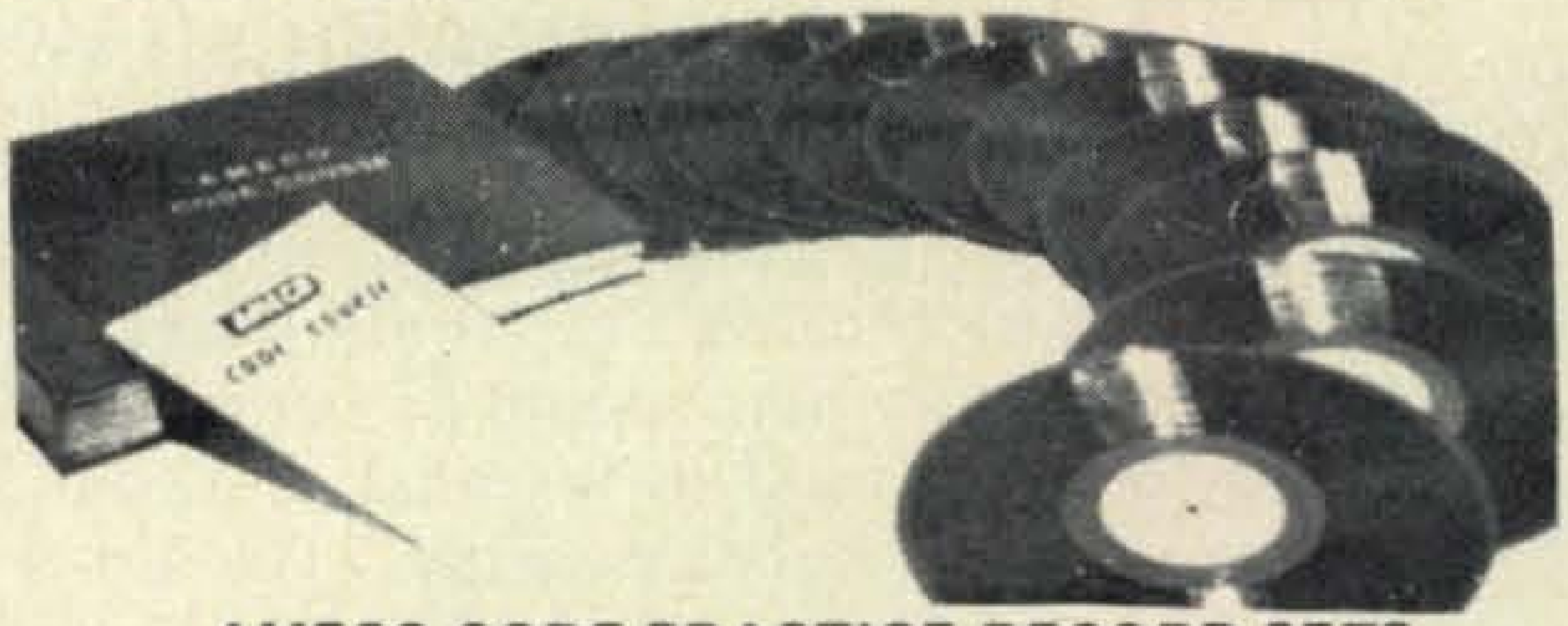

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CONTEST CAPERS

BY ALAN SHAWSMITH,* VK4SS

DON'T smile, because I'm serious when I say that the family man should be permitted a points bonus to add to his total score in whatever contest he participates. The unmarried op usually gets away with a lap start.

It's a game father who tackles a 48 hour weekend contest stint, and really believes he will see it out, uninterrupted—no matter how well he plans in advance.

Take my case, where man proposes, but God disposes—It's Friday morning before the *CQ* C.W. Test. In approx. 26 hours, viz 10 A.M. Saturday EAST, the big battle is due to commence.

The YF is making notes at the breakfast table of the things I *must*, yes, *must* do today, if I'm to be free tomorrow.

"There", she says in a cold final voice, "don't forget anything." The list seemed as long as a road to infinity. Suddenly it was all not worth the effort.

"Ring the office and say I won't be in today. Not with this to attend to." I received no answer, only a smug selfish smile.

I dropped into bed around 11:30 P.M. as flat as my kid's bike tire. Seven hours good sleep and I'll be OK I remembered thinking dimly.

I was just dozing off, or so it seemed, when I felt the wife beating the soles of my feet with a coat hanger, (one of her barbarous little acts which she does with utmost sadistic satisfaction, when I'm really flaked out).

"Wassametter. Fair Go. Its not the grog," I began to mumble.

"It's 7 A.M.," she said. "Time you got young Ian off to the Y Camp."

"To the where?" I queried, still mentally disorganized.

"The YMCA Camp. No bus going, so the fathers have to drive the boys out".

*35 Whynot St., West End, Brisbane, Queensland, Australia.

Women love without the need of articulate words but my YF has an added facet. She nags with her eyes and never have I met a woman more able than this gifted elfin creature. She stood silently at the foot of the bed giving me the treatment and slowly getting her own way.

Finally, angrily I flung the bedclothes aside. "I've got a contest in a couple of hours. What happened to the hired bus? Why the change of plans?"

She smiled sweetly and said. "Darling, there's no milk. Truck's broken down. Run along to the store will you?"

I lumbered towards the bathroom for some cold water for my face.

Two blocks away, I came across our milko, and like a fool I stopped. (How could I pass up an ole cobber from the last war.)

"Bit of trouble, Sid?" I queried.

"Hi, Al, you're just the man. Take these four crates up to your place and distribute them."

How could I say no to a stout fellow, who had done me many a good turn previously; before I knew it, I was back home with 120 bottles of milk.

What with the delivery of same and rushing No. 2 son to the Y Camp, I arrived home one hour late for the Contest, sweating and exhausted, and only a little consoled by the fact of having done a Boy Scout deed for the day.

Have you ever listened to the commencement of a big contest? Being a 'Dog Fight' veteran, I'm used to the procedure. Usually, before starting time, the bands are quiet: the lull before the storm; everybody's warming up the gear and getting things shipshape, etc. Right on time, as if a stadium gong is struck, bedlam breaks loose. Like ghosts from the tombs there arises a cacophony of sound. In the A1 mode there are notes of all descrip-

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tions and fists of all kinds. There are those so chirpy that they rise from the QRM like some banshee wail. There are those who sound tremuluous and uncertain. There are those who frequency drift is so severe they positively gallop across the band as if off on some long journey into spectrums unknown. There are those who resemble under done T-bone steaks, so bloody is the note. The keying runs from that which is first class down to the utterly unintelligible.

I was about to warm up the rig and join the melee when the YF appeared and said, "Have you made your supplications to the Gods of Communication and pinned the Olympic Games Motto above the rig?"

"No", I replied.

"How very foolish."

"Lets face it. I've thought a lot about that maxim, but I compete to win, not fool around."

A light brush of her lips on as yet my unshaven cheek and I knew I had her encouragement. The forces of will-to-win and determination rose within me several db. (Other hams YF's please note this psychology.) Anyone who beats ole Al is gonna hafta work hard that's for sure. So I sidled my 40 watts into a spot of low QRM and joined the fanatics.

0300 z: Apart from a Local, one mile away, testing and calling CQ, all's going well. Receiver Output seems down; am I being blanketed?

0345 z: It's happened. I saw the thin pencil of smoke before I smelt the heated wax. Automatically I hit the big switch. Sitting mute, I watched the faint line of smoke fade into oblivion, and with it went the hopes of this *CQ* Contest...The Receiver power trannie had packed up.

Others react to such circumstances in their own individual way. For my part, for a fleeting second, I would have gladly smashed in the goitered face of the ole faithful AR88, if my hand could have come to anything suitable. I stood straight up and let the tightness out of the diaphragm with a long series of softly spoken cuss words; then I turned on my heel and fell prone on the nearest bed—for the moment licked, and utterly let-down.

'Twas here the YF found me.

"So you've won it," she said with affected warmth.

"Don't be crazy," I replied. "The rig's cracked up."

"Can you set it right in time?"

I stared mutely and miserably at the ceiling.

"Either way," she said, "get up and look cheerful; quit the self-pity."

It was a challenge I could hardly ignore, and retail by self-respect. My forebears are noted for their determinedness, rather than anything else, and it's a wonderful ingredient to possess – provided it doesn't get to the mulish stage.

Three hours later, with a new trannie installed, the ole AR88 came gustfully to life and like a sail boat just rigged and launched, we were away once again.

The hours drifted on. The band was lively and it makes for pleasant and lazy operating to be called continually. I told myself I had had my bad luck and unless the fates were about to be particularly unkind, the rest would be plain sailing, especially as it looked that I would not have too much competition from my own area.

Right on 7 P.M. the phone rang and a minute later the YF appeared. "It's Mr. Jenks on the line. He says if you want that land deal to go through he'll have to get your signature now."

"Honey, explain how I'm placed here and ask him can he come over."

"Says he can't. Sprained his ankle falling into a bunker at golf while wooing your client."

I let out a long deep sigh. A drive right across town 7 P.M. Saturday night traffic is not what I was looking forward to. Four hours later I arrived home with the deal still uncompleted and the band almost dead.

Around midnight the good woman appeared, fresh and fragrant in the now slightly foetid ham shack atmosphere. She placed before me coffee and sandwiches, and on me a goodnight kiss. To me she said, "No pep pills, remember last time." (As If I could forget it, but that's another story.)

In a weak moment I almost followed her. What the heck am I doing here, sweating it out, in front of this heap of junk? But the demands of one's ego are costly indeed, so I buried the ears deeper into the fones, and carried on.

DXing through the night, is like searching for new horizons each day; the attraction is insatiate. One never knows what's behind the next CQ. But contest operating slowly takes the edge off the anticipations. As the

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hours drag on the sharpness goes out of body and mind. The back begins to ache, as does the operating arm and in my case neuralgia gradually makes its appearance felt in my best listening ear. Finally numbness seems to displace the aches and pains and one has to draw on the resources of the will if one is to see the time out.

Late Sunday morning with the big effort half over the YF announced that s.w.l. Harry Klewless was on the fone and wanted words. I should have remembered this local and his regular Sunday morning call. If it is a hams duty to help s.w.l.'s then I've done it well by Harry, who is one who needs a terrible lot of assistance. There's no virtue in cheap satire but whenever I hear his name I cannot help thinking how well the name fits his radio knowhow.

"It's the chap with the high pitched squeaky voice," said the good woman. As if there could be any mistake.

"Ask him what the trouble is."

"He's built a two tube super but can only hear you and lots of noise."

"A what?," I queried.

"A two tube super."

"Ask him where he got that circuit."

"From a magazine called *CQ*."

"Never," I said.

"He's got permission of six of his neighbors to string up a long wire, through their properties. He wants to get South Africa: Will it help?"

"Why South Africa? Never mind, never mind," I said. I could see it might get complicated and time consuming. "Tell him to go right ahead."

Oh, to have such neighbors I pondered. Here if I go out and look up at the antenna they phone the Council Inspector.

Sunday afternoon was one of almost complete loss as far as the contest was concerned. Firstly the aforementioned Klewless arrived to say in deadly seriousness that he was not happy with the morning's phone conversation. The longwire was up (mighty quick I thought) but now all he could get was noise.

"Guess it's that high tension mains trannie up the road from you," I said trying to be patient.

"That what?"

"The high tension—Oh skip it." I knew it was hopeless. "Try shortening it a section at a time.

Finally, as I pushed Harry out of the shack, the phone rang. All thought of the contest disappeared at what I heard.

"This is Camp Warana. Your son has had an accident. He's in the Camp hospital."

I dropped the receiver and ran for the car. I was zooming out of the driveway when the YF flagged me down to say that the Doc had seen him and it was only very superficial, but they wanted to prepare us for a few bandages and maybe a little blood.

"Well, couldn't they have given the info tail piece first," I said angrily. I restored the car to its port badly needing a double brandy. When I settled down to the Big Din again I felt, for some reason, as low as the predicted sunspot activity.

For the OT's loss of sleep eventually becomes an unsupportable load. After two days and nights of QRM an cyphers I'm stiff sore and sorry. Headache ruins the sweet music of the code and the phones become irritating limpits to be torn off an thrown down. The point of psychological letdown arrives. The Big Battle is over. The bedlam and the frantic antics of those striving for the last ultimate point dies and the bands subside again into a calm quietness. The final tallying of points is left until one has been restored by that which knits the ravelled sleeve of care—sleep.

As I threw the big switch the YF said. "The office has been ringing for you."

I clapped a hand to an overworked neuralgic receptor. "Ring the Doc for an appointment will you honey," I said pitifully. "I'm gonna need some treatment for this ear."

"What's the use," she retorted coldly. "You went last time and what did he say. 'Go home and take some aspirin.' Most Radio Ops go in the arm but you go in the head."

"Yes, yes," I broke in testily. "What's in the bar? I'd like a short snort before I go to sleep."

"To the office is where you're going, to straighten out that land deal you messed up."

Quietly determined I wash down four aspirin with a couple of good straighteners. The whole world could wait. Sleep I must have.

I got into the car and drove to the nearby bank of the Old City River. Here there was peace and escape from all the petty care and strife. The grass was lush and green and the day balmy and warm.

[*Continued on page 142*]

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Looks aren't everything.

This new Ham Cat may be the best looking ham mobile antenna you've ever seen, but that's just the half of it.

After all, beauty is as beauty does, and this one does it better than any other ham antenna you can buy.

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Which also means you can change from one band to another in a couple of seconds by simply unscrewing one complete coil and tip rod unit and screwing another onto the foldover mast.

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Digital Meters and Multimeters

BY JOHN J. SCHULTZ,* W2EEY/1

Digital readout meters have already replaced moving pointer meters in many commercial applications. As circuit technology continues to reduce their price, they gradually will appear in the amateur field for everything from solid-state v.o.m. readouts to frequency readouts on receivers and transmitters.

DIGITAL indicator circuits are certainly not new but such readout circuits have generally, until recently, been used only with relatively expensive pieces of equipment. The laboratory type of frequency counter, for example, is a common application. Now, however, digital indicator circuits are rapidly finding their way into what might be characterized as medium price class measuring equipment. The digital readout multimeter shown in the photograph is still too expensive for the average amateur. But, multirange digital voltmeters are available for less than $200 and homebrew digital meters have been built for less than $100. Many manufacturers are intensely pursuing development programs to develop low-cost digital multimeters because of the enormous market that such equipment would have.

Many different circuits are used for digital meters and to cover them all in detail would require several book volumes. However, there are a few circuit forms which are the basis for most of the digital meter circuits. This article covers these basic circuits, at least in block diagram form, and discusses some of the advantages and disadvantages of digital meters.

Electromechanical Digital Meters

The electromechanical type of meter uses a servo motor in a balancing type circuit. The motor drives a mechanically operated digital readout. The overall principal of such a circuit is the same as the servo tuning circuits that were used on such surplus transmitters as the ART-13, although the meter's circuits are tremendously more compact.

Figure 1 shows the block diagram of a meter of this type. The unknown input voltage first encounters a precision voltage divider network, the same as in any v.o.m. or v.t.v.m. It then is filtered for a.c. components or pickup since the following circuits are highly sensitive to stray a.c. components on the input. The unknown voltage then enters a comparator (either an electronic or mechanical type). The comparator constantly switches the input to an amplifier stage between the unknown input voltage and the voltage from a precision multi-turn potentiometer which is mechanically linked to the servo motor. The potentiometer is supplied from a well regulated constant voltage source. The amplifier output provides the drive power to the servo motor.

The output of the comparator is an a.c. signal whose amplitude is a function of the

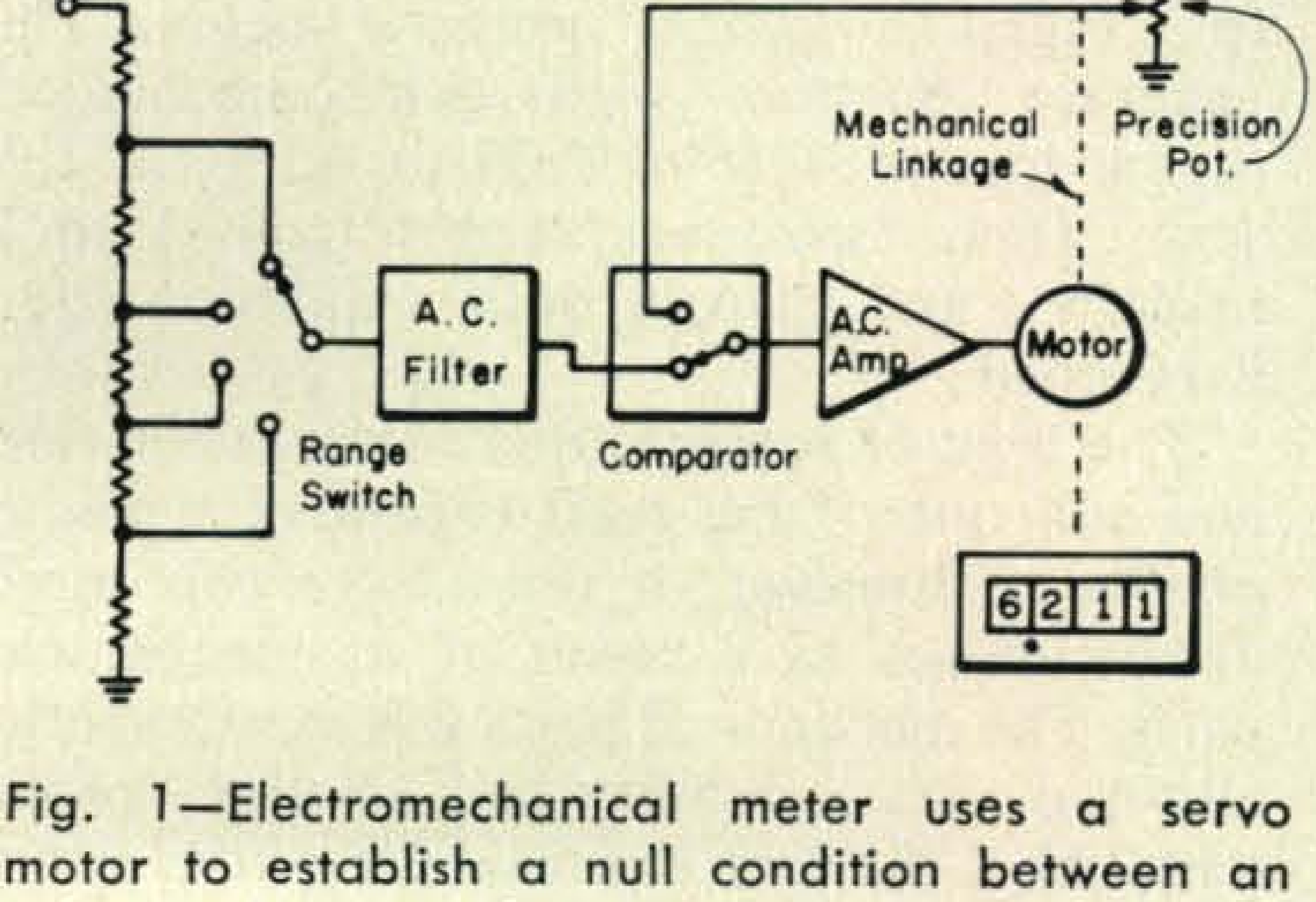
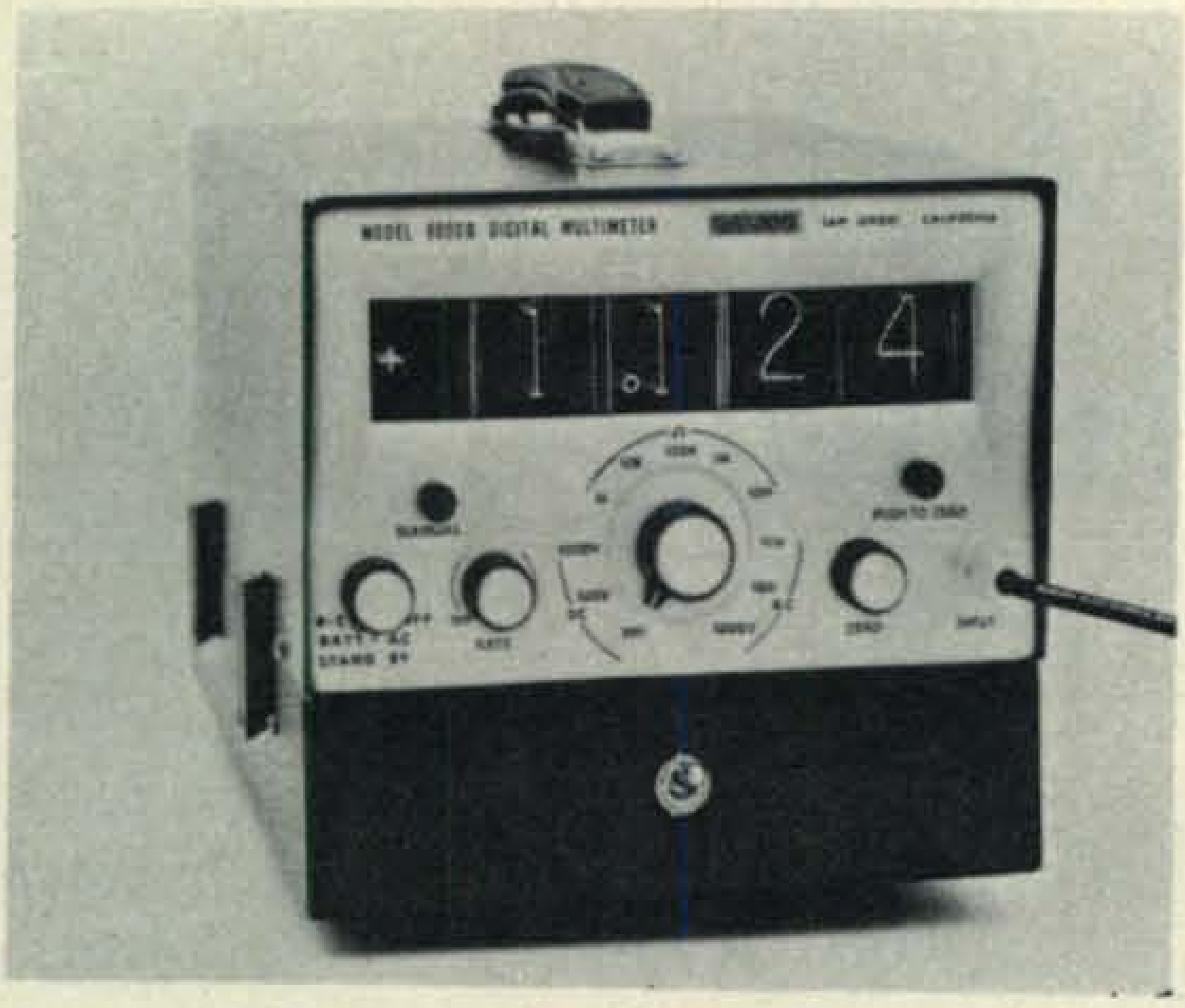


Fig. 1—Electromechanical meter uses a servo motor to establish a null condition between an unknown input voltage level and a standard voltage level.

* 40 Rossie Street, Mystic, Conn. 06355.



Imagine trying to read a voltage to this accuracy on a pointer type meter. Calico Co. Digital Multimeter is a.c. or battery powered and measures 5 × 8 front panel. Polarity selection and indication is automatic.

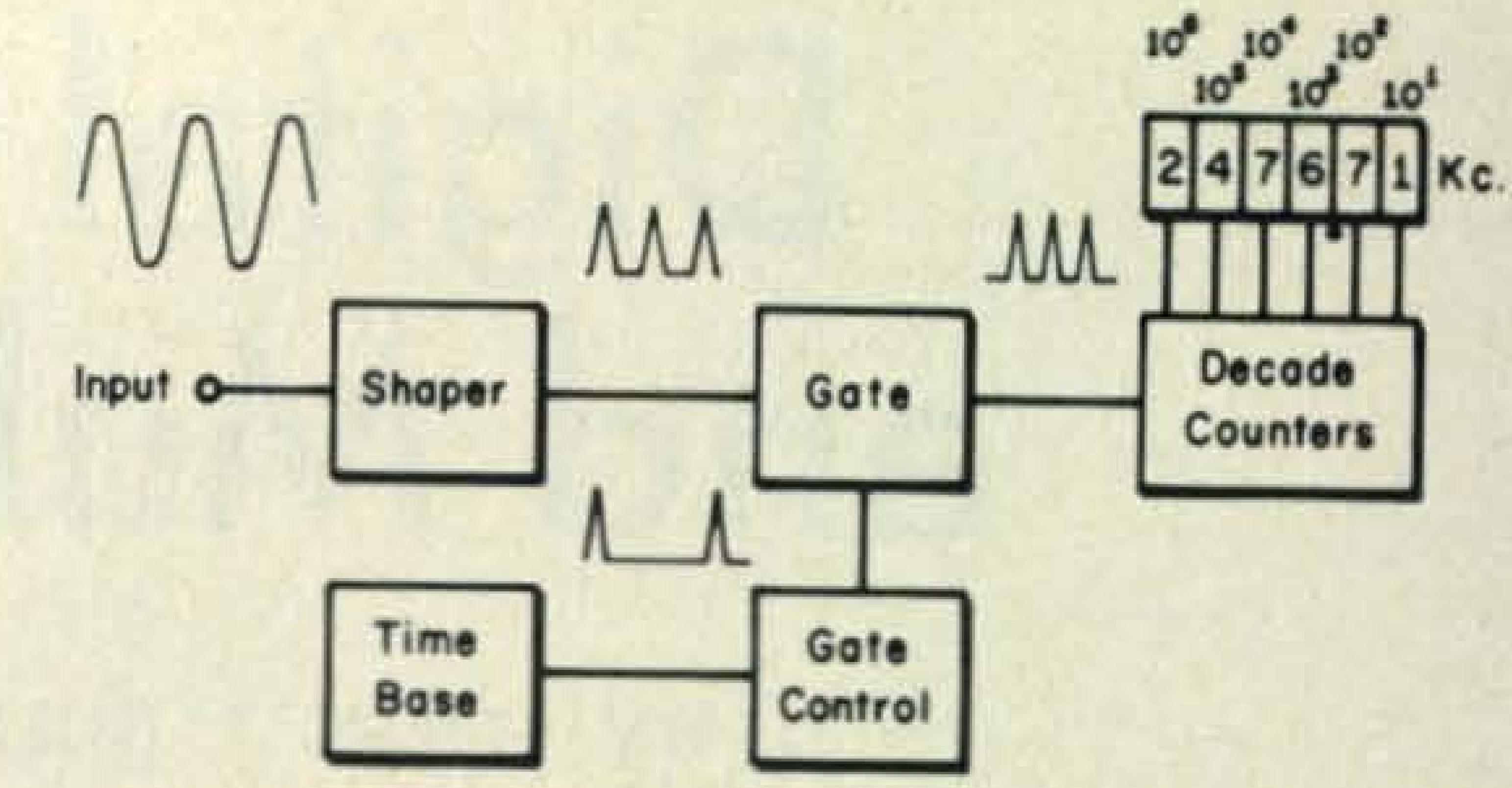


Fig. 2—Basic frequency counter. Decade counters sum number of pulses gate control allows through gate in a fixed time period.

magnitude of the unknown input voltage and whose phase is a function of the polarity of the input voltage. The servo motor is driven by the amplifier so that the precision potentiometer produces a voltage which cancels the difference voltage across the comparator. At this null condition, since the mechanical digital readout is also coupled to the servo motor, the readout displays the value of the unknown input voltage. Usually, the placement of the decimal point on the readout is mechanically determined by the setting of the range switch on the instrument. However, types have been built where the decimal point as well as polarity indication change automatically.

The readout possibility with a 4 digit wheel instrument is quite fine and certainly greater than that necessary for most general v.o.m. type applications. (Since the 4th wheel is divided into tenths, resolution is provided to read voltages such as 2.3861 or 47.455.) Most manufacturers intend to reduce the readout to 3 digits for general purpose meters. The accuracy possible with electromechanical digital meters is from 0.05 to 0.1% of full scale. Input resistance ranges from 1 to 2 megohms and changes until a null condition is reached.

The type of meter is quite straightforward and still one of the least expensive types to produce. However, it does have two main disadvantages as a result of its mechanical parts. The mechanical parts will wear eventually and create stability and accuracy problems. Also, the speed of response of the meter to a rapidly changing input voltage is limited because of the mechanical elements.

Solid-State Digital Meters

Almost all solid-state meters process an unknown input voltage so that an electronic counter is activated and the result displayed on Nixie number tubes. The basics of a counter circuit are shown in fig. 2. The signal shaper circuit forms the input signal into the necessary form for further processing, usually sharp pulses. The pulses flow into a gate circuit which is controlled by a gate control and time base circuit. The gate control allows input pulses to flow through to the decade counters for a specific time period. The decade counters total the numbers of pulses by ring counter circuits and display the total on the digital readout tubes. The time base circuit controls the accuracy of the pulse sampling *interval* and hence the accuracy of the readout. The sampling rate (how often the output display should be extinguished and a new sample read) is controlled by other circuits and frequently made variable. The counter circuit as presented is quite general and, depending upon the time interval during which pulses are counted, can be used to measure frequency or other characteristics of the input signal. Used in a digital voltmeter, a counter follows either a ramp circuit (saw tooth circuit) or a voltage-to-frequency converter.

A ramp-type meter is illustrated in fig. 3. An unknown input voltage first passes through a precision attenuator and a.c. filter, the same as in the electromechanical type meter. It then is fed to a coincidence gate which is also fed from a ramp generator. At the same time as the ramp voltage starts from zero, the counter gate permits the flow of pulses from the clock pulse generator to be counted by the decade counters. When the ramp voltage equals the unknown input voltage (fig. 3B) the counter gate closes. The count accumulated in the decade counter is

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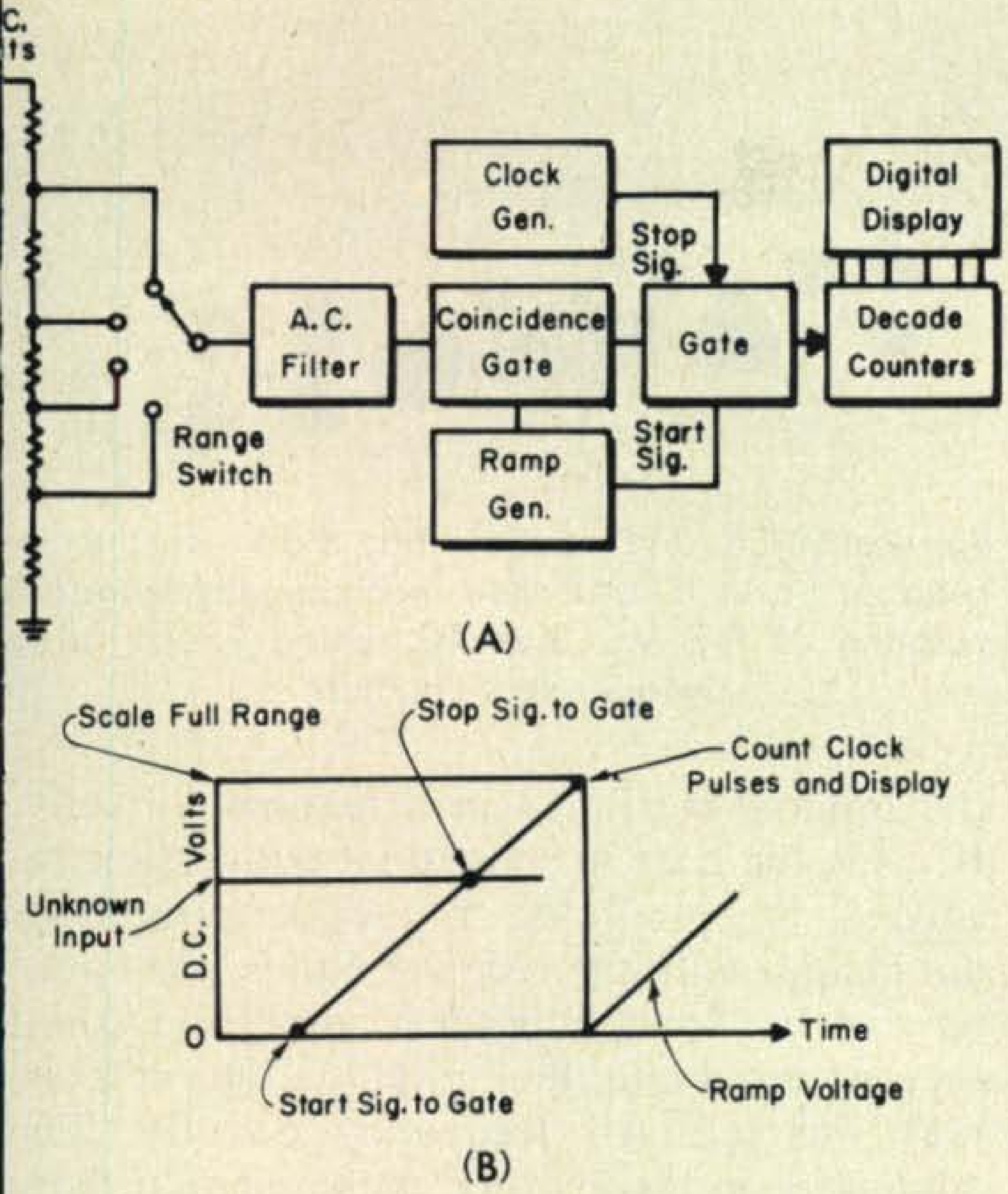

'ig. 3—Basic ramp type digital meter (A) and circuit actions as sawtooth wave progresses (B).

lirectly related to the value of the unknown /oltage. Usually, 1000 counts are arranged to equal one volt.

The measurement cycle repeats itself at ın interval determined by the sample rate ircuit. The accuracy of this method is de- pendent upon the linearity of the ramp volt- ıge and the stability of the clock pulse generator. An accuracy of .05% full scale s common in good instruments. Input im- pedances range up to 10 megohms.

The decimal point setting in the readout nay be set by the voltage range switch but requently the circuitry is arranged so that vhen the unknown input voltage exceeds the ange selected, the instrument automatically elects a higher range. This shifts the readout lecimal point and takes a new reading until ı range is found which encompasses the value of the input voltage.

The voltage-to-frequency converter meter nethod makes use of a stage which generates ı series of pulses directly proportional to the nagnitude of an unknown input voltage (fig. 4). The pulses are counted by a counter cir- cuit directly and displayed as a voltage level on the digital readout tubes. When the count- ng interval is related to the line frequency, his method provides a good order of discrim- nation against line frequency pickup on the nput. Positive a.c. noise signals cause an ex- cess of pulses from the voltage-to-frequency converter while negative signals cause the opposite effect. The total effect is that noise pickup is essentially cancelled out. The accuracy of this method depends upon the linearity of the voltage-to-frequency converter and the stability of the oscillator in the counter. Accuracies about the same as those with the ramp technique are possible.

There are many combinations and variations of digital voltmeter circuits using the ramp and voltage-to-frequency converter techniques. Often some reference type circuit is included and the basic voltmeter samples between the reference and unknown input. In essence, some of these circuits are solid-state versions of the electromechanical type meter. The accuracy attained by these methods is generally far beyond anything required in the average workshop, however, where the 3-5% accuracy of a good v.t.v.m. is totally adequate.

Digital Panel Meters

Since a digital meter can perform all the functions of the usual d'Arsonval meter movement it can be built as a one-range instrument and used as a panel meter. The meter reading can be labeled plate current, temperature, s.w.r. or whatever other factor is being measured.

A number of such panel meters are already on the commercial market. However, their price and size still need to be both considerably reduced before they can be as handily used as are ordinary meters. A much more likely prospect for such indicating devices to be used in the not too distant future is as frequency indicating devices on medium-priced receivers, as will be discussed shortlv.

Digital Multimeters

Digital multimeters which have a.c. voltage, current and resistance ranges are built up in exactly the same fashion as ordinary v.o.m.'s or v.t.v.m.'s.

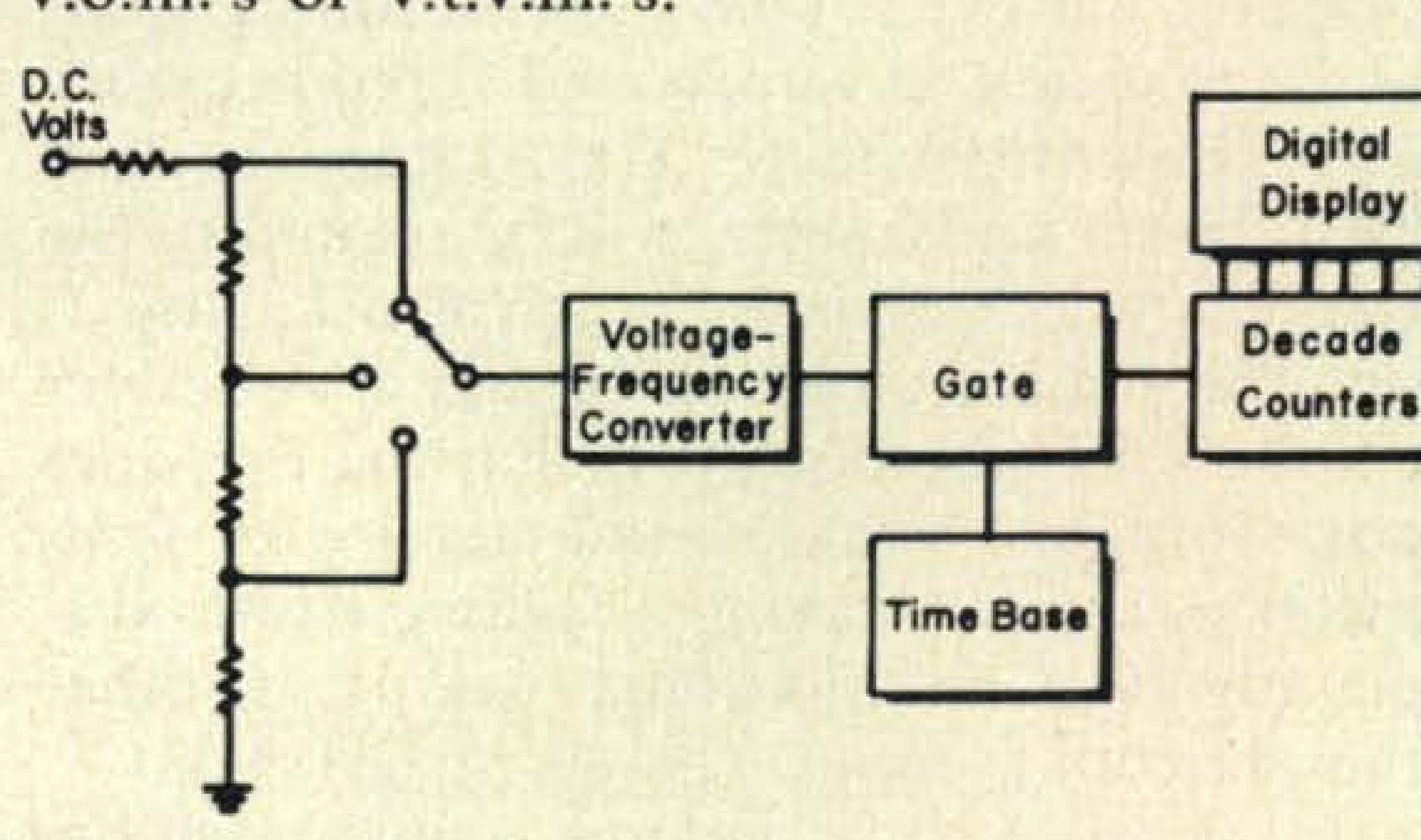

Fig. 4—Basic digital voltmeter using voltage to frequency conversion technique.

The Lorch Electronics Co. HR-240 Receiver uses Nixie tube displays for frequency readout. There is no mechanical linkage between the tuning knobs and the frequency readout.

A.c. voltages are simply rectified before passing to the precision input attenuator network and read as a d.c. voltage. For current measurements, the voltage drop across a known resistance through which the external current is passed, is measured. To measure resistance, an internal voltage supply sends a constant current through an unknown resistance. The voltage measurered across the resistance by the digital meter is directly proportional to the value of the resistance.

Digital Meters as Frequency Indicators

A number of commercial receivers already use digital readouts to indicate the frequency to which the receiver is tuned. The ease with which frequencies can be read with such receivers, as compared to looking at two scales and a pointer on the usual receiver, is truly marvelous. Anyone who uses such a receiver immediately feels that the dial and pointer system is something belonging to the dark ages.

Several schemes can be used to provide such frequency readouts. A precision potentiometer can be coupled to the tuning shaft and connected to a regulated reference voltage. The potentiometer arm voltage, as read by a digital multimeter, will be related to the frequency to which the receiver oscillator is set. The sampling rate of the digital voltmeter can be set high enough so that the eye does not distinguish that the counter in the voltmeter is actually taking a sample count, displaying it, extinguishing, taking another sample count, *etc.*

In practice, this method is not used because of various disadvantages. Normally, a counter is used to measure the frequency of

The Racal Co. 217 receiver has digital frequency readout but it is controlled mechanically from the rotation of the MC and KC tuning knobs using veeder root counters.

the tunable oscillator in a receiver directly. If, as is the case in most dual conversion receivers, the oscillator frequency range does not change with the receiver bands, the counter can be "loaded" with a correction count on each band and the digital readout will display the received frequency directly. The advantage to this method is that should there be some slight oscillator drift or non-linearity over its tuning range, the counter will still indicate the correct frequency. There is no problem of mechanical backlash or resetability in the tuning shaft mechanism since the counter faithfully only indicates the actual effect upon the oscillator frequency.

Summary

The advantage of digital meter readout is apparent from any of the photographs in this article by thinking how difficult or impossible such readouts would be with a dial and pointer indication. Aside from cost, it's difficut to find any real disadvantage in digital readouts. About the only ones that have been advanced is that it is somewhat difficult to make exact peak and null adjustments. Also digital meters do not provide "set" points such as a meter scale can have to indicate a desired reading or range.

Literature is available for those readers who would like to know more about the circuit details of digital meters. However, such knowledge is not necessary to appreciate the uses of digital meters, any more than one need become an expert on moving vane meters in order to use them. It is hoped that it has been shown that the coming of digital meters eventually will provide another bright day in improving amateur equipment. ■

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Putting the Motorola FMTU-30D and FMRU-16 on Two

BY J. R. KELLOGG,* K7CNZ

DUE to changes in the FCC requirements for commercial f. m. service, many of the old Motorola units are available for amateur use. These units consist of a crystal controlled 50 watt transmitter and crystal controlled, single channel, double conversion, superhetrodyne receiver and are designed to operate from 152 to 162 megacycles. With a little effort these units may be modified for net type, single channel operation in the two meter band. The purpose of this article is to give enough information to enable you to make this modification with a mininmum amount of experimentation.

There are two basic models of these units, the standard transmitter and receiver and the precision transmitter and receiver. For our purpose the transmitters may be considered to be identical. The standard receiver however has a 3.8 megacycle second i. f., while the precision receiver has a 1.7 megacycle second i. f. To determine which unit you have, look for a number on the bottom side of the receiver chassis directly under the vibrator pack. The standard model will bear the number PA 8333, while the precision model will bear the number PA 8333A. The only effect that this will have on our modification will be in the calculation of the crystal frequency and first i.f. The frequency of the crystal for the standard receiver is found by the formula:

$$f_{crystal} = \frac{f_{carrier} - f_{second\ i.f.}}{16}$$

For example, if the carrier frequency is 147 mc and the second i.f. is 3.8 mc, we have:

$$f_{crystal} = \frac{147 - 3.8}{16}$$

$$= \frac{143.2}{16}$$

$$= 8.95 \text{ mc}$$

The formula for the precision receiver i

$$f_{crystal} = \frac{f_{carrier} + f_{second\ i.f.}}{17}$$

For example, for a carrier frequency 147 mc and a second i.f. of 1.7 mc, we hav

$$f_{crystal} = \frac{147 + 1.7}{17}$$

$$= \frac{148.7}{17}$$

$$= 8.747 \text{ mc}$$

The calculation of the frequency requir for the first i.f. will be discussed later in t receiver tune up procedure.

The crystal frequency for either tran mitter is the carrier frequency divided by 4 For example:

$$f_{carrier} = 147/48 = 3062.5 \text{ kc.}$$

The receiver takes crystals in FT-24 holders and the transmitter takes crystals i HC-1U holders.

Transmitter Modification

Remove the dynamotor and power plug P Replace the power plug with a six pin an phenol type plug. Connect pin No. 1 of th plug to terminal No. 2 of J_5, the receiv power socket. Connect pin No. 2 to the B- terminal. Connect pin No. 3 to terminal N 4 of J_5. Connect pin No. 4 to terminal No. on the E-2 terminal strip. This is the lon

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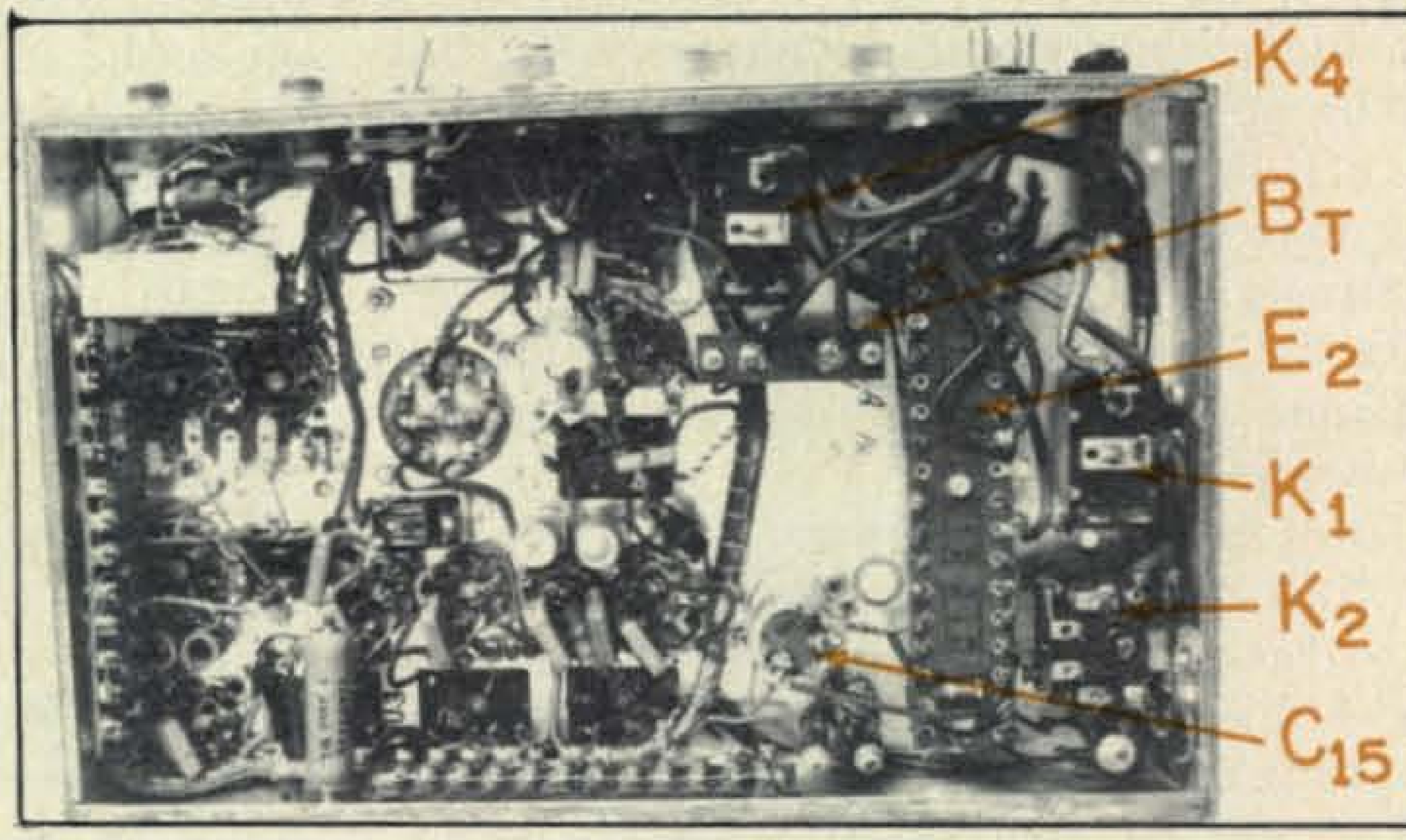
Transmitter underside. The relay in the lower right corner is K_2 with K_1 just above it. The E-2 strip runs vertical to the left of these relays. The relay at the top just left of the E-2 strip is K_4. The short strip below it is *BT* and ground strip. The electrolytic capacitor below that is C_{15}.



trip, under the chassis, below the dynamotor. This strip has terminals numbered from 1 to 18. Disconnect the jumper wire between erminals No. 4 and No. 9 on the E-2 strip o separate the filaments from the relays.

Connect a jumper between terminals No. 8 nd No. 9 on the E-2 strip to keep the driver nd final amplifier filaments on. (They were riginally energized by a relay connected to he push to talk switch.) Connect pin No. 5 of the new power plug to ground. Connect pin No. 6 to terminal No. 4 on the E-2 strip. Connect a wire from terminal No. 15 on the E-2 strip to C_{15B}. This is a 20 mf canned lectrolytic capacitor near the E-2 strip, and ection "B" goes to the cathodes of V_2 and V_3. This provides voltage for the microphone.

If a microphone that is more sensitive han the original is used it may be necessary o insert a resistor, between C_{15B} and terminal No. 15 on the E-2 strip in order to cut down he microphone voltage. Remove the ground wires from terminals "S" on the relays K_1 nd K_4. Remove (temporarily) the driver ransformer T_{6U} and install a 5 mmf capacitor from the stator terminal of the trimmer capacitor to the shield can. Reinstall T_{6U}.

Solder a copper strip ⅜ × 1 inch onto each of the plate lines just above the final amplifier ube caps. Arrange these strips so that they re parallel to each other with about ⅛ inch eparation. This is done to add some capacity o the lines in order to resonate them in the wo meter band.

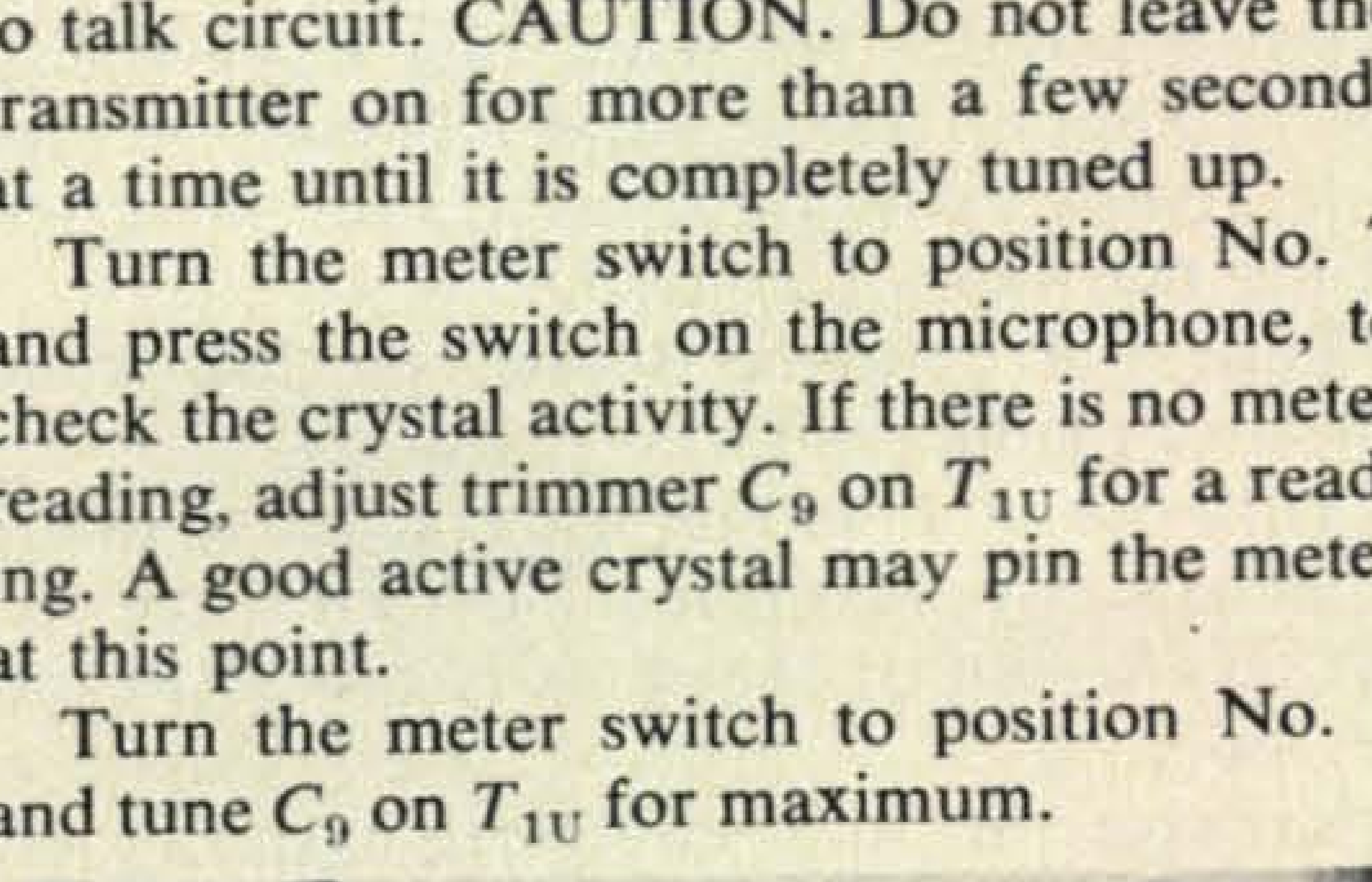
This completes the transmitter modification. Connect power to the six pin power plug s follows: Pin No. 1—200 v.d.c. at 50 ma, Pin No. 2—450 v.d.c. at 200 ma, Pin No. 3—6.3 v.a.c. at 3 a., Pin No. 4—6.3 v.a.c. at 3 a., Pin No. 5—ground, Pin No. 6—6 v.d.c. at 1 a.

Transmitter Tune Up

Connect a dummy load to the antenna receptacle. Set the HI-LO switch, on top of the chassis, to LO. Plug a 0-50 microammeter into the meter jack on the front apron. This meter should have an internal resistance of 2000 ohms. Plug the crystal into terminals No. 2 and No. 4 of the crystal socket. Plug the microphone into the microphone receptacle. If the original microphone is not available, almost any carbon microphone will do. Pins No. 1 and No. 2 are the microphone connections and pins No. 3 and No. 4 are the push to talk circuit. CAUTION. Do not leave the transmitter on for more than a few seconds at a time until it is completely tuned up.

Turn the meter switch to position No. 7 and press the switch on the microphone, to check the crystal activity. If there is no meter reading, adjust trimmer C_9 on T_{1U} for a reading. A good active crystal may pin the meter at this point.

Turn the meter switch to position No. 1 and tune C_9 on T_{1U} for maximum.



Final amplifier compartment showing the copper tabs on the plate lines. The size and spacing of these tabs are not critical as the shorting bar has considerable tuning range.

Turn the meter switch to position No. 2 and tune primary and secondary of T_{2U} for maximum.

Turn the meter switch to position No. 3 and tune the slug tuned coils in T_{3U}, for maximum.

Turn the meter switch to position No. 4 and tune the primary and secondary of T_{4U} for maximum.

Turn the meter switch to position No. 5 and tune the slug tuned coils in T_{5U}, behind the driver tube, for maximum. (The precision model transmitter will have one trimmer capacitor instead of two coils.)

Turn the meter to position No. 6 and adjust T_{6U} for maximum. If it is not possible to find a peak on this adjustment, tune for maximum indication and then remove T_{6U} and observe the position of the trimmer capacitor. If it is set at maximum capacity increase the value of the padder capacitor slightly (about 2 or 3 mmf). If it is set to minimum capacity decrease the value of the padder. Do not attempt to pre-tune this transformer with a grid dip meter as it will dip at about 210 mc when removed from the chassis.

After T_{6U} is tuned it is time to start tuning in the final amplifier compartment. All adjustments in this compartment must be made with an *insulated* tuning tool. Leave the meter switch in position No. 6 and tune C_{43} and C_{54} for maximum. Keep these trimmers in the same relative position so as to keep the grids of the two tubes balanced.

Turn the coupling screw, on the front apron to the left as far as it will go.

Turn the antenna tuning capacitor to minimum capacity. This is indicated when the red dot on the slot of the shaft is turned to the left side.

Remove the snap cover from the P. A. metering jack on the front apron and plug the meter into it. Tune the plate lines by adjusting the shorting bar for a dip in plate current. If the meter used has less than 2000 ohms internal resistance it may be pinned. In this case, insert a 1000 ohm resistor in series with the meter to get the reading on scale.

After a dip in plate current is obtained, set the HI-LO switch to the HI position and recheck the dip. Observe the meter reading and then throw the toggle switch, on the front apron above the meter jack, to the other side and check for equal meter reading. If these readings differ by more than 3 microamps, adjust the capacitors C_{43} and C_{54} to balance them. If this is necessary, switch the meter back to position No. 5 and recheck the tuning of the slug tuned coils or trimmer capacitor behind the final compartment. Be sure to plug meter back into the meter jack for this adjustment.

With the meter in the P.A. meter jack, adjust the coupling screw to load the transmitter to 39 microamps, for units using 2E24 or 2E26 tubes, or to 45 microamps for units using 5516 tubes. The transmitter is now ready to operate.

Receiver Modification

Remove the vibrator pack. Remove the power plug from the vibrator pack, mount it on a 2½ × 3 inch aluminum plate, and install it in the hole in the receiver front apron. Connect pin No. 2 of this plug to the black filament jack. Connect pin No. 3 to the red B+ jack. Ground pin No. 5.

Solder a 2 mmf capacitor across C_2 on the antenna transformer T_{S30}.

Solder a 2 mmf capacitor across C_3, the primary of the first r.f. transformer T_{S31}.

Solder a 5 mmf capacitor across C_4, the secondary of the first r.f. transformer T_{S31}.

Solder a 2 mmf capacitor across C_5, the primary of the second r.f. transformer T_{S32}.

Solder a 5 mmf capacitor across C_6, the secondary of the second r.f. transformer T_{S32}.

Solder a 2 mmf capacitor across C_7, the primary of the multiplier transformer T_{S34}.

Solder a 2 mmf capacitor across C_8, the secondary of the multiplier transformer.

All of these padder capacitors should go from the stator terminal of the trimmer to the nearest ground point. Keep the leads short and avoid running the plate and grid circuits near each other to avoid oscillation in these stages. This completes the padding of the receiver.

Plug the crystal into the "A" side of the crystal socket. If the cables for the unit are available, plug them in. If they are not they

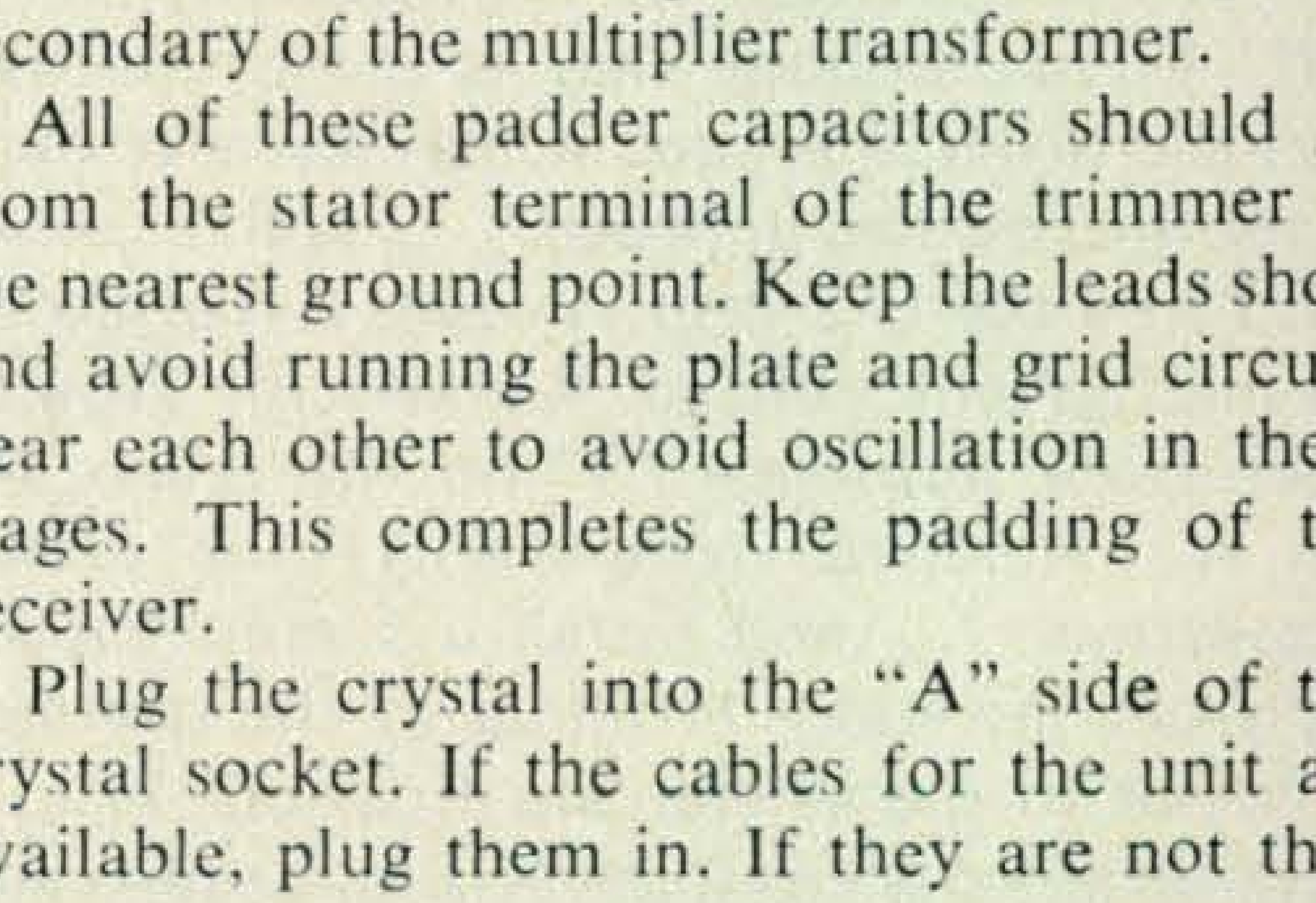


Fig. 1—Circuit of the Volume and Squelch controls that may be used if no control head is available.

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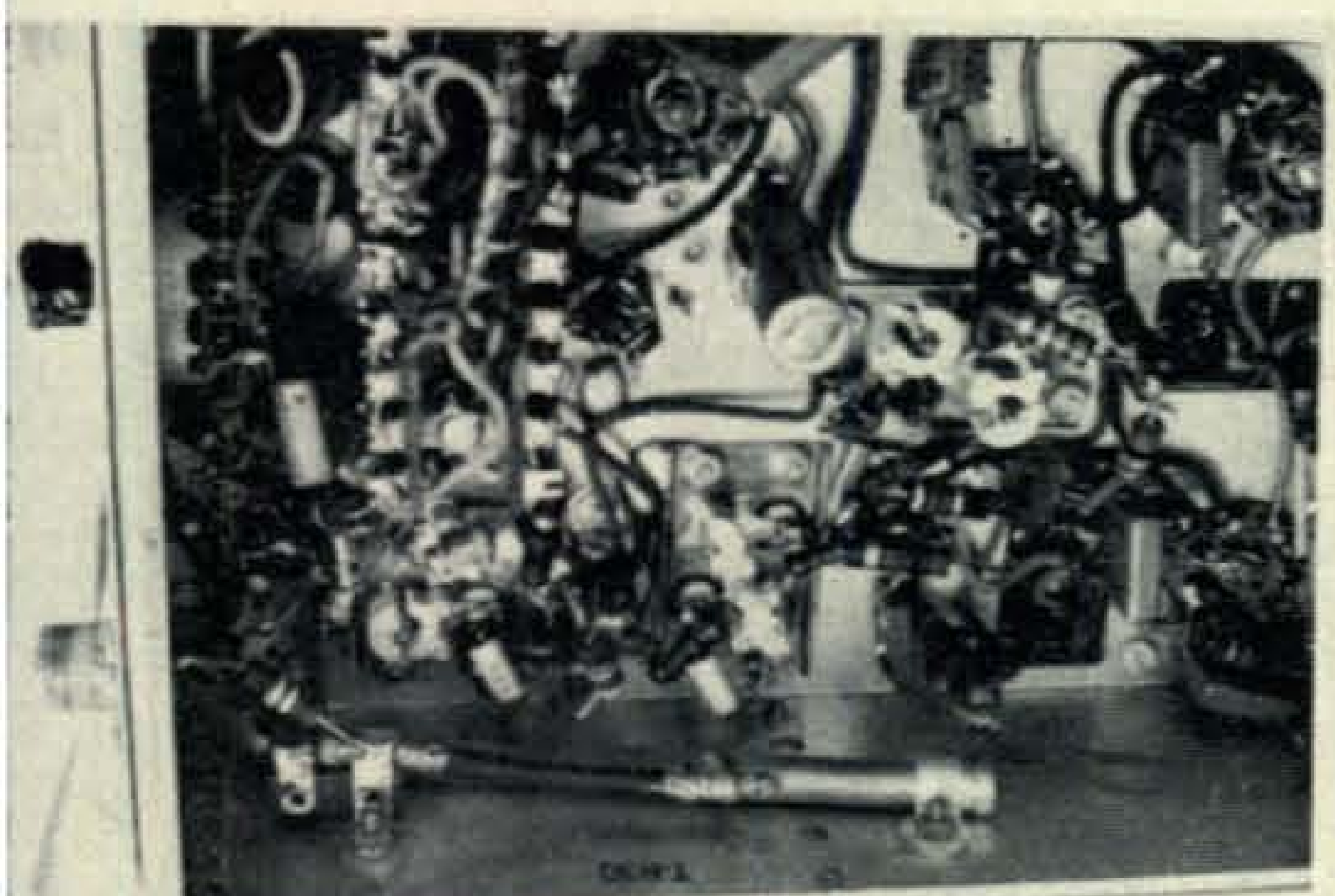
will have to be made up. A 6 pin amphenol plug and socket should fit the power connections. These connectors are connected straight across, that is, pin No. 1 to socket No. 1 etc. If the original control head is available, connections to it are as follows:

Trans Recpt.	*Cont. Hd. Jack*	*Rcvr. Plug*	*Cont. Hd. Jack*
1	6	1 & 2	N/C
2	7	3	12
3	5	4	13
4	4	5	16
5	8	6	14
6	3	7	17
7	2	8	15
8	1		

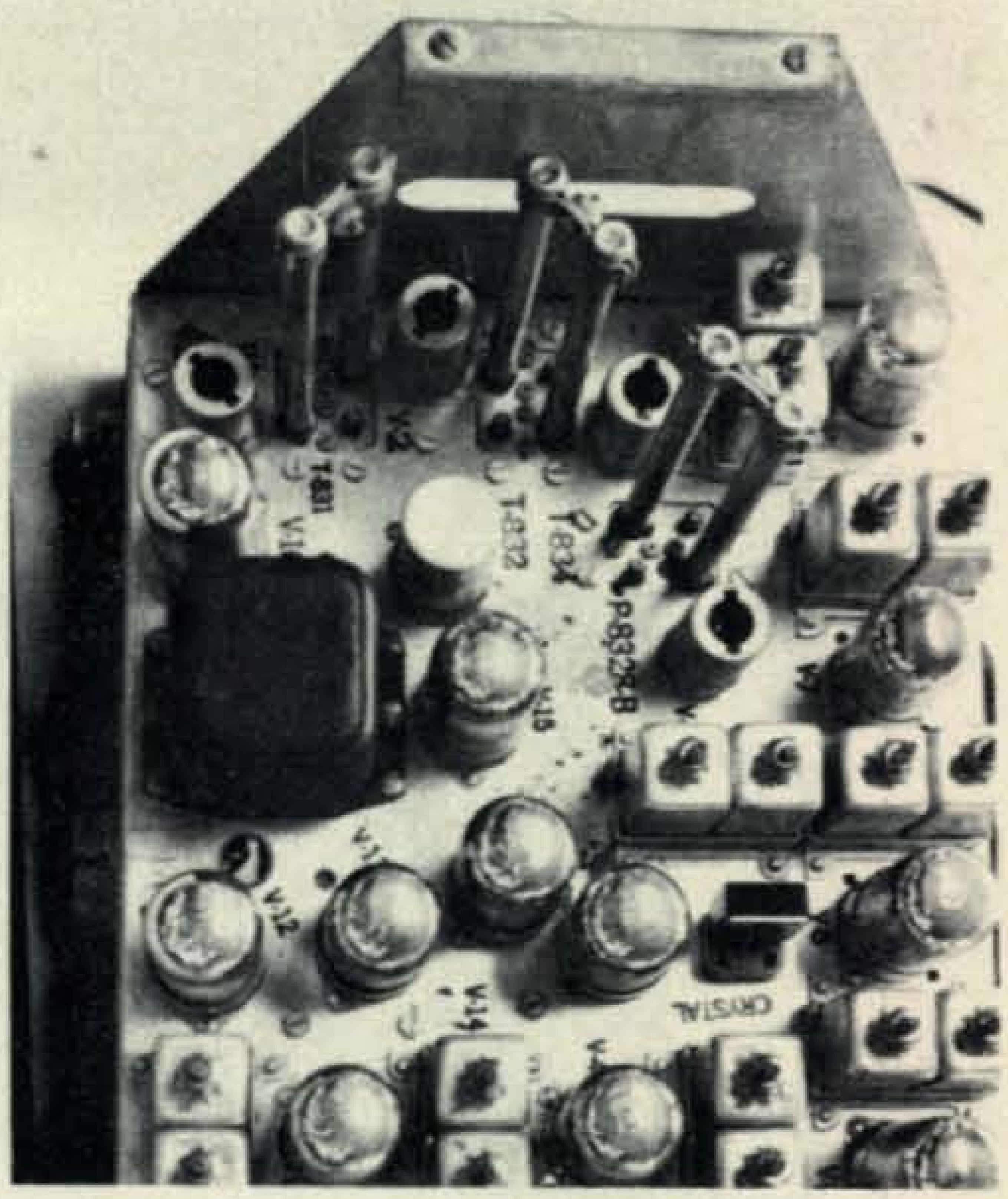
Control head jacks No. 9 and No. 18 are connected together. The speaker jacks are No. 10 and No. 11. The receiver squelch and volume controls are contained in the control head. If this unit is not available these functions will have to be provided. The speaker can be plugged into the jacks on the front apron. The volume and squelch circuits are wired as shown in fig. 1.

Receiver Tune Up

Plug the microammeter used to tune the transmitter into the receiver meter jack. Turn the volume control all the way to the right and the squelch control all the way to the left. Turn the meter switch to position No. 6 and adjust the primary and secondary of T_{833} for maximum.



Receiver underside showing T_{830} at the bottom and the trimmers with padders.



Receiver topside view. The parallel lines with shorting bars across them are T_{831}, T_{832} and T_{834}.

Turn the meter switch to position No. 2, tune the signal generator to 3.8 mc for the standard receiver, or to 1.7 mc for the precision receiver, and connect it to the grid of V_9. This is pin No. 6 of the tube socket. Reduce the output for a meter reading of 4 microamps or less and tune the primary and secondary of T_{839} for maximum.

Move the signal generator to the grid of V_8, also pin No. 6, and tune the primary and secondary of T_{838} for maximum. Keep the output of the signal generator as low as possible because overloading the receiver will cause misalignment.

Turn the meter switch to position No. 3 and tune the primary and secondary of T_{840} for maximum.

Turn the meter switch to position No. 5 and tune the primary of T_{841} for maximum.

Turn the meter switch to position No. 4 and tune the secondary of T_{841} to zero.

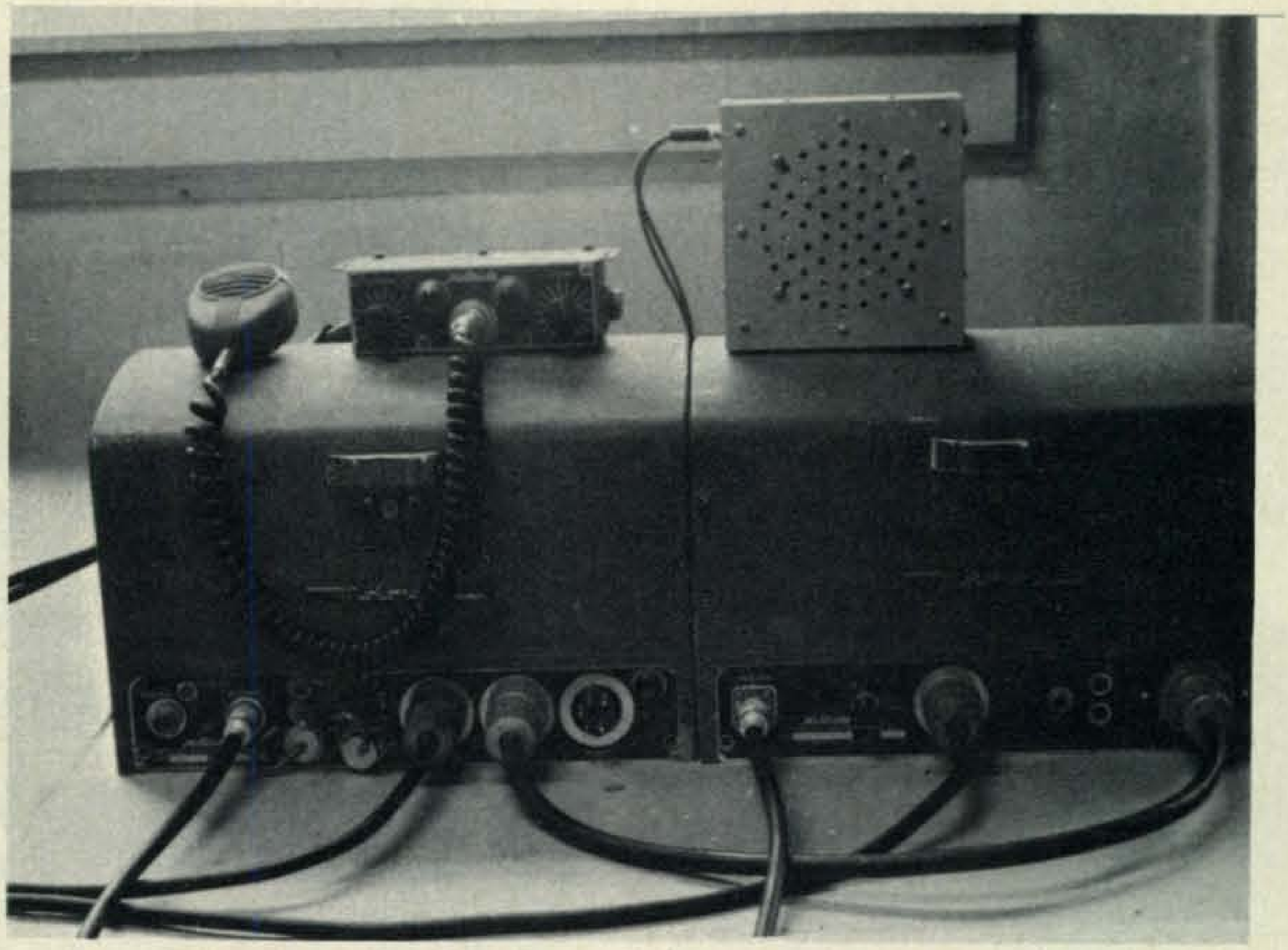
Turn the meter switch to position No. 2 and tune the signal generator to the first i.f. This frequency is calculated as follows:
Standard receiver:

$$First\ i.f. = f_{crystal} + second\ i.f.$$

For example, for the crystal frequency of 8.950 mc calculated earlier for reception on 147 mc, we have:

$$First\ i.f. = 8.950 + 3.8\ mc = 12.750\ mc$$

For the precision receiver the first i.f. is determined from:



Assembled units with cables, speaker, control head and microphone.

$$\begin{aligned} \textit{First i.f.} &= f_{crystal} - \textit{second i.f.} \\ &= 8.747 - 1.7 \\ &= 7.047\ mc \end{aligned}$$

Now back to the alignment. Connect the signal generator to the grid of V_7 and adjust the primary and secondary of T_{837} for maximum. Move the signal generator to the grid of V_6 and adjust the primary and secondary of T_{836} for maximum.

Move the generator to the grid of V_3 and tune the primary and secondary of T_{835} for maximum.

Temporarily jumper terminals No. 3 and No. 4 of the receiver power socket on the transmitter. Turn the transmitter on and observe the meter reading. If it is less than 10 to 15 microamps put a short wire in the receiver antenna receptacle so as to get this much reading. Turn the meter switch to position No. 4 and readjust T_{841} to zero if necessary.

Turn off the transmitter and disconnect the temporary jumper on the receiver power socket. Connect the signal generator to the receiver antenna receptacle, using full output, and adjust it to the transmitter frequency. This will be indicated by a zero reading on the meter. Turn the meter switch to position No. 2 and reduce the generator output so that a meter reading of 10 to 15 microamps is obtained. Adjust capacitors C_7 and C_8 on T_{834} for maximum meter reading.

Check the position of these, and all the other trimmers which have been padded, after adjustment. They should not be set at maxi mum or minimum capacity. If they are change the value of the padder slightly. Kee the generator output down so that the mete does not read more than 15 microamps an adjust C_5 and C_6 on T_{832} for maximum. Ad just C_3 and C_4 on T_{831} for maximum. Adjus C_2 on T_{830} for maximum. Work on bac through the receiver repeaking all adjust ments. This completes the receiver alignmen If it has been done carefully it should onl be necessary to peak the antenna trimmer o the received signal with the meter switch i position No. 2. Also, check the discriminato balance with the received signal. This is ind cated by zero meter reading with the mete switch in position No. 4.

Power Supply

The power supply used is not described be cause it was already on hand and is muc larger than needed. It was decided to plug separate power supply into the units, rathe than try to build it in, so that several unit could be modified and tested at one time.

Incidentally, if purchasing these units, b sure they have the full complement of tube as some of the loktal varieties may be difficu to obtain.

At this point I would like to express m appreciation to Jess, W7WKP, for his assis ance in the development of this project an to Mr. Walt Edelman for the photograph used in this article.

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THE EXPANDED LAZY-H ANTENNA

BY JOHN J. SCHULTZ, *W2EEY/1

The author presents a simple variation of the lazy-H antenna which both improves its gain and makes the feed point impedance a more convenient value. For those interested in a directive, wire-type antenna with good gain, the expanded lazy-H is worth considering.

SOME time ago a wire type antenna which the author had erected came down during a storm. The supports for the antenna, being two tall trees, fortunately didn't come down. It was desired to quickly erect a directive antenna for 10 meters and the author's attention was directed by another amateur to the old standby lazy-H design (fig. 1). It is basically a one-band antenna of moderate gain, although with resonant feeders multiband operation is possible.

A little checking of antenna literature produced some figures on the gain of the antenna as a function of the spacing between the upper and lower set of elements. A ⅜λ spacing produces only 4.4 db gain but the gain goes up to 5.9 db with ½λ spacing and 6.7 db with ⅝λ spacing. For only ¼λ more spacing, a significant increase in gain is produced and it was decided to build the antenna with this spacing.

Looking further at the lazy-H, it was seen to consist of two 1λ colinear elements spaced and fed in phase. A single colinear element by itself does not produce very much gain (about 1.9 db) and that is why it is rarely used alone. However, it was remembered that a single colinear element is frequently slightly lengthened to 1.3λ, the greatest length that can be used before the broadside antenna pattern splits into lobes, to form a so-called extended double zepp antenna. The gain increases from 1.9 to 3.0 db for this small increase in antenna length.

Unfortunately, lengthening of the simple colinear antenna into an extended double-zepp produces an impedance at the antenna terminals having a reactive component. The addition of a small 0.11λ stub, however, as shown in fig. 2, takes care of the reactive component and presents a 140 ohm resistive termination. Figure 3 shows how the extended lazy-H is formed using two extended double-zepp elements. A ½λ phasing line is used between the antenna elements. The phasing line is twisted once since a phase reversal takes place every ½λ along the line and the twist is necessary so that the two elements will be fed in phase. The ½λ line reflects the same impedance that it is connected to without change so point *A* in fig. 3 presents basically the impedance at the termina-

*40 Rossie Street, Mystic, Conn. 06355.

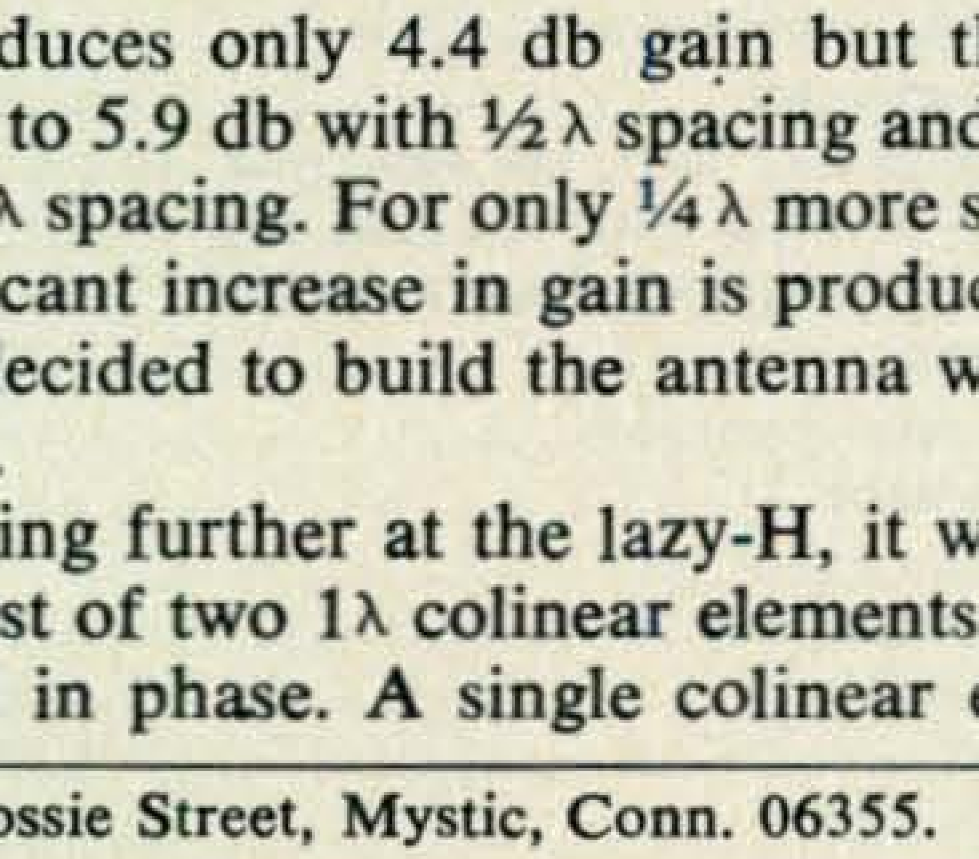

Fig. 1—Conventional lazy-H antenna configuration.

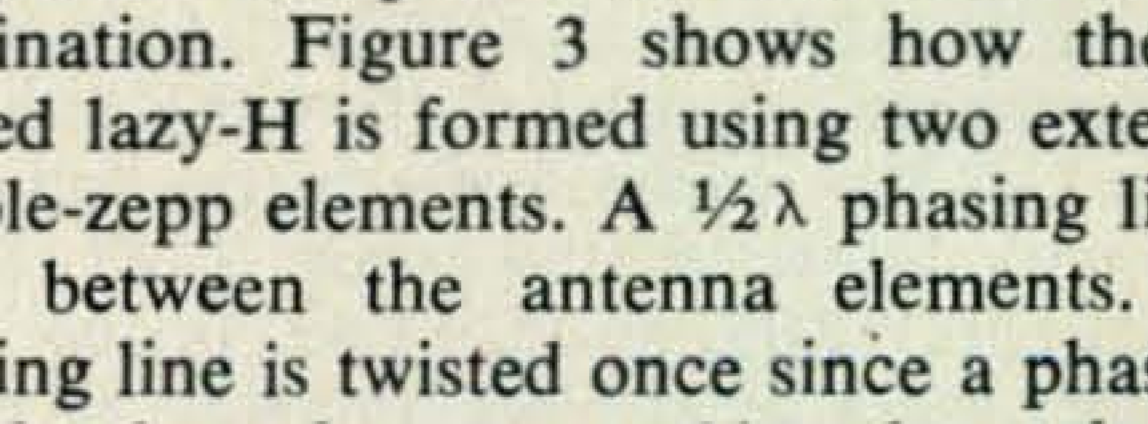

Fig. 2—Extended double zepp antenna with impedance stub.

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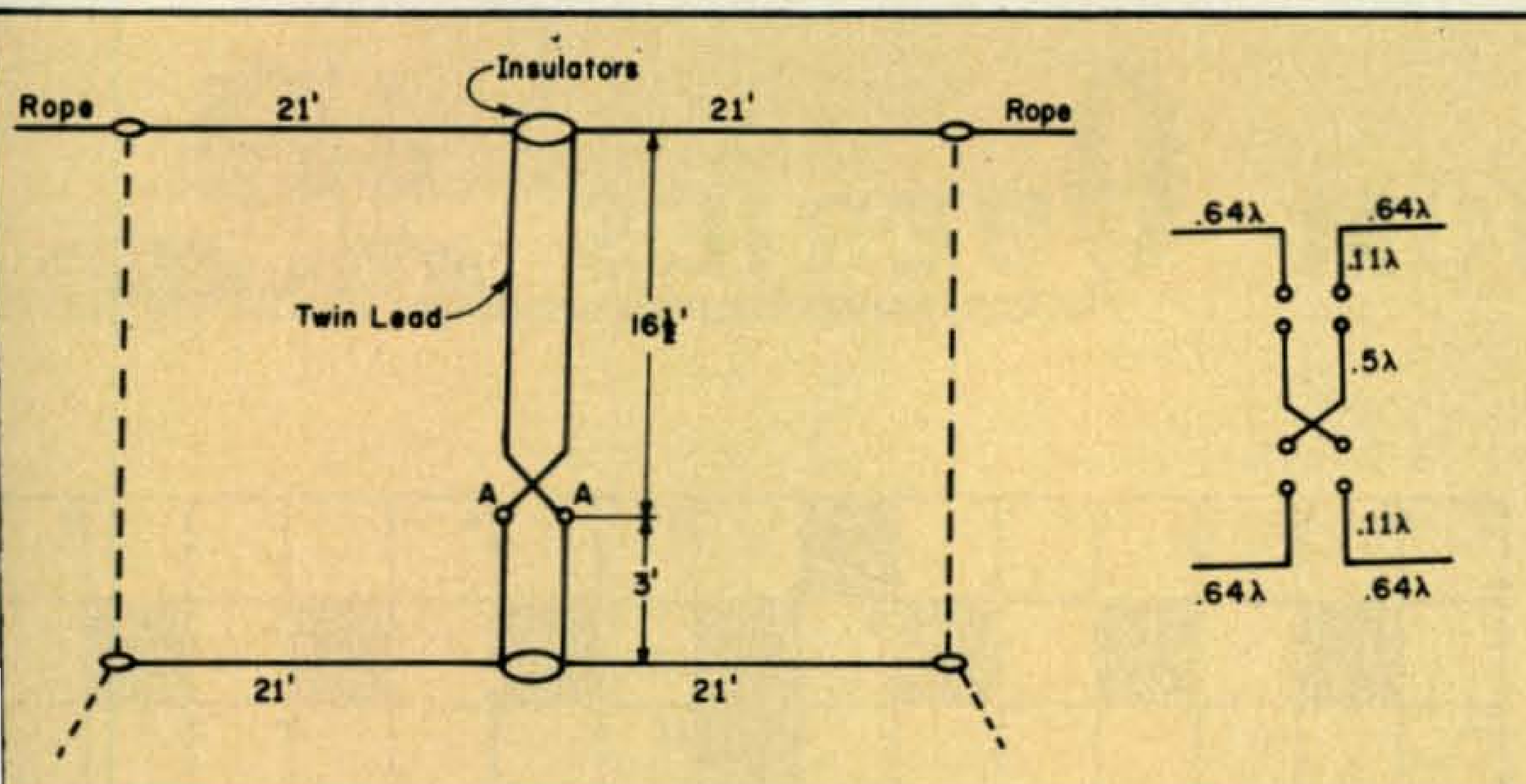


Fig. 3—Expanded lazy-H antenna with dimensions for 10 meter model.

tion of the two extended double zepp antenna stubs in parallel. The 70 ohm impedance thus produced allows direct connection of point *A* to a standard 50 or 70 ohm coaxial cable. Of course, on 10 meters there is some advantage to using a coupling device to transform the unbalanced coaxial line to a balanced form for connection to the antenna. A balun or commercial transformer can be used with a 1:1 impedance ratio. The author did not use any matching device only because of the desire to quickly erect the antenna.

Construction

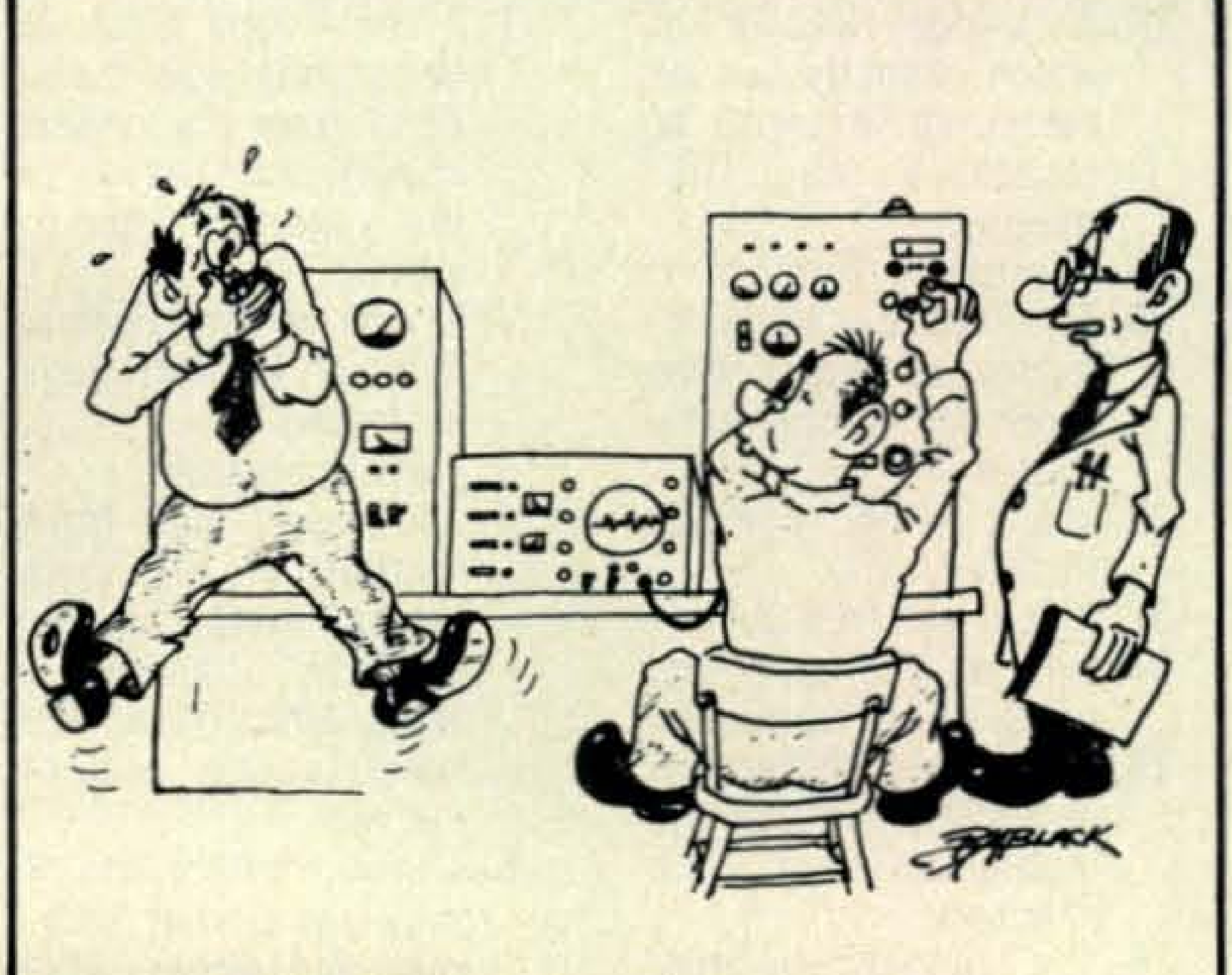
Construction of the antenna is simple and straightforward. Copperweld or phosphor bronze wire is used for the antenna elements. Standard 300 ohm twinlead (or the transmitting type for high power) is used for both the stubs and the ½λ phasing section. There is, of course, then no distinct point physically where a connection must be made between the stubs and the phasing section. The section of line from the upper element must still be twisted one turn, however. The dimensions which are given in fig. 3 take into account the velocity factor of the transmission line as must be done if the antenna is constructed for another band.

The coax feedline is simpled connected across the 300 ohm line at the correct point without having to break the line. The insulation on the line is stripped away for about ½" on either side in sequence and the coax leads soldered to the line. The whole connection is covered with electrical tape or heat shrinkable tubing. The coax is run downwards so moisture from the line above does not enter the connection. Nylon rope is used to connect the ends of the upper element to their supports. Inexpensive plastic clothesline can be used to connect between elements at the ends and hold them in position since only enough stress need be applied to keep the elements reasonably taut.

Results

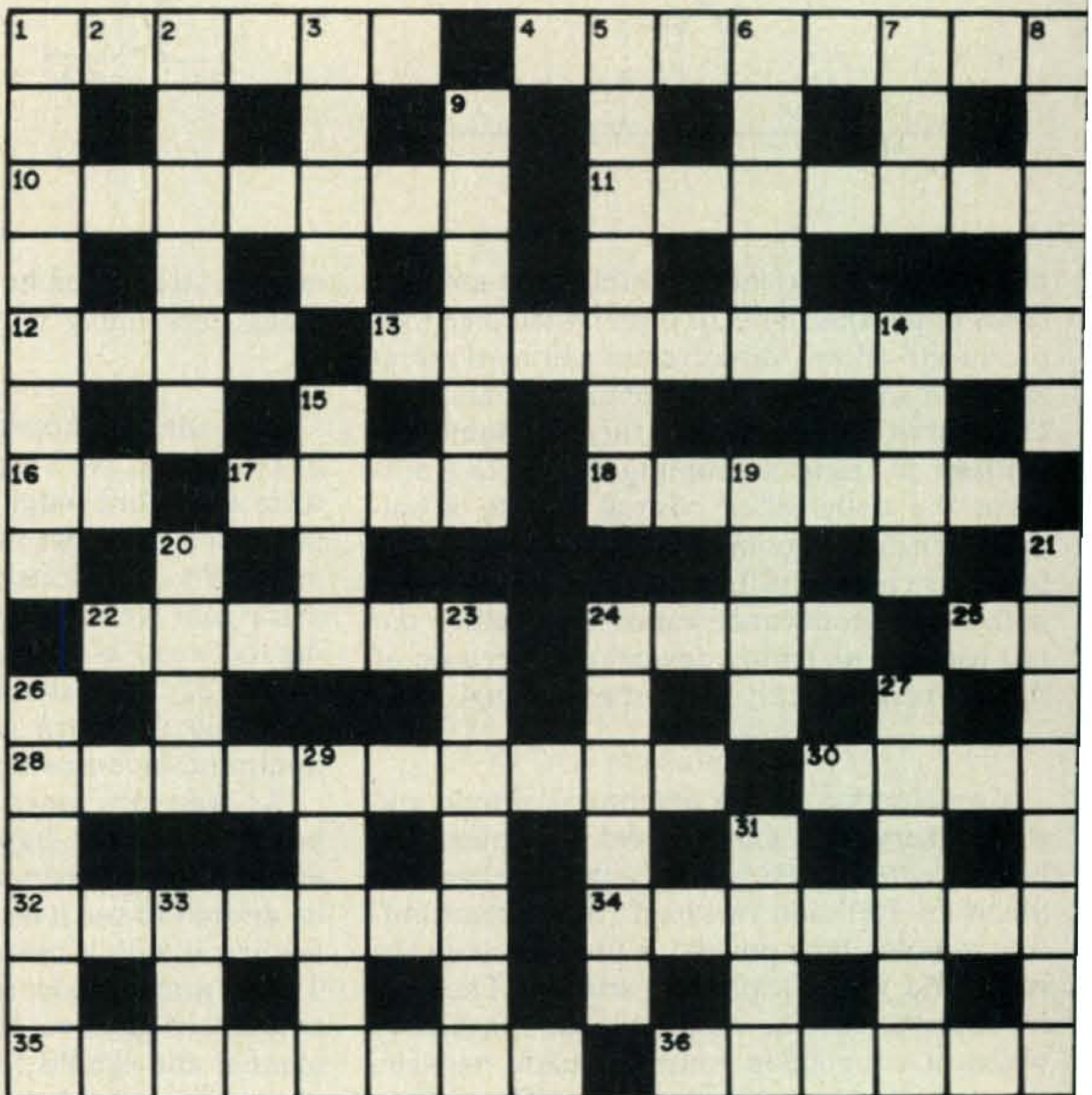
The antenna appeared to work very well in operation. No formal gain measurements were made but judging from comparison reports, the gain was estimated to be from 7.5 to 8.0 db. It definitely is felt that several db extra gain was achieved by using wide spacing between elements and having the elements of the extended double-zepp form. Certainly the extra gain was achieved for a minimum investment in wire and other parts.

As was mentioned before, the antenna is basically a one-band type. However, if erected for permanent installation it might be desired to use it as a multiband antenna by feeding it with a resonant, balanced feedline. The 10 meter model may still produce a small amount of gain on 15 meters if used in this manner and should certainly be at least as effective as a dipole on 20 meters, perhaps a bit better. ■



"He must have a resonant cavity."

CRANIUM QUERIES



ACROSS

1. An assembly of component parts linked by some form of interaction into an organized whole.
4. A finely divided carbon used as a lubricant.
10. Any component part of a vacuum tube.
11. In television, the part of the circuit that separates the video and sync signals.
12. The type of power measured by a wattmeter, taking phase into consideration.
13. A variable inductance having a movable coil mounted inside a stationary one.
16. A world-governing organization. (Abbr.)
17. An image which remains in a fixed position in the output signal after the camera is moved to a different position.
18. Often used as the crystal in a variable crystal detector.
22. A material included in a vacuum system for the purpose of absorbing the residual gas.
24. A bridge circuit in which capacity can be measured in terms of resistance and frequency.
25. Possessive form of I.
28. An active semiconductor device, having three or more electrodes.
30. Also called current-transfer ratio.
32. A four-electron tube.
34. One of the end sections of a transistor.
35. The actual difference in density between the highlights and the shadows.
36. The original capacitor.

DOWN

1. A continuous range of electromagnetic radiations, from the longest known radio waves to the shortest known cosmic rays.
2. A type of transformer in which the voltage is increased.
3. Equally balanced.
5. The back and forth rotation of the main tuning gang as the oscillator padder is being adjusted at the low frequency end of the dial.
6. A solid whose bases or ends are similar polygons and whose sides are parallelograms.
7. A mischievous child.
8. Mistakes.
9. The physical deformation, deflection, or change in length resulting from stress.
14. A sound wave capable of exciting an auditory sensation having pitch.
15. A pulverized core for use in transformers consisting of iron particles mixed with a binding material or matrix.
19. A sly, sidelong look showing ill will.
20. A decimal prefix designated by the symbol M.
21. A four electrode vacuum tube.
23. An illuminated pictur tube screen obtaine without modulatior (P1.)
24. A bass type speaker.
26. Noise heard in a radi receiver due to atmos pheric disturbances.
27. The quality of bein hot.
29. Clean by rubbing.
31. A solid or strande group of solid cylindr cal conductors havir a low resistance current flow.
33. Chemical elemen malleable at ordina temperature.

Answer appears on page 139.

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"World's Largest Distributor of Amateur Radio Equipment"

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INCENTIVE LICENSING: STAGE ONE

WHAT we've talked about and worried about for the past year-and-a-half is now staring us right in the eye: Incentive Licensing. Unless you've been completely isolated from amateur radio for the past five years, the term is surely familiar. But familiar or not, a brief resume of Incentive Licensing and how it affects the amateur in his day-to-day operating is certainly in order.

What is Incentive Licensing?

Incentive Licensing is the general term applied to a recently-adopted program of amateur licensing designed to create a strong desire in amateurs to improve their technical background. It provides for a real and useable reward to the amateur for a real and useable increase in his technical knowledge.

In pratical terms, each higher class of license brings with it a corresponding broadened list of operating privileges. The "standard" class of license remains the General class, but as of November 22, 1968 no longer is the General privvy to any and all amateur frequencies. He will henceforth be restrained, to some extent, from operating in certain choice h.f. frequencies.

What may the General class operator do to regain full operating privileges? He may take and pass a written examination for the next higher class of license; the Advanced license. But although the Advanced class license entitles the operator to roam a *wider* selection of frequencies, it still does not enable him to operate on *all* of the amateur frequencies. Further restrictions remain, and only by obtaining the Extra class, the *highest* class of amateur license, may a General class operator regain *all* the operating privileges he possessed prior to November 22, 1968.

License Requirements

As in the past, the requirements for the General class amateur license are: 1—Ability to send and receive International Morse Code at the rate of 13 words per minute; 2 — Written examination Element; 3 — General amateur Practice and Regulations. There is no prior amateur experience necessary for obtaining this license.

The requirements for the Advanced class license are: 1—Ability to send and receive International Morse Code at the rate of 13 words per minute; 2—Written examination Element 4A (Intermediate Amateur Practice) in addition to Element 3. Again, no prior amateur experience necessary.

The Extra class amateur license, naturally has the most difficult requirements of any of the amateur licenses. A code test of 20 words per minute and a written examination covering Advanced Amateur Practice (Element 4B) in addition to Elements 3 and 4A are the requirements, but the license is available only to amateurs who have held an FCC issued amateur license for at least two years (except Novice and Technician).

Frequency Privileges

The adjacent Table shows graphically how amateur operating privilege will shape up after November 22. Note that only the 80, 40, 20, 15 and 6 meter amateur bands are affected by the Incentive Licensing rules. The areas shown are those in which each class of license is valid.

The effect of the new rules on most opera-

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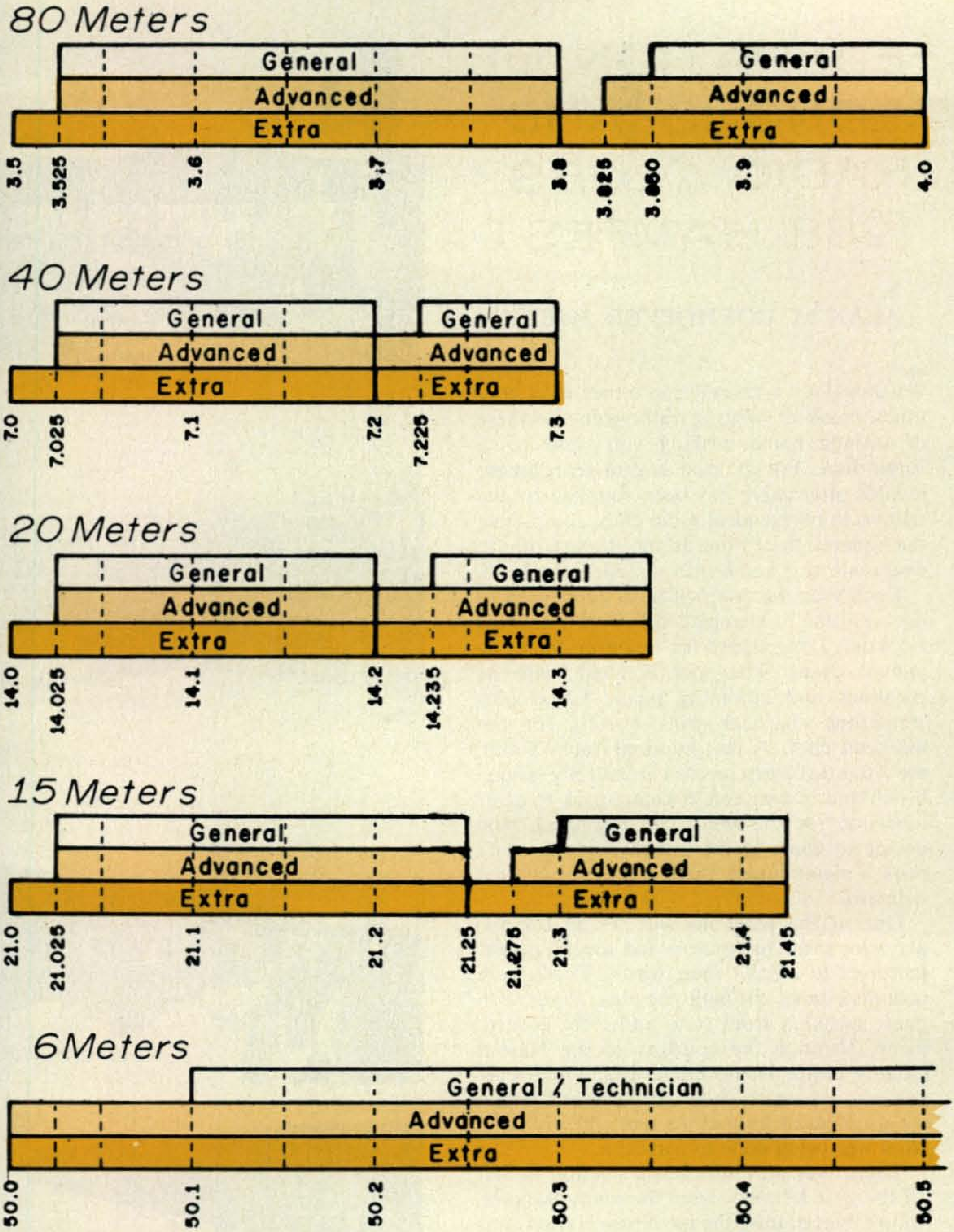

tors will be minimal, but the DXer and contester will be seriously handicapped unless he is able to achieve the Advanced or Extra license. It is urged that General and Advanced class licensees clip out Table I and post it prominently at the operating position to help prevent inadvertant out-of-band excursions in the heat of a pile-up.

The next stage in the implementation of Incentive Licensing will take place on November 22, 1968, with still further restrictions on the frequencies available to General and Advanced class licenses.

In a nutshell, the soundest advice to the non-Extra class licensee is: 1—Watch that bandedge, and 2—Get that Extra ticket. ■

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FEDERATION OF LONG ISLAND RADIO CLUBS' 1968 HAMFEST

ALAN M. DORHOFFER, K2EEK*

LABOR Day weekend can either be a continual hassle of fighting traffic going nowhere or staying home wishing you were going somewhere. For the past several years an enjoyable alternative has been supplied by the fellows in twelve local radio clubs comprising the Federation of Long Island Radio Clubs to overcome this sometimes dreaded weekend.

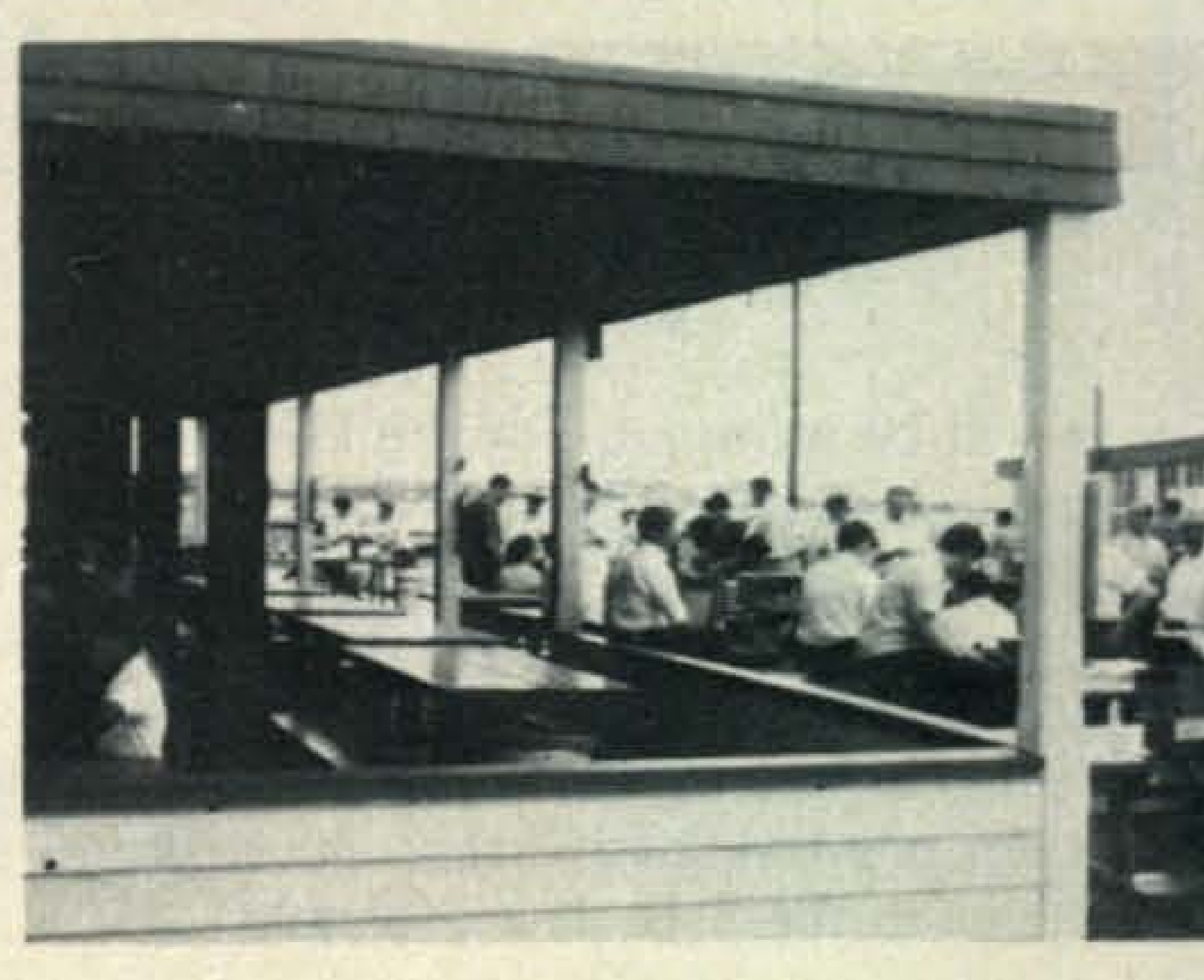
Each year the group secures permission to use a portion of Hempstead Town Park, Point Lookout, Long Island for this ever-enlarging annual event. The spot is ideal, with its pavilions and adjoining picnic tables plus numerous charcoal grills waiting for the weekend chef. A few hundred yards South, the Atlantic Ocean meets a beautifully sanded beach and in between, a kiddie park to offer diversion for the small fry. For those who decide to come at the last moment or don't pack a picnic lunch, there is a park-operated cafeteria.

One of the pavilions was set up for displays for local distributors and several manufacturers to exhibit their wares. There were technical talks through the day along with guest speakers from state and local government. Through the courtesy of the Nassau County Police Department, a mobile display van was set up to show the gathered public the problem of drug abuse and addiction and what was being done to correct it.

There was an enthusiastic auction to sell off the gear left over from the many Swap N' Shop tables dotting the pavilions. Varied contests for everyone to enter, XYL activities, and the sure-fire thing to draw hams out... Prizes, kept everyone busy. Bill Harrison, W2AVA, and Stu Meyer, W2GHK donated two complete stations which were given away late in the afternoon.

It was a good way to spend the day. ■

*Managing Editor, *CQ*.



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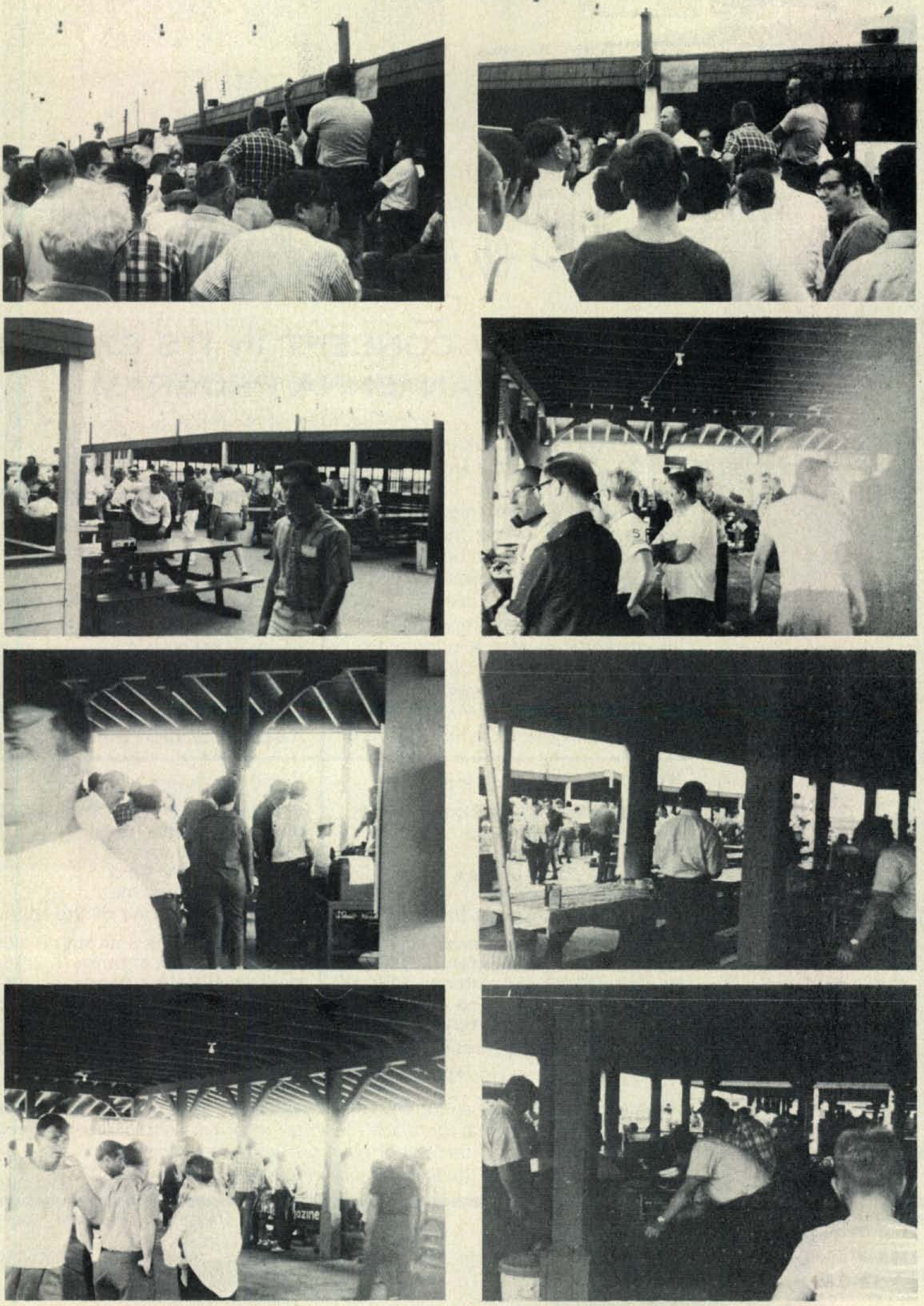
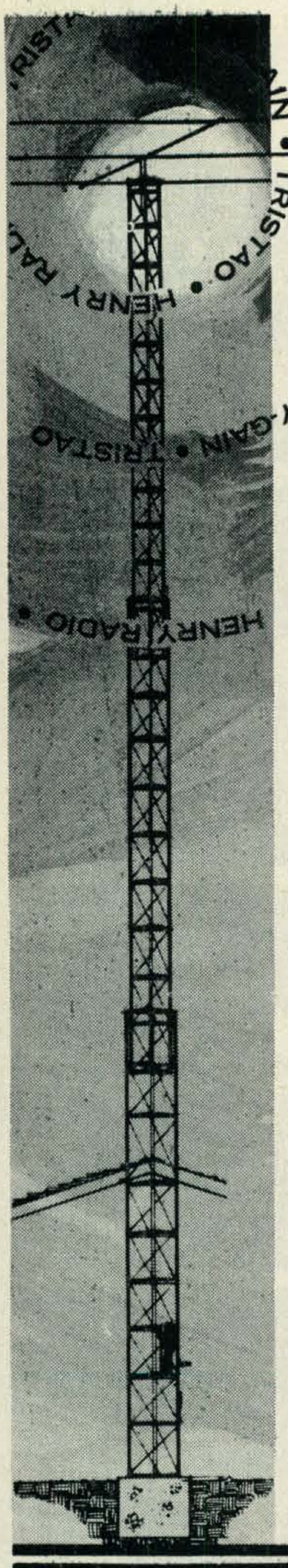


A Hamfest lets you meet old friends, make some new ones, swap some gear, bid on something you don't need, hear talks, look at new equipment and get out of the shack.



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100 ft. Control cable

Complete with one of the followin

Hy-Gain TH-3 Jr. antenna	**$325.0**
Hy-Gain TH-2 Mk 3 antenna	**$325.0**
Hy-Gain DB 10-15A antenna	**$325.0**
Hy-Gain 203BA antenna	**$330.0**
Hy-Gain TH-3 Mk 3 antenna	**$375.0**

A savings of approximately $70.00

Basic package No. HR-2

***Tristao CZ-454 New Concept 60 ft. crank-up tower w/mast**
CDR TR-44 rotator
100 ft. RG-58 A/U Coax
100 ft. Control cable

Complete with one of the following:

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Hy-Gain TH-2 Mk 3 antenna	**$480.00**
Hy-Gain DB 10-15A antenna	**$480.00**
Hy-Gain 203BA antenna	**$485.00**
Hy-Gain TH-3 Mk 3 antenna	**$520.00**

A savings of approximately $90.00

Basic package No. HR-3

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100 ft. Control cable

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Hy-Gain 402 BA antenna	**$575.0**
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Simple Heater-Voltage Regulation

BY WILFRED M. SCHERER,* W2AEF

It is sometimes necessary to provide a regulated voltage for the heaters of vacuum tubes such as those used in a v.f.o., d.c. amplifier or other critical circuits.

Simple methods of accomplishing this to a limited extent use gaseous regulator tubes or zener diodes such as shown at figs. 1 and 2. Use of the gaseous VR tubes reduces the input voltage to the transformer and thus reduces the available heater potential, unless a higher than normal output-voltage transformer is used. Also, the maximum heater-current drain (with 6.3 volt tubes) will be limited to about 250 ma. Finally, considerable space may be required for installation of the tubes. The limitations of this method, therefore, leaves much to be desired.

Use of the zener diode is an up-to-date approach with modern solid-state components and is quite helpful; however, the zener devices are fairly costly when it comes to those with power ratings above 2 watts such as may be needed in most applications. In addition, the transformer output voltage must be 20-50% higher than the desired heater voltage to be regulated by the diodes.

Regulated Transformer

The scheme shown at fig. 3 is an inexpensive expedient that we have successfully used over a number of years for regulating critical 6.3 v.a.c. circuits with load currents of 0.3 to 4 a. Better than 2% regulation can be obtained with this method. This surpasses that attainable with zener diodes employed for the particular application. Only one additional component is required besides the transformer, which might possibly be found in one's surplus-parts box along with the needed transformer.

The setup consists of a suitable size capacitor connected in series with one leg of the primary winding of the transformer. The principle of operation is based on saturation of the transformer core, in which case the secondary-output voltage is maintained at a value determined by the dimensions of the core and is independent of the applied line voltage during the saturated condition.

Saturation with normal line voltages takes place when the capacitance is such that the total primary-circuit reactance (X_L-X_C) is inductive and considerably less than that of the transformer primary. A higher than normal current then flows through the primary, producing a much greater voltage across it than the line potential. The magnetic lines of force then build up to a point that causes saturation of the core.

Excess current resulting in overheating of the transformer under these conditions is

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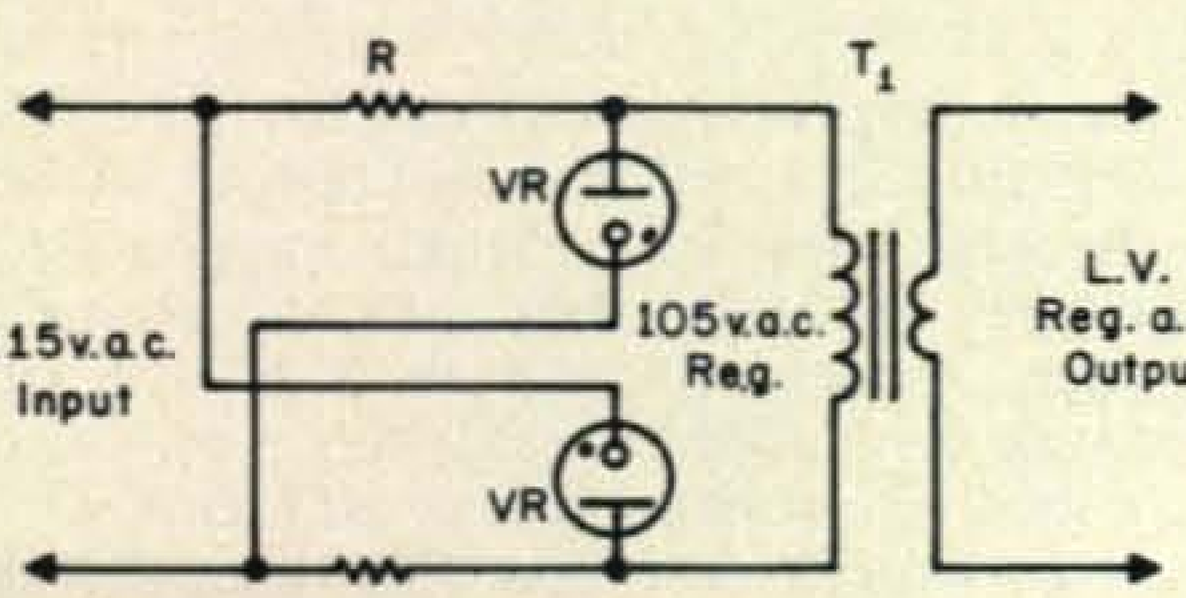

Fig. 1—A.C. heater supply with voltage regulation obtained using gaseous VR tubes.

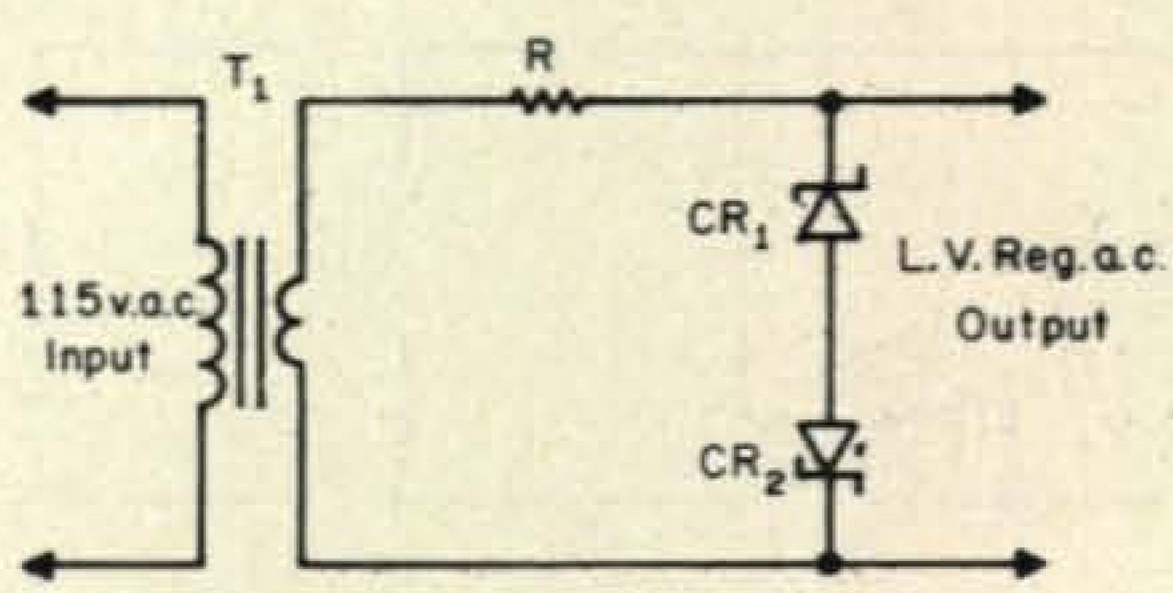

Fig. 2—A.C. heater supply using zener diodes (CR_1, CR_2) for voltage regulation.

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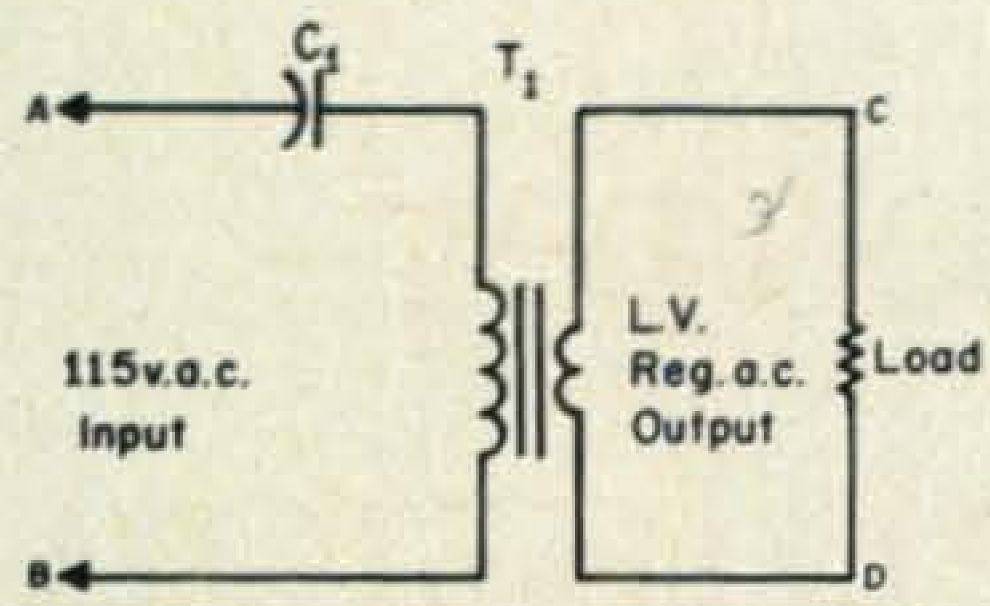

Fig. 3—Setup for obtaining regulated a.c. heater voltage using a capacitor in conjunction with a filament transformer. Components C_1 and T_1 and selected as described in text.

prevented, because during saturation, the primary inductance, on the current-peaks, decreases by an amount that makes the inductive reactance less than the capacitive reactance which then limits the current flow.

Although heating due to high current is minimized by the current-limiting action of the capacitor, the transformer temperature can otherwise rise, because with saturation the waveform is considerably distorted, producing harmonics that result in increased eddy-current losses. The eddy-current losses can be reduced by use of a good-grade transformer with thin core laminations. Heating also will be lessened with a transformer that has an output-current or wattage rating several times that required for the desired load.

Capacitor Size

Selection of the proper size capacitor is best a matter of experimentation, depending on the transformer characteristics and the load requirements. If the capacitor is too small, saturation does not take place. If it is too large, excessive heating of the transformer will result.

We found it well to start off with a random size capacitor, say 1 mfd, then trying various other values and choosing the *smallest* size that starts regulation at the proper point and maintains a secondary-output voltage (under load) constant to ±2% or better with line-voltage variations ±10% of a nominal 115 volts. [1]

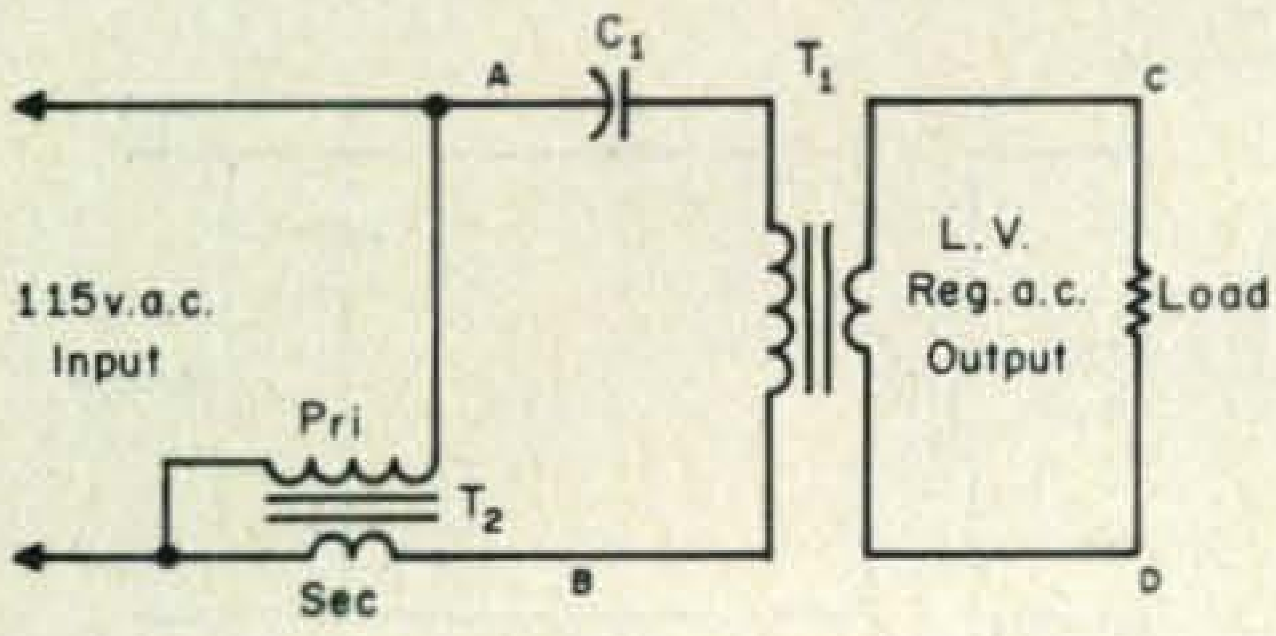

Fig. 4—Method of using a filament transformer as an autoformer for testing operation of fig. 3 setup.

Because of the higher voltage developed across the transformer primary, the output will be proportionately higher (usually 50-100%), thus necessitating a voltage-dropping resistor in series with the load or the use of a transformer with a somewhat lower normal-output rating. Another expedient may be the use of only half the transformer output winding if it is equipped with a center tap. This will provide slightly better regulation. These measures should be employed at the same time the following procedures are conducted.

Test Procedure Using A Variac

Determination of the correct size capacitor needed to meet the aforesaid requirements may be most easily accomplished while using a variable autoformer, such as a Variac, to vary the line voltage during the test procedure. When the voltage is slowly raised from below 50 volts, the saturation point, and the onset of regulation, will be indicated by a sudden jump in the secondary output voltage of the transformer.

This snap action occurs, because saturation does not take place immediately, but rather, is a cumulative action that proceeds in cycles wherein the magnetic lines of force build up toward saturation, during which time the current flow increases due to the attendant lowered inductive reactance. This action continues until sufficient lines of force are produced to cause saturation.

Regulation should commence when the line potential is raised no higher than to 100-105 volts. This will ensure the start of regulation when a line potential about 10% below a nominal supply potential is initially applied. Regulation may then be had over a ±10% range from the usual nominal; however, once regulation starts, the line potential may be decreased to about 60 volts, before

[1]The a.c. voltage requirements for tube heaters are based on r.m.s. values. The output waveform from the regulated transformer approaches that of a square wave. Correct output voltage measurements, therefore, require the use of the proper type a.c. voltmeter. Most v.o.m.'s respond to the r.m.s. or average values and thus will provide close enough readings. On the other hand, the common v.t.v.m. responds to the peak value and is calibrated in terms of r.m.s. of a *sine* wave. It, therefore, will not provide accurate indications for the job at hand.

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saturation and regulation ceases.

Subsequent checks by varying the line voltage with the variac should result in a fulfillment of the specified regulation tolerance. Reference also should be made to the procedure which follows below.

Test Procedure Using Fixed Autoformer

If a Variac is not available, a fixed autoformer can be improvised using a 6.3, 7.5 or 10 volt filament transformer as shown at fig. 4. This will alter the voltage applied to the regulating setup by an amount equal to the filament-winding voltage of T_2. The applied voltage then will be either higher or lower, depending on the polarity of T_2's primary connections which result in a phase relationship that provides series aiding or bucking of the a.c. voltages.

The procedure for checking the regulator setup is as follows:

1–With the load connected to T_1 and one side of the T_2 primary disconnected, measure and record the voltage at *A-B* and *C-D*. Refer to these as the center line-and-load-voltages, respectively.

2–Connect the primary of T_2 across the 115 volt supply line and again measure and record the voltages at *A-B* and *C-D*.

3–The difference between the voltage now found at *C-D* and the center load-voltage of step 1 should be 1-2% of the center load-voltage.

4–Reverse the primary connections of T_2 and repeat steps 2 and 3.

5–If when the primary of T_2 is so connected that the voltage at *A-B* is lower than the center line-voltage and if the change in load voltage at *C-D* is greater than the percentage specified in step 3, the transformer is not regulating and a larger capacitor will have to be used.

6–As a final check, let the setup operate for about an hour with the load connected to make sure the transformer does not heat up excessively. If it does so, the capacitance should be reduced to a value that still meets the specified regulating requirements. If this is not possible, a better transformer will have to be used.

Where regulation must be held to a closer tolerance than possible with the regulated transformer, it may be had at extra cost by the addition of zener diode regulators at the transformer output or by the independent use of a transistorized regulated low-voltage d.c. supply. ■

EXPERIMENTS WITH THREE ARRAYS ON ONE BOOM

BY SAM E. PARKER, *W6ZWK

Part I

This two part series discusses the results of tests using ten elements intermixed on a 36 foot boom with a single coaxial feed line for 20, 15 and 10 meters. Part I covers the general concepts, tuning of the elements, coaxial baluns, adjustment techniques and relay switching methods. Part II discusses isolation by line sections, isolation by networks, s.w.r. characteristics and the effects upon the antenna patterns.

STARTING with a four element 20 meter array built in August, 1964, three 15 meter elements were added in December, 1965, as illustrated in fig. 1. Three 10 meter elements were recently added, giving the composite structure pictured in fig. 2. This article describes certain tests with these Yagi-Uda arrays including three alternate methods of interconnection that permit the use of a single transmission line without a separate control cable.

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General Plan

Figure 3 gives element spacings and information regarding their resonant frequencies. Physical lengths of the elements are not shown since they depend upon the choice of design frequencies (f_{10}, f_{15} and f_{20}), upon

Fig. 1—Photograph taken in December, 1965, after three 15 meter elements were combined with four 20 meter elements on a 36 foot boom.

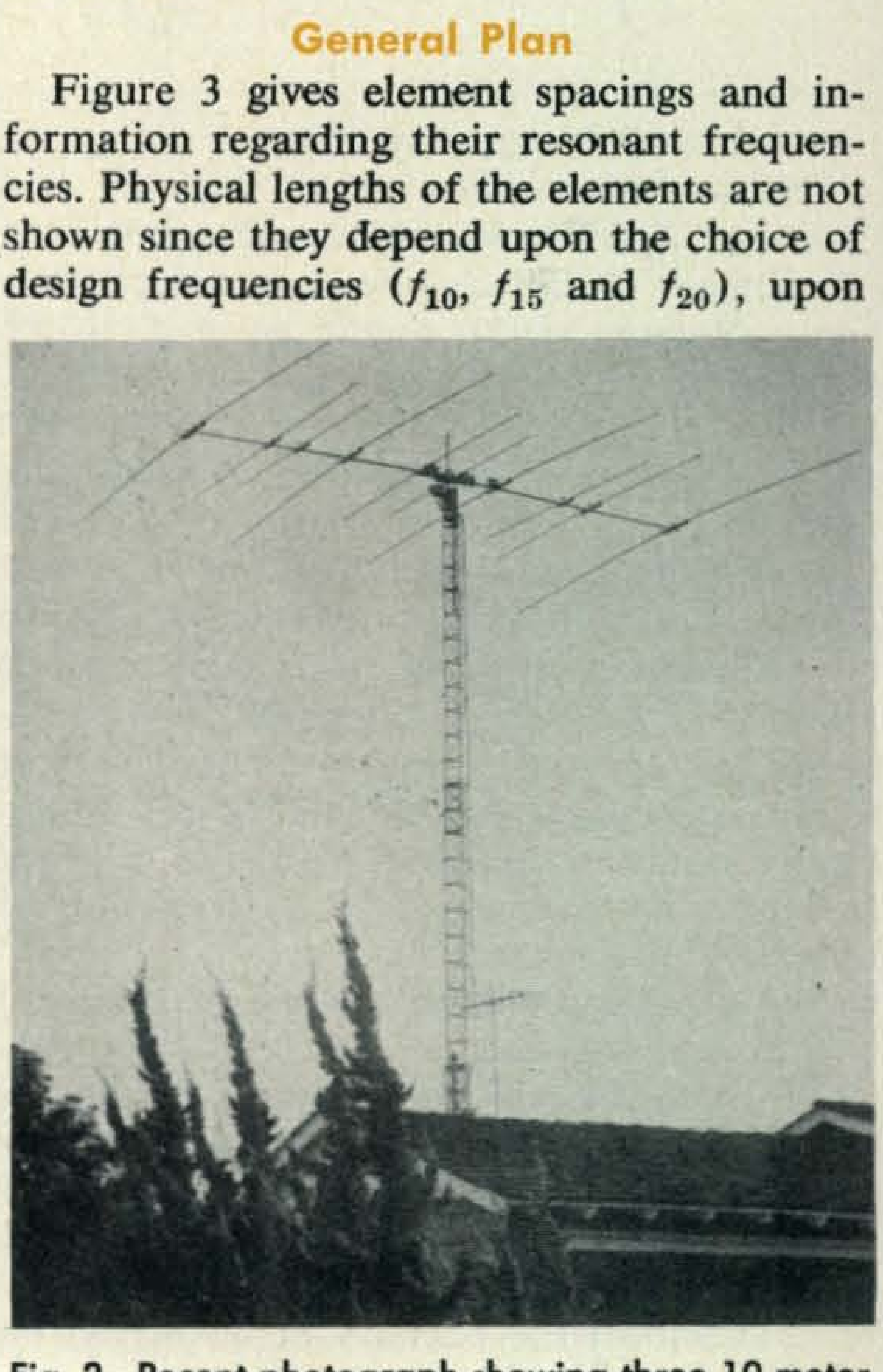

Fig. 2—Recent photograph showing three 10 meter elements intermixed with the 15 and 20 meter elements shown in fig. 1.

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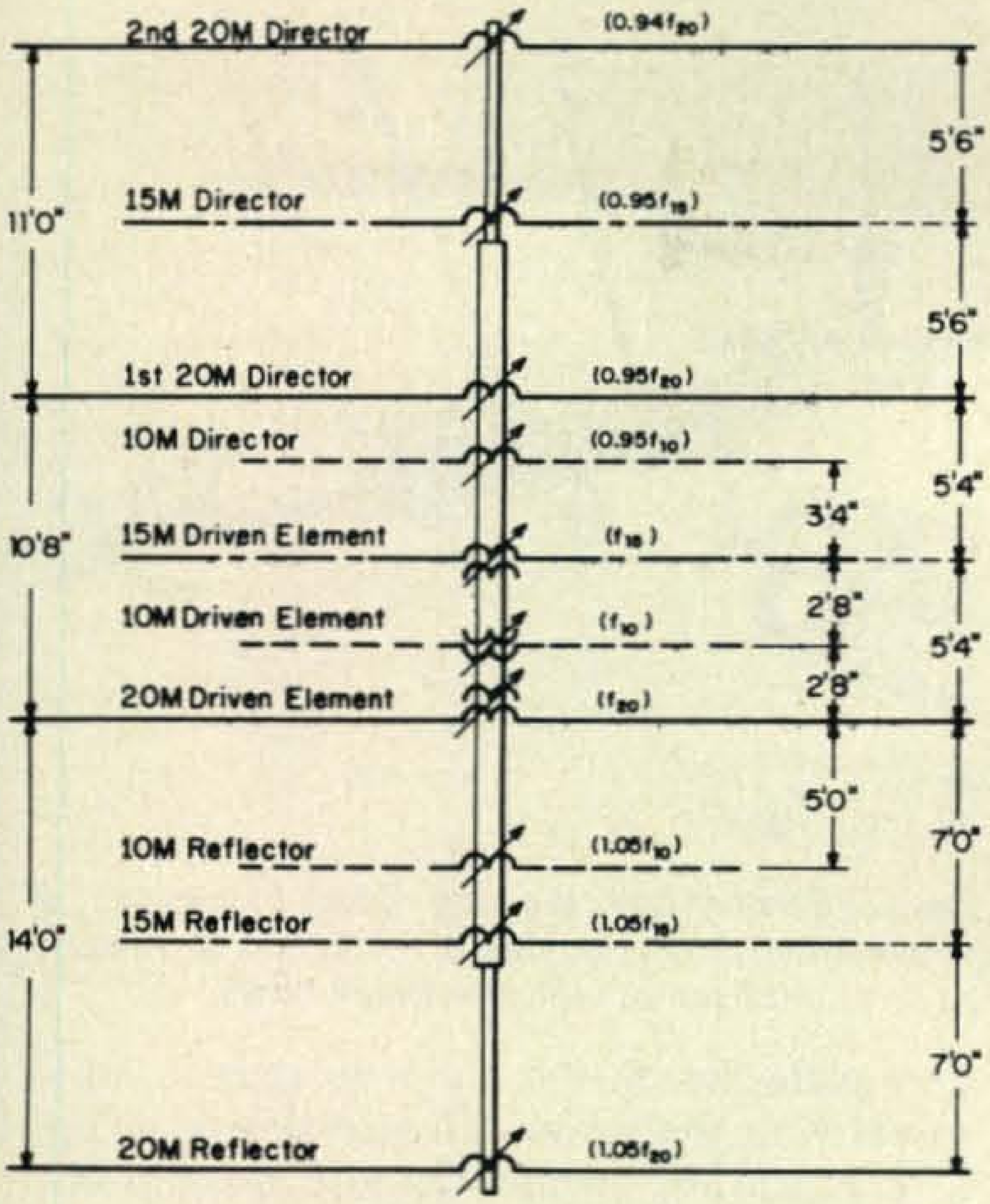

Fig. 3—General plan of the composite three band array with element spacing and information used in establishing element lengths.

diameters of the elements, and upon details of adjustable coils and coaxial transformers that are connected at the center of the elements.

A typical variable inductor is illustrated in fig. 4. A small coil of #6 copper wire with a Teflon sleeve is closely wound on a low loss dielectric form having an outside diameter of 1.5 inches. The form is drilled and threaded to accommodate a 1 inch brass slug 1.5 inches long. A large slot in the slug permits adjustments from the center of the boom, if desired, using a long rod or bamboo pole with a tapered end. All variable inductors are similar except fewer turns are used with the parasitic elements having progressively higher frequencies. Coils of 3.5, 2.5 and 1.5 turns were arbitrarily chosen for 20, 15 and 10 meters respectively.

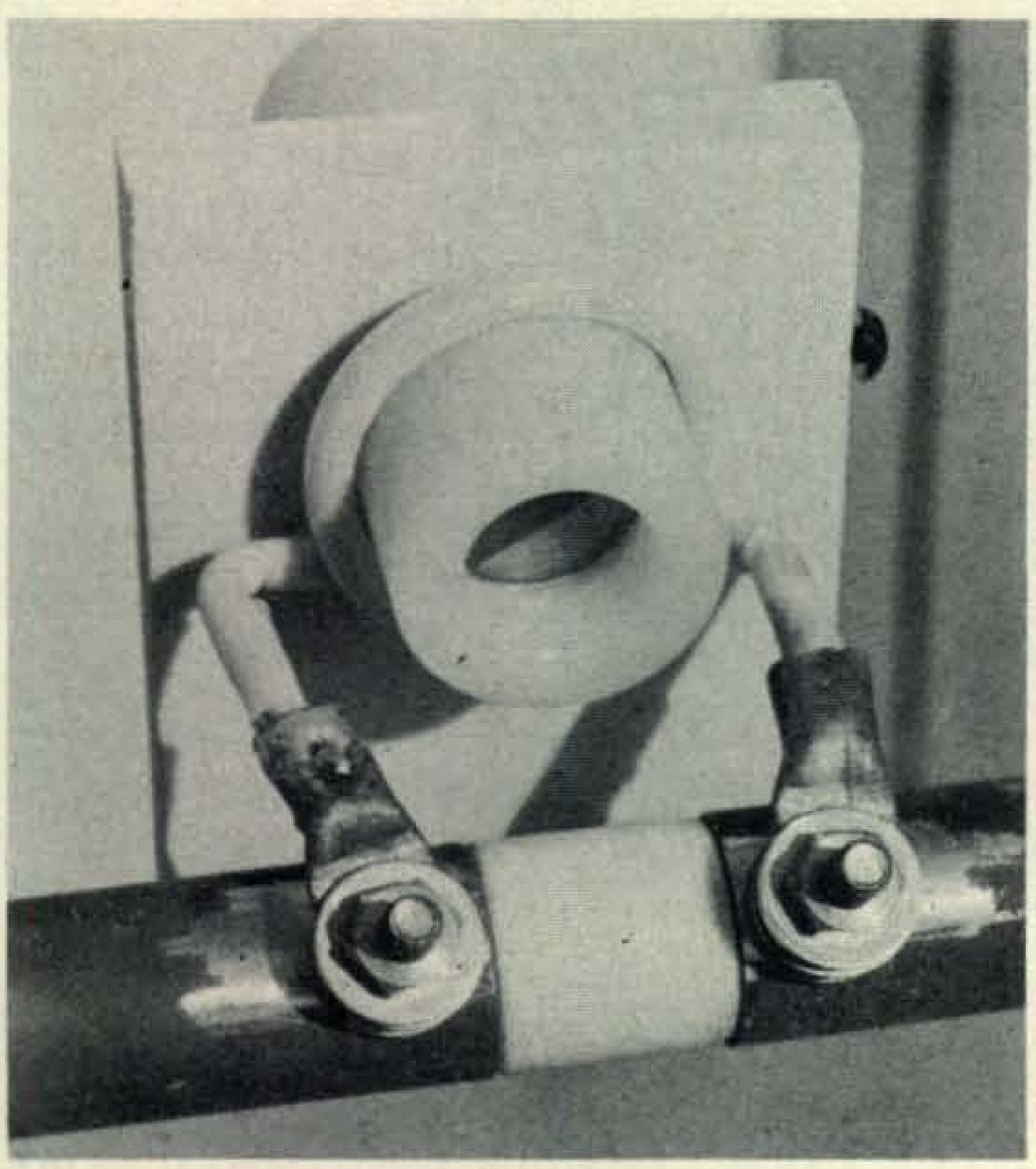

Fig. 4—Variable inductor assembly controlled by threaded brass slug.

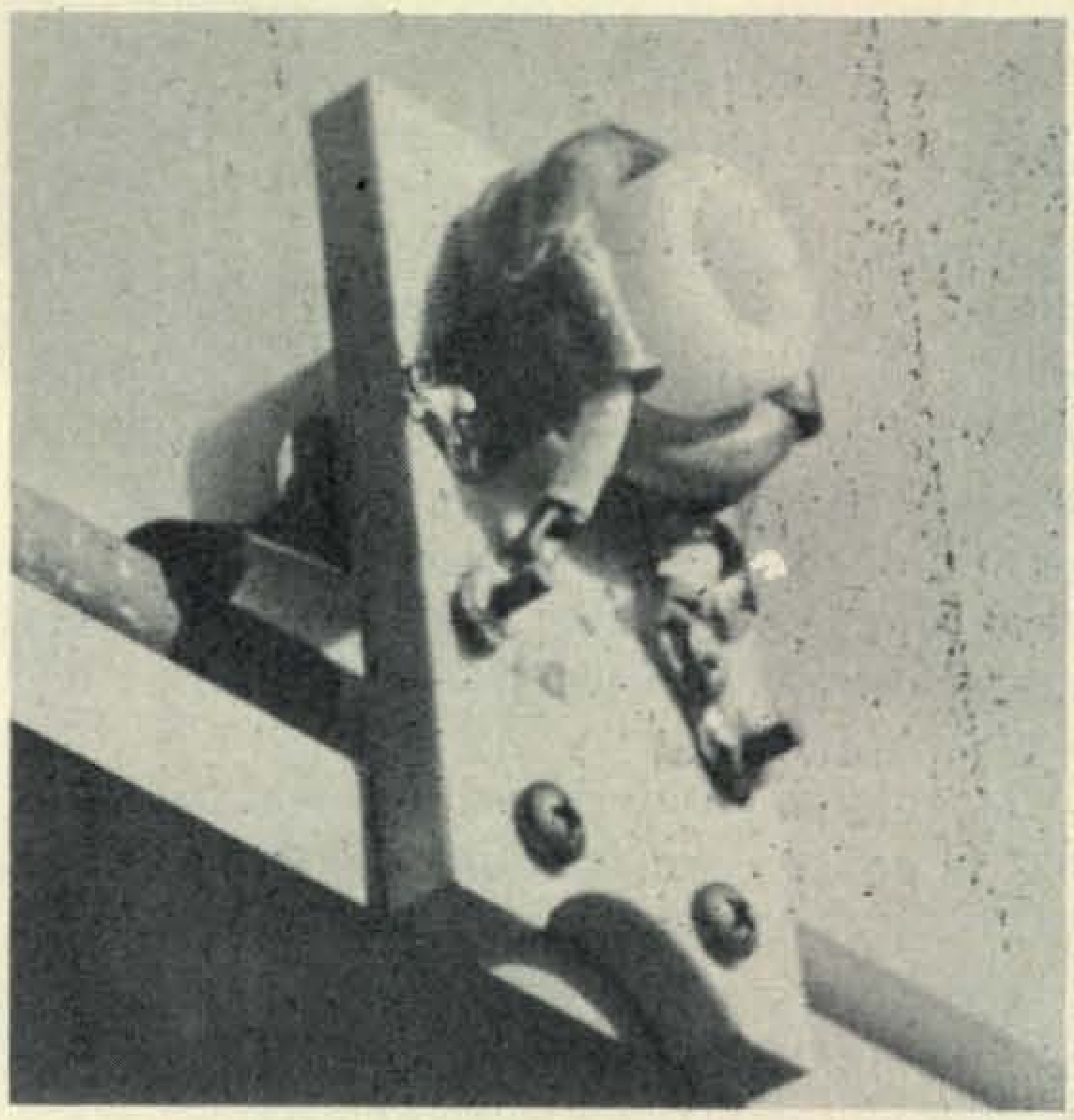

Fig. 5—Slug controlled coaxial transformer of the general type used for impedance matching.

Variable slug controlled coaxial transformers of the type shown in fig. 5 are used for impedance matching. Owing to the small diameter of the forms which are identical with those used with the variable inductors described above, the transformers are wound with coaxial cable having Teflon dielectric. This prevents possible problems with displaced inner conductors as a result of "cold flow" in polyethylene. In this series of tests, the transformers utilize 3.5, 2.5 and 1.5 turns of type 142B/U cable with the 20, 15 and 10 meter driven elements respectively.

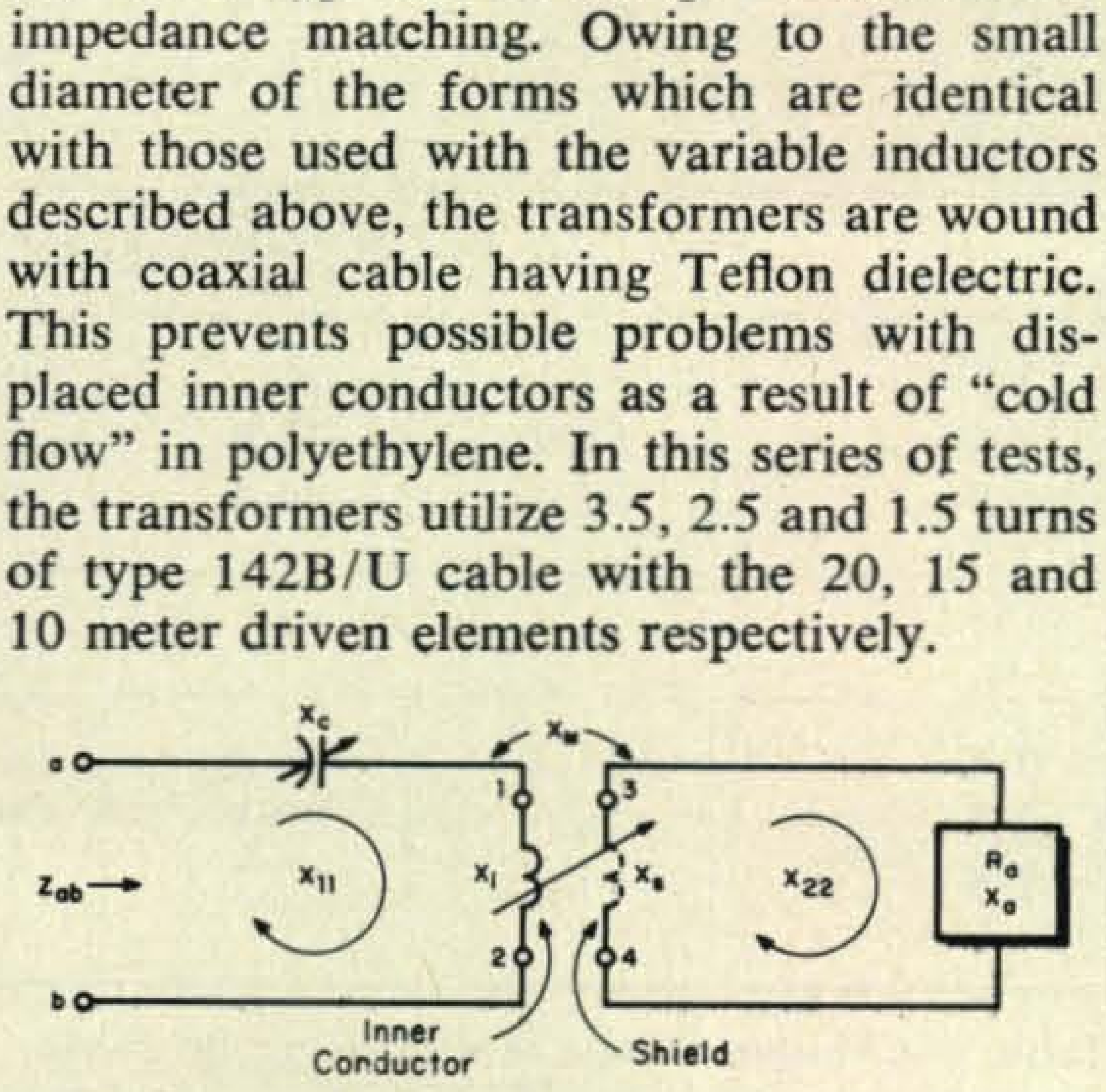

Fig. 6—Simplified representation of two circuits with variable inductive coupling and a tuning capacitor in the primary.

Adjustment Technique

After the parasitic elements have been individually adjusted, the driven element of each array should be adjusted for resonance in the secondary circuit ($X_{22}=0$) with the primary open-circuited. (See fig. 6) The capacitor should be adjusted for resonance in the primary circuit ($X_{11}=0$) as the slug's position is varied for proper value of mutual reactance (X_M). The simplified schematic diagram in fig. 6 identifies the essential network parameters.

In common with other antenna matching techniques certain refinements are necessary to obtain optimum performance. In this study, a grid dip meter was used in resonating each parasitic element at the desired frequency on an 8 foot wooden ladder in a relatively open area. When suitable crystals were available, a Collins 75S-1 receiver served to establish the frequencies indicated by the grid dip meter. With the boom horizontal at a height of about 12 feet, all elements were mounted in the position shown in fig. 3. A pair of door hinges on a ¼ inch steel plate permit the boom to remain horizontal with the tower tilted as shown in fig. 7. The grid dip meter was also used in adjusting the lengths of the driven elements with their transformer assemblies for the desired resonant frequencies. After the posi-

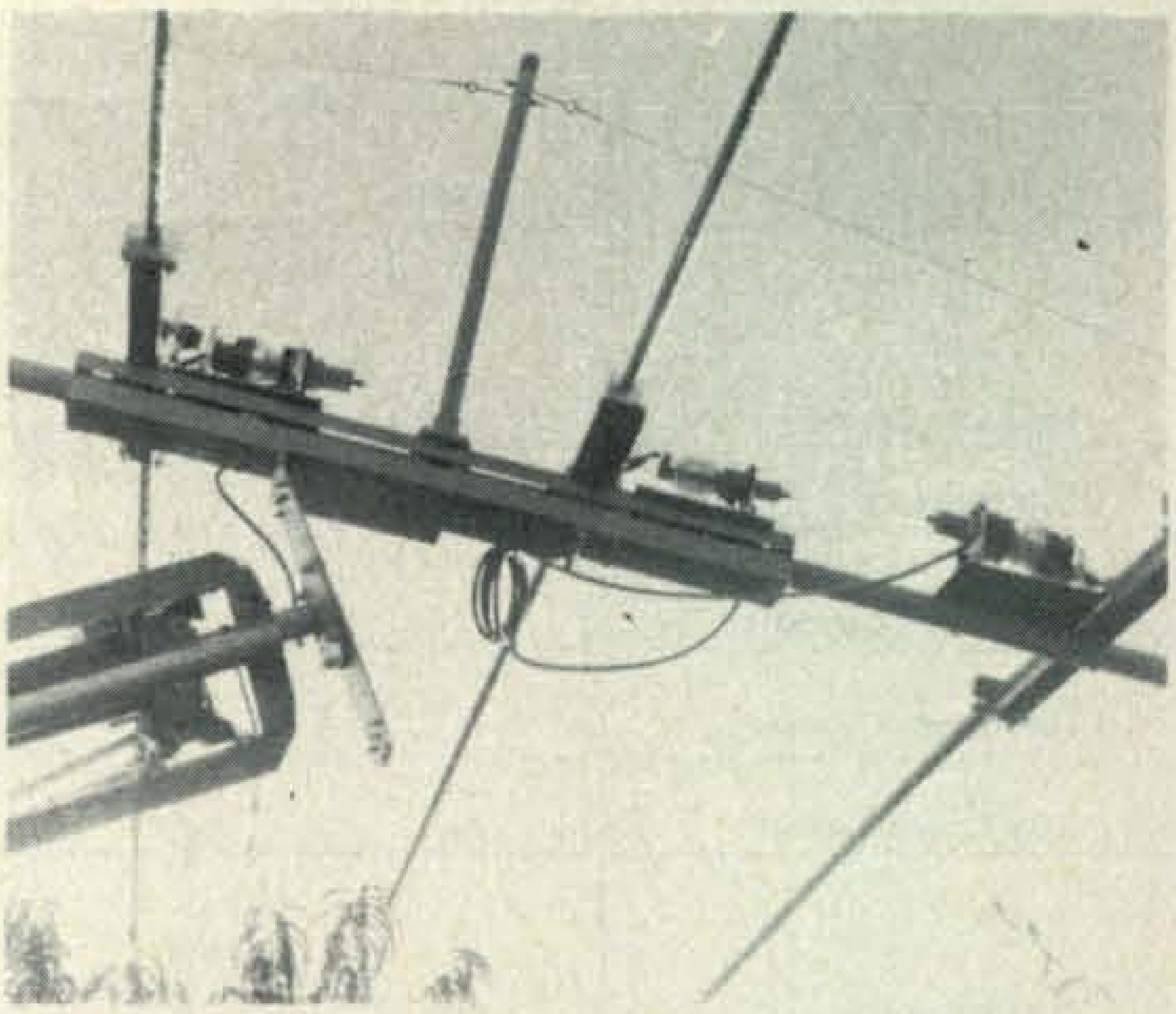

Fig. 7—Photograph showing door hinges on a heavy steel plate permitting the boom to remain horizontal with the tower tilted.

	$X_s(ohms)$		$X_i(ohms)$		$R_a = X_M^2/50$	
Slug / Turns	*Out*	*In*	*Out*	*In*	*Out*	*In*
(a) At 14 mc						
3.5	54.3	40.7	63.5	50.7	128.0	56.7
2.5	35.7	27.5	43.2	35.0	27.1	18.4
1.5	21.3	17.5	24.2	22.9	8.4	5.3
(b) At 21 mc						
3.5	88.1	65.2	102.4	81.9	1186	305.4
2.5	55.9	42.9	69.0	53.1	721	60.2
1.5	32.0	27.4	40.2	35.6	25	15.9
(c) At 28 mc						
3.5	123.2	89.2	144.6	112.5	(*)	(*)
2.5	78.6	60.7	92.8	75.0	193.1	100.7
1.5	44.6	37.1	56.9	49.1	57.9	36.2

Table I—Changes in the reactance of the shield, X_s, and inner conductor, X_i, as a function of the position of the brass slug, are shown above. The reactances are shown for three different frequencies using different numbers of turns of RG-142B/U cable on a dielectric form having a diameter of 1.5 inches. Values of the antenna resistance, R_a, that can be accommodated are also included. In the cases marked with an asterisk antiresonance was approached with coils connected series-aiding.

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tions of the slugs had been approximately determined, using a simple *RC* resistance bridge,[1] minor changes in the lengths of the driven elements were made to compensate for detuning of the antenna circuit by the slugs. Further adjustments of slug positions and capacitor settings were made at various heights using a sensitive reflectometer.

The data in Table I assisted in selecting and adjusting these coaxial transformers. Using the symbols in fig. 6, variations in the reactance of the shield X_s and of the inner conductor X_i are shown as functions of (extreme) slug positions. Under resonant conditions, the right hand columns give values of antenna input resistance, R_a, that can be accommodated by the measured variations of X_M obtained using the relationship,

$$X_M = \frac{X_{aid} - X_{opp}}{4} \quad (1)$$

with the coils connected series aiding and series opposing. When series aiding (*e.g.* with terminals 2 and 3 joined in fig. 6) the currents in the inner and outer conductors flow through the short section of cable in the same direction and their effects on an external metallic slug are additive. When series opposing (with terminals 2 and 4 or 1 and 3 joined) the cable is short circuited and the inner and outer conductors carry equal currents in opposite directions. Since these currents are close together, their effects on an external slug cancel in this instance. Thus, while the position of the slug influences the value of X_{aid}, the effect upon X_{opp} is negligible.

Table I shows that values of X_s and X_i are functions of the slug position, increasing and decreasing with X_M. Thus, in common with other matching techniques such as the T and gamma, loading adjustments influence circuit tuning. For this reason, both the secondary and primary circuits in fig. 6 should be retuned after any substantial change in the slug's position.

Observe that the coefficient of coupling between the inner and outer conductors of the cable,

$$k = \frac{X_M}{\sqrt{X_s X_i}} \quad (2)$$

remains practically constant, explaining the variation of X_s, X_i and X_M. Moreover, owing to the close proximity of the cable's conductors, the value of coupling coefficient is approximately unity.

Referring to the right hand columns in Table I, the values of R_a accommodated by the brass slugs were computed under the assumption that the antenna or secondary circuit is resonant. Neglecting component losses, elementary circuit theory shows that the components of input impedance in fig. 6 are:

$$R_{ab} = \frac{R_a X_M^2}{R_a^2 + X_{22}^2} \quad (3)$$

and

$$X_{ab} = X_{11} = \frac{X_{22} X_M^2}{R_a^2 + X_{22}^2} \quad (4)$$

When $X_{22} = 0$, equation (3) becomes:

$$R_{ab} = \frac{X_M^2}{R_a} \quad (5)$$

and the values of R_a that can be transformed to 50 ohms were computed by means of this expression, using measured values of X_M.

Equations (3) and (4) are helpful in understanding the matching circuits under nonresonant conditions. If the antenna circuit is improperly adjusted or detuned by environ-

[1] ARRL Staff, *The Radio Amateur's Handbook*, 42nd Edition, pp. 537-539, 1965.

Freq. (mc)	*Shield Reactance* (X_s)			*Inner Conductor* (X_i)			*Mutual Reactance* (X_M)		
	No Slug	*Brass*	*Ferrite*	*No Slug*	*Brass*	*Ferrite*	*No Slug*	*Brass*	*Ferrite*
14	21.2	17.5	34.6	24.2	22.9	38.6	20.57	16.27	36.42
21	32.0	27.4	58.6	40.2	35.6	59.5	35.67	28.20	64.70
28	44.6	37.1	85.7	56.9	49.1	77.7	54.05	42.55	116.87

Table II—Shown above are the reactances X_s, X_i and X_m measured at three frequencies using 1.5 turns of RG-142B/U cable, showing the effects of slugs of brass and Feramic Q2. Feramic Q2 is a registered trade mark of Indiana General Corporation, Keasbey, N.J.

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mental effects, it is still possible to obtain the desired 50 ohm input resistance provided X_M can be made sufficiently large. The right hand term in (4) shows that the sign of the reactance reflected into the primary is different from that of the secondary reactance X_{22} and, for low v.s.w.r. this must be compensated for by appropriate adjustment of the capacitor.

A magnetic slug exerts an opposite and perhaps larger effect upon X_s, X_i and X_M than a brass slug of comparable size and shape. This is illustrated in Table II. In addition to certain measurements with the brass slug, data are included using a square piece of ferrite measuring 0.718 inches on each side and about 2 inches in length. This is actually a piece of a standard C core having a rated maximum permeability of 115 at 1 mc. The data in Tables I and II are helpful not only in matching adjustments but also in combining two arrays by special lengths of transmission line, as explained later.

Relay Switching Details

Having used a pair of chrome-plated slip rings for feeding several different rotary beams since the early 1950's, we desired to retain this flexibility of operations when the 15 meter array was combined with the 20 meter array in 1965. A s.p.d.t. vacuum transfer relay was utilized as indicated in fig. 8, the relay being activated by the same coaxial cable that feeds the antennas. The coaxial cable from the 20 meter array is shown connected to the normally-closed contacts and the 15 meter array is connected to the normally-open contacts. Both the relay and its 26.5 volt d.c. supply are connected to the main cable through special r.f. chokes. Being wound on grooved forms 1 inch in diameter and 6 inches long, these chokes consist of 100 turns of No. 21 enameled wire wound 20 turns per inch. It is emphasized that all extraneous d.c. paths to ground must be avoided using this technique. This precludes the use of an r.f. choke across the output terminals of the transmitter or exciter (if used alone); and a blocking capacitor of 0.01 mf or so may be required in series with the receiver's input terminals. Also, caution is required in using a reflectometer, attenuator, or any other device that may be damaged by the relay's actuating voltage or provide a low resistance d.c. path to ground.

Recently, when faced with the problem of

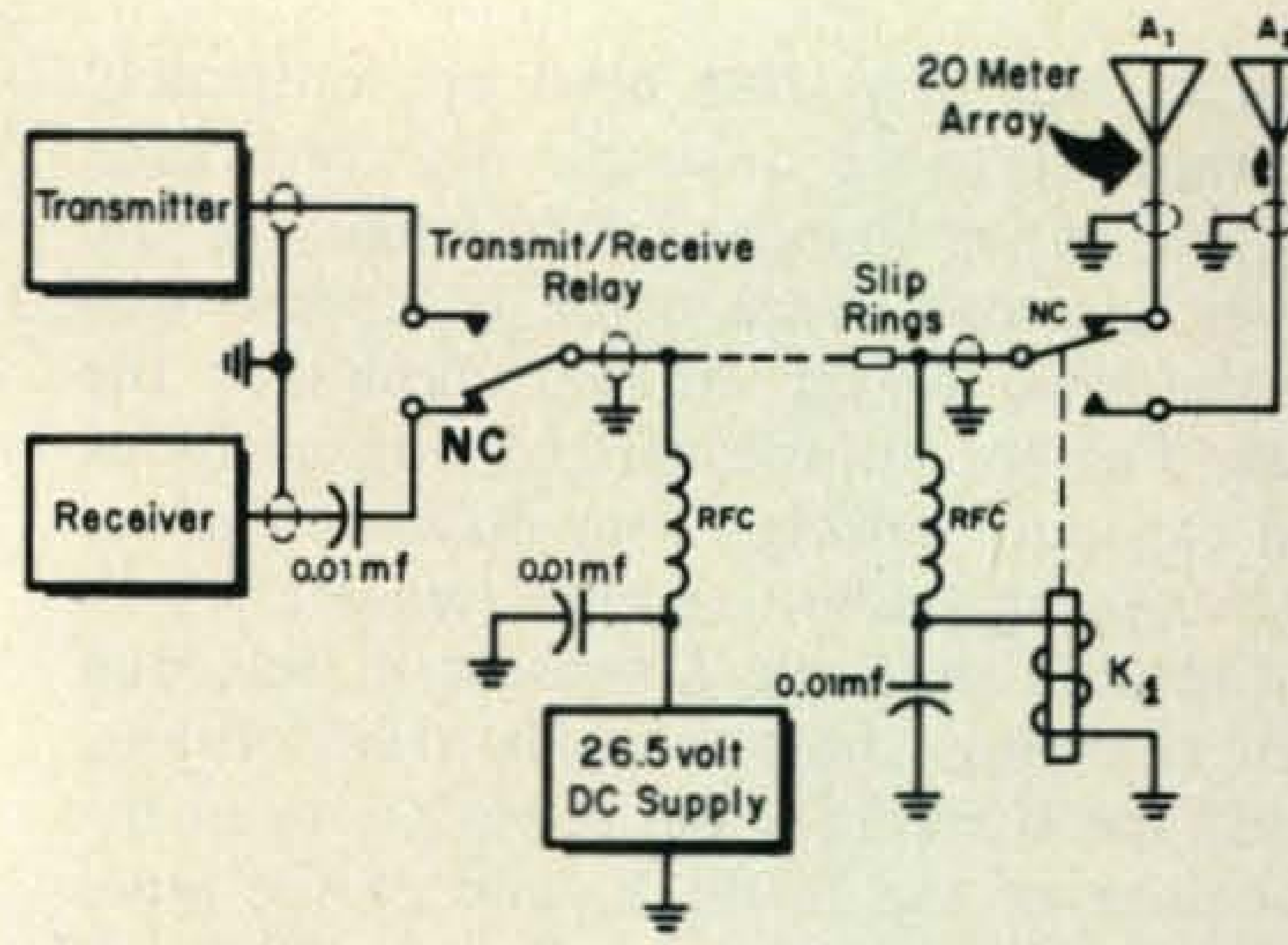

Fig. 8—Method used to energize 26.5 volt d.c. antenna transfer relay by means of the same cable that supplies r.f. energy to the antennas. Details of special r.f. chokes are given in text. The antenna transfer relay, K_1, in a Jennings type RB1.

adding a 10 meter array, a brief but unsuccessful search was made for a suitable single pole triple throw transfer relay. The Dow-Key Company makes a relay of this type, their DK78 series, but it normally utilizes a separate control cable with three separate actuating coils. In consequence, we decided to isolate two of the three arrays by sections of transmission line connected in parallel at one set of contacts of the existing relay.

The next installment, Part II, will cover isolation of the three arrays using line sections and networks.

[*To be Continued*]

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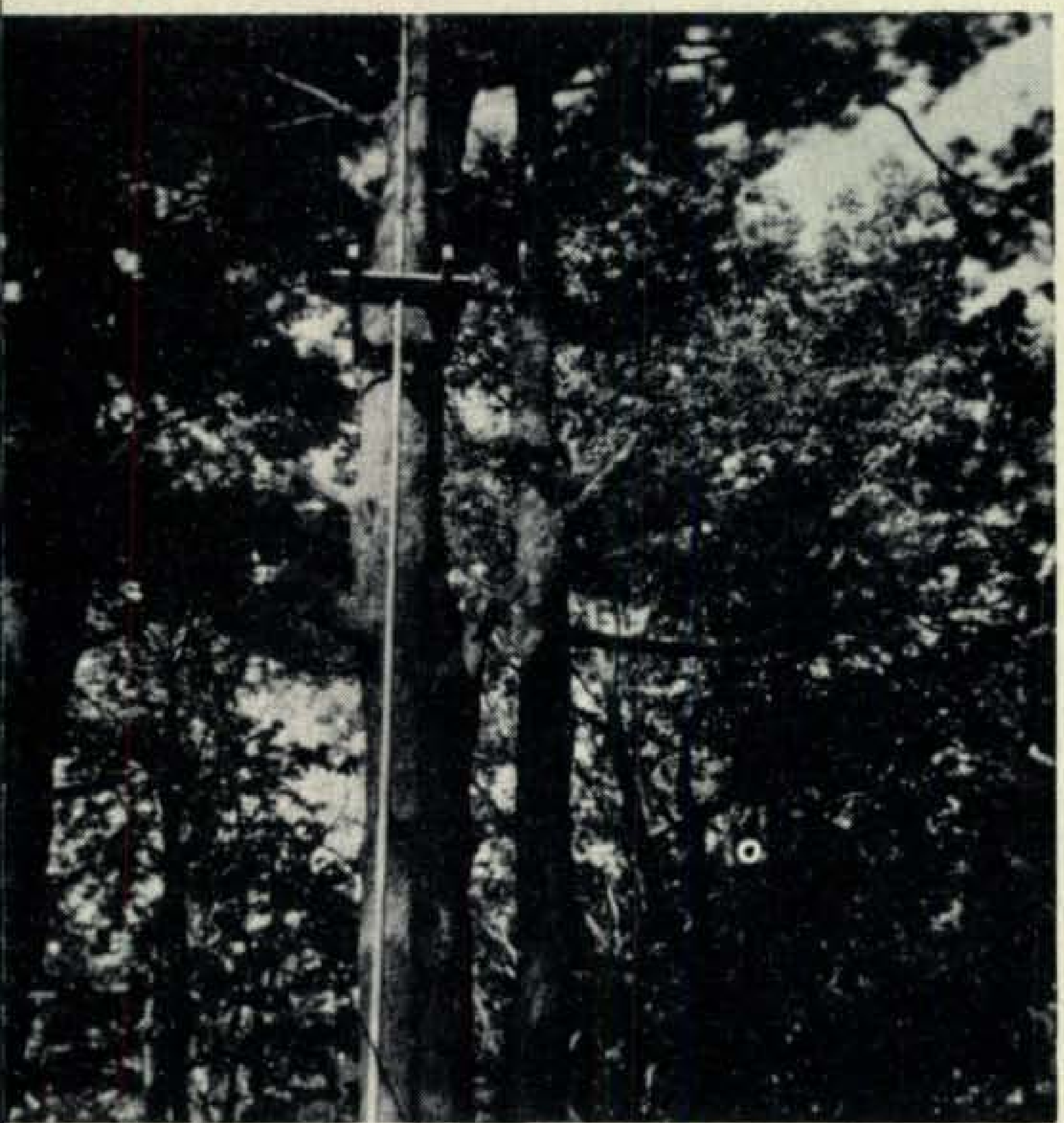
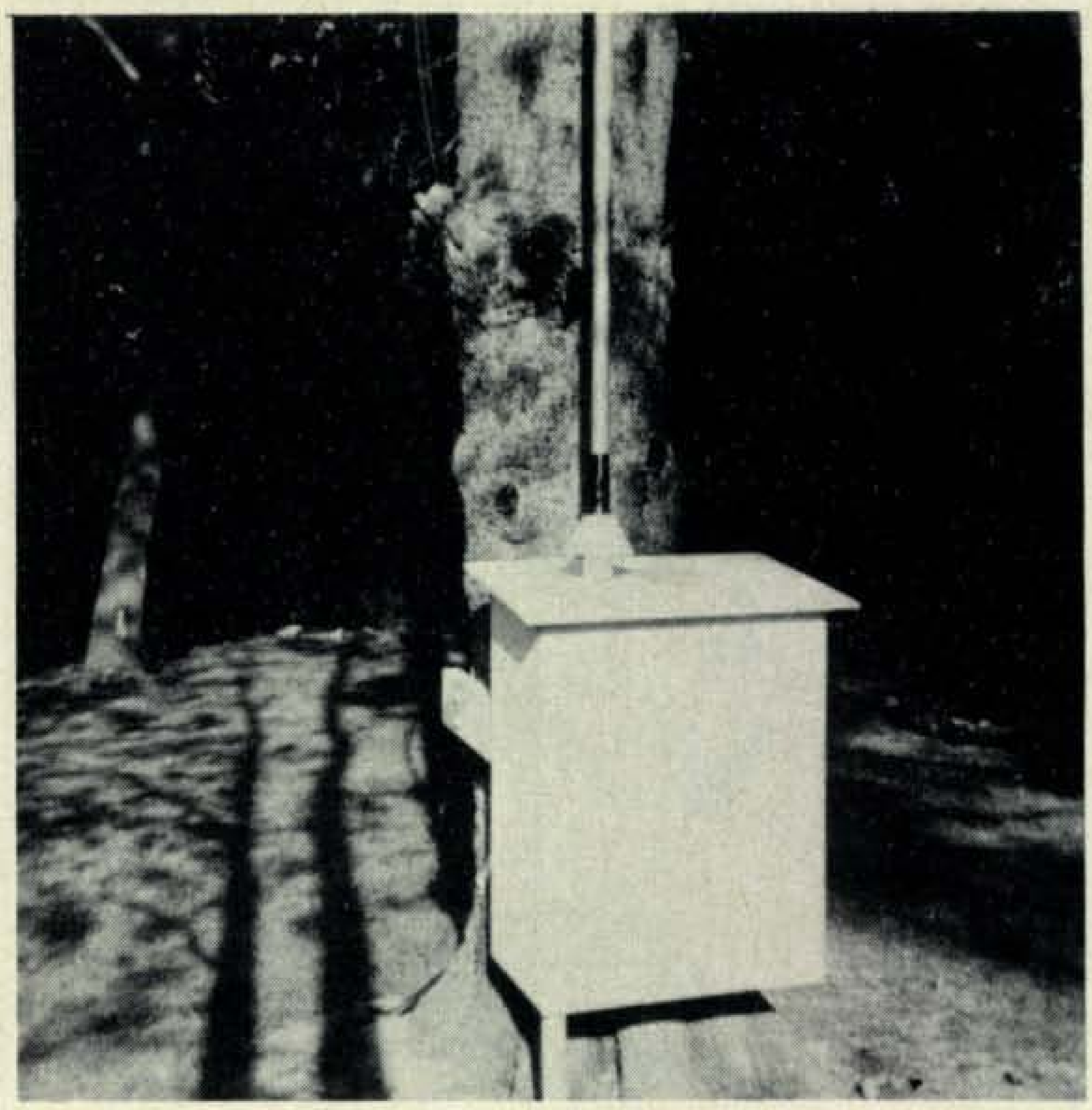

Fig. 1—Two views of the tree mounted antenna installation at W1RIL. This type of structure is inexpensive and gets the antenna up where it belongs, quickly.

Natural Towers

BY KEN SCHOFIELD,* W1RIL

The use of a tall pine or fir tree is an inexpensive way of getting the antenna up where it will do the most good. In this type of installation, described below, the antenna rotator motor is housed at the base of the tree tower providing quick access for simple servicing.

COMMERCIAL towers suitable for amateur antenna installations, be it for a single 10 meter beam, a 10/15/20 Christmas tree or a large trap antenna, can be a relatively expensive item, sometimes equalling the cost of the transmitting/receiving equipment, and often times exceeding it.

This article presents a method of mounting, installing and rotating an antenna array in a tower provided by nature, a tree, in this particular case, a pine tree as shown in Fig. 1. Many of our ham brethren living in new housing developments or in cities, won't find those natural towers in their back yards, but those of us who are fortunate, can make economical use of what nature has provided. The tree mounted system described here, not including the antenna array, rotator or selsyn systems, can be constructed for approximately $25.00.

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Location & Selection

On occasion more than one tree is available and a choice must be made as to which is most convenient relative to location from a feedline/control line standpoint and also from the standpoint of the clearance of powerlines, other tree limbs, *etc.* The tree selected should be healthy and structurally sound, with a good solid trunk and as straight as possible. Pine and fir usually fill these requirements nicely, although some other types are also suitable.

Preparation

The top of the tree should be cut off at a

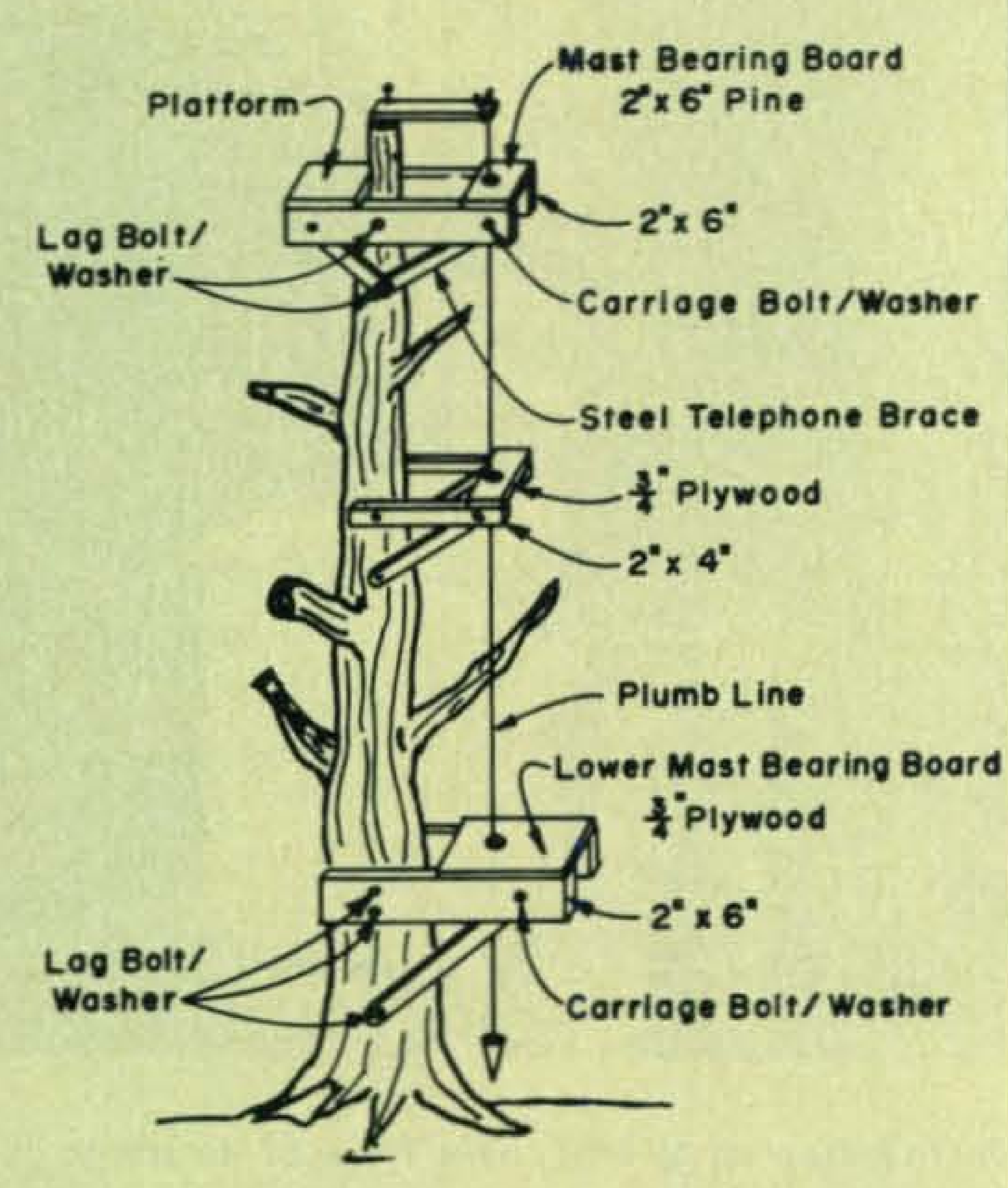

Fig. 2—Construction and mounting details of the mast bracket assemblies. The number needed depends on the tree height. The steel support braces are crossarms from telephone poles, and are 3/16" thick, 1 3/16" wide. The ones used at W1RIL are 28" long but other lengths are available.

point where the main trunk is a good 4 to 5 inches in diameter. A sealer is applied to prevent water from rotting the exposed wood where the cut was made. XYL's are inclined to become a little irrational at this point, but I have been assured by experts that topping is not injurious to the tree; in fact the loss of the top will increase limb growth and the tree will actually become fuller to make up the loss.

A few branches are next removed from the top of the trunk below the cut area, leaving the bare trunk extending from the top of the tree approximately 1½ to 2 feet. Attach a plumb line to a small board nailed across the top so that the line will be about fourteen inches from the side of the trunk at the top and extending downward toward the ground. Pick an area where the line will fall between 12 and 14 inches away from the trunk at the base of the tree. A little branch trimming may be necessary down the side of the tree to allow clearance for the plumb line and later for the masting.

Wind Load

If a 2 or 6 or 10 meter beam only, is to be installed, no further trimming will be necessary because the top and branches already removed would have constituted a wind load on the tree in excess of the imposed load of this type of array. If a 10/15/20 Christmas tree or a trap antenna is to be installed, it is advisable to thin out a few more branches to compensate for the additional wind load imposed by the larger array. No definite figures are available; your own judgement is advised, bearing in mind, one limb from a pine tree with all its side branches and needles represents a fairly large wind load. With this in mind, excessive thinning to a point that would be injurious to the tree is not necessary. During the thinning process, make a path up through the tree branches on the opposite side from the plumb line. This will be used later to transport the antenna parts to the top, for assembly.

Mast Bracket Installation

Figure 2 illustrates the mast bracket assemblies. The number needed will be determined by the height of the tree utilized. For a 50 foot height four are adequate, one at the top, two of the smaller type spaced in the middle, and one at the bottom. These are bolted to the tree trunk prior to the installation of the bearing boards, using lag bolts and washers, along the sides of the plumb line at the top and bottom of the tree. After these are leveled and the metal arms attached to the trunk, the two smaller center supports are added. After all the brackets are installed, the bearing boards are attached making certain that the plumb line runs through the center of each mast hole in each bearing board from top to bottom. The top bracket has an overhang on the opposite side from the mast for mounting a platform. Inch and a quarter inside diameter steel water pipe, connected together with standard couplings, was used for the mast material.

Thrust Bearing, Rotator, Selsyn Cabinet

Figure 3 shows the thrust bearing located at the bottom of the mast assembly. Use of more than one thrust bearing is not recommended as equal distribution of vertical thrust on more than one bearing is not easy to come by. The bearing location is a matter of choice, top or bottom, bottom being preferred however, where it can be installed in the weatherproof cabinet housing the rotator and selsyn systems.

Once the brackets, mast and thrust bearing are installed, the rotator and selsyn assemblies are attached, per fig. 3, in the weatherproof

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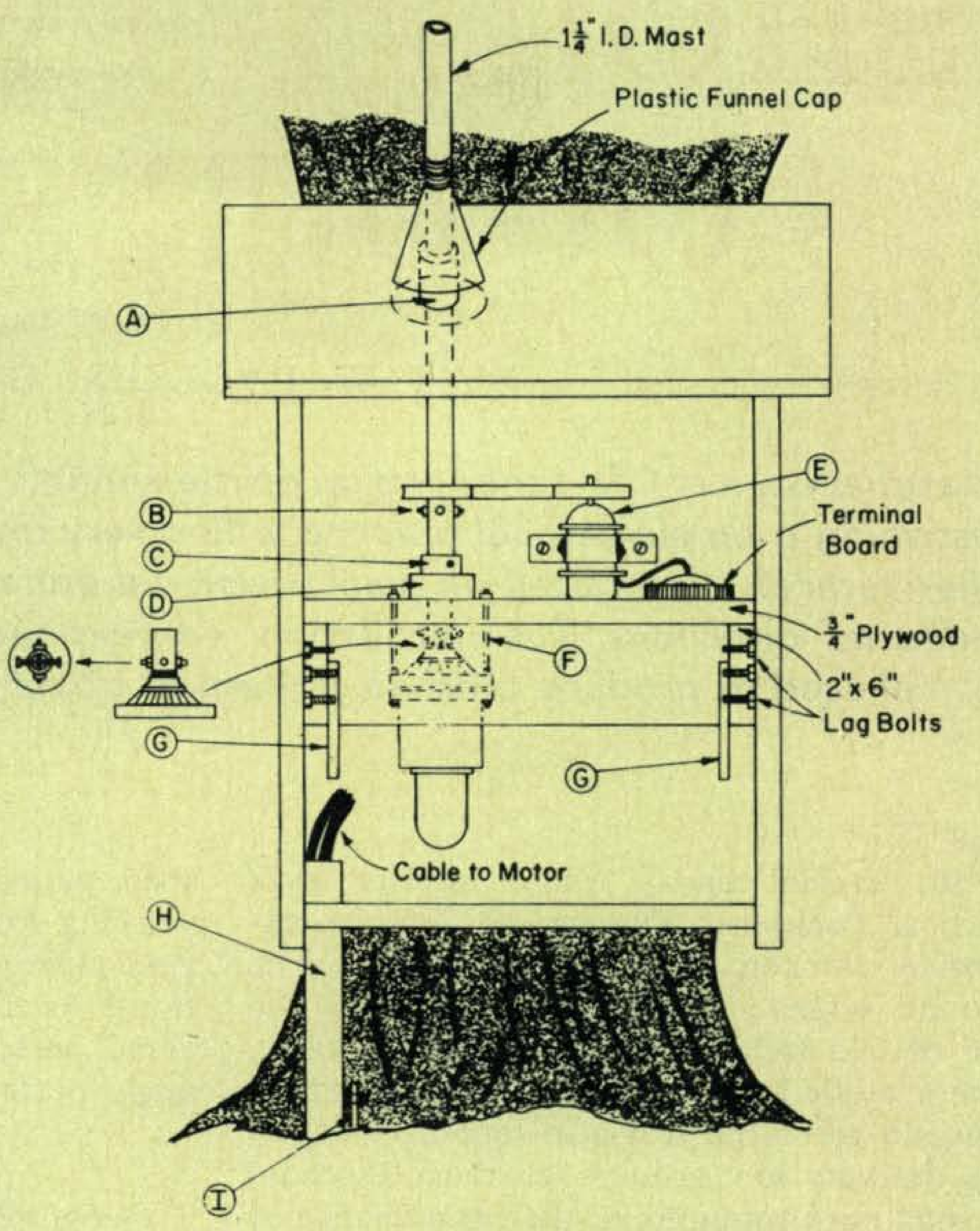

Fig. 3—Details of the motor-selsyn cabinet built around the lower mast bracket assembly. The points of interest are: **A)** Feedthrough flange; **B)** Pin and lock drive from motor to mast; **C)** Collar, Boston Gear #SC162; **D)** Bearing, Boston Gear 600 series; **E)** Selsyn transmitter, **F)** Rotator motor spacers, as required; **G)** Lower crossarm braces protruding through back of cabinet; **H)** Entrance conduit; **I)** Ground rod. The inset shows the motor-to-mast coupling details.

cabinet built around the lower mast bracket. The selsyn can be geared to the mast so that one turn of the mast produces one turn of the selsyn shaft or a pulley drive arrangement can be fashioned. The relative positions of the motor and selsyn are shown in fig. 3. To keep the cabinet water tight a funnel cap assembly is used. The inside of the feedthrough flange is stuffed with a piece of urea-foam to discourage insects, particularly of the winged stinger carrying type, from homesteading in the cabinet. The cover is attached with brass wood screws. Lightning protection is provided by running a #8 solid copper wire to a ground rod located under the cabinet, driven 6 to 8 feet into the ground next to the entrance conduit. The upper end of the ground wire is securely fastened to the gear case of the rotator.

Antenna Assembly

Needless to say, unless you have over thinned the tree branches, the antenna cannot be assembled on the ground and hoisted up the tree to the top. It is pulled up through the clearing made previously on the opposite side from the mast, a piece at a time, usually boom first, and assembled at the top. The small platform aids in assembly and allows adequate footing for the assembler. A word of caution at this point—*don't* step back to admire your work. Once assembled, the array is fastened to the mast, and feed line connected and you are ready for S.W.R. measurements and testing.

Cost is not the only advantage gained by using a natural tower. Once installed, the antenna is almost invisible from the ground as it is obscured by the tree branches. Also maintenance is minute as compared to a man made structure.

The installation as pictured in fig. 1 has been up for 5 years utilizing a 15 meter optimum spaced yagi, 4 years with a 20 foot boom and 1 year with a 30 foot boom. The 10 meter beam was a recent addition. It has withstood winds in excess of 65 M.P.H. and radial ice loading of 3/4 inch without so much as a problem. Anyone know of a high QTH, with a 200 foot pine, located 50 feet behind the house, in Central Mass? □

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SHORTY TWINS—LOUDER STILL

BY J. W. PADDON,* G2IS

An earlier issue of CQ[1] contained an article entitled "Loud Shorty On The Bottle," describing a simple vertical antenna with a very low angle of radiation. As any other vertical, it produced an omnidirectional pattern and pushed signals out in undesired directions. The installation was expanded to two driven verticals phased to produce a broad pattern of about 120° and a 6 db gain.

THE original Shorty[1] was a quarter wave vertical (unipole) antenna set upon an extensive chicken wire ground screen. The ground screen, in turn, was spread on the sod of Old Ireland at EI9Q's antenna farm. The aforesaid sod is not only the traditional emerald green but it is also sopping wet giving the very low ground resistance essential to high performance and the maintenance of a vertical angle of radiation of 0° or very close thereunto. The antenna farm is on a point of land almost completely surrounded by salt water and the site far exceeds the requirement of *at least fifty wavelengths* of flat low resistance take off for signals in all directions.

It should be stressed that building this type of antenna in an area of high ground resistance is a waste of time. For instance, in some desert areas the ground one stands upon is practically Al-Si-Mag and an excellent insulator. True ground will exist at the water table which may be hundreds of feet down.

From the time it was first turned on Shorty's horizon hugging radiation angle rammed potent signals into the antipodes far outperforming the comparison ZL Special which had some 6 db gain whereas Shorty had none.

The author believes neither in Santa Claus nor antenna evaluation taken over short periods. Accordingly, Shorty was kept working for a solid year in order to encompass changing seasons and sun spot conditions. As the pile of logged data grew it became perfectly clear that the low vertical angle performance was consistent.

Phased Verticals

Geographical plotting of stations worked quickly threw up the fact that a large portion of the radiated energy was illuminating nothing except thousands of empty square miles of heaving sea water. This could hardly be classed as a startling discovery since 70% of the world's surface is ocean. It also showed that from EI9Q's particular QTH an electrically reversible, non-rotateable beam with a bull nosed pattern would cover by far the greater amount of the territory in which we were interested.

Blocking out the beam requirements it was decided:

(a) The low angle of vertical radiation must be kept at all costs.

(b) A broad pattern with a 6 db gain along the most favored bearing would be adequate.

(c) The same mechanical construction and method of guying as used in the original antenna would be retained, more especially because of its proven ability to withstand tremendous gales.

(d) Concept to be as simple as possible, uncritical and easy to construct. Equally, feeder arrangements were to be uncomplicated.

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1 Paddon, J. W., "Loud Shorty On The Bottle," *CQ*, Sept. 1967, page 56.

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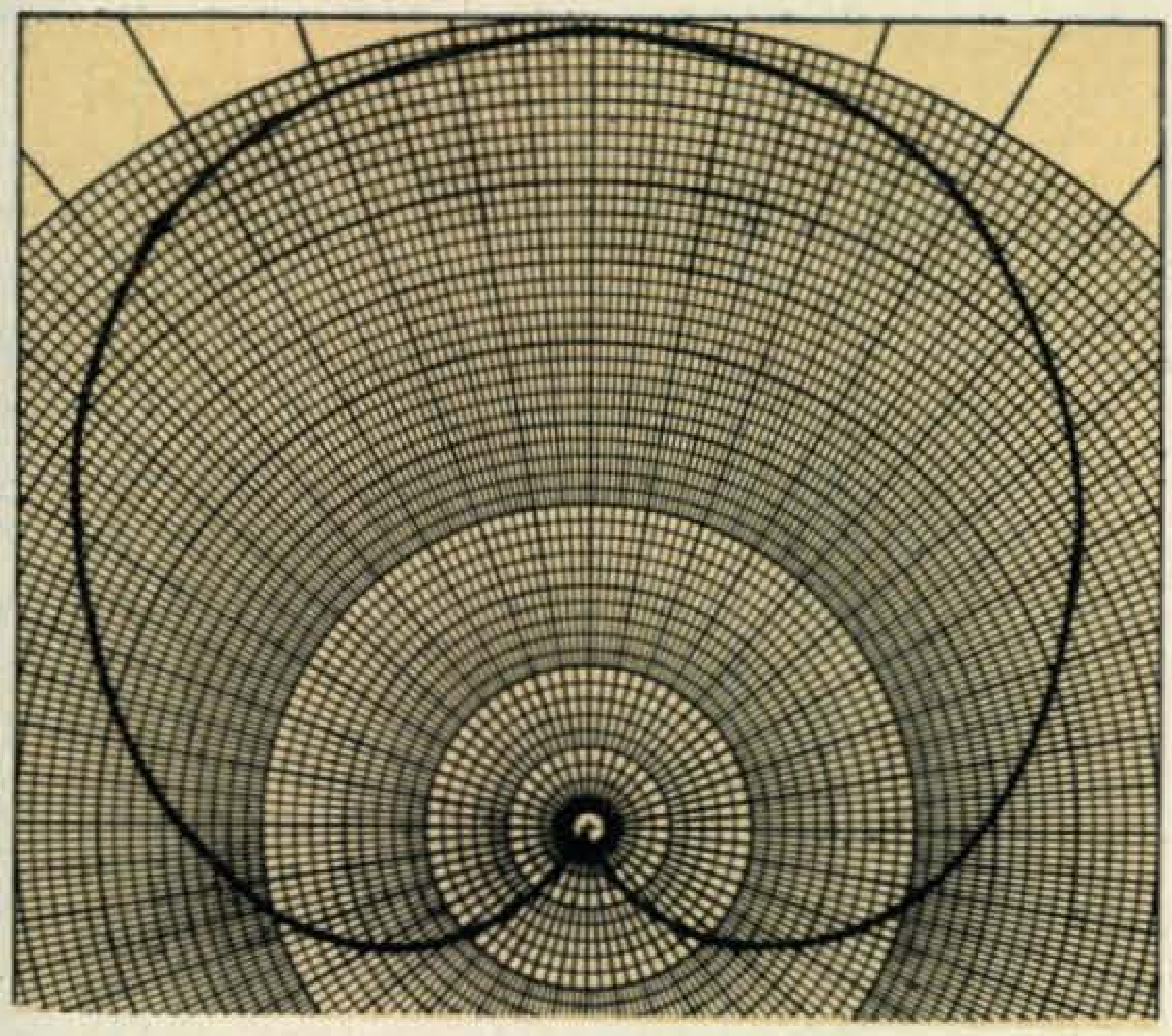


Fig. 1—Polar pattern resulting from two phased "Shorty" verticals.

After consuming pads of scratch paper an antenna consisting of two quarter wave vertical antennas (unipoles), both driven, was chosen. Figure 1 shows the computed polar diagram. It agrees closely with results achieved.

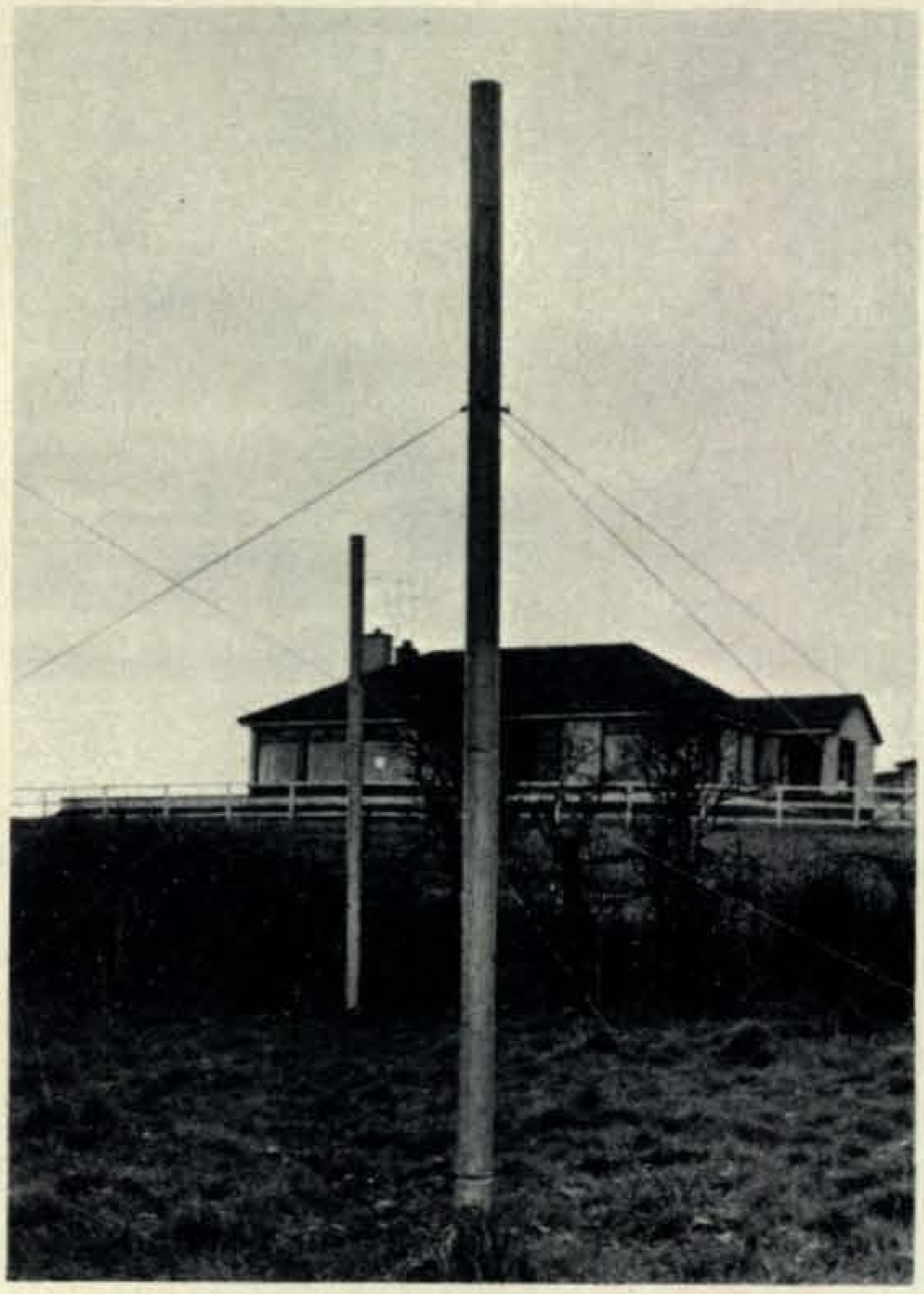
Construction

The original Shorty was made of 3" diameter aluminum down spouting. It was decided to double the diameter in the interest of both improved broad banding and mechanical strength. Aluminum tubing of 6" diameter was not available so a local metal works produced two 6" diameter lengths of galvanized iron pipe which were given many coats of metallic aluminum paint. It is not thought that the minor increase in the skin resistance of the radiators has any significant negative effect. The original "Guinness" bottle base insulators, being too small, were replaced with glass gallon jugs.

In both cases the radiator length is arrived at by: *Length in feet* = $234/f_{mc}$. It would, perhaps, be wise to start with an excess length and trim to resonance against a grid dip meter or a series of s.w.r. readings.

The two radiators are spaced ¼ wavelength apart. based on *Spacing in feet* = $246/f_{mc}$.

The area needed for this antenna can be drastically reduced by using ⅛ wave spacing instead of ¼ wave spacing. The distance between the two radiators will then become $123/f_{mc}$. The dimensions and layout of the phasing lines between the two radiators remain entirely unchanged. The reduction of spacing will tend to narrow the pattern a little with a slight attendant increase in gain. Another practical consideration is that the ground screen area will also be reduced."



View of the Twin Shortys, phased verticals located at EI9Q's.

The two radiators are fed with coaxial cable as in fig. 2. Three pieces of coax are needed each $\lambda/4$ long. The length of each $\lambda/4$ piece is equal to $[246/f_{mc}] \times$ *cable velocity factor.*

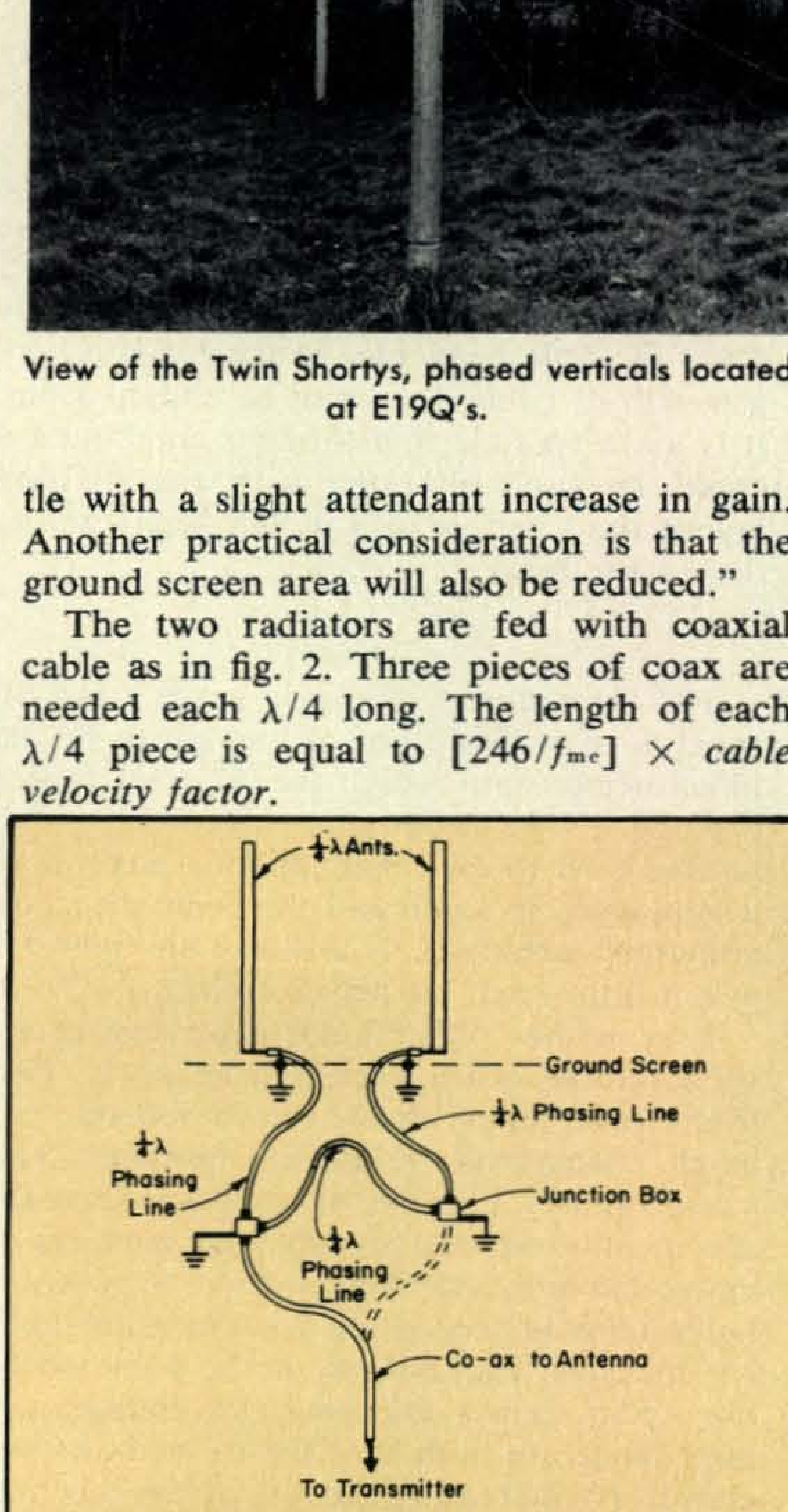


Fig. 2—Phasing line arrangement. Direction of fire may be changed by shifting the coax feed from one junction box to the other as shown by the dotted line.

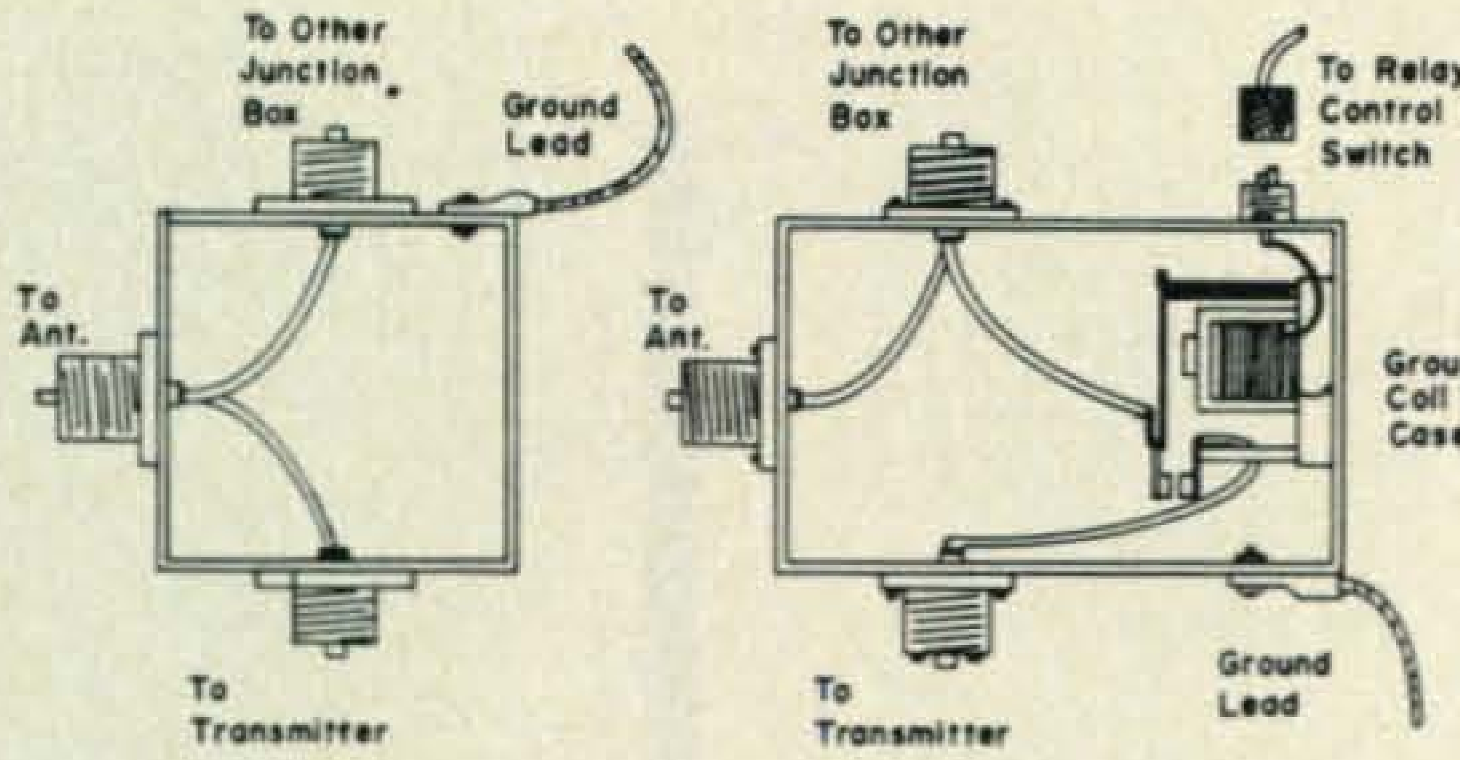


Fig. 3(A)—Details of the junction boxes of fig. 2 used for manual switching. (B) Interior of junction box containing a relay for remote switching. All junction boxes must be watertight and the connectors weatherproof.

Two junction boxes are shown in fig. 2; detail of the junction boxes is given in fig. 3. The boxes need to be sturdy, weather-tight and to be provided with a heavy grounding lead. The plugs and sockets used to connect the cables should be weatherproof.

At EI9Q the $\lambda/4$ coaxial cable sections have an impedance of 75 ohms while the cable from junction box to transmitter is 52 ohms. These values were dictated by the only types of cable available. In the USA, where a wealth of cable types can be chosen from, it is quite possible that a better combination could be used although with the existing layout the s.w.r. is well within limits across the 14 mc band.

Switching

The technique of changing beam direction consists of walking out of the shack to the junction box into which the 52 ohm feeder is plugged. The feeder is unplugged there and walked over to the other junction box where it is plugged in again and the beam direction is thereby reversed. As a bonus the operator gets a little fresh air and exercise.

It is neither difficult nor expensive to set up a remote beam switching network. Two single pole, single throw relays and one coaxial changeover relay are needed. The s.p.s.t. relays can be of modest electrical specification as long as they have contacts of ample current carrying capacity. A good reliable relay is needed but not one with super r.f. characteristics because at the point where the s.p.s.t. relays are used the voltage and impedance are both low. Figure 4 shows the circuit. By increasing the size of the junction box the s.p.s.t. relay can easily be built in as shown in fig. 3.

Each radiator must, of course, have its own chicken wire ground screen as described in the original article. A good, low resistance interconnection between them is essential.

Measurements with a field strength mete show that the 6 db gain figure has bee realized. Of broadside lobes there are none The simple test equipment available is inadequate to give a precise front to back rati figure. Suffice to say that listening tests an on-the-air checks confirm that the backward portion of the pattern is so small as to b ignored.

The modest amount of work and materials involved have been amply justified b improved performance along the lines o shoot of the beam. The beam width is adequate to cover most of the Americas in on direction and of Australasia in the other.

Conclusion

In locations where more than two bear directions are needed it is clearly not a complicated matter to devise a family of $\lambda/4$ vertical radiators disposed in such relation t each other as to provide a number of directions of shoot. Selection would be a simpl process of plugging the right cables into th correct junction boxes.

A steerable 80 meter horizontal bear
[Continued on page 142]

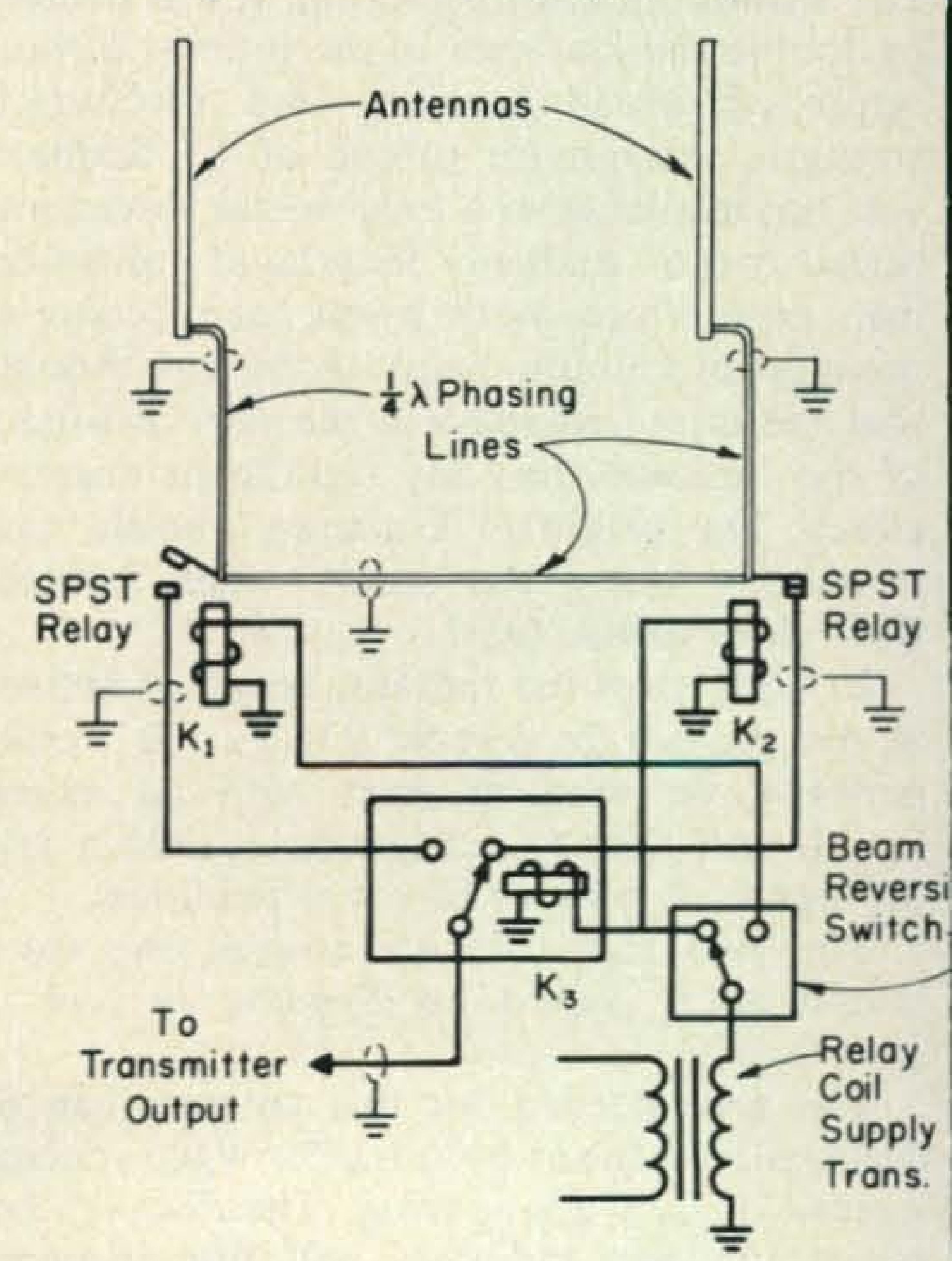


Fig. 4—Circuit arrangement for remote switchin of the direction of fire. Relays K_1 and K_2 can b ordinary s.p.s.t. types as the r.f. voltage at thes points is low (the current is high). Relay K_3 mus be a coaxial changeover type.

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Front view of the table top linear. The blower motor is shown on the left rear of the enclosure but could be relocated elsewhere as explained in the text.

A 2 KW P.E.P. Linear Amplifier

BY LT. TIMOTHY P. HULICK,* W9MIJ/1

This 2 kw p.e.p. linear operates from 10 through 40 meters and uses external anode tubes.

INSPIRED by the article written by Lee Aurick, K3QAX/W2QEX, in the June, 1968 issue of *CQ*,[1] I decided to make use of several external anode tubes that I had acquired throughout the past several years. Four 4X150A's could easily provide 2 kw p.e.p. in any s.s.b. linear power amplifier. The 4X250B's are a direct replacement for the 4X150A's for all practical purposes and being of higher power capability, could also serve as the tubes necessary to deliver the maximum plate input power allowed by the FCC. Since these tube types are quite small, the thought of a table top lightweight linear amplifier capable of 2 kw p.e.p. and styled after the exciter, an SB-400, seemed very appealing. I might add that after searching the classified ads in *CQ*, 4X150A's could be purchased for as little as $7.50 each. Tube replacement, therefore, presented no problem financially.

Since the 4X150A is a tetrode, it seemed to be a waste of good tube design to operate the final in grounded grid and yet it spells trouble to attempt grounded cathode tuned grid tuned plate in a compact high power amplifier. Not wishing to risk the chance of mass oscillation in the amplifier, it was decided that the best overall design would be to feed the grounded cathode tubes by low impedance drive straight into the grid, untuned. The grid being untuned and driven at a very low impedance of 75 ohms will make self-oscillation extremely unlikely. No neutralization should be required because the tubes are tetrodes and the screen is grounded for r.f. The output circuit could be of conventional pi-network design. Only about 30 watts will be required to drive the final to maximum legal power input.

Circuit Description And Construction

The linear amplifier shown in fig. 1 is operated in class AB_1. This means that no grid current is to be drawn during any of the operating cycle and that the tubes are biased

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* Lt., U.S.N., 30 Lynn Road, Brockton, Mass. 02402.

[1] Aurick, L., "External Anode Tubes And The Radio Amateur," *CQ*, June 1968, p.51.

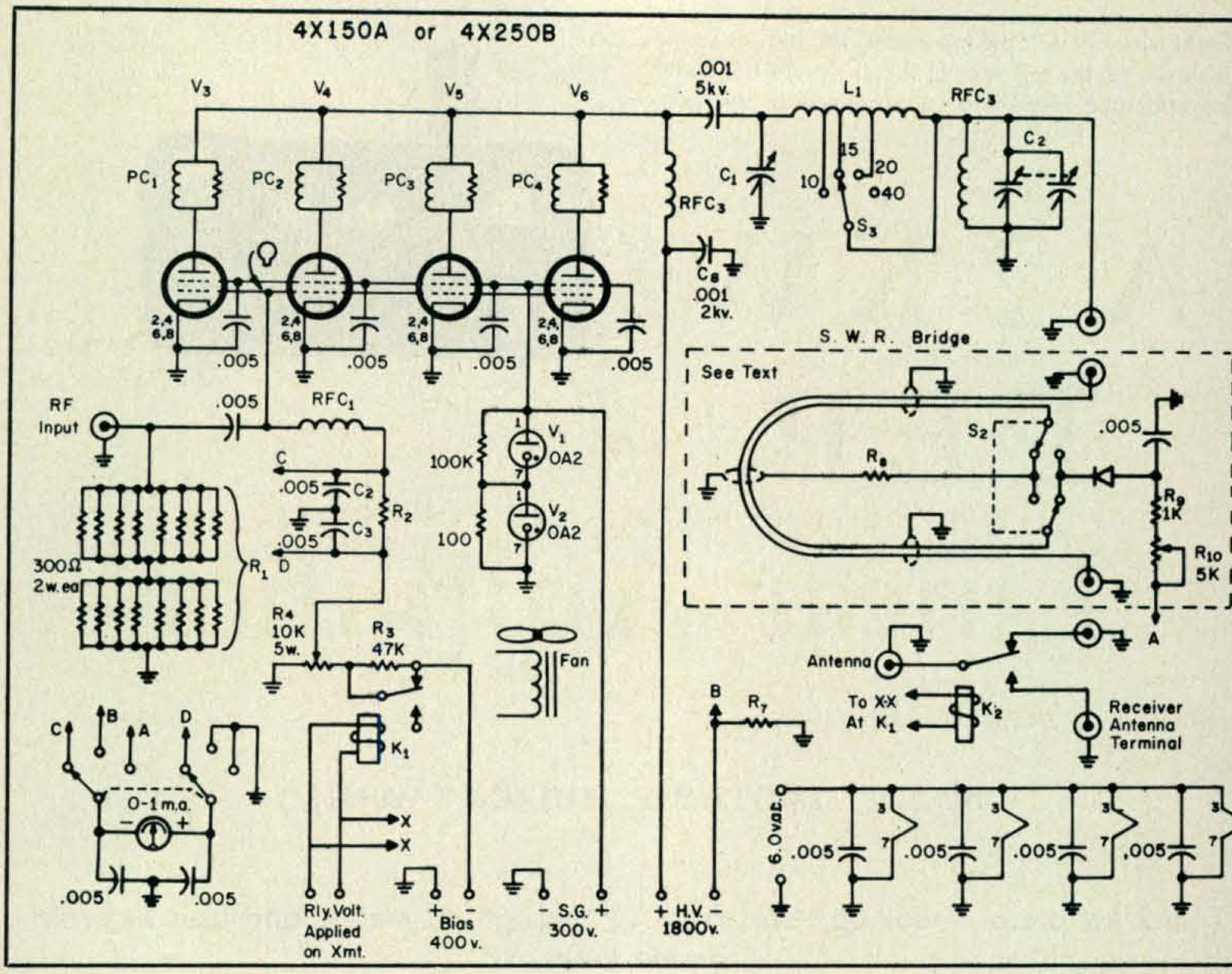

Fig. 1—Circuit of a 2 kw p.e.p. linear power amplifier for use on 10 to 40 meters. Meter M_1 reads grid current in position #1, cathode current in #2 and relative power output (or s.w.r.) in #3. Capacitors with values less than one are in mf; values greater than one are in mmf unless otherwise noted. All capacitors marked 0.005 are 600 volt disc ceramics. All resistors are ½ watt except where noted otherwise.

C_1, C_2—See text.

K_1—S.p.s.t. relay, coil voltage as determined by exciter.

K_2—Coaxial relay, coil voltage as above.

PC_1 PC_2 PC_3, PC_4—5t #14 e. on a 47 ohm, 2 watt composition resistor.

R_1, R_2, R_7, R_8—See text.

RFC_1, RFC_3—2.5 mh National R50 or equiv.

RFC_2—See text.

between Class A and Class B. Approximately minus 50 volts of grid bias are required to operate the tubes in AB_1 with 1800 volts on the plate and 300 volts on the screen. Since the control grid does not draw grid current the bias supply does not have to be capable of supplying power. It can be as physically small as possible supplying power only to its own bleeder resistor, R_3 and R_4, (in fig. 1) which is practically negligible. The grid bias can therefore be obtained by tapping off one side of the screen voltage power supply transformer. This method is suggested in fig. 2. Control R_4, in fig. 1, is then used to vary the grid bias voltage over the proper range in order to set the operating condition at Class AB_1.

The v.r. tubes V_1 and V_2 serve to regulate the screen grid voltage at 300 volts. It is not absolutely necessary to use v.r. tubes here if a very stiff power transformer and high value filter capacitors are used in the screen supply. However, in order to be certain that the amplifier is operating linearly, the screen voltage must be very stable. A stiff power transformer will provide a fairly constant voltage output under varying load, but it is much easier and more economical to provide

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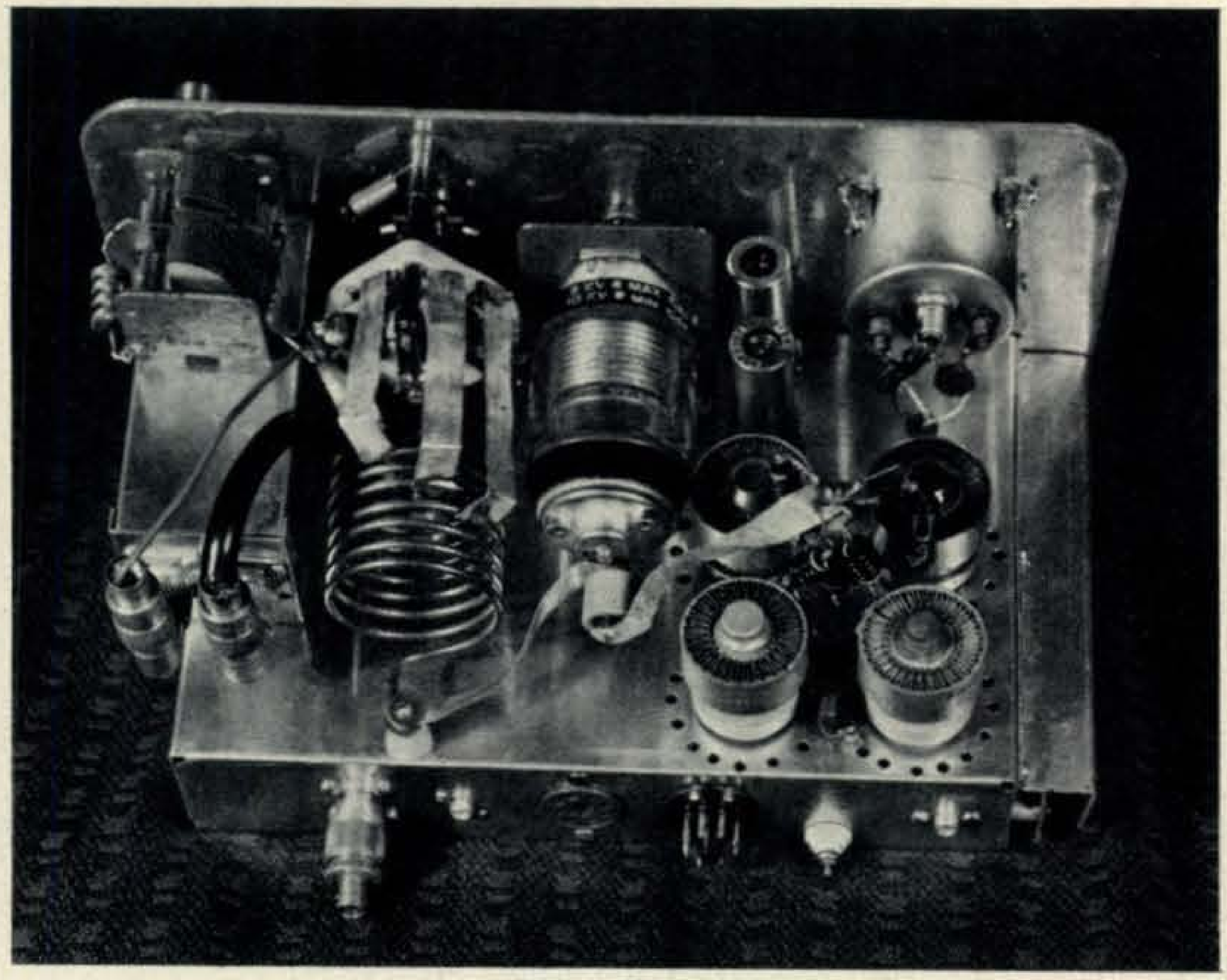

Top rear view of the 10 to 40 meter linear using external anode tubes. The input load is under the shield on the right. The two v.r. tubes are located alongside the vacuum variable, C_1. Capacitor C_2 is mounted on the s.w.r. bridge housing on the left. The connectors on the rear of the chassis are, from l. to r., Antenna, Receiver Antenna, Relay Control, Power Input, High Voltage, Exciter Input. The r.f. choke shown is the one that burned up and was replaced as explained in the text.

a lighter screen grid power supply and use v.r. tubes in order to maintain voltage stability. Resistors R_5 and R_6 serve only to assure equal firing potential for each v.r. tube when the power supply is first turned on.

Most exciters provide 110 v.a.c., controlled by the push-to-talk switch, for operating external relays. Relays K_1 and K_2 can be operated by this voltage. Naturally 110 v.a.c. coils in the two relays must be used if this is the voltage available. Relay K_1 is normally closed when the coil is not energized. This serves to provide more bias voltage to the 4X150A's and effectively cut the tubes off during receive, eliminating noise and wasted heat. During transmit, K_1 is activated, unshunting R_3 dropping the grid bias voltage to that value necessary to operate in Class AB_1. Relay K_2 is any coax type use for an antenna changeover relay. Dow-Key DK-60 is recommended for K_2. DK-60-2C or DK-60-G2C may be preferred however, since the latter have external d.p.d.t. terminals which will eliminate the need for purchasing the additional relay, K_1.

Notice that pins 2, 4, 6 and 8 of the 4X150A's are all cathode pins. It is not so essential that all of them are grounded at these frequencies but it certainly wouldn't do any harm to ground each one of the pins with short leads to the chassis. (Four pins are used for the cathode terminal in this family of tubes mainly to assure low inductive grounding and reduced possibility of self-oscillation when operating in the v.h.f. or u.h.f. ranges.)

Filament Supply

Notice that the 4X150A filament voltage is rated at 6.0 volts and not 6.3 volts. It is absolutely imperative that no more than 6.0 volts be applied to the filaments. Tube life will be greatly shortened if this voltage requirement is violated. Not being able to find a 6.0 volt filament transformer anywhere, I was forced to use the 6.3 volt winding on the screen power transformer and somehow drop the voltage to 6.0 volts. A 0.03 ohm resistor is necessary to do this, but a 0.03 ohm 3 watt resistor is just as difficult to find. At this point it was noticed that the specified current capability of the filament winding was only 7 amps and the tubes require 10.4 amps. It turned out that trying to draw 10.4 amps from a 7 amp supply was just enough to drop the transformer output voltage to 5.9 volts. The transformer tends to get only slightly warm under this load since it is only handling 3 additional watts. If a filament transformer capable of the full 10.4 amps is used at 6.3 volts, a 0.3 ohm, 3 watt resistor will have to be used for R_{15} in the power supply circuit or if the filament supply winding is accessible, turns can be removed until 6.0 volts is obtained. It may also be possible to wire the filaments in series since 24 volt transformers are readily available. Only 2.6 amps would be required in this case. The wiring of the filaments is entirely up to the discretion of the builder.

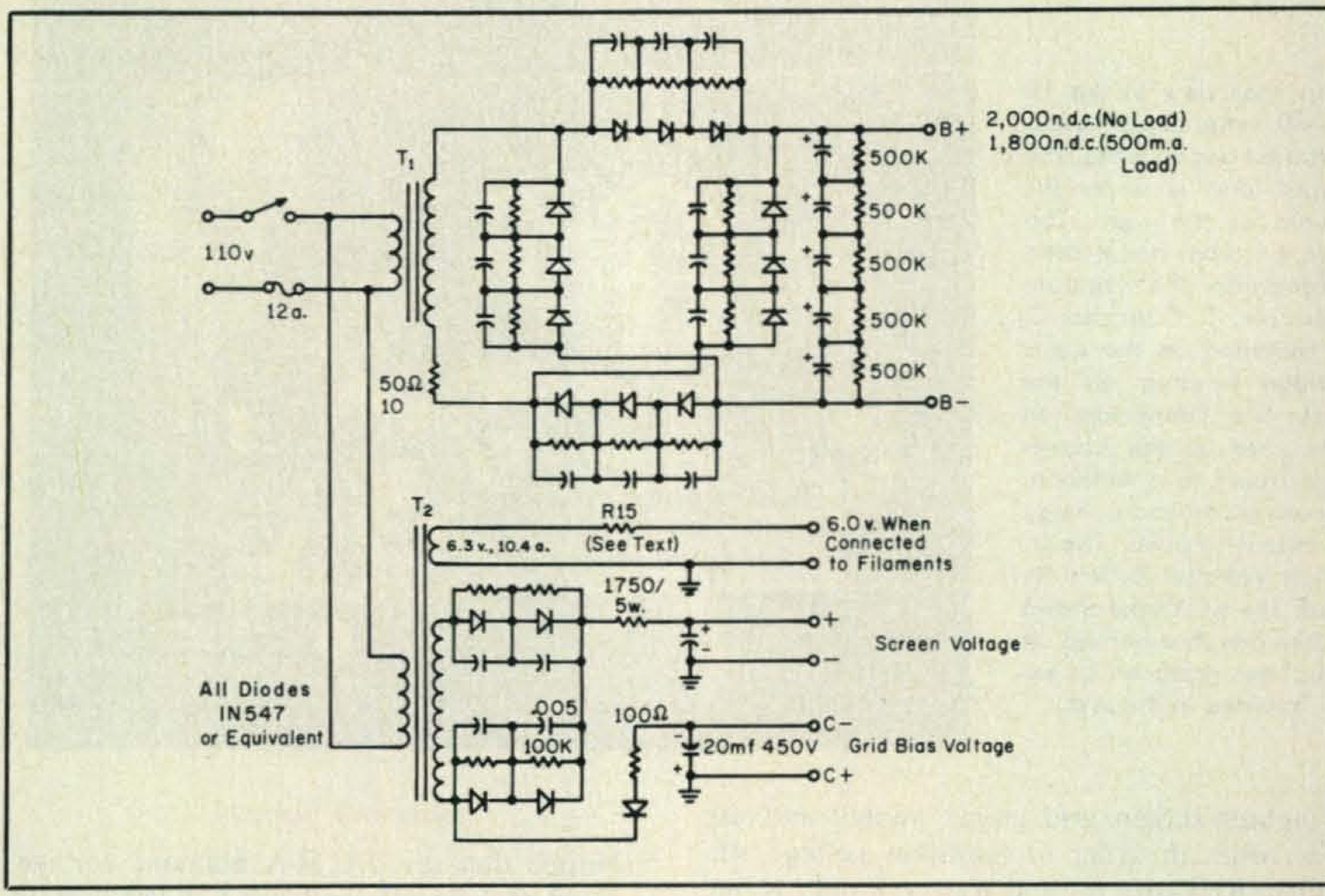

Fig. 2—Circuit of a power supply adequate for the 10-40 meter table top using external anode tubes. The diodes are 750 ma 1 kv p.i.v. types each paralleled by a 100K ½ watt resistor and a 0.005 1 kv disc ceramic. The filter consists of five 100 mf, 450 volt units in series with ½ megohm resistors in parallel.

T_1—1400 v.a.c. at 500 ma.

T_2—350-0-350 at 50 ma., 6.3 v. at 11 amps.

S.W.R. Bridge

The s.w.r. bridge is identical to the one described in any ARRL Handbook. The selection of a value for R_8 is also described in the handbook and is usually in the vicinity of 33 ohms, ½ watt.

Metering

The highest voltage applied to the meter at any time is 400 volts negative when the meter is in the GRID position and the operator is receiving. The measurement of plate current is done by switching the meter across R_7 in series with the B− lead to chassis ground. Resistors R_2 and R_7 are meter shunts designed according to the full scale meter deflection desired in the GRID and PLATE positions. I found it convenient to select 0-100 ma for the plate current measurement and 0-5 ma for grid current measurement. The values of R_2 and R_7 also depend on the internal resistance of the meter selected and its original or unshunted full scale value. The meter used is from an old DX-100 and has a full scale deflection of 1 ma and an internal resistance of 40 ohms. The proper shunt can then be determined by use of the formula:

$$R_{shunt} = \frac{R_{meter}}{Scaling\ Ratio - 1}$$

It follows that in order to increase full scale deflection from 1 ma to 5 ma with an internal resistance of 40 ohms, we have:

$$R_2 = \frac{40}{5-1}$$

$$R_2 = 10\,\Omega$$

The same procedure is followed in finding R_7. The scaling ratio here is 1000 for a 0-1000 ma scale.

$$R_7 = \frac{40}{1000-1}$$

$$R_7 = 0.04\,\Omega$$

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Most likely a 0.04 ohm resistor would not be available but it can easily be constructed. Consulting the wire table in the ARRL Handbook, the resistance per 1000 feet for different size wire is tabulated. An appropriate size can be chosen taking into consideration current handling capabilities, how much is needed and what you have in the junk box. For example, #26 wire has 41.62 ohms per 1000 feet or 0.04162 ohm per foot which is almost exactly what is needed. The shunt wire can be wound on a resistor form such as a 1 megohm 1 watt resistor and wired in parallel with it. It is best to wind the shunt noninductively by forming a hair-pin with the wire and then winding it on the resistor.

If you use a meter with a different full scale deflection and different internal resistance than the one used, it will be necessary to solve for the proper shunt resistances using the above formula. Incidentally, no meter shunt is required when the meter is used with the s.w.r. bridge.

Pi-Net

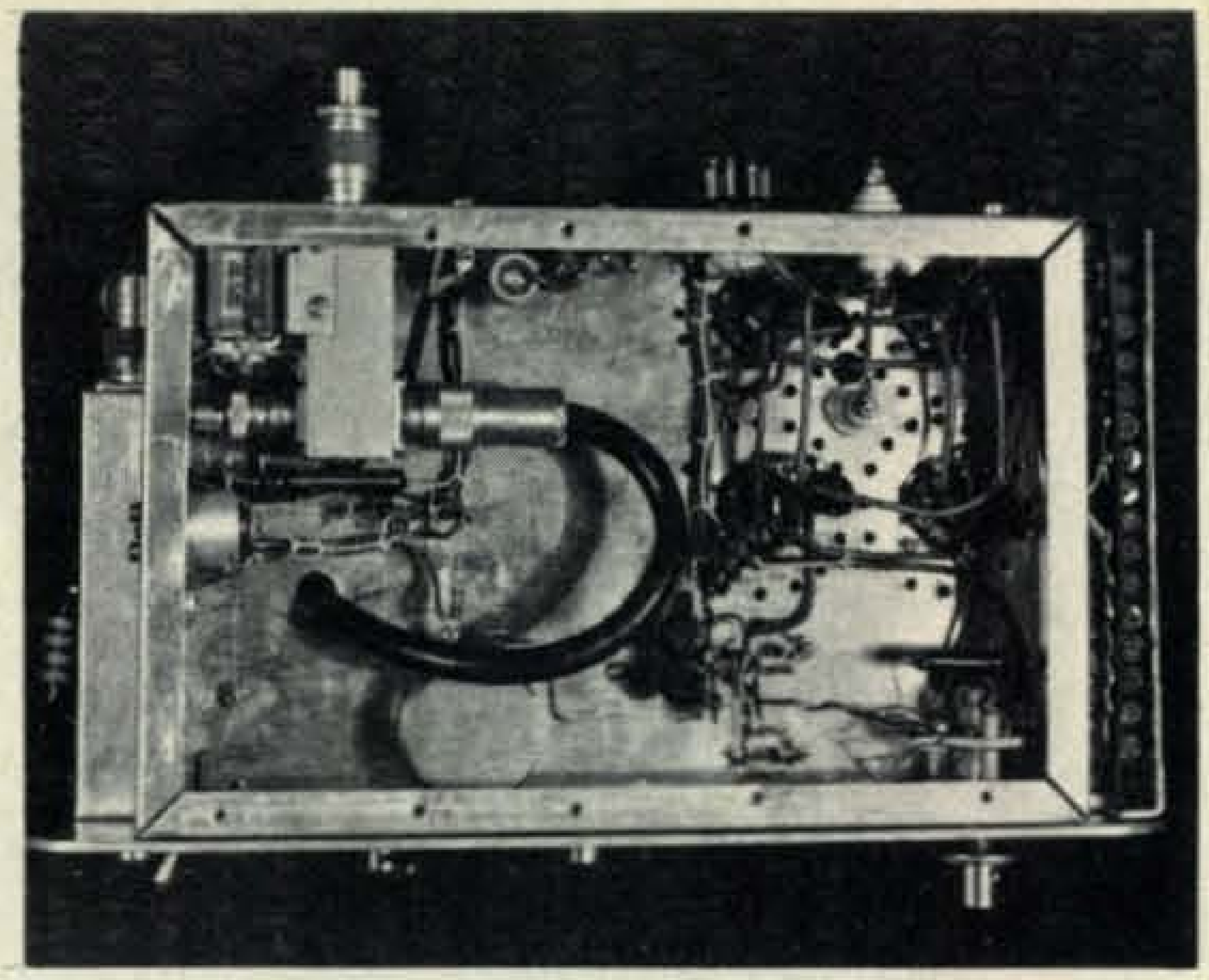
Inductor L_1 is made from one-eighth inch diameter copper tubing. It can be purchased quite inexpensively from any auto supply store. The inside diameter of the coil is two inches and each turn is spaced by three-sixteenths inch. The ten meter tap is at 3½ turns from the plate side of the coil, the 15 meter tap is 4½ turns from the same end and the 20 meter tap is 6½ turns from the plate end. The whole coil of 8 turns is used on 40 meters. The ends of the coil are mounted on two one inch long standoff insulators.

Capacitor C_1 is a 30-460 mmf vacuum variable even though the highest capacity required is on 40 meters and is about 200 mmf. (See parts list.) Vacuum variable capacitors are rather expensive so any wide range variable capacitor with about three-sixteenths inch plate spacing or greater can be used. The only problem might be that air dielectric capacitors are quite large. The required maximum capacity should be about 250 mmf. A suggested substitute for the vacuum variable capacitor is E. F. Johnson #250E45.

Capacitor C_2 is an ordinary 465 mmf per section receiving variable such as Allied #43B3528. The two sections are connected in parallel.

Hardware

The chassis used for the amplifier is an 11 × 7 × 2 inch Bud aluminum chassis



Bottom view of the 2 kw p.e.p. linear amplifier shows the two relays in the upper left corner. The bias pot is shown in the center of the chassis.

#AC-407. The front panel is made from one-eighth inch thick aluminum plate measuring six and three-eighths by thirteen and one half inches. The s.w.r. bridge is housed in its own enclosure measuring 2¼ × 2¼ × 5¼ inches, Bud #CU-3004A.

The tube sockets for the 4X150A's are not those that are recommended by the tube manufacturers. The recommended tube sockets proved to be much too expensive but of course can be used if desired. It was decided to use the old locktab tube sockets found in the antiquated auto radios. They fit the 4X150A's exactly and also have a metallic center keyway which is the grid terminal of the tube. The sockets do not have any provisions for cooling the tubes. This will be discussed later. If the above tube socket substitution is made, keep in mind that the metal ring around the base of the tube is connected to the screen grid. Make sure that it doesn't touch any screw heads used to mount the tube sockets.

Contact to the external anode or plate is made by drilling a hole in the side of the anode and then driving a sheet metal screw through the hole in order to hold the plate lead. Remember that the anode can get hot enough to melt solder so that the solder used on the parasitic chokes should not be in excess.

Input Load

Resistor R_1 is made up of sixteen 300 ohm 2 watt resistors which are the only real load presented to the exciter. The resistor, R_1, is built up of carbon units because the load pre-

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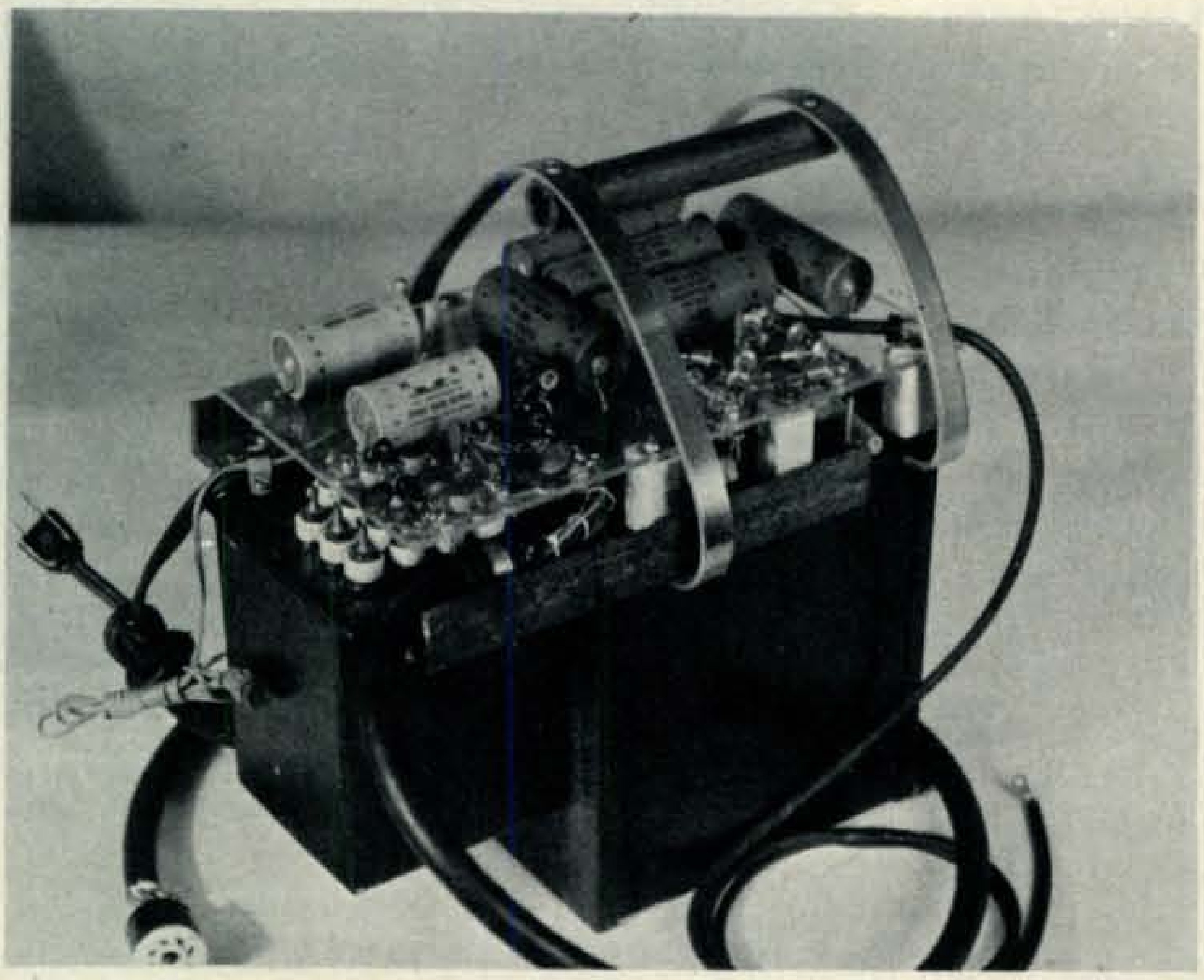

View of the power supply for the 2 kw p.e.p. linear. An enclosure is recommended.

sented to the exciter must be resistive. The resistors are all mounted side by side on a 1½ × 6½ inch piece of phenolic circuit board mounted outboard to the chassis and shielded by an overhanging flange.

Miscellaneous

All leads from the power supply except for the B+ lead are connected to the amplifier by means of a male-female octal plug. The B+ lead connects to its own feedthrough insulator at the rear apron of the linear.

At first the National R-154U r.f. choke was used for RFC_2. This is the choke that appears in the top view of the linear. After about a day of operation, the choke began to arc between turns and finally burned itself out. It was concluded that the turns of this choke were too close together. Instead of investing money in a new choke of a different kind that might also burn up the left-over form from the R-154U was used to construct a new one with the turns spaced from each other. The R-154U form measures 2½ inches long by ½ inch in diameter and is made of ceramic. A small clamp on each end of the form was necessary to hold the choke wire in place. It was constructed by winding #32 d.c.c. wire simultaneously with ordinary sewing thread used as a spacer between turns until the length of the form was used up. Only one layer is to be wound. The thread is left on the form and secured at each end to the small clamps. Remember that when winding this choke it is essential to keep the turns spaced by at least the width of a thread. While #32 wire is light for single winding open air operation it works just fine and does not heat at all.

After the choke is wound, it can be mounted on a ceramic feedthrough insulator so that B+ can be connected to the choke on the under side of the chassis.

H.V. Power Supply

The schematic diagram of fig. 2 is only a suggested circuit for the power supply. Naturally any power supply furnishing 1800 to 2000 volts at 500 ma, +400 volts at 50 ma −400 volts at negligible current, and 6.0 volts at 10.4 amps will work. The power supply can be tucked away behind the operating desk away from hands, feet and the family cat. The copper tube mounted between two stainless steel straps is a convenient carrying handle.

Cooling The Tubes

The 4X150A's require considerable air flow through the anode fins in order to keep them cool enough. If they get hot enough to melt solder, should any solder drops be on the anode, they're running too hot. This happened to me several times, but apparently no damage was done to the tubes. The tubes will not get excessively hot during s.s.b. operation, but may overheat during prolonged key-down c.w. or tune up procedures; try to avoid this. It may be convenient to mark the dial settings for each band so that tune-up time when band switching can be kept to a minimum.

The cooling fan motor can be seen in the front view photo. The shaft is connected to

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a 3 inch diameter 4 blade fan and is mounted so that it is centered over RFC_2 and blows down on the tubes. The fan motor protruding out of the top of the case is a bit unsightly, but nevertheless, serves the purpose. It could just as easily be mounted on the back of the cabinet blowing across the tubes.

The Cabinet

The cabinet was fabricated out of perforated sheet aluminum. The hump in the upper right corner of the cabinet was necessary so that C_{11} would not rub against the cabinet. If a larger cabinet is used this can be avoided. The corners can be formed by bending the sheet around a pipe or similar object.

The two feet toward the front of the case are nothing more than one inch long stand-off insulators with rubber feet attached. The rear units are rubber feet mounted on the case without stand-offs. The amplifier will therefore be sitting on a slant which is coincidental with the modern table-top equipment.

Operation And Tune-Up

Rotate R_4 so that maximum negative bias voltage is applied to the grids. This voltage should be at least negative 75 volts. It is advisable to remove the tubes and check this voltage before applying screen or anode voltage. *Do not apply screen voltage to any tube without also applying B+ to the plate.* If this is done to any tetrode or pentode tube it will be destroyed in a matter of seconds.

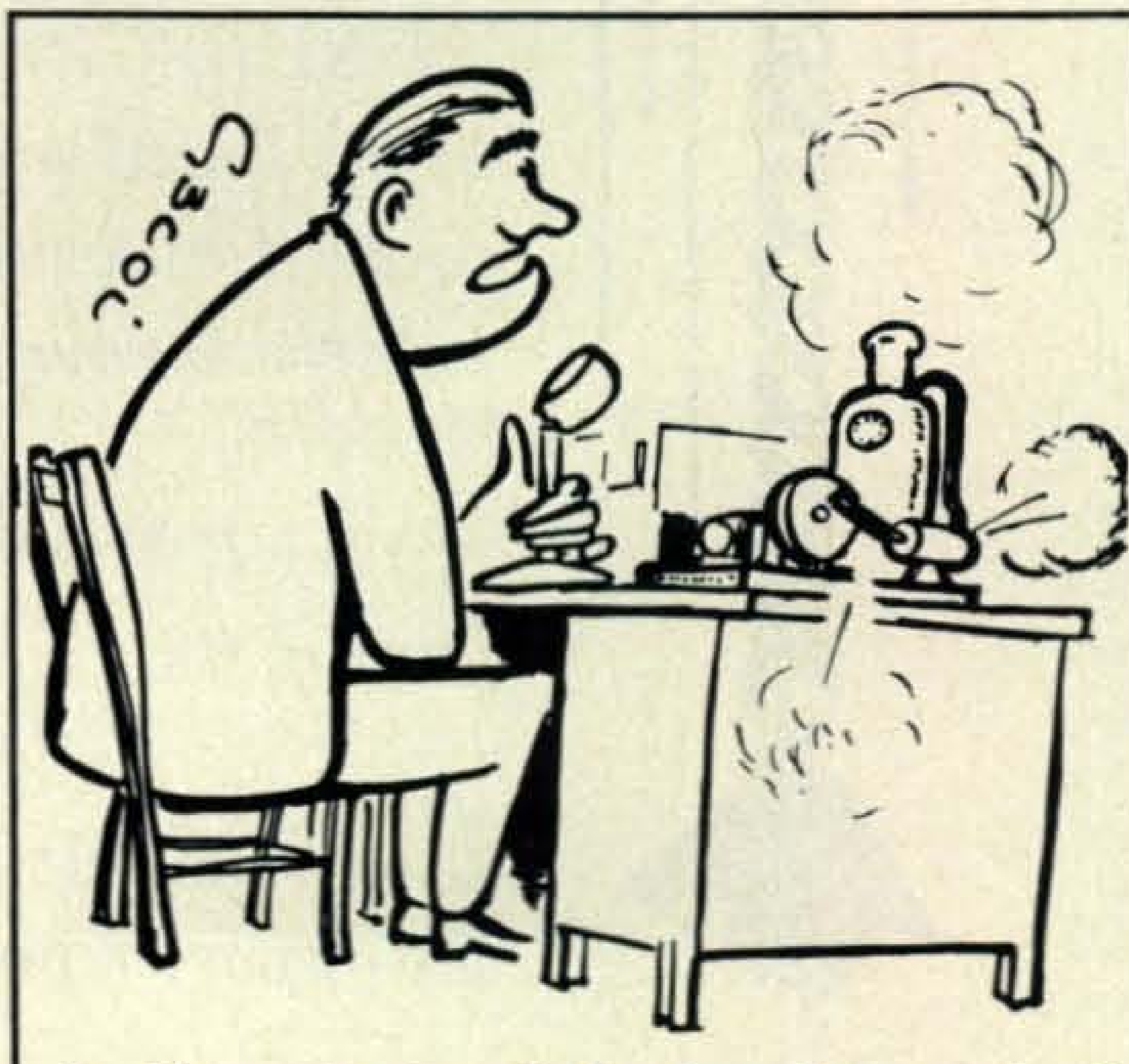
After it has been established that at least negative 75 volts is on the grid, put the tubes into their sockets and connect up the B+ lead. Turn on all power and check to see that all tubes are lighting. It may be necessary to look into the narrow glass slit on the side of the tubes in order to see the filaments.

Energize K_1 and K_2 by putting the exciter into TRANSMIT but do not apply any drive to the final. The amplifier plate current should read zero or very close to zero. Rotate R_4 until about 100 ma of plate current is registered. The amplifier is now operating in Class AB_1. When the exciter and final are taken out of the transmit mode the amplifier plate should return to zero. The 4X150A's are now cut-off due to the action of K_1. Now apply a little r.f. drive to the final until the amplifier plate current reaches about 200 ma. Search for resonance in the amplifier plate circuit by tuning C_{10} and C_{11}. It is proper to tune up a linear amplifier not by searching for a dip in plate current, but by looking for maximum deflection on the meter in the s.w.r. position (relative power). After this is done, advance the drive in several steps, retuning the final after each step until 500 ma is indicated with the amplifier loaded as heavily as possible. The final is now tuned up.

Switch to u.s.b. or l.s.b. and speak into the microphone. The plate meter should swing between 100 and 500 ma. A reading of 100 ma must be maintained when not speaking or readjustment of R_4 may be necessary. If you modulate over 500 ma you will be operating illegally and most likely splattering. Peaks of 500 ma, as indicated by the meter, will provide 1 kw d.c. input and supposedly 2 kw p.e.p. (Actually the d.c. power input will be 900 watts since the plate voltage is 1800 and not 2000 volts. This is the maximum legal input power when the plate voltage is not monitored.) The grid current must not exceed 1 ma on voice peaks and preferably no current at all should be registered.

My 4X150A power amplifier has been in service for many hours and has produced no problems worthy of note. It may be well to remember that creeping idling plate current may indicate gassy tubes and creeping grid current indicates that the tubes are running too hot. You should not experience any creeping grid current as long as the fan is running and the final is not keyed for several minutes at full input power.

I believe that building this linear amplifier will prove to be more educational and provide enjoyment to almost any ham. Time on the air with it will prove to be very satisfying. It is a great companion to the SB-400 or similar exciters. ■



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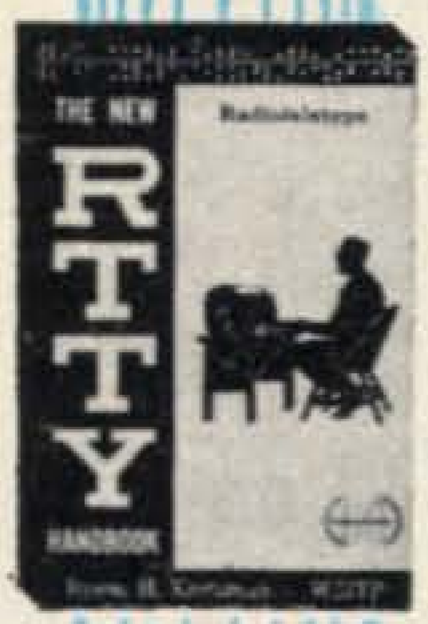

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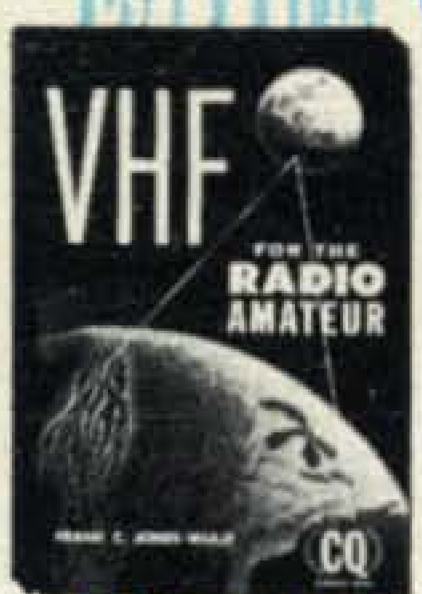

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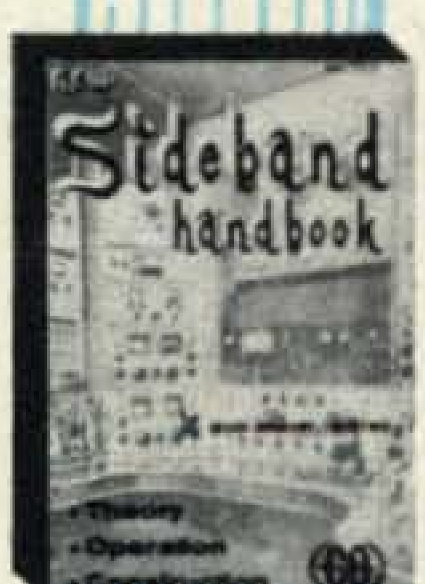

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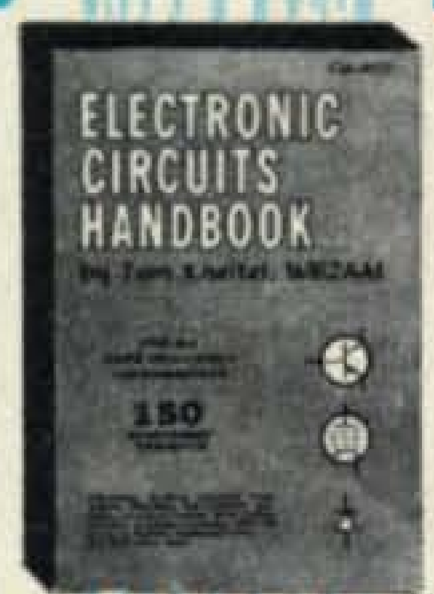

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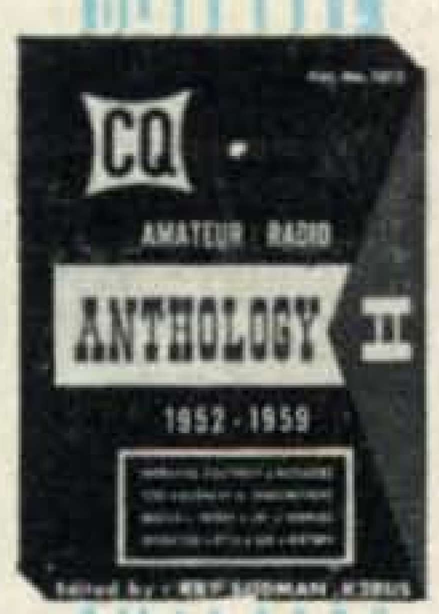

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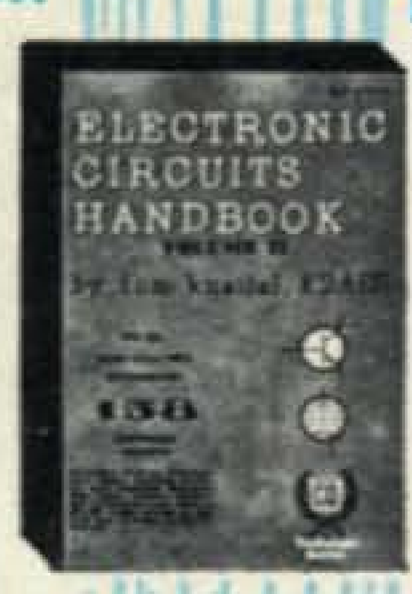

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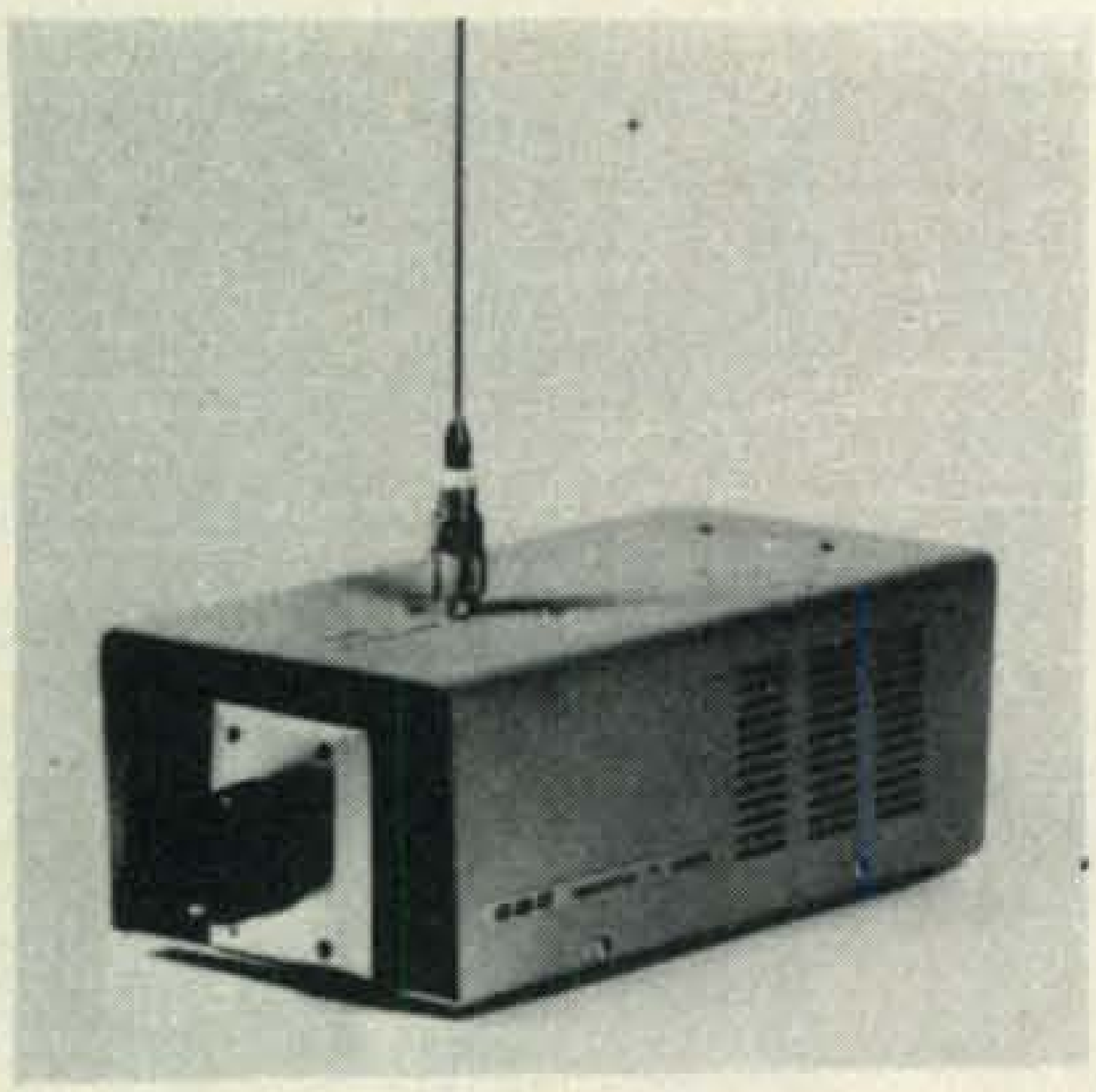

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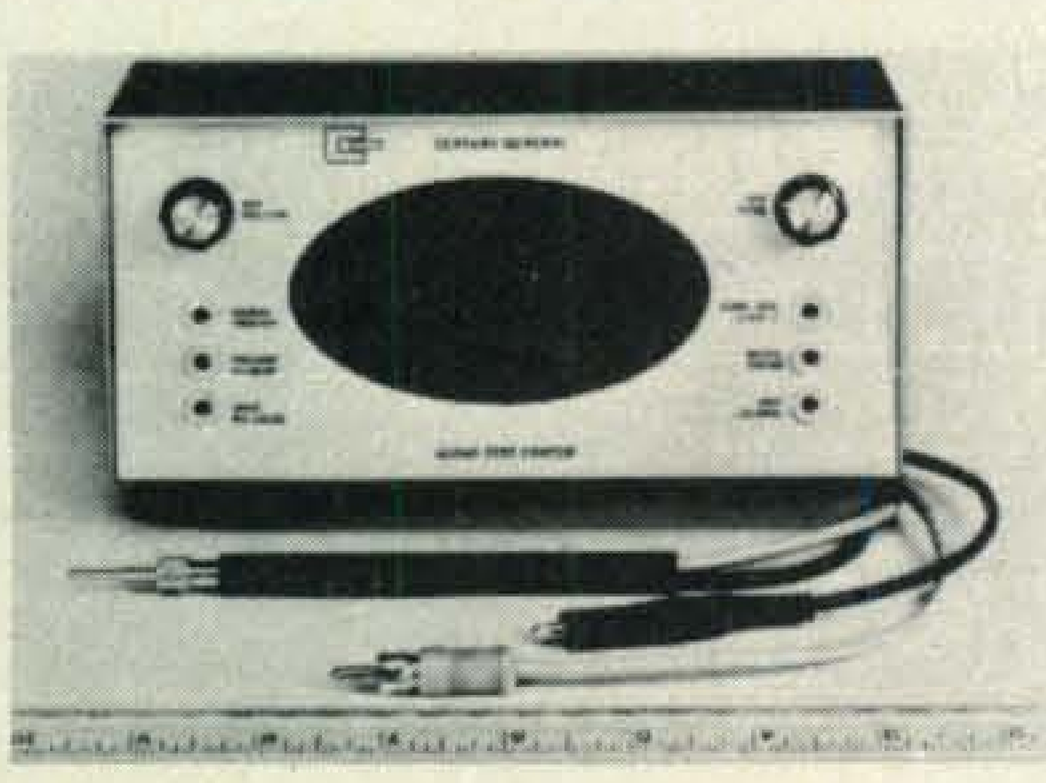

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See page 150 for New Reader Service

A Letter From Don Miller

Editor, *CQ:*

You will recall, I'm sure, my proposed article for the September *CQ* discussing the favorable court settlement of my libel suit against John Huntoon and the ARRL and how we discussed that, just as the settlement was accomplished by both sides in the best interests of amateur radio, it would be in this same best interest to simply drop the matter and not publish the article.

You will also recall that we expected *QST* to include a rather defensive, one-sided account of the proceedings, with the emphasis on the operation from St. Peter's and St. Paul's Rocks (PYOXA) instead of on the libel suit itself. Now that the October *QST* has carried such an article, mentioning only one side of the story as expected, I feel most strongly that the amateur radio fraternity, and *CQ's* readers in particular, should be told *all* the facts, including why the case was filed, what it involved, and how it was settled. So as not to burden our hobby and fellow amateurs with further controversy, this will be my final comment on the matter, regardless of who says what, where, and to whom. Our remaining DXpedition articles in *CQ* will concentrate on the DXpedition itself.

The annonymous article in last month's *QST* stated, "in essence the suit revolved around the Awards Committee's refusal to allow DXCC credit for certain of his claimed operations." As you well know, Dick, this was not at all the essence of the suit. The suit was for libel; it revolved around what I claimed were libelous statements by John Huntoon and his committee, many of which were published by ARRL and distributed throughout the world not only to DX Clubs, Bulletin Editors, IARU Societies and others having a primary interest in DX, as the *QST* article claimed, but also to governments and government agencies, and to some disinterested operators who were not even ARRL members or DXCC holders! Some examples of libelous statements implied or stated outright were that I had jeopardized the acceptance and support of amateur radio in various countries and had trespassed on Coast Guard property; others were similarly untrue or unsupported. Many of these statements were published and distributed before any investigations were completed without consulting me, and without even notifying the Directors of ARRL (violating their directive of the 1966 Directors' meeting).

When any case is decided out-of-court, as this one was and as the term "settlement" implies, both sides make concessions. As you know, this was not simply "withdrawal of suit," as the *QST* article would have us believe. In *every* settlement the plaintive withdraws his suit in exchange for what is fair concession or reimbursement by the defendant (ARRL, in this case). The League's concessions were as follows:

1. The Awards Committee agreed to accredit me three operations (Geyser Reef, Blenheim Reef, Nelson's Island-Chagos) and to count the first two as new DXCC countries.

2. I was paid through attornies (the standard method of payment, the sum of $2,500.00).

3. In addition to that sum, I was reimbursed most of my legal (deposition, hotel, etc.) expenses in the case.

It was what I considered a fair settlement of the case, and so I signed the settlement agreement, knowing full well that they would seek to publicize PYOXA to make it seem as though the League had won some kind of a "victory". I presume that Mr. Huntoon and the Directors were satisfied with the settlement, or they would not have signed the agreement.

As of this date, seven of the eleven DXpedition operations discreditted by the Awards Committee have been reinstated or accredited to full standing. Four of these, Gloriosos Is'and (FR7XP), DesRoches Island (VQ9AA/D), Aldabra Island (VQ9AA/A), and Minerva Reef (1M4A), were reinstated when the Committee learned that its charges of unethical QSL card distribution were unfounded. For this they never apologized. Three more, the three recent operations mentioned above, have also been reinstated as part of the settlement, although the *QST* article would have us believe that they were going to count them all along (HI!). Four remain discreditted by the DXCC Committee: Navassa Island, where the League (but not the Coast Guard) claims we trespassed; Heard Island, where they claim my license was invalid (although they have seen my Australian license authorized for operation from Heard); Laccadive Island, where they state the license was valid only for the mainland and not for the island, and St. Peter's and Paul's Rocks (PYOXA), discussed below.

Certain points pertaining to our three-year DXpedition and the recent settlement have never been mentioned by ARRL or Mr. Huntoon:

1. Over 60 valid operations were conducted that were never challenged by ARRL.

2. Proven illegal DXpeditions are still accreditted by the Awards Committee (example: Bouvet Island, where the South African government has confirmed to Huntoon that the ship did not land on Bouvet). Still think their actions were to "protect the integrity of DXCC," instead of a personal vendetta?

3. No explanation could be offered during the depositions on how the League or its officials could involve themselves in the personal affairs (visas, travel documents, etc.) of one of their members.

4. Of all of our operations of the three years, John Huntoon was unable to cite a single case where any license or permit issued to me was ever revoked, suspended or cancelled; he was similarly unable to cite a single action taken against me or my DXpedition by the government or any example of where amateur radio had been jeopardized at all.

5. My disqualifications from past ARRL DX contests were wholly unsupported; a check of my logs during the deposition showed them to be as accurate or more accurate than the other logs checked! (The 1968 ARRL DX Contest results, page 58 of October *QST*, for some reason lists me in first place, without disqualification for the first time in recent years!)

Regarding the PYOXA expedition, I feel our readers and all amateurs, are entitled to a full explanation. Under oath, I *volunteered* the statement that this operation took place from the boat and also that this was the *only* operation on the DXpedition which was misrepresented in any sense. Naturally, I was fully aware that Huntoon and the League would make the most of this instance, and in the annonymous *QST* article they did so, to the exclusion of the true basis of the suit and its outcome!

The PYOXA expedition took place from a ship, not from the rocks. We were unable to reach the rocks before the license's 30-day term expired and it was nonrenewable. The following points are not intended to justify that operation – only to reply to those who justifiably ask "why?"

1. The only previous "operation" from those rocks had been accepted by ARRL, despite verification from the Brazilian IARU Society that the license was for Maritime Mobile use only and not for operation from the rocks! In the same sense, our license should have been valid for maritime mobile use, honored by the Awards Committee along with the previous illegal operation.

2. Never, during the PYOXA operation did I state we were at St. Peter's and Paul's Rocks.

3. Of all the world's DX'ers, only those in the North Jersey DX Association (about 25 of 50 contacts) had credit for these rocks, for having contacted the illegal DXpedition. It simply wasn't fair to the remainder of the DX fraternity.

continued on page 136

See page 150 for New Reader Ser

BY JOHN A. ATTAWAY,* K4IIF

Attention Contesters! ! ! ! !

As you know "Incentive Licensing" goes into effect the day before the *CQ* Worldwide C.W. Contest. To clear up any last minute misunderstandings with respect to multi-operator entries we got the straight poop from Bill Grenfell, W4GF, of FCC, regarding what you can and can't do. The major points are as follows: 1.) The operator license of the station licensee or club station trustee sets the highest level permissable. (This means that if the station licensee or trustee has a General ticket, the station can only be operated on frequencies alloted to General class operators regardless of the class of license other operators may have.) 2.) No individual operator may exceed his own privileges. (Therefore, even if the station licensee or trustee has an Extra Class license, General class operators can only use General class frequencies when they are at the key.)

For editorial comment on the situation see De Extra.

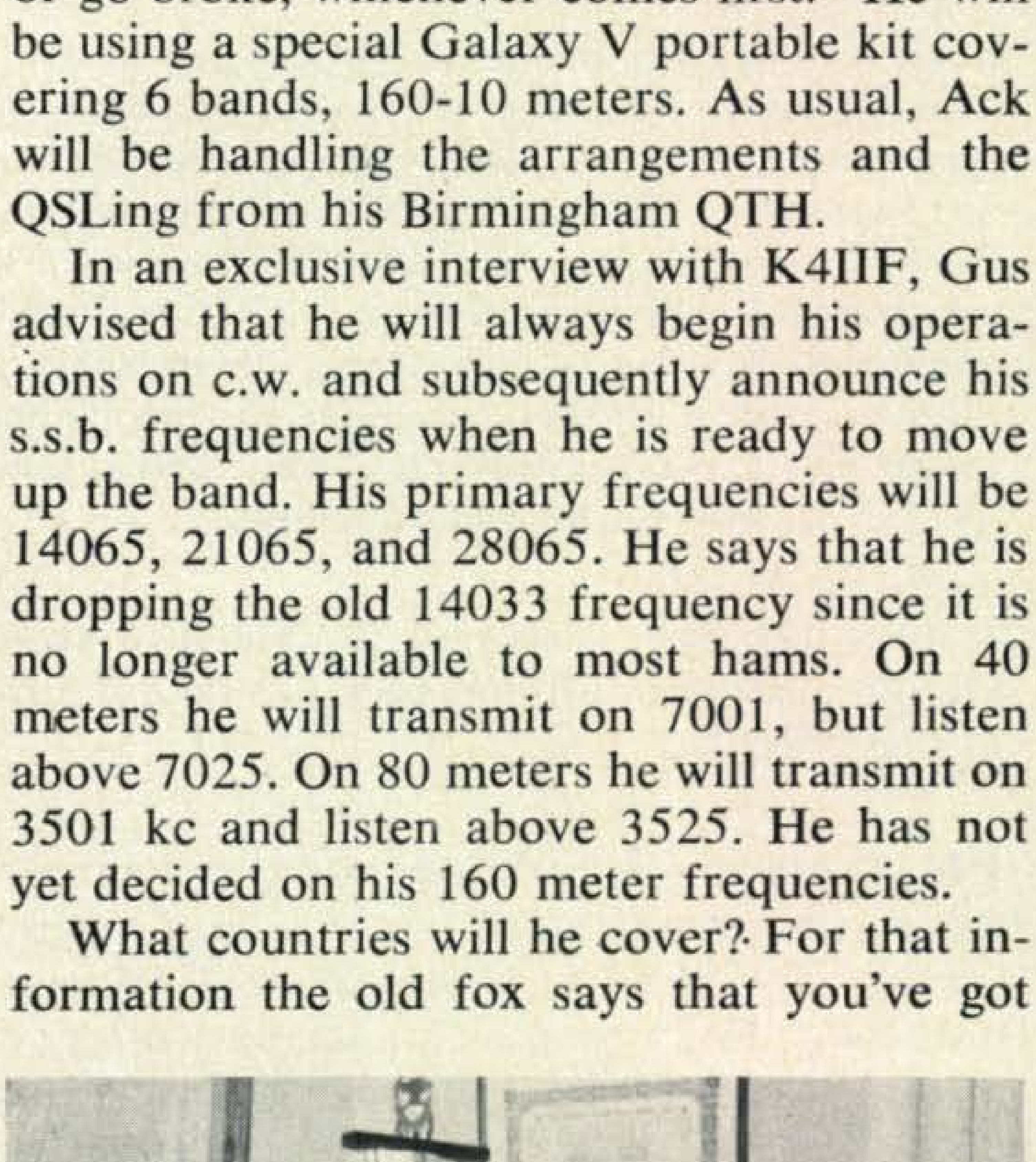
DXpeditions

Here is a new section for the column. We don't usually have information of this nature sufficiently far ahead to get it in print before the action is over. However, these items were sent to us more than 2 months in advance giving us a chance to use them. If future DXpeditions will give us long range notice of their plans we can continue this feature in the months ahead.

GUS-ACK—There's good news tonight!!! The greatest DXpedition team of all time, Gus Browning, W4BPD, and Ack Atkerson, W4ECI, will shortly be on the circuit again. Gus expects to kick off about Jan. 1 on a trip which will "last 'till we run out of countries or go broke, whichever comes first." He will be using a special Galaxy V portable kit covering 6 bands, 160-10 meters. As usual, Ack will be handling the arrangements and the QSLing from his Birmingham QTH.

In an exclusive interview with K4IIF, Gus advised that he will always begin his operations on c.w. and subsequently announce his s.s.b. frequencies when he is ready to move up the band. His primary frequencies will be 14065, 21065, and 28065. He says that he is dropping the old 14033 frequency since it is no longer available to most hams. On 40 meters he will transmit on 7001, but listen above 7025. On 80 meters he will transmit on 3501 kc and listen above 3525. He has not yet decided on his 160 meter frequencies.

What countries will he cover? For that information the old fox says that you've got



To this gentleman belongs the credit for the smooth state of affairs for WPX, Howard W. Kelley, Jr., K4DSN, CQ WPX Manager. It you're interested in getting started with WPX, just send Howard an s.a.s.e. and he'll get the rules and application blank to you. His address is 6563 Sapphire Drive, Jacksonville, Florida, 32208.

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

S.S.B. DX Honor Roll

W9ILW	320	WØQVZ	305	K1IXG	289	K8ONV	270
W2TP	319	W2BXA	304	K8RTW	288	G3NUG	270
VK3AHO	318	G3AWZ	303	W6UEF	287	MP4BBW	270
WA2RAU	315	G6TA	303	W9EXY	286	W2MJ	267
G3FKM	313	W3DJZ	303	W1LLF	282	G2PL	266
W3NKM	313	W8DE	303	W3KT	282	G2BVN	264
WA8AJI	312	W4PAA	301	W6UOU	282	G3DO	261
TI2HP	312	KP4CL	301	K4OEI	280	DL3RK	261
WA2IZS	311	5Z4ERR	301	K4HYL	277	W4LRS	260
DL9OH	310	W4QCW	300	W7DLR	277	W6WNE	260
G8KS	310	W8EVZ	300	DL1IN	276	WA2SOQ	269
W2RGV	309	K2DX	300	HB9TL	276	PJ2AA	258
W4OPM	309	W8BT	299	W4IC	276	K1SHN	257
W5KUC	308	W4SSU	299	PZ1AX	275	W6BAF	254
K6CYG	308	W4MYE	297	K9LUI	275	K6CAZ	254
I1AMU	308	W2FXN	294	W6RKP	274	PAØSNG	252
W2ZX	307	XE1AE	294	K9EAB	274	W1AOL	250
W6YMV	305	W3MAC	293	W2LV	271	K6LGF	250

Dona Maria Luisa Mateo de Fernandez, KP4WT, ham radio's grandmother of the year and her OM, Don Joaquin, KP4BMZ. Dona Maria, now 72, was first licensed in 1953 as WP4WT, and received her General ticket on July 15, 1954. Don Joaquin, 79, was licensed as a Technician in 1963. The KP4WT equipment includes a Collins 32V2, Heath Mohawk receiver, and a Hornet Tribander for the higher bands plus converted Command gear and a long wire for 40 and 80 meters.

to read the *DXers Magazine*. He also says, "Smile everybody, this is going to be a happy DXpedition."

PJ∅, Curacao—A multi-operator, multi-transmitter station will be activated from Curacao during the 1968 CQ World Wide C.W. contest, Nov. 23-24 by the Connecticut Wireless Association and the Potomac Valley Radio Club. The callsign will be PJ∅CC, and will be the first PJ∅ call ever issued. Also, the first 160 meter operation from Curacao is assured with 1800-1850 kc and 1950-2000 kc authorized. Operators definitely going include W4GF, W2ADE, W1TX, W1FJJ, and W1-BIH. W4KFC and K1ANV will probably also be included. QSL to W2ADE for PJ∅CC contacts between Nov. 16 and Nov. 30, 1968. *(Tnx W1BIH)*

VK2, Lord Howe Island—Karl, VK2BKM, plans to operate from Lord Howe during his vacation period, Nov. 19-28, 1968 using the call VK2BKM/2. His main objective is to operate on 5 bands during the CQ World Wide C.W. contest, but he will also operate s.s.b. prior to the test. Times and frequencies will vary according to conditions and activity, but Karl has submitted the following general guideline for his s.s.b. activity. C.w. activity during the contest is expected to take care of itself. To the States:

2030-0130 GMT—28560 kc
0130-0230 GMT—21300 kc
0600-1400 GMT—14195 kc or alternatively;
0900-1000 GMT— 7095 kc tuning 7200 up,
1000- GMT— 3695 kc tuning 3800 up.

To Europe:

From 0630 GMT—28580 kc
From 1030 GMT—21300 kc plus 20, 40 and 80 meter operation via the long path.

Karl states that we will reply to every QSL card received either via the VK2 Bureau or direct if an s.a.s.e. is sent. No strings attached, and no contributions required. *(Tnx VK2-BKM)*

Canadian South Pacific DXpedition—VE6-AST and VE6APV advise that they hope to hit the Gilbert and Ellis Islands in early November, British Phoenix Islands in mid-November, and then Wallis, Manihiki, and others. For WK anateurs, they will listen on 14210±5. QSL to VE6AO, 3211 Kenmore Circle S.W., Calgary, Alberta, Canada.

4A∅, Mexico—4A∅FCR plans to be on during the phone and c.w. weekends of the *CQ* contests. QSL to WB6FCR. *(Tnx WB6FCR)*

PX1, Andorra—Operation from Oct. 22-29, including *CQ* Contest weekend, was planned by Jim McVay, K∅BWN/DL5NJ, as PX1BW. QSL as shown in QSL Information section.

PJ5, Sint Maarten Island & FS7, St. Martin—A major DXpedition was planned for the phone weekend of the *CQ* Worldwide contest, Oct. 26 and 27, by W9AQW, W9POK, W9VNE, W9ZRX, W9ZTD, K9RHN, K9-KIC, PJ2MI, and possibly W2GHK. Operation on 80, 40, 20, 15, and 10 was definite and 160 was a possibility. QSLs are being handled by DXpedition of the Month. *(Tnx W9ZRX/PJ5MN)*

YB1, Indonesia—KH6CXP/YB1 applied for operation as a foreign national in Indonesia. For those interested, applications go to Lt. Col. Kuntojo, Dewan Telekonmunikasi R.I., Telecommunications Council, 69 DJ 1 Petenungen, Djakarta, Indonesia. REMEMBER: *This one is banned for W,K operators.*

DXpeditioners International Club—Ed De-Young, KH6GLU, is interested in forming a club made up of experienced DXpeditioners. It's purpose would be to organize a clearing house for DXpedition information. All members would contribute pertinent data on rare places where they have operated for the use of others who might be interested in going to those places. Contact Ed if you are interested.

See page 150 for New Reader Service

De Extra

Anachronism, 1968—"Incentive Licensing" Effective One Day Before C.W. Contest: On Nov. 22, 1968 the vast majority of U.S. amateurs will lose their privilege to transmit c.w. signals over the prime contest frequencies from 3500-3525 kc, 7000-7025 kc, 14000-14025 kc, and 21000-21025 kc. On Nov. 23, 1968 the CQ Worldwide C.W. DX contest begins. Needless to say all general and advanced class contesters will have to exercise great caution to avoid an unwelcome pink letter from Uncle Fox Charlie Charlie.

This was a most awkward date to select for the beginning of the new system, and as a consequence the CQ Contest Committee was beseiged with requests to move the date up to the proceeding weekend. There was an overwhelming sentiment that this was ARRL's baby and they should reap the confusion of their own private whirlwind. However, the Committee concluded that abandoning the traditional weekend would only aggravate the situation so Frank, W1WY, and the boys will do their best to make it a well-managed affair despite these adverse circumstances. It is hoped that everyone will make an effort to have an extra neat log.

As a member of the loyal opposition who fought this thing from beginning to end without threatening to drop my League membership I feel entitled to express my sadness at least one more time. "Incentive Licensing" was conceived as an emotional reaction against crowded bands during the sunspot minimum. It is totally irrelevant to 1968. We should be encouraging c.w. operation, not discouraging it. This new system provides no incentive to improve operating ability, no incentive to use the bands more courteously, no incentive to serve amateur radio, and no incentive to serve the public through amateur radio. A sad, sad situation for those who love the hobby. In the future maybe they'll look before they leap.

The WAZ Program

The new WAZ certificate winners this month are as follows:

WAZ S.S.B.: K3YBR–585, DJ3GG–586, K5AWR–587, 7P8AR–588, XE1YG–589, JA4ZA–590, WA6YVW–591, PY3BXW–592, W5OBS–593, W9ABM–594, WA5-JSF–595, W6CDJ–596, W1HX–597.

WAZ C.W./Phone: K4IEP–2483, WB6PNB –2484, OE6SWG–2485, ZL2VN–2486, W8QXQ–2487, I1ZQ–2488, KØHUU–2489,

George Radion, UC2AR, a member of the CQ WPX Honor Roll. George uses a 17 tube double conversion receiver, a home-brew 100 watt transmitter, and a ground-plane antenna.

WB4FIN–2490, W1FJJ–2491, UV3TQ–2492, K3CHP–2493, W4HY–2494, W6VK –2495, W4BSB–2496, OE3SJW–2497.

WAZ Phone: OE3PZ–388.

The WPX Program

WPX certificate and endorsement winners were the following:

WPX C.W.: OK2BLG–870, OK2BFX–871, WA2ZEZ–872.

WPX S.S.B.: K9QFR–355, VK2PF–356, KØILI/KG6–357, DL3HJ–358.

WPX Mixed: VE1TG–174, K6IC–175.

Endorsements: *Continent* – Europe: OK2-BFX, OK2BLG.

Band—21 mc: WA2ZEZ. 3.5 mc: PAØSNG. 1.8 mc: OK2BLG.

Mode—Mixed: W4UB–650.

S.S.B.: K1SHN–600, PAØSNG–550, W8FPM–400, DL3HJ–300, K9QFR 250.

C.W.: W2EQS–750, PAØSNG–450.

Phone: CT1PK–800.

It was our original intent not to publish another WPX Honor Roll until after we were ready to use the standard list of current prefixes. However, it has taken us longer than expected to get the new forms ready, so WPX Manager K4DSN has prepared up-to-date Honor Rolls based on our list of all prefixes which have been used since the end of World War II. The s.s.b. and mixed standings are as follows using 500 prefixes as the cut-off point for s.s.b. and 600 prefixes as the cut-off point for mixed. The phone and c.w. rolls will be published next month.

Ernie, 5Z4SS, who operates the QSL Bureau in Kenya. Ernie says that cards to the 5Z4 Bureau via surface mail arrive in batches through the port of Mombasa. It takes an average of 2 months by this route from the USA. Cards are picked up by Robbie, 5Z4ERR, and sorted immediately by Ernie. The address is P.O. Box 30310, Nairobi, Kenya, East Africa.

WPX S.S.B. Honor Roll

W4OPM–750	W3DJZ–575	UC2AR–504
W4NJF–701	PAØSNG–555	K2POA–500
KP4CL–661	W4RLS–523	K4HPR–500
DL9OH–609	W9DWQ–523	WA5LOB–500
K1SHN–601		

WPX Mixed Honor Roll

W4OPM–950	W4HA–658	HB9EU–619
W9WHM–856	W4RBZ–655	4U1ITU–616
W9DWQ–762	K2ZKU–642	W5LGG–615
DL3RK–752	SM5BPJ–642	W8JIN–613
G3DO–744	W8WT–642	K9EAB–606
K1SHN–702	PAØSNG–636	W3NKM–605
W9GFF–701	W9YSX–635	W8UMR–604
K2CPR–700	OE1FF–630	W9IRH–604
W3GJY–671	WA6MWG–630	W4IC–603
W4UB–659	KØBLT–621	

WPNX Award

Award's manager K4GRD reports a new winner of *CQ*'s DX Award for Novices. He is also the first winner from a DX location. His name is Donald L. Alberty, WP4DGR, WPNX winner No. 6.

Novices interested in DX should send a self-addressed, stamped envelope to K4GRD so that he can send you rules and application blanks. His address is P.O. Box 524, Lakeland, Fla. 33802.

VPX Award

During the past year several short-wave listeners, including officials of the International Short-Wave League, have written in asking that WPX be offered to s.w.l.'s. We took these requests under consideration and decided that the designation WPX would not be proper since it means *Worked* Prefixes. However, there should be a prefix award for s.w.l.'s so we arrived at the designation VPX for Verified Prefixes. For the time being applications will be accepted on *CQ* form 1051, the regular WPX application form. These may be obtained from WPX Award Custodian K4DSN, 6563 Sapphire Drive, Jacksonville, Fla. 32208, by sending a self-addressed, stamped envelope.

The S.S.B. DX Awards

The change in management of the S.S.B. DX awards is continuing to bring about improvement of this program. Louise, W8HDB, authorized 10 new certificates this month, 5 for 100 countries, 3 for 200 countries, and 2 for the grand prize, 300 countries on 2 way s.s.b. This is the first time this program has hit the "double figures" since yours truly became DX Editor. The winners and their certificate numbers are the following:

100 Countries: WA9MGK–518, W9VNE–519, WA2VSQ–520, JA1NDO–521, and W9FPM–522.

200 Countries: K9LUI–156, W6UEF–157, and W9QLD–158.

300 Countries: W8DE–35, and W6YMV–36.

The complete rules for these awards were published in the DX COLUMN of the September, 1968 issue. Application blanks may be obtained from Award's Manager W8HDB, 3785 Susanna Drive, Cincinnati, Ohio 45239.

The Country Status Question

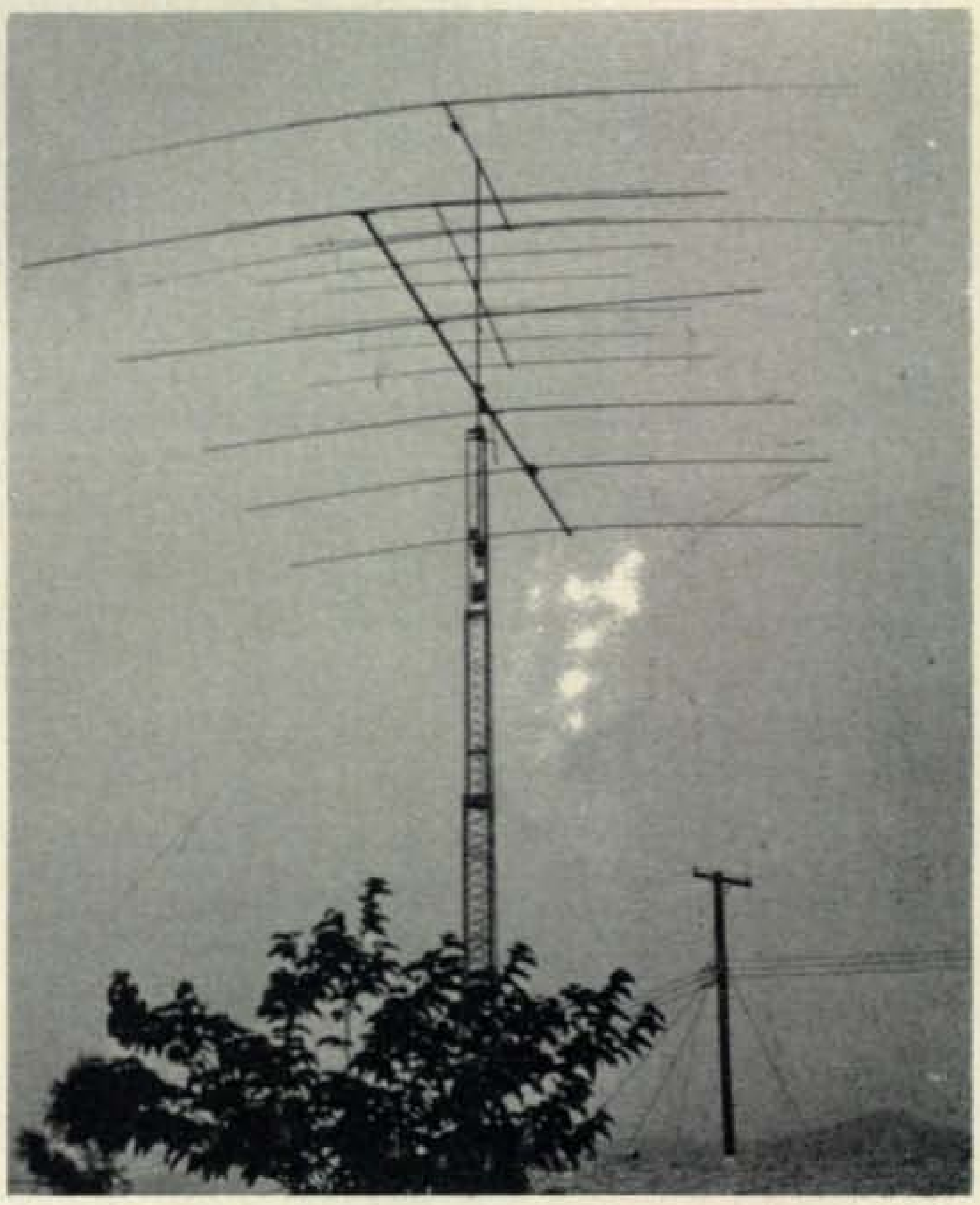
As announced earlier, the new CQ DX Award's Advisory Committee decided by a margin of 1 vote to reconsider the preparation of a separate countries list for the S.S.B. DX Awards. As the balloting was so close, we decided to proceed with great caution. Rather than rush out immediately with a list, we will first carefully consider all of the criteria involved in defining a country. We hope to arrive at a definition which will be unanimously accepted by the committee, and subsequently with a list which will also be unanimously accepted by the committee.

To help us attain this ideal we need the help of all DXers. Therefore, this deliberation will be spread over a period of several months so that everyone who wishes to contribute will have time to send us his comments.

The following ballot was sent to the Committee on Sept. 3, 1968. It contains several

See page 150 for New Reader Service

Gary Stilwell, W6NJU, the Southern California DX Club representative on the CQ DX Award's Advisory Committee. The other shot shows what's responsible for that potent signal from W6NJU: 2 elements on 40 meters, 5 elements on 20 meters, 4 elements on 15, and 3 elements on 10.



criteria which could be used in part to establish country status. Numbers 1-3 are essentially the same as those used by the A.R.R.L. except for small changes in mileage requirements. The mileage's involved are subject to negotiation. No. 4, if adopted, would yield a short, highly conservative list containing only member countries of the United Nations. This would eliminate all dependencies and most island groups, etc. No. 5 would produce a fairly conservative list as it would require the presence of a permanent community. No. 6 would eliminate the smaller reefs and sandbars, and No. 7 would eliminate the reefs and sandbars not claimed by any recognized national government.

By the time most of you read this, the opinions of the committee will have been received. However, we will not proceed to the next step until at least another month so that the opinions of all interested DXers can also be obtained. Comments should be addressed to the DX Editor, P.O. Box 205, Winter Haven, Florida 33880.

CQ DX Advisory Ballot

Please note your opinion in the space below each numbered provision. Use an extra sheet of paper if necessary. Lengthy comments are encouraged if you wish to make them.

What constitutes a country?

1.) Government administration: An area by reason of government or a separate administration constitutes a separate entity.

2.) Separation by water: An island or group of islands not having its own government may be a separate entity under the following conditions—

a.) Islands situated off shore from their governing or administrative area must be geographically separated by a minimum of 200 miles of open water. This point is not concerned with islands which are part of an island group or are geographically located adjacent to an island group.

b.) Islands forming part of an island group, or which are geographically located adjacent to an island or island group which have a common government or administration, will be considered separate entities provided there is 400 miles of open water separation between the 2 areas in question.

3.) Separation by foreign land: If there is a separation of a country by a minimum of 75 miles of foreign land, the country is considered as 2 separate entities. This applies to land areas only.

4.) Only member countries of the United Nations should count.

5.) A separate entity must have a postoffice.

Don Mullen, KØHUU, one of our recent WAZ winners.

6.) A separate entity should have a certain minimum high water line.

7.) No *unclaimed* islands or reefs sould be counted as countries. This would eliminate Minerva, Maria Theresa, Geyser, Blenheim, etc.

FCC Monitoring Stations

In the July, 1968 DX COLUMN, **De Extra** dealt with the subject of deliberate interference to contest operations. This editorial received many favorable comments, and as a result the FCC has given us a list of it's monitoring stations. When you hear flagrant examples of interference it would be to everyone's best interest if you communicated the details to the FCC. They maintain a file on interference, and your observations might be just what they need to squelch a particular offender. The Class A monitoring stations are as follows:

Allegan Monitoring Station, P.O. Box 89, Allegan, Mich. 49010

Anchorage Monitoring Station, P.O. Box 6303 Annex, Anchorage, Alaska 99502

Canandaigua Monitoring Station, P.O. Box 374, Canandaigua, N.Y. 14424

Fort Lauderdale Monitoring Station, P.O. Box 22836, Fort Lauderdale, Fla. 33315

Grand Island Monitoring Station, P.O. Box 788, Grand Island, Nebraska 68801

Kingsville Monitoring Station, P.O. Box 632, Kingsville, Texas 78363

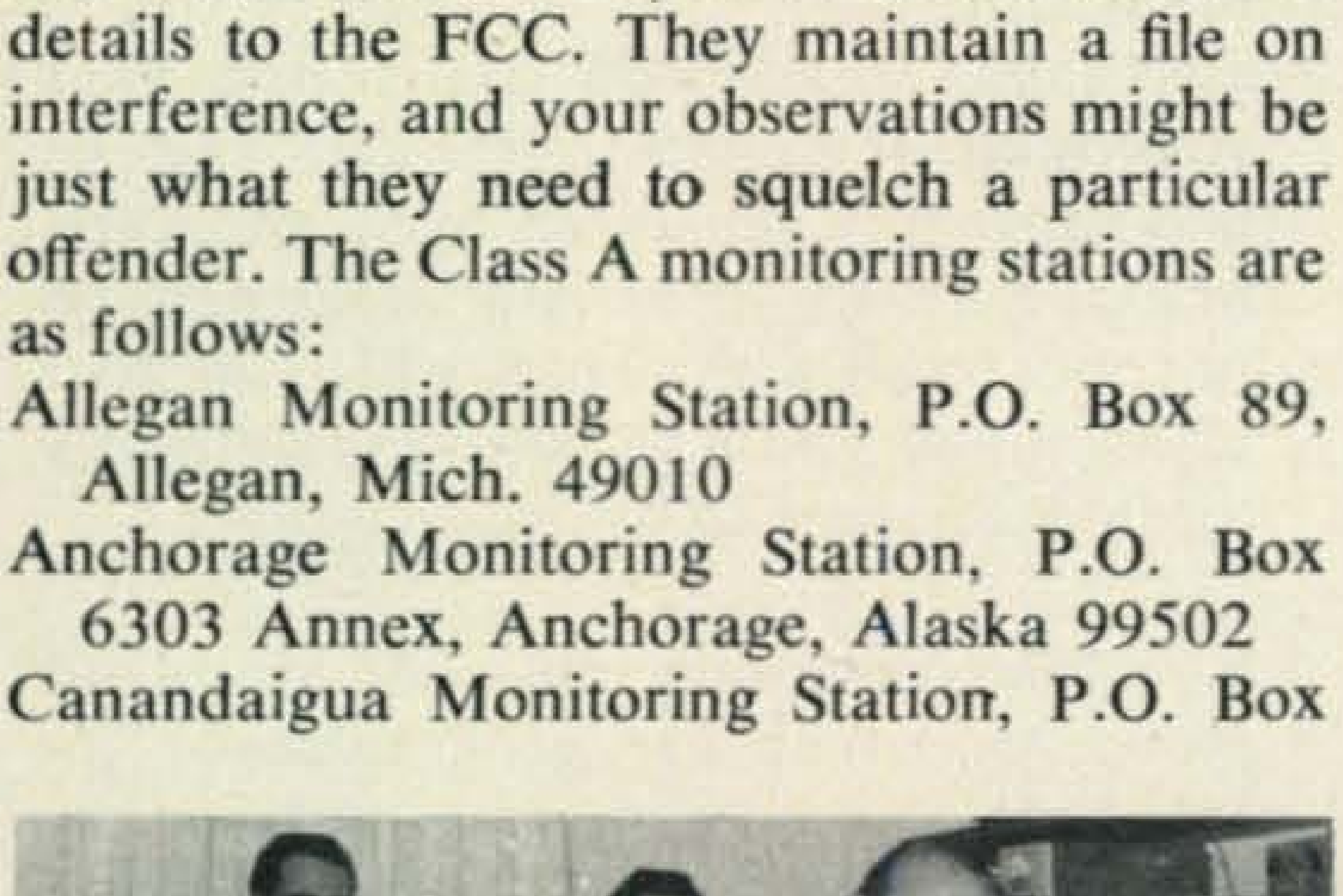
Laurel Monitoring Station, P.O. Box 40, Laurel, Md. 20810

Livermore Monitoring Station, P.O. Box 311, Livermore, Calif. 96551

Powder Springs Monitoring Station, P.O. Box 85, Powder Springs, Ga. 30073

Santa Ana Monitoring Station, P.O. Box 5126, Santa Ana, Calif. 92704

Waipahu Monitoring Station, P.O. Box 1035, Waipahu, Hawaii 96797



Left to right: the W9BGX contest gang from Northwestern, Fred, W9ICE, John, K9WEH, and Ed, K4HNA. The antenna system was a TH6DX up 120 feet with 2, 80-40 meter trap dipoles at right angles 100 feet up. The station was on top of the Northwestern Technological Institute right on the shore of Lake Michigan. (Photo courtesy of K9WEH)

Newark News Radio Club

The following information on an interesting, DX-oriented club is from Bill Schultz, President of Newark News Radio Club (NNRC):

"The NNRC was organized in December, 1927 as the world's first DX listeners club. It was founded on the premise that exchange of information between those with like interests would result in a greater measure of enjoyment and success for all. The club now has the largest membership in the western hemisphere which testifies to the forethought and care with which the charter members laid the club's foundations.

"The medium of exchange of information for NNRC is the NNRC Bulletin, which publishes more than 600 pages each year. Regular monthly sections are devoted to Medium Wave Broadcast, Short Wave Broadcast, Amateur, Commercial, TV, and FM DXing. A sample copy can be obtained for 25¢ from Secretary Harold S. Williams 50 Third Avenue, Seymour, Connecticut 06483.

"NNRC is a co-operative and democratic venture. A full slate of officers is elected every second year as required by the club constitution. The constitution itself is amendable only through vote of the membership. Day to day operation of the club's affairs rests in the hands of the NNRC Executive Board comprised of all the club's officers and Bulletin editors. The annual membership fee is $5.00 in U.S. funds."

Anybody Need a QSL Manager???

The following 2 gentlemen would like to volunteer their services as QSL Managers for any DX station:

Greg, WB6ZNM, 1240 21st Street, Her-

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mosa Beach, Calif. 90254.

Bill, K4RTA, P.O. Box 404, Hendersonville, TN. 37075.

New CQ DX Committeeman

Herb Kline, K1IMP, who did such a fine job with the Hall of Fame Award banquet for W1BB, has been forced to resign his CQ DX Advisory Committee post to go on active duty with the U.S. armed forces. His replacement on the Committee is Ray Walker, W1DHL, who we are sure will do a fine job. Ray has already checked cards for 3 WAZ award applicants and is busily soliciting business for both WAZ and the S.S.B. DX Awards. His address is 8 Yukon Ave., Watertown, Mass. 02172.

New Oversea's Checkpoints for CQ DX Awards

We are very pleased to announce that cards for WAZ and the S.S.B. DX Awards may now be checked in Japan and Brazil, enabling amateurs of those countries to apply for the awards without sending their cards to the U.S. The checkpoints are as follows:

JAPAN: Mr. Nobutaka Kiso, JA1KIS, Japan Amateur Radio League, P.O. Box 377, Tokyo Central, Tokyo, Japan.

BRAZIL: Mr. Manoel Borio, PY1MB, Liga de Amadores Brasileiros de Radio Emissao, Caixa Postal 2353, Rio de Janeiro, Brazil.

This brings the number of authorized overseas checkpoints to 20. The addresses of our representatives in Argentina, Australia, the Benelux Countries, Central America, Czechoslovakia, Denmark, England, France, Germany, Morocco, New Zealand, Poland, Portugal, Spain, Sweden, Switzerland and the USSR were given in the August issue, while the address of our representative in South Africa was given in the October issue.

From the Mailbag

de W2CTN: "Please accept my sincere thanks for your kindness in sending along the DX Hall of Fame Plaque. It is one of my most prized possessions and has a prominent location in the shack for all to see. Please pass along my appreciation to all concerned."

de W2GT: "Many readers might like to know that ex-FL8RA is now F9NI, but is presently active as DL5RS. His correct address as of this date is: Andre Rotger, French Air Base, Flug Platz Tegel 52, 1 Berlin, Germany."

Trieste Award

The Trieste DX Club issues this award for the following contacts:

Some of the ops of the Sofia City Radio Club—LZ1KPG/LZ0WYF. Left to right: LZ1FP, LZ1BC, LZ1FO, LZ1ZO, and LZ1PN. They put in double duty during the ninth annual communist youth festival this past summer. (Photo via K4DSN)

1. Italian stations—7 contacts with stations in Trieste
2. European stations—5 contacts with stations in Trieste
3. DX stations—2 contacts with sations of Trieste

There are no restrictions regarding band or mode.

In addition, a special seal of Trieste will be granted to those who exceed the above limit as follows:

1. Italian—10 contacts
2. European—8 contacts
3. DX—4 contacts

Applications certified by your Radio Club or 2 other hams should be sent with 10 IRC's or $1.00 to the award manager, Luciano Hinze, I1HL, P.O. Box 1342, 34100 Trieste, Italy.

The Trieste DX Club Net for the USA meets every Monday at 2100 GMT on 14205 kc.

QSL Information

AP5HQ—QSL Direct, S.a.e. and IRC'c are a must.

CE0AE—"Clark", Box 37, APO, New York, N.Y. 09339

CT2AS—Via K2AGZ

EA6AR—To DL7FT

EA6ITU—C.W. QSO's via W4BV, 512 Hatcher Drive, Fayetteville, Tenn. 37334 —S.S.B. QSO's c/o W3MR, 182-D Clubhouse Road, King of Prussia, Pa.

EI2VAE/p—Via WA0KXJ

EP2DA—To W2MXB

ET3USA—c/o VE3IG

F0CV—Dan Weinstein, Year-in-France Program, 14, rue du Quatre-Septembre, 13-AIX-EN-PROVENCE, France

[*Continued on page 140*]

Propagation

BY GEORGE JACOBS,* W3ASK

LAST month's column contained special DX Propagation Charts for use during the c.w. section of the 1968 *CQ* World Wide DX Contest, which will be held over the weekend of November 23-24. If you plan to participate in the Contest be sure to check the band opening predictions, work plans, and other propagation data appearing in last month's column; they could be helpful in piling up contacts and points. For a day-to-day forecast of propagation "weather" expected during November, including the contest period, see the "Last Minute Forecast" appearing at the beginning of this column.

Here are some propagation rules of thumb that should be helpful in working DX during November, especially during the c.w. contest period:

> During and shortly after sunrise, excellent conditions are forecast for 20 meters, in practically all directions. Also check reception from the south and west on 40, 80 and 160 meters.
>
> From a few hours after sunrise until late afternoon, it should be a toss-up between 10 and 15 meters for optimum DX conditions. Excellent openings are predicted for both bands, to all areas of the world.
>
> During the late afternoon and early evening hours, check 15 meters for signals arriving from the south, west and north, while 20 meters is expected to be optimum for reception from an easterly direction. Fairly good DX reception from the east and south should also be possible during the early evening hours on 40 meters.
>
> During the late evening and early morning hours, 20 meters should be open for DX to the south, west and northwest, with strong signals, while good 40 meter openings are predicted to almost all areas of the world. Some 80 and 160 meter openings should also be possible during the hours of darkness.

Signal levels on most DX openings should be noticeably stronger during the summer and early fall months, as a result of a seasonal decrease in static and solar absorption expected during November.

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for Nov. 1, through Dec. 15, 1968

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **11, 13, 17, 20, 9, 11, 15**	A	A-B	B	B-C
Normal: **4-6, 10, 12, 14, 16, 18-19, 21, 23-24, 26-28, 2-4, 8, 10, 12, 14**	A-B	B	C	D
Below Normal: **1, 3, 7, 9, 15, 22, 25, 29, 1, 5, 7, 13**	B-C	C-D	D	E
Disturbed: **2, 8, 30, 6**	C-D	D-E	E	E

HOW TO USE THESE CHARTS

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

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

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

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

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

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

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

6—These Propagation Charts are valid through Jan. 15, 1969. These Charts are prepared from basic propagation, data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

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

See page 150 for New Reader Service

Short Skip Charts

This month's column contains a Short-Skip Propagation Chart for use in the continental United States for predicting one-hop openings between distances of approximately 50 and 2300 miles. Special propagation Charts centered on Hawaii and Alaska are also included.

Sunspot Cycle

The Zurich Solar Observatory reports a monthly mean sunspot number of 111 for August, 1968. This results in a smoothed running number of 103 centered on February, 1968. While the experts cannot agree on which direction the cycle is heading at the present time, as of that date it was still *increasing* in intensity. *CQ* forecasts a smoothed sunspot number of approximately 110 for November, 1968.

Solar activity during the 1968 c.w. contest is expected to be at least 15% more intense than observed during last year's contest, and more intense than has been observed during any contest period since 1959. Because of the almost straight-line relationship between solar activity and h.f. propagation conditions, *conditions during the 1968 c.w. contest are expected to be at least somewhat better than last year and better then they have been during any contest period for the past nine years,* barring the development of any sudden ionospheric storm or disturbance during the contest weekend.

V.h.f. Ionospheric Openings

Several meteor showers are expected to take place during November, and the increase in the number of meteors entering the earth's atmosphere during these periods should produce some meteor-type ionospheric openings in the v.h.f. bands. Check November 5 and 10 when the *Taurids* shower is expected to peak, and November 14 when the *Bielid* shower should take place. *Leonids,* the big shower of the month, is expected to occur from November 14-18, reaching peak intensity during the early evening hours of November 16.

Solar activity has now reached a level where there is a possibility of some F-layer openings on 6-meters across the continent, between the mainland and Hawaii, and between the USA and Latin America and perhaps other areas of the world as well. The best time to check for 6 meter F-2 openings is from just before noon, through the early afternoon hours, or when conditions appear to be peaking on 10 meters.

November should also be a good month for TE, or trans-equatorial scatter openings between the USA and Latin America. The evening hours are the best time to check for TE openings, between approximately 8 and 11 P.M. at the path mid-point.

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

Good luck in the c.w. contest, and please let me know how the DX Propagation forecast for the contest turns out.

73, W3ASK

CQ Short Skip Propagation Chart

NOVEMBER 15, 1968 - JANUARY 15, 1969

LOCAL STANDARD TIME AT PATH MID-POINT
(24-HOUR TIME SYSTEM)

Distance From Transmitter (Miles)

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

EA4AO of OSCAR-3 fame, EA4JW of TV SPAIN and W3ASK, CQ's Space Communications Editor, where?, why entering the famous OSCAR restaurant in Madrid, of course.

Bob, W3MR (ex K3BGX) at the SBE-33 which put EA6ITU on the air from Palma de Mallorca this spring. QSLs were delayed, but are now going out. A feature article on this operation will appear shortly in CQ. (QSL Managers: W3MR and W3ASK for s.s.b.; W4BW for c.w.)

160	07-09 (3-2) 09-11 (2-0) 11-17 (1-0) 17-19 (3-2) 19-07 (4)	07-09 (2-1) 09-17 (0) 17-19 (2-1) 19-04 (4) 04-07 (3-2)	07-09 (1-0) 09 17 (0) 17-19 (1-0) 19-21 (4-2) 21-04 (4) 04-06 (2) 06-07 (2-1)	07-19 (0) 19-21 (2-1) 21-04 (4-3) 04-06 (2-1) 06-07 (1-0)

ALASKA

OPENINGS GIVEN IN GMT‡

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

HAWAII

OPENINGS GIVEN IN HAWAIIAN STANDARD TIME†

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	06-07 (1) 07-10 (2) 10-11 (3) 11-13 (4) 13-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	13-15 (1) 15-17 (4) 17-21 (3) 21-00 (2) 00-06 (1) 06-08 (2) 08-13 (1)	18-19 (1) 19-20 (1) 20-01 (3) 01-02 (2) 02-04 (1) 19-20 (1)* 20-01 (2)* 01-03 (1)*
Central USA	06-07 (1) 07-09 (2) 09-10 (3) 10-14 (4) 14-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 97-08 (2) 08-09 (3) 09-11 (2) 11-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	07-09 (3) 09-14 (2) 14-16 (3) 16-18 (4) 18-22 (3) 22-00 (2) 00-06 (1) 06-07 (2)	18-19 (1) 19-20 (2) 20-02 (3) 02-03 (2) 03-05 (1) 19-21 (1)* 21-02 (2)* 02-04 (1)*
Western USA	07-08 (1) 08-09 (2) 09-10 (3) 10-12 (4) 12-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-08 (2) 08-13 (3) 13-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	08-10 (4) 10-16 (3) 16-22 (4) 22-00 (3) 00-03 (2) 03-06 (1) 06-08 (2)	18-19 (1) 19-20 (2) 20-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-21 (2)* 21-04 (3)* 04-05 (2)* 05-06 (1)*

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

‡ To convert to Local Standard Time in Alaska, *subtract* 8 hours in the Pacific Standard Time Zone; 9 hours in the Yukon Zone and 10 hours in the Alaskan Standard Time Zone, from the GMT times shown in the Chart. GMT is 5 hours *ahead* of EST; 6 hours *ahead* of CST; 7 hours *ahead* of MST and 8 hours *ahead* of PST. For example, when it is 18 GMT it is 13 or 1 P.M. EST in NYC.

† Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours*behind* MST; and 2 hours *behind* PST and 10 hours *behind* GMT or Z time. For example, when it is Noon in Honolulu, it is 17 or 5 P.M. EST, in NYC.

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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

November	2-3	Teenage QSO Party
November	2-3	Okinawa (KR6) Contest
November	6-7	YLRL Anniv. Phone Party
November	9-10	OK C.W. DX Contest
November	9-10	RSGB 7 mc Phone Contest
November	9-11	ARRL SS Phone Contest
November	16-18	ARRL SS C.W. Contest
November	**23-24**	**CQ WW DX C.W. Contest**
November	23-25	Trilliums Memorial Party
December	7-8	CHC International C.W.
December	14-15	CHC International SSB
January	18-19	Louisiana RSO Party
January	24-26	Old Old Timers QSO Party
January	**25-26**	**CQ WW 160 C.W. Contest**

Teenage QSO Party

Starts: 0100 GMT Saturday, November 2
Ends: 2300 GMT Sunday, November 3

This is the 1st annual Teenage Party sponsored by the Cornhuskers Teenage Traffic Net.

Teenagers are classified as all amateurs up to and including 21 years of age. Teenagers may work both teens and OMs, but OMs must work teens only. A station may be worked on each band and mode for QSO points.

Exchange: QSO Nr., RS/RST, ARRL section and age (OMs use "OM" instead of age).

Scoring: Multiply total number of QSOs by number of ARRL sections worked (DX may be worked for QSO points only). An additional 30 points may be added to the final score for each net control worked (WAOs: OCW, ODH, OHO, ORO, OYT, QMZ).

Frequencies: 3565, 3965, 7065, 7265, 14065, 14265, 21065, 21365, 28065, 28565.

Awards: Certificates to the Top Teenager and OM scorer in each section. Certificates also to the high scoring Novices.

Mailing deadline December 5th and logs go to: William Hohnstein, WAOOCW, 210 Carolyn Court, Lincoln, Nebraska 68510.

Okinawa (KR6) Contest

Starts: 0000 GMT Saturday, November 2
Ends: 2359 GMT Sunday, November 3

Here's your chance to work your quota of KR6's. Get your logs off before Nov. 15th to: Okinawa A.R.C., Contest Committee, APO San Francisco, Calif. 96331.

YLRL Anniversary Party

Starts: 1800 GMT Wednesday, November 6
Ends: 1800 GMT Thursday, November 7

This party is open to YLs only. The c.w. section was held last month, this is the phone section. Logs must be received before Dec. 9th by Claire E. Bardon, W4TVT, 2238 Morgan Lane, Dunn Loring, Virginia 22027.

OK DX C.W. Contest

Starts: 0000 GMT Sunday, November 10
Ends: 2400 GMT Sunday, November 10

We hope this activity will not be curtailed because of the current developments in that country. Get on and give the boys a lift. Mailing deadline is Dec. 31st and logs go to: The Central Radio Club, P.O. Box 69, Prague 1, Czechoslovakia.

RSGB 7 mc Phone Contest

Starts: 1800 GMT Saturday, November 9
Ends: 1800 GMT Sunday, November 10

The c.w. section took place two weeks ago. Mail your logs before Nov. 25th to RSGB, H.F. Contests Committee, 35 Doughty Street, London, WC1, England.

Complete rules for the preceding events appeared in last Month's CALENDAR.

ARRL Sweepstakes

Phone—Nov. 9-11 *C.W.*—Nov. 16-18
Starts: 2100 GMT Saturday
Ends: 0300 GMT Monday

No need of going into any explanation for this one. You SS fans know what it's all about. If you don't the October *QST* should give all the details.

Requests for free log sheets and the final product should go to: ARRL Communications Dept., 225 Main Street, Newington, Conn. 06111.

*14 Sherwood Road, Stamford, Conn. 06905

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Jim Ray, HS1RZ delivers his QSL in person. The occasion at a meeting of the Gateway Radio Club at the Rhein-Main Air Force Base. Front L. to R.—HS1RZ, DL9RE, DL4FS. Rear—DL6QX, DL5LR, DL5OM, DJ9AC.

(Photo courtesy SSgt. M. J. McLemore, USAF.)

Trillium Memorial Week

Starts: 0030 GMT Saturday, November 23
Ends: 0030 GMT Monday, November 25

This is the 2nd year of competition for the Albert Jensen Memorial Trophy, donated by Dot and Jack Abel.

The object is to work as many members of the Trilliums (a VE YL organization) as possible, but its going to be a tough assignment for the ladies. The week-end of the CQ WW Contest is hardly the ideal time for a local contest.

Exchange: Signal report, name and QTH. Trilliums will also give their club number and identify themselves by calling "CQ TMU."

Scoring: C. w. contacts 2 points, phone contacts 1 point. There is also a power muliplier of 1.25 for stations using 150 watts or less on c.w. or a.m. and 300 watts p.e.p. on s.s.b. (Each station can be worked only once, regardless of band or mode.)

Logs go to: Bubbles Timlick, VE4ST, 1317 Magnus Ave., Winnipeg 14, Manitoba, Canada.

CHC International Contest

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

This is the first International contest held by the Certificate Hunter's Clubs, Chapter 73 for c.w. and Chapter 88 for S.S.B.

It's a world wide contest in which you can work anyone. In the c.w. section the #73 members will identify themselves, "Call/73," and in the s.s.b. section the identification will be "Call/88." All other CHC'ers will use, "Call/CHC." Non-members will sign, "Call/HTH."

Exchange: The conventional 5 or 6 figures, signal report plus a progressive QSO number starting with 001.

Scoring: 3 points for contacts with club members, CHC #73 in the C.W. contest, CHC #88 in the S.S.B. contest. Contacts with other CHC'ers, 2 points. Contacts with non-CHC members (HTH'ers) 1 point. Take double credit if QSO is with a station outside your own continent. Work K6BX, HQ station, and you get 2 extra points.

Multiplier: Sum of different countries (ARRL List) worked on each band.

Frequencies: C.W. — 3575, 7030, 14075, 21090, 28090. NOVICES: 3710, 7160, 21140. S.S.B.—3960, 3943, 7260, 7210, 14320, 14340, 21360, 21440, 28620, 28690. (DX — 3790, 3775, 7060, 7090.)

Awards: Certificates to the top scorer in each country and call areas of W/K, VE, JA, VK. In addition the 3 top stations in each continent will also receive awards. There are also World High Trophies in 3 categories: Single operator, Club stations (single transmitter only) and for portable operation.

Logs should show, date/time in GMT, station worked, exchange sent/received, band and QSO points claimed. A summary sheet showing the scoring by bands, the final score and your name and address in BLOCK LETTERS is also requested.

Contest logs may be used in lieu of QSL cards for the many CHC awards (Get list from Clif Evans, K6BX, 3212 Mesa Verde Rd., Bonita, Calif. 92002. Include s.a.s.e.).

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

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

Editor's Notes

The Dr. Harold Megibow, K2HLB Memorial Trophy for the 1967 C.W. Contest has been donated by Dr. Donald Miller, W9WNV. Many thanks Don.

The Luxembourg operation by K1DWQ/LX and W8IMZ/LX in the phone contest, was made by a couple of DL4's. QSL's may be sent to: SMSgt. Bernie Welch, DL4FS, 7310 USAF Disp. CMR Box 4488, APO

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New York 09057, or home QTH's

And the Sint Maartin multi operation by PJ5MN was a group of W9's. The QSL chores will be handled by "The DXpedition of the Month."

In the coming C. W. Contest you can expect a massive operation on all bands, 10 thru 160 (that's right, 160) by PJOCC. Last year's Multi-Multi Champs PJ3CC, the same group from the Conn. Wireless Assoc. and the Potomac Valley R.C. (See page 84, Oct. CQ).

We are all aware of the new frequency restrictions that go into effect on November 22nd, by a strange coincidence, the day before our C. W. Contest. Or is it a coincidence?

If you are not a holder of an Extra Class ticket, you had better avoid the low end of the 15, 20, 40 and 80 meter bands. Better review the table listing the frequency privileges of Extra Class and Advanced Class licenses on page 31, October 1967 *CQ*. (O.K. you can pack your gear and go on a Contest Expedition to the many spots in the Caribbean, there are no restrictions down there.)

In multi-operator stations the usable frequencies are determined by the license held by the licensee of the station being used. And *not* by the license of the individual operators.

Therefore if the station licensee, or trustee in the case of a club station, does not hold an Extra Class license, the operation of that station is limited to the provisions of the license. By the same token, the individual operators at the station cannot exceed the restrictions of the station license nor can they exceed the restrictions of their own operating license.

Any violations of the above, reported to us by the FCC, will mean disqualification of the station's score.

We solicit your logs, regardless of the length of your activity. All calls of received received logs will be published in the final results.

Mailing deadline for your phone entries is December 1st, and January 15th for the c.w. contest. Send your logs to: *CQ* Contest Committee, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

73 for now, Frank, W1WY

Q AND A

BY WILFRED M. SCHERER,* W2AEF

Determining S. S. B. Peak Power

DURING QSO's we're often asked about the determination of peak power with an s.s.b. rig as compared with the steady-state or "d.c." values.

The way we do it is to observe the r.f. envelope on an oscilloscope and note the difference between peak amplitudes during modulation and the amplitude of the signal under steady-state or c.w. conditions. The peak power is then calculated from these relationships. The procedure is as follows:

1–Connect an oscilloscope and a dummy load to the transmitter output. Use of an r.f. wattmeter also is necessary if *output*-power readings are desired; otherwise, the comparisons must be releated to *input*-power only.

2–Tune up the transmitter in the customary manner for proper loading or maximum r.f. output.

3–With the horizontal sweep of the scope reduced to zero, note the amplitude of the r.f. envelope which will appear only as a single vertical line. The amplitude may be referred to the c.r.o. graticule calibrations or determined by measurement with a ruler.

4–Also note the r.f. power output indicated by the watt-meter or note the d.c. plate-power input of the amplifier (plate ma × plate volts).

5–Switch the transmitter for the s.s.b. transmit mode and modulate with voice to normal operating levels.

6–Note the percentage of amplitude increase during the r.f. envelope peaks compared to the steady-state tune-up amplitude as observed with step 3. The percentage is found by percent increase $= 100\ (E_P - E_{DC}) \div E_{DC}$, where E_P = peak amplitude, E_{DC} = steady-state amplitude. This is the degree of *voltage* increase.

*Technical Director, *CQ*

The horizontal frequency on the scope is not used with these tests in order that the dynamic peaks during modulation will be concentrated at one point at both the top and bottom of the trace, making it easier to visually follow their amplitudes and provide better accuracy.

7–Since, with all else being equal, any increase in voltage is accompanied by a like increase in current and since $P = I \times E$, multiply the percentage determined above by 2 to find the percentage of *power* increase.

8–Determine peak envelope power from p.e.p. $= P_{DC} \times$ percent power increase $+ P_{DC}$ where P_{DC} = steady-state output or input power.

For example: if $E_{DC} = 10$ units and $E_P = 11$ units, then from step 6, percent voltage increase $= 100\ (11\text{-}10) \div 10 = 10\%$. From step 7, percent power increase $= 10\% \times 2 = 20\%$. From step 8, if P_{DC} was 100 watts, p.e.p. $= 100 \times 20\% + 100 = 120$ watts.

The peak input or output power thus found will be that for the particular modulating conditions. The amplitude relationships between the steady-state and the peak levels depends on the duty cycle of the peaks above the steady-state value (determining the average level) and on the plate-voltage regulation for the amplifier; that is, how well the filter capacitors hold up the voltage during the modulating cycle. Use of a large amount of a.l.c., compression or overdrive can raise the duty cycle and place a heavier average demand on the power supply, thus holding down the plate voltage and limiting the maximum peak power otherwise attainable. Also, because of the load demand and voltage regulation, the application of a single modulating frequency (with operation at maximum power) will not produce any higher output than the maximum possible steady-state value, while the peak power on a two-tone test signal may be only slightly higher.

Coax or Twin-Lead Feed for Window Antenna:

QUESTION: I am interested in erecting a Windom-type antenna made of 300-ohm twin lead. This antenna requires a balun to match the 300-ohm feedpoint to the 75-ohm output of the transmitter. Would it be more efficient to run a 300-ohm twin lead to a balun at the transmitter, or install the balun at the antenna feedpoint and use 75-ohm coax?

ANSWER: Use 300-ohm twin lead with the balun at the transmitter. Twin lead has less

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loss per foot than coax, so it should be a better proposition, especially at the higher frequencies and with long line lengths in which cases the line loss would be less significant.

Also, twin lead is lighter in weight, placing less strain and sag on the antenna than would coax and a balun installed at the antenna.

Although use of a balun at an antenna (such as a dipole or a beam) can be helpful in maintaining antenna balance, the Windom is an unbalanced affair anyway, so the balun at the antenna might not gain anything in this respect.

Article About Collins 75A Series of Receivers

QUESTION: Can you tell me what articles have appeared in *CQ* concerning the Collins 75A series of receivers?

ANSWER: The following articles on the 75A-type receivers have appeared in *CQ* Magazine:

"75A-1 Modifications," Sept. '51, page 21.

"Tricks with the 75A-2," Feb. '60, page 62.

"Modifying the 75A-3 for S.S.B.," Nov. '60, page 82.

"20 Kc Filter Adapter and S.S.B. Noise Limiter for 75A-4," April '60, page 32.

"General Coverage for the 75A-4," Sept. '62, page 44.

"Updating the 75A-4," Nov. '62, page 76.

"Wideband Filter for 75A-4," Jan. '64, page 50 .

"Improving the 75A-4 on S.S.B.," June '65, page 53 and Sept. '66, page 37.

"2.1 Kc Filter for the 75A-4," July '67, page 22.

Supply Source for McCoy 9 Mc S. S. B. Filters

QUESTION: Where can I obtain a 9 mc McCoy Filter for use in the CQ-150 Mark II S.S.B. Transmitter described in *CQ* Dec. '66?

ANSWER: The McCoy filters may be obtained directly from McCoy Electronics Co., Mt. Holly Springs, Pennsylvania 17065. The Silver Sentinel, Model 32B1, has a 2.8 kc bandpass at 6 db with a 6 to 50 db shape factor of 1.56:1 and is priced at $32.95. The Golden Guardian, Model 48 B1, also has a 2.8 kc bandwidth, but with a 1.44:1 shape factor and is priced at $42.95. Upper and lower sideband carrier crystals are included with both models.

T. V. I. on Channel-3 Sound

QUESTION: I am causing interference on TV Channel 3's sound while I'm transmitting with a Swan 250. The unit is clean with a dummy load, but when the antenna is connected, I might as well go into the broadcast business. The TV set is equipped with a Drake high-pass filter. What is your recommendation for a solution or dope on building a transmission line filter?

ANSWER: The difficulty could be due to a spurious response from the transmitter around Channel 3's sound frequency of 66.75 mc. Suggest you first try an open quarter-wave stub across your transmission line with the stub length related to 66.75 mc. An open quarter-wave stub at this frequency should function as a trap without adversely affecting the transmitter output (it may slightly change the loading, however). The stub length may be checked with a g.d.o. (see *CQ* July '68, page 70) or be first cut to approximate length as determined by the formula: $246/f_{mc} \times$ velocity constant of the stub, usually 0.66 for coax. For 66.75 mc it will be about 2′3″ long, but first make it slightly longer, connect it across the transmitter output and trim by cutting off 1/2″ at a time until maximum effectiveness is realized when the transmitter is operating.

A homebuilt filter is described in the ARRL *Handbook*. A good ready-built 6-meter low-pass filter is available from Drake (Model TV-1000 L.P.) or Waters (Model 373-6).

If the difficulty is due to front-end overloading of the TV set, make sure the filter used at the TV set is properly installed with all connections, including the ground, made directly at the tuner input rather than at the end of a 300-ohm lead at the back of the set.

Power-line filtering and a bottom plate on the TV chassis also may provide improvement.

Radio Astronomy Information

QUESTION: I am looking for the diagram of a transceiver for the 404-406 or 38-38.16 mc radio astronomy frequencies. Can you help me or otherwise furnish the address of radio astronomy publications?

ANSWER: We have no information on hand concerning this subject or related publications, but suggest that you communicate with Andrew Furlong of The Radio Astronomy Club at the Watchung Hills High School, Stirling Road, Warren Township, Plainfiield, N.J. 07060.

Crystal Control for Heath Cheyenne

QUESTION: How can I change a Heathkit MT-1 Cheyenne Mobile Transmitter over for

See page 150 for New Reader Service

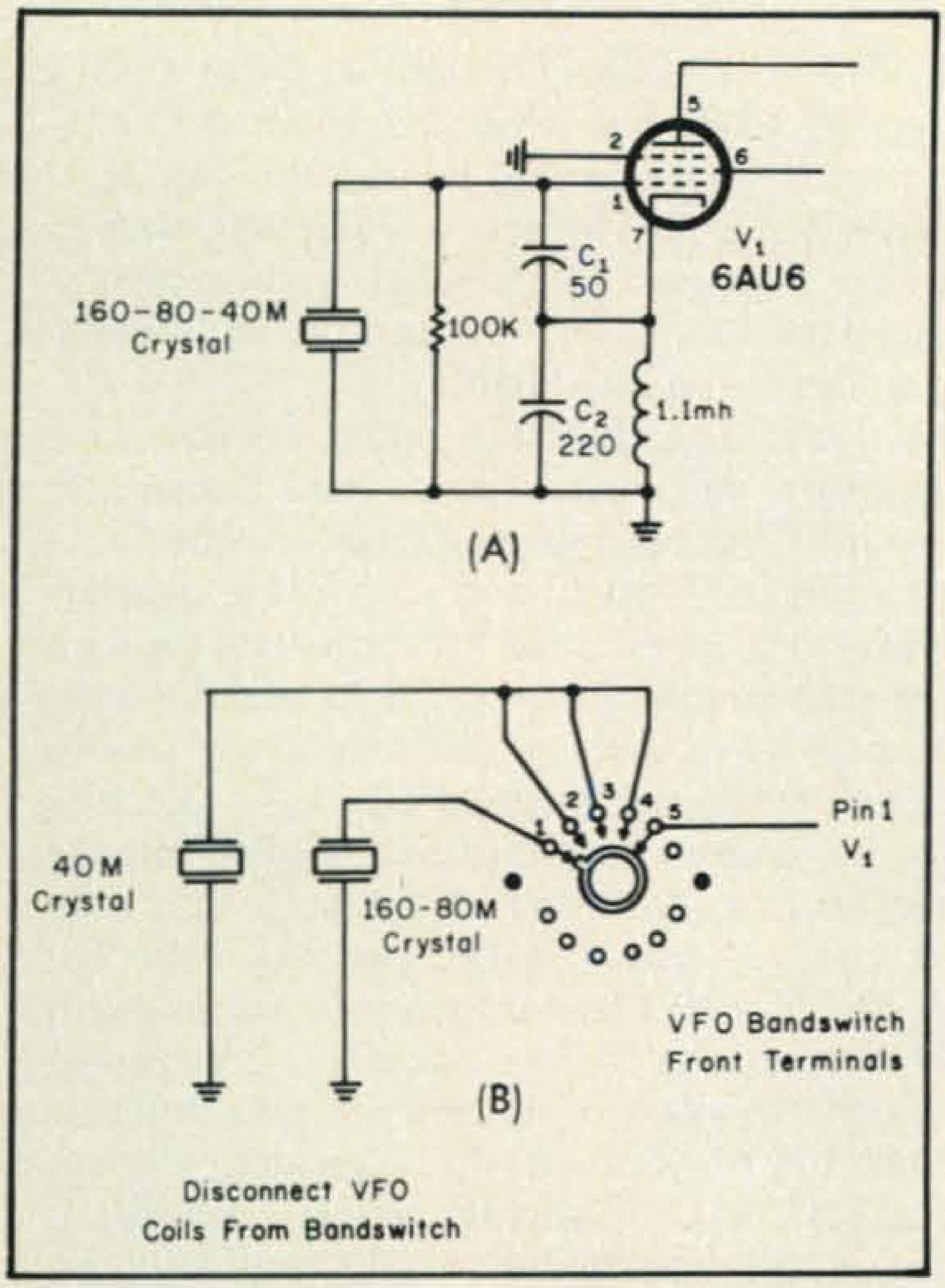

Fig. 1—Basic circuit for converting Cheyenne transmitter to crystal control. (B) Method of employing the bandswitch with circuit at (A). The b.f.o. tuned circuits must be disconnected from the switch.

crystal-control operation?

ANSWER: The Cheyenne Transmitter may be modified for crystal control operation as shown at fig. 1. The basic arrangement is at fig. 1A where one crystal socket is used without the bandswitch. If you wish to employ the bandswitch, the additional wiring is shown at fig. 1B. In either case, you might have to experiment with the size of C_2 which will be somewhere between 100 and 330 mmf. These changes will permit crystal-control only.

Increasing V. F. O. Drive for T-60 on 6 Meters

QUESTION: I do not get enough output from a Heathkit HG-10 v.f.o. to drive a Knight T-60 transmitter on 6 meters. It does a good job on the other bands. The T-60 works OK with crystals. Can an 8 mc amplifier be used between the v.f.o. and the transmitter?

ANSWER: Another reader had a similar problem some time ago in connection with driving a Globe Scout 680. The circuit for a suggested v.f.o. amplifier was shown in the Q & A column for Jan. '68, page 104. It also is applicable to the T-60.

Fading Grid Drive

QUESTION: I have a Johnson Ranger I which periodically loses grid drive on 15 and 10 meters. When the exciter tuning control is adjusted, drive can again be attained, but it keeps dropping back down. The transmitter does not do this on 80, 40 or 20. Have you any idea as to the cause?

ANSWER: Dropping off of grid drive in a transmitter may be due to a poor r.f. connection or a defective bypass capacitor. Suggest you employ a soldering iron to reheat and touch up all the soldered connections involved with the particular bands, especially at the bandswitch and the coil taps. Even though they may appear tight and also show d.c. continuity with a v.o.m., a good r.f. contact may not be present and may further deteriorate with r.f. heating.

If reheating or soldering these joints does not solve the problem, check the Ranger I capacitors C_{32}, C_{33}, C_{35} and C_{36}. Also make sure the bandswitch contacts are clean and exert proper pressure. Although the problem does not exist on the other bands, you might check the tubes, just as a matter of course.

Homemade 1 Kw Tank Coil

QUESTION: I'd like to build my own all-band plate tank for a 1 kw linear. Have you any dope on doing this?

ANSWER: An excellent homemade all-band plate-tank coil for the job was described in *CQ*, Feb. '65, page 28, under the title, "1 kw Plate-Tank Coil," (appropriately enough)!

Extending Range of Heath IG-72 A. F. Generator

QUESTION: Do you have any articles on modifying the Healthkit IG-72 Audio Generator to add another decade range?

ANSWER: We know of no articles on the subject, but another decade range (×10,000) might possibly be set up by making C_1 and C_2, for the bridged-T "notch" network, smaller by a factor of 10. This would make C_1 4.7 mmf and C_2 50 mmf; however, the actual capacitance at C_1 might turn out higher than 4.7 mmf due to circuit "strays". In all probability, C_1 could be eliminated or made a small trimmer (0.5-1.5 mmf). This would be subject to some experimentation.

The added range would have an upper limit of 1 mc, but it is questionable as to how stable it might be, how good a waveform will result and how well the calibration will be maintained.

Heath HW-16 Keying

QUESTION: When keying my Heathkit HW-16 Transceiver, the start of a character often

See page 150 for New Reader Service

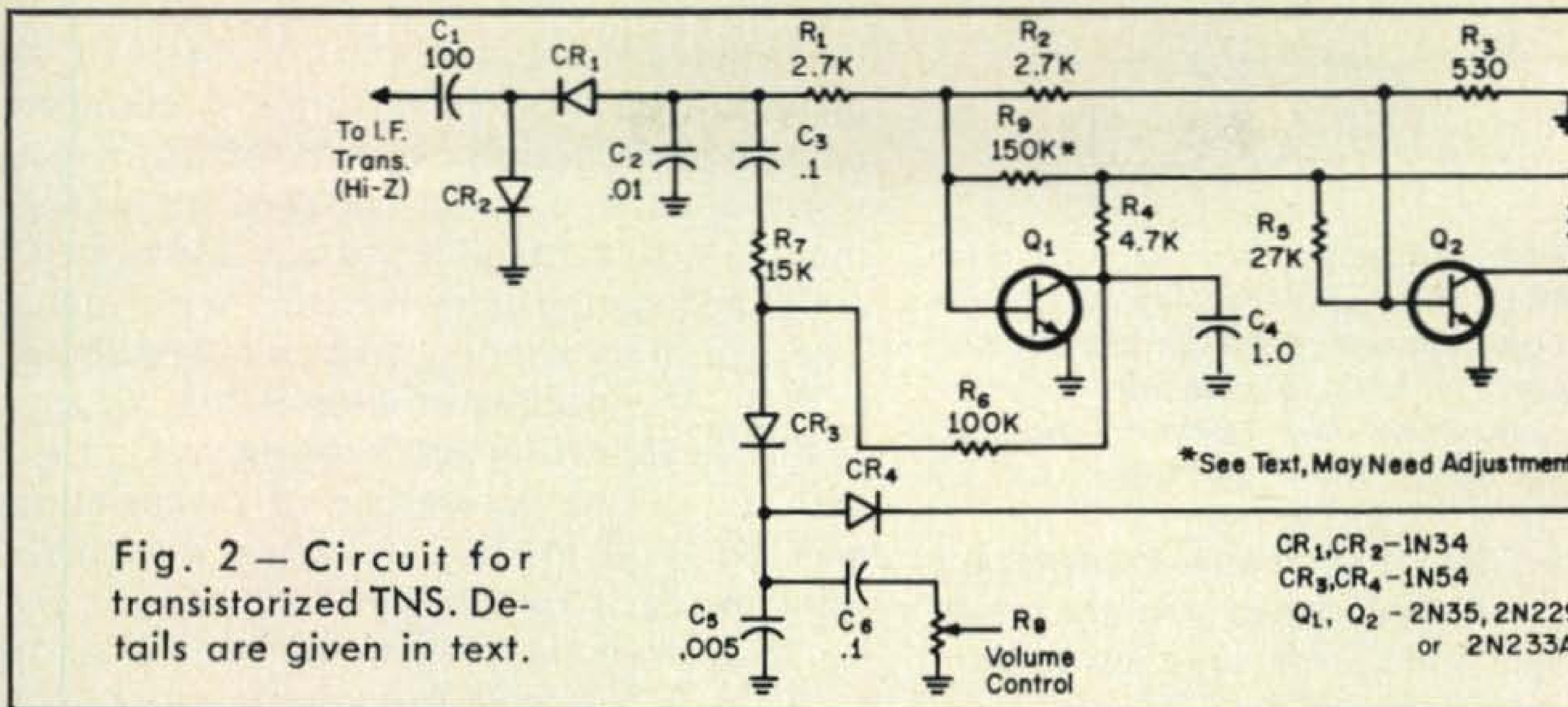

Fig. 2—Circuit for transistorized TNS. Details are given in text.

seems to be hesitant, particularly when 40-meter crystals are used. Is there any remedy?

ANSWER: Faster crystal starting and better keying without shortened dots or dashes using the HW-16 may be obtained by the installation of a 22-50 mmf capacitor between ground and pin 8 of V_7 (crystal oscillator).

Transistorized TNS Noise Limiter

QUESTION: Have you a solid-state version of the TNS Noise Limiter?

ANSWER: The circuit for a transistorized TNS, dreamed up by W4RDM, appeared in *CQ*, May '61, page 80. Since we've had quite a few requests for such a version, we'll repeat the essential data at this time. The circuit is shown at fig. 2.

The setup has the additional characteristics of full limiting and compression. The latter is advantageous for c.w., although the adjustment is critical. It is possible to bring about an almost complete phase cancellation or bring all the signals and noise to the same level. The squelch is effective when needed, but under heavy noise conditions, the squelch level and optimum noise-limiting settings do not correspond.

The squelch threshold-adjustment characteristic can be varied by slight changes in R_3, R_9 and R_5. A higher output from the receiver i.f. requires higher bias on the transistors. R_9 should be selected to give a no-signal collector current of 1-3 ma through Q_1. The value of R_3, R_9 and R_5 may be made to give complete limiting on c.w.

If very high back-resistance diodes are available, such as these used in computors, all resistance values may be increased by the same multiplication factor and capacitor values divided by the same factor. The bias on each transistor should be the same (about −0.2 volts).

Note that this TNS includes its own detector (D_1, D_2) and is one that provides greater output than conventional circuits. When used with a vacuum-tube receiver, the positive 9-15 v. may be obtained from the cathode of the a.f. output tube.

Heath HW-16 on 14 MC

QUESTION: Would it be possible to modify the Healthkit HW-16 Novice C.W. Transceiver for 14 mc operation in place of one of the other bands?

ANSWER: Yes, but not for Novice licensees'. The job could be done by padding the 15-meter inductors for the transmitter-driver and the receiver r.f. and mixer stages, moving the p.a. plate-tank tap and changing the 15-meter band heterodyning crystal for the receiver to 19.545 mc.

Cutting out one of the other bands instead, would involve altering or changing the associated inductors and capacitors for the stages mentioned above, as well as selecting another p.a. tank tap.

Tuned Loudspeaker for C. W.

Here is an interesting idea suggested by Dave Atkins, W6VX. It is a tuned loudspeaker that cuts down the unwanted noise and peaks up a desired c.w. signal, resulting in an improved signal-to-noise ratio.

Dave's description of the setup is as follows:

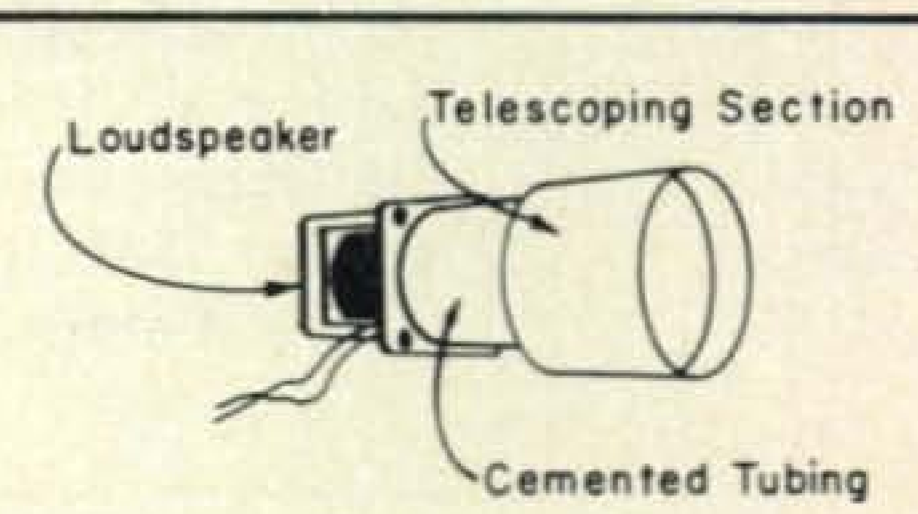

Fig. 3—Tuned speaker for c.w. using an acoustical resonator made of mailing tubes as shown here.

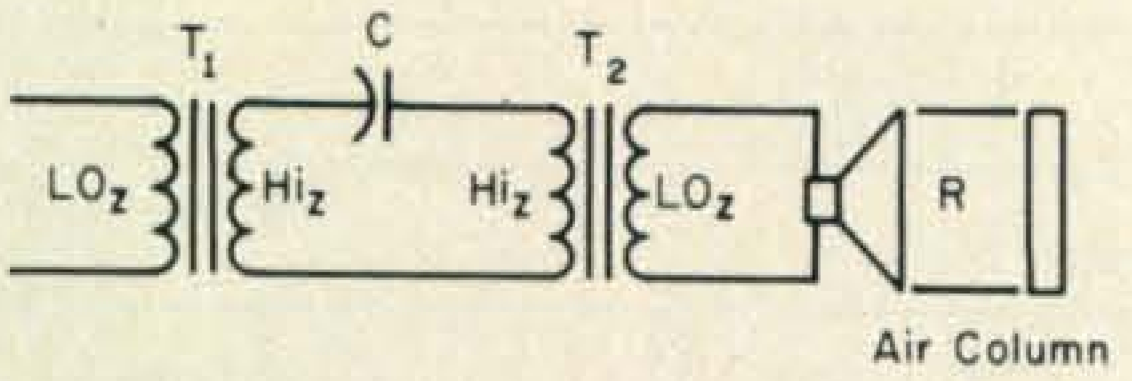

Fig. 4—Circuit for sharpening overall resonance using two plate-to-voice-coil transformers back-to-back. The high-impedance windings of T_1 and T_2 are resonated with C to coincide with the resonant frequency of the paper-tubing air-column resonator. See text.

A wide band device such as a loudspeaker is not exactly desireable when you are trying to copy a single tone from another station. Improved results may be had by putting a resonator in front of the cone of a small speaker (fig. 3). This consists of nothing more than a short section of mailing-tube.

In this case, it wound up being less than 2½ inches long by one and five eighths inches in diameter. The air column is tuned by another telescoping section, one half inch long. 1300 c.p.s. is the frequency used here since there is already an audio filter of this frequency in one of receivers used in tests. This approximate frequency is near the center of the passband used in the usual s.s.b./c.w. receiver. For receivers with narrower i.f. passbands, a longer tuning section resonating near 800 c.p.s. gives somewhat better *Q*, judging from experimenting with tubing length. Receivers with separate b.f.o. control could use this lower frequency to advantage, as then the received signal may be placed in the passband and the second harmonic of the resonator will not fall on the station up band about 800 c.p.s. further. For example, with a resonant speaker on a receiver with no b.f.o. control, a frequency not much below 1500 c.p.s. is satisfactory with a passband around 2.5kc. The second harmonic will be on the upper skirt where it will be attenuated. Tests with a 3.1kc bandpass i.f. and a tunable b.f.o. show an appreciable reduction of noise from QRM and electrical hash.

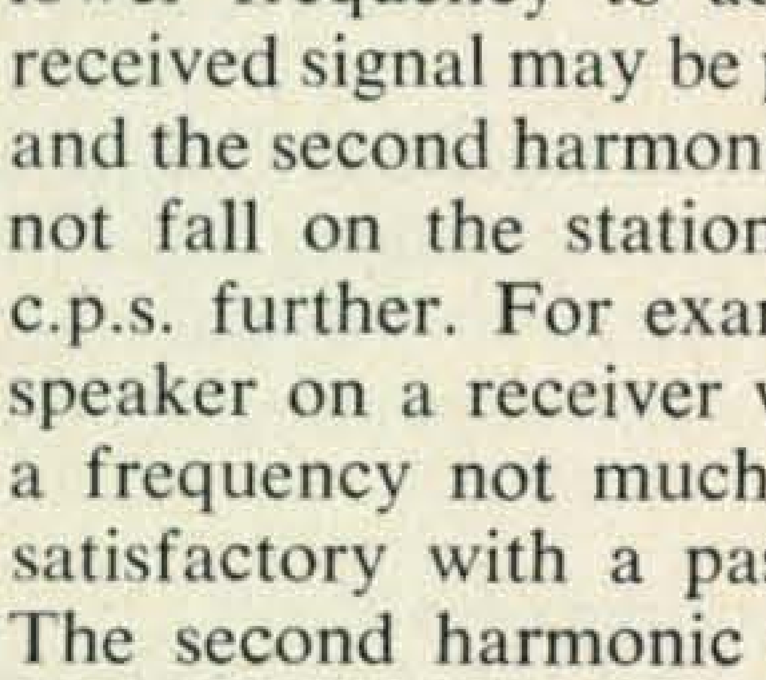

Fig. 5—Circuit for eliminating key clicks with the Eico 753 Transceiver. See text for details.

An added circuit (fig. 4), consists of two plate-to-voice-coil transformers, connected back to back, coupled by a capacitor in series resonant configuration. The *Q* of this arrangement is not outstanding either, however, the combined tuning improves the performance. These primary windings each showed about 3 henrys. A capacitor of near 0.003 mf tunes to the speaker resonant frequency. A v.t.v.m. with a.c. probe across one of the primaries may be used to indicate when the correct capacitance is found. Final adjustment may be made with the telescoping section on the speaker. A beat note from the receiver, or an oscillator may be used to furnish a signal to the tuned system. One voice coil secondary is connected to the a.c. source, the other to the tuned speaker.

Unfortunately a signal at zero beat is still a thing difficult to eliminate. One that is off to one side may be dropped to a level so your built-in computer and some concentration will permit copy. Only a sharp audio filter or single crystal can do the job when it comes to almost zero beat competition. This c.w. aid is for DX men with tender ears.

More on Eico 753 Key Clicks

Here is a unique approach for curing key clicks with the Eico 753 Transceiver or possibly with other rigs. It is suggested by R. M. McIntosh, K6AQA, who had less success than we did with inductive filtering as described a short time ago.

K6AQA's comments with details on his solution are as follows (the circuit is shown at fig. 5):

"I have tried inductive filtering, but with little or no success. This is probably due to the fact that the key current is only 1 m.a. and I did not have a large enough choke. The clicks are caused on the make, not the break. This is because the key instantly discharges the internal .1 mf capacitor.

My solution was to install a constant-current generator in series with the key to limit the turn-on time. R_1 is adjusted to permit twice the normal current flow to the key. Half of this current comes from the Eico unit and half from C_1. When C_1 is completely discharged, its potential will be nearly zero volts. If a resistor alone is used, it would have to be quite large and the resulting voltage drop would prevent the Eico unit from working.

I have used this for one year with my Eico 753 and a 1 kw linear."

Well thought out, Bob. Many thanks. ■

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VHF TODAY

BY ALLEN KATZ,* K2UYH

IN the past months this column has run, we have devoted much space to the theory of v.h.f. amateur radio, but we have devoted little space to one aspect of amateur radio without which all theory becomes meaningless. That aspect is "measurement." Many hams try to get by on blind faith and pure intuition. Most of these fellows end up fooling themselves. It is very hard to admit (after spending many hours and much money) that the new high power final you have just constructed is not giving the output it should or that the noise figure of your new preamp is not what its transistor specifications would indicate it would be. On the other hand it is very easy to blame your equipment when the fellow in the next town makes a contact you cannot duplicate. Guesswork does not yield states worked. The only way you can know where you stand is to make measurements and keep a record of them. We plan in the months to come to discuss various v.h.f. measurement techniques, explaining their importance and how they can be accomplished by amateurs.

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

1296 mc source antenna on the ground.

Antenna Measurement Contests

The consequences of accepting the performance of v.h.f. antennas on faith have proven so disastrous that a new form of amateur activity has developed—the antenna measurement contest. The purpose of these contests is to indicate which antenna design can produce the largest gain. Scores "of-course" in many cases depend more on the builder than the design, but even these results prove valuable since they indicate which designs are more critical. Often a size factor is included in the contest scoring since, at least in theory, the gain of an antenna should increase with size.

We had the opportunity of attending the second annual Central New Jersey VHF Society Antenna Measuring contest. It was organized by Paul, WA2ZZP, and seemed much better planned than the last one during which it rained. Antennas were judged solely on the basis of gain and pains were taken to insure the accuracy of the measurements (a feat easier said than done). Entries were accepted for both the 432 and 1296 mc bands, and the test range was assembled as shown in fig. 1. The source antenna heights were increased over the previous year and corner reflectors were used to limit ground reflections. Stable r.f. power sources were supplied by Cliff, W2CCY for 1296 mc and by myself for 432 mc. Commercial mains was used to supply a.c. to these transmitters. Last year an auto battery had been used as the primary source of power and there was some question as to its condition at the end of the contest. Antenna gain was determined by measuring the power received by the antenna under test

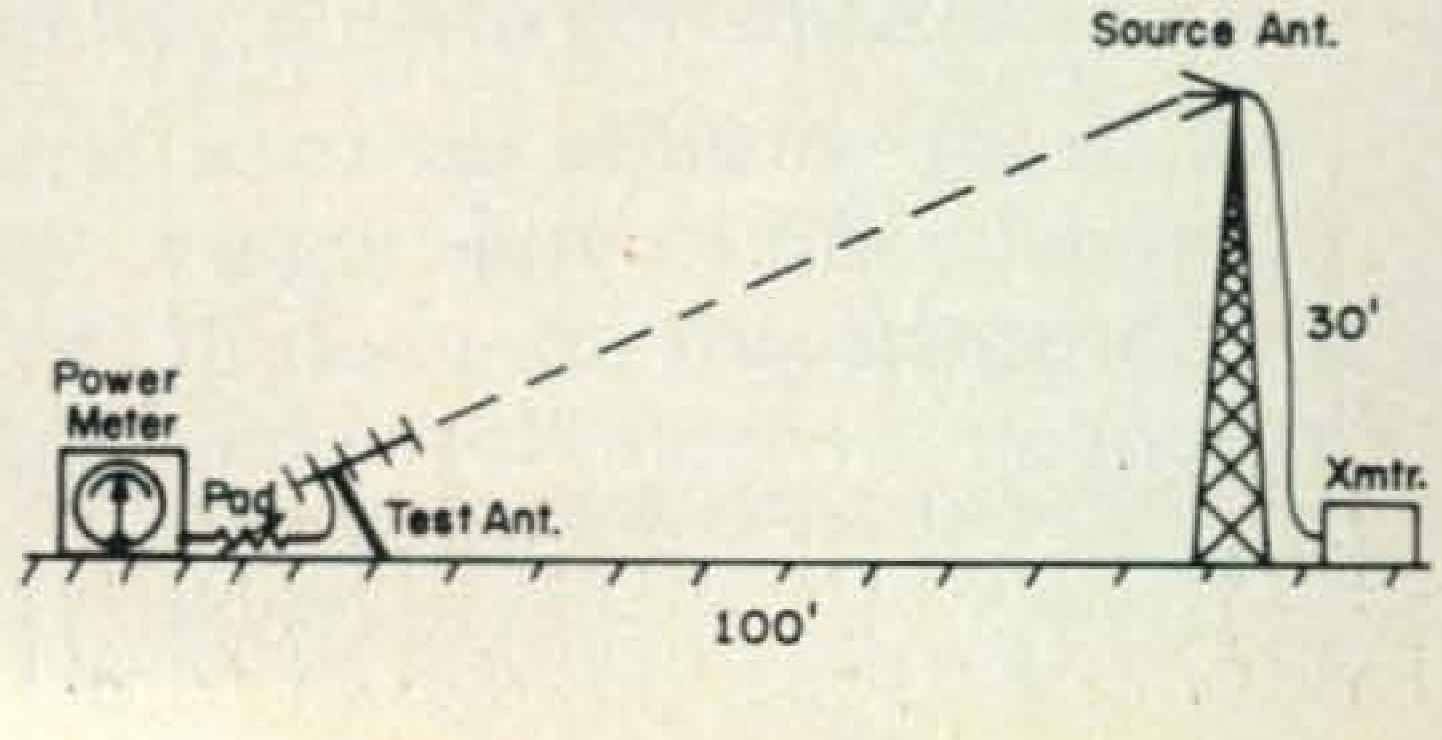

Fig. 1—Antenna measurement contest test range.

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K2PPZ's 7' dish.

"Krauss Can't Be That Wrong." W2CQH with 1296 mc quad helix. Directly to Reed's right is W2CCY and K2UYH. At far right can be seen W2CCY's large h.b. horn.

on H.P. power meter (also supplied by W2CCY).

Much of the local 432 and 1296 mc gang showed up for the contest: the results of which are shown in figs. 2 and 3. On 1296 dishes, by far, upon the day. First place was essentially a tie between Pat, K2PPZ and W2CCY. Cliff won the contest officially by readjusting his feed antenna for an extra 0.1 db. Both antennas were seven foot parabolic reflectors constructed on a concrete mold. The mold was a joint project of Pat, Cliff, and Reed, W2CQH. We plan to have information on this and other methods of dish construction in a future column. The only difference between the two dishes was that Pat's was constructed from aluminum mesh, while Cliff's was solid.

Horns also made a nice showing, however, in the larger sizes they really cannot compete with the dishes because of their large depth dimension. Horn construction apparently is just about fool proof. WB2TBA entered a horn which he made by simply soldering pieces of galvanized iron together. It scored 0.1 db higher than the commercial standard gain horn it was modeled after (also entered in the contest). We captured the booby prize with a much-used corner reflector. It scored 2.2 db with a mud wasp's nest in the balum. We discovered the nest after the contest. On 432 mc we faired a little better, taking second place with a 24 element colinear-yagi. Bill, K2TKN, took first place with a pair of colinear-yagis stacked horizontally. This antenna looks like a colinear except for two halfwave parasitic directors placed in front of the fullwave collinear elements. We have used this type of antenna on 432 mc for several years now with excellent results. See the March 1966 CQ VHF column for colinear yagi details.

Although the above results indicate certain patterns, they do deserve further interpretation. On 1296 mc the first antenna tested was a standard gain horn belonging to Olie,

CALL	ANTENNA TYPE	GAIN db
W2CCY	7 ft. (same as above with feed readjusted)	25.9
W2CCY	7 ft. solid dish (home brew)	25.8
K2PPZ	7 ft. dish (aluminum mesh) H.B.	25.8
W3PZK	4 ft. home-brew dish (hardware cloth)	19.7
W2CCY	Large home brew horn	19.5
K3MAW	32 el. collinear (beautifully const.)	16.5
W2CQH	Quad helix (same as below without tripod)	16.0
K2PPZ	6 ft. cylindrical parabola (col. feed)	15.9
K3MAW	15.5 db standard gain horn horn	15.5
WB2TBA	Home-brew horn	15.4
WA2ZZF	L.E.C. (Commercial) horn	15.4
W2CQH	Quad helix 11 turns	14.2
K2TKN	Corner reflector	11.9
W2IMU	Slotted dipole	6.7
K2RMD	Quad helix 10 turns	6.7
K2UYH	Corner reflector (same as below)	2.2
K2UYH	Corner reflector	0.9

Fig. 2—Results of 1296 mc antenna measuring contest. Gains are specified with respect to an isotropic antenna. Many contests in the past have referenced their gains to a dipole, however, the present industrial practice is to specify antenna gains with respect to an isotropic radiator and this was the standard adopted here. To convert these gain measurements to the dipole reference simply subtract 2.1 db.

WA2FGK with 24 element collinear yagi.

K3MAW. Olie had calibration curves for this horn which showed it to have a gain of 15.5 db on 1296 mc. This antenna was used as a reference for calculating the gain of all other 1296 mc antennas tested. The presence of this antenna was fortunate. Antenna measurement contests usually have a dipole as their reference antenna. One of the major stumbling blocks to accurate antenna gain measurement, however, is the problem of ground reflections. To lessen this problem

CALL	ANTENNA TYPE	GAIN db
K2TKN	48 el. collinear yagi with screen ref.	13.5
W2SJU	48 el. (W6AJF) collinear	11.3
WA2FGK/ K2UYH	24 el. collinear-yagi	10.6
WA2ZZF	11 el. tilton yagi	10.2
WA2ZZF	EIA Reference Antenna	9.8
K2TKN	Dipole	4.2
K3MAW	Corner reflector	4.0
WB2MMM	13 el. Hy Gain yagi (off top)	4.0

Fig. 3—Results of 432 mc antenna measuring contest. Gains are specified with respect to isotropic radiator.

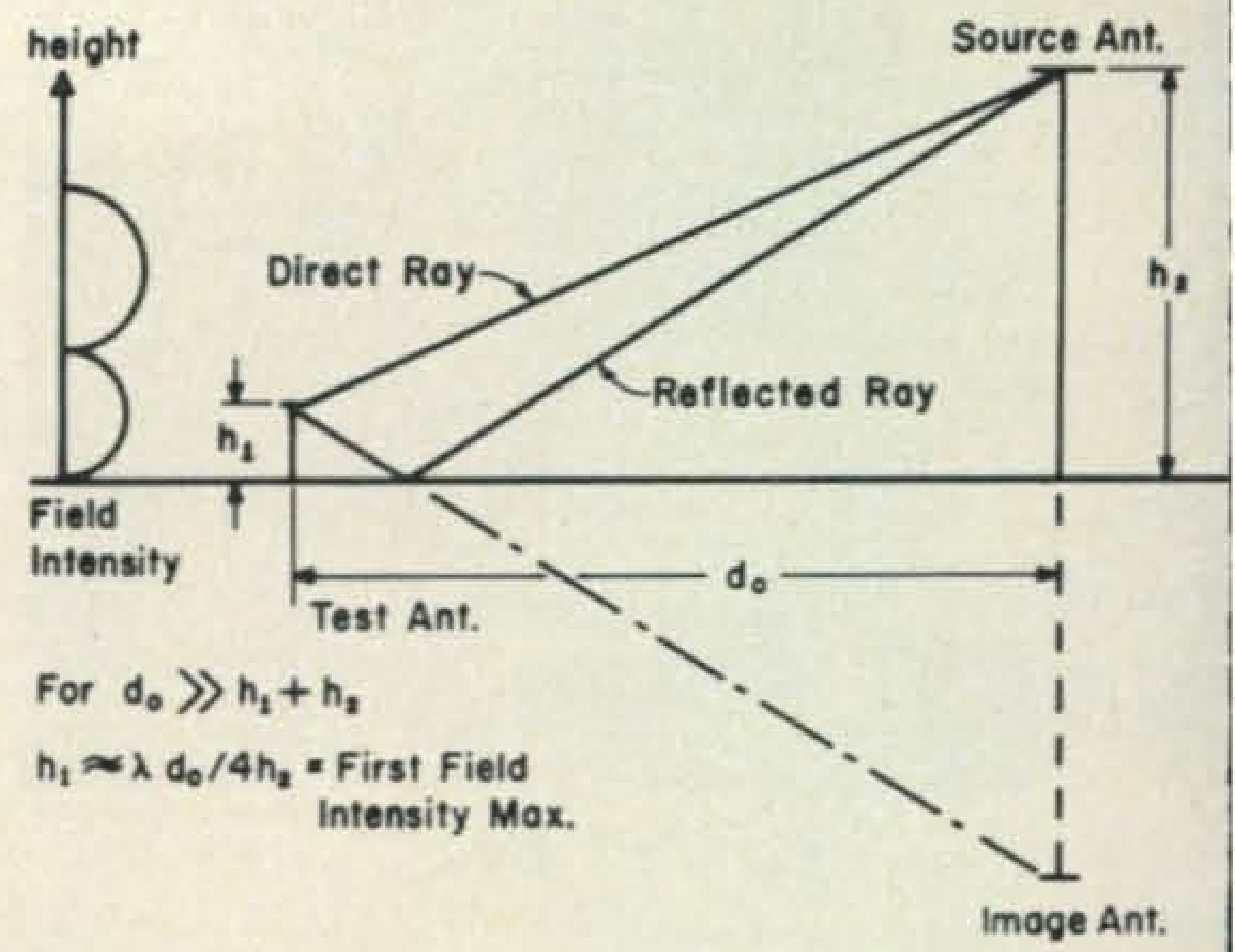

Fig. 4—Effect of ground on antenna measurements.

the source antenna is usually elevated so that the test antenna looks up to it at an angle. This arrangement does not so much lessen ground reflections as it moves them to the rear of the antenna under test. High gain antennas tend to have high front to back ratios and reject the reflected signal coming in from the back. Thus relative gain measurements between high gain antennas are more accurate than between high and low gain antennas (which do not reject the reflected signal). The dipole entered by Dick, W2IMU, measured 6.7 db. By probing the field with the dipole, Dick found that a 5 db variation in gain could be obtained by moving the dipole up and down, but that the field was essentially flat with horizontal motion. The pattern indicated is typical of a situation where ground reflections exist and is particularly detrimental to the measured gain of antennas that have a large vertical (aperture) dimension as an array of dipoles stacked one on top of the other; see fig. 4. No field probing

[*Continued on page 134*]

W2CCY's 7' dish.

THE awards PROGRAM

BY ED HOPPER,* W2GT

THE November, "Story of The Month", about Bill, K4ISE following this information on awards issued. A USA-CA-2500 award was earned by Phil, WA0EVO. Bob, W2OST received a USA-CA-2000 award endorsed All 14 mc s.s.b., as well as USA-CA-500, 1000, and 1500 awards. Dean, K7JWZ also kept me busy making out awards for him, including a USA-CA-2000 award (3rd to 7th district and 1st to Idaho), also USA-CA-1500, 1000, and 500 awards. John WA5TOS (ex-WB2LZF/W9OIJ) qualified for a mixed USA-CA-1500 award. Mixed USA-CA-1000 awards went to Don, W2GA (exWA2WEE) and Ennis, W3CDG. John, WA8YSQ received a USA-CA-500 award endorsed All 2 X s.s.b. Wilberta (Willie), WN7IRD, with much help and encouragement from Hank, WB2RMM, received a USA-CA-500 award endorsed All A-1 (1st to a Novice in Oregon, in fact 1st to a Novice in the 7th call area). Mixed USA-CA-500 awards went to Bob, W4BA and Oscar OZ7ON (2nd to Denmark).

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

USA-CA HONOR ROLL

2500	WA0EVO	32
2000	W2OST	49
	K7JWZ	50
1500	W5TOS/W9OIJ	77
	W2OST	78
	K7JWZ	79
1000	W3CDG	133
	W2GA	134
	W2OST	135
	K7JWZ	136
500	OZ7ON	678
	WA8YSQ	679
	W2OST	680
	W4BA	681
	K7JWZ	682
	WN7IRD	683

William S. Todd, K4ISE

Born in Bound Brook, Somerset County, New Jersey in February 1920, Bill attended schools there and graduated from Bound Brook High School in 1938.

He entered the U.S. Army as a Private as the clouds of WWII grew darker. Leaving Langley Field, Virginia in July 1942, Bill was to spend three years in Europe before returning to the U.S. and being separated from the service in October 1945.

But many good things happened to Bill during that period in Europe, and probably the nicest was meeting Enid Williams of Aberysthwyth, Wales and they were married in 1944.

K4ISE's neat layout.

K4ISE antennas, including TV and mobile ones.

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NaBaGe Certificate.

Bill and Enid have three children. Tom, age 21, will enter the nuclear powered submarine service of the U.S. Navy after graduation from the University of Missouri at Columbia, Missouri in January 1969. Richard, age 18, is a sophomore at Raleigh, N.C., majoring in aero-space engineering. He is in the ROTC program and probably will not desert the Army like Tom did, Hi. Karen, age 14, is a ninth grader.

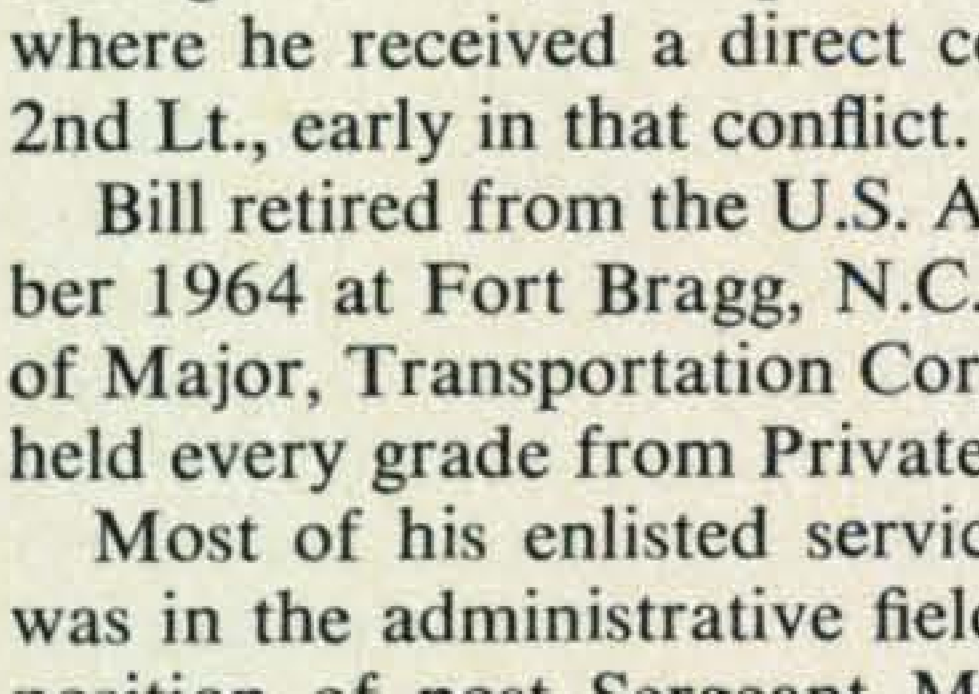
Now back to Bill—After his service in Europe, an attempt was made to adjust to civilian life for a couple of years in Bound Brook but in 1948, during the crisis in Greece and the beginning of the rumblings in Korea, Bill found himself back in uniform.

So, in addition to the three years in Europe during the war, Bill spent a year in Korea where he received a direct commission as a 2nd Lt., early in that conflict.

Bill retired from the U.S. Army in September 1964 at Fort Bragg, N.C., with the rank of Major, Transportation Corps, after having held every grade from Private on up.

Most of his enlisted service in the Army was in the administrative field, including the position of post Sergeant Major. He sailed aboard U.S. Army Transports as ship's Sergeant Major when the U.S. Army had the largest "Navy" in the world.

Other interesting assignments include: teaching for 3 years at the U.S. Army Transportation School, Fort Eustis, Virginia; two years near Tokyo, where Bill and family visited much of Japan; stationed in Germany from 1959 to 1962 and during this period Bill and family traveled and camped in every west European country except the Scandinavian countries.



Texas NAHC Award.

Upon returning from Germany in 1962, Bill was assigned to the U.S. Army Center for Special Warfare (now called the John F. Kennedy Center for Special Warfare), with his final two years of service divided between the 5th and 6th Special Forces Group (Airborne) at Fort Bragg with the "Green Berets".

Bill has been involved in both cub scouting and boy scouting for years. While serving as a scoutmaster with a troop in Newport News, Virginia, and in testing the boys for their merit badges. Bill picked up an avid enthusiasm for ham radio which has never dwindled. Tom, his older boy who was then 11, also became interested and acquired his Novice ticket, KN4IPH, but they soon moved to Germany where Tom was unable to operate and his interest soon waned.

While in Germany, Bill operated DL4ZM. He was also the custodian for the Mannheim Youth Activities (MYA) club station DL5MYA for three years. MYA sponsored code and theory classes for not only the youth of the area but even for some adults who were to develop an interest in ham radio. The scouting program was also supported, especially in the testing for merit badges.

Bill was introduced to county hunting by Otts, K8CIR on May 29, 1964 and this was immediately followed by words of encouragement from Lou, K8IWI, who needed Cumberland county, N.C.

County Hunting began in earnest when Bill went to Omaha, Nebraska in September 1964. 500 counties were acquired by December, 1000 by the end of January 1965 and 1500 by June. Confirmations and the necessary paper work took a little longer, and it took two more years to acquire the next 500, mostly due to limited time for radio. By September 1967, 2000 had been worked and 2500 by April 1968 and the present score is 2620 confirmed with another 70 worked but not yet confirmed.

One of the earliest "friends" that Bill made with county hunting was Joe, W2JWK back in October 1964 and Bill has had the pleasure of giving Joe some 50 counties while mobiling and also had the pleasure of visiting Joe a few times but so far has been unable to get Joe and family down to N.C. for a return visit.

Other "renown" county hunters that Bill has had the opportunity to visit include, Vic,

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W∅GYM; Art, W∅MCX; Charlie, W∅JWD (now W∅BL); Harry, K8KOM; Glenn, K8VZW; Earl, K9UTI; Mac, W9ICF; Gene, WA4NBC; Bob, K9WSL; Mike, K4PNG; and Ben, W5HDK. Although not classed as a county-hunter, but rather a county-giver, "Little George", W4BPC has also been visited.

The rig at home is an HT-32-B transmitter (no linear), SX 101-A receiver, a tri-bander TA-33, and inverted V's for 40 and 75 meters. The rig in the Volkswagen is an HW-22.

Bill completed high school near the end of the depression and thus did not have the opportunity to go to college. When thinking about retirement from the service, this lack of education loomed big. So he completed three and one-half years of undergraduate work during the last five years of service, this being all on a part-time evening basis. In order to garner enough credits, he attended the University of Virginia, William and Mary College, University of Maryland, University of Calfornia, East Carolina College, Southeastern Baptist Theological Seminary (although Bill is Catholic), North Carolina State University, and the University of Omaha, at Omaha, Nebraska and graduated from there in January 1965 with a B. G. E. (Bachelor of General Education) and a major in Geography.

Enrolling at East Carolina University at Greenville, N.C. in March 1965 to begin work for a Master of Arts (M.A.) degree, Bill was fortunate to be offered a teaching fellowship while there. The requirements were completed and Bill was awarded his M.A. with a major in Geography.

In July 1966, almost two years after retirement, Bill thought it best to go back to work. Although his advanced education had been geared towards teaching Geography in a small college, he could not resist the opportunity to return to the U.S. Army, this time as a civil service employee.

For the past two years he has been employed as a Geographer with the U.S. Army's Continental Army Command Intelligence Center at Fort Bragg, N.C.

Bill has continued his education towards the Doctor of Philosophy (Ph.D.) on a part time basis, but he will probably have to take a year out to complete the residence requirements on campus. In the meantime he is also doing some moonlighting, teaching Geography at the Fort Bragg Branch of North Carolina State University (no wonder he has not been active on the bands of late—Hi).

Cherry Blossom Award.

Much gratitude must be passed along to the many mobileers, as Bill insists they are so very important to the net and county hunting.

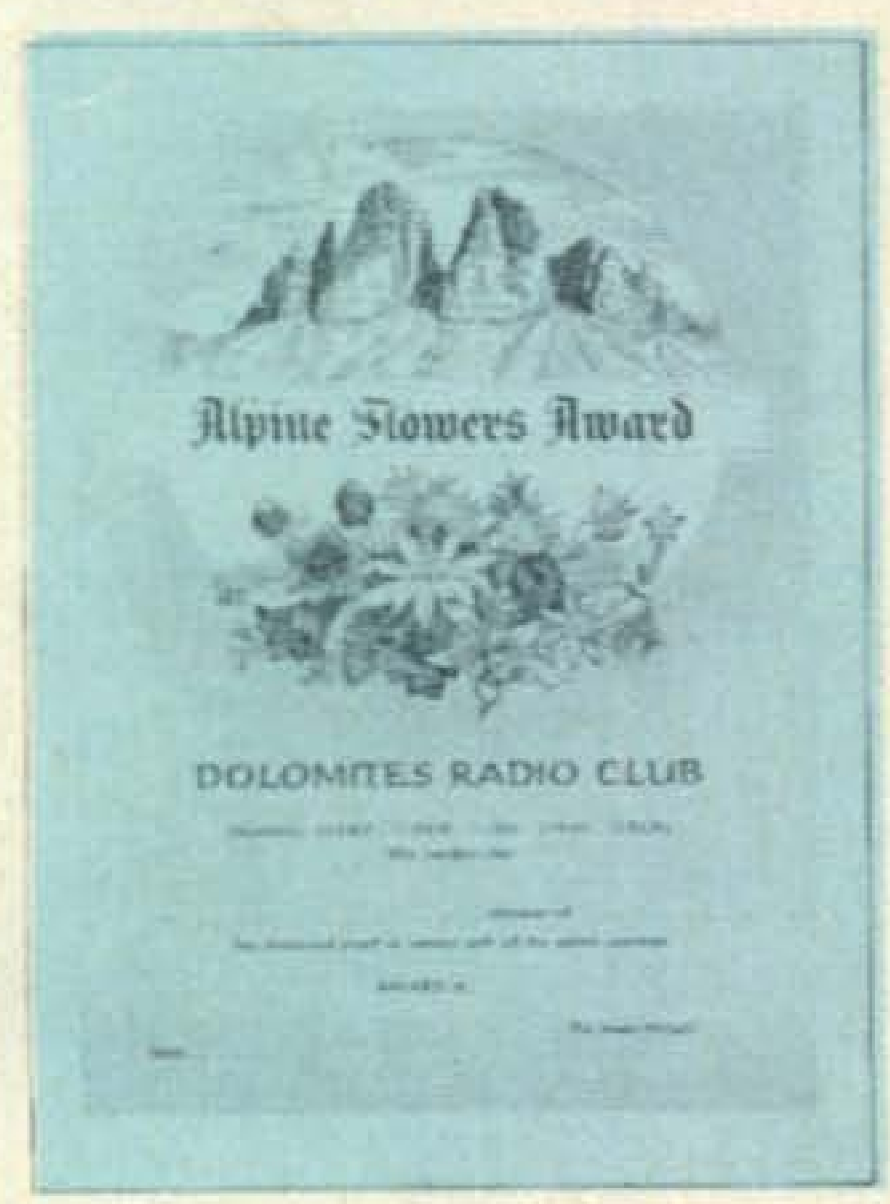
To conclude this story on a high note—effective 8 July 1968, Bill received a fine promotion and is now a computer systems analyst—more headaches, worries, responsibilities and less time for COUNTY HUNTING—but, CONGRATULATIONS!

Letters

Vic, W∅GYM, writes: "I'm very proud of the PLAQUE and it hangs in a prominent spot in my shack. Several county hunters have stopped by to say hello, including, Leo, WA5AEB; Jack, W5DAU; John, W5EHY and XYL; WA∅EVO, Phil; WA∅KGD, Mike and XYL; K7JWZ, Dean and XYL; WA∅LRQ, Corwin; WA∅LPA, George and XYL; W5OYG, John and XYL; also WA9-FZR and son, WA9FZU. It is sure a great pleasure to meet the hams you have worked many times."

Mas, K6PIH, writes: "Received my WAJA Award from JARL. This award is equal to our WAS award and is issued by JARL for working all Japan's 46 prefectures. They also issue AJD award for working all 10 Japan call

[*Continued on page 141*]



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THE RADIO AMATEUR'S JOURNAL

CQ

Be it known to all those present, that on this day ______

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1000 COUNTIES

1500 COUNTIES

3000 COUNTIES

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RULES and PROGRAM

The United States of America Counties Award sponsored by **CQ**, is issued for confirmed contacts with specified numbers of U.S. counties under Rules and conditions hereafter stated.

A. Awards Classes:

The USA-CA is issued in seven (7) different classes, each a separate achievement as endorsed on the basic certificate by use of special seals for higher class. Also, special endorsements will be made for all one band or mode operations subject to the rules.

Class	Counties Required	States Required
USA-500	500	any
USA-1000	1000	25
USA-1500	1500	45
USA-2000	2000	50
USA-2500	2500	50
USA-3000	3000	50

USA-3079-CA for ALL counties and Special Honors Plaque

B. Conditions:

1—USA-CA is available to all licensed amateurs everywhere in the world and is issued to them as individuals for all county contacts made, regardless of calls held, operating QTHs or dates whatever.

Special USA-CA's also available to s.w.l.'s on a heard basis.

2—All contacts must be confirmed by QSL and such QSLs must be in one's possession for identification by certification officials.

3—Any QSL card found to be altered in any way disqualifies applicant.

C. County Identity:

1—The Directory of Post Offices (P.O.D. Publication #26) will be the official guide in determining identity of counties of contact as ascertained by name or nearest municipality. It is suggested a copy of P.O.D. Publication #26 be obtained to facilitate operating reference and precheck cards for application purpose. Publication #26 is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Price $2.75).

2—Unless otherwise indicated on QSL cards, the QTH printed on cards will determine county identity.

3—For mobile and portable operations the postmark shall identify the county unless information stated on QSL cards make other positive identity. When in doubt of location, mobile stations should name the nearest municipality as identified by road sign or road map.

4—In the case of Cities, Parks or Reservations not within counties proper, applicants may claim any one of adjoining counties for credit.

D. Administration of USA-CA Program:

1—The USA-CA program will be administered by a **CQ** staff member acting as USA-CA Custodian, and all applications and related correspondence should be sent direct to him at his QTH.

2—Decisions of the Custodian in administering these Rules and their interpretation including future amendments are final.

E. Record Book and Bookkeeping:

1—The scope of USA-CA makes it mandatory that special Record Books be used for application. For this purpose, **CQ** has provided a 108 page 8½ x 11" Record Book which contains application and certification forms, a USA county map, maps of each of the 50 U.S. States showing county outline, and which provides record-log space meeting the conditions of any Class award and/or endorsement requested.

2—A completed USA-CA Record Book constitutes medium of basic application and becomes the property of **CQ** for record purposes. On subsequent applications for either higher classes or for special endorsements, applicant may use additional Record Books to list required data or may make up own alphabetical lists conforming to requirements. In this connection, through a printer's bust, the Record books left out the column for naming Cities/Towns, mandatory to validate County identity, so it is suggested that the time/date column be renamed and used for this purpose.

3—Record Books are to be obtained directly from **CQ**, 14 Vanderventer Ave., Port Washington, L.I., N.Y. for $1.25 each. Recommend two be obtained, one for application use and one for personal file copy.

F. Application:

1—Make Record Book entries necessary for county identity and enter other log data necessary to satisfy any special endorsements (band-mode) requested. It is mandatory that Cities and Towns or other specific location be named.

2—Complete application forms provided in Record Book, or, if preparing own lists for later applications, use special application forms available from the Custodian for s.a.s.e. or 1 IRC.

3—Have the certification form provided signed by two licensed amateurs (General Class or higher) or an official of a national-level radio organization or affiliated club, verifying that QSL cards for all contacts as listed have been seen. The USA-CA Custodian reserves the right to request any specific cards to satisfy any doubt whatever. In such cases applicant should send sufficient postage for return of cards by registered mail.

4—Send original completed Record Book and certification forms and handling fee of $1.00 U.S. or 10 IRC's to USA-CA Custodian, Ed Hopper, W2GT, 103 Whittman St., Rochelle Park, N.J. For later applications for higher class seals, send either Record Book or self prepared list per the rules and 25¢ or 3 IRC's handling charge. For application for later special endorsements (Band/Mode) where certificates must be returned for endorsement, send certificate and 50¢ or 5 IRC's for handling charges. Note: At the time any USA-CA award certificate is being processed there are no charges other than the basic fee regardless of number of endorsements or seals; likewise, one may skip lower classes of USA-CA and get higher classes without losing any lower awards credits or paying any fee for them.

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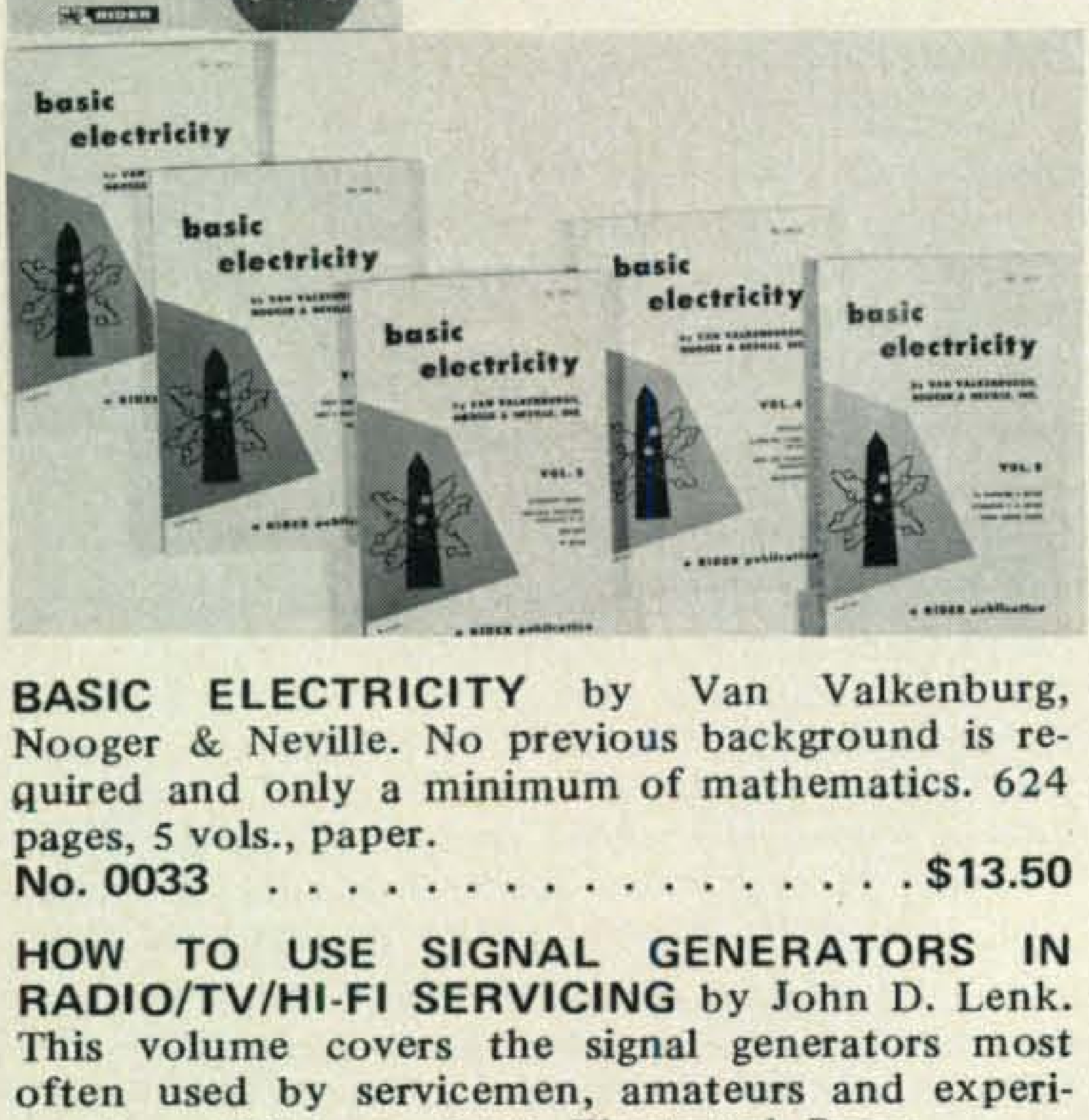

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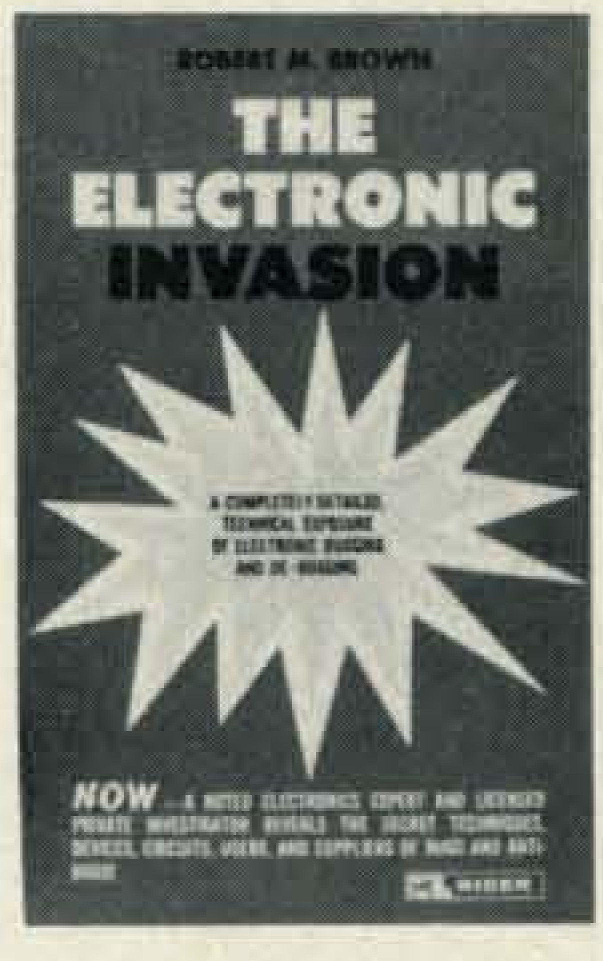

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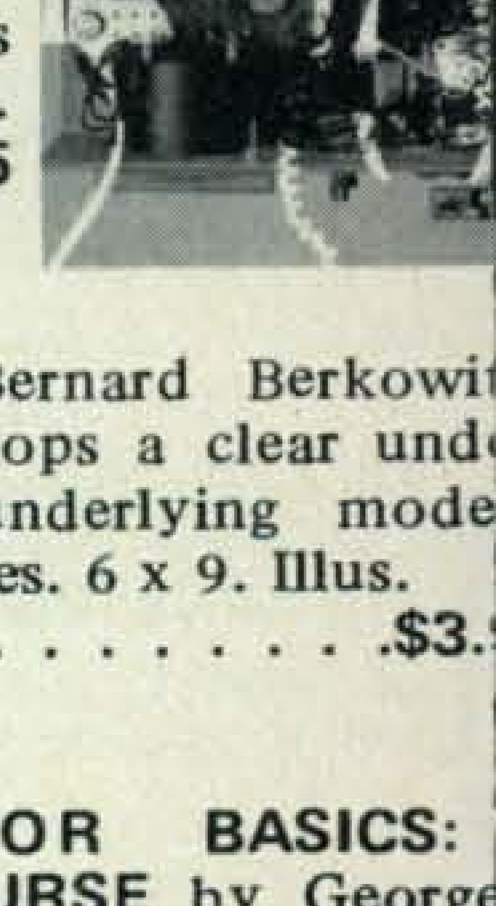

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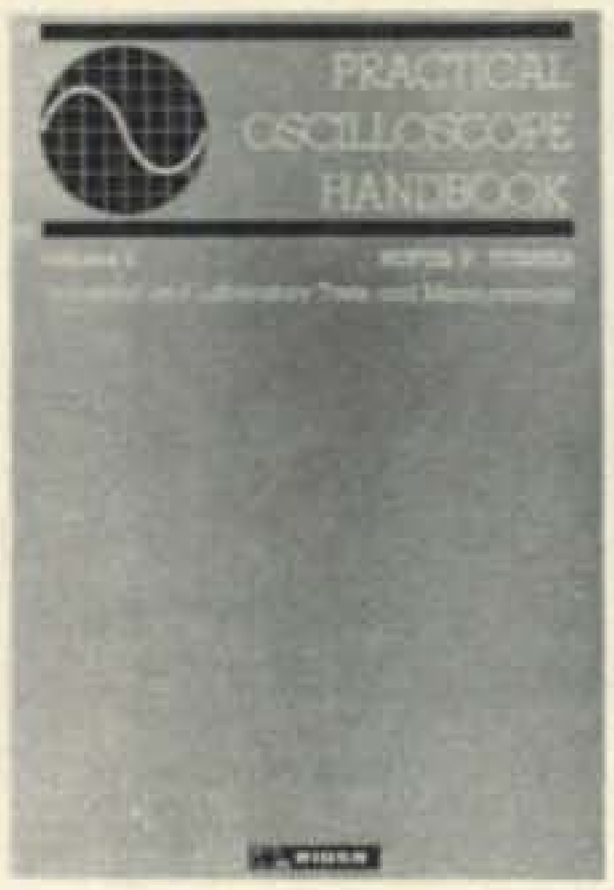

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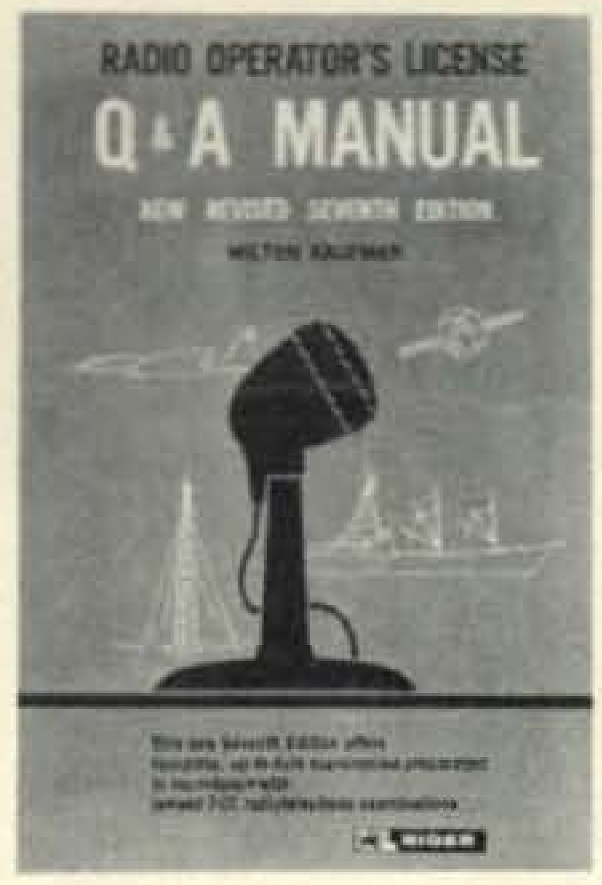

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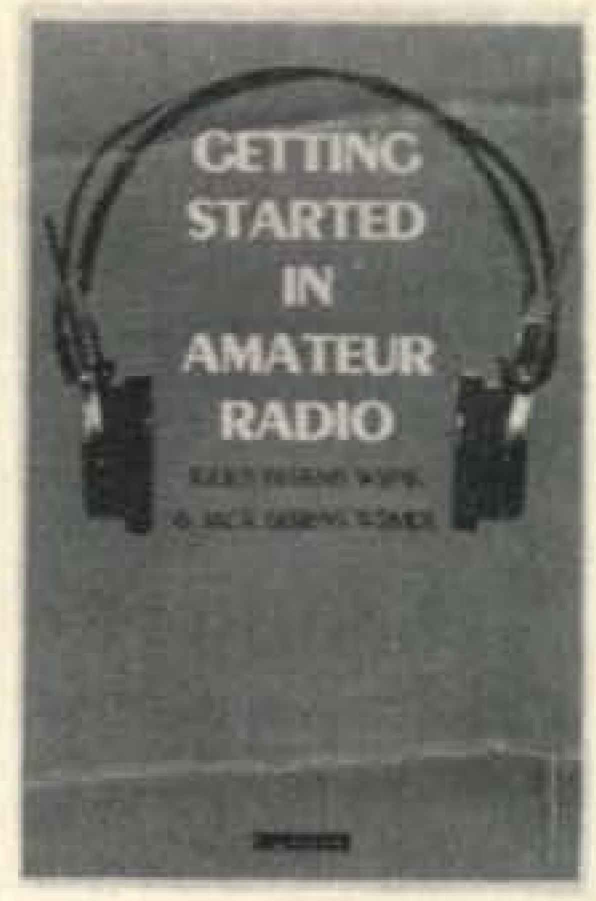

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

AFTER the police tear gas had dissipated a bit, and the Yippie epithets had stopped reverberating in my skull, I made a quick surplus expedition through Chicago late last summer. As always, Chicago turned up some old reliable friends and some new faces in surplus. Here is a quick Baedaker:

Action Electronic Sales Inc., 1633 N. Milwaukee Ave. BE 5-2830;

Arrow Sales, 2534 South Michigan Ave.: a well-stocked store with many familiar items including the Command Sets; also some of the newer type surplus components. Phone CA 5-4750.

Amateur Electronic Supply Inc., 4828 West Fond Du Lac Ave., Milwaukee;

B C Electronics, 2333 South Michigan Avenue, CA 5-2235—an old line surplus dealer, apparently now open only on Saturdays;

Richard Hirsch, Electronic Surplus, 3061 West Devon, 539-3610—sells equipment occasionally of interest to amateurs;

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

Fig. 1—Production model of Raytheon LTP-100 ruby optical laser head. The drum contains the ruby rod and the "pump" or flash discharge tube. For greatest efficiency the head should be cooled by liquid nitrogen.

C. B. Goodman, 5826 South Western Ave., handles Western Union salvage, also some Bell scrap and a great deal of the older type electrical gear including stock market tickers in the glass dome and panel meters, etc.;

Gordon Brothers, Iron and Metal, 1334 West Lake St., handles Teletype salvage and can sell motors and other basic components, also Western Electric #314A mercury-wetted polar relays which are the latest replacement for the 255A;

General Materials Corp., 229 West Madison, sells general electrical and electronic surplus of ham interest, open until 5:30 P.M., 726-0607;

Norman Electronic Sales, 1413 West Howard, RO 4-0600. Specializes in aircraft equipment;

R W Electronics, 2244 South Michigan Ave., CA 5-1281. An old-line electronics surplus house which now carries Command Sets, components (toroids, electrolytics, etc.) and other items;

Jack Thomsen, 8280 South Tennessee, Clarendon Hills, Ill., an individual who trades in mobile f.m. gear and other ham equipment.

If readers in the Chicago area know of other good surplus outlets, I'd love to get their recommendations, now that good surplus is in a period of scarcity. It seems actually as though the scarcity is more a case of news traveling slowly, for I have seen good quantities of surplus in Chicago, Miami, and Atlanta, to mention only three stops I made this summer.

Microwave Equipment, near Miami's International Airport entrance, and Radio Ham Shack, a few blocks away, had interesting stocks of gear, chiefly in components, when I checked them in mid-August. Fred G. Schmidt, 405 NW 30th Terrace, Ft. Lauderdale, Florida, was well-stocked with Teletype gear as well.

In Atlanta, I was told that the largest surplus source is J. S. Betts Co. in suburban Red Oak.

Politically, Chicago was a mess, but I had a chance to drop in at the Teletype Corporation for a very pleasant quick tour. Bob Gullicksen gave me a look at the production lines and a peek at the normally closed-to-visitors museum of Teletype equipment stretching back to the days when the company was known as Morkrum. Actually Morkrum was founded in 1907. It became Morkrum-Kleinschmidt in 1924, and Teletype Corporation in 1929, just 20 months be-

See page 150 for New Reader Service

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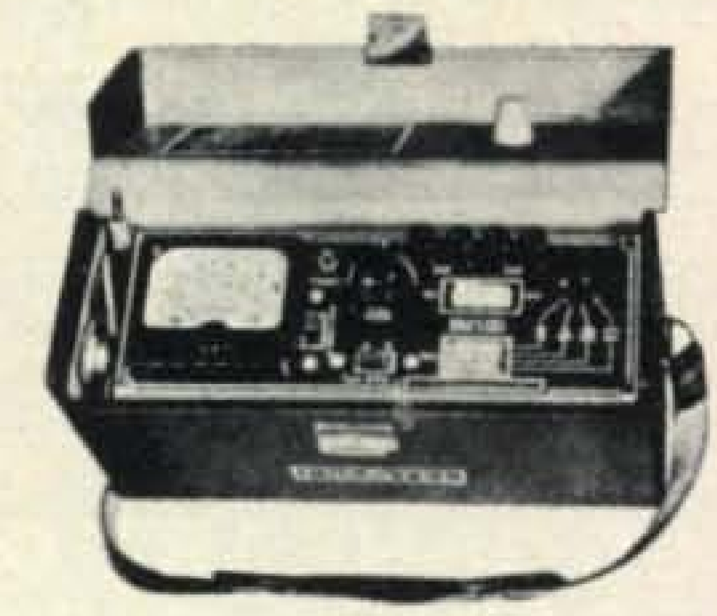

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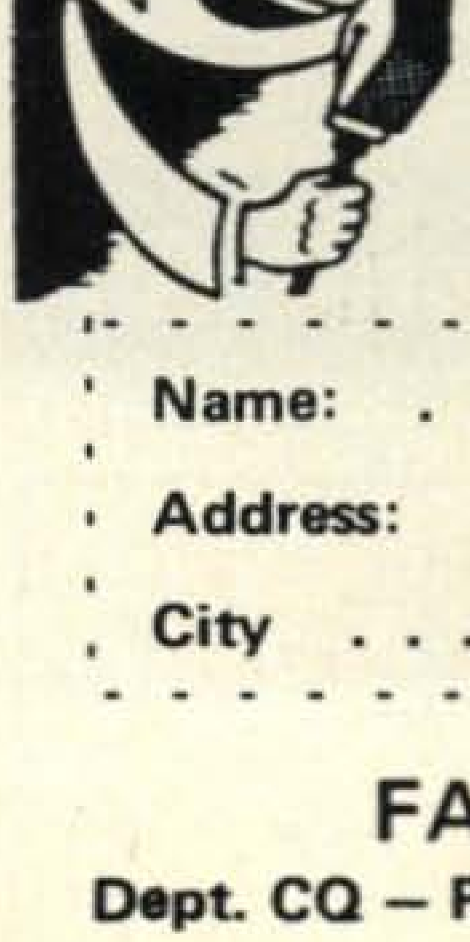

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See page 150 for New Reader Service

Back Issues

Back issues of *CQ* are available from our Circulation Department. Issues in the curent year sell for face value (.75) and all others in stock are one dollar each, postpaid. If the issue is no longer in stock, photo copies of specific articles are available at one dollar each. Preferably, the entire issue will be sent.

fore it was sold to American Telephone and Telegraph Company. Kleinschmidt, by the way, is now the property of Smith-Corona-Marchant Company, and has no relationship to Teletype aside from the fact that they compete for military teleprinter sales.

Teletype produced its 300,000th modern typing unit last May. That includes Models 28, 29, 34 and 35. The model 28, the first high-speed Teletype machine, was conceived in 1940, but development was held up by World War II. It was redesigned and engineered after the war, and was first produced in quantity for the Navy in 1951.

The stages of development of teleprinters, from the 19th Century designs through the Morkrum Model 12, the 14, 15, 19, 28, 32, 35, and finally the Model 37 and the Inktronic, are shown in the museum in an extremely interesting display, though visits must be arranged in advance through AT & T officials.

Incidentally, Teletype showed me their Mylar plastic test tapes, with "Quick Brown Fox RYRYRY" punched into them, and formed into permanent loops. These make good, durable, test items. They are part number 305734 and list at $2.85. About 10¢ postage would undoubtedly cover the shipping.

I have had some queries from readers who want to know where the "new breed of surplus" can be found. Primarily it is a case of looking long and hard, especially for those outside the larger cities or areas with heavy electronic industry concentrations. Surplus goodies may be found virtually anywhere—I have a correspondent in rural Pennsylvania who digs up a lot of bargains. New York, Miami, Boston, and other major cities support many surplus dealers, many of whom know next to nothing about electronics, and sell their wares on a basis of its metal content. They can usually be found with a few hours work in the yellow pages or by scouting the disposal offices of electronic companies including your local Western Union maintenance shop.

One of the most glittering new surplus goodies I have seen this year is a Raytheon pulsed Ruby laser, which cost $5,850 a few years ago. This system is being offered now at 10¢ on the dollar by Sasco Electronics, 1009 King Street, Alexandria, Virginia. Known as model LTP-100, the laser consists of a laboratory-grade system of laser head, cables, power supply and controls. An early version of the Raytheon laser was used in

Woman-Priced At $399.95

But Man-sized in performance, the new National NCX-500 offers 500 watts on 5 bands. Functioning on SSB, AM, and CW, this late arrival was designed especially for the new ham. It provides generous overlap for MARS operation, and includes a built-in side-tone monitor that can be used as a practice code oscillator.

The NCX-500 includes incremental tuning, enabling you to follow the others without disturbing your own transmitted frequency. Unlike some transceivers this unit has a separate detector for AM and SSB. The balanced modulator is of the diode ring type featuring permanent carrier suppression.

Attractively styled—we offer the NCX-500 on a unique basis. When ordered by itself the price is $399.95; when bought with the matching AC supply the total price is $489.95; when purchased with *our* meat and potato supply kit, the gross is but $439.95. All quotes are FOB Harvard, Massachusetts. So fellows, if you are looking for maximum wattage per dollar, this deal is suggested.

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POWER INPUT: 500 watts PEP SSB; 360 watts CW; 125 watts AM.
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FREQUENCY DETERMINATION: Single conversion with pre-mixed crystal-controlled high frequency oscillators and tunable VFO.
OPERATING FACILITIES: (All modes) Full AGC and S-meter on receive; (SSB) PTT or front panel manual operation on transmit with ALC, product detector on receive; (AM) PTT or front panel manual operation on transmit with automatic carrier insertion, AM detector on receive; (CW) grid-block keying on transmit, automatic carrier insertion, side tone generator and a product detector on receive.
RECEIVE FREQUENCY VERNIER: Front panel control provides a ± 3 kHz vernier of the receiver frequency.
SSB GENERATOR: Crystal lattice filter; 6-50 db shape factor 2.2 to 1; Bandwidth 2.8 kHz at 6 db; Center frequency 5.202 MHz. Solid state balanced modulator.
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FREQUENCY STABILITY: Nominal 1500 cps in first 30 minutes after 5 minute warm-up; long-term stability nominal 400 cps in room ambient conditions.
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"Helping Hams to Help Themselves"

1962 for moon-bounce work.

Lasers have been around since 1960, but still are hardly common amateur items, though some science fair entrants have built them. The pulsed laser is chiefly useful for ranging, somewhat like radar. Communications applications would probably turn to continuous wave lasers, which at the extremely high frequencies involved, offer potentials for carrying a great deal of information.

The Raytheon LTP-100 laser is rated at 1 joule, output, though the addition of liquid-nitrogen cooling will triple the efficiency of the unit. (Low temperatures, vital to c.w. laser operation, are a factor in almost all solid-state laser efficiency.)

So if you are wondering if there is a new breed of surplus, drop in at Sasco and look at a ham-priced laser. ■

VHF [*from page 122*]

was conducted on 432 mc, however, the presence of a 5 db ripple on 1296 mc would indicate an even larger one on 432 mc.

In planning an antenna measurement contest certain minimum test range conditions should always be met. For instance, neglecting ground reflections and assuming a flat range to start with, one should have a minimum distance of $2D^2/$ between source and test antennas. Here, *D* is the largest radiating dimension of any antenna to be tested. For a parabolic reflector *D* would be the diameter, for a yagi *D* would be either one side of the effective aperture or the boom length, which ever is larger. There are also equations for estimating the ground reflection fringes; one of these is given in fig. 4. However, these equations are based on idealized conditions which are seldom met in practice, and besides they do not tell the whole story. The CNJVHF Society's contest is an example of one which was planned out. Just obeying equations did not guarantee results. The only way to ensure a good test range is to probe it first. A ripple below 3 db should be adequate for amateur purposes. If the first test site you choose does not work out, don't give up; try another.

There is still much more to be said about antenna measurement contests, but we have exceeded our allotted space already. We will continue on this subject next month along with some other topic from the world of "VHF TODAY".

73, Allen, K2UYH

See page 150 for New Reader Service

Vertical Antennas *[from page 30]*

mean of the limits of the frequency range.

As to the number and size of conductors, the simulation of the solid disc and cage improves as the number and diameter of the conductors is increased. There is, however, a practical limit to this. Experience has shown that a cage made of 12 conductors performs very well. A top disc simulated by 12 spreaders and interconnecting wires is used. Figure 60 shows this configuration. Aluminum pipe, or a small aluminum tower, can be used as the center support. As with the conical monopole, the structure lends itself to being guyed by use of some of the cables as portions of guys, isolated from the remainder of the guys by strain insulators. The disc can be mounted to the top of the mast or tower as shown in fig. 61. A circular plate is used to secure the upper ends of the cone cables. Another circular plate rests on this, supported by four standoff insulators. The disc spreaders are bolted to the plate. A small supporting rod is mounted in the center of the upper plate, to hold the cables which support the far ends of the spreaders. A waterproof relay box is mounted on the side of the mast. Power for the relay is run up through the mast, and, inasmuch as the mast is grounded at its base, the power line can be merely bypassed to ground with a pair of 0.1 mf 600 volt capacitors at the base of the mast.

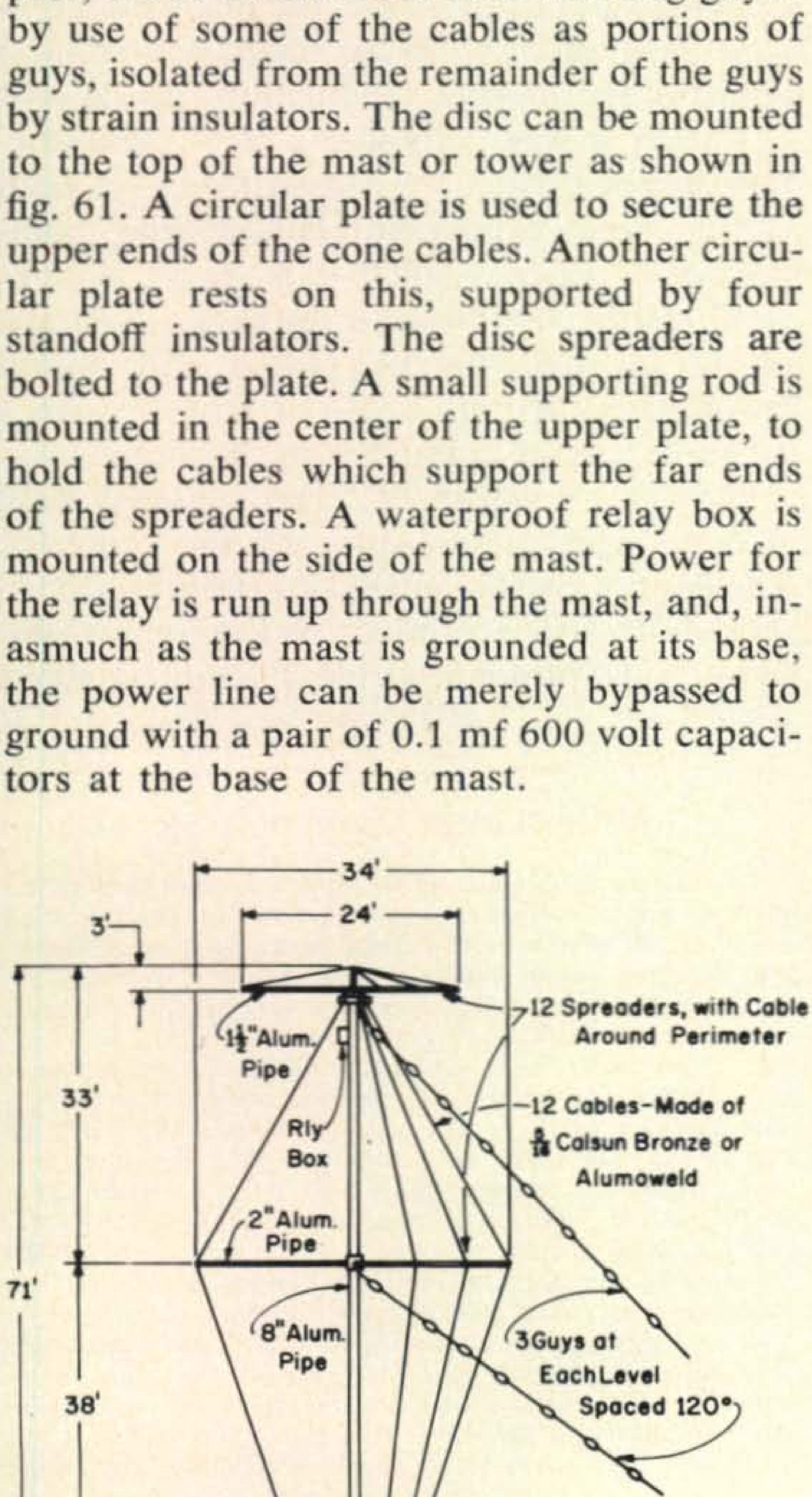

Fig. 60—Dimensions of a 2-32 mc discage antenna. The relay box mounted at the top of the 8" aluminum mast houses a relay which shorts out the disc when the cage is being fed.

It was mentioned previously that the terminating conditions of the discone must be either controlled or switched in order to make use of the top-loading effect of the disc at the cage's low frequency limit. In shipboard applications[60] we often feed this antenna with two or more transmitters, through multicouplers, with several transmitters operating in the high band and several in the low band, all operating simultaneously. In order to do this, and to prevent unwanted interactions between high and low band equipments, it is necessary to use a high pass filter in the coaxial line to the discone, and a low pass filter in the line to the cage. The high pass filter is so designed as to properly terminate the discone so that the disc will act as top-loading at the low frequency limit of the cage. The high pass filter is located up on the mast near the feed point of the discone. However, for amateur applications, where we are not operating transmitters simultaneously, this termination can be switched by means of a relay, mounted on the mast as shown. The relay shorts the disc to the cage, when operating in the low frequency portion of the cage's band.

The dimensions shown in fig. 59 are for a low limit of 2 mc. Throughout the 2 to 8 mc band and the 8 to 32 mc band the s.w.r. will be less than 2.5 to 1, referred to 50 ohms. If it desired to operate this antenna down to 1.8 mc, it size can be increased by a factor of

[Continued on page 138]

[60] Wilson, K. D., "Communications, A Limiting Factor in Naval Warfare," *Naval Engineers' Journal*, Feb. 1963, p. 51.

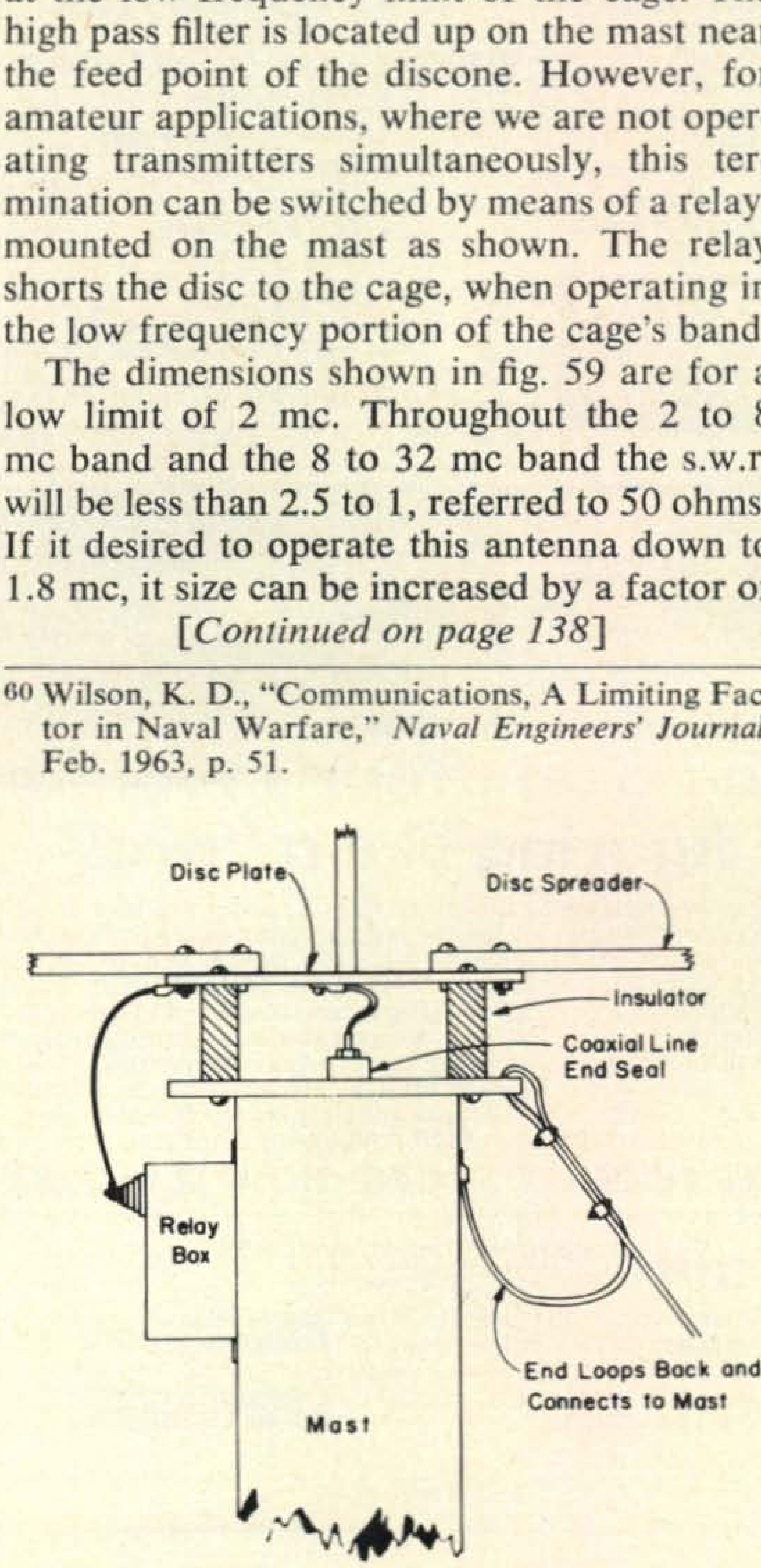

Fig. 61—Detail showing the mounting of the disc plate, disc spreaders and relay box.

CQ Reviews [*from page 36*]

since these usually do not incorporate any means of dynamic-level control to minimize overmodulation. This also applies to other modulated gear not so equipped.

Comparisons with the Auto-Level in or out may be made simply by operating its power switch one way or the other; however, it must be kept in mind that the compressor output is somewhat higher than the usual mic level alone (6 db in the case where the latter is 0.035 v. and the compressor output is 0.07 v. as specified previously). In order to obtain a valid comparison, the mic gain therefore must accordingly be readjusted in each case for the normal modulation indications.

Earlier it was pointed out that a.f. distortion is not created by the Auto-Level such as that which occurs with clipper-type "compressors." Since a "picture is worth a thousand words" oscilloscope displays are shown at fig. 2, demonstrating input and output waveforms for both types of devices with a given degree of compression or clipping.

Raytrack's slogan of "The Cleanest Talk Around," just about sums up the situation. The Auto-Level Volume Compressor is priced at $87.50. It is a product of Raytrack Company, 211 Springhill Drive, Columbus, Ohio 43221. ■

Miller Letter from page 99

4. I informed ARRL, quite sometime ago, that many of the photos submitted to various magazines and amateur publications were not actually of the Rocks, but of some other location. The caption in the *QST* article failed to mention this. I apoligize for not similarly informing *CQ*.

5. There were two of us on that DXpedition; the other individual's livelihood depends upon his position with a leading manufacturer of amateur equipment; I felt his reputation had to be protected and this, frankly, was more important to me than any possible dishonor I might suffer, justified or not.

Dick, those are the *facts* of that operation and of the outcome of my suit against the League and Huntoon. Regardless of what you or your readers may hear or believe, I must state, unqualifiedly, that I am completely satisfied with the outcome, and believe that the settlement including both the reinstatement of my operations and the financial outcome were perfectly fair and appropriate. The *important* result should be that some manner of dignity should now be restored at Newington and that future membership and international dealings will be carried out in a dignified manner by the headquarters staff under strict supervision of our Directors, whom we elect to represent us.

I'm looking forward to the final DXpedition articles in *CQ* and hope that our readers will enjoy them. Thanks for the opportunity to keep you informed of what has happened and for your fair, unbiased approach to this and the other problems of amateur radio.

Donald A. Miller, MD, W9WNV
Suring, Wisconsin

See page 150 for New Reader Service

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100kc Calibrator kit for 350C		19.50
500kc Calibrator kit for 250		19.50
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55 Swantenna – remote control		95.00
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Vertical Antennas [*from page 135*]

10%, or one can be content to tolerate an s.w.r. of 3 to 1 in this region. If one wishes to start at a low limit of 3.5 mc, the size can be scaled down by a factor of 0.57, thus giving an antenna which would cover 80, 40, 20, 15, 10 and 6 meters. If one is only interested in 7 mc and up the size can be reduced by a factor of 0.286, and 40, 20, 15, 10, 6 and 2½ meters could be covered. The height of a 3.5 mc version would be 39.7 feet and that of a 7 mc version would be only 19.85 feet.

In the naval service, for shipboard use, we do one other little trick with this antenna, and that is to mount a small u.h.f. unipole antenna on top of it, utilizing the disc as the ground plane for the u.h.f. antenna. One way of carrying the u.h.f. feed line across the h.f. discone feed point would be to coil up the u.h.f. feed line in the form of a choke coil which would have little effect on the h.f. discone feed point. Such a choke could be used to terminate this feed point, instead of using the shorting relay. The choke would thus act as a small loading coil between the cage and the top disc, at the low frequency limit of the cage. This is shown schematically in fig. 62.

As for vertical patterns, fig. 63 shows those for the cage, with the discone feed point shorted, for 2.5, 4.0, 5.5 and 7.5 mc. In fig. 64 we see the vertical patterns of the discone portion, with the cage feed terminated. While the latter show multiple lobes, this antenna is considered to be quite suitable for omnidirectional medium and long distance communications.

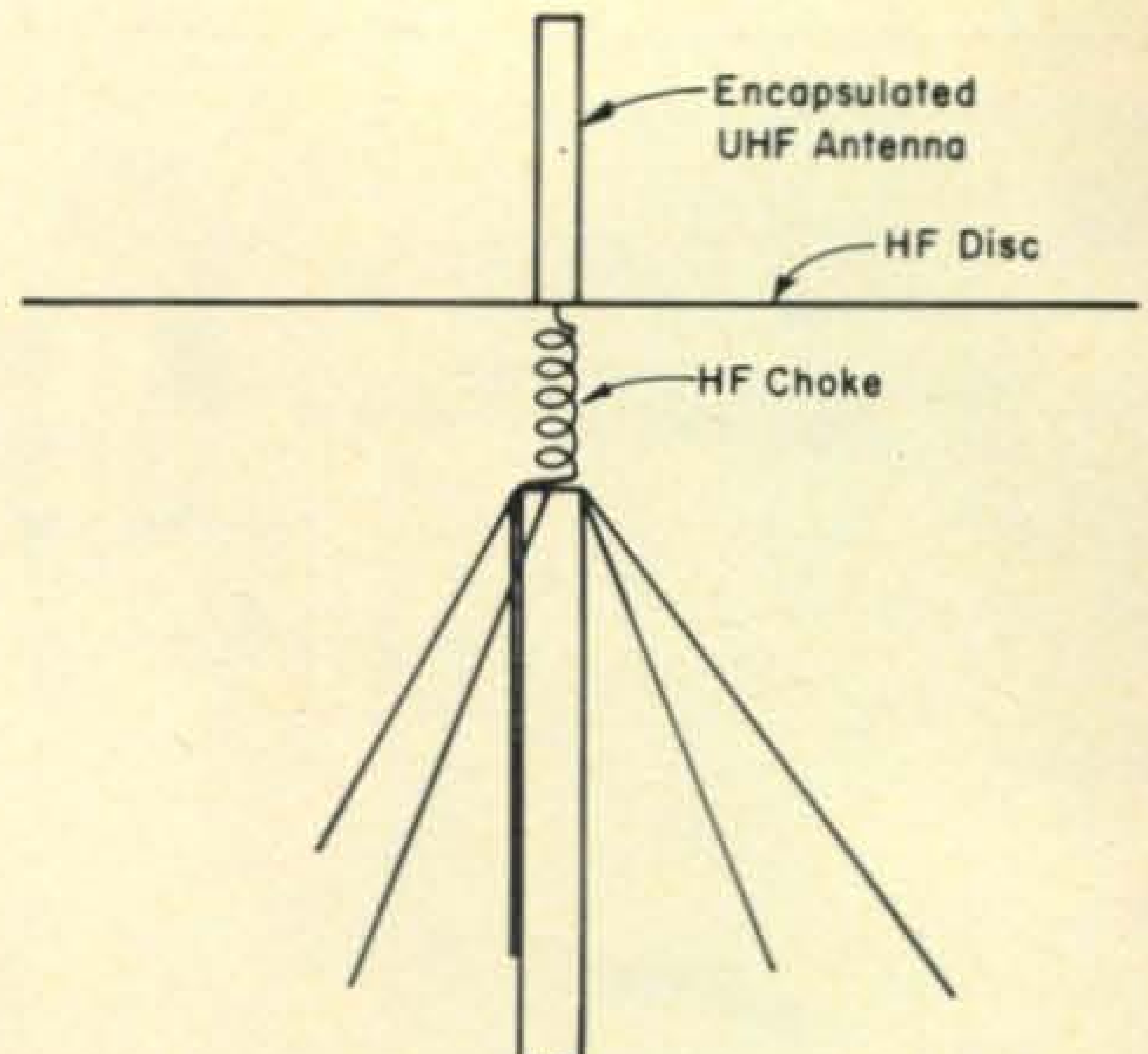

Fig. 62—Configuration of a method of u.h.f. feed across the h.f. discone. The u.h.f coaxial line is wound into an inductance, the h.f. choke. The u.h.f. line then runs down through the h.f. antenna mast.

The discage antenna would be ideal for someone who is limited as to space and who wants one antenna to cover a number of frequencies. While the Mark IV DX Antenna[61] is ideal for amateur band use only, it is not suitable for MARS use, for example, without the addition of more relays and matching networks in the tuning unit. A discage antenna, on the other hand, enables one to operate on *any* frequency without the use of tuning networks or switching. Power at 2 to 8 mc is fed in through one coaxial line, and the other line is used for 8 to 32 mc operation. It is reasonable in size, even for 2 mc.

[61] Lee, P. H., "Mark IV DX Antenna," *CQ*, Feb. 1967, p. 60.

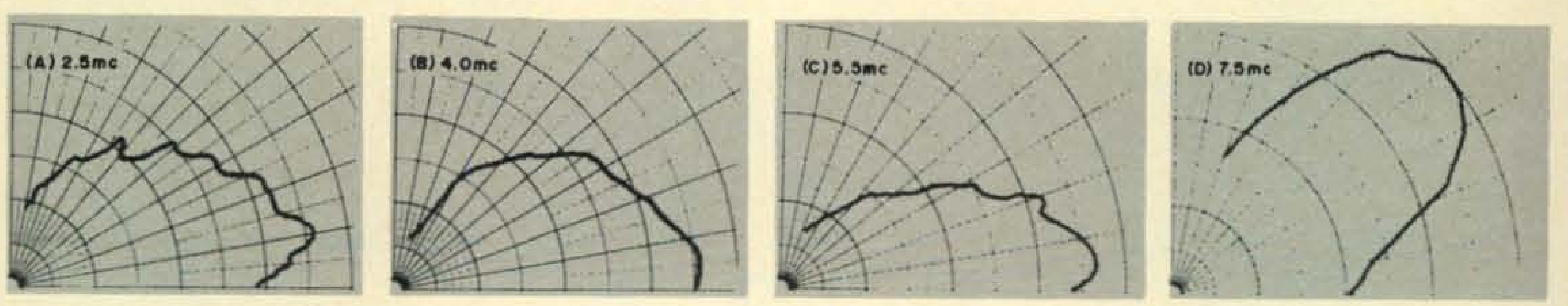

Fig. 63—Vertical patterns of the cage with the discone feed point shorted.

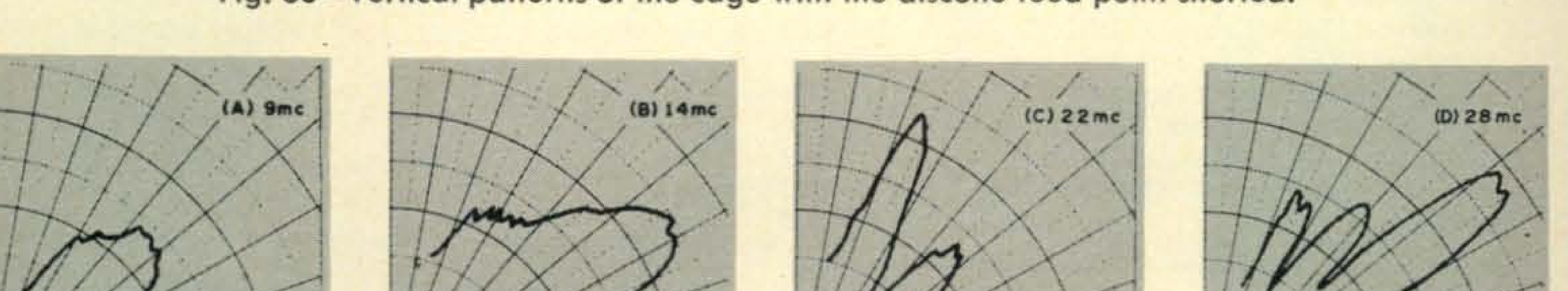

Fig. 64—Vertical patterns of the discone portion with the cage feed terminated.

 See page 150 for New Reader Service

In the next part of this series, we shall discuss additional broadband types in current use. Incidentally, the N.E.L. reports which I have referenced in this part[59] and in Part V[44,45,46] are not only "Unclassified," but are marked "For Unlimited Distribution." I have not tried to do so, but it is possible that they may be obtained by purchase from the Clearinghouse for Federal Scientific and Technical Information, U.S. Department of Commerce, by those who are interested. Of course they are obtainable through the Defense Documentation Center.

[*To be continued*]

Puzzle [*from page 68*]

S	Y	S	T	E	M		G	R	A	P	H	I	T	E
P		T		V		S		O		R		M		R
E	L	E	M	E	N	T		C	L	I	P	P	E	R
C		P		N		R		K		S				O
T	R	U	E		V	A	R	I	O	M	E	T	E	R
R		P		D		I		N				O		S
U	N		B	U	R	N		G	A	L	E	N	A	
M		M		S						E		E		D
	G	E	T	T	E	R		W	I	E	N		M	Y
S		G				A		O		R		H		N
T	R	A	N	S	I	S	T	O	R		B	E	T	A
A				C		T		F		W		A		T
T	E	T	R	O	D	E		E	M	I	T	T	E	R
I		I		U		R		R		R		E		O
C	O	N	T	R	A	S	T		L	E	Y	D	E	N

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DX [*from page 107*]

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FB8WW—Via W4BRE
FG7TH—To F2VX
FPØEB—c/o VE2AFC
G5AKQ/A, GW5AKQ/A, & GM5AKQ/A—North American Stations QSL via WAØKXJ, 5200 Shriver Ave., Des Moines, Iowa 50312—European stations QSL to GM3SSB
HBØLL—c/o WA4WAO, 1815 Forney Drive, N.W., Huntsville, Ala. 35810
HKØBKX—Via WA6AHF
HPØA—To HP1AC
KA1MI—Via W6ANB
KC6JC—To W2RDD
KG6IC (Oct. 1, 1967-June 26, 1968 QSO's)—Donald Janicki, K8WXV, 44 Magill St., Manistee, Michigan 49660
KH6BZF/Kure—c/o KH6BZF
KH6CXP/YB1—Box 179, Waimanalo, HI 96795
KH6EDY (June 8-15, 1968 QSO's)—Via KH6GLU
KH6EDY (August-December, 1968 QSO's)—USCG Loran Station, Box 36, FPO, San Francisco, Calif. 96614
KS6CX—Via K4ADU, 5330 Buena Vista Rd., Columbus, Ga. 31907
KW6EO—To WA6AHF
KW6GA—c/o WA6AHF
MP4TCF—Via G3WET
ON8VW—To W8IMZ
OX5AY—c/o VE3DLC
OY5NS—Via K1QLJ
PJØCC (Nov. 16-30, 1968)—John A. Doremus, W2ADE, Pocono Rd., Mountain Lakes, N.J. 07046
PX1BW—DL5NJ Box 5034, 23 TTS, APO, New York, N.Y. 09132
PX1SZ—Via DL6SV
PX1UP—To HB9UP
PZ1DC—c/o WA6AHF
SM7TE—Via Vincent Chinn, K6KQN, 738 Washington St., San Francisco, CA 94108
SVØWN—c/o K3EUR
UA1CK/JT1—Vlad Cupleen, UA1CK, P.O. Box 2, Central Post Office, Leningrad, USSR
VK2BKM/2 (Lord Howe Island)—Karl Kozlik, 21 Leichmardt St., Leichmardt, NSW, Australia 2040
VKØJW—To VK3UQ
VP2DAJ—c/o WB4EFE
VP2LA—Via VE3EUU
VQ9DM—To WA6AHF
VS5TJ—c/o Arkansas DX Assn., P.O. Box 7325, Little Rock, Ark.

See page 150 for New Reader Service

XE∅GJR—Jim B. Hendrix, P.O. Box 154, Tehuacan, Puebla, Mexico
ZD8GA—Via WA6AHF
ZD9BL—To WA6AHF
ZS9L—VE7BEM, R.R. 1, Winfield, B.C., Canada
3V8AA—c/o F5OJ
3V8AB—K6KQN, 738 Washington St., San Francisco, CA 94108
4A∅FCR—WB6FCR, A. C. Crespo, 8032 San Marino Drive, Buena Park, Calif.
4L1A—Via UA3KAA
4S7PB—To K6CAZ ■

USA-CA [*from page 125*]
areas. I'm working on their JCC award which is issued for working more than 100 cities in Japan (there are 565), and stickers will be issued for consecutive 100-200-300 etc., cities. If anyone is interested, I have lists of the 46 prefectures and also lists of the 565 cities. Please send s.a.s.e. to Mas Takata, K6PIH, 721 N. 20th St., San Jose, California 95112". (Note—each award costs 10 IRC's and QSLs must be sent to—JARL, P.O. Box 337, Tokyo Central, Japan.)

Wilberta (Willie), WN7IRD, writes: "With much help, advice, and cheering on from Hank, WB2RMM, I finally made my first 500 U.S. Counties.

Thank you very much for publishing Hank's letter about me in July *CQ*. I was quite surprised and pleased, but am sure other Novices have done as much or better.

Have subscribed to *CQ* and enjoy it immensely—always turning to your section first. Am anxious to get my son Jim, WB6SCH interested in County Hunting. He has given me several counties as he does quite a bit of traveling—always c.w.—mobile.

Thanks again Ed., am jumping on one foot and then the other waiting for the award."

Dean, K7JWZ, writes: "Finally getting around to sending in my application for 2,000 counties. As of this date, I have 2162 confirmed and another 63 worked, but cards not yet returned.

As a result of the county hunting, we have been able to meet in person many of the county hunters. Would like to meet a lot more, but realize it is nearly impossible to meet them all.

Have greatly enjoyed giving out the counties. So far have given out all the counties in Idaho except Boundary, tried to give it out once, but no signals due to aurora borealis. Have given out many counties in Washington, Oregon, California, Nevada. Utah, Wyoming, Montana and even a few in the Central States while on vacation".

Awards

NaBaGe Certificate: Issued by the NaBaGe Radio Club for working all members of the NaBaGe Radio Club who are: WA9AYI, K9BQL, W9CZA, W9FED, K9GHW, W9KYO and K9TAG. Any band and any mode may be used. Send data and s.a.s.e. to NaBaGe Radio Club, c/o Don Williams, W9KYO, 113 Brandywine Circle, Batavia, Illinois 60510.

Texas NAHC Award: The newly formed Texas Chapter of the National Award Hunters Club offer this fine award for working 10 of their members (membership already over 50). Also issued to s.w.l.s. Send GCR list and $1.00 to Awards Chairman, Douglas Bright, WA5RUP, Terminal Annex Box 5927, Dallas, Texas 75222.

Cherry Blossom Award: Sponsored by the Belleville (N.J.) Amateur Radio Club and dedicated to the memory of K2UCY. Issued for working ten radio amateurs in Belleville, N.J., any band any mode and no date limit. Send GCR list and 50¢ to custodian, George Kupp, K2DQT, 61 Cortland St., Belleville, N.J. 07109.

Alpine Flowers Award: This beautiful certificate is sponsored by the Dolomites Radio Club (Italy). The requirements for European Stations are: One QSO confirmed by QSL with one of the following charter members: I1CBZ, I1DEG, I1HO, I1NW, I1RLA or other member of the Club. In *France* only ∅4; ∅5; ∅6; 73; 74, or 83 departments (1 needed). One in *Switzerland* or *Lichtenstein*. One in *Germany*—DOK C or T only. In *Austria*—one of these only—OE2, 3, 6, 7, 8, or 9. In *Yugoslavia*—YU3 only. One in *Italy*—the following provinces only—Cuneo, Aosta, Sondrio, Bolzano, Trento, Belluno, Udine, Gorizia, Imperia, Varese, Como, Novara, Vercelli. So, for Europeans a total of 7 QSLs needed. For v.h.f. stations in Europe—Only 3 confirmed QSOs with 3 different alpine countries already listed are needed, his own country does NOT count. Outside Europe—One QSO confirmed by QSL with the following countries is needed: Italy, France, Switzerland or Liechtenstein, Germany, Austria, Yugoslavia—a total of 6 needed. All QSOs must be made after January 1, 1966 and may be made on any band (3.5, 7, 14. 21, 28, 144). Phone, c.w. or mixed are valid. QSLs need not be sent if the application shows all data on QSOs and is certified by two other hams or a club official. Cost: Italy L.500; 7

IRCs, or 1 U.S. Dollar. Send to AFA Manager, Lercher Andreas, I1RLA, Ospedale Civile, 39038 San Candido (Pr. Bolzano) Italy.

Notes

The only active ham in Worth County, Ga. is James D. Hardy, K4HAV, P.O. Box 192, Sylvester, Georgia 31781 and he is willing to make schedules for QSOs.

Investigation of a complaint of David, WAØLJM regarding his application for an award being issued by the Nittany ARC of State College, Pa., as described in November 1965 *CQ* brought a quick telephone call and explanation and apology for the delay. Due to a big turnover in membership due to the cancelling of some government contracts caused a back-log, which is now up-to-date.

Again many thanks for all the nice letters and comments and even thanks for that one nasty letter from California. As this is being written, the summer is about over and thus most vacations (holidays) are over, so drop me a line and tell me—How was your month? 73, Ed., W2GT.

Contest Capers [*from page 52*]

I stretched out contentedly. The brandy and soft fingers of Morpheus caressed my brain. Like an over tired car driver who sees again the ribbon road in his sleep, so the events of the past 48 hrs. weaved fantastic patterns in my mind. Sleep, wonderful sleep.

At first it appeared dimly in the conscious as the squeaking of a wheel. It increased in tempo and seemed to turn me with it until I too spun like some child's top. I awoke with a start. A figure was standing over me and a very squeaky voice was saying: "Lucky man —no work. Saw car—stop for a chat. Now its about my 2 tube super. It won't go unless I lay it on its side."

My conditioning as a young and growing man was to be a gentleman no matter what. But I'm not one bit ashamed of the common assault charge they brought against me over Harry Klewless. The YF paid bail and said the next contest would cost me much more —a divorce. ■

Loud Shorty [*from page 88*]

would be a structure of enormous size and quite impossible to build.

An eighty meter vertical beam of the type described in this article is, admittedly, ambi-

See page 150 for New Reader Service

tious. Two (or more) vertical radiators at least sixty feet tall would be needed although, in all probability, the use of shorter base loaded ones would exact little penalty in performance.

For 80 meter DX chasers the combination of 6 db gain and a very low angle of radiation should do much to swell the "countries worked" list.

The author, again, expresses his unreserved admiration for Dick Madigan's (EI9Q) enthusiasm, ingenuity and energy without which this article could never have happened. ■

Multi-Band Mobile [*from page 24*]

few tenths of an ohm of r.f. resistance in the loop circuit can greatly decrease the efficiency of the system.

Simple d.c. resistance measurements are quite useful in the evaluation of series loss resistance in this antenna system. If we refer back to fig. 1, we see that if we short-circuit the capacitance, the entire series resistance of the circuit can be measured across the connector from the transceiver. Rough calculations indicate that the r.f. resistance of this configuration may be more than ten times the d.c. resistance. Therefore, we would like to reduce the d.c. resistance to less than one tenth of an ohm, if reasonable efficiency is to be attained.

Measurements of d.c. resistance for the system described in reference[1] indicated approximately nine tenths of an ohm. The principal contributors to this resistance were the flexible top whip sections, the contacts between these sections and the top wire clamps and the bonds to the car body and chassis.

In the present system an effort has been made to reduce the resistances at these points. The top whip sections have been replaced by five eighths inch diameter mast sections, and the top clamps have been replaced by large solder lugs secured by ⅜-24 studs and nuts. Bonds, composed of copper braid, have been placed at the four corners of the car so that both bumpers are securely bonded to the body and to the chassis at either end of each bumper.

The measured d.c. resistance of the system was approximately one-tenth of an ohm. This represents a substantial improvement, but some additional decrease in resistance would be desirable. The use of one inch diameter copper-plated aluminum tubing shaped to form an arc above the car would be near the ultimate. This approach is especially recom-

See page 150 for New Reader Service

mended for married hams who are thinking of divorce.

Results

Results of this unconventional antenna system have been outstanding. In the 75 meter band reported signal strengths are always a few S-units stronger than for a conventional center-loaded whip used for comparison. Receiving operators have repeatedly commented concerning the outstanding signal strength and the apparent reduction of fading displayed by this antenna system. ■

Grumbles [*from page 40*]

end—which you probably can not now get anyway.

DO be sure to zero-beat anybody who has managed to evade your efforts and actually snagged a DX station. Keep your transmitter going, yelling "Break, break" so that any doubts as to who controls ham communications in your area will be dispelled.

DO NOT be discouraged if nobody wants to talk to you on the air; this is to be expected. This does, however, present another fine opportunity. Simply, and frequently, call some hypothetical DX station. Carry on a conversation with your make-believe station. Now you really have the locals stymied as they frantically strain their ears to find his QRG. Add remarks like, "Yeah, you're 4 by 4 here too." Again, you've shown your superiority.

DO develop an on the air image. See how loudly you can eat an apple or slurp coffee next to the mike. Teach your XYL to shout witty comments from the background. Be identified with a unique and original catch-phrase such as "what can I tell ya," or "oh, my achin' back," "that's for sure," or even "mamma mia." Best of all you must have a callsign which could not possibly be confused with any other station on the air, this means that the standard phonetic alphabet must be totally ignored. Instead, devise a humorous, and preferably suggestive, slogan based upon the letters in your callsign. Top this off with a whiskey type coarse laugh, and you will have created for yourself your own air image and personality. Whenever your carrier appears, everyone will immediately give you the band.

Give careful attention to our suggestions. A religious adherence to these methods and principles will guarantee your domination and fame.

It's now dark enough for me to slip up on the roof and swing the tri-bander a few degrees, so 73 and 30! ■

See page 150 for New Reader Service

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $2.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day in the second month preceding date of publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

Direct All Correspondence & Copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.**

See page 150 for New Reader Service

6 METER Transceiver, Gonset G50. Like new $180.00. D. Schermer K2AIP, 1864 Cole Drive, E. Meadow, N.Y. 516-481-6695.

SWAN 500C, 117XC, w/warranty, $530.00. F. Smith, 20122 Ingrum, Torrance, Calif.

FOR SALE: NCX-3 xcvr, NCXA AC supply, home brew 4-811A Linear, Dow Key coax relay J-47 key, Shure 707A ptt xtal mke. All $300. K8DLF, 603 Fifth, Jackson, Michigan.

FOR SALE: SBE-34 with mike $300 or best offer. Collins mechanical filters: F455-FA-21, $20. each. F455-Y21, $30. each. Dean Gearhart, 48 East Jefferson, Naperville, Ill. 60540.

WANTED: Coil set to cover 500kc and the 14 to 30 mc. also, for surplus HRO type receiver, RC-105. Will swap other cail sets, preferably. W2EEJ Herb Greenberg, 821 Rutgers Road, Franklin Square, N.Y. 11010.

Q.S.L. CARDS $6.95 (1,000) Free samples, C.B. Wholesale Printers, P.O. Box 994, Anderson, Ind. 64015.

WRL's used gear has trial-terms-guarantee! HW12—$89.95; Galaxy 3—$189.95; Galaxy 5—$289.95; Galaxy 300—$159.95; Galaxy V mk2—$329.95; SR46—$49.50 HX500 — $289.95; HA14 — $94.95; NC155 — $119.95; SB300—$249.95; RME6900—$149.95; hundreds more. FREE "blue-book" list. Write WRL, Box 919, Council Bluffs, Iowa, 51501.

HAM novelty business cards 50 for $1.00. Faivre K4EBT, 3418 Obispo, Tampa, Florida.

SALE: Heath SB110 6M Xcvr $195. SB200 1K Linear $161. HG10 VFO $19. Viking 11 $68. Viking 122 VFO $17. King Preselector DB68 $19. WA5PBX 5011 F. St. Little Rock, Ark. 72205.

WANTED: Skeds with YL's in Hawaii, Nev., S.D., Utah, W. Va. and Wyo. to complete WAS/YL. A. La Placa—K2DDK, 28 The Beach Way, Manhasset, L.I., New York 11030.

WANTED: National-NCL-2000 Linear, state price and condition. N. F. L'Heureux-W 1 SCM, 13 Libby Ave., Lewiston, Maine 04240.

RG-17 is kid stuff! Have 125' times coax. High power, long life. $7 a ft., make offer. Also 120 mfd. 3000 volt Cap. $35. K5TGJ. Jack Kreska, 2817 Lakewood Dr. Garland, Texas. 75040.

GONSET G-66B Receiver, 6/12/115 V Pwr. Sup. Covers 80-10 M plus BC. Includes speaker, manual. Will ship and guarantee, $75. J. K. Gardella, WN1JFG, 120 Oaktree Dr., No. Kingstown, R.I., 02852.

OLD RADIOS, Tubes, Parts, Circa 1925, AY's Amrad, Lemco, etc. West Coast Only. Jack Mayr-Radio Doctor, 818 Salem St., Chico, Calif. 95926.

HY-GAIN 40 Meter Beam Model 402-B, very clean condition $50 or trade for small general coverage receiver. W. J. Davis-K6KZT,.4434 Josie Ave., Lakewood, Calif. 90713.

HELP get more TA stns on the air. Donate old handbooks, mags., callbooks to T.R.A.G. Box 699, Karakoy-Istanbul, Turkey Rates: 6¢ 1st 2oz., 4¢ ea. add. oz. You may get a sket out of the deal. K4EPI R. L. Guard, CMR Box 7542, Patrick AFB, Fla. 32925.

WANTED: 3 Speed Gear Shift box for model 28KSR. Give condition and price. Also model 28TD.

WANTED for preservation, any pre-war QSL's showing prefixes no longer in use. Any quantity and the older the better. F. A. Herridge, 96 George St., Basingstoke, Hampshire, England.

FOR SALE: Two Surplus 813's and Flament Transformer for same, all new, never used. $30 FOB Sheridan. Frank Kedl, WNCRP, 55 E. 8th, Sheridan, Wyo. 82801.

FOR SALE: HT-37 in A1 shape, homebrew 4-1000. Linear with a monster power supply and other items. Write for details and prices. L. Kirschemann, Box 633, Regent, North Dakota 58650.

FOR SALE: Collins 75A3, like new, ser. 505, F455B-31 filter, manual, 30 day money back guarantee, will ship, $210. J. K. Gardella, WN1JFG, 120 Oaktree Dr. North Kingstown, R.I. 02852.

FOR SALE: Mint SX101A $145, T-150 A and Dowkey $50. TA33jr 30ft-2 in. od mast and AR-22 $75. You take down. WB2RTF, 524 Broughton Ave., Bloomfield, N.J. 07003.

WANTED: Mixer and output coils for CE 10B Exciter-160, 15, and 10 meters. R. W. Myers WA2JZX, 25 Harding St., Copiague, New York 11726.

FOR SALE: 2-way radio business and property for sale. 100 ft. Tower. Ideal QTH. Retiring. Jack Mayr, 818 Salem St., Chicogo, Ca. 95926.

FOR SALE: R-100A mint w/spkr S-mtr calb $80. T-150 $50 Adventurerer 50w CW $25. VF-1 VFO w/hb supply $18. Coax relay DPDT $12. Shipped prepaid. W5QNY W. Wortman, Box 305, Los Alamos, N.M. 87544.

WANTED: QRP F meter transceiver. Must run under 500mw. Join WAS net. Meets weekends on 7170 kc at 1000 GMT. R. Hajdak WA 3TDT, 4 Homer St., Greenville, Pa. 161625.

SALE: Selling out. SB-400. $260. Ranger $70. Johnson T-R Switch $18. Send stamp for list. J. Shank, 21 Terrace Lane, Elizabethtown, Pa. 17022.

JOIN THE OOTC. If you have been licensed for 40 years you are eligible. Send a QSL card to Chas. W. Boegel, Jr. WCVU, 1500 Center Point Rd., NE, Cedar Rapids, Iowa 52402.

FOR SALE: ARN-7 Radio Compass, $15. SCR-522, $25 unconverted; RME 4300 receiver, $45. Trades considered. Want 2 meter FM, 1200 UAC trans. F. L.J. Hertwig, 347 S. Wash., Oconto Falls, Wis. 54154.

FOR SALE: old handbooks, call books, early radio magazines, books, etc. Send stamp for list. Erv. Rasmussen W6YPM,164 Lowell Street, Redwood City, Calif. 94062.

FOR SALE: Filter chokes, U.T.C., GG-108, 10 Hy., 500 Ma., 52 ohm, pull outs $5.00 ea., 22 lbs. FOB Bethlehem. Dale R. Lee—W3RM, 1228 Shelbourne Dr., Bethlehem, Pa. 18018.

FOR SALE: SBE-33 D.C. supply #30. SBE-34 VOX unit $25. Both good condition. D. K. Holstein, 2020 Golden Arrow Drive, Las Vegas, Nev. 89109.

NOVICES: Sell Eico 720 X MTR & 730 MOD and Knight T-150 A. Great shape. Want mobile setup. Frank Higson, WN1HRT, 14 Foster Rd., Bedford, Mass. 01730.

WANTED: C.Q. 1946 Feb. Q.S.T. Before 1930. E.D. Guinmares, Jr.—WA1BFD, 14 West End Ave., Middlebord, Mass. 02346.

FOR SALE: B&W TR Switch Completely Electronic. No relays. $20. WA2DEY, Jim Randel, 86 Fairmount Ave., Chatham, N.J. 07928.

FOR SALE: Heathkit Apache (TX-1) with Single Side Band Adapter (SB-10) in excellent condition. $140. Leroy A LaBardi-W9NWG, Box 46 #4, Edwardsville, Illinois 62025.

FOR SALE or trade: Johnson Wiploading 6 mobile loading coil. 10 thru 75 meters. Cost $22.95. Never Used. TNX. Ken Birmingham, 413 Holmes Drive, Burlington, N.J. 08016.

FOR SALE: Shack junk box cleanout. $$$ worth useable goodies for projects you intend building some day. No trash, money back guarantee. PPD pkg $3.50. Irv Mogeff, W2DXK, 5015 Weekslane, Flushing, N.Y. 11365.

FOR SALE: NC 173 Receiver $100. E. S. Fox, 215 Linden St., Clayton, N.J.

FOR SALE: CE 100V Excellent $325. R-388 Good Condition $425. Waterman UPM-45 Dual Scope, Perfect 100. W4A1S, G. D.Tates, W4A1S, 7 Artillery Rd. Taylors, S.C. 29687.

See page 150 for New Reader Service

OSCILLOSCOPE stands with adjustable tilt. New—In original cartons. $35.00. P. Halmbacher, P.O. Box 217, Hartland, Wisconsin 53029.

USED RCA Jr. Velocity factory reconditioned $25. Turner 101B Dynamic $20. Slim-X. 777 Crystal $12. All plus postage. Roache, Canterbury, Conn.

FOR SALE: Northern Radio Company, RTTY Demodulator Type 104. $30. P. L. Lemon, W6DOU, 3154 Stony Point Road, Santa Rosa, Cal. 95401.

SACRIFICE: Raytheon model 1030 marine xceiver $75. Lafayette HA-230 $35. Both in excl. working cond. Want SB-300, SX-117 or HQ-170C. Glenn Anderson, 1100 New Jersey Ave., Pine Beach, N.J. 08741.

FOR SALE: Excellent GSB-100, $125, deliver 200 mi. Want: Hickock 533 chart, newer than '61. J. Shatterlee, 213 Frederick, Fort Atkinson, Wis. 53538.

FOR SALE: Call books of 1916, 1922, 1934, 1925 on up thru the thirties. Erv Rasmussen, 164 Lowell St., Redwood City, Calif. 94062.

EICO 720/Eico 730 AM-CW Transmitter, Hallicrafters SX-99, Heath Twoer,, 2 meter converter, extras. Make offer. Want 6 meter Am-Cw Transceiver, Will trade. R. Hajdek, 4 Homer St., Greenville, Pa. 16125.

WANTED: 6 & 2 Meter National Converters and 6 & 2 meter VFO for MX NC 303. John J. Connell, 390 Franklin St., Mansfield, Mass. 02048.

TRADE—General Radio 1304A oscillator, serial 379, Good to Excellent condition. Want tektronix scope. Aubrey Hutchison, 5780 S.W. 11th St., West Miami, Florida.

GONSET IV 2 M, in very good condition. $200. National 200; A/C200:&NCXD, All Like New. $400 or best offer. WA2OHN W. B. Shapiro, 845 Cliffside Ave., North Woodmere, New York 11581.

TUBE TESTER, mutual conductancce, Military #I-177-B with MX-949 A/U adapter, new condition. $75. G. W. Richie, R. #2, Box 149, Salem, Virginia 24153.

FOR SALE: RMR-8 receiver. 7 Bands. BC thru 6 mtrs. SSB, CW and AM. $50. PP USA48. William Deane, 8831 Sovereign Rd., San Diego, Calif. 92123.

LAFAYETTE HE30 Rec. $54; Johnson Valiant $81; Monitoradio DR200 $90; Lampkin 105B $100. J. Wasiewicz, 4230 NW 10 St. Pompano Beach, Fla. 33063.

SELL DX-60A xmtr in good condition with manual for $49. You pay shipping. WA3DVH, Dayton Jones. T. Field, 224 W. Willow Grove Ave., Philadelphia, Penn. 19118.

NEED: Curta Calculator, mobile SW BC convertor, Gonset Super 12. Swap or sell I-177 dynamic conductance tube tester, Astra Cub. Auto. K5MVN. O. H. McMahon, Jr. 113 Woodcrest Circle, New Iberia, La. 70560.

FOR SALE: One of the last Collins 75A4's made, in mint condition with all modifications, vernier knob, manual $399; HT-37 SSB transmitter $199; HEATH MT-1, MR-L Mobile Rig w/AC and DC power supplies, make, speaker, mount: all for $150. Curtis May, 5400 Loch Lomand #1-8 Houston, Texas, 77035.

GOING transceive, must sell HT-37, HQ-110A, Sixter, Norelco 101 recorder, more. All excellent. Best Offer. Tom Fitzpatrick, WB4FOT, 1923 Oxford Cir., Lexington, Ky. 40504.

FOR SALE: Heathkit (QF-1) Q-Multiplier Wired-New $9. CQ's 1946 thru 1957. D. Scher—W2KDW, 11 Webster St., Irvington, N.J. 07111.

WANTED: Heath HA-20 6-meter linear. G. Smith—WSZFQ, 915 Lovera Blvd., San Antonio, Tex. 78201.

FOR SALE: Like new National NCX-3 transceiver with AC supply, $250. Conset 2 meter "Sidewinder" SSB transceiver perfect condition, with AC power supply $210. Equipment located in Chicago area. Write to: WA9HRN Craig L. Pitcher, 829 So. 20th Street, Terre Haute, Ind. 47809.

S.B.E. Mobile P.S.—12VDC to 117 VAC—Will trade for Match box or equal tuner. Geo. L. Oom, 31 Colfax N.E. Grand Rapids, Mich. 49505.

COLLINS equipment—75A3 RCVR with 800 and 3.1 filters excellent $250. TCS 12 transmitter VFO or crystal control tunes down to 160 with power supply, cables input, 28VDC at 23 amps. output. Relay Rack mounted new $275., BC 348 unmodified with dynamotor $40. BC 453 new $12. RME DB23 $15. vacuum variable 10-500 mmf 10KV $32. Send stamp for list—above FOB. W3KA, R. B. Ladd, 10406 Insley, Silver Spring, Md. 20902.

FOR SALE: W2AU vinyl jacketed bamboo quad, tri-band, complete, never used. $45. Will deliver 100 miles of Allentown, Penna. Jack Koplin WA3EXJ, Rd. 1, Zionsville, Penna. 18092.

FOR SALE: Heath Tunnel Dipper $15; SB-101 mobile rack $10; HP-13 DC supply $45; National NCL-2000 $395; all manuals DM-35 with new brushes $25. W4ZJZ, M. K. Boynton, 3410 S.E. 19th Ave., Gainesville, Fla. 32601.

FOR SALE: Elmoc AF-67-AC power homebrew but matching. One or both—No reasonable offer refused. W4DGY, Wm. L. Pple, 2748 Abingdon La., Mountain Brook, Ala. 35243.

WILL TRADE or sell: Collins KWM-Z without A.C. sply. $695. Wanted Collins 312B4. F. E. Coble, 251 Collier Ave., Nashville, Tenn. 37211.

FOR SALE: 8 Vinyl coated bamboo Quad spreaders. $20 plus extras. Prefer local pick-up. Paul Mayo, 2409 Ocean Pkway., Brooklyn, N.Y., 11235.

WANTED: Heath HW-32 and/or HP-23 Power supply. Non-working or damaged condition acceptable. Mike Ludkiewicz, 143 Richmond Rd., Ludlow, Mass. 01056.

FOR SALE: 175 Head drum Memory in almost new condition. IBM 360 typewriter I/O Good Condition. K4ANV, Aubrey Hutchison, 5780 S.W. 11th St., West Miami, Fla. 33144.

2 METER TRANSCEIVER—V.F.O. Triple Conversion—Brand New. $175. Mail only. Allan Rabinowitz, 574 E. 79th St., Brooklyn, New York 11236.

QCWA members plan to attend the So. Calif. Chapter, QCWA breakfast Jan. 11, 1969 at "SAROC" Convention in Las Vegas. Others wishing to join QCWA write to W6IL, 12620 Washington Blvd., L.A. Calif. 90066. Ralph Cabanillas, Jr. W6IL.

FOR SALE: AN/ART-13B with power supply and push to talk microphone. $60. You pay shipping costs. WA4FCC, John E. Carr, Route #2, Rockmart, Ga. 30153.

HAMMARLUND HX-50 Sideband exciter (A-1 condition) $190. Webster Bandspanner mobile whip (like new) $18. Precise Model 111 Gm tube tester (works OK) Century CRT checker (needs work) both $25. Jim Owen K4CGY/3, 215 W. Harrison St., Rockville, Md. 20850.

MECH. filters Collins 2.1 kc455 type F455Y21 1S2 with one BFO Xtl $20 Mech. Filter 500 cy. $10 Calif. Perf cab. 5½ x 8½ x 11 in. deep—Squirrel cage blower L-R #3 $8. E. H. Marriner, W6BLZ, 528 Colima St., La Jolla, Calif.

ANTIQUE radio tubes wanted. Made prior to 1920 W2EZM. SM LA Dage, 431 Oakland Ave., Maple Shade, New Jersey 08052.

WANTED: Hallicrafters S 36 and Grid Dipper. State condition. All letters answered. Leland J. Wuertz, Sr., 517 Camp Street, Sandusky, Ohio 44870.

FOR SALE: Leaving country, must sell 2 M FM equipment. Write for details. Also Collins 516-2 power supply. KOFMF, M.O.C., Stony Point, New York 10980 (Dick Long).

VFO for sale: Heath HG-10 with manual $20. Perfect condition. Will ship but you pay shipping. Richard C. Vail, 2514 Birch Drive, Richmond, Ind. 47374.

See page 150 for New Reader Service

READER SERVICE

To help our readers obtain literature from advertisers, we're instituting a new reader-service facility in this issue. Simply check the box next to the name of each advertiser listed below whose product or service is of interest to you. We'll pass your name on and you'll get literature from the advertiser in short order.

This Form Expires November 30, 1968

- ☐ Amateur Electronic Supply
- ☐ Arrow Electronics
- ☐ Aquadyne, Inc.
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- ☐ Electronic Assistance Corp.
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- ☐ Fair Radio Sales
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- ☐ Texas Crystal
- ☐ Weller Electric Corp.
- ☐ WRL World Radio Laboratories, Inc.

CQ Reader Service
14 Vanderventer Ave.
Port Washington, N.Y. 11050

Sirs:

Please send me information on the products and services which I have checked above.

Name ____________ Call ____________

Street Address ____________

City ____________ State ______ Zip ______

Advertiser's Index

See page 150 for New Reader Service

HT-40 transmitter, 75 W 80-6 meters, and Knight Kit VFO with manuals, excellent condition. $49. FOB or trade for Z M or test gear. T. L. Hardin, Route 1, Matthews, Ga. 30818.

6 M Converter International Crystal 3 transistor, 6-12 Volt., output 600-1600 KH2, with manual. Sell or trade for 2 M converter with high freq. I.F. T. L. Hardin, Route 1, Matthews, Ga. 30818.

FOR SALE: Complete file of CQ. Want RTTY mag., etc. Fred Schmidt, W4NYF, Box 8873, Ft. Lauderdale, Fla. 33310.

EICO 753-1 (solid-state VFO) Mint Cond., 752 DC. P.S. Both cheap, make offer to K4EP1, R. L. Guard, Box 7542, Patrick AFB, Fla. 32925.

FOR SALE: Modulation Transformer, 1kw, $25. Constant Volt. Transformer, 500 W., $25. A. H. Bett, 340 S. 24, Quincy, Ill. 623301.

FOR SALE: Heath 10-21 Scope. Excellent condition. Extras! $40. William Karl, 24 Mill Street, Cooperstown, N.Y. 13326.

FREQ. METER Bc-221. $45. Ts-323. $85. Ts-186 $125. Sprague interference locator $75. SSD-100MIL $150. Cleanup list stamp. Spitz, 1420 S. Randolph St., Arlington, Va. 22204.

MORE DX with a new QSO phrase book spanish-german-french-russian. $3. M. Holubov, 22 Vaundreuil, Baie Comeau, P.Q., Canada.

FOR SALE: 75A4-Vy Mint condition. 3 filter. Manual $375. G. Ted Anderson, Southland Acres, Box 104, Tuscola, Ill. 61953.

WANTED: Old battery operated radios of the early 1920's. Also early ham transmitting gear. Need not be in working condition. State your price. David T. McKenzie, KOSVJ, 1200 West Euclid, Indianola, Iowa 50125.

AMECO PCL-P. 1.8-54 Mc. Nuvistor Pre-amp. $20. Hallicrafters S-36, 27-144Mc. Good except s-meter, make offer. Siegel, 2613 Grad. College, Princeton, New Jersey 08540.

QSL manager for ZD8CC, VP7CC, and VP5RS is ZD8AR. R. C. Strong, c/o RCA/Mtp, Ascension, Patrick AFB, Fla. 32925.

TRADE FLL License Course (1st class) for Ranger 1, Ranger 2 Ce-204 or other ham gear. T. G. Soukup, RFD 3, Bob Hill Rd., Ridgefield, Conn. 06877.

FOR SALE: Hallicrafter receiver. SX 101 mark 3A with yearnier knob. Excellent condition. $115. Original owner. Will ship FOB N.Y. John DiBlasi, 155 Bayview Road, Plandome Manor, L.I., N.Y.

POLICE & FIRE DEPT. RADIO STATION DIRECTORIES show frequencies, callsigns, locations of state, county, local and volunteer agencies in all areas. A must for all VHF buffs, VFD members, SWL's, members of AREC & CD. Send stamp for a catalog. Communications Research Bureau, Box 56-F, Commack, N.Y. 11725.

FOR SALE: Heath twoer w/manual. $30. HQ 170, SB11CA, HP13, HP 23, SB 600, SB 100-1, HD 15 fone patch. Write for cheap prices. J. R. Hart, 26 William St., Glen Falls, New York 12801.

PAWNEE for sale: late model, excellent condition, 2 meter transceiver, vfo, bfo, 6v, 12v, 110v, all built in: $125. C. F. Enix, W8EN, Box 474, White Pigeon, Mich. 49099.

BERKELEY/BECKMAN model 510 counter. Readout to eleven digits. Send sase for information. Robert H. Johnson, 505 So. Elmwood, Waukegan, Ill. 60085.

WANT TO BUY: Old magazines, RTTY-all; CQ-1967 QST-all 1960, part of '62 & '64—For sale: Hornet 3-element tri-bander and radiart heavy-duty Rot. Make offer. M. D. Jabara, 1354 Elm St., Plymouth, Mich. 48170.

FB SB 301 400 HZ. CW filter. Sell at kit cost $285. R. S. Price, 5593 Hamill Ave., San Diego, Calif. 92120.

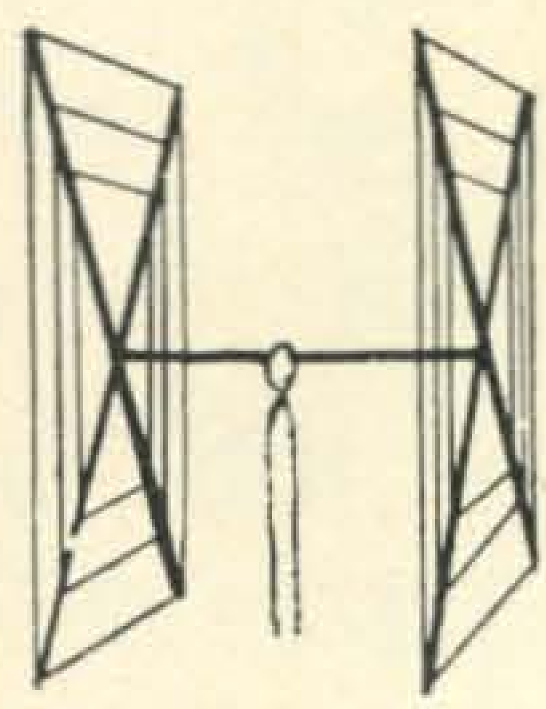
See page 150 for New Reader Service

GOTHAM ANTENNAS ARE MUCH BETTER
OF COURSE, YOU PAY MUCH LESS

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... W3



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

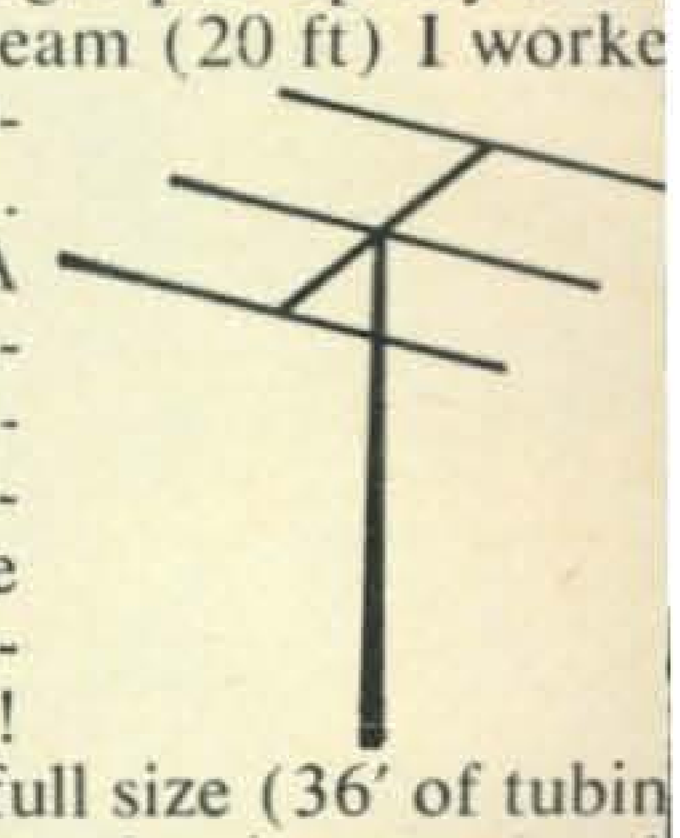
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

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 ele ment Gotham beam (20 ft) I worke 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 tubin for *each* 20 meter element, for instance); ab solutely complete including a boom and all har ware; uses a single 52 or 72 ohm coaxial fee line; the SWR is 1:1; easily handles 5 KW; ⅞ and 1″ alumnium alloy tubing is employed f maximum strength and low wind loading; a beams are adjustable to any frequency in th band.

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3 EL 20	22*	7 EL 10	32
4 EL 20	32*	4 EL 6	15
2 EL 15	12	8 EL 6	28
3 EL 15	16	12 EL 2	25
4 EL 15	25*	*20′ boom	
5 EL 15	28*		

ALL-BAND VERTICALS

"All band vertical!" asked one skepti "Twenty meters is murder these days. Let's se you make a contact on twenty meter phone wit low power!" So K4KXR switched to twent using a V80 antenna and 35 watts AM. Here i a small portion of the stations he worked VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2 ODH, WA3DJT, WB2FCB, W2YHH, VE3 FOB, WA8CZE, K1SYB, K2RDJ, K1MV K8HGY, K3UTL, W8QJC, WA2LVE, YS1 MAM, WA8ATS, K2PGS, W2QJP, W4JW K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3 KT, Moral: It's the antenna that counts!

FLASH! Switched to 15 c.w. and worked KZ5 IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT XE2I, KP4AQL, SM5BGK, G2AOB, YV5 CLK, OZ4H, and over a thousand other stations

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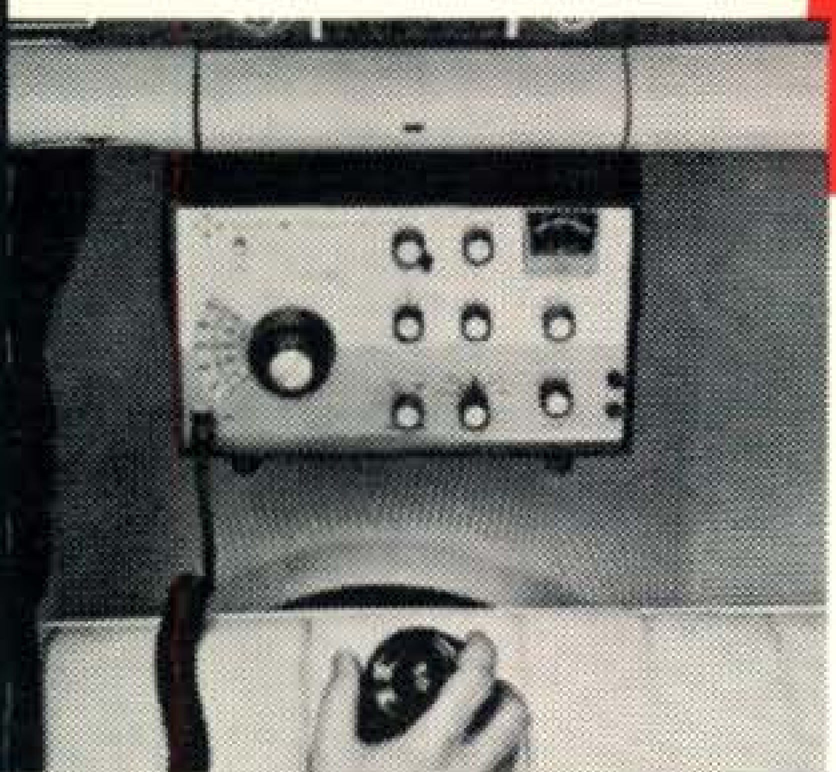

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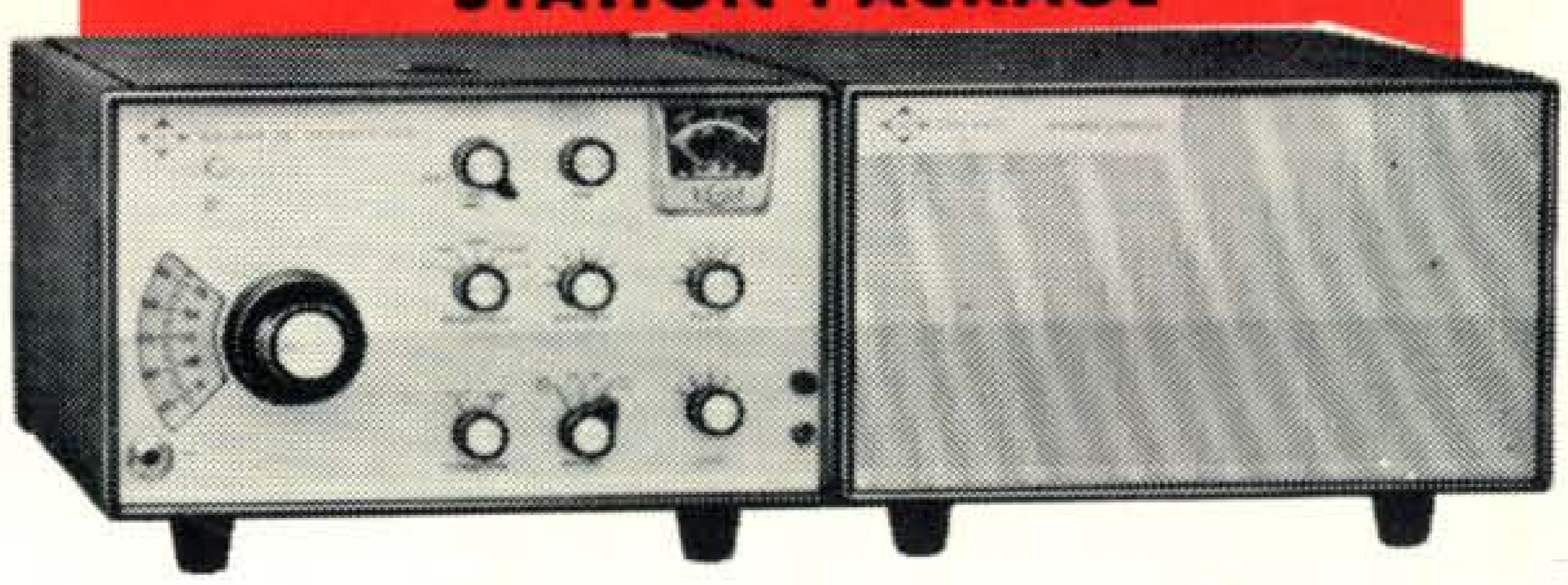

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